West Virginia
Mussel Survey Protocols

March 2014

Middle Island Creek mussels including federally endangered Snuffbox. Photo by Janet L. Clayton

Prepared By

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Introduction

All mussels are protected in the State of West Virginia. In addition, nine federally endangered freshwater mussel species are known to occur in the State. These species are protected by the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Impacts to State and Federal protected mussels and their habitats should be avoided and minimized to the maximum extent practicable. If impacts cannot be avoided, all streams which contain mussels or potential mussel habitat must be surveyed prior to any proposed streambed disturbance.

As such, the protocols herein are designed to document the potential presence or absence of federally listed mussel species as well as provide for the protection of all native mussels within West Virginia. These protocols were developed to provide consistent and standardized guidance to project applicants about acceptable survey methods and levels of effort for different types of project types that are commonly encountered. These protocols may be appropriate for use in areas outside of West Virginia, and other states within the Upper Ohio River Basin should consider the application of these protocols.

Brief History of Ohio River Protocol

Most previous survey efforts have been based on the "Ohio River Protocol" (ORP) which was developed and then clarified by the Ohio River Valley Ecosystem Mollusk Subgroup in April 2004. This group is made up of both State and Federal agencies with interests in the Ohio River Basin as well as other interested parties including academia and mussel consulting companies. In 2004, the protocol also noted that it needed to be adequately field tested to determine if the standard guidelines presented were sufficient to protect the mussel resource and corresponding riverine habitat. The ORP was developed to guide mussel surveys in the Ohio River and protect sections which support federally listed mussel species and/or a native mussel concentration from the impacts of dredging/disposal activities. The ORP outlined a visual surface sampling approach designed to detect mussel concentrations, which were defined as one mussel per square meter. The assumption behind the ORP was that when a mussel concentration trigger was hit, that area would be avoided. Thus, the ORP was not designed to fully characterize the full species composition or density of a bed, and the recommended level of effort was not sufficient to determine probable presence of federally listed species.

Although the protocol was meant primarily to address commercial sand and gravel dredging, and later dredging/disposal activities (primarily for the COE maintenance dredging program), those types of activities have declined over time. Instead, in WV and other States, its primary use has been for proposed river based and shoreline development projects, which the original protocol was not designed to address. In most recent situations, the projects to which the surveys had been applied could not be moved, so the agencies were left with a survey detecting a mussel concentration that was not adequately characterized and would not be protected.

The ORP also did not address appropriate survey designs for smaller streams and the agencies realized that consistent recommendations for these types of surveys were needed. Finally, with the recent federal endangered listing of the snuffbox (*Epioblasma triquetra*), a species that spends much of its time buried and not visible on the surface of the substrate, the visual search method in the original ORP is generally not adequate to detect this species. Therefore, after numerous reviews of survey results and resulting activities, the WV Division of Natural Resources (WVDNR) and the U.S. Fish and Wildlife Service, West Virginia Field Office (USFWS) have determined that the Ohio River Protocol is not adequate for the protection of mussel resources that could potentially contain federally endangered species (ES) in the upper Ohio River Watershed, and that revised protocols needed to be developed.

The old ORP is defunct, and the protocol for surveying large rivers in WV has been refined along with the development of additional protocols for all mussel streams in WV. Given the number of contracting companies that are now available for conducting such work, standardized protocols are needed to address all stream types and the diversity of potential instream activities.

General Protocol Guidelines and Definitions

Prior Notification: Even though standardized protocols are established, survey plans must be provided to appropriate State and Federal officials when applying for a scientific collecting permit. This is to ensure that the appropriate protocol is being applied for given stream type and construction activity and to allow time for agency staff to review existing data from the proposed survey area and work with the applicant to design the appropriate survey extent as described below. Appropriate State and Federal officials shall be notified at least 30 days prior to the time the actual survey will occur. In addition, State and Federal agencies shall be given at least 30 days to review survey results prior to the anticipated start of the activity. State and Federal contact information is provided in Table 1.

Activities to be conducted on any ES or potential ES stream must have received concurrence from the USFWS prior to conducting any project activities including surveys, relocations and/or construction activities.

Data Longevity: Survey data collected on a specific site will be considered valid for five years from the date the survey was conducted. If mussel relocations are conducted, they should be done within the same field season as the expected instream activities. If these instream activities are to be conducted before June 15, then relocations may be conducted within the previous field season. Additional effort may be required just prior to construction activities depending on the results of earlier relocation efforts. Facilities/areas that have been dredged within the past 5 years do not need to be resurveyed unless the area is to be expanded or moved.

Mussel Survey Period: The survey period shall be from May 1 to October 1. Requests to conduct surveys outside this time period will generally not be approved. Any survey work outside this period will

be done only under extenuating circumstances, with separate approval obtained from the appropriate State and Federal agencies prior to conducting the work, and may require a revised protocol.

Visibility Requirements: Qualitative surface surveys must have a minimum visibility of one-half meter (m) (approx. 20in), with or without lights at **depth of survey**. When recording visibility along with other data, report the actual visibility rather than just note that it met the minimum requirement. If suitable visibility is not present at the intended time of the survey, then the survey must be re-scheduled, or a different protocol must be employed in consultation with the appropriate State and Federal agencies. (Example, more extensive quantitative surveys with excavations may be required).

Workable Flow Requirements: If the area cannot be effectively surveyed under existing flow conditions then the survey must be re-scheduled. Any variance must be approved by the appropriate State and Federal agencies.

Minimum Data to be Recorded: Standard data sheets shall be provided with the scientific collection permit. **Data sheets are to be completed in their entirety and shall be incorporated as appendices in the final project report.** Data shall be compiled and summarized separately at a minimum for area of direct impact (ADI), downstream (DS) buffer, upstream (US) buffer, and, at lateral (LT) buffer, if applicable. At a minimum, coordinates, in decimal degrees, shall be provided for the US and DS extent of each area defined above and any relocation sites. A photographic voucher of all native species must be provided to the appropriate State and/or Federal representatives. Any questionable species can and should be videoed providing a better reference for verification. The final report shall also include a map of the surveyed area along with the proposed project activities, and a copy of the valid collecting permit. **Note: Stating "see attached report" on the data sheet is not acceptable.**

Stream Groups: For ease of determining the appropriate protocol, West Virginia streams have been placed into four groups. A stream list by Group is provided as Appendix A.

Group 1: High Quality Streams (as listed by the WVDNR as having potential habitat for mussels) and State listed mussel streams, ES not expected.

Group 2: Small to mid-sized streams with ES expected.

Group 3: Large Rivers where ES are not expected. These include the Ohio River US of Hannibal Lock and Dam and the Monongahela River.

Group 4: Large Rivers where ES are expected. These include the Ohio River DS of Hannibal Lock and Dam, Little Kanawha River (slackwater section adjoining the Ohio River) and the Kanawha River.

Regardless of stream classification, all 4 groups of streams require a mussel survey (described in Project Specific Guidance section below) if the watershed area above the impact point is 2590ha (10mi^2) or larger. Those stream reaches designated as 2(1/2) require surveys regardless of size.

Potential ES and Mussel Concentrations Defined: Not detecting an ES during a Phase 1 survey does not confirm that it is not present. The presence of a diverse bed/mussel concentration indicates ES potential. At this time, a diverse bed or mussel concentration in small to mid-sized streams (Group 2) is defined as one that includes at least two mussel species not listed in Table 2. For large rivers (Group 4) a diverse bed is defined as one that includes at least three species not listed in Table 2 along any one transect, and/or 5 or more mussels per 10m segment on a surface search. If a diverse bed/mussel concentration is found, then ES may be present. If the area cannot be avoided then a Phase 2 survey must be undertaken as described below. The species listed in Table 2 are not used in describing a diverse bed with ES potential due to their general habitat preference and being commonly found in silt and sand not typically associated with the current list of ES found within West Virginia.

Visual or Surface Searches: A visual search includes moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5cm (2in) of substrate in order to better view the mussels which may be there. A minimum of 1 minute/m^2 of visual searching shall be expended in each segment of heterogeneous substrate.

Excavation of Quadrats: Substrate shall be excavated from all .25m^2 quadrats down to a depth of 15cm (6in) or hardpan. The material shall be collected and taken to the surface and sorted removing all live and dead shell material.

Project Justification

Alternative Construction Methods: On ES streams, alternatives must be addressed and evidence provided to the USFWS that avoidance is not possible before submitting a survey proposal. Any proposal shall include a survey area large enough to include all alternative locations. Activities such as pipeline/waterline crossings shall address alternative methods such as directional boring. Horizontal drilling practices shall be the first priority over open trenching to avoid impacts to mussels and avoid habitat fragmentation. A "frac-out" response plan shall be provided along with a notation on the potential for such a "frac-out". Survey permits may not be approved if the applicant does not provide adequate justification that instream impacts cannot be avoided. **Discussion of alternatives and how impacts will be avoided and minimized shall be included in the scope of work if the applicant wishes to proceed directly from a Phase 1 to a Phase 2 survey.**

Alternative Sites: Any project that has potential alternative locations for activities (example bridge alignments, pipeline crossings) should include surveys for alternative locations. We recommend a phased approach to prioritize sites with follow-up surveys within the least impacting project site selected.

Extent of Areas to be Surveyed

Survey Extent: Minimum coverage shall include area of direct impact and appropriate buffers, for each potential project alternative. Table 3 summarizes buffer requirements by stream group and activity

type. If the project may affect the natural hydrology of the stream, such as hydropower projects or installation of in-stream structures, then the survey effort shall encompass the area that may be affected. Hydraulic modeling may be required to determine the extent of hydraulic changes. If modeling is not conducted prior to surveying, the survey shall extend at least 1.6km (1mi) downstream. Additional surveys may be required if subsequent modeling determines hydraulic changes will extend farther downstream. Likewise, the mixing zone of an outfall shall be included within the survey area as shall the appropriate buffers described below and in Table 3.

Survey Approach

With the exception of streams with watersheds < 2590ha (10 mi^2) above the Area of Direct Impact (ADI), all other streams require mussel surveys of the ADI and all buffers US, DS, and LT, if applicable. Group 2(½) require survey regardless of upstream watershed area. The first step is a Phase 1 survey using timed area searches, transects or cells. Depending on the stream Group and outcome of the Phase 1 surveys, a Phase 2 quantitative or intensive qualitative survey may be required.

Timed Search Surveys consist of visually searching throughout a larger defined area (such as DS buffer, ADI, US buffer or mussel concentration) for a given period of time. This type of search can be used in Group 1 streams to determine if mussels are present and to define the limits of a mussel concentration or in all streams to generate a species richness curve. Timed search surveys covering each of the entire DS buffer, ADI, and US buffer are acceptable for Group 1 streams only. At a minimum, data shall be provided for each area separately.

Transect Surveys are required for Group 2, 3 and 4 streams unless conducting complete coverage using cells (described below). Transects shall be established throughout the proposed site perpendicular to the river. Each transect will be sub-divided into 10m segments for Group 3 and 4 streams and 5m segments for Group 2 streams. Along each transect, surveyors shall visually search an area 1m wide for mussels. If using transects, a Phase 1 survey for Group 2 and 4 streams must include a qualitative timed search survey for development of a species richness curve as previously discussed.

Cells may be used in lieu of transects. The establishment of cells is more appropriate for small to mid-sized Group 2 streams. Rather than transects spaced throughout each of the three designated areas, each area would be divided into a series of cells in which each would be surveyed. Maximum acceptable cell size is 10m by 10m. Minimum level of search effort per cell shall be 20 minutes. If any mussels are found then an additional 30 minutes per cell is required which provides for a total search effort of $2m^2$/minute.

Quantitative Samples are required as part of a Phase 2 survey on Group 2 streams. These samples shall consist of $0.25m^2$ systematic quadrats using the three random start methodology as described by Smith 2001. Substrate shall be excavated to a depth of 15cm (6in) or hardpan. The material shall be collected and taken to the surface and sorted removing all live and dead shell material.

Species Richness Curve shall be developed in addition to transect surveys for all streams in Group 2 and 4. Surveys using cells do not need to conduct additional qualitative surveys for development of a curve as the entire area has already been searched. The searches for curve development should be limited to the area of mussel concentrations (as determined in previous surveys). A sufficient number of searches should be conducted (typically 5 to 10 minute increments) such that a plateau is reached on a plot of cumulative number of individuals vs. cumulative species. Searches shall be conducted until at least 6 samples are collected with the addition of no new species.

Mussel Processing: In each segment or cell, any mussels observed will be bagged and brought to the surface for further processing and positive identification, unless the appropriate State and Federal agency representative both agree to allow some mussel identification to occur at the survey depth. However, any species which may resemble a federally listed species must be brought to the surface for positive identification. Mussels should be kept in water at all times, except for the brief period that they need to be out of the water to be measured or photographed, but no longer than 1 minute at a time. Mussels observed along the transect or within a cell will be recorded as occurring in a particular segment or cell. Appropriate information describing the depth and habitat conditions along each transect and within each cell, such as depositional areas, silt, mud, detritus, hard-pan, sand, and scoured areas where mussels cannot burrow, gravel, cobble, etc., shall be recorded for each segment or cell.

Stream Type Specific Guidance

Group 1 streams are those small to mid-sized streams not suspected of containing ES and timed search surveys are acceptable. At a minimum, data are to be provided for the ADI, US buffer, and DS buffer. If an ES is found then all work shall cease and the WVDNR and USFWS contacted.

Group 2 streams are those small to mid-sized streams with ES expected.

Phase 1- The objective of Phase 1 is to determine if a diverse mussel community is present in the project area. The survey design shall consist of transects, 1m in width, spaced no more than 10m apart, placed perpendicular to stream flow or cells not to exceed 10m by 10m in size. Data shall be compiled for each of the three areas (US buffer, ADI, and DS buffer) separately. Record data by 5m segment along the transect or by cell position. If a trigger is met (see below) and avoidance is not an option, then a Phase 2 survey shall be conducted.

Survey results that trigger avoidance or a Phase 2 survey include:

1. Mussel density of $0.5/m^2$ within any area of the survey and/or
2. Presence of at least two species not listed in Table 1 found within the survey extent described above.

Phase 2- The objective of Phase 2 is to collect sufficient data to determine if ES are present within the mussel concentration defined in Phase 1. Prior to conducting a Phase 2 survey, acceptable

justification for not avoiding the area must be provided to the WVDNR and USFWS. This should be included in the survey proposal. The Phase 2 survey for a Group 2 stream consists of a quantitative survey using excavations as described by Smith (2001). This survey shall be conducted using the three random start methodology throughout the area meeting the trigger criteria. The number of quantitative samples to be collected shall be calculated at the rate of 2 quads per 10m of transect. (Example: initial survey consisted of twenty 30m long transects resulting in a total of 600m of survey effort. Mussels were found throughout the entire area and met established triggers. Therefore, at the rate of 2 quads per 10m, 120 quads shall be excavated.) If two or fewer segments or transects separate target areas then those areas shall also be used in quad calculations and delineation of Phase 2 survey area. If cells are used then 2 quads shall be randomly collected from each cell that met established triggers and from each adjoining cell.

If the above effort has not detected an ES, timed search surveys shall be conducted within the area meeting the trigger for development of a species richness curve. This plots cumulative number of individuals vs. cumulative species.

Group 3 streams are large rivers where ES are not expected. These include the Ohio River US of Hannibal Lock and Dam and the Monongahela River.

Phase 1- The objective of Phase 1 is to determine if a mussels are present and to delineate the area. The survey design shall consist of transects, 1m in width, spaced no more than 100m apart, placed perpendicular to stream flow or cells not to exceed 10m by 10m in size. Data shall be compiled for each of the three areas (US buffer, ADI, and DS buffer) separately. Record data by 10m segment along the transect or by cell position.

Group 4 streams are large rivers where ES are expected. These include the Ohio River DS of Hannibal Lock and Dam, Little Kanawha River (slackwater section adjoining the Ohio River) and the Kanawha River navigation pools.

Phase 1- The objective of Phase 1 is to determine if a diverse mussel community is present and to delineate the area with a mussel concentration. The survey design shall consist of transects, 1m in width, spaced no more than 100m apart, placed perpendicular to stream flow or cells not to exceed 10m by 10m in size. Data shall be compiled for each of the three areas (US buffer, ADI, and DS buffer) separately. Record data by 10m segment along the transect or by cell position. If a trigger is met (see below) and avoidance is not an option, then a Phase 2 survey shall be conducted.

Survey results that trigger avoidance or a Phase 2 survey include:

1. 5 individuals/10m segment in any area of the survey and/or
2. Presence of at least three species not listed in Table 2 along any one transect (at least 100m in length) or combination of adjacent transects (at least 100 m combined length) or within a qualitative survey conducted between transects.

Phase 2: The objective of Phase 2 is to collect sufficient data to determine if ES are likely to be present within the mussel concentration defined in Phase 1. A Phase 2 survey within a Group 4 stream shall consist of more intensive qualitative surveys as described by Smith (2006). This requires an additional percentage of area to be surveyed and can be accomplished by adding additional transects between and around transects meeting trigger(s). The area meeting the trigger criteria shall be delineated and the amount of additional survey effort shall be calculated using the following criteria and formula from Smith (2006). A spreadsheet format is provided in Appendix B. A copy of the spreadsheet can be provided upon request. This is used for calculating the number of additional transects needed. **Note: The 10m transect spacing is not quite adequate to meet the 90 % probability of detection mentioned below. Be sure to calculate needed survey area if ES are expected.** Criteria to be used in calculations are:

1. .01 expected density
2. Ohio River DS of Willow Island Dam and Kanawha River US of Elk River, minimum 90 % probability of detection.
3. Ohio River, Willow Island Pool, Kanawha River downstream of Elk River, and Little Kanawha River slack water, 75 % probability of detection.
4. 0.4 search efficiency

Project Specific Guidance

Table 3 summarizes the specific layout of buffer zones and survey areas, organized by stream Group and potential project type. Those project types and any special considerations are discussed in more detail below.

Dredging

Group 4:

1. Mussel beds shall be protected by a buffer of 500m US, 150m DS and 150m LT. Instream disposal of dredge material is not covered under these buffers and will require additional coordination with the WVDNR and USFWS.
2. If less than 5 years has elapsed since the last dredging of the specific site, then no additional surveys shall be required. If more than 5 years has elapsed or the previously dredged area is being expanded or moved, then mussel surveys shall be required.
3. Minimally, a survey of 5 transects, with transects placed no more than 100 m apart, across the entire dredge site and buffers shall be required.
4. If no mussels are observed in two adjacent transects, with at least one of the transects containing apparent suitable mussel habitat, then a qualitative search for a minimum of 10 minutes will occur between the two transects in the area of suitable mussel habitat. If any live and/or fresh dead mussels are found between the two transects during the search, then an additional transect will be placed there and a search conducted as previously described.
5. If a trigger is reached, as previously identified, then a Phase 2 survey is required.

6. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI and a 10m buffer surrounding the area.

Group 3:
Sand and Gravel Dredging has the potential for a much greater impact to mussel habitat than more localized maintenance dredging at facilities. Therefore, buffers around mussel beds shall be the same as described above for Group 4.

1. Maintenance dredging: the buffers are reduced to 150m DS and 50m US and LT of the ADI.
2. A minimum survey of 5 transects, with transects placed no more than 100m apart.
3. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI plus a 10m buffer surrounding the area.

Linear Projects (example, barge loading facility with mooring structures)

1. A minimum survey of 5 transects, with transects placed no more than 100m apart, across the mooring areas and buffer zones is required.
2. A minimum of 500m of transect length shall be surveyed. (Example, 50m transects require a total of 10 transects to be surveyed.)
3. If the location of mooring cells are known, transects shall be placed to bisect these areas or placed as close to anticipated locations as possible. If cells are 50m apart then transects shall be placed 50m apart, not to exceed 100m apart.

Group 4: If the proposed activity is a new facility or expansion of an existing facility downstream, the survey extent shall include 500m DS and 150m US and LT of the ADI. If the proposed activity includes an existing facility and the expansion is upstream then the survey extent shall include a 150m buffer surrounding the ADI.

If a mussel survey has been conducted at an existing active facility within the past 10 years and reported poor habitat and low diversity and density, and the habitat is not expected to have changed, then the initial survey effort may be reduced by half.

In either case if a trigger is reached, as previously identified, then a Phase 2 survey is required.

Group 3: the survey extent shall include a 25m buffer around the ADI.

If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI and a 10m buffer DS, 5m US and 5m LT.

Large Scoping Projects (such as hydropower studies)

1. Transects should not be more than 100m apart.
2. Such a transect layout is not designed to find ES but to document mussel concentrations. Once a concentration is found (triggers noted above), a Phase 2 survey shall be completed for Group 2 and 4 streams.

Bridge Projects,

1. Groups 1 and 3 shall include a 10m buffer US and a 25m buffer DS of ADI.
    a. A timed search survey in each of the above areas shall be conducted at a minimum. Data shall be recorded separately for surveys within the DS buffer, ADI, and US buffer. The three areas should be broken into smaller cells for Group 3 streams and larger Group 1 streams.
    b. If avoidance is not possible and relocations are approved, mussels may be collected and relocated during the initial survey.
2. Groups 2 and 4 the buffer shall be a minimum of 100m DS and 50m US.
3. A minimum of three transects shall be surveyed within the ADI.
4. Transects shall be spaced no more than 10m apart throughout the survey area.
5. **Note: hydraulic changes occur with causeway construction and shall be considered as potential impact areas.**
6. The DS survey extent shall include any area that may be hydraulically impacted by bridge construction, demolition, or causeway, etc.
7. For new bridges, or complete removal and replacement of existing bridges, initial surveys shall include all areas that can be used for alternative construction sites.
8. If a trigger is reached, as previously identified, then a Phase 2 survey is required for Groups 2 and 4 streams.
9. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI and a 5m buffer US and 10m DS.
10. A 5m clearance buffer shall also surround a causeway that includes temporary bridges. This is the preferred causeway design. A 10m buffer shall surround a culverted causeway.
11. A 5m buffer shall surround piers.

Waterline/Pipeline and other Corridor Disturbances

1. Groups 1 and 3 shall include a 10m buffer US and 25m buffer DS of the ADI.
    a. A timed search survey in each of the above areas shall be conducted at a minimum. Data shall be recorded separately for surveys within the DS buffer zone, ADI, and US buffer zone.
    b. If avoidance is not possible and relocations are approved, mussels may be collected and relocated during the initial survey.
2. Groups 2 and 4 survey extent shall include a minimum of 100m DS and 50m US from the ADI.
    a. A minimum of three transects shall be surveyed within the ADI. One transect should occur within the footprint of the proposed corridor construction.
    b. Transects shall be spaced no more than 10m apart throughout survey area.
3. If a trigger is reached, as previously identified, then a Phase 2 survey is required for Groups 2 and 4 streams.
4. Discharge Outfalls shall include the mixing zone (MZ) and appropriate buffer as described above.
5. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI, a 5m buffer US and 10m DS. If pipe is not dug in (example – suspended on pillars), a 5m

buffer is acceptable on the DS extent. Depending on discharge composition of outfall, relocation of mussels from the MZ may be required.

Shoreline Protection (example rip-rap, gabion baskets, longitudinal dikes, etc)

1. All stream groups shall include a 10m buffer surrounding the ADI.
2. For Groups 1 and 3 a timed search survey in each of the ADI, DS buffer, LT buffer, and US buffer shall be conducted at a minimum. Data shall be recorded separately for surveys within the DS buffer zone, the ADI, and the US and LT buffer zones.
    a. If avoidance is not possible and relocations are approved, mussels may be collected and relocated during the initial survey.
3. If a trigger is reached, as previously identified, on a Group 2 or 4 stream then a Phase 2 survey is required.
4. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI and a 10m buffer DS and a 5m buffer US and LT.

Projecting Dike Structures (Group 3 and 4 streams only, finger dikes, zipper dikes, those not parallel to shore)

1. All surveys shall include a 10m buffer US and a 20m buffer DS and LT.
2. If a trigger is reached, as previously identified, on a Group 4 then a Phase 2 survey is required.
3. If avoidance is not possible and relocations are approved, mussels are to be relocated from the ADI and a 10m buffer DS and a 5m buffer US and LT.

Non-Commercial Docks in Group 3 and 4 streams do not require a mussel survey as long as they meet the following criteria:

1. Do not extend riverward more than 10m from low water mark (water's edge),
2. Do not contain any fill material other than pilings or post,
3. Contain 4 or fewer pilings or posts that are less than $1m^2$,
4. Are less than 10m (32.8ft) in length,
5. If within 500m (1640ft) of an island must receive clearance from USFWS.

Relocations

All native mussels are protected within the state of WV and if avoidance options are exhausted, must be relocated from the area of direct impact and buffer areas. **No mussels are to be moved without prior authorization from appropriate State and Federal authorities.** On streams with potential ES (Groups 2 and 4), coordination with the USFWS must occur prior to any relocation efforts. Relocation of any federally listed mussels will require formal consultation. This consultation process requires that the project applicant develop a Biological Assessment (BA) that quantifies the potential impacts to the species and that an incidental take authorization be issued by the USFWS prior to conducting any

activities that could adversely affect these species. This process may take up to 135 days from the time that a completed BA is submitted to the USFWS. Impacts to federally listed mussel species and their habitats must be avoided and minimized to the extent practicable. Additional conservation measures in above and beyond relocations may be required if the proposed project may adversely affect federally listed species.

1. For Group 2 and Group 4 streams relocations shall not be conducted until a review of findings by the WVDNR and USFWS has been conducted and approved. On Group 1 and 3, prior approval to relocate at time of initial survey may be granted.
2. Multiple passes shall be made through the area until less than 5 percent of the number collected on the original pass are recovered on the final pass.
3. Relocation effort shall be systematically conducted by a "moving transect" or establishing cells not to exceed 10m by 10m.
4. Effort shall meet the same standards as surveys, using standards for visual or surface searches.
5. Relocation sites shall be upstream (preferred) to an area of equal or better habitat, or to an approved relocation site in a discrete area recommended by the WVDNR. At a minimum, conduct a 15 minute qualitative survey of the relocation site and note all observations of resident mussels. **These shall be reported**, including coordinates in decimal degrees, to the responsible agency (WVDNR for all mussels, USFWS for ES species).
6. **If any ES are found during relocation efforts for projects where no ES were found during previous survey efforts, and no incidental take authorization from the USFWS has been received, then relocation efforts must be stopped and the USFWS should be immediately contacted.**

Table 1. Contact information for State and Federal Agencies.

West Virginia Division of Natural Resources
Scientific Collecting Permit
Barbara Sargent
PO Box 67
Elkins, WV 26241
304-637-0245
Barbara.D.Sargent@wv.gov

West Virginia Division of Natural Resources
State Malacologist
Janet Clayton
PO Box 67
Elkins, WV 26241
304-637-0245
Janet.L.Clayton@wv.gov

U.S. Fish and Wildlife Service
Ecological Services
Endangered Species Biologist
694 Beverly Pike
Elkins, WV 26241
304-636-6586 x19
Barbara_douglas@fws.gov
(Official requests are to be sent by snail mail)

Table 2. Species that can be excluded in defining a diverse mussel concentration by stream group.		
Species	**Group 1&2**	**Group 3&4**
Anodonta suborbiculata		X
Lampsilis siliquoidea	X	X
Lasmigona complanata		X
Leptodea fragilis		X
Potamilus ohiensis		X
Potamilus alatus		X
Pyganodon grandis	X	X
Strophitus undulatus	X	X
Utterbackia imbecillis	X	X

Table 3. Summary of buffer requirements and maximum transect spacing for various types of stream disturbances. Units are in meters. Survey extent shall include all buffers and the area of direct impact (ADI). After demonstrating need and receiving approval, mussels may be relocated from area described (salvage zone).

	US Buffer	DS Buffer	LT Buffer	Salvage Zone (ADI + Buffer Below)		Maximum Transect Spacing
				US & LT	DS	
Group 4	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Dredging	150	500	150	10	10	100[c]
Linear Projects (existing facility)	25	25	25	5	10	100[ac]
Linear Projects (new or expanding US or DS, see page 11 for required buffers)						
Scoping Projects		Project Specific				100[c]
Bridge Projects	50	100	BB	5	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Shoreline Protection	10	10	10	5	10	50
Projecting Dike Structures	10	20	10	5	10	
Outfalls	10	MZ + 100	10	PS		PS[c]
Group 3	Relocation at time of survey if approved					
Dredging (Sand and Gravel)	150	500	150	10		100[c]
Dredging (Maintenance)	50	150	50	10		100[c]
Linear Projects	25	25	25	5	10	100[a]
Scoping Projects		Project Specific				100
Bridge Projects	10	25		5	10	TS
Waterline/Pipeline Corridor Disturbances	10	25	BB	5	10	TS
Shoreline Protection	10	10	10	5	10	TS
Projecting Dike Structures	10	20	10	5	10	TS
Outfalls	10	MZ + 20	10	PS		
Group 2	Potential Phase 2 Surveys Required If Phase 1 Trigger Met					
Scoping Projects		Project Specific				10
Bridge Projects	50	100	BB	5[b]	10	10
Waterline/Pipeline Corridor Disturbances	50	100	BB	5	10	10
Shoreline Protection	10	10	10	5	10	10
Outfalls	10	MZ + 20	10	PS		10
Group 1	Relocation at time of survey if approved					
Scoping Projects		Project Specific				TS or 10
Bridge Projects	10	25	BB	5[b]	10	TS
Waterline/Pipeline Corridor Disturbances	10	25	BB	5		TS

a transect
s should be placed to bisect instream structures

b 10m buffer to clear around culverted causeways

c A minimum of 500m of transects shall be surveyed

TS Qualitative Timed Search Surveys permitted

PS Project Specific

BB Bank to Bank

MZ Mixing Zone

US Upstream

LT Lateral

DS Downstream

References:

Smith, D. R., R. F. Villella, and D. P. Lemarie´. 2001. Survey protocol for assessment of endangered freshwater mussels in the Allegheny River. J. N. Am. Benthol. Soc 20(1):118-132.

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