BIOLOGICAL OPINION
Replacement of the East Brady Bridge over the Allegheny River (S.R. 0068, Section 350)

Armstrong and Clarion Counties, Pennsylvania

August 25, 2003

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CONSULTATION HISTORY

August 3, 1993	The Fish and Wildlife Service (Service) responded to a list request by KCI Technologies (an agent of the Pennsylvania Department of Transportation, or PennDOT) by indicating that the clubshell may be in the proposed project area, and recommending a sampling design for that species. PennDOT represented the Federal Highway Administration (FHWA) on this and other occasions.
August 1, 1995	The Service recommended a two-phase mussel sampling approach in response to a July18, 1995, facsimile transmission describing several bridge alignments under consideration over a relatively large area of the Allegheny River.
August 4, 1995	The Service received a scope of work from Aquatic Systems Corporation for a mussel survey near the East Brady Bridge.
September 1, 1995	Aquatic Systems submitted mussel sampling results from 109 brail tows completed August 21-24, 1995, in the project area.
October 25, 1995	The project was discussed in a telephone conversation during which the Service requested additional information regarding the project and the project area.
August 22, 1996	An August 15, 1996 memorandum responding to our request was forwarded to the Service by KCI.
September 24, 1996	The Service supplied PennDOT with a revised mussel survey protocol; this protocol was based on preliminary data, a more detailed project description, and the finding of the endangered northern riffleshell near the proposed project site.
September 24, 1997	Preliminary results of an August 22 to September 8, 1997, mussel survey at the East Brady bridge was submitted by McLaren Hart, Inc. These results documented finding five live northern riffleshells in the project area.
March 18, 1998	The Service received a March 12, 1998, report describing the results of the late summer 1997 mussel survey.
September 21, 1998	The Service commented on the mussel survey results to PennDOT, in which we concurred that the proposed project may affect the northern riffleshell, and recommended that they initiate informal consultation.
November 17, 1998	Service personnel attended a site visit with KCI and PennDOT to discuss the proposed project.

April 25, 2000	In a telephone conversation with KCI, the Service recommended that a new mussel survey be conducted since more than three years had passed since the previous survey, and a more effective sampling protocol had been developed.
May 8, 2000	The Service submitted a copy of the revised sampling protocol to KCI during a second field view with KCI and PennDOT.
June 22, 2000	Service personnel gave a presentation to the East Brady Citizen Advisory Committee regarding mussel life history and conservation.
September 11, 2000	The Service attended a meeting at the PennDOT District 10 office to further define the sampling procedure with PennDOT, the U.S. Geological Survey (USGS), and mussel survey consultants. At this meeting, PennDOT decided to quantitatively survey an area covered by several alternatives being considered. Project timing of one to two years, alternatives to causeway use, and barge-induced scour were discussed
September 18 - 29, 2000	Mussel survey performed at East Brady. Living northern riffleshells and clubshells were found.
October 17, 2001	The Service received a September 21, 2001, memo from PennDOT, on behalf of FHWA, requesting permission to conduct geotechnical investigations along the preferred bridge alignment alternative.
October 23, 2001	The Service received proposal to conduct geotechnical investigations that will avoid take of northern riffleshell and clubshell through a spot check of proposed drilling locations.
November 8, 2001	Final mussel survey report received from PennDOT for our review.
December 21, 2001	A draft of a biological assessment and the results of mussel searches related to geotechnical investigation were received.
January 16, 2002	The Service commented on a preliminary draft of the biological assessment for the proposed project. In a second letter, the Service responded to an updated endangered species coordination request confirming that the northern riffleshell and clubshell are the only federally listed species likely to occur in the project area.
January 18, 2002	A meeting was held at KCI's office with FHWA, PennDOT, and KCI to discuss the preliminary biological assessment.
March 11, 2002	Revised mussel population estimates were submitted by EnviroScience as amendments to the survey report.

August 9, 2002	The Service received a formal initiation request from FHWA(dated August 5, 2002) to initiate "early consultation" according to 50 CFR § 402.12.
September 4, 2002	The Service acknowledged initiation of early consultation.
September 24, 2002	By September 20, 2002, letter, the Service received FHWA's confirmation that they intended to implement the proposal submitted if the project was determined to not jeopardize the continued existence of either endangered mussel species.
January 2, 2003	The Services preliminary biological opinion was submitted to FWHA.
March 31, 2003	By March 27, 2003, letter, FHWA expressed concerns about the validity and justification for several of the Reasonable and Prudent Measures, and implementing Terms and Conditions included in the preliminary biological opinion, and submitted proposed revisions.
May 2, 2003	A conference call was held between the Service, FHWA, and the applicant to discuss the Reasonable and Prudent Measures, and Terms and Conditions in the preliminary biological opinion.
June 11, 2003	The FHWA provided a June 9, 2003, supplement to the biological assessment, requested that the preliminary biological opinion be confirmed as final, and that it be revised based on the amendment and May 2 suggested revisions.
August 25, 2003	The Service's biological opinion submitted to FWHA.

BIOLOGICAL OPINION

This biological opinion is based on information provided in the following documents: *DRAFT Mussel Survey Report, East Brady Bridge Site, Allegheny River M.P. 69.5, S.R. 0068, Section 350, Clarion County, Pennsylvania, August 22 through September 8, 1997* (Aquatic Systems 1998); *Freshwater Mussel Survey, Clarion and Armstrong Counties, S.R.0068, Section 350, East Brady Bridge Replacement Project* (Skelly and Loy, Inc. 2001); *Biological assessment (Preliminary Draft) for the proposed East Brady Bridge replacement project (State Route 0068, Section 350) over the Allegheny River, Armstrong and Clarion Counties, Pennsylvania* (KCI Technologies 2001); *(final) Biological Assessment of the State Route 0068, Section 350, East Brady Bridge Project over the Allegheny River, Armstrong and Clarion Counties, Pennsylvania* (KCI Technologies 2002); *Addendum to Biological Assessment of the State Route 0068, Section 350, East Brady Bridge Project over the Allegheny River, Armstrong and Clarion Counties, Pennsylvania* (PennDOT, May 2003)*; (memo of January 18, 2002, meeting on East Brady Bridge replacement project)* (KCI Technologies 2002); *Clubshell* (Pleurobema clava*) and Northern riffleshell (*Epioblasma torulosa rangiana*) Recovery Plan* (U.S. Fish and Wildlife

Service 1994); and other information available in Service files. A complete administrative record of this consultation is on file at the Pennsylvania Field Office.

DESCRIPTION OF PROPOSED ACTION

The following project and project area descriptions are taken from FHWA and PennDOT District 10-0's revised May 17, 2002, *Biological Assessment of the State Route 0068, Section 350, East Brady Bridge Project over the Allegheny River, Armstrong and Clarion Counties, Pennsylvania* (BA) and the May 2003, Addendum to that Assessment. A summary of the project description follows.

As defined in 50 CFR § 402.02, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States. The "action area" is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (e.g., the area in which physical disturbances are expected during bridge construction or demolition). Delineation of the action area requires a biological determination that considers the anticipated direct, indirect, and interrelated/ interdependent effects to listed species and their habitats. Although the action area was not clearly defined in the BA, the Service has described the action area to include: 1) a project area extending from 300 feet upstream of the existing East Brady Bridge to 1,200 feet downstream of the proposed new bridge, which includes the area that will be directly disturbed and the extended area where siltation, river bed instability, and hydrologic alteration are expected to occur; and 2) an as-yet undetermined off-site mussel holding location for animals salvaged from the project area prior to any instream activity. Subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take are based upon this action area.

The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present federal, State, or private activities within the action area. This biological opinion addresses those actions for which we believe adverse effects may occur. In the BA for this action, FHWA and PennDOT outlined those activities that would adversely affect the clubshell and northern riffleshell. The following opinion addresses whether implementation of the project is likely or not likely to jeopardize the continued existence of these two species.

Within the action area at East Brady, the Allegheny River (river mile 70.7) flows generally south towards Pittsburgh through the sharply turning river channel known as Brady's Bend. Brady's Bend is in the Pittsburgh Plateau region of the Allegheny Plateau physiographic province. The valley is steeply cut, and the general area is bisected by rolling hills. The width of the river is approximately 720 feet (220 meters), with average depths typically between three and 25 feet (1-8 meters). Depths near the proposed new bridge and at the existing bridge average about 12 feet. Four flood control projects have been constructed in the Allegheny River watershed upstream of the proposed project. These include Union City Dam, Woodcock Creek Dam, Tionesta Dam, and Kinzua Dam. Kinzua Dam is the largest of these structures, and has the greatest effect on river discharge at East Brady. The water surface at the existing bridge during late September 2000 was recorded to be 822 feet above mean sea level (amsl). The 100-year floodplain elevation is 843 feet (amsl) and the high ice elevation is 853 feet.

Locally, a small tributary stream, Sugar Creek, enters the proposed construction area from the west and appears to contribute significant silt loads to the Allegheny River, as evidenced by silt deposits just downstream of its confluence. A second (unnamed) tributary joins the Allegheny River on the eastern side of the river after passing through East Brady Borough.

Existing land use is primarily residential and recreational homes, and service industry. Water quality is primarily affected by past and present coal extraction, domestic sewage, and non-point source runoff. The river is maintained at navigable depths by the U.S. Army Corps of Engineers up to the existing East Brady Bridge by Lock and Dam Number 9, located at river mile 62.2. The Pennsylvania Fish and Boat Commission (PFBC) maintains a boat launch on the west side of the river upstream of the existing bridge in Brady's Bend Township. The area is popular with recreational boaters, who launch from this point, from local river-front residences, and from downstream locations in the navigation channel. The river has a designated use of "warm water fishes" according to the Pennsylvania Department of Environmental Protection, Chapter 93 Water Quality Standards.

The proposed project involves construction of a new bridge on State Route 0068, Section 350, over the Allegheny River at East Brady, Pennsylvania, and demolition of the existing SR 0068 bridge. The proposed bridge construction is on a new alignment approximately 360 feet (110 meters) downstream of the existing bridge. Bridge approaches will also be changed on both ends of the structure. The construction sequence calls for traffic to be maintained on the existing bridge until the replacement bridge is completed. Bridge demolition is proposed to occur when traffic can be directed onto the new structure. A mussel salvage from the area anticipated to be directly affected by construction and demolition activities, along with captive holding, is proposed for the northern riffleshell, clubshell, and a limited number of rayed bean (*Villosa fabalis*), a species currently under review for federal candidate status.

The project description below is based on a preliminary bridge design, project schedule, and generalized implementation plan. Final project design, and detailed pollution and sediment control plans are proposed to occur later.

New Bridge Construction

The proposed new bridge structure consists of a four-span, continuous composite steel, multi-girder bridge supported by three piers, two of which are in the wetted portion of the river channel. The proposed pier locations have been positioned such that only one of the three piers is entirely within habitat occupied by the northern riffleshell and clubshell, while only a portion of the second pier is in occupied habitat. The proposed structure is approximately 1036 feet long by about 51 feet wide, and will be constructed of unpainted weathering steel, therefore periodic painting will not be required. Alignment changes are proposed for both sides of the bridge to remove roadway curvature on the bridge approaches and to provide access to the new bridge. Design plans for the new bridge approaches are not detailed in the BA.

Bridge and in-stream pier construction is proposed to occur from barges anchored in place by two or three 2-foot (0.6-meter) diameter spuds. The barges are comprised of interlocking 10-foot by 40-foot steel pontoons that can be self-propelled. Staging and launching of the barge

components is proposed to occur on the west (Armstrong County) side of the river between the new and existing alignments. Complete construction will require that the barges be relocated and re-anchored approximately 70 times. Barge placement is needed to access various bridge components during construction; therefore, barge placement is expected to occur in an area extending from 75 feet upstream to 75 feet downstream of the new bridge.

The proposed pier type is a reinforced concrete single shaft, multiple shaft, or solid wall constructed on buried rectangular footings. The proposed structure results in a reduced number of piers and barge anchor points, thereby reducing streambed effects over the five-span alternative. The construction method proposed for the two in-stream piers is to de-water and excavate the river bed material at each of the proposed pier locations. This will be done behind cofferdams constructed of sheet piling driven to below the foundation depth and supported during de-watering. The size and dimension of each of the cofferdams is not specified in the BA. The cofferdams will be maintained during excavation of river bed material, and construction and placement of the foundation, footings, and pier stems. The pier foundations will be placed below the natural streambed elevation, and no scour protection around the piers is proposed; therefore, the final structure will occupy approximately 703 $ft.^2$ of riverbed per pier.

The bridge deck drainage system will be designed to intercept runoff using scuppers near the ends of the bridge, and in troughs below the tooth expansion dams at the abutments. Collected drainage will be conveyed through a piping system until runoff can be discharged to the ground on erosion and sediment controlled areas.

Additional geotechnical investigations may be needed to finalize pier placement and design. If necessary, these investigations are proposed to be conducted from a barge, using four spud locations for each of the two core borings proposed for each of pier foundation sites.

Demolition of the Existing Bridge

The existing bridge is proposed to be removed by use of rapid controlled burns to cut the superstructure and drop it into the river. The wreckage will be disassembled and removed by barge with mounted cranes. The three existing piers are proposed to be entirely removed by a barge-mounted crane to a depth of three feet below the existing river bed. This will include the wooden cribbing used in the original pier foundation. Natural streambed material will either be placed into the river bed depressions created by pier removal, or will be allowed to be refill these voids via natural bed movement.

For both the construction and demolition phases of the project, an approved erosion and sedimentation control plan will be developed and submitted to the Clarion and Armstrong County Conservation Districts for review and approval. Erosion and sediment control measures will be monitored during pier construction and bridge demolition. Similarly, contingency plans for rapid response or remediation of impacts from unexpected events on the construction area (*e.g.*, floods, fuel spills, siltation) will be submitted to the Service and PFBC for review and comment. The Department will provide an inspector proficient in erosion and sediment control; preparedness, prevention and contingency plan implementation; and other environmental problems related to bridge and roadway construction. This inspector will be on the site daily

when the site is not stabilized, and this is intended to supplement, not replace, inspections employed by the contractor(s).

Maintenance

Annual cleaning of the bridge deck, neoprene troughs located under the open-tooth expansion dams, scuppers, down-spouts, and horizontal steel surfaces is proposed as maintenance. Periodic use of de-icing materials will be required to maintain a safe roadway during the winter months. Channel clearing and repair of scour protection will be performed on an as-needed basis, but the scope and timing of these activities are not described.

CONSERVATION MEASURES

Measures to offset potential direct and indirect effects to the northern riffleshell and clubshell will consist of on-site design and management features to reduce direct and indirect effects to a minimal level, and off-site measures that include captive holding and propagation. Incidental take associated with direct and indirect effects will be partially offset by a combination of on-site preservation, post-construction restoration of riverine habitat, and salvage and reintroduction of mussels. The FHWA/PennDOT propose to implement the following measures will be implemented as part of the proposed action to minimize incidental take of northern riffleshell and clubshell (BA pages 29-32; May 2003 amendment, page 5).

On-site Measures

1. The contractor will be made aware of the concern about introduction of zebra mussels to the site (*e.g.,* on construction equipment).

2. All equipment will be decontaminated and the contractor will be required to document the "exotic free" condition of all equipment and protective gear utilized during the project.

3. During the final design and refinement process, modifications to the bridge design will be pursued to further reduce the amount of runoff directly entering the river.

4. Salvage of northern riffleshell, clubshell, and up to 200 rayed bean mussels from the direct effect areas to a temporary off-site holding area is proposed. These animals will be returned to the project area after construction is complete, and the site has returned to pre-construction conditions. Immediately following salvage, non-listed mussels will be released into suitable habitat outside of the direct and indirect effect areas of the project.

5. Post-construction monitoring is proposed to occur for one year after salvaged specimens are returned to the site to determine their health and survival/mortality.

6. If requested, reintroduction of clubshell and/or northern riffleshell mussels may be augmented by laboratory-raised brood stock to supplement existing populations.

Monitoring of reintroduced progeny is proposed during the third year following reintroduction of the same.

Off-site Measures

Salvaged mussels will be held during the construction period at a facility approved by the Service.

STATUS OF THE SPECIES

Clubshell

The clubshell was listed as endangered in 1993. No critical habitat has been designated. This is a small to medium-size mussel, up to three inches long. The shell exterior is yellow to brown with bright green blotchy rays. The shell interior is typically white. The shell is wedge-shaped and solid, with a pointed, and fairly high umbo.

This mussel occupies a variety of stream and river conditions but is typically associated with clean, stable, coarse sand and gravel runs, often just downstream of riffle areas, in medium to small rivers and streams (Stansbery *et al.* 1982). It typically burrows completely beneath the substrate to a depth of two to four inches, relying on water to percolate between the sediment particles (Watters 1990). More than 50 percent of a population may not be visible from the substrate surface (Smith *et al.* 2001). As a fluvial organism, the clubshell can tolerate a range of water velocities annually, but appears to be intolerant of permanently slack water conditions (U.S. Fish and Wildlife Service 1994).

Many aspects of the life history of this rare mussel are not known, but probably generally follow those of closely related species. The adult clubshell is a sedentary filter-feeder, obtaining oxygen and food (most likely algae and detritus with associated fungi and bacteria) directly from the water column or from water flowing through the substrate (hyporheic flow). The breeding season appears to be initiated by seasonal changes, such as water temperature. Females hold unfertilized eggs in water tubes within specialized regions of the gills called marsupia. Males of the genus *Pleurobema* liberate sperm into the water in April, May, and June, and downstream females uptake the sperm with incoming water (Weaver *et al.* 1991). The eggs are then fertilized in the water tubes within the marsupium. The fertilized eggs develop into minute bivalve larvae, or glochidia, which are unique to freshwater mussels (Parmalee and Bogan 1998). While in the marsupium, developing glochidia are exposed to the adult's circulatory fluid, but not directly to the water column (Gardiner *et al.* 1991, Richard *et al.* 1991). The glochidia are discharged into the water column in June and July (Ortmann 1919).

Clubshell glochidia are obligate parasites on fish gills, a possible adaptation for upstream dispersal of a relatively immobile organism living in flowing water, and which would otherwise be flushed from the system over time. Not all fish species are suitable hosts. The striped shiner (*Notropis chrysocephalus*), central stoneroller (*Campostoma anomalum*), blackside darter (*Percina maculata*), and logperch (*Percina caprodes*) were capable of serving as hosts for the clubshell under laboratory conditions (Watters 1996, Watters and O'Dee 1997, O'Dee and

Watters 2000). It is likely that additional, as yet untested, fish species can be utilized by the glochidia of the clubshell in the wild.

As a sessile animal, the clubshell must lure a host fish to ingest the glochidia, which are bound together in a mucus matrix called a conglutinate. This structure mimics fish prey items, and often contains a high proportion of unfertilized eggs to make it more palatable. The gills and mouth of the host fish become infested when the fish attempts to eat the conglutinate (U.S. Fish and Wildlife Service 1994). The glochidia quickly become encysted on a suitable host fish and transform into juvenile mussels over a period of days to weeks. The transformed young fall from the host fish and burrow into the substrate. Unlike the adults, which are filter feeders, juveniles are relatively mobile and appear to be pedial feeders, sifting food items from sediments with hairlike structures (cilia) arranged on their foot.

The clubshell likely reaches sexual maturity between three and five years (Weaver 1991), and has a life span of 20 years or more. The clubshell is long-lived, and annually has low juvenile survival rates. This species, like many mussels, is susceptible to both temporary and periodic environmental degradation, as well as more permanent effects. Reduced populations may take several decades to recover, even if no further degrading events occur.

Few mussel species have declined as drastically in numbers as the clubshell. There is probably no single causative factor, but the decline is attributed to physical loss of habitat and degraded water quality resulting from impoundment, altered hydrologic regimes, point and nonpoint source pollution, agricultural effects, streambank clearing, coal mining, and urbanization (U.S. Fish and Wildlife Service 1994). The clubshell's apparent preference for smaller particle-size substrates that are relatively free of fine particulate (which would block interstitial flow) may also be a factor. Pockets of stable sand and small gravel substrates naturally occur in many streams; however, these areas may be more susceptible to deposition when sediment input is increased. Further, this substrate type may be more susceptible to scour resulting from more rapid precipitation runoff after land-clearing. Most of the remaining populations occur downstream of glacial lakes and reservoirs that reduce silt loads to the receiving stream, and buffer hydrologic changes resulting from land-clearing.

Pollution from municipal, agricultural, and industrial waste discharges has decreased or eliminated mussel populations directly, and indirectly through elimination of host fish species, resulting in reproductive failures (U.S. Fish and Wildlife Service 1994). Increases in turbidity and suspended sediments are detrimental in that they decrease the depth and amount of light penetration, affect primary productivity, decrease oxygen levels, increase water temperature, irritate or cause clogging of gills, and result in a blanket of silt on the substrate. Clubshells may be directly affected by siltation through smothering. High turbidity may interfere with sight lures, such as conglutinates, that attract host fish. Siltation also affects mussels by smothering eggs or larvae of the fish host populations and by reducing food availability. Siltation also fills interstitial spaces, eliminating spawning and habitat critical to the survival of young fish and juvenile mussels.

The exotic zebra mussel (*Dreissena polymorpha*) was accidentally introduced to North America through ship ballast water from interior European ports in the mid-1980's. The zebra mussel is

prolific, invasive, and poses a severe threat to all native mussel fauna, including the clubshell, through competition for space, food, and survival of glochidia. Zebra mussels are now present in several headwater lakes and reservoirs upstream from extant clubshell populations.

Historically, this species was once abundant and appears to have been a highly successful species occupying a range of riverine habitats throughout the Ohio River basin and tributaries of western Lake Erie (Stansbery *et al.* l982). It has been documented in over 100 streams throughout its range, although it now appears to be limited to only 19 streams (Watters 1988). In less than half of the stream of recent occurrence do the clubshell population show evidence of recent reproductive success (Table 1). Few of the extant clubshell populations occupy habitats that are protected from the threats identified to affect this species. This species often shares habitat with the northern riffleshell, and although more extensively distributed than that species, few populations appear to be stable, and population numbers are typically lower than the northern riffleshell, even within the Allegheny and Tippecanoe River watersheds. The Allegheny River and its tributaries, and the Tippecanoe River in Indiana, support most of the remaining clubshells.

Table 1. Clubshell populations are presently known to occur (or appear to be extant) in the following streams.

Basin	Meta-population	Stream	State	Approximate Range	Status[1]
Lake Erie (St. Lawrence River system)	St. Joseph River	St. Joseph River	OH	1 site	fresh-dead shell found
		East Fork of the West Branch of the St. Joseph River	MI	scattered over a 10- mile reach	present; reproductive status unknown
		West Branch of the St. Joseph River	OH	not reported	present; reproductive status unknown
		Fish Creek	OH	7-mile reach	rare (1995 oil spill over entire known population); status unknown
Ohio River	Tippecanoe River	Tippecanoe River	IN	scattered over 150 miles	present; reproducing (ESI 1993); zebra mussels in Lake Tippecanoe and other tributary lakes
	Green River	Green River	KY	Hart and Taylor Counties	rare; only fresh-dead shells found
	Scioto River	Little Darby Creek	OH	12-mile reach	present; reproducing (in metropolitan Columbus Area)
	Beaver River	Pymatuning Creek	OH	10 individuals at four sites	rare; no reproduction noted
		Shenango River	PA	2 sites	present; reproducing
	Muskingum River	Walhonding River	OH	not reported	rare; reproductive status unknown

Allegheny River	Allegheny River	PA	scattered over 66 miles	present; reproducing
	Conneaut Outlet	PA	500-foot reach	rare; no reproduction (3 live individuals found in 2002)
	Conneauttee Creek	PA	1 site	rare; no reproduction
	French Creek	PA	scattered--Erie, Venango, & Crawford Co.	present; reproducing
	LeBoeuf Creek	PA	3-mile reach	present; reproducing
	Muddy Creek	PA	1 site	rare; unknown
Kanawha River	Elk River	WV	Braxton and Clay Counties	present; reproducing
Monongahela River	Hackers Creek	WV	100-yard reach	rare; reproductive status unknown
	Meathouse Fork	WV	not reported	rare; reproducing

[1] A status of “rare” indicates that less than ten individual living or recently dead specimens have been observed in recent years in that water body.

The northern riffleshell is a small to medium-size mussel, up to three inches long. The shell exterior is brownish-yellow to yellowish-green with fine green rays. The shell interior is typically white. The species is sexually dimorphic; male shells are irregular ovate in outline, with a wide shallow sulcus just anterior to the posterior ridge. Female shells are obovate in outline, and greatly expanded post-ventrally.

According to Williams *et al.* (1993), the genus *Epioblasma* is among the most diverse of the Unionidae in North America, with 25 recognized taxa. This genus once ranged from the St. Lawrence River system to the Mobile River system, principally in larger rivers. All but one species in this genus are either thought to be extinct or are listed as endangered species under the Endangered Species Act. The two sibling species associated with the northern riffleshell, the tubercled blossom (*E. torulosa torulosa*), and green blossom (*E. torulosa gubernaculum*) have not been seen alive or freshly dead in recent decades, and may be extinct.

The northern riffleshell occurs in clean, packed, coarse sand and gravel in riffles and runs of small and large streams (Stansbery *et al.* 1982, Watters 1990). The species buries itself to the posterior margin of the shell, although females may be more exposed, especially during the breeding season (U.S. Fish and Wildlife Service 1994). From May to September, gravid females of this species expose a brilliant white mantel margin to attract host fishes. The northern riffleshell is a long-term breeder (bradytictic), with fertilization in the late summer and glochidial release the following spring or summer (Ortmann 1919).

The host fish of the northern riffleshell have been identified as the banded darter *(Etheostoma zonale*), bluebreast darter (*E. camurum*), brown trout (*Salmo trutta*), and banded sculpin (*Cottus carolinae*). Some of these species (brown trout and banded sculpin) are not native to the extant range of this species. The host suitability studies described above did not test all of the fish species that are native to the range of the northern riffleshell; therefore, it is likely that additional host species can be utilized by northern riffleshell glochidia.

No detailed life history studies of the northern riffleshell have been completed, but it probably generally follows those of closely related species. Like the clubshell, the adult northern riffleshell is a sedentary filter feeder, obtaining oxygen and food directly from the water column or from water flowing through the substrate (interstitial flow). The breeding season appears to be initiated by seasonal changes, such as changes in water temperature. Females hold unfertilized eggs in water tubes within a more specialized marsupial region of the gill than does the clubshell. In the related tan riffleshell, males liberate sperm into the water in August and September, and downstream females uptake the sperm with incoming water (Rodgers *et al.* 2001). The eggs are then fertilized in the water tubes within the marsupium, where they are held until the following summer. The expanded shell shape of the female riffleshell results from shell growth around the expanded marsupial gill region. The fertilized eggs develop glochidia as in clubshell, except that they are discharged primarily in May and June. Individuals within a population exhibit a range of behaviors, and may release glochidia from spring through late summer. The tan riffleshell populations in Virginia are not visible on the substrate surface from

a seasonal vertical migration (Anderson 2000).

Riffleshells appear to have a relatively short life-span for a freshwater mussel. Sexual maturity can be reached in as little as three years, and most individuals probably live for only eight to 15 years (Rodgers *et al.* 2001). Like other mussels, the northern riffleshell probably experiences very low annual juvenile survival. The combination of short life span and low fecundity indicates that populations depend on a large annual cohort resulting from a large population (Musick 1999). Species following this reproductive strategy are susceptible to loss of individuals from predation and stochastic events, and are slow to recover from such losses (Rodgers *et al.* 2001), but may be well suited to exploit dynamic micro-habitat shifts characteristic of free-flowing rivers.

Overall, the northern riffleshell is more restricted in range than the clubshell, but population numbers may be higher. As stated above, large populations appear to be necessary for the long-term conservation of this species; below this level, mortality exceeds reproductive potential and the population may crash.

The northern riffleshell is subjected to many of the same threats as described for the clubshell above. As with that species, there is probably no single causative factor for its decline, although physical loss of habitat and degraded water quality are key factors. Altered hydrologic regimes resulting from land-clearing, mining, agriculture, urbanization, and channelization were probably responsible for many of the population losses observed (U.S. Fish and Wildlife Service 1994). Point and non-point source pollution and acid mine drainage probably contributed to the species decline in various portions of its range.

The historical range of the northern riffleshell was somewhat similar to that of the clubshell, but with extensions farther north into Michigan and Ontario tributaries of Lake Erie, Lake St. Clair, and the Detroit and St. Clair Rivers (U.S. Fish and Wildlife Service 1994). The northern riffleshell has suffered a range reduction of over 95 percent. Of 54 known streams once known to be occupied by this species, six still support populations of the northern riffleshell, and only three of these show evidence of reproduction -- two in the Allegheny River system (Allegheny River and French Creek, Pennsylvania), and the Sydenham River, Ontario, Canada (Table 2). The northern riffleshell was listed as endangered, without critical habitat, in 1993.

In 1992, a population of the northern riffleshell in the Detroit River in Michigan was found to be threatened by invasion of the exotic zebra mussel. Divers collected 30 to 40 individuals, which were relocated to the St. Clair River in Michigan. About a dozen individuals were kept in captivity. Populations of northern riffleshell in the St. Clair and Detroit Rivers appear to have been extirpated by zebra mussels (M. DeCapita, USFWS, personal communication 2002).

In the Allegheny River, the subpopulations are distributed over 66 miles of river (C. Bier, WPAC, *in litt.*, 6 January 1994; in U.S. Fish and Wildlife Service 1994). The species has been documented to occur in good numbers at several locations in the Allegheny River, but its distribution is discontinuous (*i.e.*, localized to areas of suitable habitat) and the condition of these

depressed vigor and a predominance of older adults.

Zebra mussels, as noted above, appear to have eliminated northern rifflesheIls in Lake Erie and the Detroit River. The zebra mussel was documented to be in French Creek in 2002, but is not known to occur in the free-flowing portion of the Allegheny River at this time. Zebra mussel populations are known from the Allegheny River basin at Edinboro Lake and the lower navigation channel of the Allegheny River.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR § 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions that are contemporaneous with the consultation in progress.

During a quantitative sampling effort of the Allegheny River in 2000, from 75 m upstream to 300 m downstream of the existing East Brady bridge (a 58,201 m^2 area), 1,443 0.25-m^2 quadrats were excavated, documenting 993 freshwater mussels of 14 species. Three areas of greater mussel density were reported; two are downstream of two of the existing piers, and a third is along the left descending bank. Mussel densities in these areas generally ranged from 1.5 to 5.7 mussels/m^2, with a maximum density of 14.3 mussels/m^2 (Skelly and Loy 2001). Approximately 80 percent of the project area is estimated to contain suitable mussel habitat (an area of about 46,481 m^2). The overall mussel density in the project area is 2.75 mussels/m^2; therefore, approximately 127,824 mussels inhabit the project area.

In order of abundance, the spike (*Elliptio dilatata*), mucket (*Actinonaias ligamentina*), and rayed bean (*Villosa fabalis*) constitute 42.4, 31.0 and 18.2 percent of the overall mussel population, respectively. The presence of between 25,237 to 36,454 rayed bean in the project area is notable, since this species may become a federal candidate and eventually be listed as threatened or endangered. The rayed bean population at East Brady is among the largest known.

Candidate species are species for which the Service currently has substantial information on file to support the appropriateness of proposing to list as threatened or endangered. The rayed bean currently receives no regulatory protection under the Act, and it is not yet a candidate for such protection; therefore, the effect of the proposed action on this species will not be considered in this opinion, although salvaging up to 200 rayed bean mussels is proposed.

Table 2. The present range of the northern riffleshell has been reduced to the following streams; however, occupied stream reaches are generally restricted to a few miles or less.

Basin	Meta-population	Stream	State/ Canadian Province	Range	Status[1]
Lake Erie (St. Lawrence River system)	Detroit River	Detroit River	MI/Ontario		unknown; possibly extirpated by zebra mussels
	St. Joseph River	Fish Creek	OH	~2 miles	rare; possibly extirpated by a 1995 oil spill
	Sydenham River	East Sydenham River	Ontario	lower reaches	present; reproducing
Ohio River	Green River	Green River	KY	Hart and Edmonson Counties	rare; unknown(only freshly dead shells have been found)
	Scioto River	Big Darby Creek	OH	15-20 mile reach	rare; unknown reproductive status
	Allegheny River	Allegheny River	PA	scattered over 66 miles	present; reproducing
		French Creek	PA	Erie, Crawford, and Venango Counties	present; reproducing
	Kanawha River	Elk River	WV	Clay County	rare; only 2 live young animals have been found in recent years

[1] A status of "rare" indicates that less than ten individual living or recently dead specimens have been observed in recent years in that water body.

Within the vicinity of the East Brady Bridge, the clubshell occurs in low numbers. Prior to the freshwater mussel surveys conducted in relation to planning for the subject bridge replacement project, this species had not been documented to occur within the immediate project area. The closest previously documented location was at the Parker Bridge over the Allegheny River, approximately 14 miles upstream.

There are between 122 and 858 clubshells present in the area sampled from 246 feet upstream to 984 feet downstream of the existing bridge. The overall density of clubshells is estimated at 0.007 individual per m^2). Quantitative sampling is suitable for producing population estimates, but is generally not as efficient at finding rare organisms as is qualitative sampling; however, previous qualitative sampling at East Brady failed to find this species. The clubshell population located at East Brady was near the left descending bank, 260 to 820 feet downstream of the existing East Brady Bridge, and is bisected by the proposed new alignment. This species may be distributed elsewhere in the project area, but at a population density less than that which would be detected using the sampling protocol (*i.e.*, at a density less than 0.003 individuals/m^2) (Skelly and Loy 2001).

East Brady represents the most downstream, extant clubshell occurrence in the Allegheny River drainage. It is important because it is spatially distant from other populations of this species and, therefore, buffered against pollution and natural stochastic events, such as drought, that might damage upstream populations. Furthermore, this population represents a potential source for colonization of other areas of Pool 9 and perhaps the lower navigation pools.

Overall, this population is subjected to predation, acid mine drainage, and non-point source pollution in the Allegheny River watershed upstream. The zebra mussel poses a potential future threat to this population. Zebra mussels have become established at several locations upstream of the project area, as well as in the lower navigation channel of the Allegheny River, and in the Ohio River. However, zebra mussel populations in the Allegheny River have remained small, consisting of scattered individuals, suggesting that the Allegheny River may only provide marginal habitat for zebra mussels. This species does not currently pose a threat to the clubshell population at East Brady.

The right descending bank (west side) of the Allegheny River in Brady's Bend Township is influenced by heavy silt loads originating from Sugar Creek. This area is unlikely to be occupied by clubshells.

Northern Riffleshell

Within the vicinity of the East Brady Bridge, the northern riffleshell occurs in low to moderate numbers and has been known from this location since 1996. The closest documented occurrence upstream is at Parker, Pennsylvania, and downstream the northern riffleshell has been documented below Lock and Dam 9, in the tail-waters of Navigation Pool 8.

e existing bridge) is 0.045/m^2. Therefore, there are an estimated 2092 northern riffleshells in the surveyed area. Five of the 13 individual northern riffleshells collected were under 1 inch (25 mm) in length, indicating that this population is successfully reproducing. Furthermore, the population is broadly distributed in the area sampled, suggesting that suitable habitat is available for this species throughout that area. Mussel sampling data were divided into four cross sectional zones, each approximately12,000 m^2 in area. Densities of northern riffleshell were found to be somewhat higher in zone 3 (0.07/m^2) than in the other three zones (Skelly and Loy 2001). The proposed new bridge angles these zones starting in zone 3 on the right descending bank and finishing in zone 2 on the East Brady side of the river in the upstream leading edge of the concentration of mussels identified along that shore.

The northern riffleshell population at East Brady is subjected to many of the same threats as the clubshell, but because it is more widely distributed within the action area, it may be more resistant to degrading effects that are not channel-wide. Like the clubshell take of this species is in the action area may occur as a result of sewage and septic discharge, abandoned mine drainage, streambank clearing and subsequent erosion, and recreational boat grounding and anchoring. The northern riffleshell may be in the process of recolonizing areas of the river in the navigation channel, since it has not been reported from these river reaches until recent years.

The zebra mussel poses a potential future threat to northern riffleshell populations, but, as with the clubshell, zebra mussels are not currently known in the immediate vicinity of East Brady. Therefore, zebra mussels do not currently pose a threat to clubshell at this location.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

We anticipate the direct effect area associated with bridge construction will include: 1) the area outside, under, and inside the cofferdams, including substrate subjected to percussion impacts during sheet-pile placement and any external cofferdam supports; and 2) areas subject to the placement of barge spuds for pier and superstructure placement. Direct effects may also occur during: construction of barge launch facilities; construction and use of staging areas and access roads near the river; implementation of construction activities on the bridge deck; and operation of cranes and heavy equipment. We anticipate increased downstream siltation during construction. Additional geotechnical investigations may be necessary to complete final design. Drilling associated with this activity will kill or harm any northern riffleshell or clubshell in the vicinity of this drilling.

upland abutments; 2) the drop zone of the bridge superstructure; 3) the area subjected to immediate siltation following bridge demolition; 4) the areas where side-slope failure occurs during pier excavation; 5) and the areas where barge spuds are driven to allow for wreckage and pier removal. Direct effects will occur annually during seasons when bridge construction and demolition occur.

The areas within which direct effects are expected to occur extend from 75 feet upstream to 75 feet downstream of both the old and new bridge. An estimated 826 northern riffleshell and 129 clubshell occur in these zones. Within these areas 896 $ft.^2$ of direct effects are anticipated due to anchoring by barge spuds (this is less than one percent of the total area of suitable mussel habitat). Mussels that are inside, beneath, and immediately outside the cofferdams associated with the new bridge and in the existing bridge demolition fall area will be crushed or otherwise significantly disturbed during bridge demolition and removal. The area that will be directly affected by bridge demolition and the removal of the existing piers (through the use of a crane mounted on a barge) is estimated to be 18,342 ft^2. The area of suitable mussel habitat that will be directly affected by new pier placement is estimated to be 3,377 $ft.^2$ (703 $ft.^2$ for pier stems and 2,674 $ft.^2$ for the foundations). We anticipate that all clubshell and northern riffleshell occurring in the area defined as suitable mussel habitat beneath the East Brady Bridge, at the new pier locations, and at any barge anchoring points will be taken. Take (*e.g.*, death, injury, harm, harassment) is expected to occur due to suffocation, crushing, and/or displacement by construction and demolition activities.

A salvage of northern riffleshell, clubshell, and rayed bean from the direct impact area is proposed. Husbandry techniques for these species are poorly understood; therefore, losses over the five-year holding period may be extensive (up to 100 percent mortality is possible).

Barges and cranes are at risk of flooding, capsizing, or sinking during high flow events unless precautions are taken to avoid this. Construction materials and equipment may affect mussels downstream if washed into the river, and either physically transported downstream by currents, or if they spill toxic materials such as fuel into the river. Such spills may directly or indirectly affect both species, and result in take.

Design plans for the new bridge approaches, and an assessment of their potential direct and indirect adverse effects to listed mussels are not specified in the BA. We anticipate that construction of the new bridge approaches will potentially increase siltation (during earth disturbance) both to the Allegheny River and to Sugar Creek. We anticipate that the new bridge approaches will also change runoff patterns that may locally alter mussel habitat.

The concentration of mussels (*e.g.*, mussel bed) along the left descending bank that contains the clubshells observed will be especially sensitive to erosion on the East Brady side of the bridge approach. Sediment originating along this shore is likely to remain concentrated over this bed before becoming mixed in the Allegheny River. As filter feeders on microscopic food items, the northern riffleshell and clubshell are very susceptible to smothering by silt and other sediments in the water (Ellis 1936, in U.S. Fish and Wildlife Service 1994). Siltation also may result in reduced dissolved oxygen and increased organic material at the substrate level (Ellis 1936,

1987, in U.S. Fish and Wildlife Service 1994). Because the clubshell typically burrows completely beneath the substrate, it is particularly susceptible to siltation, which clogs the substrate interstices and suffocates the animal.

The area subjected to indirect effects from the proposed action is less well defined, in part because of the preliminary nature of the proposed project design. However indirect effects are expected to occur in the following areas: the streambed areas subjected to altered hydrology resulting from the removal of the three existing piers and placement of two new piers; the instream areas affected by new surface runoff patterns; and streambed areas that are de-stabilized during pier removal. An indirect effect area of two meters beyond the direct effect area of demolition is identified in the BA, but this does not include long-term hydrologic alteration of the streambed resulting from the removal of the existing bridge piers. Indirect effects are expected to occur downstream and upstream of the construction/demolition area, even during periods when construction activity is minimal, due to the presence of materials and additional structures (*e.g.*, piers) in the action area. Indirect effects are also expected to occur for several years post-construction as river currents and river bed stability are affected by the placement of piers in a new location. Indirect effects may result from sediment re-deposition and changes in flow patterns, resulting in loss or injury of mussels, changes in fish host distribution, and a reduction in habitat availability and/or quality for both mussels and fish.

A long-term alteration in habitat quality may occur within the action area. Water velocities during low flow periods may fall below required thresholds for these species in a less confined channel having two piers rather than the existing three. There is a potential for substrate scouring and re-deposition in association with removal of the existing piers and abutments, as well as the presence of the cofferdams during construction, especially during high flows that induce riverbed movement (*e.g.*, scour). Those mussels not killed or injured during this process may still suffer death, injury, or increased predation risk if they are unable to right themselves and re-burrow into suitable habitat downstream. Mussels downstream of the construction area may be subjected to adverse effects (*e.g.*, gill clogging, suffocation) caused by sediment re-deposition.

Due to the construction sequence, which calls for removal of the old bridge only after the new bridge is completed, five piers (two old and three new) will be present in the river during at least one winter, a normally high flow period that is also characterized by ice jams. If a significant flow event occurs when the new piers and old piers are in the river, scour in the project area could be extensive due to the constriction of the channel. Such an event is likely to directly affect northern riffleshells and clubshells by dislodging them from the substrate, transporting them with shifting substrate, and burying them downstream where the river flow decreases and transported material is deposited. Long-term indirect adverse effects are likely to occur as this material is then redistributed in subsequent flood events until a stable channel configuration is achieved.

Mussels will be smothered, buried and/or have their gills clogged from project-related silt and other sediments. Mortality, injury, and stress to mussels are expected from siltation and other

realignment of the bridge approaches, abutment construction, staging areas, and access road construction). Barge placement and use will require construction of a launch on the west side of the river, and an associated road to transport equipment to the barges. This will increase the likelihood of sediment and other pollutants reaching the river. Implementation of erosion and sedimentation control practices should help to minimize these sources of sediment.

Habitat degradation in the form of water quality impairment may also occur. Instream areas are likely to be adversely affected by runoff from the bridge deck when rain flushes oil, dirt, and other road surface deposits directly into the river. Declines in mussel populations have been documented downstream of bridges; these declines appear, in part, to be related to water quality changes (Andersen *et. al* 2003). Water quality degradation may result from bridge deck and approach road runoff carrying silt, hydrocarbons, deicing materials, and spilled toxic materials (should an accident occur on the bridge or approach road). Truck traffic and the related risk of potentially toxic spills may increase (in comparison to the existing bridge) because of the improved access provided by more direct bridge approaches. Treatment of some runoff near the bridge abutments is proposed. The extent of the risk to listed mussels from bridge deck runoff is related to the amount of the deck for which runoff can be intercepted and treated rather than being directly discharged to the Allegheny River.

Juvenile and adult clubshell and northern riffleshell, and fishes that serve as hosts for their glochidia, could be taken (*e.g.*, killed, injured, or stressed) or adversely affected by substrate disturbance (*e.g.*, scouring), increased turbidity, sediment deposition, and introduction of petroleum products into the river. The physical presence of construction activities may affect clubshell and northern riffleshell reproduction upstream and downstream by affecting transport of sperm and glochidia, or by modifying host fish behavior, travel patterns, or habitat use. These effects are expected to be short-term and localized in extent, but may result in take in the form of harm or harassment.

Interrelated and interdependent with the proposed action are instream effects from bridge maintenance activities, including channel cleaning, scour repair, and use of de-icing chemicals. These are not evaluated in the BA, and may differ from the effects of the existing bridge due to differences in structure design. The BA, however, does not contain sufficient information regarding the potential scope, location, scale, and timing of these actions for the Service to analyze potential effects to the clubshell and northern riffleshell.

The extent of both direct and indirect effects will depend on construction practices; river flows during construction; silt load in disturbed substrates; and the effectiveness of erosion and sedimentation control, and pollution prevention and remediation measures. Indirect effects may continue for the life of the bridge, especially since bridge maintenance is expected to be an ongoing periodic activity that may intermittently affect both species, and the new piers will result in ongoing channel re-configuration affecting the distribution and abundance of suitable mussel habitat.

iffleshell and clubshell will eventually return to near their present levels within the action area. However, significant silt and erosion, a toxic material spill event, or a rapidly altered scour pattern (events beyond what have been considered in this opinion) could eliminate the clubshell from the action area. Northern riffleshells have a higher reproductive potential and a larger population at East Brady than the clubshell. They are, therefore, expected to be more resilient and recover sooner. Recovery of the clubshell at this site will depend upon limiting activities that would alter flow patterns and disturb occupied clubshell habitat area along the left descending shore. These conclusions regarding long-term effects are based upon the following factors: 1) populations of the northern riffleshell and clubshell occur in the Allegheny River, immediately upstream and downstream of the construction area; 2) recruitment has been documented for the northern riffleshell within the action area; 3) direct adverse project-related river modifications are, for the most part, temporary; 4) the most significant adverse project-related effects are expected to be hydrologic adjustments by the river in response to the new structure (although these effects are expected to occur periodically in response to moderate to high river discharge events); and 5) PennDOT and FWHA will implement conservation measures to minimize impacts.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section, since they would require separate consultation pursuant to section 7 of the Act.

Residential and commercial developments are expected to increase in the action area, primarily in the form of seasonally-occupied homes. Continued recreational boating in the action area increases the likelihood that zebra mussels will be introduced. Some activities anticipated to affect the northern riffleshell and clubshell within the foreseeable future may require Federal involvement, because this species occurs in waters under the jurisdiction of the U.S. Army Corps of Engineers and U.S. Coast Guard. Therefore, to the extent that these actions are subject to consultation, they are not considered cumulative effects. In addition, non-Federal projects that are adjacent to habitat occupied by the northern riffleshell and clubshell, and which affect silt loads and flow in the action area, may be proceeding without mitigation.

gheny River at Brady's Bend Township, Armstrong County, and East Brady Borough, Clarion County, Pennsylvania. Suitable mussel habitat excludes heavily silted habitat within approximately 200 feet of the western side of the river.

Action type	Directly affected habitat	Indirectly-affected habitat
New piers	3,377 ft^{2} [a]	area predicted to extend 1,200 feet downstream
Bridge maintenance	unknown	area unknown; water quality effects possible
Bridge approach changes	near-shore areas along the eastern shoreline	near-shore areas along the eastern shoreline
Staging and barge anchorage [c] during bridge construction	660 ft^2	navigation Pool 9; possible zebra mussel introduction if precautions are not implemented
Barge anchorage during bridge removal [c]	236 ft^2	
Demolition and pier removal	18,342 ft^2 [b]	area predicted to extend 300 feet upstream and into indirect effects area of the new bridge
Total	22,615 ft^2 (19,238 ft^2 temporary and 3,377 ft^2 permanent [a])	300 feet upstream of the existing bridge to 1,200 feet downstream of the proposed new bridge

[a] Includes 703 ft^2 permanent pier area and 2,674 ft^2 potentially recoverable mussel habitat over the buried pier structure.
[b] Includes 1,134 ft^2 of potential mussel habitat after existing piers are removed.

[c] Barge anchorage consists of two, two-foot diameter spud touch-down points for each of two barges proposed. Each barge anchorage point will cover a total of approximately 3.14 ft^2 and will placed within 75 feet of either side of the bridges. Estimate assumes 70 barge relocations during construction and 25 barge relocations for bridge debris removal.

PREVIOUSLY ISSUED BIOLOGICAL OPINIONS

In reaching a decision about whether the implementation of activities is likely or not likely to jeopardize the continued existence of the clubshell and northern riffleshell, the Service must factor into its analysis previous biological opinions issued involving these species, especially for those opinions where incidental take was authorized. Those opinions are summarized in Table 4.

Table 4. Clubshell and northern riffleshell incidental take authorization in the United States

Project Name	Clubshell		Northern riffleshell		Citation
	Authorized Take	Number Relocated	Authorized Take	Number Relocated	
Kennerdell Bridge	208	41	875	529	U.S. Fish and Wildlife Service (1998a); U.S. Geological Survey (2002)
Utica Bridge	0	0	389	99	U.S. Fish and Wildlife Service (1998b); U.S. Geological Survey (2002)
Bicycle Bridge	52	0	0	0	U.S. Fish and Wildlife Service (1998c)
Foxburg Bridge	NA[1]	NA[1]	65	33[2]	U.S. Fish and Wildlife Service (2001)
Sugar Creek Township sewer siphon	0	0	20	10	U.S. Fish and Wildlife Service (2002)

[1]Not available; species is known to be present in project area, but at densities below detection based on the sampling methodology used.
[2]Action not yet completed, take and relocation effort estimated.

After reviewing the current status of the clubshell and northern riffleshell, the environmental baseline for the action area, the effects of the proposed East Brady Bridge replacement project, and the cumulative effects, it is the Service's biological opinion that replacement of the East Brady Bridge, with implementation of the conservation measures proposed by FWHA and PennDOT, is not likely to jeopardize the continued existence of the clubshell or the northern riffleshell. No critical habitat has been designated for these species; therefore, none will be affected.

The Service has based this determination on the relatively small size, scale and duration of anticipated effects to the species due to project implementation (*e.g.*, because of barge use, conservation measures, etc.). Considering this, relatively few northern riffleshell and clubshell are likely to be killed or injured. The site at East Brady is significant because it extends the range of the clubshell downstream to the navigable portion of the Allegheny River, and represents one of two sites within the navigation system that supports northern riffleshell. However, several higher-density northern riffleshell sub-populations, and several other clubshell populations occur upstream of the action area in French Creek and the Allegheny River. Many of these documented sites support greater numbers of these species, and have higher quality habitat. The quality of the habitat in the action area has been influenced by impoundment and siltation from Sugar Creek, resulting in reduced northern riffleshell and clubshell populations. Therefore, based on the anticipated effects of the action on the species, and on our range-wide review of the species' status, reproduction, numbers, and distribution, the Service has determined that the proposed action will adversely affect endangered mussels in the action area, but not to the extent that this will appreciably reduce the likelihood of survival and recovery of the northern riffleshell and clubshell.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the FHWA so that they become binding conditions of any grant or permit issued to the PennDOT, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to

implement the terms and conditions; or 2) fails to require PennDOT to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FHWA or PennDOT must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates that take in the form of killing, harm, and harassment (as defined in 50 CFR §17.3) could occur as a result of the proposed action. We anticipate that clubshell and northern riffleshell will be taken during replacement of the East Brady Bridge through direct mortality, injury, and stress. Take is predicted to occur within the footprint of the barge spuds; cofferdams associated with construction of the new bridge piers; the demolition area of the existing bridge and piers; and in an area surrounding each of these features. Mortality and injury will also occur outside these directly affected areas due to sedimentation resulting from construction activities, scouring, and changes in hydrology related to the new bridge design.

Stress, short-term reproductive impairment, and limited mortality due to changes in hydrology, and construction-induced scour and deposition, are predicted to occur in an area extending from 300 feet upstream of the existing East Brady Bridge to 1,200 feet downstream of the proposed new bridge. Stressors include low oxygen, decreased food and sperm availability in the water column, and increased silt and other sediment loading. The project will also result in loss or decreased suitability of mussel habitat due to sedimentation and scouring. These events could result in harm to adult clubshell and northern riffleshell, the glochidial life stage of these species, and populations of host fishes.

We anticipate that clubshell and northern riffleshell populations within the action area will recover to near their present levels. Once the project is constructed, much of the mussel habitat will be restored following removal of the construction materials and equipment, and that mussels will eventually recolonize the area.

The actual level of incidental take will be difficult to detect or quantify for the following reasons: 1) as indicated by the results of the mussel survey within the project action area, the clubshell represents a small component of the mussel community; 2) individuals (juveniles and adults) of both species are small, and often buried in the substrate, making them difficult to locate; and 3) finding dead or injured specimens is unlikely.

The estimated take of the northern riffleshell within the action area of the proposed East Brady Bridge replacement is based on the area of suitable mussel habitat anticipated to be directly affected by the proposed activities. The anticipated area of suitable mussel habitat that the BA indicates will be directly affected by all proposed activities (*i.e.,* areas with a high probability of being subjected to actual substrate disturbance) is 2,102 m^2 (22,615 $ft.^2$). Based on the 1443 excavated quadrat samples taken during the September 2000 mussel survey, densities are 0.045 northern riffleshell/m^2 and 0.007 clubshell/m^2. Implementation of the proposed project would be

of mortality and harm.

If a thorough survey and effective salvage attempt are conducted, this level of take should be reduced to 57 northern riffleshell and 12 clubshell, assuming: 1) mussels visible at the substrate/water interface will be located and retrieved during the salvage attempt; 2) salvage of the northern riffleshell and clubshell will be approximately 50 percent and 20 percent, respectively [based on field observations of the percentage of individuals visible on the substrate surface (Smith *et al.* 2001)]; and 3) captive holding mortality will not exceed 20 percent. However, some mortality, injury, and stress are also expected to occur from salvage activities. In addition, when handling mussels during salvage activities, spontaneous abortion of glochidia may occur.

The numerical take levels listed above are intended to provide estimates of the level of take due to direct effects only. The Service is unable to quantify the expected levels of take outside the areas in which direct effects are anticipated due to uncertainties regarding the extent of adverse effects (*e.g.*, hydrologic changes, scouring, and sedimentation). Any take that may occur outside the area in which direct effects are anticipated is expected to be minimal and in the form of harm and harassment. These levels of take are also based on preliminary project design; assumptions regarding the effectiveness of erosion and sedimentation control and pollution control plans at previous bridge projects in Pennsylvania; and full implementation of the conservation measures.

To further clarify and encompass all levels of anticipated take (direct and indirect), the Service is providing the following additional narrative criteria:

1. A maximum loss of 5 percent of mussel habitat within the area in which direct effects are anticipated to occur due to incomplete removal of project-related materials (*e.g.*, demolition debris) from the river following construction;

2. A maximum decline of 25 percent in total freshwater mussel abundance three years post-construction vs. pre-construction within the area in which direct effects are anticipated as determined from monitoring data (see Terms and Conditions, No. 4). It is anticipated that northern riffleshell populations will have recovered sufficiently within the five-year period following construction, through natural reproduction and reintroduction, that the overall population decline from the pre-project baseline will not exceed 10 percent. (The population density of both the northern riffleshell and clubshell are near detection levels, and though more sensitive, these two species respond as non-endangered species do to environmental disturbance. Therefore, population densities and diversity of the overall mussel community may be used as a surrogate measure for this criterion. Use of such a surrogate is prudent to avoid the monetary and ecological expense of monitoring with sufficient intensity to accurately detect changes in population density of the listed species);

3. Flood events occur at less than a 30-year re-occurrence interval while the new and existing piers are in the river. (While floods may result from either natural events or

ncrease the level of take evaluated in this opinion);

4. No spill or release of petroleum products or other hazardous substances into the Allegheny River;

5. The discharge of sediment during construction, as defined by a noticeable sediment plume extending up to 200 feet downstream of the construction site, or 75 feet downstream of the construction site along the left descending river bank.

If Criterion 1, 4 or 5 is exceeded, the FHWA shall immediately take remedial action(s); contact the Service for recommendations, and to determine if reinitiation of consultation will be required; and initiate with the Service an evaluation to determine the cause. If evidence suggests that the cause was related to this project, remediation and/or reinitiation of consultation may be required. If Criterion 2 or 3 occurs, contact the Service for recommendations and to determine if reinitiation of consultation will be required.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the clubshell or northern riffleshell.

REASONABLE AND PRUDENT MEASURES

We believe the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the clubshell and northern riffleshell, and expect that FHWA will ensure their implementation.

1. Implement project and conservation measures described in the Biological Assessment (pages 31 and 32) and Addendum (page 5).

2. Assess mussel populations and habitat (*e.g.*, streambed elevation and scour) after construction to determine if conditions are suitable for reintroduction of salvaged animals and to monitor take.

3. Implement measures to minimize adverse, project-related effects to *P. clava* and *E. t. rangiana* and their habitat.

4. Minimize the impact of bridge operation and maintenance on mussels and their habitat.

To be exempt from the prohibitions of section 9 of the Act, FWHA and/or PennDOT and their contractors must comply with the following terms and conditions which implement the reasonable and prudent measures described above, and outline reporting and monitoring requirements. The following terms and conditions are nondiscretionary:

1. Implement the project modifications and conservation measures proposed in the BA and Addendum to minimize project-related siltation and hydraulic impacts (*e.g.*, backwater and scouring) and other impacts to the clubshell and northern riffleshell and their habitat, plus the measures listed below.

    A. FHWA and/or PennDOT (as the applicant) will provide a description of the final bridge design, erosion and sedimentation control plan, and pollution prevention plan to the Service for review and concurrence at least three months prior to the start of any proposed construction activities to ensure that the resulting effects are consistent with those disclosed in the Biological Assessment and evaluated in this opinion (as related to the preliminary design).

        i. The erosion and sedimentation control plan will address all sources of project-related erosion and sedimentation, including barge launching sites, construction access roads, roadway approaches, staging areas, pier and abutment removal and replacement, etc.

            a. FHWA and/or PennDOT (as the applicant), and contractors, will monitor the project site daily when the site is active and not stabilized, and as soon as possible following severe storms or ice flows when the site is inactive and/or otherwise stabilized to ensure the erosion and sedimentation control practices are implemented, and to identify any project-related impacts due to scouring or sedimentation.

            b. To protect the concentration of mussels along the East Brady shore, including the clubshell, no sediments originating from abutment or access roads will be allowed to enter the Allegheny River along this shore.

            c. Best Management Practices for erosion and sedimentation control will be in place before, during, and after any work is conducted.

            d. A penalty system will be established for contractors that do not fully implement the erosion and sedimentation control plan**.**

        ii. Develop and implement a spill avoidance/remediation plan based on the most effective prevention and remediation practices to prevent hazardous materials (*e.g.*, petroleum products, solvents, paints, etc.) from entering

contained fueling and fuel storage areas away from the river.

a. FHWA and/or PennDOT (as the applicant), and contractors, will monitor the project site daily when the site is active and not stabilized, and as soon as possible following severe storms or ice flows when the site is inactive and/or otherwise stabilized, to ensure that spill avoidance practices are implemented.

b. No storage of toxic materials or fuels will be permitted along the East Brady side of the river to protect the concentration of mussels along this shore, including the clubshell.

c. If a spill does occur, emergency remediation procedures to contain the spill and/or prevent the spill from entering the Allegheny River will be implemented.

d. Implement a penalty system for contractors that do not fully implement the spill avoidance/remediation plan.

e. If flooding is anticipated, weather and river stages will be monitored and hazardous materials will be removed from the river and floodplain.

f. The Service will be notified immediately of any spills of hazardous materials.

B. No project-related or project-generated materials, waste, or fill will be deposited in areas which would result in fills of, or sedimentation to, any streams inhabited by threatened or endangered mussels.

C. Evidence will be provided to the Service that either 1) all equipment to be used in the Allegheny River (during construction or mussel relocation) has never been in zebra mussel-infested waters; or that 2) equipment has been appropriately cleaned, disinfected, and inspected for zebra mussel adults and veligers, using accepted protocols.

D. Contractors will be instructed on the importance of the natural resources in the project area and the need to ensure proper implementation of the required erosion and sedimentation control, and spill avoidance/remediation practices.

E. During the bidding process, prospective project contractors will be notified regarding the presence of endangered species in the project area and the special provisions necessary to protect them.

demolition contracts awarded for project implementation.

i. Endangered species are present in the project area and there is a risk of take (Endangered Species Act section 9 violation) if the Term and Conditions of the Service's biological opinion are not closely followed.

ii. All equipment to be used in the Allegheny River (during construction or mussel relocation) must either never have been used in zebra mussel-infested waters, or have been appropriately cleaned, disinfected, and inspected for zebra mussel adults and veligers, using accepted protocols.

iii. Best Management Practices for erosion and sedimentation control will be in place before, during, and after any work is conducted.

iv. Contractors will monitor the project site daily when the site is active and not stabilized, and as soon as possible following severe storms or ice flows when the site is inactive and/or otherwise stabilized to ensure the erosion and sedimentation control and spill avoidance practices are implemented.

v. Develop and implement a spill avoidance/remediation plan based on the most effective prevention and remediation practices to prevent hazardous materials (*e.g.*, petroleum products, solvents, paints, etc.) from entering the Allegheny River or contaminating soils or waters within the watershed. Such measures will include, but are not limited to, stationing of emergency response equipment at the project site, and designation of contained fueling and fuel storage areas away from the river. This plan will be submitted to the Service for review and concurrence at least three months prior to construction.

vi. Contractors will monitor weather and river stages, and remove any hazardous materials from the river and the floodplain in the event that flooding is expected.

vii. If a spill does occur, implement emergency remediation procedures to contain the spill and/or prevent the spill from entering the Allegheny River.

viii. The Service will be notified immediately of any failures of erosion and sediment control measures or spills of hazardous materials.

ix. No project-related or project-generated materials, waste, or fill will be deposited in areas which would result in fills of, or sedimentation in, any streams inhabited by endangered mussels.

ix) has been included in construction and demolition contracts prior to the initiation of construction.

G. To minimize take of endangered mussels in areas of that will be directly affected by bridge demolition and construction, conduct a salvage effort in the summer/fall season (*i.e.*, July thru September) prior to initiation of construction (excluding any additional geotechnical drilling) to locate mussels visible on the substrate surface. The salvaged mussels will be held in a suitable captive holding facility. We anticipate that the level of effort necessary to accomplish the salvage operation will be two teams of divers (two divers per team) conducting the salvage for three to five days.

i. The salvage will be conducted in the areas of that will be directly affected by bridge demolition (the expected debris fall area beneath the existing bridge) and immediately adjacent to, and within, the new pier locations and associated cofferdams. Excluded from the salvage area are the 75-foot barge anchoring zones upstream and downstream of both the proposed and existing bridges where direct effects are expected to be limited to barge spud placement.

ii. Develop and implement a plan for mussel salvage from the salvage areas, and mussel holding at an appropriate holding facility. The plan should include a protocol for maximizing the probability of finding the endangered mussels; a protocol for removing mussels from the substrate; and protocols for handling and holding mussels. Salvage of mussels must be done only when the water temperature is above 55 degrees Fahrenheit and water clarity is good. All procedures and techniques will require Service approval through the Pennsylvania Ecological Services Field Office. The mussel salvage plan will be submitted to the Service for approval at least three months prior to initiating any instream salvage activities.

iii. Prior to the salvage effort, the salvage areas will be clearly marked. Temporary and/or permanent marking shall be done in such a manner as to assist the salvage team. Bank and instream reference marking shall be done for the purposes of defining the salvage area prior to the construction season.

iv. Approved, qualified personnel who are thoroughly briefed on the techniques to be used will perform the salvage of mussels. These personnel will survey the salvage area via diving, wading, and/or snorkeling, as appropriate. Because dive conditions at the river bottom, will preclude consistent and accurate identification of mussels by divers, all mussels located shall be collected by hand and transported to the surface for identification. All mussel identifications will be done by a

from the Service, as well as a Scientific Collector's Permit from the Pennsylvania Fish and Boat Commission.

vi. A report documenting the salvage effort shall be prepared and submitted to the Service's Pennsylvania Field Office and the Pennsylvania Fish and Boat Commission within six months of completion of the salvage. The report shall include an introduction, methods section, results section, conclusion and/or summary, and any relevant supplementary information (*e.g.*, names and qualifications of surveyors). The methods section should detail protocols used for surveying, holding, handling, and transporting mussels; and proposed husbandry conditions and methods of the holding facility. The results section should include the total number of individuals of each mussel species collected; date collected; water and air temperatures; river stage; total number of live and dead clubshell and northern riffleshell collected; condition, size and approximate age of live clubshell and northern riffleshell; data regarding non-endangered mussels; and maps or figures showing project features (cofferdams, old bridge, new bridge) and salvage area. The report should also identify the location of the holding facility; primary project contact person at the holding facility; list of mussels (number, sex, and size) transferred to holding facility; mussel death or injury during transit; the time of departure from the salvage area; and the time of arrival at the holding facility. Annual reports of mussel survival will be made for the period of holding.

H. While in holding, clubshell and northern riffleshell will be held using a Service-approved protocol that will maximize survival and minimize stress (*e.g.*, held in containers circulating river water to ensure appropriate and consistent water temperature and oxygen levels).

i. Individual clubshell and northern riffleshell shall arrive at the holding facility within twelve hours of collection.

ii. In accordance with the project conservation measures, FWHA and PennDOT will incur the cost of transferring and maintaining salvaged mussels at a Service-approved holding facility for up to five years to encompass construction and site recovery time in anticipation of reintroduction on-site or elsewhere.

iii. If construction is delayed, FHWA is responsible for holding salvaged mussel for the additional period until reintroduction conditions in the project area are appropriate.

2. In accordance with the project conservation measures, FWHA and PennDOT will incur the cost of returning salvaged mussels and their progeny to the Allegheny River at East

after the salvage.

A. Within four years following the salvage, the area of anticipated direct adverse effects (75 feet upstream of the existing bridge to 75 feet downstream of the new bridge) shall be surveyed to determine the percent cover of project-related material (*e.g.*, demolition and construction debris) remaining in the river. A sampling plan shall be submitted to the Service for review and approval at least three months prior to conducting this sampling.

B. Assess impacts to the mussel community within the area in which direct effects are anticipated (75 feet upstream and downstream of both the old and new bridge) to determine if reintroduction of salvaged animals is appropriate and to monitor take.

i. Four to five years following the salvage (between May 1 and October 15, and under appropriate survey conditions), monitoring should be conducted to determine mussel diversity, and mussel abundance to determine if reintroduction of salvaged animals is appropriate. Surveys for mussels will be performed by approved, qualified personnel who are thoroughly briefed on the techniques to be used. These personnel will survey the direct effects area via diving, wading, and/or snorkeling, as appropriate. All mussels located shall be identified to species, recorded, and replaced in the substrate.

ii. Changes discovered in mussel diversity and abundance as detected by monitoring will be compared to the "Extent of Take" criteria. Should any of these criteria be met or exceeded, it will trigger a re-evaluation of project impacts on the clubshell and northern riffleshell. This may result in reinitiation of consultation with the Service.

iii. Prior to the reintroduction, develop and implement a monitoring plan capable of detecting survival and mortality of reintroduced animals or their progeny. The monitoring plan should be developed by a reputable biologist in coordination with the Service, and will be subject to review and approval by the Service.

iv. A report documenting the monitoring and reintroduction effect will be prepared and submitted to the Service's Pennsylvania Field Office and the Pennsylvania Fish and Boat Commission within six months of completion of monitoring. The report shall include an introduction, methods section, results section, conclusion and/or summary, and any relevant supplementary information (*e.g.*, names and qualifications of surveyors). The methods section should detail protocols used for surveying, reintroduction, and monitoring of mussels. The results section should include the total number of individuals of each mussel species collected;

regarding non-endangered mussels; and maps or figures showing project features (cofferdams, old bridge, new bridge) and salvage area.

v. One additional post-construction monitoring event may be necessary to determine survival of reintroduced individuals, pending Service review of the post-construction monitoring reports.

3. To minimize take of endangered mussels and alteration of their habitat, minimize instream construction- and demolition-related disturbance.

A. To reduce the area of streambed directly affected by bridge demolition, all decking and bridge members that are not necessary for bridge support should be removed through shore access (rather than dropping them in the river) when possible.

B. To reduce the area of direct and indirect effects related to pier removal, remove to the existing riverbed elevation.

C. The presence of additional bridge piers during high flow periods and periods of ice flows will increase the risk of take; therefore, instream construction will be completed in no more than two consecutive construction seasons.

i. Develop and implement a plan to monitor riverbed movement in the area where direct and indirect effects are anticipated (300 feet upstream of the old bridge to 1200 feet downstream of the new bridge) for evidence of scouring and sediment deposition. Monitoring will be conducted annually during construction and following any flood event with a greater than 30-year recurrence interval for a period of three years after the old bridge piers are removed. If it appears that scouring or sediment deposition is beyond that considered normal, the Service should be contacted promptly.

ii. A report documenting the scour and sediment monitoring will be prepared and submitted to the Service's Pennsylvania Field Office within six months of completion of each monitoring event. .

4. Operation and maintenance of the East Brady Bridge over the expected life of the project presents an ongoing potential effect on the northern riffleshell and clubshell. A plan should be developed to limit this effect.

A. Review alternatives for de-icing the roadway surface, and select materials that have minimal effects on aquatic biota.

B. To the extent practicable, implement drainage control measures (*e. g.*, runoff collection and settling basins, permeable roadway surfaces) that remove silt and

scour-hole repair, pier and abutment work, etc.).

5. If the instream portion of the project is not completed by 2008, FWHA shall reinitiate section 7 consultation to re-evaluate project impacts on the clubshell and northern riffleshell, and to determine the appropriateness of the reasonable and prudent measures contained in this biological opinion.

6. The Service's Pennsylvania Field Office and Region 5 Division of Law Enforcement are to be notified within 24 hours should any endangered or threatened species be found dead or injured as a direct or indirect result of the implementation of this project. Notification must include the date, time, and location of the carcass, and any other pertinent information.

   Clubshell or northern riffleshells that are accidentally killed, or that are moribund or freshly-dead and contain soft tissues, are to be preserved according to standard museum practices, properly identified or indexed (date of collection, complete scientific and common name, latitude and longitude of collection site, description of collection site), and submitted to a recognized museum or research facility (*e.g.*, USGS facility in Leetown, WV). The appropriate person at the selected repository institution should be contacted regarding proper specimen preservation and shipping procedures.

7. Notification must be made to the following Fish and Wildlife Service offices at least two weeks prior to beginning instream salvage activities.

   - Region 5 Division of Law Enforcement; 300 Westgate Center Drive, Hadley, MA 01035-9589 (telephone: 413-253-8343).

   - State College, Pennsylvania Field Office (Attn: Endangered Species Specialist); 315 South Allen Street, Suite 322, State College, PA 16801 (telephone: 814-234-4090).

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, we believe that no more than 57 northern riffleshells and 12 clubshells will be incidentally taken due to the direct effects of the project. An unknown number of clubshell and northern riffleshell (up to ten percent of the population in the action area) will be taken due to indirect effects. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service's Pennsylvania Field Office the need for possible modification of the reasonable and prudent measures. An unquantified level of incidental take is expected to occur outside the area in which direct effects are anticipated.

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid the adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service has identified the following actions, which, if undertaken by PennDOT and/or the FHWA, would further the conservation and assist in the recovery of the clubshell and northern riffleshell.

1. Implement conservation strategies identified by PennDOT's working group on mussels.

2. Participate in the development of a conservation plan for the northern riffleshell and clubshell in Pennsylvania, along with agencies that carry out activities that potentially affect the species (Recovery Plan, Task 1).

3. Host a workshop with bridge demolition experts to develop alternatives for bridge demolition that do not require dropping the structure into a river prior to removal.

4. Support research to determine captive husbandry techniques suitable for propagation of the clubshell and northern riffleshell. This action would partially meet the objectives of the Recovery Plan (Tasks 4.23, 4.24, and 4.3) for these species and may offset project-related effects elsewhere.

5. Within the Allegheny River watershed, implement and/or support projects that would improve water quality by reducing non-point source pollution. Such projects would include, but are not limited to, wetland preservation, wetland restoration, streambank fencing, and streambank restoration (via establishment of native plant species). This action would partially meet the objectives of the recovery plan (Recovery Plan, Task 2.2) for these species and may offset project-related effects elsewhere.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any of the above conservation recommendations.

This concludes formal consultation on the action outlined in the information presented with the Federal Highway Administration's September 20, 2002, request for initiation of formal consultation. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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David Densmore, Supervisor Date

Aidridge, D.W., B.S. Payne and A.C. Miller. 1987. The effects of intermittent exposure to suspended solids and turbulence on three species of freshwater mussels. Environmental Pollution 45:17-28.

Andersen, E. F., Eads, C., Devine, H. A., and Levine, J. 2003. Effects of land use and land cover on freshwater mussel populations in the Upper Neuse River Basin, NC: A GIS approach. The Freshwater Mollusk Conservation Society (abstract), March 16-19, 2003, Durham, North Carolina, USA.

Anderson, R.M., 2000. Assessment of freshwater mussels in the Allegheny River at Foxburg, Pennsylvania, 1998. U.S. Geological Survey, Water-Resources Investigations Report 00-4058. Lemoyne, Pennsylvania. 18 pp.

Ellis, M. M. 1936. Erosion silt as a factor in aquatic environments. Ecology 17: 29-42.

Gardiner, D.B., H. Silverman, and T.H. Dietz. 1991. Musculature associated with the water canals in freshwater mussels and response to monoamines *in vitro*. Biological Bulletin 80:453-465.

Harman, W.N. 1974. The effects of reservoir construction and channelization on the mollusks of the upper Delaware watershed. Bulletin of the American Malacological Union for 1974:12-14.

Musick, J. A. 1999. Ecology and conservation of long-lived marine animals. American Fisheries Society Symposium, 1999. 23:1-10.

O'Dee, S. H. and G. T. Watters. 2000. New or confirmed host fish identifications for ten freshwater mussels. Proceeding of the Conservation, Captive Care and Propagation of Freshwater mussels Symposium, 1998, pp. 77-82, Ohio Biological Survey, Columbus, OH.

Ortmann, A. E. 1919. A monograph of the naiades of Pennsylvania. Part III. Systematic account of the genera and species. Memoirs of the Carnegie Museum 8:1-385.

Parmalee, P.W. and A. E. Bogan.1998. The Freshwater Mussels of Tennessee. The University of Tennessee Press, Knoxville, TN. 328 pp.

Richard, P.E., T.H. Dietz, and H. Silverman. 1991. Structure of the gill during reproduction in the unionids *Anodonta grandis, Ligumia subrostrata*, and *Carunculina parva texasiensis*. Canadian Journal of Zoology 69:1744-1754.

Rodgers, S.O., B.T. Watson, and R. J. Neves. 2001. Life history and population biology of the endangered tan riffleshell (*Epioblasma florentina walkeri*) (Bivalvia: Unionidae). Journal of the North American Benthological Society 20:582-594.

American Benthological Society 20:118-132

Stansbery, D.H., K.G. Borror, and K.E. Newman. 1982. Biological abstracts of selected species of Unionid mollusks recovered from Ohio. Unpublished report prepared for the Ohio Heritage Foundation. Ohio Department of Natural Resources.

U.S. Fish and Wildlife Service. 1994. Clubshell mussel (*Pleurobema clava*) and northern riffleshell (*Epioblasma torulosa rangiana*) recovery plan. Hadley, MA. 68 pp.

U.S. Fish and Wildlife Service. 1998a. Biological Opinion for the proposed replacement of the Kennerdell Bridge (S.R. 3008, Section B00), located over the Allegheny River in Clinton and Rockland Townships, Venango County, Pennsylvania. Prepared for the Federal Highway Administration. U.S. Fish and Wildlife Service, Pennsylvania Field Office, State College, Pennsylvania. 32 pp.

U.S. Fish and Wildlife Service. 1998b. Biological Opinion of the Replacement of the Utica Bridge over French Creek (S.R. 3017, Section B00), Venango County, Pennsylvania. U.S. Fish and Wildlife Service, Pennsylvania Field Office, State College, Pennsylvania. 28 pp.

U.S. Fish and Wildlife Service. 1998c. Biological Opinion of the Replacement of the Bicycle Bridge over the Tippecanoe River, Carroll County, Indiana. U.S. Fish and Wildlife Service, Indiana Field Office, Bloomington, Indiana. 10 pp.

U.S. Fish and Wildlife Service. 2001. Biological Opinion, Replacement of the Foxburg Bridge over the Allegheny River (S.R. 0058, Section 150), Armstrong and Clarion Counties, Pennsylvania. Prepared for the Federal Highway Administration. U.S. Fish and Wildlife Service, Pennsylvania Field Office, State College, Pennsylvania. 30 pp.

U.S. Fish and Wildlife Service. 2002. Biological Opinion on the Impacts of the Sugarcreek Borough Pipeline Stabilization Project on the Northern Riffleshell and Clubshell. Prepared for Sugarcreek Borough, Venango County. U.S. Fish and Wildlife Service, Pennsylvania Field Office, State College, Pennsylvania. 23 pp.

U.S. Geological Survey. 2002. Summary report on monitoring of freshwater mussels relocated from the direct impact areas of the bridge at Kennerdell on the Allegheny River and the bridge at Utica on French Creek. U.S. Geological Survey, Kearneysville, WV. 26 pp.

Watters, G.T. 1990. 1990 survey of the unionids of the Big Darby Creek System. Final Report to The Nature Conservancy. 229 pp.

Watters, G.T. 1996. Hosts for the northern riffleshell (*Epioblasma torulosa rangiana*). Triennial Unionid Report, Report No.10, September 1996. 14 pp.

(Rafinesque 1820), and *Pleurobema clava* (Lamarck 1819). Triennial Unionid Report, Report No. 13, November 1997, pp. 38-39.

Weaver, L.R., G.B. Pardue, and R.J. Neves. 1991. Reproductive biology and fish hosts of the Tennessee clubshell *Pleurobema oviforma* (Mollusca: Unionidae) in Virginia. The American Midland Naturalist 126:82-89.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation Status of Freshwater Mussels of the United States and Canada. Fisheries, Vol. 18, No. 9., pp. 6-22.