CONSULTATION DOCUMENT FOR THE NISOURCE MSHCP

Biological Opinion, Incidental Take Statement, Informal Consultation, & related documents

U.S. Fish & Wildlife USFWS
Regions 3, 4, & 5

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INTRODUCTION

This biological opinion (BO) responds to the U.S. Fish and Wildlife USFWS (USFWS) requirement for intra-USFWS consultation on the issuance of a section 10(a)(1)(B) permit pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq) (ESA), for the NiSource Multi-Species Habitat Conservation Plan (MSHCP). The MSHCP covers NiSource's construction, operation, and maintenance activities that may result in take of endangered or threatened species along its pipeline network. The permit application was certified as complete on April 1, 2011, and was officially transmitted by the USFWS's Regional Office in Bloomington, Minnesota. This BO also responds to the inter-USFWS consultation for multiple federal actions associated with the MSHCP. The MSHCP planning area is defined as a total of 9,783,200 acres surrounding NiSource's onshore natural gas systems in the states of Delaware, Indiana, Kentucky, Louisiana, Maryland, Mississippi, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia, along with several counties where potential expansion may occur in Ohio, Pennsylvania, Maryland, and West Virginia.

The USFWS worked closely with other federal agencies and NiSource to develop the MSHCP and other documents including the Final Environmental Impact Statement (EIS) and Implementing Agreement. NiSource approached the USFWS in 2005 to discuss options for complying with the ESA. They noted that certain natural gas transmission activities that may affect listed species are conducted without specific federal authorization or funding and would not be subject to consultation under section 7 of the ESA. In addition, NiSource recognized that individual project-by-project reviews under section 7 were time-consuming, inefficient, and likely not achieving the most effective conservation through a holistic, landscape approach. The USFWS agreed that an MSHCP and Incidental Take Permit (ITP) for all of NiSource's ongoing activities within the entire onshore pipeline system could provide greater conservation benefit through a landscape-scale conservation approach. Other federal agencies with permitting or funding authority were also brought in to the MSHCP development, as they were likely to benefit through reduced section 7 consultation workload. The MSHCP participants determined it is more practical, and gives a more complete picture of the extent of effects, to address the effects of all federal and non-federal actions in one analysis and develop a conservation package that is sufficient to address all effects and provide additional conservation that would contribute to the recovery of listed species. This resulted in the NiSource MSHCP and application for an ITP, and the resulting section 7 consultation.

Pursuant to section 7(a)(2), all federal agency actions (including issuance of the ITP) must be reviewed to determine whether such actions are likely to jeopardize the continued existence of any federally listed or proposed species or likely to cause destruction or adverse modification to designated or proposed critical habitat. The consultation will also address any proposed or candidate species that are in the action area. The BO summarizes and documents this section 7(a)(2) review.

The USFWS's primary federal action is issuance of the section 10(a)(1)(B) permit (incidental take permit; ITP) and associated implementation of the MSHCP. In conjunction with the primary action, the MSHCP involves federal actions by the U.S. Army Corps of Engineers (USACE), federal Energy Regulatory Commission (FERC), U.S. Forest Service (USFS), National Park Service (NPS), and multiple National Wildlife Refuges. As provided for in the section 7 implementing regulations (402.04), the consultation and conference responsibilities may be fulfilled through the lead federal agency. The USFWS has principal responsibility and therefore the lead role for this consultation. All other federal agencies are engaged and providing data as appropriate. An agency-specific summary of the actions subject to this consultation is provided in the Description of the Proposed Actions section of this BO.

Consultation Approach

This section outlines the section 7 consultation approach for the federal action agencies for all NiSource activities with a federal nexus. The MSHCP analyzes impacts of NiSource activities on forty-two listed species (defined as MSHCP Species) and requests take authorization for ten of these species (see Species That May Be Affected section). It is the applicant's prerogative to choose the species for which it develops an MSHCP and seeks incidental take authorization under section 10(a)(1)(B) of the ESA. However, pursuant to section 7 (and the USFWS's HCP Handbook), we must evaluate the impacts to any listed species that may be present within the action area. There are forty-seven additional listed species that occur within the MSHCP planning area, but are not currently addressed in the MSHCP (defined as non-MSHCP Species). Yet the agencies must still ensure that the proposed MSHCP activities do not jeopardize any species or destroy or adversely modify critical habitat. Therefore, the section 7 consultation will include an analysis for all listed or proposed species or critical habitats that may be directly or indirectly affected, regardless of their status in the MSHCP.

Multiple Federal Jurisdiction

If there is more than one federal authorization required for a project, consultation will be done by the lead federal action agency. Under most circumstances, we expect the lead action agency to be the FERC. However, the lead agency may be designated on a project-by-project basis according to the specific agency roles and connections.

ESA Requirements for Protection of Plants

The ESA treats listed plants differently from listed animals with respect to applicable prohibitions. For instance, the section 9 prohibition on "take" does not apply to plants. Therefore the USFWS cannot issue incidental take authorization for plants. But because plants are listed, we still must comply with the mandate of ESA section 7(a)(2). We will therefore assess listed plants to determine whether proposed actions will cause jeopardy, etc. We note that listed plants are protected from removal, malicious damage, destruction or being reduced to possession on federal lands, and other prohibitions elsewhere (see section 9(a)(2); 50 CFR

17.61; 50 CFR 17.71). It will be incumbent on the action agencies and the applicant to design step-down projects and subsequent authorizations with these restrictions in mind.

Informal consultation

For "no effect" or "not likely to adversely affect" (NLAA) species, we have created the appropriate file documentation (no effect determinations;
Appendix A) or a concurrence letter (NLAA species; **Appendix B**) to complete the consultation, including a process to revisit these determinations over the 50 year permit period. For completeness, these records are appended to this BO (see Appendices A and B).

Consultation Approach for MSHCP Species

For MSHCP species, we have sufficient information to complete an incidental take[1] analysis and determine the amount or extent of take that is reasonably certain to occur, and will complete a one-time consultation for the MSHCP/ITP through this biological opinion. For these species, no further consultation will be required provided projects proposed are in compliance with the MSHCP, ITP, and the incidental take statement (ITS).

Consultation Approach for Non-MSHCP species

We are lacking the necessary information to complete a full take analysis for non-MSHCP species; therefore, we will address take and conservation measures programmatically.

The programmatic portion of this BO establishes a two-level consultation process for future activities completed that may affect non-MSHCP species (Table 1). Evaluation of the MSHCP and associated federal authorizations represents the Level 1 consultation, with all subsequent site-specific evaluations for future actions completed as described by the MSHCP (and authorized by the ITP and other federal authorizations) being the Level 2 consultations. Under this approach, the Level 1 programmatic BO establishes guidelines and conditions that each individual future project must adhere to and operate within. These future projects will be subject to Level 2 consultations. The Level 1 programmatic opinion and ITS will estimate the level of incidental take that is anticipated to occur from future Level 2 projects. Due to the temporal and spatial uncertainty that exists at the programmatic level regarding the anticipated incidental take, however, incidental take will be exempted in the Level 2 biological opinions for site-specific actions as they are proposed, consulted on, and appended to the programmatic opinion.

[1] Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species, respectively, without 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.

Table 1. Outline of a programmatic consultation approach

Level 1 Consultation	BO establishes guidelines and conditions applicable to all future projects
	ITS estimates incidental take that is anticipated to occur from all future projects, but does not provide exemption
Level 2 Consultation	BO establishes project-specific guidelines and conditions
	ITS estimates and exempts incidental take that is expected for each project, including appropriate reasonable and prudent measures and terms and conditions

Under this programmatic approach, the federal agencies must continue to review all future individual projects to determine if they may affect a non-MSHCP listed species or designated critical habitat. Future projects that are likely to adversely affect listed species or designated critical habitat will be individually reviewed to determine: (1) whether they were contemplated in the Level 1 programmatic BO and (2) if they are consistent with the guidelines established in the Level 1 programmatic BO and whether any reasonable and prudent measures and terms and conditions provided in the incidental take statement are applicable. This will ensure that the effects of any incidental take resulting from individual projects is minimized. In response, the USFWS will produce a Level 2 BO that will be appended to the original programmatic BO.

Level 2 BOs will update the status of the species and environmental baseline project-by-project, as appropriate. The Level 2 BOs will provide exemption for some incidental take in accordance with the reasonable and prudent measures and terms and conditions provided in the Level 1 programmatic incidental take statement, *plus any additional project-specific measures required to minimize effect of the incidental take deemed necessary*. The original programmatic BO taken together with all project documentation contained in the Level 2 BO will make up the complete BO for each Level 2 project. In most cases implementing a programmatic consultation approach should significantly reduce the time required to complete formal consultation.

Future projects that are likely to adversely affect non-MSHCP listed species or critical habitat, and do not adhere to the guidelines and conditions evaluated during the programmatic consultation, or any future projects that are considered to be outside the scope of the proposed action (e.g., actions not contemplated in the MSHCP), will require separate formal consultations. NiSource is not authorized for take of non-MSHCP species that may occur during activities not permitted or funded by the federal agencies.

Information Standard

Section 7(a)(2) of the ESA requires that federal agencies undergoing consultation use the best scientific and commercial data available. The regulations implementing this section reiterate that both action agencies and the USFWS must employ this information standard in carrying out their consultation responsibilities [50 CFR §402.14(d) and (g)(8)][2]. The USFWS's Policy on

[2] Section 402.14(g)(8) also states that the Service "will give appropriate consideration to any beneficial actions taken by the federal agency or applicant.. ."

Information Standards Under the ESA [59 FR 3427 1 (July 1, 1994)l calls for the review of all scientific and other information to ensure that the information used by the USFWS to implement the ESA is reliable, credible, and represents the best scientific and commercial data available. The regulations [(50 CFR §402.12(d)(2)] also state that the USFWS may recommend discretionary studies or surveys that may provide a better information base for the preparation of a biological assessment (BA). However, any recommendation for studies or surveys is not to be construed as the USFWS's opinion that the federal agency has failed to satisfy the information standard of section 7(a)(2) of the ESA. The USFWS's Consultation Handbook [section 1.2(D)] states that, where significant data gaps exist, the agencies can agree to extend the due date of the biological opinion until sufficient information is developed for a more complete analysis, or the USFWS can develop the biological opinion with the available information, giving the benefit of the doubt to the species. The USFWS's regulations again reiterate this point, noting "if no extension of formal consultation is agreed to, the Director will issue a biological opinion using the best scientific and commercial data available" [50 CFR §402.14(f)].

Another ubiquitous issue in ESA decisions is the robustness of available data. More samples over longer time periods increase confidence that natural variability inherent to natural systems has been captured. However, while cautious scientists always value additional data, benefit of doubt to the species can be conferred by other means. For example, cushions can be added to best existing estimates, or sensitivity tests can be performed to explore effects of higher or lower values. Information from one location can be compared with larger data sets collected elsewhere and potential reasons for any apparent differences can be evaluated.

This BO contains (among other things) a description of the project, species affected, and anticipated impacts. We based our findings on our independent review of the best scientific and commercial data available. In doing so, we reviewed field reports and investigations by USFWS staff and others, evaluated information in our files and the scientific literature, and conducted interviews with species and technical experts regarding species ecology, phenology, and behavior.

CONSULTATION HISTORY

NiSource contacted the USFWS in late 2005, to discuss options for accomplishing ESA compliance and incidental take authorization with respect to natural gas transmission activities potentially affecting species listed as threatened or endangered under the ESA. NiSource wanted to explore options for ESA compliance that would provide more efficiency and flexibility than the traditional ESA consultation approach. The USFWS agreed that a MSHCP developed under Section 10(a)(1)(B) of the ESA could provide greater opportunities to address listed species' conservation needs.

On July 16, 2009, the FWS received the section 10(a)(1)(B) permit application package from NiSource. The permit application package included a draft HCP, draft appendices, the application form and application fee. In initial reviews, the application package was judged

incomplete and could not be certified due to the need to complete the species impact analyses, address funding uncertainty, and more thoroughly describe the response to changes and unforeseen circumstances. After addressing these issues, NiSource provided a revised MSHCP on April 1, 2011, which completed the application package. The USFWS certified the application package as complete and provided notice to the public that the application and MSHCP were available for public review and comment on July 13, 2011. The initial 90-day comment period was extended by a second notice on October 14, 2011. Ultimately, the comment period ended on December 13, 2011. Three public meetings were held in Columbus, Ohio, Lexington, Kentucky, and Charleston, West Virginia, on August 16, 17, and 18, 2011, respectively to provide additional opportunity for the public to receive information about the MSHCP. Following incorporation of public and agency comment, NiSource submitted the final MSHCP on May 1, 2013.

In late 2009, the FWS, NiSource, and other federal agencies began discussions began discussing the consultation requirements, and finalized an approach in December 2009. Overall, we agreed to a structure that incorporated both a single (one-time) and programmatic consultation approach, as outlined in the consultation documents (concurrence letter, BO). The USFWS determined that the MSHCP would serve as the BA for the MSHCP species, but that a separate BA would be necessary for the non-MSHCP species. In March 2011, the FWS, acting as the lead federal agency, in cooperation with NiSource, completed the BA for the non-MSHCP species. The BA was amended in June 2011 to incorporate analyses for the revised listing of the West Virginia Northern Flying Squirrel. The BA was further amended in May 2013 to revise analyses and conclusions due to changes in the proposed action. Based on the analyses in the MSHCP and BA, a draft BO, including appendices and attachments, was submitted to the federal agencies and NiSource for review in March 25, 2013. Further review of specific sections of the BO were completed in May and July 2013. Comments from this review were considered and incorporated into the final BO, as appropriate.

During entire consultation period, the FWS, federal agencies, and NiSource participated in numerous discussions and information exchanges via e-mail, conference calls, and meetings. Over this time, these entities acquired and exchanged information, performed impact analyses, and developed conservation measures for the listed species and critical habitat. Records of these events may be found in the administrative record.

BIOLOGICAL OPINION

1 DESCRIPTION OF THE PROPOSED ACTION

The action evaluated in this BO is the implementation of NiSource's MSHCP and ITP. NiSource Inc., provides natural gas transmission, storage, and distribution, as well as electric generation, transmission and distribution. NiSource Inc.'s wholly-owned pipeline subsidiaries are interstate natural gas companies that maintain and operate their onshore pipelines and appurtenant facilities. These companies are collectively referred to as NiSource throughout this BO and associated MSHCP and ITP including: NiSource Gas Transmission and Storage Company, Columbia Gas Transmission, LLC, Columbia Gulf Transmission, LLC, Crossroads Pipeline Company, and Central Kentucky Transmission Company. NiSource has requested section 10(a)(1)(B) incidental take permit for ten species (see Species That May Be Affected section) with a 50-year term. The federal actions addressed in this consultation are the specific activities in or involving the MSHCP for which the federal agencies have permitting or funding authority. As the lead federal agency, the USFWS also requested coverage of its and other federal agency actions for 50 years.

1.1 Action Area

The action area is defined as the area likely to be affected by the direct and indirect effects of the proposed agency action (50 CFR §402.02). Because there may be indirect effects from the federal actions included in the consultation that occur outside of the geographic area of the proposed action as described by the action agency, the action area of the biological opinion may not be the same as the actual geographic area of the proposed action.

The NiSource pipeline system includes approximately 15,562 miles of buried steel pipe ranging in diameter from 2 to 36 inches, 117 compressor stations with approximately 1.1 million in combined horsepower, and 6,236 measuring and regulating stations. NiSource also operates 36 storage fields comprised of approximately 3,600 individual storage wells in West Virginia, Ohio, Pennsylvania, and New York. For the purposes of this BO, the USFWS has defined the action area as the 9,783,200-acres defined as the covered lands in the MSHCP (Figure 1). The Covered Lands overlay NiSource's onshore pipeline system in the states of Delaware, Indiana, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. They include a one-mile-wide corridor centered on NiSource's pipeline or existing facilities and the full extent of 12 counties in which existing storage fields occur, namely Hocking, Fairfield, Ashland, Knox, and Richland counties, Ohio; Bedford County, Pennsylvania; Allegany County, Maryland; Kanawha, Jackson, Preston, Marshall, and Wetzel counties, West Virginia. The covered lands do not extend offshore into the Gulf of Mexico, but are limited to onshore NiSource facilities.

A description of the Action Area, including the physical and ecological setting, can be found under the Section 3 "Environmental Baseline."

Figure 1. General location of NiSource's covered lands and the action area

1.2 Habitat Conservation Plan

The MSHCP addresses the construction, operation, and maintenance activities of NiSource's pipeline and underground natural gas storage fields, and the effects of these actions on forty-two listed species. The MSHCP provides measures to avoid and minimize adverse effects to these species, and also to minimize and mitigate for the take of ten of these species. In this section we describe the covered activities and the conservation measures included in the MSHCP.

1.2.1 Covered Activities

Covered Activities are defined as the activities (i.e., actions) defined in Chapter 2 of the MSHCP to be carried out by NiSource and its agents in the covered lands during the implementation of the MSHCP. This section provides an overview of NiSource's proposed pipeline activities, including: (1) general operation and maintenance of NiSource's natural gas systems; (2) safety-related repairs, replacement, and maintenance of NiSource's natural gas systems; and (3) certain expansion activities related to NiSource's natural gas systems. The MSHCP does not cover activities outside the covered lands, emergency response activities, or activities associated with NiSource Inc., electric transmission or distribution facilities. This information is summarized from Chapter 2 of the MSHCP.

It is important to note, however, that the MSHCP does not contemplate unlimited construction or other surface disturbance within those counties or that corridor. NiSource will not utilize, clear, or disturb the entire one-mile-wide corridor or storage field counties, or even a significant portion of such corridor or counties. Actual surface disturbance associated with the covered activities will be far less than the covered lands in their entirety. In its MSHCP, NiSource estimated the annual average disturbance anticipated from both general O&M and construction activities to be at 19,409 acres. NiSource further estimates that 18,505 acres will be impacted within previously disturbed lands each year, most of which will consist of vegetation maintenance. New disturbance from construction, such as establishment of new ROWs and new storage field easements, will account for 904 acres annually. Based on this information, over the 50-year life of the permit, the total disturbance acreage impact from all activities is estimated at 970,450 acres.

In general, NiSource's activities occur on or within three main types of locations: pipeline right-of-ways (ROWs), appurtenant facility sites (AFSs), and access roads. The ROWs consists of a cleared and maintained corridor for the entire length of the pipeline (with the exception of coastal-area ROWs, which often have submerged pipeline facilities). The permanent cleared corridor width for a single pipeline is typically 50 feet centered on the pipeline; however, additional parallel pipelines (loop pipelines) require a larger width. An additional five to 50 feet of temporary ROW width may be utilized to facilitate pipeline construction activities. Temporary ROWs are cleared, graded, and restored during construction, and do not become a permanent part of the operating easement. Once construction is complete, landowners

typically allow temporary ROWs to revert to their original land-use status. In addition, extra work spaces outside of the ROW are often necessary. These extra work areas are temporary in nature and include staging areas, contractor's lots, or pipeyards, and various work activities that require extra space not provided by the standard construction ROW. Once a project is near completion, these areas are restored. A typical staging area may measure 50 feet by 100 feet, while a pipeyard or contractor's lot may occupy several acres.

Appurtenant facility sites (AFSs) contain appurtenant facilities apart from the pipeline that are accessory and integral to the operation of a pipeline system, (e.g., valve sets, launchers/receivers, compressor stations, measurement and regulation stations, storage wellheads, cathodic protection). The AFSs range widely in size, but are typically cleared and maintained locations and may be graveled, paved, maintained in a mowed herbaceous state, or a combination of the three. The sites may also be fenced. The AFSs may be owned in fee title (such as compressor station lots) or occupied through a lease/easement. Many AFSs can be and are accommodated within the standard ROW corridor width or may exceed or be located away from the ROW. Only AFSs that exceed an existing or planned ROW will be discussed explicitly in this document, with the remaining facilities categorized under ROWs.

NiSource facilities are accessed through the combined use of public roads, the ROW, and NiSource access roads. Access roads are non-public or otherwise non-traditional roads that are utilized and maintained (solely or in part) for access to existing or proposed facilities. Access roads are typically dirt and gravel and are typically constructed and maintained to 25-feet in width, with additional width provided for tight turns. The roads will either be temporary (used for access during construction only) or permanent (used during and after construction for operation and maintenance of the facilities). Length of a new road is normally contingent upon the facility's proximity to a public road and the area's topography (e.g., mountainous terrain may not be conducive to direct-access routing). Access roads are typically utilized under a lease/easement agreement with the landowner or land management agency.

There are two general categories for NiSource activities: Operation and maintenance (O&M) and New Construction. Operation and maintenance constitutes the overwhelming majority of NiSource's field activities and consists of those activities that do not require significant excavation or earth disturbance. Operation and maintenance includes activities conducted to keep the pipeline system operating efficiently and safely, and cause relatively minor disturbance, generally limited to ingress/egress and vegetation management. These activities are limited to existing ROWs, AFSs, and access roads.

New Construction includes those activities that require grading, excavation, or other significant forms of earth disturbing activities in order to construct, replace, inspect, and maintain the pipeline system. The disturbance may be minor such as a small (15-foot by 15-foot) excavation to repair damaged pipeline coating, or may be as significant as constructing 100 miles of pipeline within a new ROW. While New Construction activities occur far less frequently than O&M activities, construction has a far greater potential to impact the environment.

The MSHCP identifies several groups of actions within the O&M and New Construction categories. These groups of actions cover all of the activities necessary for operation of the pipeline system. For each group, the USFWS, with the assistance of NiSource, deconstructed the action into activities and subactivities. The subactivities allowed the USFWS to better understand the nature of each group of activities and, thus, better understand their potential impacts.

The following sections summarizes each group of covered activities as they will be used in this Biological Opinion, along with their constituent subactivities. Additional detail on each activity type may be found in the MSHCP (see Chapter 2). Here we breakdown the activity types into their constituent subactivities, to facilitate the analyses.

1.2.1.1 Vegetation Management (O&M)

Subactivities:

- Vegetation Management - mowing
- Vegetation Management - chainsaw and tree clearing
- Vegetation Management - herbicides - hand, vehicle mounted, aerial applications
- Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking
- Vegetation Disposal (upland) - brush pile burning
- Vegetation Management - tree side trimming by bucket truck or helicopter
- ROW repair, regrading, revegetation (upland) - hand, mechanical
- ROW repair, regrading, revegetation (wetland) - hand, mechanical
- ROW repair, regrading, revegetation - instream stabilization and/or fill

This group of subactivities includes the periodic vegetation control conducted to protect facility integrity and to accommodate the continued O&M and inspection of facilities. These activities may occur during any time of the year and will be confined to the ROW, AFSs, and access roads. Full-width mechanical clearing (mowing, tree clearing, and side-trimming) of ROWs is typically conducted every seven years and may occur as often as every three years.

NiSource uses an Integrated Vegetation Management (IVM) program aimed at managing vegetation and the environment to balance benefits of control, cost, public health and safety, environmental quality, and regulatory compliance. The IVM program is a system of controlling unwanted vegetation in which (1) undesirable vegetation is identified and action thresholds are considered, (2) all control options are evaluated and selected controls are implemented, (3) control choices include biological, chemical, cultural, manual, and mechanical, and (4) choice is based on effectiveness, environmental impact, site characteristics, worker/public health and safety, security, and economics. Through IVM, NiSource attempts to produce high quality wildlife habitat by promoting the establishment of a diverse mix of native grasses, sedges, and forbs, controlling nonnative species, and creating a transitional edge along the ROW border.

Vegetation management activities are conducted to prevent significant woody plant growth on the ROW which would restrict access for facility O&M and inspections. ROW repair, regrading,

and revegetation consists of minor actions to stabilize the ROW from erosional forces, install erosion control devices such as silt fence and/or interceptor diversions, and revegetate areas with insufficient plant growth. These activities can occur anywhere within the ROW or AFS. Field personnel access the facilities using ATV or rubber tired vehicles for repair work that is done by hand, larger projects could require tracked equipment for regrading and stabilization actions. ROW repair, regrading, and revegetation can occur any time of the year. Vegetation management techniques include tree clearing and side-trimming, mowing, and herbicide application. These techniques may be employed singly or in varying combinations. Techniques include hand removal (e.g., pulling, cutting), in addition to mechanical tools such as chainsaws and mowers. This group of actions also includes the disposal of vegetation, via burning or hauling or chipping.

Mechanical mowing consists of full ROW width clearing and is typically conducted every five years and may occur as often as every three years. To facilitate periodic inspections and surveys, a corridor typically not exceeding 10-feet in width (centered on the pipeline) may be mowed annually. Equipment typically consists of four wheel drive tractors equipped with a brush hog mower and hand operated chain saws. Vegetation is typically cut to a 6-inch height. Removal of woody vegetation up to 5-inches dbh is included in this activity. Full width clearing does not occur between April 15 and August 1. Specifications for mechanical mowing can be found in the EM&CS, Section II "ROW Maintenance and Monitoring" page 9.

Tree clearing for ROW maintenance includes the removal and disposal of all woody vegetation from the ROW, AFS, or access road. Usable timber is generally cut into pole lengths and stacked just off the edge of the ROW for use by the land owner. Equipment typically consists of chain saws, small rubber tired or tracked equipment, and trucks. Tree clearing for ROW maintenance does not occur between April 15 and August 1. A subset of tree clearing is tree side trimming. Tree side trimming ROW maintenance includes the removal and disposal of branches overhanging the ROW and thus obstructing aerial patrols. Branches which are side trimmed are usually greater than 5-inches in diameter measured at the trunk. Trimmed branches are disposed of in a manner described for brush disposal. Equipment typically consists of helicopters with specialized side-trim saws or personnel with chain saws working from bucket trucks. Tree clearing for ROW maintenance does not occur between April 15 and August 1. Specifications for tree clearing for ROW maintenance can be found in the EM&CS, Section I "Operation and Maintenance (O&M) Work (including minor construction)", page 1.

Hand application of herbicides utilizes "backpack" style sprayers and is targeted only at undesirable plant species within the existing ROW or AFS as needed. ROW treatment does not occur between April 15 and August 1. Typically this is conducted on a "spot treatment" basis. Equipment typically consists of backpack sprayers. Field personnel access the facilities on foot or in rubber tired vehicles. Vehicle mounted sprayer application of herbicides utilizes spray equipment mounted to rubber tired ATVs or trucks. The equipment is designed to facilitate treatment of the entire ROW or AFS. Field personnel access the facilities using the ATV or rubber tired vehicles. Aerial spraying of herbicides utilizes spray equipment mounted to a helicopter or fixed-wing aircraft. The equipment is designed to facilitate treatment of the

entire ROW or AFS. Field personnel access to facilities is not required. NiSource does not apply herbicides or pesticides in or within 100 feet of a waterbody or wetland (except as specified by the appropriate land management or state agency). Specifications for application of herbicides can be found in the EM&CS, Section II "ROW Maintenance and Monitoring", page 13.

During clearing operations, all brush and trees are felled into the construction work area to prevent off-construction work area damage to trees and structures. When the landowner requests salvage of these materials or approves wood products be stockpiled and left on site, they will be stockpiled just off the edge of the construction work area, but not within 50 feet of streams, floodplains, or wetlands. Off-site disposal of wood products in other than commercially operated disposal locations is subject to compliance with all applicable survey, landowner approval, and mitigation requirements.

All cleared brush may be disposed of by multiple methods. Brush may be piled just off the edge of the construction work area. No brush piles will be placed within 50 feet of streams, floodplains or wetlands. Brush piles will be constructed a maximum of 12 feet wide and compacted to approximately 4 feet high, with periodic breaks at a minimum of every 200 feet to permit wildlife travel. Landowners will be consulted to determine acceptable brush pile locations. Brush piles may also be burned. Fires will be of reasonable size and located and patrolled so that they will not spread off the construction work area. Brush may also be chipped and given away, buried, thinly spread (less than 2 inches thick) over the construction work area, or blown off the construction work area except in agricultural lands or within 50 feet of streams, floodplains, or wetlands. Brush chipping requires landowner approval. During restoration, soil will be augmented by the addition of 12 to 15 pounds of nitrogen per ton of chips to aid revegetation. Lastly, brush may be hauled to an off-site disposal facility, in compliance with all applicable survey, landowner approval and mitigation requirements.

Maintenance of ROWs is adjusted when in or near wetlands or waterbodies. When adjacent to waterbodies a riparian strip least 25 feet wide, as measured from the mean high water mark, will be allowed to grow. In wetlands, a corridor up to 10 feet wide centered on the pipeline will be maintained in a herbaceous state. In addition, trees that are located within 15 feet of the pipeline and greater than 15 feet tall may be selectively cut. All felled trees will be removed from the wetland. If erosion/sediment control and stabilization problems are identified where the ROW crosses a stream, NiSource will address the problem directly. The area may be revegetated with conservation grasses and legumes or native plant species, preferably woody species. Where vegetative stabilization is inadequate, mechanical stabilization of the stream banks, including riprap, gabions, and jute netting, may be used. Where used, application of riprap must comply with any USACE, or its delegated agency, permit terms and conditions. The clearing crew and related equipment and equipment necessary for installation of equipment crossings will be permitted a single pass through streams prior to equipment crossing installations unless the stream is a high quality stream or designated as an exceptional value water, in which case federal, state and local agencies having regulations more stringent than this shall supersede. Additional information can be found in NiSource's Environmental

Construction Standards (ECS, Chapter 5 of the MSHCP), Section V, "Waterbodies, Wetlands, And Environmentally Sensitive Areas", p. 28.

1.2.1.2 Pipeline and Appurtenant Facility Operation, Maintenance, Monitoring, and Inspection

Subactivities:

- Facilities - vehicles, foot traffic, noise, communication facilities (O&M)
- Inspection Activities - ground and aerial (O&M)
- Vehicle Operation and Foot Traffic (New Construction)

This category of subactivities involves the presence of field personnel at NiSource facilities[3]. Personnel access facilities via motor vehicles, such as pickup trucks or other maintenance vehicles. The facilities will be accessed via public roads, access roads, and traveling within the ROW. Once at facility, field personnel move around the site on foot or in vehicles. All activities are confined to the established ROW or AFSs (this may include crossing streams at fords or other low flow sites). These activities may occur at any time during the year.

For O&M, sites are most commonly accessed for routine maintenance actions, including superficial routine actions such as valve greasing, recording information from gauges, refilling methanol injectors. The majority of these actions require little, if any, ground disturbance.

Facility inspection includes the multiple field actions that are necessary to maintain and operate a safe and reliable pipeline and storage system. NiSource facilities are inspected on a continual basis to ensure safe and reliable service and to adhere to applicable regulations and company policy.

Inspection activities include underground facility location and identification, communications facility O&M, compressor station O&M, pipeline liquid-removal activities, valve O&M, methanol injection system O&M, cathodic protection system O&M and monitoring, storage well O&M and monitoring, and above-ground facility painting. Above-ground inspections may be done by aerial means (e.g., fixed wing and/or helicopter surveys), but are often performed by ground personnel on foot or in motor vehicles. While the majority of these inspections require no earth disturbance, there are instances where disturbance is required to complete the inspection. Coating inspection, facility verification, and temporary launcher/receiver installation to facilitate internal inspection of the pipe all require earth disturbance. This earth disturbance is typically contained within the ROW and generally requires minimal (typically bell-hole or footer/foundation pad) excavation.

[3] For all of the O&M subactivities, the potential impacts of the presence of field personnel is evaluated separately under the "Facilities - vehicles, foot traffic, noise, communication facilities" subactivity.

The pipeline occasionally requires internal inspections conducted using “pigs”. This requires existing or temporarily-installed launching/receiving facilities that supply access to the buried pipeline.

1.2.1.3 Facility Abandonment (O&M)

Subactivities:

- Pipeline Abandonment - in place
- Pipeline Abandonment - removal
- Well Abandonment - plugging, waste pits, site restoration
- Well Abandonment - facilities/building removal and site restoration
- Abandonment - Ownership transfer

This group of actions includes the steps involved in abandonment of facilities that are no longer in use by NiSource. Where a pipeline, storage well, or appurtenant facility is no longer necessary, it may be abandoned or retired. Depending upon varying factors, pipeline abandonment may be in-place, by removal, or a combination of the two. Abandonment may also occur by sale, where the facility and its easement/property rights are transferred directly to the purchaser. In-place abandonment causes minimal site disturbance, with only minor excavations to remove appurtenant facilities (e.g., valves, drip tanks), pipeline fluids, and to cut and cap the pipeline segment for proper abandonment. Abandonment by removal results in more disturbance than in-place abandonment, as the entire pipeline segment (along with its associated appurtenances) is physically removed from the ground.

Storage well abandonment requires the well to either be plugged or converted to an observation well (used to monitor the utilization of the storage formation). Well abandonment may require some level of construction activity (typically confined within the existing and maintained well site) in order to convert or plug the well in accordance with State requirements.

Large appurtenant facilities, such as compressor stations, may also be abandoned. When these facilities are abandoned, above- and below-ground appurtenances are typically removed from the site unless otherwise conditioned in a sale agreement. Buildings may be left in place at the discretion of NiSource, the current landowner, or the potential purchaser of the associated property.

1.2.1.4 General Appurtenance and Cathodic Protection Construction (O&M)

Subactivities:

- General Appurtenance and Cathodic Protection Construction - Off ROW Clearing
- General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole

Pitting or corrosion of underground steel pipes occurs as current generated or carried by the pipe moves into the soil. These pits can weaken sections of pipe that could burst due to the

internal pressurized gas. Natural gas pipelines are coated to prevent corrosion, but pipeline coatings degrade over time, particularly in high moisture areas or where pipelines are exposed to large amounts of induced alternating current (typically from adjacent high-voltage electric transmission lines). To slow degradation of pipe coating, NiSource uses cathodic protection, which consists of a thin cable connected to the pipeline that is buried along or directly adjacent to the pipeline ROW. The cable, which is attached to sacrificial anodes, delivers a direct current to the pipeline system. Cathodic protection facilities are commonly installed with a vibratory plow mounted on a bulldozer, Ditch Witch, tracked excavator, or backhoe. Cathodic protection may increase the area of pipeline disturbance (additional trenching) or it may be installed along the length of the pipeline in the same trench.

1.2.1.5 Access Roads

Subactivities:

- Access Road Maintenance - grading, graveling (O&M)
- Access Road Maintenance - culvert replacement (O&M)
- Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling (New Construction)
- Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation (New Construction)

This group of subactivities necessary for constructing, maintaining, and operating NiSource's access road system. Road maintenance includes the regrading of the roadbed and gravel placement and maintenance performed on road ditches and other water conveyances.

For new facilities in areas not previously occupied by NiSource, new access road construction will often be necessary. New access roads are built only if existing access is inadequate. The roads will either be temporary (used for access during construction only) or permanent (used during and after construction for operation and maintenance of the facilities). Length of a new road is normally contingent upon the facility's proximity to a public road and the area's topography (e.g., mountainous terrain may not be conducive to direct-access routing). Access road construction uses procedures similar to the clearing, grading, and E&S control device installation, as described under Pipeline Construction. Once the site is prepared (cleared and graded), the access road is typically constructed of gravel and maintained to 25 feet in width, with additional width provided for tight turns. After construction, temporary access roads (including any additional width used for construction) will be graded and left intact for the landowner's benefit, or removed and the area restored using the same specifications as applied to the construction work area.

Roads will cross streams and wetlands as close as possible to right angles. Road gradients approaching these crossings will be flattened to decrease runoff velocity. Runoff will be dispersed just prior to the crossing by means of an interceptor diversion with a sediment filter device at the outlet. Where conditions permit, new roads will be located at least 25 feet from any stream or wetland except at crossing locations. Where necessary, access roads will include

culverts for stormwater conveyances and stream crossings. Culverts will be sized and placed to permit water flow under the access road. Additional information on access roads may be found in the ECS "Access Roads" section, p. 10-11 (NiSource 2013).

1.2.1.6 Appurtenant Facilities (New Construction)

Subactivities:

- Compression Facility, noise
- Communication Facility - guy lines, noise, lights
- Storage wells - clearing and drilling
- Storage wells - reconditioning
- Storage wells - waste pits

Compression Facilities. This subactivity includes the operation and maintenance of compressor stations. Compressor stations produce the pressures necessary for the transport of natural gas through the pipeline system, and the injection or withdrawal of natural gas in a storage field. Spaced throughout the pipeline system, compressor stations typically represent the largest AFSs, often occupying several acres.

Compressor station lots are typically fenced, and the stations themselves are often staffed full or part-time. Compression facility sites typically include, among other things, office buildings, paved lots and driveways, compressor and maintenance buildings, above-ground and below-ground tanks, above-ground and below-ground pipe and compression appurtenances, and communications facilities.

When additional compression is required to meet new or increased market demands, modifications may be made to an existing station through the addition of compressor units. Compressor station modifications are typically done within the existing fenced compressor station lot or adjacent NiSource property limits. The additional compression may be installed within the existing compressor building, or it may require that a new building or building-addition be constructed.

Far less frequently, an entirely new compressor station may be built. A compressor station development site will encompass several acres, and depending on the condition of the preferred site, may require significant amounts of permanent recontouring to accommodate the facilities.

Communication Facilities. This subactivity includes the use of communication facilities within the pipeline system. Remote communication technologies are used in operating, monitoring, and communicating between NiSource facilities. These communication systems may utilize hard-wired and/or broadcast signals. The construction of these facilities typically includes the installation of cable (often done by a Ditch Witch) within existing ROWs and/or the construction of communication towers.

Storage Wells. These subactivities include the necessary actions for the construction and operation of storage wells. Storage wells are locations where natural gas is temporarily stored underground. A typical well site is approximately 1 to 3 acres and contains above-ground appurtenances, such as a wellhead, meter house, and telemetry equipment. Storage well sites require periodic O&M activities throughout the life of the well. Vegetation maintenance is usually confined to the amount of space required to maintain, operate, and monitor the well (i.e., not the entire 400-foot by 400-foot site). Once a storage well is in operation for a period of time, enhancement or reconditioning activities may be required to increase or return the well to previous injection/withdrawal efficiency. Depending upon the current extent of the maintained well site, temporary site expansion up to the original construction work area may sometimes be required in order to accommodate the equipment necessary to conduct these activities.

A new storage well location may require a construction work area measuring approximately 400 feet by 400 feet. Surface preparation for storage-well construction is similar in sequence and practice to pipeline construction activities described above (e.g., clearing and grading for pipeline construction) and are completed using the same environmental standards found throughout the ECS. Unlike pipeline construction, which typically follows existing land contours, a storage well site may require permanent recontouring in order to establish a suitable construction and operating location. Drilling sites must be large enough to accommodate the large drilling rig, multiple equipment trailers, drilling mud recirculation tanks, drilling mud waste pits, office trailers, and numerous trucks and personal vehicles. The duration of drilling activities varies from location to location but typically will last from one to three months. Upon completion of the well, the well site will be restored to a condition suitable for operation.

Storage wells occasionally require enhancement or reconditioning to increase or return the well to previous injection/withdrawal efficiency and increase the deliverability of the wells. Some activities may be required to enhance or recondition new or existing injection or withdrawal wells associated with NiSource's permitted underground storage reservoirs. Clearing of re-established vegetation may be required to allow for these activities. Depending upon the current extent of the maintained well site, expansion may be required in order to accommodate the equipment necessary to conduct these activities.

These activities may include reconditioning, acidizing, coil tubing cleanout, drilling to deepen the well, hydraulic fracturing, re-perforating, and wellbore stabilization. Reconditioning involves replacing existing casing, installing new casing, cementing casing, and wellhead replacement. Equipment needed includes a well service rig, mud pump, pipe skids, pipe tubs, and water tanks. Reconditioning is typically completed in seven to 20 days. Acidizing involves pumping acid down the well's flow string and into the storage zone to dissolve and remove materials which are restricting flow from the well. This requires a pump truck, acid trucks, nitrogen trucks, flow-back tanks, and water tanks. Generally, acidizing will be completed within five days. Coil tubing cleanout involves using a coil tubing unit to pressure wash the inside of the flow string and the formation face and clean out debris from surface to total depth. This

requires a coiled tubing unit, pump truck, nitrogen truck(s), and flow-back tanks. Coil tubing cleanout can be completed in one to three days. Deepening the well is done to expose additional storage formation. Equipment needed includes a drilling rig or well service rig and support equipment as listed in reconditioning. Drilling deeper is completed in one to two days. Re-perforating involves shooting additional holes through the well casing and cement sheath into the storage zone. This process may also involve pumping liquids, such as acid and water, into the well prior to perforating. Equipment needed includes a pump truck, acid truck, crane truck, logging truck, flow-back tank(s), and water truck(s). Generally, the time needed for reperforating will be one to two days. Lastly, wellbore stabilization involves using a coil tubing unit to place materials in an open-hole well to prevent formations (typically shale) from caving in across the storage zone. Equipment needed includes a coiled tubing unit, pipe transport truck(s), flow-back tank(s), and water tank(s). Generally, the time needed for wellbore stabilization will be one to three days.

Underground storage well enhancement and reconditioning activities also include wellbore clean-outs, changing wellhead valves and well tubing, formation fracturing, and well testing. These activities typically require a well service rig (a small drilling rig mounted on a truck). Materials removed include sand used during hydraulic fracturing treatments, wellbore cuttings, bentonite drilling muds, and other fluids. These materials are captured in an enclosed steel tank, or occasionally a temporary plastic-lined surface pit, typically 50 feet long by 20 feet wide and up to 10 feet in depth. Any fluids generated by these activities are ultimately disposed of in approved offsite injection wells or at third-party disposal facilities. Naturally occurring solids (e.g., bore cuttings) are typically buried on-site. Any remaining materials are disposed of in an approved landfill.

Hydraulic fracturing is utilized by NiSource as necessary for the construction or maintenance of its underground storage wells[4]. NiSource only uses this technique in the counties included in the covered lands where NiSource has existing underground storage reservoirs (i.e., storage well counties). The most important industrial use for the practice is to stimulate oil and gas wells where it is commonly used to make reservoir rock more permeable, allowing natural gas to flow more efficiently to the wellbore. This type of hydraulic fracturing has been used for over 60 years in more than one million wells, including an estimated 90% of the natural gas wells in the United States. The process also is commonly used on many wells drilled or operating within underground storage reservoirs, such as those covered by this MSHCP.

[4] NiSource and its subsidiaries engage in the exploration and development of new production of natural gas, where hydraulic fracturing also is used. Thus, NiSource's covered activities do not include hydraulic fracturing or any other activities associated with new exploration and development. The hydraulic fracturing processes utilized in underground storage well work are fundamentally the same as those used during natural gas or oil well development, except for the size of the treatments. Hydraulic fracturing processes for exploration or production wells use much more fresh water – typically in the millions of gallons per well whereas the treatments used for NiSource's underground storage wells typically use a significantly lesser amount, typically tens of thousands of gallons per well. In addition, the FERC exercises significant regulatory oversight over NiSource's hydraulic fracturing activities.

Hydraulic fracturing creates fractures in rocks to increase the output of a well. Specifically, hydraulic fractures are formed by pumping fracturing fluid into the wellbore to increase the pressure to a level that fractures the formation rock. Fractures are maintained by injecting a solid proppant, commonly sieved round sand, to the fracturing fluid. The "propped" hydraulic fracture then becomes a high-permeability conduit through which the natural gas can flow more freely into the wellbore. Hydraulic fracturing may also be used during the drilling of a new borehole or well, where rock chips and fine rock particles that may enter cracks and pore space at the wellbore wall that result in damage to the permeability at and near the wellbore. In such instances, hydraulic fracturing may be used to mitigate damage that occurred during drilling of the new well or to enhance flow from an existing well where particles or other debris have clogged the fractures over time.

Hydraulic fracturing efforts target, through control of pressures and fluid injection, the intended formation and avoid impacts extending into adjacent formations. For NiSource storage well treatments, these fractures typically extend up to several hundred feet radially from the wellbore, but always within the FERC-approved storage reservoir. Hydraulic fracturing typically takes place well below the water table and is isolated from drinking water by thousands of feet and millions of tons of impermeable rock. Further, these activities must comply with strict local, state, and federal regulations and regularly monitor and test to confirm their work is proceeding safely. The existing storage wells that are included in this MSHCP were constructed, monitored, and tested in accordance with all applicable regulations. NiSource will further comply with all applicable local, state, and federal regulations in the construction of any new storage wells within the covered lands, this would also include any new regulations that would become effective during the duration of the permit and that would pertain to storage well construction or operation.

The injection fluids used in NiSource's hydraulic fracturing processes are recovered and transported to a commercial, licensed disposal facility. NiSource does not release any of the fluids recovered from a hydraulic fracturing process directly into the environment or into any waterbody. All fluids are initially captured in special recovery until transport to the disposal site. If recovered fluids exceed the volume in the recovery tanks, the excess volume is placed in a lined drilling pit on location for temporary storage until disposal. NiSource's typically recovers 70% more of its fluid injections, with the remainder of the fluid either entrained in the gas stream or retained in the fractured formation. The unrecovered fluids are retained well below near-surface formations and ground or surface water. This is accomplished via natural geological trapping mechanisms that enable natural gas to collect and be stored. NiSource also installs multiple strings or well casings and uses properly designed cementing procedures ensure that fluids, as well as natural gas, are contained down-hole and are unable to migrate upward. Further, state regulations require the installation of special freshwater protection casing strings to isolate the freshwater zone from deeper brines, produced hydrocarbons, and formation fluids. Significantly, NiSource has never had an incident occur where natural gas or any fluids escaped into near-surface formations or groundwater from its underground storage operations.

NiSource performs a hydraulic fracturing on almost all newly constructed underground storage wells (typically 40 wells per year). When functionality testing results indicate that well productivity can be enhanced by performing a fracturing treatment, NiSource initiate that process (typically 60 wells per year). Well-designed fracturing treatments typically last for decades before any re-treatment is necessary, although additional treatments may be necessary to clean a clogged wellbore.

1.2.1.7 Pipeline Construction (New Construction)

Subactivities:

- Grading, erosion control devices
- Clearing - herbaceous vegetation and ground cover
- Clearing - trees and shrubs
- Vegetation Clearing - tree side trimming by bucket truck or helicopter
- Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking
- Vegetation Disposal (upland) - brush pile burning
- Trenching (digging, blasting, dewatering, open trench, sedimentation)
- Stream Equipment Crossing Structures
- Crossings, wetlands and other water bodies (non-riparian) - clearing
- Crossings, wetlands and other water bodies (non-riparian) - tree side trimming
- Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading
- Stream Crossings, wet ditch
- Stream Crossings, dry ditch
- Stream Crossings, steel dam & culvert
- Stream Crossings, dam & pump
- Stream Crossings, Horizontal Directional Drill (HDD)
- Crossings, wetlands and other water bodies (non-riparian) - pipe stringing
- Crossings, wetlands and other water bodies (non-riparian) - HDD
- Crossings, wetlands and other water bodies (non-riparian) - Horizontal bore
- Pipe Stringing - bending, welding, coating, padding and backfilling
- Hydrostatic Testing (water withdrawal and discharge), existing line
- Hydrostatic Testing (water withdrawal and discharge), new line
- Regrading and Stabilization - restoration of corridor

This group of subactivities includes everything involved in construction of pipelines, with separate attention paid to pipelines in upland, stream, and wetland environments. This includes both the construction of a new transmission or storage pipeline on a new ROW and the replacement of an existing pipeline. The range of disturbance varies depending on the scope and magnitude of a specific project or construction activity

Pipeline construction may involve the construction of a new transmission or storage pipeline on new ROW or the replacement of an existing pipeline in an existing ROW. The replacement may be “same size” in order to address pipeline age and condition concerns or it could be larger in

order to serve an increasing market or accommodate an engineering need. The range of disturbance varies depending on the scope and magnitude of a specific project or construction activity.

Fourteen-inch or larger diameter pipelines on new alignments typically require a 50-foot wide permanent ROW. During construction, and additional 25-foot wide temporary construction is used, which is subsequently restored or allowed to revert to its previous uses. Twelve-inch and smaller diameter pipelines on new alignments also require a 50-foot wide permanent ROW without the 25-foot temporary construction ROW due to a narrower trench and the use of smaller equipment.

In certain situations, extra work areas are needed for topsoil conservation, side hill construction, equipment staging, pipe and material storage, borrow and disposal areas, temporary and permanent access, and related construction activities.

Pipeline construction projects follow a consistent sequencing. First, the ROW is clearing and graded and the trench for the pipeline is excavated. This is followed by the stringing, bending, welding, and inspection of the pipeline, which is then lowered into the trench and backfilled. The new pipeline then undergoes hydrostatic testing. Lastly, the ROW is stabilized and restored. These steps are discussed in detail here.

1.2.1.8 Upland Pipeline Construction

Clearing and Grading. Construction begins by delineating the limits of the project's footprint or construction work area in the field. The work area includes the ROW (permanent and temporary), access roads, staging areas, temporary road entrances, and other necessary spaces. Clearing crews commence construction in these marked areas, removing trees and brush as necessary.

Vegetation including large trees all the way down to herbaceous ground cover must be cleared from the construction area. Techniques include hand removal (e.g., pulling, cutting) and mechanical tools, such as chainsaws and mowers. These techniques may be employed singly or in varying combinations. This group of actions also includes the disposal of vegetation, via burning or hauling.

Tree clearing includes the removal and disposal of all woody vegetation from the construction area. Usable timber is generally cut into poles lengths and stacked just off the edge of the ROW for use by the land owner. Equipment typically consists of chain saws, small rubber tired or tracked equipment, and trucks.

During clearing operations, all brush and trees are felled into the construction work area to prevent off-construction work area damage to trees and structures. When the landowner requests salvage of these materials or approves wood products to be stockpiled and left on site, they will be stockpiled just off the edge of the construction work area, but not within 50 feet of

streams, floodplains, or wetlands. Off-site disposal of wood products in other than commercially operated disposal locations is subject to compliance with all applicable survey, landowner approval and mitigation requirements.

Cleared brush may be piled just off the edge of the construction work area. No brush piles will be placed within 50 feet of streams, floodplains or wetlands. Brush piles will be constructed a maximum of 12 feet wide and compacted to approximately 4 feet high, with periodic breaks at a minimum of every 200 feet to permit wildlife travel. Landowners will be consulted to determine acceptable brush pile locations. Brush piles may also be burned. Fires will be for brush piles no greater than 12 by 14 feet, spaced no closer than 200 feet apart, and patrolled so that they will not spread off the construction work area. Brush may also be chipped and given away, buried, thinly spread (less than 2 inches thick) over the construction work area, or blown off the construction work area except in agricultural lands or within 50 feet of streams, floodplains, or wetlands. Brush chipping requires landowner approval. During restoration, soil will be augmented by the addition of 12 to 15 pounds of nitrogen per ton of chips to aid revegetation. Lastly, brush may be hauled to an off-site disposal facility, in compliance with all applicable survey, landowner approval and mitigation requirements.

The construction work area is then graded using bulldozers and graders to create a safe and stable working surface. Grading is done to the minimum extent necessary. Large rocks and tree stumps may be cut (includes grinding), graded, or removed as appropriate. They may also be buried within the construction work area, or windrowed just off of the construction work area. Stumps and large rocks will be disposed of according to landowner approval, using: burial within the construction work area (except in agricultural, residential, or wetland areas); windrowing just off the edge of the construction work; or off-site disposal at an approved landfill or other suitable area.

In certain areas (e.g., agricultural lands, residential areas), topsoil segregation techniques will be used during grading activities. Topsoil segregation minimizes mixing of topsoil and subsoil layers, allowing site restoration to more natural conditions. The topsoil is stockpiled separately from all subsoil and replaced last during backfilling and final grading. In deep soils (more than 12 inches of topsoil), at least 12 inches of topsoil are segregated. In soils with less than 12 inches of topsoil, the entire topsoil layer is segregated. Where topsoil is stripped from the entire construction ROW, an additional 25-foot wide temporary work area may be used for topsoil storage (with landowners' permission and appropriate environmental approvals).

Temporary erosion and sediment controls are installed immediately upon initial soil disturbance. The most effective and versatile erosion control devices are interceptor diversions (temporary slope breakers) and sediment filter devices. Temporary diversions are maintained during the construction phase until final diversions are installed. At a minimum, temporary sediment barriers (i.e., silt fence, staked hay or straw bales, compacted earth, sand bags, or other appropriate materials) are installed across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until vegetation is successfully reestablished. All

temporary erosion control devices, including roadside ditches, are inspected near the end of each work day or after each rain event of 1/2 inch or greater, to ensure proper functioning. Any devices damaged beyond functioning are repaired promptly. Additional information on erosion control devices and techniques may be found in under "Erosion Control Devices" beginning on p. 5 of the ECS.

Trenching. A trench that will be occupied by the new pipeline is then excavated. Trenches are short-term, typically remaining open for less than 30 days (unless specially authorized). Trenching is typically conducted with a backhoe, and the spoil removed from the trench is side-cast along and within the edge of the construction work area. Sediment filter devices are installed around spoil storage areas before digging bore pits, stream crossings, and wetland crossings (where necessary). The trench is excavated to a sufficient depth to allow for proper padding beneath the new pipeline and to accommodate a typical minimum of three feet of cover above the pipeline upon backfilling. Trenchline breakers are used to reduce water velocity and erosion of the trench bottom.

Where consolidated rock impedes the excavation of the trench, blasting may be required. Blasting will only be performed to the extent necessary to fracture any rock in the trench. Vibration is controlled through the use of shape charges, stemming materials, and delays to prevent significant vibration outside the work area. Blasting is conducted by a licensed contractor and in accordance with all applicable laws and regulations. The rock is then excavated with a backhoe.

Pipe stringing, bending, welding, and inspection. Once trenching is complete, the joints of pipe are transported to the construction work area and placed beside the trench in a procedure called stringing. The joints of pipe are carried via a truck, the size and type of which is commensurate with the diameter and amount of pipe joints being transported. Pipe segments are most often offloaded by a side boom. The pipe joints are then bent to conform to the contours of the existing landscape. After that, the pipe joints are welded together, inspected, and coated with a protective layer.

Backfilling. Next, the pipeline is backfilled. Backfilling follow pipe lowering as closely as possible so that the trench is not open for more than 30 days. Soil that has been excavated during construction is used to fill the trench, including conserved and segregated topsoil. Excess rock, including blast rock, may also be used to backfill the trench to the top of the existing bedrock profile. Trenchline barriers are placed in the trench prior to backfilling to prevent water movement and subsequent erosion.

Hydrostatic Testing. The constructed pipeline is then hydrostatically tested to verify its integrity prior to placing it into service. The test requires that the pipeline be filled with and then pressurized above its proposed operating limit.

Water is withdrawn from a local source, such as a stream, pond or public service department. The source is selected to minimize impacts to the environment and existing users and is

designed to maintain adequate stream flow. NiSource will not use water from state designed high quality streams or exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or streams utilized as public water supplies unless other water sources are not readily available and the appropriate federal, state or local agency permits have been obtained.

NiSource is required to operate within the bounds of all required federal, state and local approvals for the withdrawal and discharge of hydrostatic test water; all necessary permits are obtained prior to such activities. Jurisdictional agencies must further be notified of the intent to withdraw water from streams at least 48 hours before testing. NiSource screens all water intake hoses to minimize the risk of aquatic life becoming entrained. NiSource locates hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable. NiSource maintains adequate flow rates to protect aquatic listed species (through the various avoidance and minimization measures for listed aquatic species that limit water withdrawals) and provide water for downstream withdrawals by existing users.

Once the test is completed, the water is discharged to the ground. The discharge of the hydrostatic test water will be performed in a manner that minimizes erosion. NiSource dissipates the energy of the released test water by discharging the water a well-vegetated upland area, a tank, a body of water (with all required permits), or through sediment filter devices or a sediment trap to filter out various particulate matter or allow it to infiltrate through the soil. As necessary, NiSource will further regulate the water discharge rate using energy dissipation device(s) and installing sediment barriers to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow. NiSource does not discharge into waters from state designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or streams utilized as public water supplies unless the appropriate federal, state or local agency grants permission.

Final Grading and Restoration. As the final step in the construction sequence, the construction work area is stabilized via final grading and restoration. These activities typically occur during the summer and fall of the year. Final grading is typically completed within 20 days of backfilling the pipeline trench (10 days in residential areas). This includes regrading the construction work area to restore pre-construction contours, topsoil replacement, removal of excess rock in agricultural lands, and the placement of final E&S control devices. Equipment typically consists of rubber tired or tracked equipment, and trucks.

Restoration of the work area will begin quickly, within 6 days of final grading. Restoration includes seedbed preparation and subsequent seeding and mulching activities. The seedbed is prepared by disking fertilizer and lime into the soil. The seedbed may also be scarified to facilitate seed germination. This is followed promptly by seeding and mulching the construction work area. Seeding is typically done with a seed drill equipped with a cultipacker, but broadcast or hydroseeding can be used (at double the recommended seeding rates). Where necessary on steep slopes, jute netting may be used to stabilize the construction area.

Restoration is considered successful if the ROW surface condition is similar to adjacent undisturbed lands, construction debris is removed, revegetation is successful, and proper drainage has been restored. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. NiSource will also work with each landowner to identify measures to discourage off-road vehicle use of new ROWs using one or more of the following methods: (1) planting conifer rows as barriers, (2) installing slash and timber, pipe, or boulder barriers, (3) installing a fence with locked gate access, and (4) hanging "no trespass" signs.

1.2.1.9 Stream and Wetland (non-riparian) Pipeline Crossing Construction

Projects that require crossing streams or wetlands are completed as separate construction projects to ensure that they are completed as quickly as possible. These crossings are constructed similarly to upland sections and follow the same general sequence of activities, but typically use construction methodologies that do not require conventional surface trenching techniques. Upland construction techniques may be used, however, for intermittent waterbody crossings without perceptible flow at the time of the crossing, provided that a culvert is promptly installed to carry storm water flow across the trench area and the erosion and sediment control devices illustrated in are installed.

NiSource techniques are focused on minimizing water turbidity, maintaining downstream flows, and minimizing impacts to sensitive aquatic species. The appropriate jurisdictional agencies will be formally notified at least two days prior to any trenching in waterbodies (or as specified in permits). NiSource will work crossings when stream and wetland water levels are low and final site restoration will be completed as soon as possible, typically within 48 hours. Where a trench must be dewatered, it will be done to minimize erosion and avoid heavily silt laden water flowing into the waterway or wetland. The water is pumped into a heavily vegetated upland area where the water may filter into the ground, a sediment trap, a sediment filter bag, or through a sediment filter device. Water impounded in the trench will not be released directly or by overland flow into any waterbody or wetland. Any sediment logs or flocculent logs used will be placed at least 10 feet from any stream or wetland in order to minimize erosion and subsequent sedimentation of streams or wetlands. Unless expressly permitted or further restricted by the appropriate state agency in writing on a site-specific basis, crossings will be constructed in cold water fisheries between June 1 and September 30 and in cool water or warm water fisheries between June 1 and November 30. NiSource will also install precautionary downstream oil sorbent booms, as necessary. Wetlands will be clearly marked in the field by a knowledgeable person prior to the start of construction with signs and/or highly visible flagging until construction is complete. A maximum 75-foot wide construction work area may be used through wetlands.

At stream crossings, NiSource will attempt to complete restoration of the waterway and its banks within 24 hours of backfilling. Restoration includes returning all waterbody banks to preconstruction contours or to an otherwise stable angle of repose. Revegetation with

conservation grasses and legumes or native plant species, preferably woody species, will be targeted for riparian areas. Mechanical stabilization (riprap, gabions, jute netting) will only be used where the waterbody banks are such that an unstable final soil grade would result and vegetative stabilization is inadequate. Rip rap may only be used in areas where flow conditions preclude effective vegetative stabilization techniques (e.g., seeded erosion control fabric). Any application of riprap must comply with the USACE, or its delegated agency, permit terms and conditions. Additional information on restoration of stream crossings may be found in the ECS, "Stream Crossings" section, beginning on p.19.

Wetland crossings will be restored to the original contour of the wetland. NiSource will develop a project-specific wetland restoration plan in consultation with the appropriate land management or state agency. The restoration plan should include measures for re-establishing natural vegetation, controlling the invasion and spread of undesirable exotic species (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Additional information on regrading and restoration in wetlands may be found in the ECS "Wetland Crossings" section, p. 24.

Equipment Crossing Structures. Where needed, equipment bridges are installed during grading operations at all waterbodies. Equipment bridges may be one or more culverts with clean rock fill of non-erodible material or equipment pads and will be built to maintain unrestricted flow and to prevent soil from entering the stream. Equipment bridges are not required at minor waterbodies that do not have a state-designed fishery classification (i.e., agricultural or intermittent drainage ditches). Crossings will be constructed to withstand high flow events and will be removed when they are no longer needed. For proper culvert installation, some grading/excavating equipment may enter the water. Culverts will be built at 20" minimum and stone a 4" minimum. Specifications and details for stream equipment bridges can be found in the ECS, Section III "Stream and Wetland Crossing, Stream Crossings" at page 18 and figures 21 and 22.

Clearing. Site clearing will be performed as previously described under Upland Pipelines construction. All materials will be disposed of at least 50 Feet from the water's edge. In wetlands, vegetation will be cut off just above ground level, leaving existing root systems in place, and removed from the wetland for disposal.

Grading, Erosion, and Sediment Control. Site grading is managed to minimize erosion of sediment and other particulates into the waterway. Equipment does not enter the waterbody. Stream banks are graded only to the extent necessary to permit safe and efficient operation of construction equipment. In wetlands, NiSource will limit the pulling of tree stumps and grading to directly over the trenchline, unless safety concerns requires the removal of tree stumps from other areas of the construction zone.

Grading spoils are piled at least 10 feet from the stream banks and immediately protected with sediment filter devices to minimize erosion into the waterbody. Sediment filter devices are installed across the entire construction right-of-way, including the travel lane, and all disturbed

areas within 50 feet of the water's edge are mulched (no mulch will be used in wetlands). In wetlands, sediment filter devices will be installed promptly across the construction work area during grading at any wetland edge and maintained until construction work area revegetation is complete. Where crossings are sloped at 5 percent or greater, interceptor diversions will be installed 50 feet from the water's edge to divert surface runoff into adjacent vegetation. Where wetlands are adjacent to the construction right-of-way and the ROW slopes toward the wetland, NiSource will install sediment barriers along the edge of the construction work area as necessary to prevent sediment flow into the wetland.

Trenching - Streams. Trenching in streams may be done with a variety of methods, including dry-ditch (flume pipe), wet ditch, dam and pump, boring and horizontal directional drilling.

Wet-ditch crossings. Wet-ditch crossing involves installing a pipeline across a waterway by simply digging the trench without diverting water flow. The wet-ditch method is used for minor and intermediate waterbody crossings provided the waterway is not a state-designated significant fishery. The stream crossing crew uses a backhoe or an excavator typically sitting on the streambed (sometimes on pads) to excavate a trench across the stream. The spoil is typically piled in the stream on the upstream side of the trench. This process may be conducted from a barge or temporary work bridge in deeper streams. The primary goal when wet-ditching a stream crossing is to complete pipeline installation as quickly as possible; within 24 hours for minor waterbodies and 48 hours for intermediate water bodies. When wet-ditching, equipment within the stream bed is limited to equipment necessary for construction. Specifications and details for wet-ditch crossings can be found in the ECS, Figure 20 (MSHCP, Chapter 5).

Coastal-area pipelines are often located in canals as opposed to a typical upland ROW. Typically, low ground weight bearing equipment (commonly referred to as "swamphoes" or "swampbuggies") is used on saturated soils that cannot support conventional excavation equipment. In more open water marsh environments, the pipeline may be constructed using barge mounted equipment or "lay barges." In both instances, the pipe is typically welded in multiple joint sections, and then floated or push-pulled into the excavated trench. Concrete weights are commonly placed on the pipe to prevent it from floating. As mentioned above, rock or wooden structures known as bulkheads are placed at the intersections of pipeline canals and public waterways used for access. These structures prevent unwanted intrusion into the pipeline canals.

Dry-ditch crossings. The main objective of a dry-ditch stream crossings is to isolate the construction activities from the stream flow. Several techniques may be used, including Dam & Culvert, Dam & Pump, and Steel Dam & Culvert. Dry-ditching is used for crossings of cold water fisheries and cool water and warmwater fisheries considered significant by the state or as required by a Corps permit, unless approved otherwise in writing by the appropriate state or federal agency. Specifications and details for dry-ditch crossings can be found in the ECS, Figures 18 and 19 (MSHCP, chapter 5).

Dry-ditch methods involve the installation of a water diversion structure that diverts clean water around or through the work area. Then, a pre-assembled pipe is placed in trench and backfilled. The water diversion structure is then removed immediately followed by temporary stabilization and final restoration of the crossing. There are three types of dry-ditch methods: Dam & Culvert, Steel Dam & Culvert, and Dam & Pump.

- Dam and Culvert involves the construction of coffer-dams, typically with sandbags, across the stream on both the upstream and downstream sides of the proposed trench. The dams are typically 75 feet apart (i.e., a 75-foot work area). A culvert is run through the length of the work area and the stream flow is piped through the culvert effectively dewatering the area within the coffer dams.
- Steel Dam and Culvert is the same as Dam and Culvert, only in place of the usual sandbags used for the coffer-dams, steel sheet pile is used.
- Dam and Pump is again similar to Dam in Culvert, but instead the stream flow is pumped around the coffer dams on the stream bank (typically enclosed in a pipe, sandbags, or some other artificial channel) and is directed back into the channel on the downstream side of the work area.

Prior to trenching within a waterbody, water impounded in the upland trench is pumped into a sediment trap and/or a filter bag or a series of terra tubes, sediment logs or flocculent logs, or a heavily vegetated upland area where the water can filter back into the ground. Measures are further taken to prevent the flow of spoil or heavily silt-laden water into any waterbody. Sediment filter devices for trench spoil are installed prior to commencing trenching activities. For minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, spoil will be placed in the construction ROW at least 10 feet from the water's edge or in additional extra work areas.

Horizontal Directional Drilling. Horizontal directional drilling (HDD) is most often used for major waterbody crossings, although this technique may be employed for smaller waterways. For HDD, a hole is directionally drilled under the stream or wetland. The first approach is at a 10-12 percent angle, then at about 50 feet below the waterway the drill moves horizontally and continues to the other side, and angles back up to the surface again. The pipe string is then welded above grade and pulled back through hole. This technique requires major equipment and larger impact footprint for staging areas on either side of the waterway, including potential extension of the ROW as necessary for the staging of welded pipe. Additional information on NiSource's use of HDD can be found Appendix J of the MSHCP.

Although HDD is much less intrusive and damaging than traditional open-cut trenching that cause direct soil and streambed disturbance, there is potential for "frac-outs" where fracturing of the stream bottom results in the release of drilling muds from the bore hole into the stream. Minor frac-outs are not uncommon in HDD operations, with small amounts of drilling fluids escaping into the stream. Major frac-outs result in the discharge of larger amounts of drilling fluid in the waterway, in addition to damaging the waterway. Major frac-outs are less common than minor ones, but more potentially destructive. NiSource limits the risk of frac-outs

primarily through proper geotechnical assessment to ensure that HDD is only used at suitable locations. Further, careful monitoring of HDD operations and response plans (e.g., having response equipment on location) will further limit the risks of frac-outs.

The Appendix J of the MSHCP describes the contents of drilling muds used during HDD. The HDD procedure uses drilling fluids or lubricant, composed primarily of a water and bentonite slurry. Although bentonite is non-toxic, when released into waterways it can impact aquatic species by temporarily increasing water turbidity and clogging the streambed, smothering non-motile species and eggs. Drilling muds may also contain additives, including long-chain polymers and detergents to facilitate the drilling process. Soda ash may also be added to raise the pH in the bore hole.

Trenching – Wetlands. In wetlands, crossings without standing water or saturated soils, upland construction techniques can be used provided the top 12 inches of soil taken from the trench is stockpiled separately from the remaining excavated material. Wetland crossings in non-saturated soil wetlands will be constructed in a manner that minimizes the amount of time construction activities are occurring in the wetland. Wetland crossings with standing water or saturated soils will be constructed as separate construction entities, such that trenching, pipe installation, backfilling, and restoration are completed in the minimum number of consecutive calendar days necessary. Wetlands may also be crossed via HDD or horizontal bore techniques. Additional information on the construction of pipelines in wetland areas can be found in the ECS "Wetland Crossings" section, beginning on p. 21 (MSHCP, chapter 5).

Horizontal Bore. Horizontal bores are accomplished with traditional boring equipment, but are not "directional" like HDD. For this technique, a hole the size of a room in a house is excavated on either side of the obstacle to be bored under (typically a railroad or road). The boring equipment is placed in the hole on one side and bores through to the hole on the other.

Pipe Stringing – Wetlands. The pipeline will be assembled in the adjacent upland area, unless the wetland is dry enough to adequately support skids and pipe. The "push-pull" or "float" technique of pipe installation will be utilized whenever water and other site conditions permit.

1.2.2 Conservation Measures in the MSHCP

NiSource intended the MSHCP to provide for both enhanced conservation of forty-two listed species and streamlined ESA regulatory compliance for pipeline activities. It is a land-scape approach to conservation that is expected to provide greater benefits to species than the traditional project-by-project reviews of NiSource's pipeline activities. NiSource has stated that the goals of its Conservation Strategy of the MSHCP are threefold (see MSHCP; Chapter 5, page 1):

- Protect MSHCP species and their habitats through the implementation of an environmental compliance program that meets or exceeds federal, state, and local regulations and requirements;

- Enhance the conservation of MSHCP Species through the application of rigorous planning, adaptive management, and sound scientific principles; and
- Support species conservation actions using a landscape approach, maximizing conservation benefits to MSHCP species and the ecosystems that support them.

These strategies will be implemented through a mix of existing environmental practices, as well as new measures that have been developed in conjunction with the USFWS in preparation of the MSHCP. In addition, all NiSource personnel that will engage in the activities in the MSHCP will also be trained in all MSHCP compliance aspects.

1.2.2.1 Avoidance and Minimization Measures

NiSource uses an Environmental Construction Standards (ECS) document to provide the minimum requirements for construction, operation, and maintenance activities in environmentally-sensitive areas. The MSHCP builds on the ECS by also including avoidance and minimization measures (AMMs) for the MSHCP species. If there is a conflict between the ECS and AMMs, the AMM supersedes the ECS. All AMMs for all MSHCP species are listed in Effects Analysis sections, by species (Section 4). Implementation of these measures will be required over the next fifty (50) years in accordance with the MSHCP and the ITP. Some AMMs in the MSHCP are non-mandatory; these non-mandatory AMMs are denoted by *italic font*).

In general, AMMs were developed for the following general activities: project planning, chemical application, construction, equipment operation, habitat and species occupation surveys, pipeline abandonment, pipeline inspection, pipeline installation or repair, roads and ROWs, soil disturbance, spills (prevention, containment, and control), stream bed construction, vegetation management, and water withdrawal and discharge. Many AMMs relate to seasonal activity windows, areas to avoid, or specific construction techniques. Prior to beginning any activity NiSource will develop an Environmental Management and Construction Plan (EM&CP) to identify any required AMMs. NiSource will follow all mandatory AMMs including potentially modifying the project activity and/or relocating the project footprint to avoid effects on MSHCP species. For projects that cannot be designed to fully avoid impacts, NiSource will then evaluate the specific covered activity's potential impact and prepare a clearance package, including an EM&CP with appropriate AMMs (mandatory and non-mandatory) identified to further avoid and/or minimize the impacts on these species. NiSource will also evaluate and track the implementation of all AMMs and actual impacts to MSHCP species, including how often optional AMMs are used and documentation of why they are not when they would benefit the species.

1.2.2.2 Mitigation

Although the AMMs avoid impacts to most of the MSHCP species, NiSource anticipates there will be instances where impacts cannot be avoided or ameliorated. Therefore, they have requested take authorization for ten species in the ITP (see Species That May Be Affected section). To offset effects that cannot be avoided, the MSHCP includes mitigation for these ten

take species. Mitigation may include habitat restoration, enhancement, or protection (i.e., the acquisition of a real property interest in perpetuity, with appropriate restrictions to conserve the species and its habitat) and/or the propagation, augmentation and reintroduction of certain take species. Due to the geographic scope of the MSHCP, the mitigation strategy will be landscape based, where appropriate, and will utilize an ecoregional approach. This means that mitigation may occur at a location distant from the impact area when appropriate for conservation purposes; however, mitigation will occur within the states crossed by the covered lands.

Mitigation is divided into two components: O&M/aggregate (O&M) mitigation and project-specific mitigation. Mitigation for O&M impacts is designed to compensate for impacts from ongoing operations of existing facilities (e.g., ROW maintenance, minor erosion for the ROW, vehicles traveling on the ROW, etc.). Over time, these impacts may result in overall habitat degradation for MSHCP species. Further, some mitigation may incidentally benefit some of the non-MSHCP species. Since ROW maintenance activities typically occur on a three to seven year cycle, NiSource has committed to pay the costs for all O&M mitigation in the first seven years of the Permit term and MSHCP implementation. The total O&M mitigation funding is estimated at $784,595 total in 2010 dollars, with NiSource depositing an estimated $112,085 annually into the Mitigation Account[5].

Project-specific mitigation is designed to compensate for impacts from certain construction or non-recurring maintenance activities. It is required for all ten species when take is expected to occur. Each species varies in the compensatory mitigation required, but certain mitigation obligations are the same for all species. The specific impacts, and thus the amount of compensation required, will be measured on a project-by-project basis and any required mitigation ratio will be applied to determine the overall amount of mitigation required for that project. Impacts, mitigation ratios, and mitigation project types are all described in detail in Chapter 6 of the MSHCP. NiSource will pay the mitigation funding prior to the impact and initiate on-the-ground mitigation activities within 2 years of take occurring. If the mitigation effort does not fully compensate for impacts to a given species, NiSource will either pursue additional mitigation efforts or will use the mitigation fund described below. If the mitigation effort more than compensates for previous impacts to a given covered species, NiSource will receive a mitigation “credit” toward their future impacts to that species.

NiSource will deposit the amount owed for O&M and project-specific mitigation into an account administered by the National Fish and Wildlife Foundation (see section 8.4.1 of the MSHCP for more detail). The MSHCP includes two approaches for undertaking mitigation efforts to compensate for impact of Take of MSHCP species: (1) mitigation undertaken directly by NiSource and (2) mitigation undertaken by solicited third parties and funded under the MSHCP Fund. NiSource reserves the right to choose between the two approaches, unless specific mitigation measures and the parties to conduct them have been identified in Chapter 6 of the

[5] Due to the potential for inflation and the changes in land values, the actual amount deposited in each of the first seven years will vary based on the then-current costs of the identified mitigation projects.

MSHCP. The decision about third-party mitigation projects will be informed by a Mitigation Panel, which NiSource will chair. After evaluating proposals, NiSource will submit final written recommendations, including its reasoning and all supporting information to the USFWS, which will ultimately determine whether the proposed mitigation package is acceptable. Chapter 8 of the MSHCP also details the specific funding assurances that provide certainty for mitigation funding.

1.2.2.3 Monitoring and Adaptive Management

The MSHCP includes detailed monitoring, reporting, and adaptive management requirements that will be implemented over the term of the ITP (see Chapter 7 of the MSHCP). The goal is to provide a reliable basis for documenting compliance, effectiveness, and implementation of the MSHCP and ITP. NiSource is also specifically bound to monitor, report, and assess the impacts of the take of MSCHP species that will result from covered activities over the term of the ITP.

There are two types of monitoring described in the MSHCP: compliance monitoring and effects and effectiveness monitoring. Compliance monitoring (also known as implementation monitoring) will be completed to ensure that NiSource is carrying out the terms of the MSHCP. NiSource will monitor covered activities to document whether projects were completed with the appropriate AMMs, including specific reasons any non-mandatory AMMs were not implemented. NiSource or contracted species specialists will also monitor whether AMMs were implemented successfully. Results of any pre-activity survey AMMs conducted will be entered into a GIS database to track species and habitat information. Any mitigation measures will also be documented. Effects and effectiveness monitoring will be completed to ensure AMMs and mitigation are working as intended and the conservation program of the MSHCP is effectively achieving its biological goals and objectives. Effects monitoring includes NiSource compiling a list of all activities performed, indicating the type of activity, where it occurred, the amount of habitat affected, AMMs implemented, anticipated and calculated take of take species, and mitigation required. The amount of temporary and permanent habitat loss and the percentage and amount of that area with suitable habitat for MSHCP species will be reported along with the amount of occupied or assumed occupied habitat. NiSource will also monitor the effects of covered activities that require mitigation. In addition, there are several AMMs identified in the MSHCP as having a moderate to high risk and/or likelihood of failure that will be monitored for effectiveness as part of the adaptive management program.

Through effectiveness monitoring, NiSource and the USFWS also will be able to assess the need for implementation of adaptive management measures to improve the MSHCP's conservation strategy. Based on the best scientific information currently available, it is expected that the MSHCP's conservation measures will effectively achieve the biological goals and objectives. However, there is some uncertainty associated with take calculation and/or mitigation options, some AMMs, species known and/or modeled occurrences, and covered lands habitat conditions. Results of effectiveness monitoring may also indicate that some AMMs or mitigation measures are more or less effective than anticipated. The adaptive management

program in the MSHCP is designed to ensure that the AMMs and mitigation measures function as desired.

Adaptive management strategies are species-specific and can be found in detail in Chapter 7 of the MSHCP. In general, data will be collected and analyzed to ensure that the AMMs are effective and mitigation sufficiently compensates for the impacts of take. If the monitoring results reveal, however, that the hypotheses or presumptions are incorrect, NiSource and the USFWS will implement the alternatives identified in Chapter 7 of the MSHCP, as necessary, develop and implement other strategies to improve the AMMs and/or mitigation efforts being undertaken. Consistent with the cyclical design of adaptive management, should a change to AMMs or mitigation be triggered, further monitoring of the contingency would be required to gauge effectiveness. This will continue until the alternative achieves the desired effectiveness, or it is jointly determined that the presumed response cannot be achieved. In addition, whenever a hypothesis proves to be incorrect, NiSource and the USFWS will: (1) calculate additional take that has occurred, if any; (2) identify any mitigation required to compensate for that unanticipated take; (3) adjust the calculation of take prospectively, where appropriate; (4) evaluate whether there is a need to further adjust the allowable level of take in the ITP; and, if necessary; and (5) amend the MSHCP and ITP.

1.3 Federal Agency Actions

NiSource's covered are subject to regulation and oversight of federal action agencies, including the USFWS, USACE, USFS, and NPS. Issuance of permits or authorizations for NiSource actions by these agencies represent "federal actions" and are subject to compliance with the ESA. This section describes the federal actions that are anticipated or will occur during the implementation of the MSHCP. NiSource's activities must also comply with the Natural Gas Pipeline Safety Act of 1968, which authorizes the USDOT to regulate pipeline transportation of gases; however, when there is a federal permit involved under other legislation, the activities are typically under the purview of the other federal agencies (e.g., FERC permits, USACE permits, etc.). Therefore, we do not address federal actions under the USDOT specifically. Federal landholdings that are crossed by MSHCP covered lands are identified in Appendix E of the MSHCP.

1.3.1 U.S. Fish and Wildlife USFWS Actions

The USFWS, in the Department of the Interior, and the National Oceanic and Atmospheric Administration National Marine Fisheries USFWS, in the Department of Commerce, share responsibility for administration of the ESA. Among their responsibilities are incidental take authorizations under Sections 7 and 10 of the ESA, and enforcement. The USFWS is responsible, however, for the incidental take of all the species included in the NiSource MSHCP. The USFWS's primary federal action is issuance of the ITP and associated implementation of the MSHCP. This action is subject to an Intra-USFWS section 7 consultation. Because the MSHCP's covered activities are also federal actions in many cases, inter-USFWS section 7 consultation is

also necessary. This BO encompasses the issuance of the ITP and implementation of the MSHCP, along with anticipated actions by cooperating agencies.

Portions of NiSource's natural gas system do, or may in the future, cross lands owned and managed by the National Wildlife Refuge System, which is a branch of the USFWS. Depending on the nature of the right-of-way previously acquired or to be obtained, special use permits from a particular refuge may be required and issued.

1.3.2 Federal Energy Regulatory Commission Actions

The FERC, under the authority of the Natural Gas Act (NGA), has the mission to oversee energy industries in the economic, environmental, and safety interests of the American public. As provided by the NGA (15 USC § 717 *et seq.*), FERC has the sole authority to grant Certificates of Public Convenience and Necessity (18 CFR 157), which allow for the construction and operation of INGT facilities. NiSource activities are authorized by Certificate of Public Convenience and Necessity CP83-76-000. FERCs planning and permitting processes are described in Appendix K of the MSHCP, and summarized below.

The FERC provides three permitting tracks for natural gas pipeline projects. Very small projects are categorically excluded from reporting or filing at FERC. Examples of categorically excluded projects are constructing facilities within fenced pipe yards (e.g., dehydrators, gas cooling equipment, station buildings, etc.), painting and greasing valves and pig traps, and installing and painting pipeline right-of-way markers. The FERC also offers a Blanket Automatic Authorization certificate. Under a blanket certificate issued pursuant to section 7(c) of the Natural Gas Act, a natural gas company may undertake a restricted array of routine activities without the need to obtain a case-specific certificate for each individual project. The blanket certificate program provides an administratively efficient means to enable a company to construct, modify, acquire, operate, and abandon a limited set of natural gas facilities, and offer a limited set of services, provided each activity complies with constraints on costs and environmental impacts set forth in FERC regulations. There are two types of blanket certificate projects: 1) Automatic and 2) Prior Public Notice.

Automatic projects are smaller scale blanket certificate projects where the company must notify potentially affected landowners of the planned project at least 45 days in advance, describing the planned project and how a landowner can contact the company. The notification must also include an explanation of the FERC's Enforcement Hotline procedures and the Enforcement Hotline phone number. The FERC and the public, other than the affected landowners, do not receive notification of planned projects that qualify under this type of blanket certificate authority. The project may proceed after the landowner notification requirement has been met.

All other blanket certificate projects are subject to Prior Public Notice, whereby a company, in addition to providing potentially affected landowners with advance notice, must also file a description of a planned project with the FERC. Notice of the planned project will be issued by

the FERC and published in the Federal Register. Within 60 days of publication in the Federal Register, any person may participate by intervening or by protesting a planned project. Once the 60-day period expires, if no protest has been filed, the project may proceed. However, if a protest is filed by the public or by FERC staff, interested persons have 30 days to resolve the issues. If the issues are not resolved, and the protest is not withdrawn or dismissed, the planned project will not be authorized under the company's blanket certificate, but will instead be treated as if the proposed project were presented in an application for project-specific certificate authorization.

NiSource activities that would fall under the Blanket Certificate Authorization are minor piping changes or adjustments that do not enlarge the certificated design delivery capacity of the system, miscellaneous rearrangement of facilities due to highway construction, dam construction, etc. The FERC has done a NEPA analysis on potential impacts of activities certificated under its Blanket Certificate Program, and the results were a “finding of no significant impact” (FONSI). If, in fact, NiSource would undertake to construct and operate a facility under its FERC blanket certificate that was something other than a FONSI, then that undertaking would not be permissible and NiSource would have to file a complete Section (7)c application with the FERC to seek authorization. Larger pipeline projects that exceed the established criteria for blanket certification require applicants to follow the FERC natural gas certificate process.

The FERC oversees environmental matters related to natural gas transmission projects, including the evaluation of project impacts under the ESA. NiSource, as FERCs non-federal representative, consults with the USFWS when projects have the potential to affect federally listed species. Projects that qualify for coverage under blanket certificates may not include construction in areas that include sensitive species or their habitats unless further review is completed. In the event that sensitive species (or habitats) occur within an area, NiSource would be required to file additional reports with FERC if any incidental take were likely to occur during construction. Pursuant to 18 CFR 157, activities in sensitive areas (including areas containing listed species or their habitats) would not proceed without additional evaluation under Section 7 of the ESA.

1.3.3 U.S. Army Corps of Engineers Actions

The Corps, in the Department of Defense, regulates the discharge of dredged or fill material into waters of the U.S., including wetlands, under Section 404 of the Clean Water Act (CWA) (33 USC § 1344; 33 CFR 320-332). Other activities are also regulated under other permit authorities of the Corps, including certain structures or work in or affecting navigable waters of the U.S. pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 USC § 403; 33 CFR 320-332). In all cases, the Corps must comply with all applicable statutes and regulations as part of their regulatory review. Many of the covered activities in the MSHCP, when they result in the discharge of fill material into jurisdictional wetlands or waterways, would require Corps permits. The Corps must comply with all applicable statutes and regulations when issuing such permits.

In addition to Section 10 and 404 permits, the USACE, under Army Regulation 405-80 (Management of Title and Granting Use of Real Property), may require real estate instruments (including modifications to existing instruments, if any, or new temporary construction easements) wherever the MSHCP's covered lands area crosses government fee property and flowage easements (i.e., Cumberland River, Old Hickory Lake, Tennessee). Real estate management activities may include third-party use of Army and Civil Works property including use under instruments such as leases, easements, licenses or permits. USACE regulations require compliance with environmental laws prior to the issuance of any real estate instrument.

1.3.4 National Park Service Actions

The NPS, in the Department of Interior, manages the national park system, a network of nearly 400 natural, cultural, and recreational sites across the nation. Portions of NiSource's natural gas system do or may in the future cross lands owned or managed by NPS. Right-of-way permits are required when utilities pass over, under, or through NPS lands. NPS must comply with the ESA when issuing right-of-way permits.

1.3.5 U.S. Forest Service Actions

The USFS, in the Department of Agriculture, manages public lands in national forests and grasslands. Portions of NiSource's natural gas system do, or may in the future, cross USFS lands. All national forest lands are required to have a resource management plan (i.e., Forest Plan). In the event that NiSource must implement one or more of the covered activities on National Forest System lands, the USFS would evaluate the activity through its special use permitting process. The USFS would assess whether the activities are allowed by that unit's Forest Plan, and then conduct project-specific environmental analysis to identify and evaluate effects to various resources, including listed species and species proposed for listing. Normally the USFS has consulted with the USFWS for their Forest Plan through a programmatic BO and initiates consultation or conference with the USFWS when the USFS determines that proposed activities may affect listed species; are likely to jeopardize the continued existence of a proposed species; or result in the destruction or adverse modification of critical or proposed critical habitat.

1.4 Conservation Measures For Non-MSHCP Species

As described in the Consultation Approach and Section 2 below (Species That May Be Affected), the MSHCP does not address forty-six additional listed, proposed or candidate species that occur within the MSHCP covered lands (i.e., the action area of this BO). NiSource and the USFWS worked together to develop additional AMMs for the non-MSHCP species. All AMMs for all non-MSHCP species are listed in the Effects Analyses section, by species (Section 4) or in the concurrence letter (Appendix B). Similar to AMMs in the MSHCP, implementation of these non-MSHCP AMMs are also required over the next fifty (50) years in accordance with this BO,

in-line with whether the AMM is mandatory or non-mandatory (non-mandatory AMMs are indicated by *italic text*). NiSource will follow all non-MSHCP species AMMs, including potentially modifying the project activity and/or relocating the project footprint to avoid effects on non-MSHCP species. NiSource will also evaluate and track the implementation of all AMMs and actual impacts to non-MSHCP species.

2 SPECIES THAT MAY BE AFFECTED

As described within the Description of the Proposed Action section, the permittee has requested incidental take permit for ten species. It is the applicant's prerogative to choose the species for which it seeks incidental take authorization for. However, pursuant to section 7 (and the USFWS's HCP Handbook), we must evaluate the impacts to any listed species that may be present within the action area. Not all species that may be present within the action area are addressed in the MSHCP, but we must still ensure that the proposed action does not jeopardize any species or adversely modify any critical habitat. Therefore, the consultation will include an analysis for all listed species or critical habitats that may be directly or indirectly affected, regardless of their status in the MSHCP.

There are a total of 89 species (threatened or endangered, proposed threatened or endangered, candidate) that may be present within the action area. Of these, 42 have been evaluated within the context of the MSHCP (i.e., MSHCP Species) and 47 have not (i.e., non-MSHCP Species). Of these 89 species, we have concluded that 27 will not be affected by the proposed action ("no effect" species; Appendix A of this BO). We have further concluded that 42 of these species may be affected, but are not likely to adversely affected by the proposed action ("may affect, not likely to adversely affect" species; Appendix B of this BO). This information is summarized in Table 2.

Table 2. Summary of Species Effects determinations

	LAA	NLAA	NE	Total
MSHCP Species	10	9	23	42
Non-MSHCP Species	10	33	4	47
Total	**20**	**42**	**27**	**89**

2.1 SPECIES THAT ARE LIKELY TO BE ADVERSELY AFFECTED

This section describes the 20 species that we have concluded are likely to be adversely affected by the proposed action (Table 3). This species' descriptions, life history, ecology, status and threats across their range and within the action area will be described in Section 3 Environmental Baseline.

Table 3. Species that are likely to be adversely affected by the proposed action

Common Name	Scientific Name	Federal Status	Species Included in the MSHCP?
Mammals			
Indiana bat	*Myotis sodalis*	E[1]	Yes
Insects			
American burying beetle	*Nicrophorus americanus*	E	Yes
Reptiles			
Bog turtle	*Glyptemys muhlenbergii*	T[2]	Yes
Eastern massasauga rattlesnake	*Sistrurus catenatus catenatus*	C[3]	No
Fish			
Diamond darter	*Crystallaria cincotta*	E	No
Roanoke logperch	*Percina rex*	E	No
Mollusks			
Clubshell mussel	*Pleurobema clava*	E	Yes
Fanshell mussel	*Cyprogenia stegaria*	E	Yes
James spinymussel	*Pleurobema collina*	E	Yes
Northern riffleshell	*Epioblasma torulosa rangiana*	E	Yes
Sheepnose	*Plethobasus cyphyus*	E	Yes
Dwarf wedgemussel	*Alasmidonta heterodon*	E	No
Pink mucket pearlymussel	*Lampsilis orbiculata*	E	No
Rabbitsfoot	*Quadrula cylindrica*	PT[4]	No
Rayed bean	*Villosa fabalis*	E	No
Snuffbox	*Epioblasma triquetra*	E	No
Spectaclecase	*Cumberlandia monodonta*	E	No
Crustaceans			
Nashville crayfish	*Orconectes shoupi*	E	Yes
Madison Cave isopod	*Antrolana lira*	T	Yes
Plants			
Northeastern bulrush	*Scirpus ancistrochaetus*	E	No

[1] Endangered
[2] Threatened
[3] Candidate
[4] Proposed threatened

Note that because the eastern massasauga rattlesnake and rabbitsfoot mussel are not currently listed, these species are being addressed through the ESA section 7 conference procedures. Section 7(a)(4) of the ESA addresses conferences and provides a mechanism for identifying and resolving potential conflicts between a proposed action and proposed species or proposed critical habitat at an early planning stage. The FWS also conferences when proposing actions that may affect candidate species.

Federal action agencies may conference on any proposed action that may affect proposed species or proposed critical habitat. During the conference, the FWS may assist the action agency in proactively determining effects and may advise the action agency on ways to avoid or minimize adverse effects to proposed species (or candidate species if present), or proposed critical habitat

The analyses in this BO will not become fully effective until the eastern massasauga rattlesnake and rabbitsfoot are listed and the conference opinion is adopted as the biological opinion issued through formal consultation.

3 ENVIRONMENTAL BASELINE

The environmental baseline summarizes the impacts of all past and present of all federal, State, or private actions and other human activities in the action area already affecting the species or their designated critical habitat. The environmental baseline defines the status of the species in the action area to provide a baseline to assess the effects of the actions now under consultation. For our purposes, this section also describes the species' descriptions, life history, ecology, status and threats across their range.

3.1 Factors Affecting the Species in the Action Area

3.1.1 Ecological Setting: Rangewide Actions and Impacts

The action area, following the NiSource pipeline system, traverses the eastern United States from the Louisiana Gulf Coast up to the Northeast. The system landscape is thus spatially diverse, comprising myriad topographic, geologic, ecological, and unique land-use features.

Human activities in the action area have included natural gas exploration, development, production, and transmission (e.g., NiSource Activities); agriculture, coal, and mineral exploration, development and production; wind energy construction, operation and maintenance; commercial timber production; and transportation infrastructure. While many areas have undergone extensive urban or industrial development, other portions are primarily agricultural and natural lands that have experienced little development. Collectively, these past and present activities have had profound impacts to the landscape, including the loss or conversion of native landscapes to intensive agricultural production lands, urban and rural development, mining and timber operations, energy development, and transportation infrastructure.

These activities are addressed more specifically as they occur by region, within Section 3.1.2 Ecological Setting of the Action Area.

3.1.1.1 Energy Exploration, Development, Production, and Transmission

This category addresses all sections of energy production, includes exploratory drilling, construction of well pads, well installation, associated pipelines and utility corridors, access, compressor stations. There is further potential for spills/releases and subsequent need for site reclamation. Development and maintenance of ROWs is a significant component. Impacts and stressors include land clearing, habitat alteration and disturbance, introduction of nonnative

invasive species, human disturbance, application of potentially toxic chemicals, degradation of waterways.

NiSource activities, past and ongoing, help to define and figure directly into the impacts in the action area. NiSource's natural gas distribution and storage activities date back eighty years, predating NEPA and numerous other environmental laws and regulations. The system includes an existing approximately 15,000 mile natural gas distribution and storage system owned by NiSource and operating within existing ROWs and other NiSource controlled land (i.e. storage fields) across 14 east-central states.

3.1.1.2 Agriculture Development and Production

This category includes crop production, animal husbandry, and other related activities. Impacts and stressors include conversion to nonnative land cover types, habitat alteration and disturbance, human disturbance, introduction of nonnative invasive species, application of potentially toxic chemicals, and degradation of waterways.

3.1.1.3 Residential and commercial development

This category includes construction and related activities for residential and commercial development. Impacts and stressors include conversion to nonnative land cover types, habitat alteration and disturbance, human disturbance, introduction of nonnative invasive species, application of potentially toxic chemicals, and degradation of waterways.

3.1.1.4 Coal and other Mineral Exploration, Development, Production, and transportation

This category includes exploratory drilling and trenching along with access development; production within surface or underground mines along with associated access roads, processing plants, generation and transportation of solid waste, tailings, etc., and site reclamation. Impacts and stressors include massive land disturbance (e.g., mountain top removal), habitat alteration and disturbance, introduction of nonnative invasive species, human disturbance, application of potentially toxic chemicals, and degradation of waterways.

3.1.1.5 Utility Transmission and Distribution Systems

This category includes development and improvements to utility corridors, including transmission lines, along with associated infrastructure (substations, access roads, fuel transfer stations). Impacts and stressors include land clearing, habitat alteration and disturbance, introduction of nonnative invasive species, and human disturbance.

3.1.1.6 Wind Energy

This category includes all aspects of wind energy development, including vegetation clearing, turbine construction, access road construction and maintenance, turbine operations. According

to the Federal Aviation Administration, approximately 371 wind turbines have either been constructed or are planned within the action area. Impacts and stressors include land clearing, habitat alteration and disturbance, physical disturbance from human activity, and presence of turbines (impacts, collisions).

3.1.1.7 Commercial Timber Production

This category includes all aspects of timber production, including vegetation harvesting, long-term land cover conversion, access road construction, and transportation. Impacts and stressors include land clearing, habitat alteration and disturbance, introduction of nonnative invasive species, and human disturbance.

3.1.1.8 Transportation Infrastructure

This category addresses all aspects of transportation, including construction and improvements to highways, roads, parkways, railroad construction or improvements, and use. Impacts and stressors include land clearing, habitat alteration and disturbance, introduction of nonnative invasive species, and human disturbance.

3.1.1.9 Climate change

All species discussed in this BO are now or will be threatened by the direct and indirect effects of global climate change. There is now widespread consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that these increases will continue for at least the next several decades (IPCC 2001b). The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (± 0.2) since the mid-1800s, with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley and Berner 2001). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on observed climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity. Based on their review, the IPCC concluded that natural phenomena are insufficient to explain the increasing trend in land and sea surface temperature, and that atmospheric warming observed over the last 50 years is probably attributable to human activities (IPCC 2001b). Climatic models estimate that global temperatures would increase between 1.4 to 5.8°C from 1990 to 2100 if humans do nothing to reduce greenhouse gas emissions from current levels (IPCC 2001b).

There is consensus within the scientific community that warming trends will continue to alter current weather patterns and patterns of natural phenomena that are influenced by climate, including the timing and intensity of extreme events such as heat-waves, floods, storms, and wet-dry cycles. Oceanographic models project a weakening of the thermohaline circulation resulting in a reduction of heat transport into high latitudes of Europe, an increase in the mass of the Antarctic ice sheet, and a decrease in the Greenland ice sheet, although the magnitude

of these changes remain unknown (Schmittner et al. 2005, Levermann et al. 2007). As ice melts in the Earth's polar regions in response to increases in temperature, increases in the distribution and abundance of cold water are projected to influence oceanic currents, which would further alter weather patterns.

Although the precise nature and scale of these changes would vary regionally, climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of both aquatic and terrestrial ecosystems in the foreseeable future (McCarthy et al. 2001, Parry et al. 2007), including those within the action area.

3.1.2 Ecological Setting: Regional Descriptions

This section provides a description of the action area, including historic and native ecological setting, along with historic, recent, and developing threats and impacts. We have broken the action area into five broad regions, based on the ecological settings described in Omernik's Level III and IV ecoregional data framework (EPA 2011).

3.1.2.1 Southern Coastal and Mississippi Plains

The southwestern portion of the action area (Louisiana, Mississippi, Texas, western Tennessee) falls within portions of four ecoregions: Western Gulf Coast Plain (34), South Central Plains (35), Mississippi Alluvial Plain (73), Mississippi Valley Loess Plains (74), Southeastern Plains (65). Along the Gulf Coast, the pipeline crosses the flat deltaic and coastal plain as the Mississippi River enters the Gulf of Mexico.

This ecoregion is characterized by coastal and alluvial zone habitat types. Broadly speaking, streams and rivers in this area range from low-gradient, silty channels typical of the coastal and floodplain zones to more moderate-gradient, sandy-bottom systems to the north. The near coastal section is characterized by tidal marshes, bayous, lakes, swamps, mudflats and low-gradient rivers. Natural vegetation cover consists of fresh and saltwater grasses and sedges, tupelo-cypress-gum swamp, riparian bottomland forests, and prairie grasslands (inland locations). As the pipeline travels inland, up the Mississippi River corridor, the habitat transforms into broad, flat alluvial floodplain with oxbow lakes, abandoned channels, point bar deposits, and other floodplain wetlands. Natural vegetation then becomes dominated bottomland hardwood communities with occasional savanna grasslands, mixed oak forest, and loblolly pine in more xeric sites. Further north, the pipeline enters the drier southeastern plains, characterized by dissected hills and irregular plains. With the drier conditions, mixed oak and oak-pine forest become the dominant forest cover, with interspersed areas of bluestem prairie and bottomland forest.

Although significant areas of native or relatively undisturbed cover remains, this ecoregion has undergone significant land use changes and habitat alteration. Historically, the region contained some of the largest wetland complexes in North America with extensive marshes, oxbow lakes, and ponds along with the Mississippi River and its side channels. Much of this

habitat, however, has been modified through channelization, navigation, and flood control measures to support commercial land uses and urban development. The area is home to several large urban centers, most notably the New Orleans and Lafayette areas in the south. The region is also interspersed with areas of agriculture (crop, pasture). Cultivated crops include soybeans, cotton, corn, wheat, and hay. Poultry and hog farms, livestock grazing, and commercial pine plantations are common in areas. In addition, oil and gas production is also a significant land use in the region, including onshore production fields along, with refinement and transportation facilities for both offshore and onshore fields (LADNR 2010).

3.1.2.2 Central Interior Plateau

This section of the pipeline crosses the Interior Plateau ecoregion in central Tennessee, western Kentucky, and southwestern Ohio. This area crosses portions of two ecoregions: Interior (71) and Western Allegheny (70) Plateaus.

This region is characterized landforms of open hills, irregular plains, and tablelands with occasional karst features, sink holes, steep cliffs. The natural vegetation is primarily oak/oak-hickory forest, with some areas of bluestem prairie and cedar glades. Streams in this region are typically moderate to high-gradient with cobble or boulder substrates. The region has a diverse fish fauna. The bulk of the central portion of the pipeline, including portions of four storage fields, then crosses the Western Allegheny Plateau ecoregion in portions of northeastern Kentucky, southeastern Ohio, northwestern West Virginia, and southwestern Pennsylvania. The hilly and wooded terrain of the Western Allegheny Plateau is more rugged than the agricultural till plains of ecoregions to the north and west, but is less rugged and not as forested as the Central Appalachians Ecoregion to the east and south. Extensive mixed mesophytic forests and mixed oak forests originally grew in the Western Allegheny Plateau and, today, most of its rounded hills remain in forest.

Much of this region has become a mosaic of forest, woodlots, pasture, cropland, and urban development. Primary agricultural products of the region are hay, cattle, cotton, corn, small grains, soybeans, and tobacco. Dairy, livestock, and general farms are concentrated in the valleys. Urban and industrial activity is common with many medium and large settlements found in the region, including the large metropolitan areas of Nashville, Tennessee, Lexington, Kentucky, and Pittsburgh, Pennsylvania. Surface and underground coal mining common in the area. Oil and gas production and transportation are also common in the region.

3.1.2.3 North-Central Corn Belt and Great Lakes Plains

The pipeline system crosses a significant portion of the Great Lakes watershed, adjacent to the southern extent of Lakes Michigan, Erie, and Ontario. This area also passes through the northern portion of the Ohio River watershed. This area crosses portions of five ecoregions: Central Corn Belt Plains (54), Michigan/Northern Indiana Drift Plains (56), Eastern Corn Belt Plains (55), Huron/Erie Lake Plain (57), Erie Drift Plains (61)

The NiSource system crosses the Central Corn Belt Plains ecoregion in northwest Indiana. Extensive prairie communities intermixed with oak-hickory forests were native to the glaciated plains of the Central Corn Belt Plains. Hydrologically, the area naturally is covered by a low density of intermittent and perennial streams, though many areas have been tiled, ditched, and tied into the existing drainage systems to support agriculture. Farms are now extensive on the dark, fertile soils of the Central Corn Belt Plains, producing primarily corn and soybeans. Cattle, sheep, poultry, and hogs are also raised, but they are not as dominant as in the drier Western Corn Belt Plains to the west. Remnant patches of mesic prairie communities remain, dominated by big bluestem, Indiangrass, prairie dropseed, and switchgrass. Dry upland prairies are typified by little bluestem and sideoats grama. Woodlands primarily contain white oak, black oak, and shagbark hickory, along with some sugar maple and American elm on more mesic sites. Development is also common as the Chicago metropolitan area and most other major cities in Illinois are found within this ecoregion.

Moving east, the pipeline crosses northern Indiana into the Southern Michigan/Northern Indiana Drift Plains ecoregion. Bordered by Lake Michigan on the west, this ecoregion is less agricultural than the Central and Eastern Corn Belt Plains to the south, and it is better drained and contains more lakes than the flat agricultural Huron/Erie Lake Plains to the east. The region is characterized by many lakes and marshes as well as an assortment of landforms, soil types, soil textures, and land uses. Broad till plains with thick and complex deposits of drift, paleobeach ridges, relict dunes, morainal hills, kames, drumlins, meltwater channels, and kettles occur. Oak-hickory forests, northern swamp forests, and beech forests were typical. Hydrologically, the region has numerous perennial streams, small- and medium-sized lakes, and an abundance of groundwater. Once primarily forested, the area is now largely a mix of agricultural, pasture, urban, suburban and rural lands with patches of woodland and native forests. Primary agricultural products include corn and other feed grains, hay for dairy cattle and other livestock, along with winter wheat, dry beans, and some fruits and vegetables. Recreational and residential development near lake fronts, along with gravel quarries are also common in the region.

Continuing east, the pipeline system crosses the Eastern Corn Belt Plains ecoregion in northeast Indiana and western Ohio, including a portion of one storage field. The Eastern Corn Belt Plains are primarily a rolling till plain with local end moraines. Natural vegetation communities for the ecoregion include beech forests and elm-ash swamps in wetter areas. Hydrologically, the region has numerous perennial and intermittent streams, wetlands, lakes, and reservoirs along with an abundance of groundwater. This region has principally been converted to agricultural uses, with primary products including corn, soybeans, wheat, dairy, and livestock. Additional land uses include urban, suburban, industrial, and rural residential. Many of the largest cities in Ohio and Indiana occur in the Eastern Corn Belt Plains, including Columbus, Dayton, Indianapolis, and Fort Wayne. Urban, industrial, and agricultural development has severely degraded stream and river water quality in the region.

The NiSource system then crosses the Huron/Erie lake Plains ecoregion in northwestern Ohio. The Huron/Erie Lake Plain is a broad, fertile, nearly-flat plain punctuated by relic sand dunes,

beach ridges, and end moraines. Historically, elm-ash swamp and beech forests were dominant, with oak savanna restricted to the sandy, well-drained dunes and beach ridges. This region was composed of extensive swamps and marshes but most have been drained for agriculture, including highly productive corn, soybeans, livestock, and vegetable farms. The majority of the natural vegetation has been cleared for agriculture and only exists today in remnant patches. Urban and industrial areas are also extensive, including the greater Toledo area. Stream habitat and quality have been degraded by channelization, ditching, and agricultural activities.

The NiSource system crosses the Erie Drift Plains ecoregion in northeastern Ohio and northwestern Pennsylvania, including a large portion of one storage field. The glaciated Erie Drift Plain is characterized by low rounded hills, scattered end moraines, kettles, and areas of wetlands. Once largely covered by a maple-beech-birch forest, much of the Erie Drift Plain has been converted to agriculture, primarily in the form of dairy operations. Local croplands are primarily used for feed grains and forage crops. Timber operations are also common in the area, providing saw logs for construction, firewood, and specialty wood products. The area also includes scattered urban development and industrial activities. Vegetable and fruit farms, natural gas wells, recreational development on public lands, and gravel mining are also common land uses in the region.

3.1.2.4 Appalachian Mountains

The NiSource system then crosses into the mountainous region of the Appalachians. This area covers portions of five ecoregions: Central Appalachians (69), Blue Ridge (66), Ridge And Valley (67), Central Appalachians (62), Northern Allegheny Plateau (60)

The pipeline system, including two storage fields, crosses the Central Appalachian ecoregion in portions of southeastern Kentucky, southern West Virginia, northwestern Virginia, and western Pennsylvania. The area is primarily a high, dissected, rugged plateau composed of sandstone, shale, conglomerate, and coal. Hydrologically, the region has a high density of perennial streams, along with some waterfalls and reservoirs but few natural lakes. Natural vegetation for the ecoregion is primarily mixed mesophytic forest, historically dominated by American chestnut. Some areas of consist of Appalachian oak forest and northern hardwood forests with maple, American beech, birch, and eastern hemlock. Areas of red spruce and eastern hemlock occur at the highest elevations in the north-central portion of the region.

Most of the forests of the Central Appalachian region were logged by the 1900s and few remnant patches of virgin forest still remain in park areas (WVDNR 2005). Commercial forestry is common in the region, as are both surface and underground bituminous coal mines. Although agriculture is uncommon, lower areas with less rugged terrain are home to small dairy, livestock and pasture lands are interspersed with woodlands. Gas wells and Christmas tree plantations are also common.

The NiSource system also crosses the Ridge and Valley ecoregion along the northern Virginia state boundary into eastern West Virginia, central and eastern Pennsylvania, and southeastern New York. This northeast-southwest trending, relatively low-lying, but diverse ecoregion is located between generally higher, more rugged mountainous regions with greater forest cover. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. Natural vegetation for the region is dominated by Appalachian oak forest communities in the north and oak-hickory-pine forest communities in the south. Hydrologically, the regional drainage is in a trellised pattern with smaller streams on the slopes draining into meandering streams in the valley, combined with natural springs and some large reservoirs to make a diverse aquatic system.

The Ridge and Valley region is currently a mix of forested ridges with agricultural development in the valleys (Woods et al 1999). Land uses consist of pine plantations, pasture, and cropland with areas of rural residential, urban, and industrial. Regional agricultural products include hay, pasture and grain for beef and dairy cattle, corn, soybeans, tobacco, and cotton. Numerous large and medium cities are found throughout the region. In addition, coal mining and poultry operations are found throughout the region.

The NiSource system crosses a narrow strip of the Blue Ridge ecoregion in north central Virginia and southern Pennsylvania. The Blue Ridge extends from southern Pennsylvania to northern Georgia, varying from narrow ridges to hilly plateaus to more massive mountainous areas, with high peaks reaching over 2000 meters. Regional terrain is generally rugged, varying from narrow ridges to hilly plateaus with areas of massive mountains and high peaks. Hydrologically, the region has a high density of cool, clear perennial streams along with a few large reservoirs, and natural lakes are largely absent. The region's temperate broadleaf forests are some of the most floristically diverse forests in the world. Vegetation communities found in the region are a combination of Appalachian oak forests along with a variety of oak, hemlock, cove hardwoods, and pine communities. Higher elevation forests are dominated by northern hardwoods such as American beech, yellow birch, yellow buckeye, and maples. The highest elevations are covered by Southeastern spruce-fir forests, with Fraser fir, red spruce, yellow birch, and rhododendrons.

Much of the Blue Ridge region remains forested, so land uses are primarily forest-related (e.g., timber and Christmas tree farms). Agricultural uses including pasture and hay production and apple orchards are also common. Urban development is not as common as in surrounding regions. The region contains a number of large public lands including national forests and parks where recreation, tourism, and hunting play a major factor in land use design.

The NiSource system crosses the North Central Appalachian ecoregion in northern Pennsylvania and southeastern New York. Regional terrain combines plateau surfaces, high hills, and low mountains mostly unaffected by glaciations. Hydrologically, the region has numerous perennial streams and lakes. The region is covered primarily by a combination of northern hardwood forests and Appalachian oak forests along with numerous areas of bog and marsh. By 1870, most of the regional old growth forests were cut or burned and were replaced by mixed hardwood regrowth.

Land use in the North Central Appalachian region is predominated by forestry and recreation along with coal mines, oil and gas development, dairy farming, public lands, and suburban development (Griffith 2007). The Pocono High Plateau area of the ecoregion is heavily utilized for recreation and tourism, with numerous vacation and suburban developments, especially around the area's larger lakes

The NiSource system crosses the Northern Allegheny Plateau along the southern state border of New York. The region is distinct from surrounding regions by being more rugged and less cultivated and developed than regions to the north and west, and less mountainous, forested, and populated than regions to the south and east. Regional terrain is upland plateau with rolling hills, open valleys and low mountains. Hydrologically, the region has a number of perennial streams and small glacial lakes. Native vegetation communities of the area include Appalachian oak and northern hardwood forests.

The landscape of the Northern Allegheny Plateau is a mosaic of farmland, pasture, forest, and woodlands. Principal agricultural crops of the region are hay and grain for dairy cattle operations, with the regional soils, topography, and climate being unsuitable for traditional agriculture. Farming is declining regionally, with many old farmlands reverting to woodlands. Recreation and vacation developments are also becoming common in the region.

3.1.2.5 Atlantic Coastal Plains and Highlands

The far eastern portions of the pipeline system reach out along the Atlantic Coastal regions. This area covers portions of six ecoregions: Northeastern Highlands (58), Northern Piedmont (64), Piedmont (45), Southeastern Plains (65), Middle Atlantic Coastal Plain (63)

In the north, the pipeline crosses the Northeastern Highlands ecoregion in southeastern New York and northern New Jersey. The regional terrain is a combination of glaciated hills, mountains, narrow valleys and some hilly plains. The area has numerous perennial streams, some large rivers and many large and small glacial lakes, many of them affected by atmospheric deposition from industry in other regions. Native vegetation in the region is transitional between the boreal regions to the north and the broadleaf deciduous forests to the south, with dominant regional communities including mixed hardwood and spruce-fir forests. Appalachian oak forest is also found in the southern portions of the region.

The Northeastern Highlands are characterized by scenic forested mountains and a relatively sparse population. Primary land uses include recreation, tourism, and forestry. Much of the land has reverted to forest cover following historically heavy farming, although some farming remains including dairy products, forage crops, apples, and potatoes. Primary uses of regional forest land include recreational homes, tourism, and commercial timber harvest.

The NiSource system crosses the Northern Piedmont ecoregion in northern Virginia, central Maryland, southeastern Pennsylvania, and central New Jersey. The Northern Piedmont is a

transitional region of low rounded hills, irregular plains, and open valleys. The region hosts numerous perennial streams and springs. Much of the natural vegetation of the ecoregion is composed of Appalachian oak forest. Much of the region, however, has been converted to agriculture, urban, suburban, and industrial land uses. Regional agricultural products include feed and forage crops and soybeans. Other land uses common to the region include nurseries, plant farms, Christmas trees plantations, woodlots, and horse and hobby farms. Large urban areas are common, including the greater Philadelphia area.

The NiSource system crosses the Piedmont ecoregion, which forms the transitional area between the Appalachians and the eastern coastal plains, in central Virginia. Regional terrain is an erosional landscape of moderately dissected irregular plains between areas of hills. The region has a moderate to high density of perennial streams along with numerous large reservoirs, though the area largely lacks lakes. Natural vegetation in the region is dominated by the oak-hickory-pine forest community. Once largely cultivated, much of this region has reverted to successional pine and hardwood woodlands, with an increasing conversion to an urban and suburban land cover. Large developed areas in the region include outer Washington DC Beltway.

The pipeline crosses the Southeastern Plains ecoregion in southeastern Virginia (this ecoregion is also encountered in the Southern Coastal and Interior Plains region). This area is characterized by dissected hills and irregular plains. With the drier conditions, mixed oak and oak-pine forest become the dominant forest cover, with interspersed areas of bluestem prairie and bottomland forest. In the northern portion of the ecoregion, deciduous stands are increasing due to frequent fires and preferential cutting of pine. Additionally, the northern section has seen a rapid expansion of urbanization and residential development within commuting distance of the Washington DC Beltway.

The NiSource system crosses the Middle Atlantic Coastal Plain ecoregion in the northernmost portion of Delaware and eastern New Jersey. The Middle Atlantic Coastal Plain ecoregion consists of low elevation flat plains, with many swamps, marshes, and estuaries. Native vegetation in the region includes longleaf pine with areas of oak-hickory-pine forest in the northern areas. Much of the region is covered by loblolly pine and shortleaf pine with patches of oak, gum, and cypress in major riparian areas. The southern barrier islands are primarily covered by maritime forests of live oak, laurel oak, and loblolly pine. Coastal marshes are primarily covered by cordgrass, saltgrass, and rushes. Dunes are covered by beach grass and sea oats. Land use in the region is a mix of pine plantations used for pulp and lumber, agriculture in the north and central areas, and extensive urban and suburban development. Agricultural products for the region include wheat, corn, soybeans, potatoes, cotton, blueberries, peanuts, chicken, turkey, and hogs. Large portions of the coastal areas are developed for recreation and tourism.

3.2 Status of the Species in the Action Area

This section of the BO presents summarizes the species' descriptions, life history, ecology, status and threats across their range and within the action area.

3.2.1 MSHCP Species

3.2.1.1 Indiana bat

Species Background & Habitat

The Indiana bat was listed as an endangered species on March 11, 1967 (federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). In 1973, the Endangered Species Preservation Act was subsumed by ESA and the Indiana bat was extended full protection under this law. Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula, including 11 caves and two mines in six states, were listed as critical habitat including Blackball Mine in LaSalle County, Illinois.

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter, and spends the summer in wooded areas. It is a medium-sized bat, having a wing span of 9 to 11 inches and weighing only one-quarter of an ounce. The fur is described as dull pinkish-brown on the back and somewhat lighter on the chest and belly. The ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). The Indiana bat closely resembles the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). It is distinguished from these species by its shortened feet and toe hairs and a slightly keeled calcar.

In winter (typically October through April), Indiana bats hibernate in caves or mines, often with other species (USFWS 2007a). In spring, males and non-reproductive females may migrate long distances to their summer habitat (Kurta and Rice 2002). Likewise, reproductive females may migrate long distances to summer habitat – (up to 357 miles based on data from Winhold and Kurta 2006) or they may form maternity colonies only a few miles from their hibernaculum. Both males and females return to hibernacula in late summer or early fall to mate (swarm) and store up fat reserves for hibernation. By mid-November, male and female Indiana bats have entered hibernation. They typically reemerge in April, at which time they again seek their summer habitat. The Indiana Bat Draft Recovery Plan (USFWS 2007a) provides a comprehensive summary of Indiana bat life history.

After hibernation ends in late March or early April, most Indiana bats emerge, and forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting areas. Female Indiana bats emerge first from hibernation in late March or early April, followed by the males. The timing of annual emergence may vary across their range, depending on latitude and annual weather conditions. Shortly after emerging from hibernation, the

females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (USFWS 2007a). Most populations leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

Most bats migrate to the north for the summer, although other directions have been documented (USFWS 2007a, Gardner and Cook 2002). A stronger homing tendency has been observed along a north-south axis, than the east-west direction in release studies. Females can migrate hundreds of miles north of the hibernacula. Less is known about the male migration pattern, but many males summer near the hibernacula (Whitaker and Brack 2002, USFWS 2007a).

Females arrive in summer habitat as early as April 1. Temporary roosts are often used during spring until a maternity roost with large numbers of adult females is established. Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas; that is, they return to the same summer range annually to bear their young. Trees in excess of 16 inches diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Cavities and crevices in trees may also be used for roosting. In Illinois, Gardner et al. (1991) found that forested stream corridors and impounded bodies of water were preferred foraging habitats for pregnant and lactating Indiana bats.

Most documented maternity colonies have 50 to 100 adult bats (USFWS 2007a). Fecundity is low with female Indiana bats producing only one young per year in late June to early July. Young bats can fly between mid-July and early August, at about 4 weeks of age. Mortality between birth and weaning was found to be about 8% (Humphrey et al. 1977). Many males stay near hibernacula (i.e., caves and mines) and roost individually or in small groups during the summer (Whitaker and Brack 2002). The later part of the summer is spent accumulating fat reserves (USFWS 2007a). Males have been observed roosting in trees as small as 3 inch dbh.

Return to the hibernacula begins for some males as early as July. Females typically arrive later and by September numbers of males and females are almost equal. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain them through the winter (Cope et al. 1977, USFWS 1983). Swarming behavior typically involves large numbers of bats flying in and out of cave entrances throughout the night, while most of the bats continue to roost in trees during the day.

Swarming continues for several weeks and copulation occurs on cave ceilings near the cave entrance during the latter part of the period (USFWS 2007a). Adult females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from

hibernation. Young female bats can mate in their first autumn and have offspring the following year, whereas males may not mature until the second year. Limited mating activity occurs throughout the winter and in late April as the bats leave hibernation (Hall 1962).

Distribution and Range

The species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The Indiana bat is migratory, and the above described range includes both winter and summer habitat. The winter range is associated with regions of well-developed limestone caverns. Major populations of this species hibernate in Indiana, Kentucky, and Missouri. Smaller winter populations have been reported from Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia. More than 85% of the entire known population of Indiana bats hibernates in only nine caves.

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and summers in wooded areas. Its range extends from the northeast to the Midwestern United States and is divided into four proposed Recovery Units as follows: the Northeast (NERU), the Appalachian Mountains (AMRU), the Midwest and the Ozark-Central Recovery Units (USFWS 2007). As of the winter of 2010-2011, the Midwest Recovery Unit has the vast majority of these animals with 71.9% of the population in this area (USFWS 2012).

Status and Threats Rangewide

The 2011 range-wide population estimate of Indiana bats was 424,708 individuals, based on winter hibernacula survey information compiled by the USFWS. Figure 1 provides the rangewide Indiana bat population estimates from 1981-2011. Table 4 provides a detailed breakdown of the range-wide population estimates by Recovery Unit from 2001 to 2011 (USFWS 2010, Andy King, USFWS, pers. comm.).

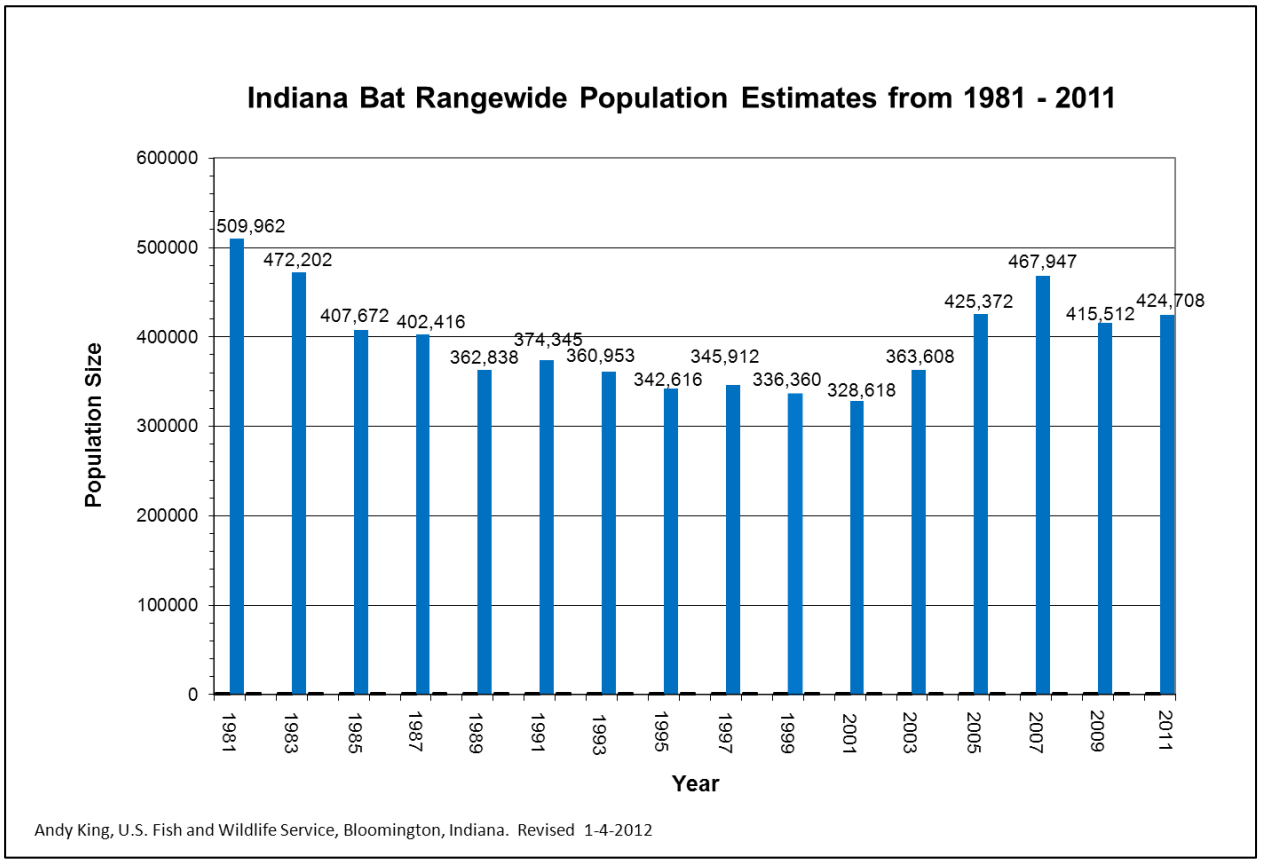

Figure 1. Rangewide Indiana bat population estimates, 1981-2011

Table 4. Range-wide population total estimates by Recovery Unit.

Recovery Unit	2001	2003	2005	2007	2009	2011
Ozark-Central (AR, IL, MO, OK)	43,151	63,632	73,261	71,547	68,510	70,822
Midwest (AL, IN, KY, MI, OH, TN, SW. VA)	238,739	246,673	285,729	320,342	281,909	305,297
Appalachian Mtns. (E. TN, PA, NC, VA, WV)	16,384	19,658	23,672	22,295	30,568	32,529
Northeast (NY, NJ, VT)	30,252	33,645	42,710	53,763	34,525	16,060
Total	328,526	363,608	425,372	467,947	415,512	424,708

The abundance of Indiana bats in the northeast has declined to almost half of the 2001 population levels due to the effects of White-nose Syndrome (WNS). The threat to the continued existence of the species from WNS remains high. Recovery efforts are primarily focused on the WNS investigation at this time and its source. As of 2013, the USFWS considers the overall Indiana bat population trend to be declining as WNS continues to spread.

Known summer occurrences cover a broader geographic area than its winter distribution including southern Iowa, northern Missouri, much of Illinois and Indiana, southern Michigan, Wisconsin, western Ohio, and Kentucky. In 2009, there were 2,400 maternity colonies

estimated rangewide for the Indiana bat. The 2,400 maternity colonies is an estimate based on 269 known locations. Thus, only 11 percent of all estimated colonies are known.

The original recovery plan (USFWS 1983) and the 2009 Five-Year Review (USFWS 2009a) identified threats as natural hazards (i.e., flooding, freezing, mine ceiling collapse), human disturbance and vandalism at hibernacula, deforestation and stream channelization, pesticide poisoning, indiscriminate scientific collecting, handling and banding of hibernating bats by biologists, commercialization of hibernacula, exclusion of bats from caves by poorly designed gates, man-made changes in hibernacula microclimate (blocking or adding entrances and/or by poorly designed gates), and flooding of caves by reservoir developments.

Several of the original threats listed above have largely been addressed and are no longer adversely affecting the species to the extent they once had (i.e., human disturbance at hibernacula, indiscriminate scientific collecting, banding of hibernating bats, commercialization of hibernacula, and poorly designed cave gates). The 2007 agency draft recovery plan (USFWS 2007a) identified additional threats including: quarrying and mining operations (summer and winter habitat), loss and degradation of summer, migration, and swarming habitat, loss of forest habitat connectivity, some silvicultural practices and firewood collection, disease and parasites, predation, competition with other bat species, environmental contaminants, climate change, and collisions with man-made objects (i.e., wind turbines, communication towers, airstrikes with airplanes, and roads). With few exceptions, all of these identified threats are still affecting the species to varying degrees.

The proliferation of commercial-sized wind turbines across the landscape of the United States poses a new threat to the Indiana bat. An injunction by federal court issued to Beech Ridge wind energy project underlined the need for project proponents to seriously consider impacts to the federally listed endangered bats when developing such projects. Many project developers are now reviewing project alternatives to minimize harm to bats from project operation.

In addition to these threats, the novel disease, WNS, has recently been identified as a significant threat to the recovery of the Indiana bat. First documented at four sites in eastern New York in the winter of 2006-07, WNS is killing cave-dwelling bats in unprecedented numbers in eastern North America. Associated with the fungus *Geomyces destructans* (Gargas *et al*. 2009), the most obvious symptom of WNS is the presence of a white fungus on the face, wing, or tail membranes of many, but not all, affected bats. Behavioral changes are also indicative of WNS affliction, characterized by a general shift of bats from traditional winter roosts to colder areas, or to roosts unusually close to hibernacula entrances. Affected bats are generally unresponsive to human activity in the hibernaculum, and may even fail to arouse from torpor when handled. Bats at affected sites are regularly observed flying across the mid-winter landscape, and on occasion, carcasses of little brown bats by the hundreds to thousands have been found outside affected hibernacula with more found inside. Affected bats appear to be dying as a result of depleted fat reserves, and mortalities are first apparent months before bats would be expected to emerge from hibernation.

Overall mortality rates from WNS (primarily of little brown bats) have ranged from 81% to over 97% at several of the sites where data have been collected for at least two years (Hicks *et al*. 2008). The syndrome has now been documented in 22 states and 5 Canadian provinces, with the apparent degree of impact to bats varying greatly by site and species. Based on observations of continued mass-mortality at several sites in the Northeast and mid-Atlantic regions, we anticipate that WNS will continue to spread rapidly, moving into and through the Midwest, South and eventually Great Plains over the next couple of years. If current trends for spread and mortality at affected sites continue, WNS threatens to drastically reduce the abundance of many species of hibernating bats in much of North America. Population modeling indicates a 99% chance of regional extinction of the little brown bat in the Northeast within the next 16 years due to WNS (Frick *et al*. 2010). The closely-related Indiana bat may be equally vulnerable due to its smaller range-wide population and social behavior traits that increase the risk of bat-to-bat transmission.

Impacts to Indiana bats have been inconsistent between affected hibernacula. When comparing the most recent counts to the last count conducted prior to signs of WNS at any given site (generally 2005 or 2007 counts), the following is a summary of what has been observed in New York at the larger sites:

- Haile's Cave 100% decline from 685 bats in 2005 to 0 every year since
- Williams Preserve Mine 98.5% decline from 13,014 in 2007 to 190 in 2010
- Williams Lake Mine 97.4% decline from 1,003 in 2007 to 26 in 2010
- Glen Park 73.6% decline from 1,928 in 2007 to 509 in 2010
- Williams Hotel Mine 66.5% decline from 24,317 in 2007 to 8,152 in 2010
- Jamesville 20.7% decline from 2,932 in 2007 to 2,324 in 2009
- Barton Hill Mine 13.7% increase from 9,393 in 2007 to 10,678 in 2010

Based on observations of continued mass mortality at several sites, we anticipate the loss of Indiana bats to continue in the Northeast/mid-Atlantic regions as well as the Midwest in future winters. In addition, we anticipate that WNS will continue to radiate out to new sites, with WNS only documented in the largest Indiana bat hibernacula in the Midwest over the past couple years. The potential for climate, or some other environmental factor, to influence the spread of WNS, or the severity of its impact on affected bats, remains unknown. Final range wide counts from 2013 will continue to reveal the severity of the spread and impacts of WNS. Given the evidence to date, however, the USFWS considers WNS to be the single-most destructive and significant threat to the Indiana bat.

Additional information on WNS, which is constantly evolving, can be found online at http://whitenosesyndrome.org/.

Status within the Action Area

The covered lands cross three Indiana bat recovery units (Midwest, Appalachian Mtns., and Northeast). Impacts and potential resulting take of Indiana bats from NiSource activities may occur in the states and counties identified below. As seen across the range of the species, Indiana bat is considered to be declining in these areas, largely due to the impacts of WNS. We expect the species status, threats, and impacts in these areas to reflect the status, threats, and impacts seen for the species rangewide.

Indiana - DeKalb, Elkhart, Lake, LaPorte, Marshall, Noble, Porter, and St. Joseph counties.

Kentucky - Adair, Allen, Barren, Bath, Bourbon, Boyd, Bracken, Campbell, Carter, Casey, Clark, Clay, Estill, Fayette, Floyd, Garrard, Greenup, Jackson, Johnson, Knott, Lawrence, Lee, Letcher, Lewis, Lincoln, Madison, Martin, Mason, Menifee, Metcalfe, Monroe, Montgomery, Morgan, Nicholas, Owsley, Pendleton, Perry, Pike, Powell, Robertson, and Rowan counties.

Maryland - Allegany, Garret, and Washington counties.

New Jersey - Hunterdon, Morris, and Warren counties.

New York - Orange and Rockland counties.

Ohio - Adams, Allen, Ashland, Ashtabula, Athens, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hancock, Hardin, Harrison, Henry, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Stark, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne, Wood, and Wyandot counties.

Pennsylvania - Adams, Allegheny, Armstrong, Beaver, Bedford, Blair, Bucks, Butler, Cambria, Cameron, Centre, Chester, Clarion, Clearfield, Clinton, Cumberland, Delaware, Elk, Fayette, Franklin, Fulton, Greene, Huntingdon, Indiana, Jefferson, Lancaster, Lawrence, Lehigh, McKean, Monroe, Montgomery, Northampton, Pike, Somerset, Washington, Westmoreland and York counties.

Tennessee - Davidson, Hardin, Lewis, Macon, Maury, McNairy, Sumner, Trousdale, Wayne, Williamson, and Wilson counties.

Virginia - Albemarle, Alleghany, Augusta, Botetourt, Clarke, Frederick, Giles, Greene, Lexington, Madison, Page, Rockbridge, Rockingham, Shenandoah, Warren, and Waynesboro counties as well as the independent cities of Lexington and Waynesboro.

West Virginia – Barbour, Boone, Braxton, Brooke, Cabell, Calhoun, Clay, Doddridge, Fayette, Gilmer, Grant, Greenbrier, Hampshire, Hancock, Hardy, Harrison, Jackson, Kanawha, Lewis, Lincoln, Logan, Marion, Marshall, Mason, McDowell, Mercer, Mineral, Mingo, Monongalia, Monroe, Morgan, Nicholas, Ohio, Pendleton, Pocahontas, Preston, Putnam, Raleigh, Randolph, Roane, Summers, Taylor, Tucker, Tyler, Upshur, Wayne, Webster, Wetzel, Wirt, Wood, and Wyoming counties.

3.2.1.2 Bog Turtle

Species Background & Habitat

The bog turtle was first described and named as Muhlenberg's tortoise (*Testudo muhlenbergii*) by Johann David Schoepff in 1801 based on specimens received in 1778 from Heinreich Muhlenberg of Lancaster County, Pennsylvania. In 1835, the species was transferred to the genus *Clemmys*, but it is now believed to be in the genus *Glytemys*. This genus name change has been recognized and supported by the Society for the Study of Amphibians and Reptiles since 2003 (Crother et al. 2003).

The bog turtle is only active during part of the year. Generally, it becomes active in late March to late April, depending upon latitude, elevation, and seasonal weather conditions (USFWS 2001). In the northern distinct population segment, the turtle is active from approximately April to mid-October. The species hibernates from October to April, often just below the upper surface of frozen mud or ice (USFWS 1997), and generally retreats into more densely vegetated areas to hibernate (USFWS 2001). Bog turtles have been found to over-winter with spotted turtles and to demonstrate strong fidelity to their hibernacula (USFWS 2001).

The bog turtle is active during daylight hours, generally from mid-morning to late afternoon, or early evening (NatureServe 2007a). In early spring, activity takes place mainly at midday and in the afternoon. The bog turtle's peak activity period occurs in late spring and summer during the morning (NatureServe 2007a). Klemens reported that daily activity in Massachusetts's populations varied considerably with the time of year, prevailing weather conditions, and the previous night's temperature (USFWS 2001). The bog turtle is more active on cloudy days than on bright sunny days (NatureServe 2007a). On cooler, windy days, turtles have been observed basking partially hidden under dry vegetation. During warm summer days, bog turtles have been observed basking half-buried in a self-made depression on a shallow, flooded mud flat, with only a small portion of their carapace breaking the water's surface (USFWS 2001).

Female bog turtles reach sexual maturity between five and eight years of age (USFWS 1997). Bog turtle courtship and mating occurs in spring, from March to May (Harding 2002). The breeding season may last from mid-May to early July, with most eggs laid in June. Unlike most other semi-aquatic turtles, the bog turtle does not leave its wetland habitat and travel to dry, upland areas to lay eggs. Instead, females select a slightly elevated site, generally on *Carex stricta* hummocks, for nesting within marshy habitat (USFWS 1997). Nesting areas typically have limited canopy closure, moist substrates, and provide ample sun exposure.

Females may also lay eggs in common nesting areas, or nurseries (USFWS2001). One to six (usually three to five) eggs are laid annually, with no evidence to suggest multiple clutches are produced in a breeding season. Eggs hatch after an incubation period of six to nine weeks, and the young emerge in August or early September (USFWS 1997). In the species' northern range, hatchlings may not emerge from the nest until October (USFWS 2001; NatureServe 2007a). Infertile eggs are common, and not all females produce clutches annually.

The bog turtle is a semi-aquatic species, and usually occurs in small, discrete populations occupying suitable wetland habitat dispersed along a watershed (USFWS 1997, 2001). Potential bog turtle habitat is recognized by three criteria: suitable hydrology, suitable soils, and suitable vegetation. Bog turtles prefer wetland habitats that include shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures that have soft, muddy bottoms; clear, cool, slow-flowing water, often forming a network of rivulets; and open canopies. Wetland habitat is a mosaic of micro-habitats that include dry pockets, saturated areas, and areas that are periodically flooded. The turtle depends upon this diversity of microhabitats for foraging, nesting, basking, hibernation, shelter, and other needs. Historically, the bog turtle probably moved from one open-canopy wetland patch to another, as succession closed wetland canopies in some areas and natural processes opened canopies in other areas (USFWS 2001). The bog turtle forages on land and in the water, and its varied diet consists of beetles, lepidopteran larvae, caddisfly larvae, snails, nematodes, millipedes, fleshy pondweed seeds, sedge seeds, and carrion (USFWS 1997; NatureServe 2007a).

Distribution and Range

The bog turtle has been reported from 12 eastern states, and is sparsely distributed over a discontinuous geographic range extending from New England, south to northern Georgia (USFWS 1997, 2001). A 250-mile gap within the range separates the species into northern and southern distinct population segments. The northern population extends from southern New York and western Massachusetts southward through western Connecticut, New Jersey, and eastern Pennsylvania, to northern Delaware and Maryland. Bog turtles in the northeast are found in the inter-montane valleys and rolling hills of the Piedmont. The southern population occurs in the Appalachian Mountains from southwestern Virginia southward through western North Carolina, eastern Tennessee, northwestern South Carolina, and northern Georgia (USFWS 1997). To facilitate recovery, the USFWS divided the species into five recovery units in the Bog Turtle Recovery Plan (USFWS 2001).

Status and Threats Rangewide

The bog turtle was listed by the USFWS as threatened under the ESA on November 4, 1997. Critical habitat was not designated for the bog turtle as the USFWS determined it was not prudent to do so. There are 601 extant bog turtle occurrences in the range of the northern distinct population segment, which when grouped make up 390 populations (USFWS unpublished data). Of the 390 populations range-wide, 251 consist of a single documented

occurrence, 74 consist of two occurrences, 32 consist of three occurrences, and 33 consist of four or more occurrences (USFWS unpublished data). Viability of a bog turtle population has not been quantified to date.

The most significant threats to the bog turtle include: (1) Indirect effects due to development, including habitat loss, degradation and fragmentation; and (2) habitat degradation due to natural succession and encroachment by invasive exotic plant species.

Status within the Action Area

The covered lands cross three bog turtle recovery units (Hudson Housatonic, Delaware, and Susquehanna/Potomac). Threats and potential conservation measures are similar among the three recovery units.

Impacts and potential resulting take of bog turtle is likely to occur in the following counties: New Castle County, Delaware; Baltimore, Cecil, and Harford counties, Maryland; Gloucester, Hunterdon, Morris, Salem, and Warren counties, New Jersey; Orange and Rockland counties, New York; and Adams, Bucks, Chester, Cumberland, Delaware, Lancaster, Lehigh, Monroe, Montgomery, Northampton, and York counties, Pennsylvania.

There are 13 known bog turtle sites within the existing ROWs. Based on modeling described in the MSHCP and discussions with USFWS and State bog turtle experts, an additional 7 bog turtle sites are anticipated to occur within the ROWs for a total of 20 bog turtle sites. Multiple Phase 1 and Phase 2 bog turtle surveys have been conducted on NiSource ROWs and additional within-ROW sites are not anticipated in New York or Delaware. Outside of the existing ROWs, there are an additional 16 known bog turtle sites within the covered lands and an estimated 128 bog turtle sites in total. We expect the species status, threats, and impacts in these areas to reflect the status, threats, and impacts seen for the species rangewide.

3.2.1.3 Madison Cave Isopod

Species Background & Habitat

The Madison Cave isopod (MCI), a rare, sightless, aquatic invertebrate, is a member of the family Cirolanidae, and is restricted to subterranean lakes and deep karst aquifers (phreatic waters). The Madison Cave isopod was first described by T.E. Bowman in 1964 and is the only member of the genus Antrolana. The species is non-migratory, although it is a strong swimmer and a benthic walker. It is thought to feed on small pieces of living or formerly living plants and animals that enter the groundwater from the surface (USFWS 1996). Because this species lives in a habitat that is extremely difficult to study, relatively little is known about its reproduction, home range, trends in population, and ecological relationships.

Madison Cave isopod are predominantly adapted to unlighted subsurface lakes and deep, water-filled fissures. It is assumed that the Madison Cave isopod does not occupy habitat

above, or in very close proximity to, the earth's surface, including surface waters. Madison Cave isopods live in deep karst aquifers and underground lakes where water temperatures range from 51.8 to 57.2 degrees Fahrenheit. Besides the observation that Madison Cave isopod is found in waters supersaturated with calcium carbonates, little is known about the chemical conditions of Madison Cave isopod habitat (USFWS 1996).

Madison Cave isopods occupy subsurface bodies of water in karst geology. In the karst geology, subsurface waters (both water contained in the bedrock and water contained in open spaces) are dynamic and may move quickly through voids in the bedrock. For this reason, bedrock is not likely to be an effective sediment filter for subsurface waters. Because the presence or absence of voids, fractures, and solution cavities within bedrock is unpredictable in karst geology, there may be instances where surface waters directly connect to subsurface waters.

Distribution and Range

The MCI lives underground in the flooded ionically-saturated waters of deep karst aquifers of Cambro-Ordovician aged carbonate bedrock (limestone and dolostone). Orndorff and Hobson (2007) delineated MCI potential habitat based on the extent of carbonate bedrock in which MCI has been found. Their layer extends through 10 counties, from Rockbridge County, Virginia to Jefferson County, West Virginia and represents approximately 865,028 surface acres. When the recovery plan was written the taxon was known initially from deep (phreatic) cave lakes and streams fed by deep cave lakes from seven sites and thought to be endemic to Virginia. Increased survey efforts have more than doubled its known range. Recently MCIs were discovered in wells that intersect phreatic or groundwater habitats, where there is no obvious nutrient source or visible indication that the area was inhabited by MCI. At these sites, it is likely the water is flowing from nutrient-rich to nutrient-poor areas.

Status and Threats Rangewide

The MCI was listed as a threatened species in 1982, under the provisions of the ESA (47 Fed. Reg. 43699-43701), without critical habitat. The listing was based on a number of factors including, but not limited to: the limited known range of the species, vandalism, siltation, and mercury contamination. Current threats include: thermal and chemical pollution from urban development and agricultural runoff (e.g., poultry farming), pollution, human disturbance (both cave vandalism and visitation). Barriers to forming recovery strategies include a lack of ecological and life history information for Madison Cave isopod and a lack of information regarding the physical limits of recharge zones that affect Madison Cave isopod habitat (USFWS 1996).

MCI habitat is degraded by altering water flow patterns, which can lead to a reduction in available habitat if water is diverted or increases in sediment and contaminant loads if the system becomes flashy. Water flow patterns are altered by many factors including increased impervious surfaces, filling sinkholes, and shifting subsurface formations and hydrology. Flow patterns may change depending on the amount of impervious surfaces in the recharge zone.

Impervious surfaces decrease the amount of land available for groundwater recharge and may increase the flashiness of the system by preventing rainwater from filtering back into the ground. In developed areas, instead of channeling water back to the aquifer, water may be directed to a central water treatment facility, in essence dewatering the MCI habitat. A drop in groundwater may prevent the MCI from accessing some of its travel corridors if the corridors can only be accessed when water levels are high. Impervious surfaces may also cause elevated sediment loads in the groundwater and clog sinkholes and interstitial spaces with sediment and debris. This prevents water from reaching the MCI and potentially blocks travel corridors. Increased impervious surfaces also results in reduced vegetation to provide nutrients in the form of detrital material and less water directed back to the system carrying these nutrients underground.

Likely physical barriers have led to isolation of sections of some populations and contributed to creating new genetic units or clades. Activities such as blasting, chiseling, trenching, or digging may cause shifts in surface and sub-surface formations and hydrology. These typically occur in concert with land clearing for land development, constructing new roads, and sewage, water, or gas pipelines. Sudden shifts in subterranean structures created from these activities may crush or trap MCIs, cause excessive sedimentation and reduced habitat suitability, and alter their travel corridors and the hydrology.

Contamination of groundwater is an increasing threat, and the degree of contamination is largely unknown. MCI habitat is susceptible to groundwater contamination due to its porous nature and limited filtering abilities. In rural areas agricultural practices such as large scale biosolids and pesticide application are ongoing and may threaten the quality of the habitat. In 2006/2007 the U.S. Geological Survey (USGS) (Boughton 2007) sampled groundwater for contaminant levels from wells in potential MCI habitat in Jefferson and Berkeley Counties, West Virginia. Samples were analyzed for a broad spectrum of contaminants including pharmaceuticals and pesticides. USGS found the herbicide atrazine in low levels in four of the six sites. One site in Jefferson County contained detectable concentrations of atrazine, prometon (herbicide), tetrachloroethylene (dry cleaning or degreasing solvent), 1-4 dichlorobenzene (insecticide and deodorizer in some manufacturing processes), and bisphenol-A (widely used plasticizer). The levels of these chemicals were found below their Ambient Water Quality Criteria, developed by the Environmental Protection Agency for the protection of aquatic organisms. It is noteworthy that contaminants were detected because we do not know how they may affect the MCI, and it illustrates the susceptibility of the phreatic aquifer to contamination.

There are no global abundance estimations for Madison Cave isopod, but mark-recapture population-size estimates of the most abundant populations range roughly between 1972 (+/- 851) and 6,678 (+/- 3,782) individuals (USFWS 1996). The large standard errors were associated with low recapture rates.

Presence/absence sampling for this species has numerous uncertainties, which make data difficult to interpret. Sampling for MCI requires access to phreatic water, which fluctuates in

depth depending on water table levels. Without knowing how large an area the baited traps are sampling, it is unclear how large an area the survey results at discrete sampling points represent. We expect hydrologic conditions such as water level and flow would affect the size of the sampling area. Repeat sampling at known locations does not indicate a change in the populations. Sites that have traditionally yielded a large number of MCI such as Steger's Fissure and Madison Cave continue to produce large numbers. Sites that have more moderate or low numbers continue to produce similar numbers. The known species range has increased; we assume this is due to increased survey efforts rather than a species expansion. Currently MCI have been recorded from 16 locations within the Shenandoah Valley from Leetown, West Virginia south to Lexington, Virginia: a range 136.4 miles long and 24.8 miles wide (Hutchins 2007).

Status Within the Action Area

Impacts and potential resulting take of MCI may occur in the following counties: Augusta, Clarke, Page, Rockbridge, Rockingham, Shenandoah, and Warren counties, and the City of Waynesboro, Virginia. We expect the species status, threats, and impacts in these areas to reflect the status, threats, and impacts seen for the species rangewide.

3.2.1.4 Nashville Crayfish

Species Background & Habitat

Little is known about the life history of Nashville crayfish or in fact most of the over 300 crayfish species (Muck 2002). To the extent that information is lacking about the Nashville crayfish, information about related crayfish species is relied upon. Muck (2002) studied one of the Nashville crayfish congeners, *Orconectes luteus*, which is a stream species found in Missouri, and Mitchell and Smock studied *O. virilis* found in the James River in Virginia. The discussion below, particularly as it relates to reproduction of Nashville crayfish, relies heavily on data from the study of *O. luteus* and therefore should be considered as the best data currently available.

The Nashville crayfish has been found in a wide range of environments including gravel and cobble runs, pools with up to approximately four inches of settled sediment, and under slabrocks and other cover. The species has also been found in small pools where the flow was intermittent. The substrate of Mill Creek and its tributaries, the primary waterbodies in which Nashville crayfish are found, are mainly bedrock covered in some areas with gravel and scattered limestone slabs. The pools, backwater areas, and stream margins of Mill Creek are covered with silt and sand. Riverweed (*Podostemum* spp.) occurs on rocks in some swift water areas, and water willow (*Justicia* spp.) occurs along some shallow gravel shoals. Much of the stream bank is vegetated with trees and shrubs (USFWS 1989a).

No data are available on home range size of the Nashville crayfish (NatureServe 2007b). Adult Nashville crayfish tend to be solitary, seeking cover under large rocks, logs, debris, or rubble; the largest individuals (Nashville crayfish can attain lengths of over six inches) generally select

the largest cover available. Egg laying among Nashville crayfish is thought to occur in late winter and early spring with young released in early summer (USFWS 1989a; NatureServe 2007b). Females seek out large slabrocks when they are carrying eggs and young; these secluded places are also needed for molting. The species is apparently highly photosensitive and is usually found under cover during the day. Cover is aggressively defended; larger individuals drive smaller crayfish from their selected cover. Availability of cover may be a limiting factor in some areas (USFWS 1989a). Nashville crayfish are most active in the summer and although the activity level is low in winter, they have been known to move even under the occasional ice in Tennessee streams. The species is non-migratory.

Similar to other crayfish, this species is an opportunistic feeder that acts as a detritivore, piscivore, and browsing herbivore. An analysis of Nashville crayfish stomach contents found 41% materials identifiable as plant fragments and 26% parts of arthropods (NatureServe 2007b). Crayfish are preyed upon by a number of species, including particularly predatory fish.

Distribution and Range

The Nashville crayfish is currently known to exist only in the Mill Creek watershed in Davidson and Williamson counties, Tennessee.

Status and Threats Rangewide

The Nashville crayfish was listed as endangered under the ESA on September 26, 1986 (USFWS 1986), without critical habitat. A Recovery Plan for the species was completed in 1988 (USFWS 1989a). The species is threatened by siltation, stream alterations, and general water quality deterioration resulting primarily from urban development. The species' limited distribution also makes it vulnerable to a single catastrophic event such as a toxic chemical spill (USFWS 1989a).

Status within the Action Area

Impacts and potential resulting take of Nashville crayfish may occur where the NiSource pipeline crosses the Mill Creek watershed in Davidson and Williamson counties, Tennessee. The entire range of the Nashville crayfish is therefore potentially impacted by NiSource activities.

3.2.1.5 Clubshell

Species Background & Habitat

Adult freshwater mussels are filter-feeders, siphoning phytoplankton, diatoms, and other microorganisms from the water column. Mussels tend to grow relatively rapidly for the first few years, and then their growth slows appreciably at sexual maturity (when energy is being diverted from growth to reproductive activities). There is ongoing discussion among scientists

concerning the life span of mussels, but as a group, they are generally acknowledged to be long-lived organisms. Clubshells are relatively long-lived with life spans of 20 years or more (USFWS 2008a).

The minute bivalve glochidia develop over a period of days to months. This species is thought to be a short-term summer brooder, having a spring or early summer fertilization period with the glochidia being released during the summer. Glochidia must come into contact with a specific host fish, usually within 24 hours, in order for their survival to be ensured. Without the proper host fish, the glochidia will perish (USFWS 1994). After a certain amount of time (from hours to weeks) depending on water temperature and species, the glochida transform to juvenile mussels and drop off the host fish. The juvenile then burrows into the substrate or attaches to a larger object with a byssal thread (USFWS 1994).

In part because clubshell, like virtually all freshwater mussels, relies on this parasitic larval stage, it probably experiences very low annual juvenile survival. Jantzen et al. (2001) report greater than 99 percent mortality for glochidia. Though not specific to clubshell, this estimate and the estimates of survival that follow are likely typical for clubshell and most mussels in North America. Probability of survival from mussel glochidium to benthic recruit has been estimated to range from 1×10^{-6} (Young and Williams 1984) to 39×10^{-6} (Haag 2002). Transition from glochidium to juvenile represents a very large bottleneck—a single female's reproductive output is reduced from thousands of glochidia to < 1 offspring per year (Berg et al. 2008). This low fecundity suggests the need for a large population to produce a large annual cohort (Musick 1999).

The striped shiner (*Notropis chrysocephalus*), central stoneroller (*Campostoma anomalum*), blackside darter (*Percina maculata*), and logperch (*Percina caprodes*) have been shown capable of serving as hosts for the clubshell under laboratory conditions (Watters and O'Dee 1997, O'Dee and Watters 2000). It is likely that additional untested fish species can be used by clubshell glochidia in the wild (USFWS 2008a).

Extant clubshell populations occur in relatively small streams to medium-sized rivers (USFWS 2009a). It inhabits coarse sand and fine gravel substrates in shallow riffles and runs with moderate current. It is commonly found at depths of less than three feet. Because up to 70 percent of a clubshell population can be distributed below the substrate surface (Smith et al. 2001), this species is presumed to be highly dependent on interstitial flow for oxygen and food (USFWS 2008a). The clubshell requires clean substrate and flowing water and cannot tolerate mud or slack water conditions (NatureServe 2007a).

Distribution and Range

The clubshell historically occurred in the Ohio River watershed in New York, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee and Alabama. The clubshell also occurred in the Lake Erie watershed in the Maumee River drainage in Michigan, Indiana and Ohio

Currently, there are 13 known clubshell populations in the Ohio River and Lake Erie Basins, where portions of 21 streams may still support the species (USFWS 2010). Evidence of successful recruitment has been reported in nine streams, including the Allegheny River, French Creek, LeBoeuf Creek, Muddy Creek, Tippecanoe River, Middle Branch North Fork Vermillion River, Green River, Elk River, Little Darby Creek, and Shenango River. Clubshell populations in seven streams appear to be in decline and currently consist of only adults, including the East Fork West Branch St. Joseph River, Fish Creek, Hackers Creek, Walhonding River, Cassadaga Creek, Pymatuning Creek, Conneaut Outlet, and Conneauttee Creek. Lastly, based on two specimens, a new clubshell population may be establishing because of habitat management in Big Darby Creek, Ohio.

Status and Threats Rangewide

The clubshell mussel was listed as an endangered species by the USFWS in 1993, without critical habitat (USFWS 1993a). Once deemed "extremely common" and widespread, the clubshell is now considered "imperiled" (NatureServe 2007a). Few mussel species have declined in numbers as drastically as the clubshell mussel, which was once widespread and common. The decline of this species undoubtedly is not due to any one cause, but to several compounding problems. The recovery plan identified four primary factors responsible for the decline of clubshell populations: siltation, impoundments, in-stream sand and gravel mining, and pollutants (USFWS 1994). For unknown reasons, many of the remaining clubshell populations do not appear to be reproducing in locations where many other species of freshwater mussels show evidence of recent recruitment. The clubshell is now limited to a few populations distributed within a highly restricted range, although population numbers can be high in localized areas (USFWS 2008a).

The 5-Year Review (USFWS 2008a) lists ongoing threats to the clubshell. These include water quality degradation from point and non-point sources, particularly in small tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants. In addition, the species is affected by hydrologic and water quality alterations resulting from the operation of impoundments. A variety of in-stream activities continue to threaten clubshell populations, including sand and gravel dredging, gravel bar removal, bridge construction, and pipeline construction. Coal, oil, and natural gas resources are present in a number of the watersheds that are known to support clubshell. Exploration and extraction of these energy resources can result in increased siltation, a changed hydrograph, and altered water quality even at a distance from the mine or well field. Land-based development near streams of occurrence often results in loss of riparian habitat and increased storm water runoff, which combine to increase sedimentation. Because clubshell often live below the gravel surface, this species may be exceptionally sensitive to the increased siltation, which fills the spaces within the gravel, and blocks the interstitial flow of oxygen and food. Development has also resulted in an increased number of sewage treatment plants in drainages that support clubshell as well as an increase in the amount of sewage discharged from existing plants.

Some of the remaining populations of clubshell are small and geographically isolated. The patchy distributional pattern of populations in short river reaches makes them much more susceptible to extirpation from single catastrophic events.

Status within the Action Area

Impacts and potential resulting take of clubshell are likely to occur in the following counties: Franklin, Madison, and Pickaway counties, Ohio; Armstrong and Clarion counties, Pennsylvania; and Braxton, Clay, and Doddridge counties, West Virginia.

Five of the 17 known populations of clubshell are found within the covered lands. Three of these are considered stable/reproducing populations (Allegheny River, Little Darby Creek, and Elk River), while the statuses of two (Meathouse Fork and Big Darby Creek) are unknown.

3.2.1.6 Northern Riffleshell

Species Background & Habitat

Like other adult freshwater mussels, northern riffleshells (*Epioblasma torulosa rangiana*) are filter-feeders, siphoning phytoplankton, diatoms, and other microorganisms from the water column. Mussels tend to grow quickly until sexual maturity when energy appears to be focused on reproduction. While many species are believed to be long-lived, northern riffleshells have a relatively short life-span for freshwater mussels living for only 7 to 15 years (Rodgers et al. 2001, Crabtree and Smith 2009).

Most mussels, including the northern riffleshell, have separate sexes. Age at sexual maturity for the northern riffleshell is unknown, but is estimated in other mussel species to occur after a few years. The fertilization process is similar to that for clubshell. This species, based on data from the tan riffleshell (*Epioblasma florentina walkeri*), is a long-term brooder with gravid females overwintering to release glochidia in late spring (Rodgers et al. 2001). As with clubshell, absent the proper host fish, the glochidia will perish (USFWS 1994). Northern riffleshell glochidia, as in many species of mussels, will parasitize the fishes' gill tissues for a few weeks. Newly metamorphosed juveniles then detach to begin a free-living existence on the stream bottom. This is another critical stage and unless juveniles release into suitable habitat, they will die. In part because the northern riffleshell, like most other mussels, relies on this parasitic larval stage, it probably experiences very low annual juvenile survival.

Watters (1996) and O'Dee and Watters (2000) conducted host suitability studies that identified four fish species on which northern riffleshell glochidia develop into juveniles: banded darter *(Etheostoma zonale*), bluebreast darter (*E. camurum*), brown trout (*Salmo trutta*), and banded sculpin (*Cottus carolinae*). McNichols, et al. (2007) reported that Iowa darters *(Etheostoma exile*), Johnny darters *(Etheostoma nigrum*), and mottled sculpin *(Cottus bairdi*) also transformed northern riffleshell glochidia. These studies did not test all of the fish species that are native to the range of the northern riffleshell. Further, these fish species do not occur in all

habitats that support northern riffleshell. Therefore, there are probably other, as yet unidentified, suitable fish host species for the northern riffleshell – most likely several species of *Etheostoma* and *Percina* (Zanatta and Murphy 2007).

The northern riffleshell occurs in a wide variety of streams, large and small, preferring runs with a bottom composed of firmly packed sand and fine to coarse gravel (USFWS 1995). Northern riffleshell mussels also require swiftly moving, well-oxygenated water (Carman and Goforth 2000).

Distribution and Range

The northern riffleshell historically occurred in many of the same Ohio River watersheds in Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee and Alabama as the clubshell. The riffleshell also was found in the Lake Erie drainage in Ohio and Indiana, but the riffleshell's range extended farther north into the Detroit and St. Clair River watersheds in Michigan and Ontario, Canada.

The current distribution shows a reduction greater than 95% of its former range (USFWS 1993b), primarily due to loss of habitat. In some places, however, otherwise diverse mussel assemblages occur within the historic range of the northern riffleshell from which they are absent (USFWS 2008b). The northern riffleshell is now sparsely distributed within a highly restricted range, although population numbers can be high in localized areas (USFWS 2008). There appear to be four recruiting populations of northern riffleshell all in the Ohio or St. Lawrence River basins: East Branch Sydenham River, Allegheny River, French Creek, and the Ausable River. A population is extant in the Elk River, but recruitment there has not been recently confirmed. Populations in Fish Creek, the Detroit River, Green River, Big Darby Creek, and Tippecanoe River may have been extirpated since the species was listed (USFWS 2008).

Status and Threats Rangewide

The northern riffleshell was listed as an endangered species by the USFWS on February 22, 1993, without critical habitat (USFWS 1993a). The 1994 recovery plan identified four primary factors responsible for the decline of northern riffleshell populations: siltation, impoundment, instream sand and gravel mining, and pollutants (USFWS 1994). The draft 5-Year Review (USFWS 2008b) lists ongoing threats to the northern riffleshell. Ongoing threats to the northern riffleshell include water quality degradation from point and non-point sources, particularly in tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants. In addition, the species is affected by hydrologic and water quality alterations resulting from the operation of impoundments. A variety of instream activities continue to threaten northern riffleshell populations, including sand and gravel dredging, gravel bar removal, bridge construction, and pipeline construction. These can change streambed configuration and result in long-lasting altered stream flow patterns degrading habitat, often some distance from the disturbance. Exploration and extraction of coal, oil, and gas resources

can result in increased siltation, a changed hydrograph, and altered water quality, even at a distance from the mine or well field.

Land-based development near streams of occurrence often results in loss of riparian habitat and increased storm water runoff, which combine to increase sedimentation. *Epioblasma*, including northern riffleshell, appear to be exceptionally sensitive to the increased siltation and associated turbidity caused by changing land use (Peacock et al. 2005). Development has also increased the number of sewage treatment plants in drainages that support northern riffleshell, and increased the amount of sewage discharged from existing plants. Some potential exists for impacts from zebra mussels, particularly where northern riffleshell populations and zebra mussel habitat coincide (e.g., pools in large rivers) (USFWS 2008b).

Finally, large populations appear to be necessary for the long-term conservation of this species. Smaller populations in multiple streams have declined or become extirpated since listing (USFWS 2008b).

Status within the Action Area

Impacts and potential resulting take of northern riffleshell are likely to occur in the following counties: Franklin, Madison, and Pickaway counties, Ohio; Armstrong and Clarion counties, Pennsylvania; and Kanawha County, West Virginia where a NiSource pipeline crosses the Elk River within its only known northern riffleshell population. The covered lands include the known reproducing population of northern riffleshell in the Allegheny River (two other reproducing populations are completely outside of the covered lands). The status of the Elk River population is unknown, but is presumed to be precarious because only two living animals were found at one site in a 1993 survey and the species has not been found in the Elk River since that time (USFWS 2008).

3.2.1.7 Fanshell

Species Background & Habitat

Little information regarding the longevity of fanshell exists, but studies have found age ranges of from 6 to 26 years (Jones and Neves 2002). Fanshell reproduces similarly to clubshell and northern riffleshell. This species is thought to be a long-term brooder that holds glochidia over-winter for release in the spring (Jones and Neves 2002). The complex life history of the fanshell and other mussels has many weak links that may prevent successful reproduction and/or recruitment of juveniles into existing populations including very low juvenile survival (NatureServe 2007a, Jantzen et al. 2001).

Known host fish of the fanshell include: mottled sculpin (*Cottus bairdi*), banded sculpin (*Cottus carolinae*), greenside darter (*Etheostoma blennioides*), snubnose darter (*Etheostoma simoterum*), banded darter (*Etheostoma zonale*), tangerine darter (*Percina aurantiaca*),

blotchside logperch (*Percina burtoni*), logperch (*Percina caprodes*), and Roanoke darter (*Percina roanoka*) (USFWS 2007b).

The fanshell inhabits the shoals and riffles of medium to large rivers, often in relatively deep water (USFWS 2003). It has been reported primarily from relatively deep water in sandy or gravelly substrate with moderate to strong current (USFWS 2003). Some accounts also have this species occupying shallower water habitats (NatureServe 2007a; Parmalee and Bogan 1998).

Distribution and Range

The fanshell has been reduced to only a few stable populations. Most of the remaining populations are small and geologically isolated. Fanshell were once widespread throughout their historical range, but have become extremely rare, and it is believed that only three reproducing populations are currently in existence (NatureServe 2007a). An estimated 471.2 miles of rivers throughout the United States currently contain populations of fanshell, which represents 10% of its historic range (Jones and Neves 2002).

The best populations of the fanshell mussel occur in the Licking, Green, and Rolling Fork Rivers in Kentucky, and in the Clinch River in Tennessee and Virginia. These populations are considered healthy with evidence of recruitment over several years or even decades, with multiple year classes present. The Rolling Fork River population adds one more known reproducing population since the recovery plan was written; but, it is relatively small compared to the Licking, Green and Clinch River populations. Extant populations of the fanshell mussel currently exist in portions of the Muskingum, Kanawha, Ohio, Wabash, East Fork White, Tippecanoe, Tennessee, Green, Licking, and Rolling Fork Rivers. Each of these populations is susceptible to single damaging events. This includes both natural stochastic events, such as floods, and anthropogenic threats, such as toxic spills.

Status and Threats Rangewide

The fanshell mussel was listed as an endangered species by the USFWS on June 21, 1990, without critical habitat (USFWS 1990a). A recovery plan was published in 1991 (USFWS 1991a). Conservation of the fanshell is particularly problematic, in part because as Jones and Neves (2002) noted, even the more robust populations of this species seem to occur at low densities. The USFWS has identified impacts of impoundments, navigation projects, pollution, and habitat alterations, such as gravel and sand dredging that directly affected the species and reduced or eliminated its fish host as the major contributors to the decline of this species (USFWS 1991a).

The main threats to the fanshell are habitat degradation and a decline in water quality, impoundments, stream flow alteration, habitat alteration, dredging, and navigation projects affecting both the species and its host fish (USFWS 1991a). Other impacts to the mussel population includes runoff from oil and gas exploration, wastewater discharges and water supply development, and land-use practices such as coal mining and spills from a riverside coal-fired power plant (USFWS 2007b). The population in the Green River is somewhat protected in

Mammoth Cave National Park, but has been threatened by runoff from oil and gas exploration and production sites, and by an upstream reservoir (USFWS 1990a, USFWS 1991a). The steady decline of naiads in the Clinch River has been attributed to land-use practices along the river, as well as impacts from coal mining and spills from a riverside coal-fired power plant resulting in two mussel kills (USFWS 2007b). The Licking River population of fanshell has been threatened by the effects of wastewater discharges and plans for water supply development. Incidental take of the fanshell where it is co-located with commercially harvested mussel beds is also attributed to its decline (USFWS 1990a, USFWS 1991a).

Existing data (NatureServe 2007a) indicate that many of the remaining populations are remnant and comprised of older individuals. These small, isolated populations are particularly vulnerable extirpation due to losses resulting from events such as droughts, floods, toxic spills, or other stochastic events.

Status within the Action Area

Impacts and potential resulting take of fanshell are likely to occur in the following counties: Bracken, Nicholas, Pendleton, and Robertson counties, Kentucky; Coshocton, Meigs, Morgan, Muskingum, and Washington counties, Ohio; Hardin County, Tennessee; and Jackson, Kanawha, Mason, and Wayne counties, West Virginia.

NiSource activities would potentially affect five of the 14 known populations and potentially, two of the five known stable/reproducing populations (Muskingum River and Licking River). Populations of fanshell are known to persist in the Ohio River, but population levels and densities are largely unknown, but the Ohio River populations would not be impacted. It is possible that NiSource activities could affect the persistence of relic populations of fanshell assumed to be in Tygart's Creek and the Barren River in Kentucky.

3.2.1.8 James Spinymussel

Species Background & Habitat

James spinymussel (JSM) life history is similar to the previously discussed freshwater mussels. Hove and Neves (1994), who studied the life history of the JSM from 1987 to 1989, evaluated age class structure from 100 JSM found in muskrat middens and concluded a range from three to 19 years with the mean age of eight years. They estimated adult mean annual mortality at 15.6% per year, which reflects the importance of adult mussels (because of their relatively high annual survival) to the populations of this and other mussel species covered the MSHCP.

The minute bivalve glochidia are brooded over a period of days to months in only the outer gills of JSM. The JSM is a tachytictic (short-term) brooder; its eggs are fertilized in the spring and glochidia are released in spring and summer. Hove and Neves (1994) concluded that the mean fecundity of JSM is lower than most other studied mussels. They found an average fecundity of 13,407 brooded eggs per female of which 12,423 matured into larval glochidia (as compared to

up to 3,000,000 for other species). Jantzen et al. (2001) report greater than 99% mortality for glochidia.

Identified host fish of the JSM include: bluehead chub (*Nocomis leptocephalus*), rosyside dace (*Clinostomus funduloides*), blacknose dace (*Rhinichthys atratulus*), mountain redbelly dace (*Phoxinus oreas*), rosefin shiner (*Notropis ardens*), satinfin shiner (*Notropis analostanus*), stoneroller (*Capostoma anomalum*) (USFWS 1990b), and possibly the swallowtail shiner (*Notropis procne*) (NatureServe 2007a).

This species lives in stream sites that vary in width from 10 to 75 feet and depth of 0.5 to three feet. It requires a slow to moderate water current with clean sand and cobble bottom sediments. The JSM is limited to areas of unpolluted water, and may be more susceptible to competition from Asian clam species when its habitat is disturbed (USFWS 1990b).

Distribution and Range

The JSM is native to the James River system in Virginia and West Virginia, as well as the Dan and Mayo River drainages of the Roanoke River basin in North Carolina and the Tar River (NatureServe 2007a). The majority of the decline of JSM has taken place over the last 20 years. It is currently documented in only a few creeks and small rivers in the upper James River drainage in Virginia and Roanoke drainage in North Carolina.

Status and Threats Rangewide

The James spinymussel was listed as an endangered species by the USFWS in 1988, without critical habitat (USFWS 1988). A recovery plan was published in 1990 (USFWS 1990b).The endangered JSM has experienced a precipitous decline over the past two decades. The species appears to be extirpated from 90% of its historic range, with survival documented in only a few small tributaries to the James River. Its restricted distribution leaves it vulnerable to a variety of threats. The recovery plan identified sedimentation, competition with the Asian clam, impoundments, and pollution as primarily responsible for the decline JSM (USFWS 1990b).

The draft 5-Year Review (USFWS 2009b) lists ongoing threats to the JSM. It states that all populations are threatened by one or more of the following: sedimentation and siltation that comes with agriculture, silviculture, and development, contaminants (both point and non-point sources), and a general lack of public awareness about the JSM, its occurrence and biological significance in aquatic ecosystem. Petty (2005) states potential competition with the introduced Asian clam and predation by muskrats has exacerbated the effects of habitat alteration. She also references increasing spatial separation among populations as a threat to JSM.

The remaining populations of JSM are generally small and geographically isolated. The patchy distributional pattern of populations in short river reaches makes them much more susceptible to extirpation from single catastrophic events.

Status within the Action Area

Impacts and potential take of JSM are likely to occur in the following counties in Virginia: Albemarle, Alleghany, Botetourt, Goochland, Greene, Orange, Powhatan, and Rockbridge. The JSM is confined to the James and Roanoke River watersheds (Dan and Mayo Rivers) in Virginia and North Carolina. NiSource could impact four of the 21 known populations - three are considered small, isolated, or non-reproducing, and one population has unknown status. It is possible that at least some of the 79 crossings of un-surveyed streams within the covered lands could impact currently unknown populations.

3.2.1.9 Sheepnose

Species Background & Habitat

The life history of sheepnose is similar to other mussels discussed in this section. Sheepnose are relatively long-lived mussels with life spans of 20 years or more (USFWS 2012a). This species is thought to be a short-term summer brooder, having a spring or early summer fertilization period with the glochidia being released during the summer. As previously discussed, recruitment into the adult population for this species is very low – thousands of glochidia would typically result in <1 offspring per year (Berg, et al. 2008).

Little is known regarding host fishes of the sheepnose mussel. The sauger (*Stizostedion canadense*) is one known natural host, but others are assumed to be available. A new host fish, the central stoneroller (*Campostoma anomalum*), was recently confirmed by Watters (NatureServe 2007a).

The sheepnose is primarily a larger-stream species. It occurs primarily in shallow shoal habitats with moderate to swift currents over coarse sand and gravel (USFWS 2002). Habitats with sheepnose may also have mud, cobble, and boulders. Specimens in larger rivers may occur in deep runs (USFWS 2002).

Distribution and Range

Historically, the sheepnose occurred throughout much of the Mississippi River system with the exception of the upper Missouri River system, and most lowland tributaries in the lower Mississippi River system. This species is known from the mainstem Mississippi, Ohio, Cumberland, Tennessee, and Ohio, plus numerous tributaries across this range. The sheepnose was historically known from 76 streams (including one canal) in 14 states, although it may always have been comparatively rare (USFWS 2012a).

This species has been extirpated or reduced to isolated populations throughout much of its former range. The sheepnose is currently found in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin.

Status and Threats Rangewide

The sheepnose mussel was listed as endangered by the USFWS in 2012, without critical habitat (USFWS 2012a). The decline of the sheepnose in the Mississippi River system and other mussel species in the eastern United States is primarily the result of habitat loss and degradation. These losses have been well documented since the mid-19th century. Chief among the causes of decline are impoundments, channelization, chemical contaminants, mining, and sedimentation (USFWS 2002). In the vast majority of streams with extant populations, the sheepnose appears to be uncommon at best. Small population size and/or restricted stream reaches of current occurrence are a real threat to the sheepnose due to the negative aspects of genetics of small, geographically isolated populations.

The status assessment (USFWS 2002) lists numerous ongoing threats to the sheepnose. Many of these are the same activities that have caused the historic decline of this species. Much of the sheepnose habitat has already been impounded, but impoundments, if constructed in sheepnose habitat, would continue to be a threat. Channel maintenance on large rivers continues to be a threat where that coincides with sheepnose habitat. Chemical contaminants, from both point sources and spills, and the impacts of chronic low-level contamination, continue to impact sheepnose. A variety of mining activities have the potential to affect sheepnose including coal and sand and gravel mining. Sedimentation and the various stressors that it produces continue to threaten mussels, including sheepnose, throughout the covered lands. Development poses a threat to sheepnose in specific areas when it is in close proximity to occupied habitat.

Status within the Action Area

Impacts and potential resulting take of sheepnose are likely to occur in the following counties: Madison, Clark, Fayette, Bath, Rowan, Nicholas, Pendleton, Bracken, Mason, Lewis, Greenup, and Boyd counties, Kentucky; Clermont, Brown, Adams, Scioto, Lawrence, Gallia, Meigs, and Washington counties, Ohio; Wayne, , Mason, Jackson, and Kanawha counties, West Virginia; and Sunflower County, Mississippi.

No critical habitat has been designated for this species, but the Final Rule determined that designation of critical habitat is prudent but not determinable for the sheepnose (USFWS 2012a).

3.2.1.10 American Burying Beetle

Species Background & Habitat

The American burying beetle (ABB) is the largest species of its genus in North America, measuring 0.98-1.4 inches in length. It was formerly known as the giant carrion beetle. The body of the ABB is shiny black and has hardened protective wing covers (elytra) that meet in a straight line down the back. The elytra are smooth, shiny black, and each elytron has two

scalloped shaped orange-red markings. The pronotum, or shield over the mid-section between the head and wings, is circular in shape with flattened margins and a raised central portion. The most diagnostic feature of the ABB is the large orange-red marking on the raised portion of the pronotum, a feature shared with no other members of the genus in North America. The ABB also has orange-red frons (a mustache-like feature) and a single orange-red marking on the top of the head (triangular in females and rectangular in males). Antennae are large, with notable orange clubs at the tips.

The ABB is nocturnal (active at night), lives for only one year, and typically reproduces only once. During the winter months when temperatures are below 60°F, ABBs bury themselves in the soil to overwinter. When temperatures are above 60°F, they emerge from the soil and begin the mating and reproduction process. American burying beetles are scavengers, dependent on carrion for food and reproduction. They play an important role in breaking down decaying matter and recycling it back into the ecosystem. Reproduction involves burying a small vertebrate carcass (1-9 ounces; 35-250 grams), laying eggs on the carcass, and then larvae feeding on the carcass until mature. The ABB is unusual in that both parents provide care to their young. American burying beetles must compete with other invertebrate species, as well as vertebrate species, for carrion. Even though ABBs are considered feeding habitat generalists, they have still disappeared from over 90% of their historic range.

Habitat requirements for ABB, particularly reproductive habitat requirements, are not fully understood at this time. The ABB has been found in various types of habitat including oak-pine woodlands, open fields, oak-hickory forest, open grasslands, and edge habitat. Research indicates that ABBs are feeding habitat generalists. Data are lacking pertaining to ABB reproductive habitat requirements, but species experts assume that they are more restrictive in selecting their reproductive habitat than feeding habitat.

Distribution and Range

The ABB was recorded historically from at least 150 counties in 35 states in the eastern and central United States, as well as southern Ontario, Quebec, and Nova Scotia in Canada (USFWS 1991b). Its historical range includes most of temperate eastern North America. The easternmost record is from Nova Scotia, and the species has been recoded as far west as North Platte, Nebraska. A single Montana record is also known. The northernmost record is from the upper peninsula of Michigan, with the southern terminus of its range at Kingsville, Texas. In general, the historical occurrence of this species is poorly documented from higher elevations of the Appalachian region as well as from the southern Atlantic and Gulf of Mexico coastal plains.

Currently, the ABB persists in a few widely separated, naturally occurring core populations: (1) on Block Island, off the southern coast of Rhode Island, where the species is apparently stable; and (2) in eastern Oklahoma, where it has been recorded in Latimer, Cherokee, Muskogee, and Sequoyah counties. Since 1980, individuals of ABB have been recorded in southwestern Missouri and in the Platte River Valley in west-central Nebraska, as well as in Arkansas, Kansas,

South Dakota, and Texas. However, these locations are not known to support established populations of ABBs. Other population locations that are being monitored include propagated ABB release locations in Athens, Guernsey, Hocking, Morgan, Muskingum, Noble, and Vinton counties, Ohio, and historic population centers in Mississippi and New Jersey. Likewise, these areas are not known to support established populations of ABBs.

A release of propagated ABBs was conducted on the Waterloo Wildlife Area (Waterloo WA) near where Vinton, Hocking, and Athens counties meet in Ohio. Follow-up surveys of the released individuals revealed no individuals captured after over-wintering. It is anticipated that, if present, beetles occur in very low densities (Boyer 2008a, 2008b). The beetles were released each year for seven years in 1998 to 2000 and again from 2004 to 2007 (USFWS 2008b). The Waterloo WA release site was abandoned in 2008.

A new release of ABBs was initiated in 2008 on the Wayne National Forest (Wayne NF) near where Perry, Morgan, and Athens counties meet and this population is treated as listed (Boyer 2008a, 2008b; USFS 2008). The status of this population is unknown, although the species is considered to be present for a 10-mile radius around the release site. From 2008 through 2012, a total of 1,026 pairs of captively reared ABBs were released on the Wayne NF. In 2011, 80 ABB pairs were released at The Wilds, near Cumberland, Ohio. In 2012, an additional 180 ABB pairs were released at The Wilds. The status of these individuals is also unknown, but the species is considered to be present for within a 10-mile radius around the release sites. Starting in 2013, ABBs will be released at Fernald Preserve in Hamilton County Ohio. Releases at the Fernald Preserve will continue through 2017.

Status and Threats Rangewide

The ABB was listed as endangered in 1989 by the USFWS, without critical habitat (USFWS 1989b). A recovery plan for the species was published in 1991 (USFWS 1991b). A 5-year review of the status of the ABB was initiated on January 29, 2007 (USFWS 2008b) and completed in March 2008.

The best available information indicates that the ABB historically occurred in high densities throughout its range. However, there has recently been a dramatic range collapse for the species. It currently occupies less than 10% of its original range. The pattern of the ABB's decline can be inferred from examination of known specimen documentation. East of the Appalachians, extending from New England and the Atlantic seaboard south to northern Florida, the most recent historical collections were in the 1940s. In New England and south through New Jersey, the last mainland specimens were collected in the 1920s. Further, except for the North Carolina and Maryland collections, all eastern records of ABB since 1940 were collected from islands or peninsulas such as Long Island, New York and Martha's Vineyard in Massachusetts. All but one of these populations eventually became extirpated as well. Such data indicate that in the portion of its range east of the Appalachian Mountains, ABB declined generally in a north to south direction and that this decline was well underway, if not nearly

complete, by 1923. Habitat loss, alteration, and degradation have been attributed to the decline of the ABB.

Status within the Action Area

Impacts and potential resulting take of American burying beetles may occur at the sites of two experimental releases of American burying beetles in Ohio. In 2008, ABB releases began on the Wayne NF near where Perry, Morgan, and Athens counties meet and this population is treated as listed (Boyer 2008a, 2008b; USFS 2008). Releases continued on the Wayne NF through 2011. No future releases on the Wayne NF are planned. In 2011 and 2012, an ABB releases was were performed at a second third site on land owned by The Wilds, a conservation reserve for rare and endangered animals (Boyer pers. comm. 2011). Another release location is scheduled to receive ABBs starting in 2013. This site is the Fernald Preserve in Hamilton County, Ohio. Cooperative Agreements governing the release of ABBs at The Wilds and at Fernald Preserve have eliminated any regulatory oversight of ABBs that leave the designated release sites. Based on the known dispersal distance (Backlund et al. 2008) plus a reasonable margin of error and allowing for local habitat conditions, we consider the ABB to occupy suitable habitat within the 10-mile area of the Wayne NF release site.

The release site on the Wayne NF is designated as a Future Old Forest Management area. This designation limits tree clearing, restricts collection of special forest products, does not allow for motorized recreation, limits signage, and specifically limits wildlife habitat management to treatments for the protection and recovery of federally listed species (USFS 2006). The desired future condition for a Future Old Forest Management Areas describes natural processes changing the composition of the management area, which suggests that this designation is unlikely to change. While this site may not be protected in perpetuity, the population was established at the Wayne NF Release Site under these conditions with the expectation that management practices would be sufficient to protect the population once established. The Forest Service has committed to allow for a total of five years on the project.

ABB releases were initiated in the Wildcat Hollow area on the Athens Unit of the Wayne NF in 2008. From 2008 through 2012, a total of 1,026 pairs of captively reared ABBs were released on the Wayne NF. We have no current plans for future releases on the Wayne NF or any other location in Ohio that would create a regulatory burden on any lands not governed by a cooperative agreement. Releases of captively reared ABBs at The Wilds began in 2011. To date, a total of 150 ABB pairs have been released. Releases are planned to continue on The Wilds through 2015. Starting in 2013, ABBs will be released at Fernald Preserve in Hamilton County Ohio. Releases at the Fernald Preserve will continue through 2017.

3.2.2 Non-MSHCP Species

3.2.2.1 Dwarf Wedgemussel

Species Background & Habitat

The dwarf wedgemussel, a freshwater mussel found within the Atlantic drainages of the eastern seaboard. The life history of the dwarf wedgemussel is similar to other species previously discussed. This species is considered a long-term brooder, having a mid-summer to fall fertilization period with glochidial release occurring in the spring and summer of the following year (USFWS 1993b). Experiments have identified tessellated darter (*Etheostoma olmstedi*), Johnny darter (*Etheostoma nigrum*), mottled sculpin (*Cottus bairdi*), slimy sculpin (*Cottus cognatus*), and Atlantic salmon (*Salmo salar*) as potential hosts, though the tessellated darter seems to be preferred (NatureServe 2010). Adult mussels are largely sedentary, with little to no ability to move away from areas of disturbance (USFWS 1993b). The dwarf wedgemussel is most commonly found in shallow to deep water with a quick current and a stream bed of cobble, fine gravel, or firm silt/sand. Submerged aquatic vegetation and overhanging tree limbs near stream banks are also potential habitats (NatureServe 2010). Some studies have also identified muddy sand, sand, and gravel substrates in creeks and rivers of various sizes with areas of slow to moderate current, good water quality, and little silt deposits as ideal habitat (USFWS 1993b).

Distribution and Range

Dwarf wedgemussel was historically found along the eastern seaboard from New Brunswick, Canada to North Carolina, inhabiting 15 major Atlantic drainages at approximately 70 locations (USFWS 1993b). Based on preliminary information, the dwarf wedgemussel continues to be found in 15 major drainages comprising approximately 70 "sites" (one site may have multiple occurrences). However, at least 45 of these sites are based on less than five individuals or solely on spent shells (USFWS 2007c). The 15 major drainages do not necessarily correspond to the original drainages identified in the 1993 Recovery Plan although there is considerable overlap. The species is thought to be extirpated in Canada (USFWS 2007c).

Status and Threats Rangewide

The dwarf wedgemussel was listed as Endangered under the ESA in March of 1990, without critical habitat (USFWS 1990c), followed by the establishment of a Recovery Plan in 1993. The decline of the dwarf wedgemussel is primarily the result of habitat loss and degradation. Agricultural, domestic, and industrial pollution have been major contributors to this species' decline (NatureServe 2010). The majority of remaining populations of the species are mostly small and isolated geographically, leading to potential inbreeding depression, reduction of long-term colony viability, and a low likelihood of natural repopulation of extirpated areas (USFWS 1993b). Potential threats to dwarf wedgemussel populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic

invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

As of 2006, dwarf wedgemussels are found in 15 major drainages including: the Upper Connecticut River in New Hampshire and Vermont, the Middle Connecticut River in Massachusetts, the Lower Connecticut River in Connecticut, the Middle Delaware River in New York and New Jersey, the Upper Delaware River in Pennsylvania, Choptank River in Maryland, the Lower Potomac River in Maryland, Upper Chesapeake Bay in Maryland, Middle Potomac River in Virginia, York River in Virginia, Chowan River in Virginia, Upper Tar River in North Carolina, Fishing River in North Carolina, Contentnea River in North Carolina, and the Upper Neuse River in North Carolina. Strayer, Sprague, and Claypool (1996) conducted a range-wide assessment and found the most robust populations in the Connecticut River (New Hampshire), the Ashuelot River (New Hampshire), the Neversink River (New York), Po River (Virginia), and the Shelton/Tar River (North Carolina) with another possible stronghold in the Little River (North Carolina). Their data indicate that this species typically occurs at low densities of < 0.01 – 0.05 animals per square meter. They did, however, find some large populations with tens of thousands of dwarf wedgemussels.

Status within the Action Area

NiSource may affect this species in:

- Delaware River and tributaries – Delaware, Orange, and Sullivan Counties, NY; Pike County, PA
- Neversink River – Orange and Sullivan Counties, NY
- Basher Kill – Orange and Sullivan Counties, NY
- Rappahannock River – Culpeper and Fauquier Counties, VA
- Mountain Run – Culpeper County, VA
- Nottoway River – Dinwiddie, Greensville, and Sussex Counties, VA
- South Anna River – Hanover and Louisa Counties, VA
- Blue Run – Orange County, VA
- Kettle Run – Prince William County, VA
- Other Locations – Morris County, NJ (historic) and Warren County, NJ; Chesterfield County, VA

In general, populations in the north (New Hampshire, Massachusetts, and Connecticut) appear to be stable, while those in the south (North Carolina, Virginia, and Maryland) are declining. In 2006, the fate of the Delaware River populations was unknown (USFWS 2007c). The Neversink River population affected by flooding in 2005 and Hurricane Irene and Tropical Storm Lee in 2011 is uncertain at this time. NiSource ground disturbing activities would not affect any of the stable populations, which are all outside of the NiSource covered lands. Buck Mountain Creek, Rocky Creek, and Ward's Creek are thought to be small, possibly non-reproducing populations. The status of the Swift Run population is unknown.

3.2.2.2 Pink Mucket Pearlymussel

Species Background & Habitat

The pink mucket pearlymussel, a freshwater mussel found in the Ohioan Interior Basin, primarily in the Tennessee, Cumberland, and Ohio River systems. Female pink muckets may reach sexual maturity after two years (USFWS 2009c). This species is considered a long-term brooder, having a late-summer fertilization period with glochidial release occurring during the summer of the following year (USFWS 1985). As with other mussel species, glochidia require a period of parasitizing host fish prior to maturation into adult mussels. The host species for pink mucket glochidia is not currently known, though recent tests have shown that largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreum*), sauger (*Sander canadensis*), and freshwater drum (*Aplodinotus grunniens*) were suitable (USFWS 2007d). After detaching from the host fish, juveniles must land in suitable habitat or they will perish. The pink mucket is found in medium to large rivers with substrates ranging from silt to boulders, rubble, gravel, and sand. The species is primarily found in large rivers with moderate to fast flowing water at depths from 1.5 to 26 feet (USFWS 1985).

Distribution and Range

While the pink mucket was historically very widespread in distribution, with verified presence in 25 river systems, the species has never been documented in heavy densities in any location, thus the species has always been considered rare (USFWS 2009c). Of the 25 river systems, spread throughout the Ohioan Interior Basin, that the species was historically documented in, only 16 are thought to still be inhabited, with the species considered extirpated in Ohio, Pennsylvania, and Illinois. The greatest current concentrations of the species are located in the Tennessee, Cumberland, Osage, Meramec, and Kanawha Rivers (USFWS 1985).

Status and Threats Rangewide

The pink mucket was listed as Endangered under the ESA in June of 1976, without critical habitat (USFWS 1976), followed by the establishment of a Recovery Plan in 1985. The decline of the pink mucket is primarily the result of habitat loss and degradation. Chief causes of the species decline include impoundments, dredging, degradation of water quality, over harvest by the commercial mussel industry, siltation, pollution, and channelization (NatureServe 2010). The small size and isolation of populations can lead to potential inbreeding depression, reduction of long-term colony viability, and a low likelihood of natural repopulation of extirpated areas (USFWS 1985). Potential threats to pink mucket populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

Based on the Draft 5-Year Review, there are 29 known streams with extant populations of pink mucket (USFWS 2009c). Of those 29, all of them east of the Mississippi River are in the Ohio River drainage with another population center in Missouri and Arkansas completely outside of the NiSource covered lands. Of these 29 populations, a small number are considered stable or reproducing. Of these, three occur in Arkansas outside the NiSource area of operation in the Black River, the Ouachita River, and the Saline River. The Elk River, Kanawha River, Tennessee River, and Cumberland River population are considered stable (Cumberland and Tennessee population below Pickwick Dam are among the best remaining populations) and are all within the NiSource project area (USFWS 2009c). Pink mucket is recruiting and maintains a fairly large population in the Osage River in Missouri, but both that and the Gasconade River population appear to be in decline in part from destruction of habitat by dams (USFWS 2009c). There are a number of populations across the range that have unknown status, the remainder are small and often characterized by older individuals (USFWS 2009c). NiSource activities would impact the following known populations of pink mucket.

Status within the Action Area

NiSource may affect this species in the following locations:

- Cumberland River – Trousdale County, TN
- Elk River – Kanawha and Clay Counties, WV
- Kanawha River – Kanawha County, WV
- Licking River – Bath and Rowan Counties, KY
- Muskingum River – Washington and Morgan Counties, OH
- Ohio River – Pendleton County, KY; Lawrence, Gallia, and Meigs Counties, OH; Mason, Wayne, and Jackson Counties, WV
- Tennessee River – Hardin County, TN

The Cumberland River likely has a stable population of pink mucket although the total population is likely small and recruitment has not been recently verified (USFWS 2009c). Suitable pink mucket habitat is apparently limited to a roughly 35 RM reach in the middle river below Cordell Hull Lock and Dam at RM 313.5 (USFWS 2009c). The pink mucket is known from an approximately nine mile reach of the Kanawha River below Kanawha Falls from approximately RM 95 to RM 86. This population although threatened by the short reach it occupies, its isolation, and significant threats from development is considered stable and significant (USFWS 2009c). The status of the pink mucket in the Licking River is unknown. Only one live or fresh dead animal has been located since the drafting of the recovery plan about 22 RMs below Cave Run Dam (USFWS 2009c). Butler does not list pink mucket in the Muskingum River, but the distribution of the pink mucket in Ohio is limited to the lower Muskingum River and the Ohio River. It is considered known from the reach of the Muskingum within Washington County and considered potential from the reach within Morgan County. There are no recent records of the pink mucket in the Muskingum River; this population is likely comprised of a small number of widely scattered individuals. The pink mucket occurs in two population clusters throughout the length of the Ohio River. One is upstream between Ohio

and West Virginia sporadically occurring in the upper tailwaters of the pools of three Locks and Dams (Belleville, Byrd, and Greenup - the upstream population is not considered to be recruiting. The downstream cluster occurs in the lower Ohio River near Metropolis, Illinois, well outside the NiSource Covered lands. It may be the more stable (USFWS 2009c). One other documented occurrence not associated with either cluster is a 1989 record from RM 443 (USFWS 2009c). The pink mucket persists in most of the tailwaters (approximately 250 RMs cumulatively) of the nine mainstem dams on the Tennessee and is one of the best populations rangewide (USFWS 2000e).

3.2.2.3 Rabbitsfoot

Species Background & Habitat

The rabbitsfoot is a freshwater mussel historically found widely spread through numerous river systems in the eastern United States. The life history of the rabbitsfoot is similar to other mussels discussed. This species is considered a short-term brooder, having a spring fertilization period with glochidial release occurring in the summer. Host fishes include the whitetail shiner (*Cyprinella galactura*), spotfin shiner (*Cyprinella spiloptera*), bigeye chub (*Hybopsis amblops*), blacktail shiner (*Cyprinella venusta*), and rosyface shiner (*Notropsis rubellus*). The rabbitsfoot generally inhabits small to medium rivers with moderate to swift currents. In smaller streams in generally inhabits bars or gravel and cobble close to fast currents, while in medium to large rivers it usually resides in sand and gravel. The species has been documented at depths of up to 10 feet (NatureServe 2010).

Distribution and Range

Historically, rabbitsfoot inhabited large portions of the lower Great Lakes sub-basin and Mississippi River Basin, with populations in 140 streams in 15 states, including the lower Great Lakes sub-basin, the Mississippi River sub-basin, and the Ohio, Cumberland, Tennessee, White, Arkansas, and Red River systems (USFWS 2012b). This wide historical spread has experienced an over two thirds decline in both spread and density, with populations currently found in 51 streams in 13 states (USFWS 2012b). In streams where it remains, populations are highly fragmented and restricted to short reaches. It is unlikely that recruitment between populations or establishment of new populations could occur naturally (USFWS 2012b). Three of the best remaining populations, the Black River in Arkansas, the Little River in Arkansas and Oklahoma, and the Paint Rock River in Alabama are among a number of streams that data indicate have declining populations (USFWS 2012b).

Status and Threats Rangewide

The rabbitsfoot was historically found widely spread through numerous river systems in the eastern United States, has been a candidate species under the ESA since November 2009 and was proposed for listing as threatened on October 16, 2012. The Final Rule designates critical habitat for this species some of which occurs in the NiSource area of operation (USFWS 2012b).

The decline of the rabbitsfoot is primarily the result of habitat loss and degradation. Impoundments, channelization, chemical contaminants, mining, and sedimentation have combined to significantly alter or eliminate viable habitat throughout much of its range. Many of the remaining populations of the species are small and isolated geographically, increasing the susceptibility of individual populations to extirpation from catastrophic events such as toxic spills. The small size and isolation can also lead to potential inbreeding depression and reduction of long-term colony viability (NatureServe 2010). Potential threats to rabbitsfoot populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

Status within the Action Area

NiSource may affect this species in:

- Allegheny River – Armstrong and Clarion Counties, PA
- Big Darby Creek – Madison, Franklin, and Pickaway Counties, OH
- Little Darby Creek –Madison County, OH
- Muskingum River – Coshocton and Muskingum Counties, OH
- Tennessee River - Hardin and Maury Counties, TN

Rabbitsfoot occurs sporadically in the Allegheny River from Armstrong County upstream to Warren County (USFWS 2012b). Rabbitsfoot is extant at one site within Big Darby Creek where it is classified by Butler as marginal (USFWS 2012b). The Little Darby Creek population is termed sporadic in 10 of the 20 miles where it is present (USFWS 2012b). The most recent records of rabbitsfoot are from the mid-1990s and are upstream of where NiSource crosses Little Darby Creek (Angie Boyer, USFWS, pers. comm.). The Little Darby population is likely important to the recovery of the species. An exhaustive survey of the Muskingum River has not been performed in recent years and therefore there is no information on the size, distribution, or viability of this rabbitsfoot population. The USFWS assumes presence of rabbitsfoot throughout this reach of the river (Coshocton through Muskingum counties). The rabbitsfoot is considered extant in the Duck River and concentrated between River Miles 130 and 179, which includes the two NiSource crossing locations (USFWS 2012b). The rabbitsfoot is extant in Tennessee River in the tailwaters below Pickwick Dam and Kentucky Dam encompassing approximately 25 river miles and the population is classified as stable (USFWS 2012b).

3.2.2.4 Rayed Bean

Species Background & Habitat

The rayed bean, a freshwater mussel found in the upper and lower Great Lakes systems along with the Ohio and Tennessee River systems. The life history of the rayed bean is similar to other mussel species. Age at sexual maturity is unknown, but like other mussels is likely between zero and nine years (USFWS 2012c). It is considered a long-term brooder, but rather

than brooding over winter, the females brood glochidia May through October (USFWS 2012c). The only known host species for rayed bean glochidia is the Tippecanoe darter (*Etheostoma tippecanoe*. Other rayed bean hosts are likely and are thought to include the greenside darter *(E. blennioides),* rainbow darter *(E. caeruleum),* mottled sculpin *(Cottus bairdi),* and largemouth bass *(Micropterus salmoides)* (USFWS 2012c). The rayed bean is generally found in smaller, headwater creeks, though it has also been reported in larger rivers. Inhabited areas generally include shoal or riffle areas, and in shallow, wave-washed portions of glacial lakes, including extant populations in Lake Erie. It is usually found in substrates of gravel and sand, though it is also often found buried among the roots of vegetation such as water willow (*Justicia americana*) and water milfoil (*Myriphyllum* sp.) (USFWS 2005c).

Distribution and Range

Historically the rayed bean was located in 115 streams, lakes, and man-made canals in Illinois, Indiana, Kentucky, Michigan, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Ontario, though it appears to be extirpated form 74% of its historic range, no longer being found in 80 of its historical water bodies. Extant populations have been verified in 29 streams and one lake in Indiana, Michigan, Ohio, New York, Pennsylvania, and Ontario. Rayed bean was recently reintroduced into the Elk River in West Virginia and the Duck River in Tennessee, bringing the total number of extant populations to 31 streams and one lake. Of the remaining populations, few are considered to be long-term viable with their reproductive success in question (USFWS 2012c).

Status and Threats Rangewide

The rayed bean was listed as an endangered species under the ESA in 2012, without critical habitat (USFWS 2012c). The decline of the rayed bean is primarily the result of habitat loss and degradation. Chief causes of the species decline include impoundments, channelization, chemical contaminants, mining, and sedimentation. The heavy level of population concentration and development adjacent to much of its habitat invariably increases the likelihood that these impacts will continue into the future (USFWS 2005d). The small size and isolation of populations can lead to potential inbreeding depression, reduction of long-term colony viability, and a low likelihood of natural repopulation of extirpated areas (USFWS 2005d). Potential threats to rayed bean populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

Extant populations of the rayed bean include: the St. Joseph River, Fish Creek, Tippecanoe River, Lake Maxinkuckee, and Sugar Creek in Indiana; Black River, Mill Creek, Pine River, Belle River, and Clinton River in Michigan; Allegheny River, Olean Creek, and Cassadaga Creek in New York; Swan Creek, Fish Creek, Blanchard River, Tymochtee Creek, Walhonding River, Mill Creek, Big Darby Creek, Scioto Brush Creek, Great Miami River, Little Miami River, East Fork Little Miami River, and Stillwater River in Ohio; Allegheny River, French Creek, Le Boeuf Creek, Muddy

Creek, and Cussewago Creek in Pennsylvania; Duck River in Tennessee; the Elk River in West Virginia; and the Sydenham and Thames Rivers in Ontario, Canada. Of the known populations, four are considered stable (Sydenham River, Swan Creek, Allegheny River, and French Creek), seven are thought to be declining, and the status of the remaining populations is unknown.

Status within the Action Area

The NiSource project may affect this species in the following locations:

- Allegheny River – Armstrong and Clarion Counties, PA
- Big Darby Creek –Madison and Franklin Counties, OH
- Blanchard River – Hancock County, OH
- Elk River – Kanawha County, WV
- Little Miami/East Fork Little Miami River – Warren and Clermont Counties, OH
- St. Joseph River – Defiance County, OH and Dekalb County, IN

The Allegheny River population of rayed bean is large, reproducing and considered stable. It currently occurs in Pennsylvania throughout 100 river miles downstream of Allegheny (Kinzua) Reservoir in Warren County to the pool of Lock and Dam 8 in northern Armstrong County. The Allegheny River population is one of the most important remaining rangewide (USFWS 2012c). In 2006, one live rayed bean was found in Big Darby Creek at the U.S. Highway 42 bridge replacement site in Union County, Ohio and was relocated to a site upstream out of the impact zone of the bridge project. Nine additional live individuals were subsequently found at the relocation site in 2006 - in 2007, three live animals were found there. A researcher visiting the same relocation site in 2008, in a pers. comm. to the USFWS, reported finding “numerous living specimens” of the rayed bean (USFWS 2012c). The status of this population remains unknown. One of the best populations of the rayed bean rangewide occurs in Blanchard River. It is restricted to 25 to 30 river miles in the upper portion of the stream in Hardin and Hancock Counties upstream of Findlay (USFWS 2012c). In 2006 and 2007, approximately 600 adult rayed bean mussels were reintroduced into the Elk River above Clendenin (Kanawha County, West Virginia). Two live individuals were relocated in 2008 during an abbreviated monitoring survey. In 2010, none of the individuals released in 2006 were found, but an additional 200 individuals were released. These translocated adults are thought to persist in the stream (USFWS 2012c). The status of the rayed bean in the Little Miami River is considered “very tenuous”. Impacts would occur several miles upstream of the last surveyed animal (Warren County) (USFWS 2012c). The rayed bean may persist at a limited number of sites in the lower St. Joseph River in Allen and DeKalb Counties, Indiana (USFWS 2012c). Fresh dead animals were found in the late 1990s, but a survey in 2007 did not encounter rayed bean (USFWS 2012c).

3.2.2.5 Spectaclecase

Species Background & Habitat

The spectaclecase is a freshwater mussel found throughout much of the Mississippi River system. This species is considered a short-term brooder, having a spring to early summer fertilization period with glochidial release occurring during the summer. The spectaclecase may exhibit hermaphrodism, allowing smaller populations to persist. Glochidia require a period of parasitizing host fish prior to maturation into adult mussels. While numerous species of potential host species have been tested in laboratory experiments with negative results, wild-collected bigeye chub (*Hybopsis amblops*) and pealip redhorse (*Moxostoma macrolepidotum pisolabrum*) have been noted to carry spectaclecase glochidia. The spectaclecase is primarily found in larger streams and appears to be more of a habitat specialist than most mussel species. The species inhabits substrates from mud and sand to gravel, cobble, and boulders, generally in shallow riffles and shoals with variable current. Most commonly, spectaclecase is found in firm mud between large rocks in quiet water directly adjacent to swifter currents (NatureServe 2010).

Distribution and Range

Historically the spectaclecase was located throughout much of the upper two-thirds of the Mississippi River system and its tributaries, with populations in 44 streams across 14 states (USFWS 2012c). The species appears to be extirpated from more than half of the streams that it was historically found in, and is no longer found in long reaches of the Illinois, Cumberland, Mississippi, and Tennessee Rivers that it once inhabited, though remnant populations do exist in pockets of those rivers (NatureServe 2010). Extant populations of the species are currently thought to occur in 20 streams in 11 states, though six of those populations are represented by a single specimen, and are thus considered non-viable and may be extirpated (USFWS 2012c).

Status and Threats Rangewide

The spectaclecase was listed as an endangered species under the ESA in 2012, without critical habitat (USFWS 2012c). The decline of the spectaclecase is primarily the result of habitat loss and degradation. Chief causes of the species decline include impoundments, channelization, chemical contaminants, mining, and sedimentation. Exotic invasive species such as the zebra mussel (*Dreissena polymorpha*) are also considered a growing threat for many of the populations. The majority of remaining populations of the species are mostly small and isolated geographically, increasing the susceptibility of individual populations to extirpation from catastrophic events such as toxic spills. The small size and isolation can also lead to potential inbreeding depression, reduction of long-term colony viability, and a low likelihood of natural repopulation of extirpated areas (USFWS 2005a). Potential threats to spectaclecase populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

The proposed rule (USFWS 2012c) documents the distribution of spectaclecase across 19 streams in 11 States. These include the following: Mississippi River in Illinois, Iowa, Wisconsin, Minnesota, and Missouri; St. Croix River in Minnesota and Wisconsin; Meramec, Bourbeuse, Big River, Sac, Gasconade, Osage Fork, and Big Piney Rivers in Missouri; Ohio River in Kentucky and Illinois; Kanawha River in West Virginia; Green River in Kentucky; Cumberland River in Virginia; Tennessee River in Alabama and Tennessee; Clinch River in Tennessee and Virginia; Nolichucky, Caney Fork, and Duck Rivers in Tennessee; and Mulberry and Ouachita Rivers in Arkansas. Five of the known populations as declining: Mississippi River, Ohio River (single animal), Sac River, Clinch River, and Duck River (single animal). These are unlikely to be viable. The Big Piney, Osage Fork, Kanawha, Green, Cumberland, Tennessee, Nolichucky, and Mulberry Rivers have populations with unknown status. This species has strongholds in three river systems completely outside of the NiSource covered lands including the Meramec and Gasconade Rivers in Missouri, the St. Croix River in Minnesota/Wisconsin, and possibly the Upper Clinch River in Tennessee although this population appears to be declining (USFWS 201c2).

Status within the Action Area

The NiSource project may affect this species in the following locations:

- Green River – Edmonson and Hart Counties, Kentucky
- Kanawha River – Kanawha County, West Virginia
- Tennessee River – Hardin County, Tennessee

One live animal and a small number of fresh dead shells have been collected in the upper Green River from below Lock and Dam 5 upstream through Mammoth Cave National Park (MCNP) in Edmonson County and Hart County, Kentucky. This small population is thought to be most concentrated in the upstream section of this reach (MCNP to western Hart County) (USFWS 2012c). In 2002, one very old spectaclecase was found near Glasgow, Kanawha County, West Virginia approximately 20 miles downstream of Kanawha Falls. Another live individual was found in the same vicinity in 2005, as well as two additional weathered shells in 2006 (USFWS 2012c). It is doubtful that a recruiting spectaclecase population occurs in the Kanawha (USFWS 2012c). In the Tennessee River, he spectaclecase is only occasionally found below Pickwick Landing Dam. Two live animals were found in Hardin County (RM 170) in 1998 (USFWS 2012c).

3.2.2.6 Snuffbox

Species Background & Habitat

Snuffbox are suspension-feeders, typically feeding on algae, bacteria, detritus, microscopic animals, and dissolved organic material. The life cycle of the snuffbox, like most freshwater mussels, is unusual and complex. Snuffbox is a long-term brooder: spawning occurs in the summer and after brooding for up to seven months, the female expels mature glochidia, which then must attach to the gills or fins of a specific host fish species to complete development into juvenile mussels (Roe 2002). Using fish as a host species allows the snuffbox to move upstream

and populate habitats it could not reach otherwise. The snuffbox is usually found in small to medium-sized creeks in areas with a swift current, although it is also found in Lake Erie and some larger rivers. Adults often burrow deep in sand, gravel or cobble substrates, except when they are spawning or the females are attempting to attract host fish (USFWS 2012c).

Distribution and Range

Historically the snuffbox was widespread, occurring in 210 streams and lakes in 18 States and Ontario, Canada. The population has been reduced to 79 streams, which is a 62 percent rangewide decline (USFWS 2012c). Multiple streams may comprise a single snuffbox population and therefore the number of extant populations is actually less than 79. Moreover, extant populations are for the most part highly fragmented and restricted to short reaches of streams. Approximately 32 percent of streams considered to harbor extant populations of the snuffbox are represented by only one or two recent live or fresh dead animals (USFWS 2012c).

Status and Threats Rangewide

The snuffbox was listed as an endangered species under the ESA in 2012, without critical habitat (USFWS 2012c). The snuffbox is declining throughout its widespread range and has become increasingly rare. Distribution although fragmented remains relatively wide including dozens of occurrences; many with good viability. Long-term viability of most populations, however, is questionable (NatureServe 2010). Dams eliminate habitat and block fish passage leading to isolated, small, and unstable populations more likely to die out. Adult mussels are easily harmed by toxins and degraded water quality from pollution. Contaminants may directly harm mussels and affect the ability of surviving mussels to reproduce or disperse (affecting host fish). Excessive sedimentation suffocates freshwater mussels and reduces feeding and respiratory ability leading to decreased growth, reproduction, and survival. Nonnative zebra mussels pose a serious threat. Another invasive species, the round goby, is a nonnative fish that may displace native host fish species, thus reducing reproductive ability of the snuffbox reproduce. Destruction of habitat through stream channelization and maintenance and the construction of dams is still a threat in some areas. Dredging of streams has an immediate effect by physically removing and destroying individuals and also affects long-term re-colonization. Potential threats to snuffbox populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off into the water body, exotic invasive species introduction, and further population fragmentation and genetic bottlenecking through take.

Status within the Action Area

The NiSource project may affect this species in the following locations:

- Allegheny River – Clarion and Armstrong Counties, Pennsylvania

- Big Darby Creek, Little Darby Creek, Little Miami River, Killbuck Creek, Muskingum River, Olentangy River – Madison, Franklin, Pickaway, Greene, Coshocton, Marion, Muskingum, and Washington, Counties, Ohio
- Elk River, Big Sandy Creek, Buckeye Creek, Cedar Creek, Meathouse Fork, Fink Creek, Leading Creek, Fish Creek, Fishing Creek, Kanawha River, Little Kanawha River, and West Fork Little Kanawha Rivers in Kanawha, Calhoun, Clay, Doddrige, Gilmer, Marshall, Putnam, and Wetzel Counties, West Virginia.
- Licking River, Green River, Slate Creek, Red River, and Tygart's Creek – Carter, Greenup, Menifee, Montgomery, Nicholas, Powell, Robertson, Rowan, and Bath Counties, Kentucky

The snuffbox is currently known from three disjunct sites over a 42-RM reach of the Allegheny River centered in Venango County. The viability status of the small population is unknown. Big Darby and Little Darby Creeks both have declining snuffbox populations. The Little Miami River may have a small snuffbox population over approximately 20 RMs. Its viability is unknown. A live snuffbox was found in the Muskingum in 2005, but the status of this population is unknown. There may be a small, declining snuffbox population in the Olentangy River. Its viability is unknown. The Killbuck Creek population is possibly present from RM 15 to the confluence with the Walhonding, but the population may be in decline. Snuffbox were found in the Little Kanawha River in Gilmer County, West Virginia in 2010. The status of this population is unknown. The Elk River population of Snuffbox extends over approximately 30 RMs and is considered viable. The snuffbox only sporadically occurs in the Licking River and its viability is questionable. The Red River population of snuffbox persists in a 10 mile reach of river. Its viability is unknown. The Green River population of snuffbox may be nearing extirpation. Tygart's Creek is thought to have a small snuffbox population, but the viability is unknown. Slate Creek has a marginal and likely unviable population of snuffbox (USFWS 2012c). The West Virginia Field Office of the USFWS assumes presence of the snuffbox in Big Sandy Creek, Buckeye Creek, Cedar Creek, Meathouse Fork, Fink Creek, Fish Creek, Fishing Creek (Barbara Douglas pers. comm.).

3.2.2.7 Northeastern Bulrush

Species Background & Habitat

The northeastern bulrush is a perennial herb in the Sedge family found throughout the Appalachians. The species is a leafy bulrush, with fibrous rhizomes, 3-angled culms with well-developed leaves, and terminal branched inflorescences subtended by leaf-like bracts. The species is generally difficult to identify in the field due to the majority of individuals generally lacking flowers. Little is known about the life history and reproductive biology of the species due to this difficulty in identification, along with its naturally fluctuating population levels, and widely scattered distribution. The species reproduces both sexually and vegetatively, though vegetative reproduction appears more common in established populations, with sexually produced individuals appearing to have less vigor than vegetatively produced individuals. Sexual recruitment success is thought to be very low, limiting the species ability to spread into

even directly adjacent habitat (USFWS 1993c). Flowering generally occurs in mid-June to mid-July, with fruit production from July to September, and germination as early as March. Northeastern bulrush is found in open, tall herb-dominated wetlands throughout its range. It is primarily found at the water's edge or within very shallow water, though it may also be located in areas with up to three feet of water, or in upland areas (NatureServe 2010). Habitats include natural ponds, shallow sinkholes, and wet depressions, though it has not been found in artificial habitats such as ditches, borrow pits, or dredged ponds. Habitat types seem to vary geographically, with the species primarily found associated with sinkholes in the southern part of its range, and a variety of wetland types in the northern part. Many apparently suitable wetland areas adjacent to populations do not host the species for unknown reasons. The only common factor to all inhabited ponds is a seasonal and/or annual fluctuation in water levels from inundation to saturation (USFWS 1993c).

Distribution and Range

Northeastern bulrush was historically found throughout much of the Appalachians and Northeastern U.S., from Virginia in the south, up to New York, New Hampshire, Vermont, and into Quebec. Historic population levels and range are unknown. Approximately 50-60 extant populations exist, with occurrences in Maryland, Massachusetts, New Hampshire, Vermont, Virginia, West Virginia, New York, Pennsylvania, and Virginia, with most of the occurrences located in Pennsylvania. Most populations are considered small, though population estimates are rough due to difficult identification.

Status and Threats Rangewide

The northeastern bulrush, a perennial herb in the Sedge family found throughout the Appalachians, was listed as Endangered under the ESA in May of 1991, without critical habitat (USFWS 1991c), followed by the establishment of a Recovery Plan in 1993. The decline of northeastern bulrush is primarily the result of habitat destruction or modification. Development throughout much of the species range is common, resulting in direct habitat destruction through filling, draining, and dredging of wetland habitats for agricultural, residential, industrial, and recreational purposes. Pesticide and fertilizer laden run-off is also an indirect result of development, leading to a degradation of water quality in remaining wetland complexes. Any activity that has the potential to alter the natural hydrological regime of inhabited wetland complexes should be considered a threat to the species, including increased drawdown from developments, increased flow into seasonal ponds from vegetation removal or impervious surface increase. Other threats include erosion, sedimentation, and invasive exotics. Additionally, due to small population sizes, the species is vulnerable to loss by stochastic events, inbreeding depression, and a loss of long-term population viability (USFWS 1993c). Potential threats to northeastern bulrush populations from NiSource projects include habitat loss or degradation, partial defoliation, local population or individual extirpation, introduction and/or spread of exotic species, and the use of herbicides/pesticides.

Status within the Action Area

The only known occurrences of northeastern bulrush within the action area are in Pennsylvania. There are no known occurrences in the action area in Maryland, New York, Virginia, or West Virginia. In Pennsylvania, there are a total of 11 known occurrences within the covered lands, three of which are within 300 feet of the ROW, in Centre and Franklin counties. In addition, this species may occur on the NiSource covered lands in portions of Adams, Bedford, Cambria, Centre, Clinton, Cumberland, Franklin, Fulton, Lehigh, Monroe, and Northampton Counties, Pennsylvania; Washington County, Maryland; Alleghany, Augusta, Botetourt, Rockbridge, Rockingham, and Shenandoah Counties, Virginia; and Hardy County, West Virginia.

We expect the species status, threats, and impacts in these areas to reflect the status, threats, and impacts seen for the species rangewide.

3.2.2.8 Diamond Darter

Species Background and Habitat

The diamond darter is small fish of the perch family (Percidae) that historically occurred throughout the Ohio River Basin. The diamond darter has a generally translucent body that is silvery white on the underside of the body and head. It has four wide, olive-brown saddles on the back and upper side (Welsh *et al*. 2008).

The diamond darter became a Candidate species under the ESA in July 2009 (77 FR 43906). On July 26, 2012 (77 FR 43906), the USFWS published a proposed rule to list the diamond darter as endangered, and concurrently proposed to designate a total of 122.5 river miles of critical habitat. The proposed critical habitat includes 28.0 miles of occupied habitat in the Elk River, West Virginia and 94.5 miles of currently unoccupied but historically occupied habitat in the Green River, Kentucky. The proposed critical habitat on the Elk River encompasses the entire currently occupied range of the species. On July 26, 2013 (78 FR 45074), the USFWS published a final rule listing the diamond darter as endangered. A final determination on critical habitat is expected to publish shortly thereafter.

Little research exists on the natural history of this rare species (Osier 2005). However, in some cases, potential characteristics can be inferred from the information available on the closely related crystal darter, as noted below. The diamond darter is a species that inhabits medium to large, warmwater streams with moderate current and clean sand and gravel substrates (Simon and Wallus 2006). In the Elk River, adult diamond darters have been collected from transition areas between riffles and pools where moderate currents result in clean swept, predominately sand and gravel substrates that lack silty depositions (Osier 2005). Adult diamond darters congregate and forage near the heads of shoals that are often located near tributary mouths (Welsh *et al*. 2013). Adult diamond darters are benthic invertivores, feeding primarily on streambottom-dwelling invertebrates (NatureServe 2008). It is expected that similar to crystal darters, adult diamond darters eat midge and caddisfly larvae, and water mites in lesser

quantities (Osier 2005). When in captivity, diamond darters were observed resting on the bottom of the tank and taking food from slightly above their position, in front of them, or off the bottom (Welsh 2009c). Diamond darters may also use an ambush foraging tactic by burying in the substrate and darting out at prey (Ruble 2011b).

Diamond darters are most often collected at dusk or during the night and are likely crepuscular (more active at dusk and dawn) (Welsh 2008). They may stay partially buried in stream substrates during the day and then come out to feed during the night (Welsh 2009c). Individuals observed in captivity were frequently either completely buried in the substrate during the day or partially buried with only the head (eyes and top of the snout) out of the substrate. However, individuals were often on top of the substrate at night time (Welsh 2009c). Burying occurred by the individual rising slightly up above the substrate and then plunging headfirst into the sand and using its tail motion to burrow (Welsh 2009c).

Substrates with high levels of silt are unsuitable for the diamond darter, and like the crystal darter, the species has not been found in areas with large amounts of silt, clay, detritus, or submerged vegetation (George *et al*. 1996, Shepard *et al*. 2000). Substrates that are heavily embedded with silts and clays may impede the burying behavior. Embedded substrates are not easily dislodged, and would therefore be difficult for the diamond darter to burrow into for cover. Heavily embedded substrates can be the result of human activities increasing the amount of sedimentation and siltation occurring in the stream (Shipman 2000). The diamond darter requires substrates that are unembedded with silts and clays and that have a naturally high percentage of sands intermixed with loose gravel in order to fulfill their life history requirements.

Diamond darters may shift to different habitat types during different life phases, or due to changing environmental conditions such as high water or warm temperatures (Osier 2005). Deeper or sheltered habitats may provide refuge during warm weather and it has been suggested that *Crystallaria* species may use deeper pools during the day (Osier 2005). Current velocity, water depth, and stream discharge are interrelated and variable, dependent on seasonal and daily patterns of rainfall (Bain and Stevenson 1999, Grandmaison *et al.* 2003). Therefore, velocities and depths at suitable habitat sites may change over time, or diamond darters may also move to other locations within a stream as seasonal and daily velocity and depth conditions change.

Very little information is available on the reproductive biology and early life history of the diamond darter (Welsh *et al.* 2008, Ruble and Welsh 2010). When maintained in captivity, spawning began when water temperatures were consistently above 59 °F and ceased when temperatures reached 72 °F (Ruble 2011b). Females showed signs of being gravid from March to May (Ruble *et al.* 2010). Peak spawning periods likely occur from April through May, and it is estimated that larvae hatch seven to nine days afterward (Ruble *et al.* 2010). Both eggs and hatched larvae were observed in April (Ruble *et al.* 2010, Ruble 2011b). When in captivity diamond darters deposited eggs within loose sand and gravel substrates. Similarly, in the wild crystal darters lay their eggs in side channel riffle habitats over sand and gravel substrates in

moderate current. It is unknown where diamond darter spawning and rearing habitat occurs in the wild, or whether these locations are the same as those used by adults for foraging. Adult diamond darters do not guard their eggs, and the embryos develop in the clean interstitial spaces of the coarse substrate (Simon and Wallus 2006).

Although eggs were produced in all three years that diamond darters have been maintained in captivity, no young have survived and matured (Ruble *et al.* 2010, Ruble 2011b). Because no young have been successfully maintained in captivity and no studies of wild populations are available, we are not able to quantify the range of water quality or habitat conditions needed for successful survival of young. Factors that can impair egg viability include high temperatures, low oxygen levels, siltation, and other water quality degradation (Ruble 2011a). Inadequate water flow through the substrate, or low oxygen levels within the substrate, can lead to poor egg development or poor larval condition (Ruble 2011a). Inadequate food supply may also impair the ability of diamond darter larvae to survive. Juvenile and young crystal darters feed on immature stages of aquatic insects such as mayflies, craneflies, blackflies, caddisflies, and midges (Simon and Wallus 2006). Although larval diamond darters were provided a variety of these potential types of food, larval diamond darters were not seen feeding on them while in captivity. The large teeth seen in larval diamond darters hatched in captivity suggest that young diamond darters may feed on other smaller fish larvae and some cannibalism of other diamond darter larvae was observed (Ruble *et al.* 2010). Due to poor survivorship of the diamond darter larvae and lack of available smaller fish larvae to provide as a potential food source, researchers were unable to confirm their hypothesis that young diamond darter naturally feed on other smaller fish larva (Ruble *et al.* 2010).

After hatching, the larvae are pelagic and drift within the water column (Osier 2005, Simon and Wallus 2006). The larva may drift downstream until they reach slower water conditions such as pools, backwaters, or eddies (Lindquist and Page 1984). Darter larvae may be poorly developed skeletally and unable to hold position or swim upstream when stronger currents exist (Lindquist and Page 1984). The slower velocity habitats found in pools may provide darter larvae with refuge from strong currents and allow them to find cover and forage (Lindquist and Page 1984). It is not known how long diamond darters or crystal darters remain in this pelagic phase, but the pelagic phase of other darters adapted to larger rivers lasts for 15 to 30 days (Rakes 2013).

Downstream movement of young during larval drift must be offset by upstream migration of juveniles and adults, so this suggests that *Crystallaria* may move upstream to reproduce (Lindquist and Page 1984, Stewart *et al.* 2005, Hrabik 2012). This type of migratory behavior has been documented in other species of darters that use habitats similar to the diamond darter (Trautman 1981). Trautman (1981) found that bluebreast darters (*Etheostoma camurum*) were well distributed throughout a 32-mile reach of river during the breeding season, but that there was a reduction in numbers in the upper half of this reach starting in September and continuing through late winter to early spring. There was a corresponding increase in numbers in the lower half of the reach during this time. Individual bluebreast darters captured in the spring were documented to have moved 500 feet in a single day.

Trautman (1981) concluded that bluebreast and other darter species migrated upstream in spring and downstream in the fall.

Life expectancy for the diamond darter has been reported to range from two to four years, although some authors have suggested the potential to live up to seven years (Osier 2005, Simon and Wallus 2006). Sexual maturity may occur during the first year, with the first spawning event occurring the season after hatching.

Based on our current understanding of the diamond darter's life history requirements as described above and more fully detailed in the proposed rule (77 FR 43906), five primary constituent elements (PCEs) for diamond darter critical habitat have been identified. These PCEs are the specific physical or biological features of the critical habitat that support the species' life-history processes, are essential to the conservation of the species, and which may require special management considerations or protection. The five PCEs are:

1) A series of connected riffle-pool complexes with moderate velocities in moderate to large-sized (fourth to eighth order), geomorphically stable streams within the Ohio River watershed.

2) Stable, undisturbed sand and gravel stream substrates, that are relatively free of and not embedded with, silts and clays.

3) An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) that is relatively unimpeded by impoundment or diversions such that there is minimal departure from a natural hydrograph.

4) Adequate water quality characterized by seasonally moderated temperatures, high dissolved oxygen levels, and moderate pH, and low levels of pollutants and siltation. Adequate water quality is defined as the quality necessary for normal behavior, growth, and viability of all life stages of the diamond darter.

5) A prey base of other fish larvae and benthic invertebrates including midge, caddisfly, and mayfly larvae.

Distribution and Range

Historically the diamond darter was distributed throughout the Ohio River Basin, including in the Muskingum River in Ohio; the Ohio River in West Virginia, Ohio, Kentucky and Indiana; the Green River in Kentucky; and the Cumberland River Drainage in Kentucky and Tennessee. The diamond darter has been extirpated from all these streams and the only extant population of the species is located within a 28.0-mile section of the Elk River in Kanawha and Clay Counties, West Virginia (77 FR 43906). It is considered rare within its remaining range, with only 125 individuals documented over the last 30 years (77 FR 43906, Welsh *et al.* 2013).

Status and Threats Rangewide

Although there are currently insufficient data available to develop an overall population estimate for the species, the results of numerous survey efforts confirm that the species is extremely rare. Fish surveys have been conducted in the Elk River almost every year since the early 1990's using a variety of survey methods shown to be effective at capturing *Crystallaria* and similar darter species during previous efforts (Welsh *et al.* 2004, Welsh 2008, Welsh 2009a, Ruble 2011a). Despite these extensive and targeted survey efforts within the species' known range and in habitat types known to be used by the species in the Elk River, fewer than 125 individuals have been collected in the more than 30 years since the species was first collected in the Elk River (Southeastern Fishes Council 2008, Cincotta 2009a, Cincotta 2009b, Welsh 2009b, Ruble and Welsh 2010). In the past few years, new survey techniques have been developed that have a higher detection rate for diamond darters, resulting in more comprehensive surveys. Also, recent research on the species' habitat requirements, coupled with the availability of habitat maps for the entire Elk River, has allowed survey efforts to concentrate on specific areas of the Elk River where diamond darters are most likely to be captured using the new survey techniques (Ruble 2011a, West Virginia Division of Natural Resources 2012, Welsh *et al.* 2013). There are a total of 28 riffle-pool complexes within the known range of the diamond darter in the Elk River. In the summer of 2012, ten of these riffles (also known as shoals) were surveyed. The number of diamond darters located at each shoal ranged from 0 to 20. A total of 82 diamond darters in these 10 shoals were documented. These recent numbers provide a sense of the potential abundance and distribution of the species present in the Elk River in one year. Although improved species-specific survey techniques have been developed in recent years, these surveys have all been conducted in riffles at night during low water in summer and early fall. Diamond darter habitat usage and distribution during other seasons, during the day, and in other habitat types are largely unknown.

The most significant threats to the diamond darter are from the present and threatened destruction, modification, or curtailment of its habitat. These threats are ongoing and pervasive throughout the entire current range of the species. Threats from habitat destruction and modification include sedimentation and siltation from a variety of sources, discharges from activities such as coal mining and oil and gas development, pollutants originating from inadequate wastewater treatment, habitat changes and isolation caused by impoundments, and direct habitat disturbance.

Many sources have recognized that *Crystallaria* species, including both the diamond darter and the crystal darter, appear to be particularly susceptible to siltation, habitat alterations from impoundment, and degradation of water quality. These threats have likely contributed to the extirpation of *Crystallaria* within other watersheds, and are currently occurring throughout the Elk River watershed (Clay 1975, Trautman 1981, Grandmaison *et al*. 2003, 77 FR 43906). Siltation can result from increased sedimentation and erosion along stream banks and roads, and deposition caused by land-based disturbances (Rosgen 1996). Additionally, coal mining, oil and gas development, timber harvesting, and all-terrain vehicle usage have been identified as

land-based disturbances that are sources of increased erosion and siltation within the Elk River watershed (USEPA 2001b, WVDEP 2008b).

These activities, as well inadequate sewage treatment, contribute to the water quality degradation that has been documented within the Elk River watershed. In 2010, a total of 102 streams within the Elk River watershed totaling 640 miles, and including the entire portion of the mainstem Elk River that contains the diamond darer, were identified as impaired by the WVDEP and were placed on the State's 303(d) list (WVDEP 2010). Water quality impairments resulted from high levels of total iron, dissolved aluminum, total selenium, pH, and fecal coliform bacteria (WVDEP 2012). The high levels of total iron are an indication of impairment from excess sediment. For water bodies on the 303(d) list, States are required under the Clean Water Act to establish Total Maximum Daily Loads (TMDLs) for the pollutants of concern in order to improve water quality to meet the applicable standards. The draft 2012 WVDEP 303(d) report places the impaired streams in the Elk River watershed, including the mainstem Elk River, in a category where TMDLs have been developed but where water quality improvements are not yet documented (WVDEP 2012).

Invasive, nonnative plants associated with riparian areas, such as Japanese knotweed, have the potential to adversely affect diamond darter populations in the Elk River. Japanese knotweed can destabilize streambanks causing them to be more prone to erosion, and creating a source of increased sedimentation in the stream. Because leaf litter from Japanese knotweed is of lower nutritional quality than native riparian vegetation, it can negatively impact the productivity of aquatic macroinvertebrates, which are the primary food source for the diamond darter (Urgenson 2006). Japanese knotweed has already been found in the upstream portions of the Elk River watershed (Schmidt 2013).

Finally, because the diamond darter has a small geographic range and small population size, it is subject to several other ongoing, natural and manmade threats. The diamond darter's distribution is restricted to a short stream reach, and its small population size makes it extremely susceptible to extirpation from a single catastrophic event (such as a toxic chemical spill or storm event that destroys its habitat). Its small population size reduces the potential ability of the population to recover from the cumulative effects of smaller chronic impacts such as progressive degradation from runoff (nonpoint source pollutants) and direct disturbances. The long-term viability of a species is founded on the conservation of numerous local populations throughout its geographic range, which allows a species to adapt and recover in response to environmental change (Harris 1984, Noss and Cooperrider 1994). The current population of the diamond darter is restricted to one section of one stream. This population is isolated from other suitable and historical habitats by dams that are barriers to fish movement. The level of isolation and restricted range seen in this species makes natural repopulation of historical habitats or other areas following previous localized extirpations virtually impossible without human intervention.

The significance of this threat is reflected in the proposal to designate unoccupied critical habitat. We can designate critical habitat in areas outside the currently occupied range when a

designation limited to its current range would be inadequate to ensure the conservation of the species. The proposal to designate unoccupied critical habitat in the Green River, Kentucky indicates that the current range must be both maintained and expanded in order to conserve the species.

Conservation Needs of the Species

A recovery plan for the diamond darter has not yet been drafted. However, the 2011 Candidate Assessment and the 2009 Spotlight Species Action Plan both outlined conservation goals and actions for the species. In addition, the proposed rule outlined threats to the species and identified two units of critical habitat, one occupied unit in the Elk River, West Virginia and one currently unoccupied unit in the Green River, Kentucky. In the absence of a recovery plan, these documents provide guidance on the conservation needs of the species.

Based on review of these documents, we have identified five broad conservation needs required for the species' continued survival and recovery:

1. Maintain the current range and distribution of the diamond darter.
2. Maintain and increase adult diamond darter survival and fitness.
3. Maintain and improve foraging and resting habitat.
4. Maintain and increase reproductive success by:
a. Maintaining and improving spawning habitat.
b. Maintaining and improving egg and larval fish survival.
5. Expand the range and distribution of the diamond darter into suitable unoccupied habitats. This would include unoccupied critical habitat areas, as well as other areas within the historical range of the species (to be determined during future recovery planning).

These conservation needs will be used as a basis to evaluate the baseline status of the species and how any proposed action may affect the continued survival and recovery of the species. Our effects analysis will focus on whether the proposed project has the potential to affect any of these conservation needs, and if so whether the applicant has incorporated measures to ensure that potential effects are avoided and minimized to the point that the species survival and recovery will not be impaired.

Status Within the Action Area

The NiSource action area encompasses the entire current range of the species. Therefore, the baseline status of the species and threats within the action area are the same as those described rangewide above.

There are two proposed critical habitat units for the diamond darter. One proposed unoccupied critical habitat unit, located in the Green River, Kentucky, is outside the action area and will therefore not be discussed further. The other critical habitat unit, located in the Elk River, West Virginia, is entirely encompassed within the action area. The Elk River critical

habitat unit contains all the PCEs required by the diamond darter. However, the baseline status and condition of each PCE is described below.

1) A series of connected riffle-pool complexes with moderate velocities in moderate to large-sized (fourth to eighth order), geomorphically stable streams within the Ohio River watershed.

This PCE is largely intact and functioning within the action area. The Elk River is a fifth order stream within the Ohio River watershed. The 28-mile reach of critical habitat within the action area includes a series of 28 connected riffle-pool complexes with no known barriers to fish movement within this reach. Pool habitat covers approximately 76 percent (21 miles), and riffle (shoal) habitat covers approximately 24 percent (7 miles) of the total stream length of this unit. The riffles range in length from about 400 feet long to a maximum of about 4,000 feet long. Most are less than 1,000 feet long. Within each riffle there is an area of habitat with moderate velocities and depths (known as glides) that provide high quality diamond darter foraging habitat. Where glide areas have been delineated, the maximum length of these areas was 328 feet and the average length was 197 feet. Overall, the Elk River is geomorphically stable. However, streambank erosion, and excessive instream sedimentation have been noted in some reaches of the river, indicating that there is localized channel instability that may be affecting the integrity of this PCE (USFWS 2008).

2) Stable, undisturbed sand and gravel stream substrates that are relatively free of, and not embedded with, silts and clays.

This PCE is present but is somewhat degraded within the action area. Many shoals within the Elk River contain stable sand and gravel substrates that are relatively free of silts and clays (Welsh *et al*. 2013). Direct disturbance to stream substrates in the action area has been limited in recent years. Since the diamond darter was listed as a candidate species, the USFWS has focused efforts on reducing the amount of direct disturbance and sedimentation in the Elk River (USFWS 2009). A review of ESA section 7 consultations conducted in the last 10 years found that there has only been one project that involved direct disturbance to the bed of the Elk River within the area proposed for critical habitat. All other projects that proposed crossing or filling in the Elk River within the proposed critical habitat unit have been dropped or redesigned so that impacts to the river bed were avoided, including five water or gas pipeline crossings that were redesigned so that they were horizontally directionally drilled (HDD). Most consultations on projects that occurred in close proximity to the Elk River included the implementation of measures to reduce the potential for sedimentation and erosion and water quality degradation. The one project with direct impacts was a pipeline crossing where HDD was not practicable. Direct impacts were limited to 20 feet of stream and instream construction was completed in one day. At the time of construction, no diamond darters had been found in this area and they were only known to occur at locations which were many miles away. At the time of this project, we also did not have sufficient information to conduct habitat evaluations for the species. In addition to pipeline crossings, unregulated disturbances to the Elk River substrates, such as all-terrain vehicle crossings, may also be occurring (USFWS 2008). In addition, excessive siltation from mining operations, roads, oil and gas operations, land use disturbance (urban,

residential, or agriculture), and stream bank erosion has been noted in the Elk River, which is likely reducing the quality of the substrate for diamond darter feeding, breeding, and sheltering (77 FR 43906, WVDEP 2011b, WVDEP 2012, USFWS 2008).

3) An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) that is relatively unimpeded by impoundment or diversions such that there is minimal departure from a natural hydrograph.

This PCE is largely intact and functioning within the action area. There is one dam on the Elk River near Sutton that is over 70 miles upstream from the start of the critical habitat unit. Flows within the action are unimpounded and generally mimic a natural hydrograph. While the effects of flow regulation may affect the portion of the Elk River immediately below the dam, effects in the critical habitat unit are moderated by the presence of a number of large tributaries that enter the Elk River between the dam and the critical habitat unit. Flow from these tributaries help maintain natural flow regimes in the critical habitat unit. The USFWS has also been working with the U.S. Army Corps of Engineers to manage discharges from the dam so that they more closely mimic natural flow variations and temperatures. We are currently not aware of any other major flow diversions that are affecting the action area.

4) Adequate water quality characterized by seasonally moderated temperatures, high dissolved oxygen levels, and moderate pH, and low levels of pollutants and siltation. Adequate water quality is defined as the quality necessary for normal behavior, growth, and viability of all life stages of the diamond darter.

This PCE is present but is somewhat degraded in the action area. The Elk River generally has seasonally moderated temperatures, high dissolved oxygen levels and moderate pH levels. However, water quality is impaired due to high levels of fecal coliform, metals, and siltation (WVDEP 2010, WVDEP 2012). In addition to high levels of these same parameters, a number of Elk River tributaries are impaired by high levels of selenium and low pHs, which may create cumulative impacts and localized areas of additional degradation in the Elk River mainstem near the mouths of these tributaries (WVDEP 2010, WVDEP 2012, 77 FR 43906). Special management considerations may be needed to address water quality degradation in the Elk River particularly since prolonged water quality impairments can also affect the availability of relatively silt-free sand and gravel substrates (PCE 2) and healthy populations of fish larvae and benthic invertebrates that provide a prey base for the diamond darter (PCE 5). Additional information is needed to determine water quality conditions that are required to fully sustain normal behavior, growth, and viability of all life stages of the diamond darter.

5) A prey base of other fish larvae and benthic invertebrates including midge, caddisfly, and mayfly larvae.

Available information indicates this PCE is intact and functioning in the action area, but special management considerations may be needed to ensure this PCE is maintained throughout the Elk River. Data from 1997 indicated that all four sites sampled in the Elk River mainstem had

healthy benthic macroinvertebrate populations as measured by the West Virginia Stream Condition Index (WVDEP 1997). More recently, the 2012 WVDEP Statewide water quality assessment did not indicate any impairments of benthic population in the Elk River (WVDEP 2012). However, the WVDEP has noted that high WVSCI scores for the lower Elk River mainstem sites may not reflect their true health because the index was developed mostly on first through third order streams, and large rivers typically offer a wider variety of microhabitats, potentially masking some degradation in water quality. No data are available on the abundance of other fish larvae in the Elk River.

In summary, all the PCEs associated with diamond darter critical habitat are present within the action area. The action area contains a series of 28 connected riffle-pool complexes with moderate velocities and has relatively natural, unimpounded flow regimes (PCEs 1 and 3). Some degradation of PCEs has been noted, particularly in relation to excessive siltation over sand and gravel substrates, and water quality degradation (PCEs 2 and 4). Special management considerations may be needed to address these factors, since siltation and water quality degradation can result in reductions to benthic macroinvertebrate and fish larvae populations that provide food for the diamond darter (PCE 5).

3.2.2.9 Roanoke Logperch

Species Background & Habitat

The Roanoke logperch, a small freshwater fish in the Perch family found in the Roanoke and Nottoway River drainages, was listed as Endangered under the ESA in September of 1989, followed by the establishment of a Recovery Plan in 1992.

The species is considered a diurnal, visual predator, generally flipping over stones in the river bed and consuming most food items encountered, with the primary prey consisting of chironomid and caddisfly larvae, and chironomids. The species is considered non-migratory. Spawning occurs in mid-April to early May, generally in areas of deep runs with gravel and small cobble bottoms. Eggs are buried and there is no subsequent parental care.

The Roanoke logperch appears to utilize every major riverine habitat based upon life phase and season. Generally, the species occupies clean, clear, moderate to large sized warm-water streams and rivers with moderate gradients and relatively unsilted substrata. They most commonly inhabit riffle-run-pool areas and substratas made of mostly gravel and rubble. Males are generally found in shallow riffles, females in deep runs with gravel and small cobble bottoms, young in slow runs and pools with clean sand bottoms, and all classes are assumed to winter under boulders in deep pools. Except during the winter, all age classes appear to be intolerant of moderate to heavy levels of silted substrata (USFWS 1992).

Distribution and Range

The Roanoke logperch is a small freshwater fish in the Perch family found in the Roanoke and Nottoway River drainages. Historically the Roanoke logperch was found in the Roanoke River drainage, including the Pigg and Smith rivers, along with the Nottoway River Drainage. Its range extended through portions of the Ridge and Wally, Blue Ridge, and lower Piedmont provinces (USFWS 1992). The species is extant in eight discrete populations in five rivers/river reaches (USFWS 2007e). Currently, populations can be found in portions of the upper and middle Roanoke Rivers, upper and middle Pigg Rivers, the Nottoway River, and in three portions of the Smith River. The populations are separated by wide river gaps or large impoundments, comprising the remnants of a formerly widespread distribution, though the species may have never been found in large densities across its range.

Status and Threats Rangewide

The decline of the Roanoke logperch is primarily the result of destruction and modification of habitat, along with fragmentation of the species. Primary causes of the species' habitat degradation include chemical spills, non-point runoff, channelization, impoundments, siltation, pollution, and cold-water release from dams. The primary factor leading to the species decline is thought to be siltation, due to reduction of habitat heterogeneity and productivity, increases in egg and larval mortality, and reduction in available food supplies (USFWS 1992). Other threats include urbanization, industrial development, water supply and flood control projects, agricultural runoff, and industrial effluents. Potential threats to Roanoke logperch populations from NiSource projects include short-term impoundments, increased siltation, pollution run-off and small spills into the water body, potential entrainment of individuals during hydrostatic testing, and further population fragmentation and genetic bottlenecking through take.

Status within the Action Area

The NiSource project may affect this species in portions of the Nottaway River system, including the Nottoway River, portions of Stony and Sappony Creeks, and the tributaries to these Rivers in Brunswick, Dinwiddie, Greensville, Southampton, and Sussex Counties, Virginia (Figure 2).

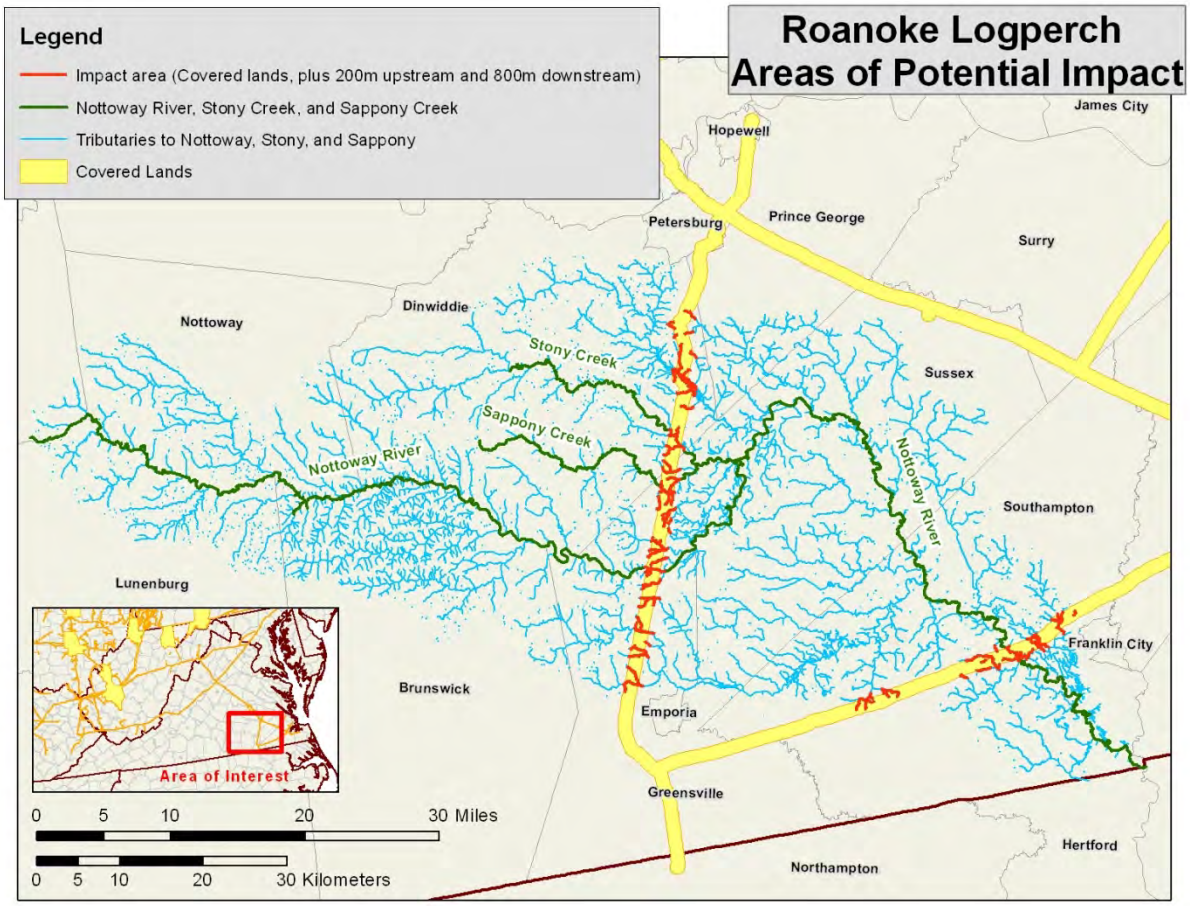

Figure 2. Roanoke logperch potential habitat within the NiSource project area

These populations are separated by wide river gaps or large impoundments, comprising the remnants of a formerly widespread distribution, though the species may have never been found in large densities across its range. We expect the species status, threats, and impacts in these areas to reflect the status, threats, and impacts seen for the species rangewide.

3.2.2.10 Eastern Massasauga Rattlesnake

Species Background & Habitat

The eastern massasauga (EMR), a medium-sized rattlesnake found in the southern Great Lakes region and Midwest, became a candidate species under the ESA in October 1999. Similar to all rattlesnakes, the massasauga bears live young, with reproduction generally occurring biennially, though some annual reproduction has been reported. Annual reproducers mate in the spring and bear their young in the later summer to autumn, while biennial reproducers mate in the autumn, with young bearing in the following summer. Young are born from late July to early September, and disperse from the mother within a week of birth. Sexual maturity is generally reached between five and seven years of age, with a total life span of up to eight to ten years.

Like all northern snakes, the species hibernates during the winter, going into the hibernacula in mid-September through late October, and emerging in late March to early April, though unlike other similar species, they hibernate individually. Typical prey species include voles, deer mice, and shrews, though they will also consume frogs, birds, eggs, and other snakes. The species is preyed upon by carnivorous mammals, birds of prey, and other snakes (USFWS 1998).

Eastern massasaugas are found on both wetland and upland habitats, and typically shift between the two seasonally, with the shift varying across the species range, along with between sexes and life stages. Occupied sites are generally contain a mix of open sunlit areas and shaded areas for thermoregulation, have a water table near the surface for hibernation, and variable elevations between the adjoining wetland and upland areas. Hibernacula typically occur in wetlands, with crayfish burrows often utilized; though other structures such as sphagnum hummocks, small mammal burrows, and tree roots are also utilized, with the key factor being the presence of water that does not freeze. It is uncommon to find the species in open water areas (USFWS 1998). Typical habitats include peatlands, marshes, bogs, sedge meadows, and swamp forest, with typical uplands including open savannas, prairies, and old fields (USFWS 2007f).

Distribution and Range

The historic range of eastern massasaugas stretched from western New York and southern Ontario to Iowa and Missouri, including portions of Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, and Minnesota. While the current range resembles the historic range, the distribution within the range is considerably patchier, with approximately 40 percent of the counties that the species was historically supported in no longer containing known populations, along with the species being considered extirpated from Minnesota. Less than 35 percent of remaining occurrences of the species are considered secure (USFWS 2007f).

Status and Threats Rangewide

The decline of the eastern massasauga is primarily due to habitat loss, and degradation. Wetland drainage for the conversion to farmland, along with the encroachment of urban development and the associated road and utility projects, have combined to eliminate much of the species' historic range, along with the fragmentation of the remaining areas of habitat and populations. The loss of suitable natural upland habitats has also led to the use of surrogate habitats, such as lawns, agricultural fields, roads, and open areas, which often leads to an increased vulnerability to indiscriminant killing and mortality. The increased fragmentation of habitat by roads has also lead to an increase in vehicle-caused mortality and injury. Additionally, the increase in development has also resulted in the suppression of natural fires, allowing woody succession to choke out the open upland habitats that the species requires. Other anthropogenic threats include illegal collection for the pet trade, and persecution and individual stress from human activity disturbance. Additionally, due to the small and disjunct nature of most remaining populations, they faced an increased threat of extirpation from stochastic events and reduced reproductive success (USFWS 1998). Potential threats to eastern

massasauga populations from NiSource projects include temporary or permanent loss or degradation of habitat, individual disturbance or mortality, chemical contaminants, facilitated predation and collection, water level manipulation and sedimentation, and further species fragmentation and genetic bottlenecking.

Status within the Action Area

The NiSource project may affect this species in portions of Elkhart, LaPorte, Marshall, Noble, Porter, and St. Joseph counties, Indiana; and Ashtabula, Champaign, Clark, Columbiana, Crawford, Fairfield, Fayette, Greene, Hardin, Huron, Licking, Lucas, Mahoning, Marion, Ottawa, Richland, Trumbull, Warren, Wayne, and Wyandot counties Ohio. Populations in these areas would be found in association with a mix of wetlands and associated uplands.

Massasaugas have experienced significant declines across their range. The primary threat to the eastern massasauga is the continued loss and degradation of its habitat. This includes the draining of wetlands for farms, roads, homes, and urban development. Vegetative succession due to suppression of natural fire and hydrological regimes is degrading massasauga habitat in many areas. Roads, towns, and farm fields prevent massasaugas from moving between the wetland and upland habitats they need. These same barriers also isolate remaining populations. Massasaugas typically do not flee from farm machinery or mowers, but instead rely on their cryptic nature to avoid detection, making them especially vulnerable to plowing and mowing activities. All of these threats have acted on the populations in Indiana and Ohio and significantly reduced the populations in those states, including within the covered lands.

Indiana - Massasaugas are state listed as endangered in Indiana. Historically, massasaugas were widely distributed across the northern half of the state. Their range within the state, however, has been severely restricted and currently includes only a third of the area that it once covered (USFWS 1998). Of the 44 historical populations in Indiana, twelve are considered extirpated, with three others possibly extirpated. The remaining sites are considered to be declining or have unknown population trends.

There are currently no known massasauga populations within the covered lands in Indiana, which consists of a single line crossing the northern part of the state. However, most of the covered lands within this area likely provides suitable habitat for the species and may be occupied now or in the future. There are 10 documented populations within the counties crossed by the covered lands, all of which are considered to be declining or have unknown population trends (Table 5). Given this information, we consider the massasauga to be present but rare within the covered lands. Any populations present are likely to be small or declining.

Table 5. Status of Eastern Massasauga Populations in NiSource MSCHP Counties, Indiana

Population	County	Last Observed	Trend	Known Threats
Simonton Lake/Mud Lake/ Malaxis Bog	Elkhart	1995	Unknown	
Springfield Fen	La Porte	1992	Unknown	Isolation
Moore Lake	Marshall	1993	Declining	Habitat destruction and indiscriminate persecution
Tamarack Lake/Tamarack Creek	Noble	1996	Declining	Vegetative succession and habitat loss
The Spreads	Noble	1992	Unknown	
Needham Lake	Noble	1992	Unknown	Isolation
Wolf Lake/Merry Lea	Noble	1987	Unknown	
Bender Woods	Noble	1995	Unknown	
Indiana Dunes National Park	Porter	1997	Declining	Habitat fragmentation and highway mortality
Mill Creek Wetlands	St. Joseph	1994	Unknown	

Source: Szymanski 1998

Ohio – Massasaugas are listed as state endangered in Ohio. Historically the species occurred over much of the state, including 38 sites in 31 counties. Currently, the species has been extirpated from approximately 24 sites. Of the 14 possible extant sites, three were considered vulnerable, one was declining, six were presumed declining, and four had unknown population trends. Anecdotal information and recent surveys clearly indicate that the massasauga populations across Ohio have declined substantially, with all remaining populations being small and isolated.

In Ohio, the covered lands consist of a web of pipeline that crosses portions of the northern and southern part of the state, including five storage well counties: Hocking, Fairfield, Ashland, Knox, and Richland counties. Known massasauga populations and suitable habitat (potential populations) are found in several areas throughout the covered lands in Ohio (Table 6).

Table 6. Status of Eastern Massasauga Populations in NiSource MSCHP Counties, Ohio

Population	County	Last Observed	Trend	Threats
Nature Pallister State Preserve/Rome State Nature Preserve	Ashtabula	2003	Presumed Declining	Vegetative succession
Orwell Township	Ashtabula	2007	Presumed Declining	Indiscriminate persecution
Cedar Bog State Nature Preserve	Champaign	2007	Vulnerable	Highway mortality and vegetative succession
Prairie Road Fen State Nature Preserve	Clark	2007	Vulnerable	Small population size
Resthaven Wildlife Area	Erie	1993	Unknown	
Spring Valley Wildlife Area	Greene/Warren	2007	Vulnerable	Collection and indiscriminate persecution.

Population	County	Last Observed	Trend	Threats
Wright-Patterson Air Force Base	Greene/Montgomery	1993	Presumed Declining	Habitat modification
Willard Marsh Wildlife Area	Huron	2007	Unknown	
Buckeye Lake	Licking/Fairfield	1996	Presumed Declining	Habitat loss
Mecca Township	Trumbull	1995	Unknown	
Mosquito Creek Wildlife Area	Trumbull	2007	Unknown	Collection and incompatible management
Killbuck Marsh Wildlife Area	Wayne	1990	Presumed Declining	
Marseilles Township/ Killdeer Plains Wildlife Area	Wyandot	2007	Declining	Habitat modification

More recent surveys in Ohio (2005-2007) have documented extant populations of eastern massasaugas in on private properties in Ashtabula County, Cedar Bog State Nature Preserve (Champaign County), Prairie Road Fen (Clark County), Mosquito Creek (Trumbull County), Willard Marsh (Huron County), Spring Valley Wildlife Area (Greene/Warren counties), and Killdeer Plains (Wyandot County).

4 EFFECTS OF THE ACTION

This section of the biological opinion summarizes an analysis of the direct and indirect effects of the proposed actions and any interrelated and interdependent activities on the species/critical habitat.

ANALYTICAL FRAMEWORK

The analytical framework for our effects analysis in the BO will take the following stepwise process (Figure 3).

Figure 3. Analytical Framework

Step 1- Effects to Individuals

This step evaluates how the proposed action and its impact on the environment will adversely affect the fitness of individuals and their critical habitat (where designated). This involves evaluating the likelihood of exposure of the individuals habitat to the action stressors and then where exposure occurs, evaluating how individuals/habitats are likely to respond. This includes the Exposure, Response, and Conservation Need Affected, portions of the Exposure-Response tables (see Appendix C). This step ends with our conclusions regarding the impacts to individual fitness (i.e., reproductive potential and survivorship) and habitat.

Step 2 – Effects to Populations

This step evaluates the aggregated consequences of the effects to individuals/habitat on the fitness of the population(s) to which those individuals belong. This involves evaluating how the affected population(s) are likely to respond to the reduced fitness of all individuals exposed. This step should close with our conclusions on the likely fate or ultimate response of the population(s), and should be couched in terms of population fitness (i.e., persistence and reproductive potential, long and short-term). For critical habitat, this step should evaluate expected impacts on the habitat on the physical and biological features of that habitat that are needed for the species to survive and reproduce there.

Step 3 – Effects to the Species Rangewide[6]

This step determines whether the anticipated reductions in population fitness will reduce the likelihood of survival and recovery of the species by reducing its rangewide reproduction,

[6] If the species recovery plan designates recovery units (RUs), this step should look at how the reduced population fitness affects the species within the affected RU and how this may affect the likelihood of both survival and recovery of the species in the RU.

numbers, or distribution (RND). This step also determines whether impacts critical habitat will appreciably reduce the likelihood of survival and recovery of the species by adversely modifying the critical habitat.

To understand the consequences of population-level impacts on the species, we must identify the RND needs of the species to achieve recovery (i.e., insure that it is no longer in danger of extinction or to become endangered within the foreseeable future). Where designated, we must also identify whether the value of the critical habitat has been diminished for both the survival and recovery of the species. A potential source for this information is the recovery plan, specifically the recovery objective, strategy, criteria, and actions. The baseline condition of the species, established in the Status of the Species section of the biological opinion, also provides important perspective for this analysis. If the population-level risks do not noticeably, detectably, or perceivably reduce the likelihood of progressing towards or maintaining the RND needs, the action is not likely to appreciably reduce the likelihood of both survival and recovery of the species. If the population-level risks appreciably reduce the likelihood of progressing towards or maintaining the RND needs, the likelihood of both survival and recovery of the species will likely be appreciably reduced.

To understand the impacts on critical habitat, we must evaluate whether the impacts to the physical and biological features will adversely modify the critical habitat by reducing its value for the survival and recovery of the species. A potential source for this information is the recovery plan, specifically the recovery objective, strategy, criteria, and actions and how the critical habitat is contributes to meeting these. If the impacts to the critical habitat appreciably diminish the use of that area to continually move towards the recovery of the species, then the critical habitat has been adversely modified.

Effects Analysis in this BO

We analyzed and evaluated the material in the BA and MSHCP relevant to the effects of the covered actions on the covered species independently of our involvement in preparing these documents. That we have incorporated (directly or by reference) portions of the BA and MSHCP into this BO to provide a direct reference to materials used in our evaluation of the effects of the actions contained in this consultation.

For species that may be affected, and are likely to be adversely affected (LAA), this section examines the effects of the proposed actions in concert with the environmental baseline for the species to describe the conditions expected to exist in the future as a result of the proposed actions. This discussion contains material from the BA (USFWS 2013) and/or MSHCP (NiSource 2013) on covered actions or effects, but does not cite all relevant items in those documents. Those documents are incorporated herein by reference.

This effects analysis, while completed here, is summarized in the Conclusion section (Section 5) of this BO, which provides our conclusion of whether the action agencies have insured that the

action is not likely to jeopardize the continued existence of the species or adversely modify its critical habitat.

4.1 MSHCP Species

4.1.1 Indiana bat

This section evaluates the effects of the proposed action on the Indiana bat. Table C1 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

The MSHCP prescribes a number of AMMs that NiSource will implement to avoid and minimize impacts on the Indiana bat. Implementation of these AMMs as proposed in the MSHCP is essential to this effects analysis and determinations made within. Specifically, these AMMs reduce impacts to Indiana bats by first identifying areas where the species is known, presumed, or may be present and then identifying the specific actions that will minimize the potential for direct and indirect take, particularly death, injury, and harassment of Indiana bats.

The AMMs will be applied to all known occupied locations (i.e., where individuals have been documented to occur) and suitable habitats where occurrence may be presumed in Indiana, Kentucky, Maryland, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia counties. These species-specific measures supplement (and supersede where conflicting) the general BMPs specified in the NiSource NGTS ECS.

A detailed EM&CP will also be prepared for any project within Indiana bat habitat. The plan will incorporate the relevant requirements of NiSource's current ECS and include site-specific details particular to the project area and potential impact. The plan will be focused on avoiding and minimizing disturbance to known hibernacula, spring staging and fall swarming habitat, as well as known summer maternity colony and suitable summer habitats as well as impacts within known foraging habitat. The plan will identify the applicable AMMs to be applied to the project. The plan will be approved in writing by NiSource NRP personnel, prior to project implementation, and will include a tailgate training session for all onsite project personnel to highlight the environmental sensitivity of the habitat and any Indiana bat AMMs which must be implemented.

The AMMs are organized by section, but numbered sequentially throughout. It is important to note that the AMMs in standard font are required where they are applicable, whereas the

AMMs in *italic* font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

<u>AMMs for Habitat Assessments/Surveys to Evaluate the Presence of the Species and/or Suitable Habitat (1-3)</u>

1. Habitat Assessment to Determine Presence of Suitable Summer Habitat
Habitat assessments will be used to complete a project-specific, on-the-ground analysis to determine if proposed activities will adversely affect Indiana bats and/or their habitat. NiSource is responsible for developing and providing sufficient information as to whether suitable summer Indiana bat habitat exists within a proposed project area. In order to accomplish this, NiSource must have knowledge of the project area sufficient to adequately and accurately describe the potential suitable Indiana bat summer habitat conditions that may or may not exist on-site. This knowledge can be derived from any number of sources including, but not limited to, on-site visits, review of aerial photography and other maps, previous mining records (if applicable), forest inventories, previous species survey reports, and the work of NiSource's consultants or other designees. At a minimum, however, NiSource must determine if suitable Indiana bat habitat is present, define the general quality of that habitat (i.e., trees ≥ 9" dbh present), and quantify the extent of each habitat class identified. The results of such assessments will be recorded and documented in NiSource's annual compliance report. Results will be valid for one year and can be completed any time of year.

i. Examine identified impact areas for the following characteristics:
    a. <u>Suitable summer habitat</u> (*see* definition of this habitat as well as suitable roost trees in the "Explanation of Terms" section in Chapter 6 of the MSHCP). Suitable primary roosting summer habitat is habitat meeting the suitable summer habitat definition but includes suitable roost tree(s) ≥ 9" dbh.
    b. <u>Suitable spring staging and fall swarming habitat</u> is habitat meeting the summer habitat definition that is located within a 10-mile radius of P1, 2, 3, and 4 hibernacula.

2. Assessments to Determine Presence of Suitable Winter Habitat (hibernacula)
NiSource will develop sufficient information as to whether potentially suitable winter Indiana bat habitat exists within a proposed project area. This knowledge will be derived from, but not limited to, the following sources: on-site visits, review of aerial photography and other maps, previous mining records (if applicable), forest inventories, previous species survey reports, and the work of NiSource's consultants or other designees. Indiana bats have been documented using caves (and their associated sinkholes, fissures, and other karst features), quarries, and abandoned mine portals (and their associated underground workings) as winter hibernation habitat.

NiSource personnel or its consultants will determine whether potentially suitable winter habitat exists within the project area by conducting "Winter Habitat Assessments" as described below. The results of these assessments will be recorded and documented in NiSource's annual

compliance report. Results will be valid for two years and can be completed any time of year. The Winter Habitat Assessment Protocols are:

i. Examine identified impact areas for the following characteristics:
   a. The ground openings at least one foot in diameter or larger.
   b. Underground passages should continue beyond the dark zone and not have an obvious end within 40 feet of entrance (Note: This may not be verifiable by surveyor due to safety concerns).
   c. Entrances that are flooded or prone to flooding (i.e., debris on ceiling), collapsed, or otherwise inaccessible to bats will be excluded.
   d. Ground openings that have occurred recently (i.e., within the past 12 months) due to creation or subsidence will be excluded. However, a written description and photographs of the opening must be included in the pre-survey report.

Surveys to Confirm Use of Suitable Winter Habitat

ii. If suitable winter habitat is discovered as a result of the habitat assessments above (AMM#2i), do not alter, modify, or otherwise disturb entrances or internal passages of caves, mines, or other entrances to underground voids (potential hibernacula) within the MSHCP covered lands until a "Determination of Suitable Winter Habitat for Indiana Bats" is completed. The survey protocols to make this determination will be provided by the USFWS and will be followed to determine if the suitable habitat is in fact, occupied. Some surveys will require modification (or clarification) of these guidelines; therefore, coordination with the USFWS Field Office responsible for the state in which the site-specific project occurs is necessary prior to initiating suitable winter habitat surveys. Results of completed surveys will be submitted to the responsible USFWS Field Office(s) prior to clearing of identified habitat. The USFWS will accept the results of these surveys for the purposes of determining whether and to what degree take is anticipated.
If surveys (conducted using approved methodology) fail to detect Indiana bats, AMMs in winter habitat are not mandatory. However, NiSource may voluntarily elect to employ any of the AMMs to maintain the viability of the suitable winter habitat. Alternatively, NiSource may assume presence of Indiana bats in this suitable winter habitat and apply mandatory AMMs.

3. Surveys to Determine Presence in Suitable Summer Habitat

NiSource may conduct summer surveys to determine presence or probable absence of Indiana bats within suitable summer habitat for site-specific projects not located within known habitat as defined above. The current "Indiana Bat Mist Netting Guidelines" provided in Appendix 5 of the 2007 Indiana Bat Draft Revised Recovery Plan or future versions of superseding USFWS-approved guidelines will be applied. Some mist-netting projects will require modification (or clarification) of these guidelines; therefore, coordination with the USFWS Field Office responsible for the state in which the site-specific project occurs is necessary prior to initiating summer presence/absence surveys. Results of completed summer surveys will be submitted to the responsible USFWS Field Office(s) prior to clearing of identified suitable summer habitat. The USFWS will accept the results of these surveys for the purposes of determining whether and

to what degree take is expected. Survey results are valid for two years unless new information changes the USFWS's view on whether certain geographic areas provide suitable summer habitat for Indiana bats.

If no Indiana bats are captured and no other recent information suggests the presence of Indiana bats, no further AMMs or mitigation are necessary. If Indiana bats are captured, the relevant AMMs and mitigation would apply. Alternatively, NiSource may elect to assume presence of Indiana bats in suitable summer habitat and apply the AMMs and mitigation measures.

<u>AMMs for Indiana Bats in Known or Presumed Occupied Caves/Winter Habitat (4-12)</u>

4. When burning brush piles within 0.25 mile of known or presumed occupied hibernacula from August 15 to May 15, the brush piles can be no more than 25 feet by 25 feet, must be spaced at least 100 feet apart, and located at least 100 feet from known hibernacula entrances and associated sinkholes, fissures, or other karst features.

5. No woody vegetation or spoil (e.g., soil, rock, etc.) disposal within 100 feet of known or presumed occupied hibernacula entrances and associated sinkholes, fissures, or other karst features (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

6. Protect potential recharge areas of cave streams and other karst features that are hydrologically connected to known or presumed occupied hibernacula by employing the relevant NGTS ECS standards such as Section III, Stream and Wetland Crossings, and Section IV, Spill Prevention, Containment and Control.

7. Blasting within 0.5 mile of known or presumed occupied hibernacula will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the hibernacula (e.g., maximum charge of two inches per second ground acceleration avoids impact to nearby structures) (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

8. Drilling within 0.5 mile of known or presumed occupied hibernacula will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the hibernacula (e.g., outer drilling tube filled with concrete to ensure no modification to any karst encountered) (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

9. If authorized by the landowner, block (e.g., gate) access roads and ROWs leading to known or presumed occupied hibernacula from unauthorized access.

10. Equipment servicing and maintenance areas will be sited at least 300 feet away from streambeds, sinkholes, fissures, or areas draining into sinkholes, fissures, or other karst features.

11. Operators, employees, and contractors (working in areas of known or presumed Indiana Bat Habitat as described in this section) will be educated on the biology of the Indiana bat, activities that may affect bat behavior, and ways to avoid and minimize these effects (AMMs in MSHCP).

12. Restrict use of herbicides for vegetation management within 10 miles of known or presumed occupied hibernacula to those specifically approved for use in karst (e.g., sinkholes) and water (e.g., streams, ponds, lakes, wetlands).

AMMs for Indiana Bats in Spring Staging/Fall Swarming Habitat (13-26)

13. No clearing of suitable spring staging and fall swarming habitat within a 10-mile radius of any Priority 1 and 2 presumed occupied hibernacula from April 1 to May 31 and August 15 to November 14.

14. *No clearing of suitable spring staging and fall swarming habitat within a 10-mile radius of any Priority 3 and 4 hibernacula from April 1 to May 31 and August 15 to November 14.*

15. Operators, employees, and contractors (working in areas of known or presumed Indiana Bat Habitat as described in this section) will be educated on the biology of the Indiana bat, activities that may affect bat behavior, and ways to avoid and minimize these effects (AMMs in MSHCP).

16. No woody vegetation or spoil (e.g., soil, rock, etc.) disposal within 100 feet of known or presumed occupied hibernacula entrances and associated sinkholes, fissures, or other karst features (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

17. Protect potential recharge areas of cave streams and other karst features that are hydrologically connected to known or presumed occupied hibernacula by following relevant NGTS ECS standards such as Section III, Stream and Wetland Crossings, and Section IV, Spill Prevention, Containment and Control.

18. Blasting within 0.5 mile of known or presumed occupied hibernacula will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the hibernacula (e.g., maximum charge of two inches per second ground acceleration avoids impact to nearby structures) (*see* related adaptive management discussion in Chapter 7).

19. Drilling within 0.5 mile of known or presumed occupied hibernacula will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the hibernacula (e.g., outer drilling tube filled with concrete to ensure no modification to any karst encountered) (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

20. *Activities (e.g., drilling) involving continuing (i.e., longer than 24 hours) noise disturbances greater than 75 decibels measured on the A scale (e.g., loud machinery) within a one-mile radius of known or presumed occupied hibernacula should be avoided during the spring staging (April 1 to May 31) and fall swarming (August 15 to November 14) seasons.*

21. Equipment servicing and maintenance areas will be sited at least 300 feet away from streambeds, sinkholes, fissures, or areas draining into sinkholes, fissures, or other karst features.

22. *Within 10 miles of Priority 1, 2, 3, and 4 hibernacula and only in areas identified as suitable summer habitat, retain snags, dead/dying trees, and trees with exfoliating (loose) bark ≥ 5-inch diameter at breast height (dbh) in areas ≤ one mile from water.*

23. Contaminants, including but not limited to oils, solvents, and smoke from brush piles, should be strictly controlled as provided for in the EMCS and ECS, Section II.C.2, and Section IV so the quality, quantity, and timing of prey resources are not affected.

24. From April 1 to May 31, and August 15 to November 14, use tanks to store waste fluids to ensure no loss of bats by entrapment in waste pits within 10 miles of Priority 1 & 2 hibernacula or presumed occupied hibernacula.

25. *From April 1 to May 31, and August 15 to November 14, use tanks to store waste fluids to ensure no loss of bats by entrapment in waste pits within 10 miles of Priority 3 & 4 hibernacula.*

26. Implement strict adherence to sediment and erosion control measures, ensure restoration of pre-existing topographic contours after any ground disturbance, and restore native vegetation (where possible) as specified in the ECS upon completion of work within and known or presumed occupied spring staging and fall swarming habitat.

AMMs for Indiana Bats in Summer Habitat (27-40)

27. No clearing of known maternity colony summer habitat within the covered lands of the MSHCP or trees greater than nine inches dbh within any existing ROW and/or appurtenant facility of the covered lands of the MSHCP from April 1 to October 15 to avoid direct affects to females (pregnant, lactating, and post-lactating) and juveniles (non-volant and volant) (*see* related adaptive management discussion in Chapter 7 of the MSHCP).

28. *Retain snags, dead/dying trees, and trees with exfoliating (loose) bark ≥ 5 inches dbh in areas identified as known maternity colony summer habitat and ≤ one mile from water.*

29. No clearing of suitable summer habitat within the covered lands of the MSHCP from June 1 to August 1 to protect non-volant Indiana bat pups or "side-trimming" of suitable summer habitat from April 15 to September 1 to avoid direct affects to females (pregnant, lactating, and post-lactating) and juveniles (non-volant and volant).

30. *No clearing of suitable summer habitat within the covered lands of the MSHCP from April 1 to May 31 to avoid direct affects to pregnant females and minimize direct effects on Indiana bats in summer habitat.*

31. *No clearing of suitable summer habitat located more than 10 miles from a Priority 1, 2, 3 and 4 hibernacula within the covered lands of the MSHCP from August 2 to October 15 to avoid direct effects to post-lactating females and volant juveniles and minimize direct effects to Indiana bats in summer habitat.*

32. Operators, employees, and contractors (working in areas of known or presumed Indiana Bat Habitat as described in this section) will be educated on the biology of the Indiana bat, activities that may affect bat behavior, and ways to avoid and minimize these effects.

33. *No aerial application of herbicide on ROWs from April 15 to August 15 to protect maternity colonies in summer habitat.*

34. *Retain snags, dead/dying trees, and trees with exfoliating (loose) bark ≥ 5 inches dbh in areas identified as suitable summer habitat and ≤ one mile from water.*

35. Contaminants, including but not limited to oils, solvents, and smoke from brush piles, should be strictly controlled as provided for in the EMCS and ECS, Section II.C.2, and Section IV so the quality, quantity, and timing of prey resources are not affected.

36. Implement and strict adherence to sediment and erosion control measures, ensure restoration of pre-existing topographic contours after any ground disturbance, and restore native vegetation (where possible) as specified in the ECS upon completion of work within suitable summer habitat and known or presumed occupied spring staging and fall swarming habitat.

37. Equipment servicing and maintenance areas will be sited at least 300 feet away from streambeds, sinkholes, fissures, or areas draining into sinkholes, fissures, or other karst features.

38. Between April 1st and November 14th, use tanks to store waste fluids to ensure no loss of bats by entrapment in waste pits in known maternity colony summer habitat within the covered lands of the MSHCP.

39. *Between April 1st and November 14th, use tanks to store waste fluids to ensure no loss of bats by entrapment in waste pits in suitable summer habitat within the covered lands of the MSHCP.*

40. *Avoid conducting construction activities after sunset in known or suitable summer habitat to avoid harassment of foraging Indiana bats.*

Impacts to Individuals

Subactivities Having No Effect/Not Likely to Adversely Affect the Species

The majority of the NiSource subactivities will have either no effect or are not likely to adversely affect the Indiana bat (see Table C1, Appendix C; NE/NLAA subactivities). Foot traffic and vehicle use associated with NiSource activities is not anticipated to occur to a level or extent that would measurably affect Indiana bats. Further, activities that involve the use of small machinery and removal of small areas of vegetation or ground disturbance are not anticipated to impact Indiana bats. Further, implementation of the AMMs serve to limit numerous potentially disturbing activities to the point where they will not measurably impact any individuals (see Table C1, Appendix C; NE/NLAA subactivities).

Subactivities Likely to Adversely Affect the Species

There are several subactivities that are likely to adversely affect the Indiana bat (see Table C1, Appendix C; NLAA subactivities). These adverse impacts are expected from subactivities that will (1) remove larger areas of vegetation, (2) impact areas of previously undisturbed vegetation

or potential roost trees, and (3) expose Indiana bats to chemical contamination. These subactivities are as follows:

O&M

- Vegetation Management - chainsaw and tree clearing
- General Appurtenance and Cathodic Protection Construction - Off ROW Clearing
- Well Abandonment - plugging, waste pits, site restoration
- Well Abandonment - facilities/building removal and site restoration

New Construction

- Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling
- Crossings, wetlands and other water bodies (non-riparian) – clearing
- Storage wells - clearing and drilling
- Storage wells - waste pits

Table 7 shows the expected types of take of Indiana bat from these subactivities. Overall, we expect the AMMs to significantly limit the magnitude and duration of adverse impacts to Indiana bats from these subactivities, as discussed in this section.

Table 7. Indiana Bat Habitat/Specific Life Stage Types and Type of Take Expected within the Covered Lands (Table 6.2.1.5-1 in the MSHCP)

HABITAT/SPECIFIC LIFE STAGE TYPE	TYPE OF TAKE[7]
Known Summer Maternity Habitat	Indirect
Suitable Summer Habitat	Direct[8] & Indirect
Immobile Indiana Bats (i.e., pups)	None
Known Spring Staging/Fall Swarming Habitat of P1/P2 Hibernacula	Indirect
Known Spring Staging/Fall Swarming Habitat of P3/P4 Hibernacula	Direct & Indirect
Presumed Spring Staging/Fall Swarming Habitat (always assumed as of P1/P2 hibernacula)	Indirect
Known Winter Hibernacula Habitat	None
Presumed Winter Hibernacula Habitat (always assumed as P1/P2 hibernacula)	None

Indiana bat surveys

[7] Direct take refers to take that occurs while Indiana bats are present at the time of impact to habitat (i.e., occupied). Indirect take refers to take that occurs while Indiana bats are absent at the time of impact to habitat (i.e., unoccupied).

[8] Direct take may only occur from ROW and storage field new construction activities only. Direct take of Indiana bats from O&M activities in the existing ROW has been avoided in suitable summer habitat (AMMs #27 and #29).

The AMMs (1-3) outline the survey process for NiSource to use for determining the presence of Indiana bat habitat or habitat use. These surveys will inform NiSource about the level of anticipated effects that covered activities may have on the Indiana bat. Once a determination is made whether the species or its habitat are present within the proposed covered activity's action area and the type and extent of effects are identified, the relevant AMMs will be implemented. Although surveys will not be required on all occasions within suitable habitat, we expect that surveys will be done frequently enough to identify many Indiana bat occurrences prior to project implementation.

Indiana Bats in Known or Presumed Occupied Hibernacula in Winter

The proposed action could adversely impact hibernacula and wintering bats by (1) disturbing or disrupting hibernating individuals with drifting smoke (i.e., inhalation risk) or loud noises (i.e., arousal form hibernation), (2) physically altering the hibernacula environment where blasting, drilling, or disposal of spoils cause physical changes in air or water flow, or blockages to entrances, and (3) contaminating water resources with herbicides or construction chemicals (e.g., gas, diesel, oil) entering the hibernaculum. Each of these potential impacts could result in injury, harassment, or death of Indiana bats or potentially cause a cave or mine to become temporarily or permanently unsuitable for hibernation.

We expect, however, that implementation of the applicable AMMs (4-12) will reduce the potential for these adverse impacts to occur, rendering all of those impacts insignificant or discountable. The AMMs will ensure that any potentially destructive or disturbing activities do not occur close enough to physically impact hibernacula (activity distance buffers) or during the times when Indiana bat are hibernating (time-of-year restrictions), making any adverse impacts extremely unlikely to occur or reducing the impacts to a level that will not measurably impact Indiana bats.

Indiana Bats in Spring Staging/Fall Swarming Habitat

We expect that implementation of the AMMs (13-26) to significantly reduce the potential for adverse impacts to swarming/staging Indiana bats and their habitat by avoiding or reducing potential direct harm, harassment, or killing of individuals, destruction and alteration of swarming/staging habitat near hibernacula, and disturbance of bats in adjacent hibernacula. Specifically, the AMMs will render some of the impacts insignificant or discountable by restricting the location, timing, or level of potentially disturbing activities in swarming/staging habitat, ensuring that any potentially destructive or disturbing activities do not occur in or near potential habitat (activity distance buffers) or during the times when Indiana bat are present (time-of-year restrictions), making any adverse impacts extremely unlikely to occur or reducing the impacts to a level that will not measurably impact Indiana bats.

However, despite these AMMs, some limited impact to swarming/staging Indiana bats and their habitat remain likely at Priority 1-4 (P1, P2, P3, P4) hibernacula. Although NiSource has avoided any direct risk to Indiana bat spring staging/fall swarming populations of P1 and P2 (see AMMs

#13 and #24), there may be impacts to those populations. Individuals at P3 and P4 hibernacula may be directly and indirectly impacted. Specifically, we expect the following impacts to individuals:

- Indirect harm or harassment of individuals due to loss of roosts from tree clearing associated with various activities when habitat is unoccupied at P1-4 hibernacula.
- Death, harm, or harassment of Indiana bats near P3 and P4 hibernacula due to tree clearing associated with various activities during spring staging and fall swarming.
- Death or harm of individuals by entrapment in open waste pits near Priority 3 and 4 hibernacula.

During spring staging, cutting trees and the operation of waste pits associated with well construction, reconditioning, and abandonment while bats are emerging from hibernation and staging before migrating to summer habitats may increase the risk of affecting pregnant females. The death of a pregnant female would result in take of two Indiana bats (the adult female as well as her fetus); affecting both the size and reproductive potential of the maternity colony to which she will migrate, at least on a short-term basis.

Similarly, a reduction in the numbers of bats present to swarm, mate, and cluster within a source hibernacula (especially at a P3 or P4 hibernaculum) may place the remaining bats at a physiological disadvantage. When a female fails to return to her hibernaculum, the size of the hibernating population is reduced. These remaining bats may be more susceptible to changes in temperature, rapid arousal, and extreme stress during hibernation, thus causing a reduction in survival or reproduction (Clawson et al. 1980)[9]. This is magnified by the loss of her unrealized reproductive potential (i.e., lost progeny that will never be part of or contribute to that hibernating population, or any other hibernating population).

Indiana Bats in Summer Habitat

We expect AMMs (27-40) to significantly reduce potential impacts to Indiana bats during the summer. These AMMs focus on avoiding (1) direct take of bats at known maternity colonies, (2) take of bats at unknown maternity colonies, and (3) loss of suitable habitat for known and unknown colonies. Because the exact location of all of all maternity colonies within the covered lands is not known, these AMMs address the most potentially damaging impacts to the species.

We expect that implementation of the AMMs will significantly reduce the potential for these adverse impacts to summering Indiana bats and their habitat. Specifically, the AMMs will

[9] There are several advantages to being a member of a large hibernating population. Clawson et al. (1980) suggests that the "substantial metabolic advantages" of large clusters, and the bats' clustering behaviors, may buffer populations within individual hibernacula from extinction. Additionally large populations benefit from the social and energetic (thermoregulatory) advantages of hibernating in dense clusters; congregating for spring staging; and having many individuals available during fall swarming to ensure reproductive success.

render some of the impacts insignificant or discountable by restricting the location, timing, or level of potentially disturbing activities in swarming/staging habitat, ensuring that any potentially destructive or disturbing activities do not occur in or near potential habitat (activity distance buffers) or during the times when Indiana bat are present (time-of-year restrictions), making any adverse impacts extremely unlikely to occur or reducing the impacts to a level that will not measurably impact Indiana bats.

However, despite these AMMs, some limited adverse impacts to summering Indiana bats and their habitat remain likely. Specifically, we expect the following impacts to individuals:

- Death, harm, or harassment of Indiana bats in unknown maternity colonies due to tree clearing associated with various activities during the early and late summer season (April 15 – June 1; August 1 – October 15).
- Indirect harm or harassment of individuals due to loss of roosts from tree clearing associated with various activities when habitat is unoccupied.
- Death or harm of individuals in unknown maternity colonies by entrapment in open pits that are used to store wastes.

Impacts to Populations

As described above, individual Indiana bats may experience decreased reproductive success and survival as a result of NiSource's activities. Of importance here though, is how these potential adverse effects to individual bats affect the overall health and viability of a maternity colony or spring staging/fall swarming populations present within the covered lands. The covered lands of the NiSource MSHCP lie near the center of the Indiana bat's range and contains numerous caves and forestlands known to contain and provide summer maternity and spring staging/fall swarming habitat for the species.

The analysis that follows describes impact of the anticipated individual impacts on affected maternity colony and spring staging/fall swarming population levels.

Maternity Colony Populations within the Covered Lands

As previously stated, we anticipate impacts to Indiana bats in their summer maternity populations, both direct and indirect take (Table 7). Approximately 18 known maternity colonies are scattered throughout the covered lands, with notable clusters of maternity colonies occurring in Kentucky, New York, Ohio, and Pennsylvania. We further anticipate that there are other maternity colonies in the covered lands that are currently undocumented or unknown.

We expect the AMMs to significantly limit potential adverse impacts to maternity colonies, known and unknown, in the action area. Following the AMMs with time-of-year activity restrictions, we expect no direct impacts to known and unknown colonies when lactating females and non-volant pups are present. This means important avoidance of impacts to the

most sensitive individuals. in turn avoids major reductions in population numbers and reproductive rate in affected maternity colonies.

For known and unknown colonies, given the linear nature and small acreage affected by NiSource projects, we do not anticipate significant areas of habitat will be removed or otherwise lost (roosting, foraging areas, commuting corridors) in any given colony. This is particularly true for ROW maintenance, which encompasses the vast majority of NiSource's annual activities, and removes very little vegetation. Given this, we conclude that adequate habitat and roosts will remain to maintain long-term numbers, reproduction, and viability for any given maternity colony.

For known colonies, time-of-year restrictions further limit impacts of vegetation removal to the indirect impacts of projects occurring outside of the maternity season (i.e., known occupied habitat will not be cut when bats are present). In unknown colonies, however, it is possible that occupied roost trees could be cut down during the early and later portions of the maternity season. This type of event would certainly cause harassment and harm of every bat in the affected trees. However, we expect few bats to be killed by these types of events for the following reasons:

- As previously stated, due to the time-of-year restrictions on projects, we do not expect roosts to be cut when lactating females and immobile pups are present.
- Given NiSource commitments to survey for Indiana bats, along with the sporadic and patchy nature of colony occurrence on the landscape, we do not anticipate that NiSource will impact a significant number of undocumented colonies. Thus, we conclude that overall occurrence rate of this type of event should be low.
- In each event, while some of the affected bats would be killed (physical trauma from the falling tree, predation when fleeing the roost in the daytime), we also anticipate that others would survive by flying to other available roosts. Thus, we conclude that most bats in affected roosts will survive this type of event.
- As previously concluded for known colonies, given the linear nature and small acreage affected by NiSource projects, we do not anticipate multiple roosts to be lost in any unknown colony. We further expect that adequate roosts will remain (i.e., will not be cut) to maintain long-term colony numbers, reproduction, and viability.

Thus, we conclude that overall long-term health and viability of maternity colonies will not be negatively impacted by NiSource activities.

<u>Spring Staging/Fall Swarming Populations around known and Presumed hibernacula within the Covered Lands</u>

We are aware of approximately 86 hibernacula (Priority 1-4) identified in the draft, revised Indiana bat recovery plan that are within ten miles of the covered lands. Ten are identified as Priority 1 or 2 hibernacula, while the remaining 76 are Priority 3 or 4 hibernacula. Of these, at least five are located within the covered lands themselves (four in NiSource identified storage

field counties and one in the ROW covered lands corridor). Many of these hibernacula occur within areas of existing conservation ownerships, both private and public. Of particular note are the Daniel Boone (Kentucky), Wayne (Ohio), and Monongahela (West Virginia) National Forests managed by the U.S. Forest Service, Carter Cave State Resort Park and Kingdom Come State Park managed by the Kentucky Department of Parks.

As previously stated, we anticipate impacts to individual Indiana bats at some Spring Staging/Fall Swarming populations, both direct and indirect (Table 7), from tree clearing activities and the operation of waste pits associated with well construction, reconditioning, and abandonment. These impacts are primarily expected at P3 and P4 hibernacula, with more limited impacts at P1 and P2 hibernacula. However, we expect few bats to be killed by these types of events for the following reasons:

- Given NiSource commitments to survey for Indiana bats, along with the sporadic and patchy nature of hibernacula on the landscape, we do not anticipate that NiSource will impact a significant number of swarming/staging populations. Thus, we conclude that overall occurrence rate of this type of event should be low.
- If an occupied roost tree is cut at a P3 or P4 hibernaculum, while some of the affected bats would be killed (physical trauma from the falling tree, predation when fleeing the roost in the daytime), we also anticipate that others would survive by flying to other available roosts. Thus, we conclude that most bats in affected roosts will survive this type of event.
- As previously concluded for maternity colonies, given the linear nature and small acreage affected by NiSource projects, we do not anticipate many roosts to be lost in these areas and we further expect that adequate roosts will remain (i.e., will not be cut) to maintain long-term numbers, reproduction, and viability of the swarming populations.

Thus, we conclude that overall long-term health and viability of swarming/staging populations will not be negatively impacted by NiSource activities.

<u>Impacts of Mitigation</u>

The MSHCP outlines NiSource mitigation commitments for the Indiana bat (MSHCP, Chapter 6, Indiana bat section). The mitigation package includes (1) protection (fee title or easement) of maternity colony habitat as mitigation for linear impacts to 14 maternity colonies, (2) protection (fee title or easement) of maternity colony habitat as mitigation for storage field impacts to 6 maternity colonies, and (3) protection of P1 and/or P2 Hibernacula and associated habitat to compensate for all impacts to spring staging and fall swarming habitat. Other potential mitigation that would address impacts from WNS and potential hibernacula restoration that would be done when options are identified that would clearly compensate for NiSource's take.

We conclude that these mitigation options will serve to compensate any impacted Indiana bat populations, maternity or hibernacula colonies, that may be affected by NiSource activities.

The mitigation will serve to further reduce pressures and impacts on these populations by alleviating threats (e.g., habitat destruction, disturbance during hibernation) and improving habitat (e.g., replacement of wooded commuting corridors).

Summary of Impacts to Populations

Within summer maternity habitat, the risk may be slightly less in April and early May, when the bats are migrating between their hibernacula and summer habitat. However, Indiana bats have been documented to arrive in maternity areas as early as early April (Armstrong 2010). Regardless, by mid-May they are usually established in their summer habitat. Cutting trees and operating waste pits associated with well construction, reconditioning, and abandonment in late April and May will increase the risk of affecting pregnant females. Injury to a pregnant female may result in injury to, or death through spontaneous abortion of her fetus, also resulting in a reduction of the colony's reproductive potential through loss of intra-season recruitment of her pup into the colony. Data regarding the year-to-year recruitment of female Indiana bats into a maternity colony is lacking at the current time. NiSource has avoided any risk to lactating females and immobile pups during the nursing period of June 1st to August 1st by agreeing to not remove suitable summer habitat or operating waste pits associated with well construction, reconditioning, and abandonment during this time (see AMMs #29 and #38). Cutting trees and the operation of waste pits associated with well construction, reconditioning, and abandonment in early to mid-August may increase the risk of affecting post-lactating females and newly volant juvenile bats, affecting both the size and reproductive potential of the colony in future years.

As explained in the individual level analysis, the risk of tree cutting and the operation of waste pits associated with well construction, reconditioning, and abandonment to bats varies depending upon the timing of the clearing activities within the occupied habitat. The use of these habitats by bats varies by season. For the purposes of completing the effects analysis, it is assumed Indiana bats could be in spring staging habitat from April 1st to May 31st, suitable summer habitat from April 1st to August 15th and fall swarming habitat from August 15th to November 14th. There is some overlap in these time periods due to the variability in when Indiana bats leave and arrive in their summer maternity and spring staging and fall swarming habitats as a result of significant climate differences from the northern and southern portions of this wide-ranging species.

Potential for mortality does exist within known spring staging/fall swarming habitat of P3 and P4 hibernacula, suitable summer habitat from tree clearing activities, and the operation of waste pits associated with well construction, reconditioning, and abandonment, the frequency in which it is expected to occur is low due to the small scale of the impact.

Because the scale of impacts to a summer maternity colony or spring staging/fall swarming population expected from the project activities is small, adverse effects at the population level from reduced colony cohesion, increased stress, or increased energy demands from searching for new roost areas are not expected. Similarly, decreased thermoregulatory efficiency is not

expected or that these impacts will lead to reduced reproductive success at the population level. As summarized above, NiSource and the USFWS expect that minor, short term effects at the population level are possible because of the removal of roost trees, and the operation of waste pits.

Therefore, we do not expect the adverse effects to individual bats will affect the overall health and viability of a maternity colony or spring staging/fall swarming populations present within the covered lands. Because we do not anticipate population-level impacts, our analysis of effects to the Indiana bat is complete.

4.1.2 Bog Turtle

This section evaluates the effects of the proposed action on the bog turtle see Table 2, Appendix C identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

The MSHCP prescribes a number of AMMs that NiSource will implement to avoid and minimize impacts on the bog turtle. Implementation of these AMMs as proposed in the MSHCP is essential to this effects analysis and determinations made within. Specifically, these AMMs[10] reduce impacts to bog turtle by (1) identifying areas where the species is known (e.g., via surveys) or presumed to be present (AMM 1) and (2) identifying specific actions that will minimize the potential for direct take, particularly death and injury, of bog turtles (AMMs 2-26). It is important to note that the AMMs in standard font are required where they are applicable, whereas the AMMs in *italic* font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

<u>Surveys to Evaluate the Presence of Bog Turtle and/or Suitable Habitat</u>

1. NiSource will assume all wetlands are suitable for bog turtles or use Phase 1 Bog Turtle Habitat survey protocols for all previously unsurveyed wetlands (within 300 feet of NiSource activities) within bog turtle counties. If suitable habitat is present, NiSource will assume presence of bog turtles or use Phase 2 (and possibly Phase 3) Bog Turtle surveys to look for individuals.

<u>Measures to Avoid and Minimize Impacts to Bog Turtles in Known or Presumed Occupied Habitat</u>

[10] This section provides an overview and summary the MSHCP AMMs for bog turtle. For a complete list of bog turtle AMMs, please see the MSHCP, Chapter 6, bog turtle section.

Where NiSource is operating in known or presumed occupied bog turtle habitat, NiSource has agreed to conduct multiple AMMs (Chapter 6, page 68-73). Many of these reduce the likelihood of impacting bog turtles to the point where effects from a variety of subactivities are considered insignificant or discountable. Others greatly reduce the extent of anticipated effects.

2-3: NiSource has committed to conducting earth disturbing subactivities during specific windows of time, conducting pre-construction turtle surveys, and installing silt fencing to isolate work areas to minimize injuring or killing individual turtles.

4-10: NiSource has committed to a variety of AMMs to minimize direct effects to bog turtles during vegetation management subactivities on existing ROWs. For example, mowing shall be conducted between October 1 and April 15 to avoid impacts to eggs and minimize impacts to hatchlings. Herbicides shall be applied in the same manner as current USFWS guidelines for use at bog turtle restoration projects. Brush piles will not be burned along a right-of-way within 300 feet of bog turtle sites. Finally, there are specific AMMs to address walking and moving vegetation in bog turtle sites to reduce the likelihood of crushing turtles or disturbing their habitat.

11-24: NiSource has committed to a variety of AMMs to minimize direct and indirect effects to bog turtles during new construction or replacement subactivities. For example, there are measures to virtually avoid all impacts from hydrostatic testing. Work in uplands and streams adjacent to bog turtle sites will be designed to avoid impacts to bog turtle wetlands. AMMs are included to reduce the likelihood of chemical spills. While these AMMs cannot completely avoid adverse effects to bog turtles from construction or replacement subactivities (any ground disturbing activities within bog turtle sites are likely to cause adverse effects), they serve to minimize effects from the overall subactivities the greatest extent possible.

25-26: NiSource has developed routing criteria for pipeline replacement and new construction projects that will significantly reduce the likelihood of impacts to bog turtles and their habitat through routing outside of bog turtle wetlands, horizontal directional drilling, or avoiding mucky areas of the wetlands (unless an existing line cannot be rerouted). While NiSource pipelines already cross 13 bog turtle sites across the covered lands, these AMMs are essential to reducing the number of additional bog turtle sites that may be impacted over time and will serve to reduce the most significant source of direct and indirect effects at known bog turtle sites.

Individual Level Analysis

Subactivities Having No Effect on the Species

A few of the proposed subactivities will have no effect on the bog turtle (see Table C2, Appendix C; NE subactivities). For example, there are no storage wells near bog turtle habitat so all subactivities associated with storage wells will have no effect on the species. Tree side

trimming by bucket truck or helicopter will also result in no effects to bog turtles (impacts from vehicle use such as crushing were considered separately). Finally, there is no evidence to suggest that noise or lighting from compression facilities or communication towers will have any effect on bog turtles.

Subactivities Not Likely to Adversely Affect the Species

There are several subactivities that may affect, but are not likely to adversely affect the bog turtle (see Table C2, Appendix C; NLAA subactivities).

Tree clearing could result in the removal of tree roots that serve as wintering hibernacula. Bog turtles generally use springs or more densely vegetated areas (e.g., tree root systems, hummocks) for hibernation and they can hibernate as close as a few inches from the surface. Hibernation sites must be "mucky" to allow burrowing and must not freeze. Existing maintained NiSource ROW generally does not provide suitable hibernating sites for bog turtles because it has previously been disturbed and likely compacted during pipe installation and/or routine O&M activities. However, there is at least one known existing hibernation sites within the ROW in Pennsylvania. NiSource has developed several vegetation management AMMs (see above) to reduce the likelihood of this occurring (discountable).

Walking and driving through mucky areas or tree clearing with chainsaws could result in the crushing of turtles. However, NiSource has agreed to avoid driving through mucky areas and to not step on hummocks and tussocks when conducting vegetation management. NiSource also agreed not to drag any vegetation through known or presumed bog turtle sites if soil conditions are saturated.

Disposal of vegetation could result in trampling of vegetation, fill of wetland habitat, crushing of individuals, burning of individuals, or alteration of habitat through burning but NiSource has developed several vegetation management AMMs (see above) and will follow their ECS to reduce the likelihood of this occurring (discountable).

Right-of-way repair subactivities could result in trampling of habitat or crushing of individuals; however, we treat all of the effects associated with vehicle-use on ROWs separately. The additional effects considered for these subactivities included alteration of habitat through spread of invasive species and use of fertilizers. Spread of exotic invasive vegetation, including common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*), and reed canary grass (*Phalaris arundinacea*), also degrades bog turtle habitat in many locations. Soil disturbance and roads often provide avenues for the introduction or spread of invasive native and exotic plants. NiSource has agreed to AMMs to ensure that indigenous, non-invasive species are planted.

Hydrostatic testing could impact bog turtles by changing water levels in wetlands through water withdrawal or discharge. If the testing was done on an existing line, chemical contaminants could be released into bog turtle sites. Bog turtles could be temporarily disturbed during the work at bog turtle sites. NiSource has agreed not to withdraw or discharge hydrostatic testing

water from or into known or presumed bog turtle sites and has several options for discharge to minimize the likelihood of any measurable change in water levels or contaminants at a bog turtle site.

All exclusively upland activities, access road maintenance (e.g., culvert replacements), and pipeline stream crossings may result in altered hydrology (temporary or permanent) of adjacent wetlands. NiSource has agreed to monitor these activities (through adaptive management) to ensure that these subactivities result in no perceivable changes to bog turtle sites.

We expect that some of NiSource vegetation management will benefit the bog turtle. Bog turtles inhabit sub-climax seral wetland stages and are dependent on riparian systems that are unfragmented and sufficiently dynamic to allow the natural creation of meadows and open habitat to compensate for the closing over of habitats caused by ecological succession. Succession of many wetlands from open-canopy fens to closed-canopy red maple (*Acer rubrum*) swamps contributes to the loss of bog turtle habitat. Invasive plant species such as reed canary grass (*Phalaris arundinacea*) and phragmites (*Phragmites australis*) also replace suitable nesting habitat (USFWS 2001). ROWs (with little to no canopy cover and low-growing vegetation) may provide some of the best remaining nesting, basking, or foraging habitat within an occupied wetland that is no longer grazed or managed in any other way. Therefore, the USFWS recognizes the benefits of maintaining suitable bog turtle habitat through activities like mowing and woody vegetation removal (USFWS 2012).

<u>Subactivities Likely to Adversely Affect the Species</u>

There are a total of thirteen subactivities primarily within New Construction that are expected to adversely impact the bog turtle (see Table C2, Appendix C; LAA subactivities). The type and magnitude of these impacts are discussed below.

Take of bog turtles from NiSource activities would occur primarily from impacts associated with the replacement or installation of pipe across occupied habitat. Individuals may experience direct impacts that range from minor nuisance (e.g., short-term nearby noise) to death (e.g., crushing bog turtles). While implementation of AMMs should significantly reduce the likelihood of lethal take occurring, it is still possible at low levels. In addition, harm to bog turtles is anticipated in the form of temporary reduced reproductive success due to alteration of nesting, basking, and/or foraging habitat.

Bog turtles may nest, bask or forage in existing or future ROWs or cross ROWs if within or adjacent to known or presumed occupied bog turtle wetland. Therefore, we do not expect that fragmentation from construction of pipelines to be a barrier to bog turtle movement. We expect, however, that the clearing of occupied habitat will displace all bog turtles within the work area at least temporarily. These displaced turtles are expected to move into the remaining suitable habitat present within the wetland.

Some forms of operations and maintenance also may result in impacts to bog turtles. For example, any vehicle use within wetlands (e.g., mowers, trucks) may crush turtles. NiSource has agreed to conduct mowing between October 1 and April 15 in known or presumed bog turtle habitat when bog turtles are usually hibernating. In addition, NiSource has agreed to avoid driving through "mucky" areas of wetlands during vegetation management; therefore, impacts to hibernating bog turtles are not expected. However, there is the potential for infrequent bog turtle activity in an area where mowing is necessary and this would result in the injury or death of these turtles.

Use of herbicides during vegetation management also has the potential to harass or harm bog turtles if unknown nesting or hibernacula are treated. Finally, minor spills (e.g., fuel spills from small containers, hydraulic hose leaks or breaks, or other leaks from equipment) could result in contaminant exposure to bog turtles. We agree with the assessment in the MSHCP that the likelihood of a minor spill event occurring within a bog turtle site appears low but given the number of times vehicles travel along the ROWs, not discountable.

Impacts to Populations

There are 13 known bog turtle sites within the existing ROWs. Based on modeling described in the MSHCP and discussions with USFWS and State bog turtle experts, an additional 7 bog turtle sites are anticipated to occur within the ROWs for a total of 20 bog turtle sites. Multiple Phase 1 and Phase 2 bog turtle surveys have been conducted on NiSource ROWs and additional within-ROW sites are not anticipated in New York or Delaware. NiSource anticipates that bog turtles at all 20 sites may be impacted during the life of the permit.

Outside of the existing ROWs, there are an additional 16 known bog turtle sites within the covered lands and an estimated 128 bog turtle sites in total. NiSource has agreed to conduct surveys (see AMM discussion above) or assume bog turtle presence at sites with suitable habitat. In addition, NiSource has agreed to route replacements and new construction projects to avoid bog turtle sites to the greatest extent practicable. Further, NiSource has agreed to impact no more than five bog turtle sites due to new construction.

In summary, NiSource may impact individual turtles over the life of the permit at a total of 25 sites. It is possible that some sites are part of the same functioning population; however, it is more likely that 25 separate populations will be impacted given the spacing of currently known occurrences across the existing ROW.

The number of turtles impacted at each site will vary. The USFWS generally agrees with the calculation provided in the MSHCP and has slightly modified the estimates to reflect certain information provided in the USFWS's Biological Opinion on the Effects of Habitat Restoration Practices (USFWS 2012) given the similar nature of activity and anticipates effects in many cases. In general, these calculations are based on (1) the anticipated effect of the AMMs on project impacts, (2) past experience in evaluating similar types of project impacts, and (3) best professional judgment by bog turtle experts.

For looping (10 sites), conventional replacement (5 sites), and new construction (5 sites) projects, a small number of turtles (0-5 per site) may be missed during pre-construction surveys and wounded or killed. All turtles at the sites are expected to experience harassment/harm in the form of a temporary reduction in reproductive success due to disturbance during construction and habitat loss/degradation.

In addition, during O&M over the life of the project bog turtles at 25 sites may be impacted as follows:

- general vehicle use may result in 0-2 turtles wounded or killed per site;
- mowing may result in one turtle wounded or killed per round of vegetation management for every 20 sites mowed[11] (every seven years for a total of 9 bog turtles spread across 25 sites)
- herbicide use may result in one turtle harassed/harmed (non-lethal) per round of vegetation management (every seven years for a total of 7 turtles/site);
- and all bog turtles at one site may be harassed or harmed (non-lethal) during a minor spill event.

For the 5 sites with no anticipated ground-disturbing work, a total of 0-3 bog turtles are anticipated to be wounded or killed and an additional 7 bog turtles harassed or harmed (non-lethal) over the life of the project.

For the 20 additional sites with ground-disturbing work anticipated, a total of 0-8 bog turtles may be wounded or killed over the life of the project and all turtles at the sites will experience a temporary reduction in reproductive success.

It is possible that a small bog turtle site could be extirpated due to ground-disturbing (e.g., pipeline construction or replacement) activities.

Impacts of Mitigation

We agree with the assessment of beneficial impacts associated with mitigation discussed in the MSHCP and the following is a summary of that discussion. There are two forms of mitigation for impacts to bog turtles included in the MSHCP. For impacts at an estimated 20 bog turtle sites (see below) associated with construction (ground disturbance) activities and all future non-ground-disturbing O&M at those sites, NiSource will either permanently protect and restore a bog turtle site to optimal habitat or protect an existing site with optimal bog turtle habitat. The mitigation projects are in line with Recovery Action 2.3.3, 6.4.1, and 7.2.

[11] The MSHCP concluded that one turtle would be taken for every 10 sites managed. Based on (1) on the limited area of mowing and (2) the AMMs to avoid mucky areas, we believe this number is actually one turtle taken for every 20 sites managed.

To mitigate for impacts to bog turtles associated with an additional 5 sites where only non-ground disturbing O&M activities are anticipated, NiSource will either protect and restore an off-site bog turtle wetland or conduct habitat restoration and long-term management (life of the permit) of the wetland impacted. Off-ROW habitat restoration will expand the amount of high quality nesting, basking, and foraging habitat which is expected to result in increased survival and reproductive success of the population. This will also serve to decrease the likely concentration of bog turtles within the ROW which will further reduce risk of future impacts to individual turtles from O&M.

Impacts to Recovery Units

Given that the NiSource project could result in population-level effects (e.g., loss of small populations), we must next consider whether the loss of a population is likely to impact the survival and recovery of the bog turtle rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

The primary strategy for the recovery of the northern population of the bog turtle is to stabilize the decline and restore its rangewide distribution through protection of extant populations by (1) focusing attention on certain key watersheds that contain multiple, viable occurrences of bog turtles imbedded in wetland systems that are relatively pristine and dynamic; (2) conducting searches for new populations; and (3) aggressively halting illegal collection and trade in this species (USFWS 2001). To facilitate recovery, the USFWS divided the species into five recovery units (RUs) (USFWS 2001). The covered lands cross three bog turtle recovery units: Hudson/Housatonic, Delaware, and Susquehanna/Potomac. The covered lands cross three bog turtle recovery units: Hudson/Housatonic, Delaware, and Susquehanna/Potomac. Only 0.5% of the lands in the Hudson/Housatonic Recovery Unit are crossed by the covered lands, while 2.8% and 4.9% of the Delaware Recovery Unit and Susquehanna/Potomac Recovery Unit, respectively, are crossed by the covered lands. Of the 13 known bog turtle sites crossed by the existing ROW, 2 are in Maryland within the Susquehanna/Potomac RU, 4 are in New Jersey in the Delaware RU and 7 are in Pennsylvania in the Susquehanna/Potomac and Delaware RUs. Mitigation projects can occur in any RU.

Recovery Criteria (abbreviated):

1. Long-term protection is secured for no fewer than 185 populations (PAS[12]) among the 5 recovery units.

[12] The term "Population Analysis Site" (or "PAS") refers to a wetland or group of wetlands supporting bog turtles, as defined by Klemens' 1993 Standardized Bog Turtle Site-quality Analysis (see Appendix C in the Bog Turtle Recovery Plan). Individual wetlands occupied by bog turtles are clustered or grouped into a PAS if they are part of the same wetland system/drainage basin and there are no major impediments to turtle movements between the wetlands.

2. Monitoring at 5-year intervals over a 25-year period shows that these 185 populations are stable or increasing.
3. Illicit collection and trade in this species have been eliminated or reduced to a minimal level.
4. Long-term habitat dynamics are sufficiently understood to manage and monitor threats to both habitats and turtles.

NiSource actions should have no effect on the illegal collection or trade of the bog turtle. However, NiSource can contribute to the conservation needs of the species through the additional survey efforts planned, the management of bog turtle sites along the existing ROW, and permanent protection and restoration of bog turtle sites as part of their mitigation package.

The USFWS (2001) established criteria for each recovery unit as follows: 10, 5, 40, 50, and 80 PAS must be protected in the Prairie/Peninsula, Outer Coastal Plain, Hudson/Housatonic, Susquehanna/Potomac, and Delaware RUs, respectively. In terms of raw numbers, as of 2008, there were 601 known northern population bog turtle occurrences[13]. Of these, 91 were considered as having good to excellent viability, 74 were considered fair, 43 were considered poor, and 393 had not had any viability assessment. Those 601 occurrences made up 390 extant PAS with 5, 6, 88, 98, and 193 distributed among the RUs above. Of these 5, 3, 14, 10, and 26 PAS were considered partially protected (USFWS 2008).

In addition to working towards permanent protection, threats must be addressed at each site. In an effort to address threats posed by habitat succession and invasive plant species, the USFWS and a variety of partners have engaged in habitat restoration activities. As of 2008, wetland restoration/management activities have taken place at 47, 19, and 47 sites in the Hudson/Housatonic RU, Susquehanna RU, and Delaware RU (USFWS 2008). Most restoration projects are short-term but NiSource mitigation projects include a long-term management plan.

NiSource is anticipated to impact 25 (or 4%) of known bog turtle sites rangewide. As discussed above, NiSource actions may adversely and beneficially affect bog turtles. The most significant adverse effects are associated with looping, replacement, and new alignment projects. However, NiSource has committed to avoid bog turtle habitat through routing and HDD whenever possible and will conduct pre-construction surveys to move bog turtles out of the way. Even with this commitment, we anticipate that some turtles will be killed and if this occurs at a wetland with a small, isolated population, this site may be extirpated. The vegetation management activities conducted on NiSource ROWs may also result in impacts to small numbers of turtles but is anticipated to be beneficial to the local populations overall. In addition, NiSource is anticipated to protect and restore 25 sites.

[13] The term "occurrence" refers to bog turtles associated with a specific location or site, typically a discrete wetland. One or more occurrences may make up a PAS.

The number of known populations in the RUs crossed by the NiSource project theoretically meets the conservation needs of the species (once sufficient populations are protected). When considering this, the potential loss of one known population of bog turtles would not measurably reduce our ability to continue to meet the conservation needs of the species. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the bog turtle.

4.1.3 Madison Cave Isopod

This section evaluates the effects of the proposed action on the Madison Cave isopod (MCI). Table C3 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

The MSHCP prescribes a number of AMMs that NiSource will implement to avoid and minimize impacts on the MCI (see MSHCP, chapter 6, MCI section). Implementation of these AMMs as proposed in the MSHCP is essential to this effects analysis and determinations made within. Specifically, these AMMs reduce impacts to MCI by (1) identifying areas where the species is known (e.g., via surveys) or presumed to be present (AMMs 1 and 2) and (2) identifying specific actions that will minimize the potential for impacts to MCIs (AMMs 3-18). It is important to note that the AMMs in standard font are required where they are applicable, whereas the AMMs in italic font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

<u>Surveys to Evaluate Karst Features (indicators of potential presence of MCI)</u>

AMM 1: NiSource funded field inspections and remote sensing for surface karst features within the range of MCI in 2009 (Denton, et. al. 2009). Findings suggest that no caves, or closed depressions, with open throats occur within the existing ROW. However, there are four locations with open throats that receive drainage from the existing ROW. In addition there are areas with vegetated closed depressions (sinkholes) that are internally drained and may be areas of potential future subsidence.

Within one calendar year prior to start of any earth disturbing activity, the area of the disturbance will be surveyed visually to document the presence of existing karst features, and to identify new karst features that may have developed after the completion of the 2009 survey. This information will be included in the annual compliance report.

Surveys to Evaluate the Presence of MCIs within Suitable Habitat

AMM 2: NiSource will assume MCI subsurface presence along the 76 miles of ROW and covered lands of mapped potential habitat. At this time, surveys for individuals are not recommended due to the limited information about the species, inadequacy of existing survey protocols, and the physical inability to survey for individuals in many cases.

Once survey protocols are available, NiSource will conduct surveys for MCIs in cases where suitable survey locations (survey points that are connected to NiSource areas of disturbance) are available and landowner permission is granted. If no suitable survey locations are available, NiSource will assume presence and follow the AMMs below. It is anticipated that the survey protocols will specify the number of years they will be considered valid. If no MCIs are found, then the findings of the survey will be documented for future NiSource activities and the annual compliance report, and no further MCI AMMs or mitigation are needed.

Where NiSource is operating in known or presumed occupied MCI habitat, the following AMMs will apply to their activities.

AMM 3, 9-13: NiSource has committed to a variety of AMMs to minimize effects to MCI associated with chemical contaminants.

AMM 4-5: NiSource has committed to AMMs to minimize sedimentation and crushing impacts from construction on MCIs and their habitat.

AMM 6: NiSource will conduct blasting in the MCI potential habitat zone to ensure that the structural integrity of the karst features will not be compromised. NiSource is employing an adaptive management strategy for this AMM.

AMM 7: NiSource will not use HDD within the MCI potential habitat zone.

AMM 8: If authorized by the landowner, NiSource will block (e.g., gate) access roads and ROWs leading to known or presumed occupied habitat from unauthorized access. This is a non-mandatory AMM that NiSource will follow whenever possible.

AMM 14: NiSource will ensure that all operators, employees, and contractors will be educated on the biology of the species, activities that may affect behavior, and ways to avoid and minimize these effects.

AMM 15-17: NiSource has committed to a variety of AMMs to minimize direct and indirect effects to MCI from hydrostatic testing.

AMM 18: NiSource has developed routing criteria for new construction projects that will significantly reduce the likelihood of impacts to MCI and their habitat through routing to avoid surface karst features.

Impacts to Individuals

Subactivities Having No Effect on the Species

A few of the proposed subactivities will have no effect on the MCI (see Table C3, Appendix C; NE subactivities). For example, there are no storage wells near MCI habitat so all subactivities associated with storage wells will have no effect on the species. Also, several activities that do not involve ground disturbance (e.g., mowing, brush pile burning, tree side trimming, pipe abandonment in place, pipe stringing) will result in no effects to MCI. Finally, there is no evidence to suggest that noise or lighting from compression facilities or communication towers will have any effect on MCI.

Subactivities Not Likely to Adversely Affect the Species

There are many subactivities that may affect, but are not likely to adversely affect the MCI (see Table C3, Appendix C; NLAA subactivities). Subactivities that could result in increased sedimentation or chemical contamination in streams or surface karst features include several vegetation management subactivities, ROW repair, access road maintenance, cathodic protection, vegetation clearing, stream crossings, and wetland crossings. NiSource has committed to AMMs to address the potential for these impacts. However, as discussed below, NiSource could not completely remove the risk of impacts from sedimentation or chemical contamination from all subactivities.

Hydrostatic testing could impact MCI by changing water levels in streams and karst features through water withdrawal or discharge. If the testing was done on an existing line, chemical contaminants could be released into MCI sites. MCI could be temporarily disturbed during the work near MCI sites. NiSource has agreed not to withdraw or discharge hydrostatic testing water from or into known or presumed MCI sites and has several options for discharge to minimize the likelihood of any measurable change in water levels or contaminants at a MCI site.

Subactivities Likely to Adversely Affect the Species

There are a total of six subactivities that are expected to adversely impact the MCI (see Table C3, Appendix C; LAA subactivities). They include pipeline abandonment (removal), grading, trenching, new construction of access roads, wetland crossings, and minor spill events. These subactivities may expose MCI to contaminants, crush or smother MCI, or result in habitat loss, degradation, and fragmentation due to collapsing or filling in subsurface features and/or altering subsurface water quality and/or quantity. The changes in habitat would render them temporarily to permanently unsuitable for future use by the MCI and may prevent movements among or between populations. Any MCI present in the zones of impact would likely be killed by crushing, smothering or poisoning.

We agree with the assessment of adverse impacts discussed in the MSHCP and the following is a summary of that discussion.

Contaminants

Minor spills include fuel, fertilizer, or herbicide spills from small containers, hydraulic hose leaks or breaks, or other leaks from equipment and could result in contaminant exposure to MCI. Impacts to the MCI from a spill would depend on the location of the spill, quantity, concentration, and material spilled, water levels and flow at the time of the spill as well as the hydrological connections to any MCI habitat. Extrapolating from the environmental tracers and dye studies conducted at wells in the region, the USFWS anticipates that chemicals released into surface or subsurface karst features during minor spill events may reach known and potential occurrences up to 1/2 mile of the spill with relatively little dilution. The hydrodynamics in karst aquifers and the folded and faulted nature of these karst systems may allow contaminants to pool behind obstructions when the water levels are low. This may mean that the contaminant may become concentrated further from the site of entry. It may also create a slug of contaminants once the water level is high enough to overflow the obstruction. Non-volatile contaminants, contaminants that do not readily bind with the subsurface sediment, contaminants with a lighter density than the phreatic waters, and contaminants that are more water soluble have the characteristics that could increase flow distance and movements (Vesper et al. 2003).

When small volumes of contaminants reach the aquifer, dilution is expected to occur, reducing the concentrations of contaminants relatively quickly depending on the volume and movement/mixing of connected waters. Once a contaminant has entered the aquifer, it is likely that it will disperse throughout connected aquifers over extended time periods, though in low concentrations. The concentrations of contaminants that result from small spills are expected to be diluted to levels with low toxicity to invertebrates at distances over ½ mile from the source.

There have been no studies on the effects of any chemicals on lethal or sublethal responses from MCI. However, a review of indirect effects of contaminants in aquatic ecosystems (Fleeger, et al. 2003) summarized that direct (lethal or sublethal) effects on aquatic biota are possible and depends on the intensity and duration of exposure to a toxicant, as well as the species tolerance to the substance. In addition, indirect or secondary effects of contaminants may alter competitive interactions and/or alter populations of predators or prey of MCI. The review included papers regarding impacts on benthic freshwater isopods from insecticides, but otherwise did not specifically address any type of contaminants impacts on this group. The MCI Recovery Plan (USFWS 1996) suggests that MCI are highly vulnerable to disturbance and includes pollution as a threat. Research on MCI sensitivities will help address this issue but until any is completed, the analysis will err on the side of the species and expect that all exposed MCI will have either lethal or sublethal (e.g., reduced reproduction) responses. NiSource has developed measures to reduce the potential of exposure of MCI to contaminants (e.g., fertilizers and herbicides). However, the risk cannot be reduced to the point where no minor spills are anticipated. Major spills (those greater than EPA reporting limits) are not addressed in

the MSHCP but will be through emergency section 7 consultation procedures with the FERC and the USFWS.

Habitat Loss, Degradation, and Fragmentation

Subsurface lakes and aquifers supporting MCI may be impacted during O&M activities, as well as by new construction. The NiSource O&M activities involve ground disturbance (e.g., replacement or removal of pipe) in wetlands that may have hydrologic connections to MCI habitats. In addition, disturbances in uplands may result in filling or caving in of sink holes or other karst features or increased sedimentation that may end up in these karst features. Primary impacts from ground-disturbing O&M and new construction activities are the initial vegetation removal and grading. Trenching, blasting, and drilling may also result in impacts.

Vegetation removal is the clearing of the trees and shrubs and does not involve significant earth disturbance. As discussed above, impacts to MCI from clearing are not expected. Grading removes all of the remaining low-growing vegetation and microtopography of the site, if there is a subsurface void and the site work digs down deep enough, it might cause the ground above the void to collapse and create a sinkhole. In addition, the topsoil and vegetation may be placed in adjacent surface karst features. Finally, surface soil disturbances may result in increased temporary erosion and sediments that may end up in karst features. This could result in smothering of individuals and degradation of habitat.

Trenching has the potential to cause subsidence in adjacent sinkholes or cut through karst features resulting in soil and vegetation falling into these features. This could range from minor sedimentation to complete filling of the features. Trenching is anticipated to result in impacts to individuals (smothering) and degradation of habitat. Crushing of individuals is not anticipated given that MCI primarily occur at depths far below NiSource activities (8-10 feet below the surface).

New access road construction has the same potential impacts as new ROW construction. Karst features will be flagged, or otherwise clearly marked, to minimize potential impacts during O&M activities. NiSource will also attempt to avoid routing new ROWs and access roads through or near any karst features in the mapped potential MCI range. However, it is possible to miss karst features that have no surface openings in the footprint of disturbance.

Alterations to local hydrologic systems also are a significant threat to MCI populations. MCI habitats are sustained by groundwater regimes that are sensitive to changes in subsurface water supplies. Patterns of subsurface water flow can be altered by infrastructure construction and other development projects.

In summary, individuals may experience impacts that causes take ranging from harassment to death (poisoning, smothering). Depending on a particular situation, individual MCIs may be able to move away from the source of the stressor (e.g., sediment pulse), which would result in only temporary impacts to individuals.

Impacts to Populations

Known Occurrences

There are currently 16 documented occurrences of MCI. Four of these occur in Jefferson County, West Virginia (the county is not crossed by NiSource covered lands). Twelve of these occur in Virginia in counties that are crossed by NiSource covered lands (from south to north - one in Rockbridge County, three in Augusta County, four in Rockingham County, three in Warren County, and one in Clarke County). None of these are within the NiSource MSHCP covered lands.

Occurrences represent a sampling point where MCIs were captured. The geographic extent of populations is anticipated to be much larger than the individual sampling point.
The closest known occurrence to the covered lands is 0.5 mile from the edge of the covered lands and 1.0 mile from the existing ROW. The strongly folded and faulted nature of the sedimentary rocks in the Shenandoah Valley indicates limited physical connectivity of deep karst aquifers in different belts of carbonate rocks (Holsinger, et al. 1994). Holsinger, et al. (1994) further suggested that some of the most widely separate populations of MCIs, such as those in Augusta and Warren county sites, are completely physically isolated. Genetic work conducted by Fong and Hutchins (2006) supports these ideas and indicate that MCI exist as at least three distinct genetic units (northern, southern, and western) with Warren County sites in the northern unit and Augusta County sites in the southern. However, the northern unit is approximately 31 miles wide and suggests periodic movements of individuals on this scale. While these periodic movements occur, it is not anticipated that sediments will move widely throughout the folded/faulted system. Sites within 0.5 mile of NiSource activities might be impacted by contaminants or sedimentation. Only one sampling point is within 0.5 mile of the covered lands (Limekiln Cave).

Limekiln Cave near the City of Lexington in Rockbridge County, Virginia is the southernmost locality of MCI, where a single specimen was collected on August 14, 1999. Three attempts to collect further specimens from this locality were made in 2006 and all were unsuccessful (Orndorff and Hobson 2007). The collection site is a deep pool along a stream emanating from an upwelling area. The collection made in August 1999 may have been the result of stranding of animals in the Limekiln Cave stream after being flushed from the aquifer under unusual hydrological conditions (Orndorff and Hobson 2007). However, given the limited sampling to date, NiSource is assuming presence of the species at that site.

Potential Additional Occurrences

Without site specific-information, the USFWS assumes presence of the MCI within phreatic waters of karst limestone in the lower Great Valley of Virginia and West Virginia (865,415 acres of medium and high probability areas in MSHCP Figure 6.2.3.3-1). The covered lands cross approximately 76 miles of these mapped karst limestone features in Augusta, Clarke, Page,

Rockbridge, Rockingham, Shenandoah, and Warren counties, and the City of Waynesboro, Virginia.

Field inspections and remote sensing for surface karst features within the range of MCI were completed in 2009 (Denton, et. al. 2009). Findings suggest that no caves, or closed depressions with open throats, were discovered within the existing ROW. However, there are four complexes of karst features with a series of open throats that receive drainage from the existing ROW. In addition there are areas with vegetated closed depressions (sinkholes) that are internally drained and may be areas of potential future subsidence.

In addition to field inspections of the existing ROW, remote sensing of the covered lands was conducted to inventory potential areas for future field investigations. Closed depressions, caves, abandoned wells, and perennial springs were located.

NiSource will conduct field inspections for any surface karst features prior to off-ROW construction projects.

In summary, there are no known MCI sites within the existing ROWs or covered lands. One MCI site (Limekiln Cave) occurs within ½ mile of the covered lands and may be impacted by NiSource activities, however, it is unclear if MCI still occur at this site. Based on discussions with USFWS and State MCI experts, one additional MCI site is anticipated to occur within the covered lands for a total of two MCI sites that may be impacted during the life of the permit.

Limited information exists on the connectivity of MCI populations, preventing an understanding of how impacts at a given site may relate to broader populations. Sites that may be impacted could be rapidly recolonized if the site was part of a larger population, or they could be eliminated with little chance of subsequent recolonization.

Recent efforts to improve knowledge of the species' range have resulted in an improved understanding of its distribution. However, within the distribution, little is known about the abundance, density, and habitat connectivity and use. As a result, there are few data upon which to base estimates of potential impacts, and a relatively poor understanding of the natural variability in abundance, density, and occurrence.

Estimates of MCI abundance at sites in Jefferson County, West Virginia are summarized below (Orndorff and Hutchins 2007):

- Irving King well population estimate density = 95
- Madison Saltpetre Cave population estimate = 360 – 1,020
- Steger's Fissure population estimate = 2,240 - 3,420

It is unclear whether other occurrences may have similar population estimates.

We agree with NiSource's assessment and do not anticipate extirpation of any currently known populations, as only one currently known occurrence (Limekiln Cave) may be impacted at all. Further, populations likely have larger geographic extents than currently mapped and the amount of sedimentation/chemical exposure from NiSource is expected to be small for most projects. However, take of individuals from populations is anticipated. The unknown assumed population may occur in close proximity to the existing or future ROW and there is potential for extirpation to this unknown population.

Impacts of Mitigation

We agree with the assessment of beneficial impacts associated with mitigation discussed in the MSHCP and the following is a summary of that discussion (see MSHCP, Chapters 5 and 6, MCI sections).

To mitigate for impacts to MCI associated with the Limekiln Cave occurrence, NiSource shall protect and restore (if needed) a minimum of 25 acres immediately around the Limekiln Cave. If that is not possible, NiSource will follow mitigation requirements for unknown occurrences. To mitigate for impacts to MCI associated with one unknown occurrence, NiSource shall protect key parcels (minimum of 25 acres) in the drainage area immediately around a known MCI site. NiSource shall restore 300-foot buffers around each karst feature on the parcel. This will protect the surface karst features from future disturbance which is very important in areas with high development threats.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects (e.g., potential loss of one population), we must next consider whether the loss of a population is likely to impact the survival and recovery of the MCI rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy and criteria may describe those conservation needs.

The Recovery Strategy for the MCI involves extending and augmenting protection efforts. This includes the protection of known sites, searches for additional populations, and collection of baseline population and ecological data (USFWS 1996).

The Recovery Criteria (abbreviated) are:

1. Populations of MCI at Front Royal Caverns, Linville Quarry Cave No. 3, and Madison Saltpeter Cave/Steger's Fissure are shown to be stable over a 10-year monitoring period.
2. The recharge zone of the deep karst aquifer at each of the population sites identified in Criterion 1 is protected from all significant groundwater contamination sources.

3. Sufficient population sites are protected to maintain the genetic diversity of the species. Protection of newly discovered populations, if any, will be incorporated into this criterion insofar as they contribute to maintenance of overall genetic diversity.

NiSource actions may result in adverse impacts to one of the known populations of MCI. However, they are unlikely to result in adverse impacts to any of the populations listed under Criterion 1. NiSource can contribute to the conservation needs of the species through the protection of two known sites and searches for additional populations.

NiSource may impact one known occurrence of MCI rangewide. As discussed above, NiSource actions may adversely and beneficially affect MCI. The most significant adverse effects are associated with replacement and new construction projects. However, NiSource has committed to avoid MCI habitat through routing whenever possible. Even with this commitment, we anticipate that some MCI will be killed and if this occurs at a small, isolated population, this population may be extirpated. In addition, NiSource is anticipated to protect (and restore if needed) upland habitat for two occurrences.

The potential loss of one unknown population of MCI would not measurably reduce our ability to continue to meet the conservation needs of the species. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the MCI.

4.1.4 Nashville Crayfish

This section evaluates the effects of the proposed action on the Nashville crayfish. Table C4 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

In this section, we focus on the impacts to animals and then look at how these individual responses affect the populations to which these animals belong. We then assess how the anticipated changes, if any, at the population level would affect the fitness of the species rangewide. The AMMs that reduce exposure and responses are described in more detail in the Description of the Proposed Action section of the NiSource MSHCP.

The take calculation on which this analysis relies, represents a reasonable worst case scenario impact with all mandatory AMMs in place. Reasonable worst case scenario can be interpreted as: construction of all potential projects; robust populations of Nashville crayfish (using estimated density and occupied area) occurring directly in the path of each constructed project; and the highest reasonable level of impact from each project (e.g., maximum sediment release, maximum area of in-stream construction, and where options concerning stream-crossing methodology exist, implementation of the methodology with the highest potential for impacts).

Measures to Avoid and Minimize Impacts

The MSHCP prescribes a number of AMMs that NiSource will implement to avoid and minimize impacts on the Nashville crayfish. Implementation of these AMMs as proposed in the MSHCP is essential to this effects analysis and determinations made within. Specifically, these AMMs reduce impacts to Nashville crayfish by (1) identifying areas where the species is known and (2) identifying specific actions that will minimize the potential for direct take. It is important to note that the AMMs in standard font are required where they are applicable, whereas the AMMs in italic font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

<u>Pre-construction Surveys within Suitable Habitat to Remove and Relocate Individuals</u>

1. Stream crossing activities will occur between May 16 and September 30 to avoid the Nashville crayfish reproductive period. Within 24 hours prior to commencement of work: (1) the area to be trenched, the water diversion structure, and a 25-foot buffer on either end of the coffer dam location (potential work area) shall be surveyed (see Appendix L of the MSHCP) for Nashville crayfish by a qualified biologist; and (2) barriers to preclude re-entry of Nashville crayfish at the propose coffer dam location put into place. Any Nashville crayfish found during the survey must be removed upstream into suitable habitat (as per specifications below) prior to construction in the stream.

- Any crayfish collected will be removed and relocated by a qualified biologist approved under Federal and State permits to conduct such work.
- All crayfish collected shall be returned within one hour of collection to the stream into suitable habitat outside the area of potential impact and no less than 150 feet upstream from the project site. Suitable habitat generally requires conditions of depth, flow, substrate, channel morphology, and riparian vegetation analogous to that from which the individuals were removed.
- During construction, a biologist shall be available to, at a minimum, monitor Nashville crayfish movement into the construction area, move any Nashville crayfish threatened by construction activities, and to monitor in-stream construction activities for significant impacts from construction outside the limits of the cofferdams.
- Within 24 hours after the water diversion structures are constructed, but before excavation of the trench begins, another sweep will be made within the water diversion structures.

If an adequate survey effort (includes the initial sweep and an inspection of the dewatered area within the coffer dam) does not indicate the presence of crayfish, the stream crossing will be classified as unoccupied habitat and the AMMs would not be mandatory. However, NiSource may employ some of the AMMs to maintain the viability of the potentially suitable habitat.

Maintaining Suitable Habitat Characteristics

2. Utility line trenches shall be backfilled to within six inches of the original stream bottom with native material (stone or gravel). The remainder of the fill shall consist of slab rocks a minimum of 1.6 square feet.

Pre-Construction Planning: Preparation of an EM&CP

3. A detailed EM&CP will be prepared for any activity with potential effects (e.g., streambed or stream bank disturbance, impacts to riparian habitat, activities causing sediment) within 100 feet of the ordinary high water mark of occupied Nashville crayfish habitat. The plan will incorporate the relevant requirements of the NGTS ECS and include site-specific details particular to the project area and potential impact. The waterbody crossing will be considered "high-quality" for the purpose of preparing this plan regardless of the actual classification. One chapter of the plan will describe in detail how NiSource will strive to avoid the take of Nashville crayfish in occupied habitat. It will provide information on how NiSource will minimize streambed and riparian disturbance since Nashville crayfish are very sensitive to loss of shade from riparian vegetation (including minimization of tree clearing within 25 feet of the crossing [Figure 24, ECS]), preventing downstream sedimentation (including redundant erosion and sediment control devices which would be designed to protect crayfish resources as appropriate), and weather monitoring by the Environmental Inspector to ensure work is not begun with significant precipitation in the forecast. The EM&CP will include the frac-out avoidance and contingency plans described in AMM #4 below. The EM&CP will also include a sediment control component for uplands reasonably likely to drain to and impact occupied habitat and specify detailed erosion control plans for slopes greater than or equal to 30% leading directly to occupied habitat. In areas with less than a 30% slope, ECS and AMM erosion control measures protective of mussels will be implemented. The plan will be approved in writing by NiSource NRP personnel prior to project implementation and will include a tailgate training session for all on-site project personnel to highlight the environmental sensitivity of the habitat and any Nashville crayfish AMMs that must be implemented.

Streambed Construction

4. For activities in occupied habitat, consider installing new or replacement pipelines and major repairs under the river bottom using HDD or other trenchless methods rather than open trenching (Section 5.2.1.1; Appendix J of the MSHCP). Drilling should be carefully undertaken and a plan should be in place to minimize and address the risk of in-stream disturbance due to frac-outs. The plan should also specifically reference crayfish resources in the vicinity of the crossing as a key conservation concern and include specific measures identified in the NGTS ECS, from standard industry practices, or other mutually agreed-upon practices by NiSource and the USFWS to protect this resource. The plan will also include a frac-out impact avoidance plan that will evaluate the specific site in terms not only of feasibility of conducting HDD, but the likelihood of large scale frac-out and its effects on Nashville crayfish, and actions to address a large scale frac-out in occupied habitat. The plan should also consider the potential effects on

Nashville crayfish if drilling fluids are released into the environment. The plan must contain all information required for a FERC Section 7(c) filing at a minimum.

If, after detailed engineering studies (e.g., geotechnical, physiological, topographical, and economic), it is determined (and agreed to by NRP personnel) that an HDD or other trenchless method is not feasible, a report will be prepared and included in the annual report submitted to the USFWS.

5. Install pipeline to the minimum depth described in the ECS and maintain that depth at least 10 feet past the high water line to avoid exposure of pipeline by anticipated levels of erosion based on geology and watershed character. Additional distance may be required should on-site conditions (e.g., outside bend in the waterbody, highly erosive stream channel, anticipated future upstream development activities in the vicinity) dictate a reasonable expectation that the stream banks could erode and expose the pipeline facilities. Less distance may be utilized if terrain or geological conditions (long, steep bank or solid rock) will not allow for a 10-foot setback. These conditions and the response thereto will be documented in the EM&CP and provided as part of the annual report to the USFWS.

6. For repairs in occupied habitat, do not install in-channel repairs (bendway weirs, hardpoints, concrete mats, fill for channel relocation, or other channel disturbing measures) except when an HDD as described in AMM#4 above is not feasible from an engineering perspective, and then, only in conjunction with a stream restoration plan based on Rosgen (*see* Wildland Hydrology 2009 http://www.wildlandhydrology.com/html/references_.html) or other techniques mutually agreed upon by NiSource and the USFWS that result in no direct or lethal take of Nashville crayfish.

7. Use dry-ditch dam and pump methodology (do not use limestone or any fill for coffer-dam bags that could affect pH or otherwise affect the water quality of occupied habitat) for all new construction and repair unless HDD is determined through AMM #4 above to be feasible.

8. Remove equipment bridges as soon as practicable (this is typically interpreted to be a few days to a few weeks unless there are extenuating circumstances) after repair work and any site restoration is completed.

9. As part of the routine pipeline inspection patrols, visually inspect all stream crossings in occupied habitat at least yearly for early indications of erosion or bank destabilization associated with or affecting the pipeline crossing that is resulting, or would before the next inspection cycle, likely result in sediment impacts to Nashville crayfish habitat beyond what would be expected from background stream processes. If such bank destabilization is observed, it will be corrected in accordance with the ECS. Follow-up inspections and restabilization will continue until the bank is stabilized (generally two growing seasons).

Stream Bank Conservation

10. Do not construct culvert and stone access roads and appurtenances (including equipment crossings) across the waterbody or within the riparian zone. Temporary equipment crossings utilizing equipment pads or other methods that span the waterbody are acceptable provided that in-stream pipe supports are not needed.

Pipeline Abandonment

11. *Abandon pipelines in place to avoid in-stream disturbance that would result from pipeline removal unless the abandonment would be detrimental to endangered crayfish.*

Contaminants

12. As described in the ECS section on "Spill Prevention, Containment and Control," site staging areas for equipment, fuel, materials, and personnel at least 300 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted occupied habitat:

a. follow spill response plan; and
b. call the appropriate USFWS Field Office to report the release, in addition to the National Response Center (800-424-8802).

13. Ensure all imported fill material is free from contaminants (this would include washed rock or other materials that could significantly affect the pH of the stream) that could affect the species or habitat through acquisition of materials at an appropriate quarry or other such measures.

14. Do not use fertilizers or herbicides within 100 feet of known or presumed occupied habitat. Fertilizer and herbicides will not be applied if weather (e.g., impending storm) or other conditions (e.g., faulty equipment) would compromise the ability of NiSource or its contractors to apply the fertilizer or herbicide without impacting presumed occupied Nashville crayfish habitat. The EM&CP prepared for this activity (AMM #3 above) will document relevant EPA guidelines for application.

Withdrawal and Discharge of Water

15. *Reserved.*

16. Do not discharge hydrostatic test water directly into known or presumed occupied habitat. Discharge water in the following manner (in order of priority and preference):

a. Discharge water down gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
b. If those circumstances occur, discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
c. If those circumstances occur, discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices (Figures 6A&B, 7, 8, 14A&B; ECS) to minimize effects to the waterbody.

Travel for O&M Activities

17. Do not drive across streams – walk these areas or visually inspect from bank and use closest available bridge to cross stream.

Time-of-Year Restriction

18. Do not work in the stream channel of Nashville crayfish presumed or occupied habitat between 1 October and 15 May.

IMPACTS TO INDIVIDUALS

Activities Having No Effect or Not Likely to Adversely Affect Species

A number of the covered activities would have no detectable effects on the Nashville crayfish (see Table C4, Appendix C; NE and NLAA subactivities). In general, several O&M activities involving vegetation management and certain vegetation disposal activities, storage well-related activities (NiSource has no storage wells in Tennessee), and inspection activities are not expected to have an impact on the species because animals would not be exposed to their effects. Similarly, new construction activities involving certain vegetation disposal activities, pipe stringing, activities in wetlands, compression and communication facilities, and storage well activities (no new storage wells in Tennessee would be covered under this permit) are not expected to affect Nashville crayfish.

One O&M activity: management of vegetation with herbicides; and new construction activities related to: vegetation disposal, vegetation clearing, trenching, one aspect of hydrostatic testing, and some activities occurring in wetlands are all not likely to adversely affect (NLAA) the Nashville crayfish because the following AMMs have been developed to avoid potential effects entirely or minimize them to the point where impacts are unlikely to occur.

AMM 3 requires that a detailed plan be prepared for any activity with the potential to affect the Nashville crayfish or its habitat. The plan would focus the applicant's attention on the potential presence of Nashville crayfish, and outline measures employed to avoid impacts (e.g., sediment and erosion control, avoidance of impacts to the riparian zone, avoidance of contaminant impacts, and minimization of stream channel impacts). In addition, the plan

would require a training session for on-site personnel to highlight the sensitivity of the project area. AMM 3 is used independently and in conjunction with many of the other AMMs as a key component of NiSource's avoidance and minimization strategy for Nashville crayfish.

AMM 14, which establishes a 100 foot buffer between the species habitat and where herbicides can be applied, and proscribes application under certain weather conditions (e.g., impending storms); it is employed with AMM 3 to reduce potential contaminant related impacts to Nashville crayfish.

AMM 15 is related to hydrostatic testing. It prohibits withdrawal of water from occupied streams and therefore avoids impacts to individuals (entrainment) and impacts to habitat (reducing the water level).

AMM 17 is important in avoiding direct physical impacts to Nashville crayfish. It prohibits driving across occupied streams (except during construction of stream crossings) and would avoid crushing from inspection and related O&M activities.

Activities Likely to Adversely Affect Species

Effects on Nashville crayfish are grouped into two categories, O&M activities and new construction activities. A number of O&M covered activities including: presence of the pipeline, components of ROW vegetation management, ROW repair, access road maintenance, cathodic protection and pipeline abandonment and removal; and new construction activities including vegetation clearing, ROW grading and re-grading, hydrostatic testing, access road construction, and stream crossings are expected to adversely affect the Nashville crayfish (see Table C4, Appendix C; LAA subactivities). In many cases, however, AMMs would be implemented that would minimize those effects. In some cases O&M and new construction activities are similar (e.g., grading to install a new pipeline versus re-grading of an existing pipeline corridor after repair). Both can impact Nashville crayfish.

Operation and Maintenance

Facilities (Sediment Impacts of an Existing Pipeline Corridor)

The scope of the potential impacts from existing facilities is the pipeline corridor within the range of the Nashville crayfish. NiSource pipelines essentially bisect the Mill Creek Watershed. Using a 100 foot wide impact zone along the existing corridor as an average disturbed area, there are 225 acres that have the potential to deliver sediments to Nashville crayfish streams. In context, Mill Creek Watershed covers approximately 69,154 acres. The effects of an acute sediment event like the washout of a pipeline crossing, where the pipeline is exposed and the streambed and bank is washed away around and under it would likely have significant habitat impacts. Although localized, depending on the severity of the washout, such an event could impact hundreds of feet of a stream channel. The chronic effects of comparatively small influxes of sediment spread out over many years (aggregate impacts) are likely to be minor, but

greater in scope and potentially long-lasting. It is likely that some component of the existing population would be affected by aggregate sediment impacts as defined below.

Sediment could enter Nashville crayfish habitat from the presence of the pipeline corridor in at least three ways: 1) erosion within the stream channel around the pipeline; 2) the existence of 50-100 foot wide corridor (s) crossing the watershed which is maintained in non-native vegetation and periodically disturbed; and 3) the related absence of natural vegetation at the point where the pipeline crosses the stream (this latter could also impact shade and input of organic material, but should be minor given the small overall loss of riparian habitat from NiSource pipelines). Erosion around the pipeline (within the channel) and erosion at the point where the pipe crosses the channel (bank slough-off) are episodic and not easily predictable. Both have the potential to cause acute localized impacts. Sediments from the presence of one or more pipeline corridors within the watershed is a long-term impact (sediments and reduction of riparian corridor), but should be minor given the relatively small percentage of the watershed affected and because of implementation of AMMs to minimize the potential for erosion.

Much of the discussion under this topic (Facilities) also applies to the other NiSource activities that result in either minor, long-term (aggregate) sediment impacts or acute sediment events. The effects of sediments on crayfish are largely un-documented, but the primary known stressor on Nashville crayfish related to sediment is its impact on habitat. Withers (2009) states that "The primary threat to *O. shoupi* populations comes from siltation associated with poor land-use practices." Modification would typically involve the deposition of sediments in areas around and under rocks where crayfish shelter (USFWS 2009), however, Nashville crayfish are likely tolerant of moderate amounts of sediment in their habitat - they have been found in slab rock habitat and pools with up to 10 cm of deposited sediment (USFWS 1987). Crayfish are omnivorous and sediments can negatively impact the availability of their food source, in particular more conservative aquatic invertebrates (e.g., species of Trichoptera) and suitable plant food. Turbidity might also affect the availability of food for juvenile crayfish that primarily filter-feed on plankton in the water column.

Another stressor pathway is invasive or competing species. Nashville crayfish share habitat in Mill Creek with at least four other crayfish species. Walton (2007) sampling multiple sites in the watershed found 67% *Orconectes shoupi,* 30%, *O*. *durelli*, 2%, *O*. *rhoadesi*, and 1% *Cambarus graysoni*. It is unclear why Nashville crayfish are the dominant species, but ongoing degradation of their habitat from sediment impacts might provide opportunities for other crayfish species to compete more successfully in the Mill Creek Watershed, or provide suitable habitat for some other invasive species (Bizwell and Mattingly 2010).

Several AMMs (3,5,9, and 17), along with the BMPs NiSource routinely employs (e.g., sediment breakers in trenches, seeding, and other sediment control measures as described in detail in NiSource's EM&CP document) should greatly reduce the likelihood of an acute sediment event and significantly limit the chronic sediment impacts of the presence of the pipeline in the watershed. AMMs 3 and 17 are discussed above.

AMM 5 requires that pipelines be buried sufficiently under the bottom of the stream channel (minimum of 48 inches or 24 inches in consolidated rock) and for a sufficient distance landward of the bank (at least 10 feet past high water line) to minimize the chances of the pipeline being exposed and thereby adding additional sediment to the stream.

AMM 9 requires annual inspections of existing pipeline crossing sites to identify potential erosion problems early and make repairs before erosion significantly affecting Nashville crayfish can occur.

Vegetation Management

Tree clearing activities affect the Nashville crayfish through impacts to the riparian corridor (shading of the stream) and through increased sedimentation resulting from elimination of natural vegetation. Vegetation management primarily involves the maintenance of the existing pipeline corridor, which focuses on herbaceous vegetation management (mowing) and brush management (brush hogging or selective herbicide application). In some instances, primarily in situations where the ROW has not been adequately maintained, some maintenance tree clearing including clearing using bulldozers or other heavy equipment may occur. The scope of this activity would likely be limited within the Nashville crayfish range, and impacts are expected to be limited to the first few years of the ITP as NiSource addresses these un-maintained areas.

Where these impacts occur in the riparian corridor, the stressor pathways include reduction of shade, which is particularly stressful in the summer, and potentially the absence of flow or the drying of pools (which provide refugia) in occupied, small tributary streams. Another stressor pathway, where a forested riparian corridor is absent from longer stream reaches, is a reduction in detritus inputs that affect the availability of cover and food. The stressors and impact of sediments from vegetation management are virtually identical and may overlap to some extent with those described above under the heading Facilities. Delivery would be similar in that areas denuded of natural vegetation (or managed vegetation) would lose sediment to streams primarily during rain events.

AMM 3 and other NiSource BMPs further minimize the impacts from tree clearing within the geographically limited parts of the Mill Creek Watershed where they are likely to occur. We would expect the impacts from O&M tree clearing to be minor, since most management within this watershed entails mowing and other activities with little or no significant impact to Nashville crayfish.

Upland ROW Regrading/Repair and Re-Vegetation

Re-grading/Repair of the ROW can cause impacts by denuding portions of the ROW for short periods of time. The scope of this activity is the entire pipeline corridor, but similar to vegetation management, only small sections of the ROW would be affected at any one time,

and the total area impacted over the life of the permit would likely be a fraction of the total corridor.

Sediment delivery and stressors would be essentially the same chronic (aggregate) sediment impacts described under Facilities. We would expect the impacts to be minor commensurate with the small amount of area expected to be disturbed. Across the entire watershed, over the life of the permit, this activity would contribute a small amount of sediment to Nashville crayfish habitat. The impacts could be somewhat greater from repairs made near occupied stream reaches.

AMMs 3 and 14 (both previously described) are used to limit impacts from this activity.
As above, AMM 3 would be used to provide awareness of Nashville crayfish in the watershed and help ensure the species is considered in the re-grading plan and that all relevant BMPs are implemented toward Nashville crayfish protection. AMM 14 would ensure an adequate buffer if herbicide were used in vegetation re-establishment.

Instream ROW Stabilization or Fill

This activity involves manipulation of the stream channel and stream bank often in response to erosion around or near a pipeline crossing. Bank re-contouring or reconstruction and the placement of hard points and reticulated mats in the channel are examples of possible stabilization actions. In-stream stabilization and fill projects, if conducted in Nashville crayfish habitat at all, would be extremely limited in number and scope. These actions are primarily in response to specific problems that NiSource would try to preclude (see AMM 9) or solve by other less-invasive methods. Impacts, should they occur, would likewise be limited to a few sites within the watershed.

Significant impacts to Nashville crayfish resulting in both direct and indirect take could occur if multiple AMMs were not in place. The impacts could include crushing or burying Nashville crayfish, alteration of flow through change in bank alignment or in-stream obstructions, contaminants, and sediment. The pathway for these impacts would be through various equipment operating along the bank and in the stream channel, spills of fuel or other contaminants from construction equipment, contaminants imported with fill material, and scarring or denuding of stream banks that results in erosion and sediment deposition (impacting food availability, cover, and breeding success) near the site of the stabilization project.

NiSource would implement AMMs 3, 6, 8, 9, 12, 13, and 18. These AMMs should be effective in minimizing impacts. AMM 6 requires no direct take of Nashville crayfish from Instream ROW Stabilization or Fill. Minor sediment impacts are likely, which would result in aggregate impacts to Nashville crayfish. AMMs 3 and 9 are described above.

AMM 6 requires that in-stream impacts (e.g., weirs, concrete mats, fill for channel relocation) would not occur in most cases, and when implemented could not result in direct or lethal take of Nashville crayfish.

AMM 8 requires that equipment bridges used for repair be removed as soon as practicable after work is completed.

AMM 12 requires staging areas be a minimum of 300 feet from Nashville crayfish streams to avoid contaminant impacts unless additional control measures are implemented (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials).

AMM 13 requires that any fill material imported for repairs is free of contaminants that could affect the species or its habitat.

AMM 18 precludes any in-channel work between 1 October and 15 May to avoid impacts during the reproductive period.

Access Road Maintenance (grading, graveling, culvert replacement)

Access road maintenance typically involves re-grading the roads, occasionally adding gravel, and replacing culverts as necessary. Individually, impacts would be minor, since culvert replacement in occupied habitat is addressed as part of stream crossing, but the scope of this category of impact could be geographically large occurring virtually anywhere in the Mill Creek Watershed (note this activity is not confined to the pipeline corridor ROW). There would likely, however, be a small number of these actions, including culvert replacements in any year.

The primary pathway for impacts from this activity is through culvert replacement, which would nearly always involve soil disturbance in a drainageway, and thus the potential release of sediment into an occupied stream reach. For the most part, sediment stressors and impacts would be similar to those described as chronic (aggregate take) under the Facilities heading. Culvert replacement, especially if near an occupied stream, could also result in acute sediment impacts as previously described.

AMMs 3 and 14 (both previously described) would be employed to minimize chronic impacts and avoid and minimize acute impacts from these activities.

Cathodic Protection

Cathodic protection involves constructing a small trench (typically a few inches wide and up to a few hundred meters long) to install a charged wire to inhibit pipeline rust and deterioration. This practice is ubiquitous along the NiSource system and therefore is likely to occur throughout the NiSource covered lands within Nashville crayfish habitat over the life of the permit.

Although widespread, the minimization measures and the minor nature of the ground disturbance would result in only aggregate level sediment impacts to Nashville crayfish habitat. The pathway is increased sediment to Nashville crayfish streams because of ground disturbance outside of the construction corridor (cathodic protection trenches are often perpendicular to the pipeline). The stressors and impacts are similar to those already discussed.

NiSource would employ AMM 3 and other BMPs to minimize impacts from cathodic protection.

Pipeline Abandonment and Removal

Pipeline abandonment and removal is the only O&M activity identified as potentially causing direct lethal impacts to Nashville crayfish. The scope of this activity is the entire covered lands within the range of the Nashville crayfish because damage or degradation could occur anywhere and might require the removal of a section of pipe. It would be rare, however, and may not be necessary at all to abandon and remove a pipeline from a Nashville crayfish occupied stream during the life of the permit. Abandonment itself is not common and the applicant's preference is nearly always to "abandon in place" and not remove the unused pipe.

The pathways for impacts from this activity are construction equipment working in and near the stream and construction related leaks or spills. The stressors would include crushing or displacement of Nashville crayfish by construction equipment, sediment impacts from the installation of coffer dams and from work in and near the stream, and contaminant impacts from fuel and other construction related leaks or spills resulting in both lethal and sub-lethal take of Nashville crayfish.

The impacts would likely be lethal to some individuals even with all mandatory AMMs in place. We would expect the lethal take to be limited since most animals would likely move out of the impact area for the comparatively short period (days to weeks) that it would take to remove the pipeline from the stream and restore the habitat. Moreover, the implementation of mandatory AMM 8, which requires the use of a dry-ditch methodology and capture and removal of animals within the coffer dams, and AMM 18, which is a time-of-year restriction should further reduce impacts. It is likely that there would be no impact to this species if non-mandatory AMM 11 were implemented (abandonment in place). We do not know how often this could be employed since it can be outside the control of the applicant (i.e., landowners may insist on pipe removal).

A number of mandatory AMMs would be employed to minimize impacts including AMMs 3, 7, 8, 12, 13, and 18. Non-mandatory AMMs 10 and 11 would be employed where technically and otherwise feasible (note that an economic justification would not be sufficient for not employing AMMs 10 and 11). AMMs 3, 8, 12, 13, and 18 are described above.

AMM 7 directs the use of a dry-ditch methodology for all new construction and repair unless HDD is determined through AMM #4 above to be feasible (HDD would not be appropriate for use in pipeline removal).

AMM 10 prohibits construction of culvert and stone access roads and appurtenances (including equipment crossing) across the water body or within the riparian zone.

AMM 11 covers abandonment in place, which would result in no proximal impacts (erosion around the abandoned pipe could still be an issue).

New Construction

Vegetation Clearing

Clearing herbaceous vegetation, shrubs, or trees using mechanical means (e.g. bulldozers) for a new construction project (outside the ROW within the one-mile corridor) has the potential to contribute additional sediments to Nashville crayfish habitat. We would expect these impacts to have a large geographic scope relative to the covered lands, since new construction could occur anywhere within the covered lands. Even reasonable worst case scenario new construction vegetation clearing, however, would impact some of the occupied streams within the Mill Creek Watershed.

The pathway, stressors, and impacts are similar to those previously described under O&M. Vegetation clearing for new construction would, in conjunction with other minor sediment causing activities, result in aggregate level impacts to Nashville crayfish habitat. In the case of tree clearing, there could also be impacts to the riparian corridors of occupied streams.

NiSource would employ AMM 3 (described above) and other relevant BMPs (as identified in the ECS) to minimize the effects of this activity.

Grading and Erosion Control Installation

Grading and installation of erosion control devices would occur on essentially the same footprint as vegetation clearing. Grading and erosion control installation, because it would produce additional ground disturbance and would extend the time when vegetation is disturbed, has the potential to result in additional sediments entering Nashville crayfish habitat. The pathway, stressors, impacts, and scope of these activities would closely match those of vegetation clearing described above.

NiSource would employ AMM 3 and other relevant BMPs to minimize the effects of this activity. These would further reduce what we expect to be relatively minor impacts to Nashville crayfish habitat.

Hydrostatic Testing (water discharge)

Hydrostatic testing involves pumping water (in some cases millions of gallons) from streams, lakes, or municipal water sources into new or existing pipes and putting that water under pressure within a section of pipeline (sometimes several miles long) in order to evaluate the integrity of the pipeline section. Withdrawal of hydrostatic test water would not impact Nashville crayfish because of the mandatory use of AMM 15 as discussed above. Hydrostatic test water, however, could be discharged into occupied streams under specific AMMs. Hydrostatic testing is a standard practice within the pipeline industry and could occur multiple times over the life of the permit and could occur anywhere within the covered lands that pipeline exists.

The primary stressor pathway related to water discharge is the introduction of invasive species, and the introduction of sediments and contaminants. With AMMs in place, we expect that impacts from hydrostatic test water discharge to be limited to aggregate level amounts of sediments over the life of the permit.

NiSource would employ AMMs 3 (previously described) and AMM 16 which pertains specifically to hydrostatic testing. Together they would limit the impact to individuals resulting in only aggregate take.

AMM 16 prohibits discharge of hydrostatic test water directly into known or presumed occupied habitat. Selection of how test water would be discharged would occur in the following sequence: down-gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge; then discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (as above) prevent such discharge; then discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices to minimize effects to the waterbody. This AMM would minimize the sediment and potential invasive species impacts from water discharge.

Re-grading and Stabilization of the Corridor

Re-grading and stabilization of the pipeline corridor has the potential to result in additional sediments and possibly contaminants, (e.g., fertilizers) entering Nashville crayfish habitat. This activity would occur on the same footprint as the grading and erosion control activity, but would occur on a much smaller scale as this activity would primarily involve comparatively small sections of the corridor where repairs or other disturbance occurring at a different time from the original grading become necessary.

The pathway, stressors, and impacts would be similar to upland ROW re-grading discussed in the O&M section above.

NiSource would employ AMMs 3 and 14 (previously described) to minimize the impacts. We would expect the AMMs to minimize further what would likely be minor (aggregate level) additional inputs of sediment and contaminants to Nashville crayfish habitat.

Access Road Construction and Upgrade

Constructing new or upgrading existing access roads has the potential for direct and indirect impacts to Nashville crayfish. A worst case scenario would involve an access road constructed across an occupied stream at a different time or outside the construction ROW of a pipeline abandonment or replacement. The scope of these impacts is the entire covered lands since access roads could be constructed anywhere in the watershed. The number of miles of access road NiSource would construct in the Mill Creek Watershed is unknown, but likely few since numerous roads exist in the area. Moreover, a permanent access road crossing a stream would be unlikely because of the additional expense of constructing a permanent bridge.

The pathway, stressors, and impacts of this activity would be similar to those of pipeline removal (i.e., heavy equipment crushing or dislocating Nashville crayfish, contaminants, sediment, etc.). Permanent access roads, however, are also a possibility and would have additional long-term impacts associated with alteration of flow and sediments. Even if not permanent, access roads would be in place for a comparatively long (months) period of time. Access road construction that affects Nashville crayfish should be rare, but even with mandatory AMMs in place, it would likely cause some lethal take of Nashville crayfish and it has the potential for significant levels of habitat degradation at discrete sites. If implemented, AMM 10 would eliminate most impacts from this activity.

NiSource would employ mandatory AMMs 3, 8, and 12 (all previously described) and where technically feasible non-mandatory AMM 10 to minimize the impacts from access roads.

Stream Crossings

Stream crossing is the term used to describe how NiSource would repair pipeline, replace pipeline or install a new pipeline under a stream. There are three main methodologies used to cross streams. They are wet-ditch or open cut crossings, dry-ditch, and HDD. In general, wet-ditch crossings are used to cross medium sized streams, but it is the most versatile of the methods and can be used to cross all but the largest rivers. NiSource has agreed not to use wet-ditch crossing methodologies in Nashville crayfish habitat and therefore, it is not discussed further here. Dry-ditch is primarily a tool for crossing small to medium–sized streams. HDD is typically used to cross large rivers, but can be used for medium-sized or small streams in certain situations.

Stream Crossing Dry-Ditch (dam and culvert, steel dam and culvert and dam and pump)

Stream crossing (along with pipeline removal and the construction of access roads) is the most invasive activity NiSource conducts in Nashville crayfish habitat. Impacts are lessened through

the implementation of dry-ditch crossing techniques. The scope of this activity would be anywhere within the covered lands since a looping (new pipeline) or replacement project could occur anywhere. Except under rare circumstances where HDD might be employed, all stream crossings within Nashville crayfish habitat would be constructed using dry-ditch methods.

The pathway and stressors from this activity would be similar to those from pipeline removal and the construction of access roads across a stream. All dry-ditch variations typically involve the construction of temporary coffer dams that delimit the construction area, stream flow is then pumped or piped to bypass that zone. All methods would dewater an approximately 75-foot reach of stream and disturb some or all of the streambed within the coffer dams. Even with AMMs, impacts could be significant (e.g., although AMM # 1 requires a robust search and relocation effort, not all crayfish within the impact zone would be captured and we estimate mortality for up to 50% of the relocated crayfish.) The impacts, however, would be localized and temporally limited (typically a crossing is completed in a few days). Sediment impacts are also possible downstream of the work zone although the combination of coffer dams and re-routing flow around the construction area would result in much less sediment transport and deposition downstream than a wet-ditch crossing.

The impacts from dry-ditch crossings would be minimized by the employment of mandatory AMMs 1, 3, 6, 12, and 18, and where feasible, non-mandatory AMM 10 (all previously described).

Stream Crossing using HDD

HDD involves drilling under the bottom of the stream (often 50-100 feet below the stream bed) and then pulling the welded sections of pipe through the bore hole. It is the preferred and sometimes the only feasible method to cross very large rivers. It is also the most limited of the crossing methods, because it requires a significant amount of space on either side of the channel and specific geological conditions under the stream to be successful. HDD is often requested by resource agencies when crossing sensitive streams because when successful, there are essentially no impacts to the aquatic environment. Harmful impacts can occur in the form of frac-out when HDD is unsuccessful. Frac-out is the unintentional escape of drilling muds into the stream from a breach in the earth surrounding the bore hole.

The scope of this activity is anywhere within the covered lands, but we expect HDD to be used rarely in the Mill Creek Watershed, because the topography and geology at most sites are likely not conducive to stream crossing using this technique.

The stressor is principally fine sediments (bentonite) from frac-out, although there is the potential for small amounts of other contaminants to be present. Stream crossings using HDD have the potential for both large-scale and minor frac-out. Frac-outs usually result when the geologic conditions under the stream permit a rupture in the earth between the bore hole and the stream bed. Drilling muds (primarily bentonite with small amounts of other substances) and the surrounding earth are then pushed through this breach under high pressure into the

stream. Minor frac-outs result in small amounts of the drilling muds escaping into the stream – they are more common, but much less harmful, in part because HDD is typically implemented in larger streams where small-scale frac-outs are quickly dispersed by the flow. Large scale frac-outs occur as a result of the same processes, but a much larger volume of material can escape into the water body.

We expect that a combination of factors make a large-scale frac-out in Nashville crayfish habitat discountable (i.e., HDD would result in very minor impacts to Nashville crayfish and its habitat). First, because of the terrain, size of streams, and geology, HDD would be employed rarely in the Mill Creek Watershed. Second, the AMMs employed in association with this activity, particularly AMM 4, require a thorough evaluation of the geology with specific consideration of potential impacts to Nashville crayfish prior to HDD implementation – a geological formation not conducive to HDD is the primary reason for frac-out. Third, AMM 4 also contains a planning requirement to address large-scale frac-out if HDD is used in Nashville crayfish habitat.

NiSource would employ AMMs 3, 4, and 12 (AMMs 3 and 12 previously described) to minimize the effects of small frac-outs.

AMM 4 requires an HDD plan that explicitly considers Nashville crayfish distribution and habitat requirements. It encompasses geophysical and other data designed to ensure that HDD is appropriate at any given site and that frac-out potential is minimized. Where questionable, HDD would not be implemented.

Individual Impacts Summary

The following O&M activities are likely to affect the Nashville crayfish: facilities, vegetation management, upland ROW re-grading, in-stream ROW stabilization or fill, access road maintenance, cathodic protection, and pipeline abandonment and removal. Of these only pipeline abandonment and removal has the potential to cause lethal take of Nashville crayfish with the mandatory AMMs in place. Pipeline abandonment and removal is expected to occur very rarely within occupied habitat, but would be potentially significant if it were to occur.

New Construction activities that are likely to affect Nashville crayfish include: vegetation clearing, grading and erosion control installation, hydrostatic testing water discharge, re-grading and stabilization of the corridor, access road construction and upgrade, and stream crossing (dry-ditch and HDD). Of these, access roads (new construction), and stream crossings (dry-ditch) are expected to cause lethal take of Nashville crayfish (there is a small potential for large-scale frac-out and spills to cause additional lethal take). The construction of new access roads outside the construction footprint of a stream crossing (note that if it occurs within that footprint Nashville crayfish would already have been impacted by the pipeline crossing) is expected to be rare, but would result in levels of take comparable to crossing a stream with a pipeline. This action could have significant impact on the Nashville crayfish in the immediate vicinity of the access road. Stream crossing is the most widespread and common NiSource activity affecting Nashville crayfish. The reasonable worst case scenario predicts stream

crossings for pipeline repair, replacement, or for a looping (new) pipeline would occur at every stream crossing within the Mill Creek Watershed over the life of the permit.

Take from these activities could be locally significant causing lethal impacts and harm and harassment to nearly all of the Nashville crayfish within the immediate vicinity of the pipeline crossing. Since dry-ditch crossings are required by the MSHCP in Nashville crayfish habitat, additional harm and harassment is expected to be limited to 100 feet downstream and 10 feet upstream of the coffer dams.

Although we do not know the precise locations where pipeline removal, access road construction, or new pipelines activities would occur within the covered lands, at least a portion of these projects would occur within Nashville crayfish habitat. The estimated number of animals impacted over the 50-year life of the permit takes into account the effect of multiple pipeline crossings at each stream potentially affected by NiSource activities, and robust population estimates of Nashville crayfish at each crossing site. NiSource activities would almost certainly cause lethal take of some number of Nashville crayfish. The actual number of animals taken would depend not only on the number and location of NiSource projects and on which non-mandatory AMMs they choose to implement, but also the number of Nashville crayfish present in the area of impact at the time of the project.

Major spill events were not analyzed in the MSHCP because they are not a covered activity, although a major spill at a NiSource crossing upstream of a Nashville crayfish population would likely have more immediate and possibly longer term impacts than any other NiSource activity. The probability of a major spill (one that threatens more than a localized area) is assumed to be low both because of the kind of activities NiSource is proposing and because of the AMMs and BMPs NiSource would implement to prevent spills.

Impacts to Populations and Species Rangewide

In this section, we analyze the impact of the NiSource project on the range wide reproduction, numbers, and distribution (RND) of the Nashville crayfish. Population and range-wide analyses are combined here because the best available information indicates that the Nashville crayfish is endemic to the Mill Creek drainage in Davidson and Williamson counties on the outskirts of Nashville, Tennessee (USFWS 2009d). Withers (2009) conducted distributional surveys for Nashville crayfish focused on the upper reaches of the Mill Creek drainage between 2005 and the winter of 2008-2009. He found more occupied streams in the 2008-2009 surveys than he did in 2005. He found Nashville crayfish in more than 20 locations in both the upper and lower Mill Creek Watersheds and documented 110 occurrences overall (Withers 2009). Our current understanding of the population dynamics of the Nashville crayfish is incomplete, but in order to be most protective of the species, this biological opinion considers the Mill Creek drainage as one population.

A 1999 study (O'Bara unpublished) found Nashville crayfish in Mill Creek, except in the lower 0.8-mile (1.3 km) reach, which is influenced by water level fluctuations in the Cumberland River

and in the upper 2.5-mile (4 km) reach, which undergoes seasonal dewatering. The species was found to be evenly distributed in the remaining 23.5 miles (38 km) of the mainstem. Nashville crayfish were also found in eight of the 15 tributaries to Mill Creek.

A study was done in 1999-2000 (Carpenter 2002) to determine density and distribution of the species. The results of mark/recapture sampling estimated an overall population of Nashville crayfish in the Mill Creek system (mainstem and tributaries) of 1,000 -2,000 individuals per 100 linear meters. For the MSHCP, NiSource estimated the population of Nashville crayfish in the Mill Creek Watershed as 915 animals per 100 meters of tributary stream and 2,536 animals per 100 linear meters for the mainstem (mid-points of Carpenter's single-site estimates recommended by the USFWS's Cookeville Tennessee Field Office, 2009) for a density of 1.4 to 1.5 Nashville crayfish per square meter (applying an average mainstem width of 17.8 meters).

Carpenter (2002) sampled approximately 35 kilometers of the mainstem of Mill Creek beginning upstream of the confluence with the Cumberland River and ending near where the flow became intermittent. He captured Nashville crayfish at multiple sample sites within those 35 kilometers. Nashville crayfish sampling data are limited, therefore, it is not possible to accurately estimate of the total Nashville crayfish population. The numbers of animals sampled per hundred meters of stream and the presence of suitable habitat throughout approximately 35 kilometers of mainstem, plus habitat in a number of suitable tributary streams, however, suggests tens to hundreds of thousands of animals in the Mill Creek Watershed.

The population structure of Nashville crayfish is unknown. Populations in tributaries may function as separate populations, or the tributaries and mainstem may follow a metapopulation structure. This introduces some uncertainty into precisely how impacts from NiSource activities would affect Nashville crayfish populations. We do know that crayfish can move on their own (e.g., to seek pools in the summer) and can be moved by natural forces like floods. We also know that there are few or no absolute barriers for Nashville crayfish (e.g., dams) separating the mainstem from the tributaries. Whatever the structure, existing data (Carpenter 2002) suggest that the Nashville crayfish population is stable. Habitat may also be stable over the near term (Withers 2009) but is subject to both acute and chronic impacts (e.g., development projects, spills, sedimentation) which would likely reduce both its amount and suitability over the long term.

The life history of the Nashville crayfish is an important consideration in how NiSource activities would impact populations and the species. Among the most important of these is their reproductive potential. Fecundity of Nashville crayfish is unknown, but is assumed to be similar to other *Orconectes* species and therefore may be related to size of the female (carapace length) as in *O. luteus*. Corey's (1987) study of *O. propinquus* suggests that young-of-the-year (YOY) reproductive females would contribute approximately 21 offspring to the population and second year reproductive females 42. Predation on crayfish is also significant. Rabeni (1992) who looked at fish predators and crayfish in an Ozark stream used a predator-prey model for O. *luteus* and *O. punctimanus* that predicted about one third of total crayfish production equaling half of those species' biomasses is consumed by centrarchid predators. Maintenance of a

population at this level of predation suggests that crayfish populations are resilient and able to withstand a relatively high annual loss of individuals. Other information also suggests crayfish in general and, by inference, Nashville crayfish are resilient to impacts. Momot (1984) identified mid-latitude crayfish species, which would include Nashville crayfish as having high resilience to external stress. Parkyn and Collier (2004) looked at the impacts of a large flood event on the crayfish species (*Paranephrops planifrons*) which may be less resilient than Nashville crayfish (longer period to maturity and less frequent reproduction). Even in a deforested area where virtually all of the crayfish were swept away by floodwaters, recovery measured as density nearly reached the pre-flood level by the third year after the event.

In order to minimize impacts, NiSource has agreed to conduct all crossings within Nashville crayfish using dry-ditch techniques, which limit the non-sediment impacts of stream crossings to the 75-foot wide area within the coffer dams. In addition, AMMs require that Nashville crayfish be re-located from within coffer dams prior to excavation. The impacts from NiSource activities at the five crossings of the mainstem should therefore be limited both in terms of the loss of individuals (even though a 50% mortality is assumed for relocated individuals) and in terms of habitat impacts. It seems unlikely if the above estimates are reflective of the actual distribution and size of the population and given the AMMs in place, that NiSource activities would pose a major threat to the reproductive potential or fitness of the mainstem population.

The MSHCP estimated as a reasonable worst case scenario that ground-disturbing covered activities would result in take of approximately four acres of habitat and 23,000 animals over 50 years. In addition, aggregate sediment impacts from several O&M activities could marginally reduce the habitat quality of another fraction of an acre. Impacts to instream habitat would not be expected to be long-term. Although associated riparian habitat would require longer to recover, loss of some riparian habitat is likely not a threat to this species (Walton 2008). Of the approximately four acres of instream habitat expected to be impacted, much of the impacts would be temporary, lasting only a few days while the area within the coffer dams was de-watered. Because the streams occupied by this species are primarily bedrock substrate, and because coffer dams and other AMMs would be employed, we expect the sediment impacts on habitat from the stream crossings to be insignificant. In addition, habitat impacts are small compared to the overall amount of habitat available.

NiSource activities would cross nine tributary streams to Mill Creek. As with the mainstem, crossings, a project could be proposed that would require all tributary crossings take place in the same year. Carpenter (2002) identified Nashville crayfish (numbers captured in parentheses) in the following tributaries in 2002: Sims Branch (two), Sevenmile Creek (315), unnamed tributary to Sevenmile Creek (two), Sorghum Branch (two), Whittemore Branch (29), Collins Creek (61), Indian Creek (41), Edmundson Branch (12), Owl Creek (386), Owl Creek North (15), and Owl Creek Middle (two). Walton (2008) subsequently found Nashville crayfish in Holt Creek. Of the tributary streams identified by Carpenter (2002) as holding Nashville crayfish, reaches of the following fall within the one-mile corridor and could potentially be impacted by NiSource activities: Collins Creek, Indian Creek, Owl Creek, Owl Creek North, Owl Creek Middle, Holt Creek. Withers (2009) identified three stream reaches as areas of high conservation

priority: Indian Creek, Mill Creek upstream of downtown Nolensville, and Bittick Creek, a tributary to Mill Creek. Of these, only a short reach of Indian Creek falls within the one-mile corridor.

Impacts of Mitigation

The MSHCP outlines NiSource mitigation commitments for the Nashville crayfish (MSHCP, Chapter 6, Nashville crayfish section). The mitigation package includes (1) enhancement and restoration of streambed and riparian sites to promote Nashville crayfish and (2) restoration and protection of riparian buffers associated with occupied Nashville crayfish habitat.

In all cases where direct take (stream crossings) occur, NiSource will restore the streambed and will restore the riparian area within the ROW disturbed as a result of its activities. The restorations will be conducted in accordance with ECS, AMMs, and requirements of FERC and other relevant action agencies. This will involve at minimum restoration of any impacts to the depth, flow, channel bottom, or banks as nearly as practical back to the pre-impact condition. Vegetation restoration must be with site-appropriate native species. As the initial step in compensatory mitigation, NiSource will also enhance the restored site to promote additional conservation of Nashville crayfish (at minimum this will include the addition of slab rock at a minimum size per slab of 1.6 square feet Walton 2008) within the 75 feet formerly enclosed by the coffer dams). The USFWS expects the enhancement of the substrate to result in more opportunities for recruitment of Nashville crayfish by providing suitable sheltering habitat.

Take of Nashville crayfish is anticipated to occur in two ways. First, the impact which may result from direct loss of individuals or habitat from stream crossings activities employed to install new pipeline, or repair or replace existing pipeline. Mitigation will entail restoration, enhancement, and protect potential of Nashville crayfish stream bed and riparian habitat within one of the priority areas identified by Withers (2009) Indian Creek, Mill Creek upstream of downtown Nolensville or Bittick Creek an unnamed tributary to Mill Creek, or another priority stream identified in collaboration with the USFWS on a 1:1 basis with the Nashville crayfish habitat area affected by its activities equaling a minimum of 4.0 acres. This equates to streambed and riparian restoration, enhancement, and protection for a length of 3,485 linear feet.

The second kind of take is aggregate, which would result primarily from sedimentation from non-aquatic activities within the watershed, and secondarily from loss of riparian habitat, and other similar comparatively minor and indirect impacts. NiSource will implement mitigation for Aggregate Take in its entirety in conjunction with the first new construction project for which mitigation is required to ensure adequate and timely compensation for O&M activities in the watersheds where impacts would likely occur over the life of the ITP. It will use habitat protection/restoration as the mitigation option. The protection or restoration of riparian habitat is designed to reduce the sediment impacts to Nashville crayfish by buffering occupied streams. The total riparian area protected to mitigate for aggregate take will be 0.4 acre.

We conclude that these mitigation action will serve to compensate for the impacts to the Nashville crayfish expected from NiSource activities. The mitigation will serve to further reduce pressures and impacts on this species by alleviating threats (e.g., sedimentation) and improving habitat (e.g., replacement of streambed and riparian habitat).

Summary of Population and Species Impacts

In summary, the existing NiSource pipeline, plus the one-mile corridor, bisects the range of this species and therefore has the potential to affect a significant portion of the species range. We do not, however, anticipate population level impacts to the mainstem and six tributary streams known to support Nashville crayfish within the Mill Creek Watershed. The reasonable worst case scenario predicts take would occur in a few "spikes" during mainstem crossing actions (or access road or pipeline abandonment and removals) over the 50-year life of the permit. We would expect that impacts to occupied tributary streams would affect the population even less because the tributary populations are assumed to be smaller and the impacts would likely be more limited in terms of animals and habitat than the potential multiple, simultaneous impacts along the mainstem. This reasoning holds true if the entire basin functions on a metapopulation or single population model, which given the interconnectedness of the habitat and the mobility of the crayfish is assumed to be the case. Providing other impacts do not cause Nashville crayfish populations to crash, there would likely be recovery between NiSource impacts. Based on our estimation of the current population sizes, our assumptions concerning the reproductive potential of Nashville crayfish, and the expected minimal long-term impacts to habitat, it seems unlikely that the persistence of the species would be negatively affected by NiSource activities over the life of the permit.

4.1.5 MSHCP Mussels

This section evaluates the effects of the proposed action on the clubshell, fanshell, northern riffleshell, James spinymussel, and sheepnose mussels (hereafter MSHCP mussels) Table C5 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for the above species and was intended to be read in concert with and support this effects analysis section.

In the first section, we focus on the impacts to individual animals and then look at how these individual responses affect the populations to which these mussels belong. We then assess how the anticipated changes, if any, at the population level will affect the fitness of the species rangewide. The AMMs that reduce exposure and responses are described in more detail in the MSHCP, chapter 6, mussels.

Measures to Avoid and Minimize Impacts

Surveys to Evaluate Presence and Relocation of Species in NiSource Action Areas

1. A survey can be conducted to determine the presence of this mussel species. Mussel survey protocols designed to detect endangered mussels that often occur in low densities; protocols as of 2009 are provided in Appendix L of the MSHCP. Survey methodologies must be evaluated at minimum every five years and updated to the most effective survey methods currently available. If the most current methodology implemented by a biologist, qualified to conduct the survey, does not indicate the presence of the species, it will be classified as unoccupied habitat and the AMMs will not be mandatory.[14]

If a survey is not completed, presence will be assumed. In that case, all suitable habitat would be treated as occupied, and all mandatory AMMs must be followed. NiSource or its contractors will follow the USFWS approved relocation plan as referenced below. Survey and relocation may be implemented in the same time period (as one action) as long as both survey and relocation protocols are followed (general relocation protocols are identified in Appendix L of the MSHCP, but may be modified in conjunction with USFWS Field Office based on conditions). Relocation may be implemented only if: (1) all required permits are in place, (2) a USFWS approved relocation plan documenting all relevant protocols including how and where the mussels will be moved is in place, (3) a contingency plan is in place to conduct additional consultation with the USFWS should the actual field survey not reflect the conditions identified in the approved relocation plan, and (4) a monitoring program to evaluate the effects of the relocation is in place. Relocation will include at least all individuals of the federally endangered species identified in the impact area and may include other species based on the assessment of the USFWS Field Office and other regulatory agencies. A copy of the survey and any reports will also be included in the annual report submitted to the USFWS.

Pre-Construction Planning: Preparation of an EM&CP

2. A detailed EM&CP will be prepared for any activity with potential effects (e.g., streambed or stream bank disturbance, impacts to riparian habitat, activities causing sediment) within 100 feet of the ordinary high water mark of occupied mussel habitat. The plan will incorporate the relevant requirements of the NGTS ECS and include site-specific details particular to the project area and potential impact. The waterbody crossing will be considered “high-quality” for the purpose of preparing this plan regardless of the actual classification. The plan will be strongly oriented towards minimizing streambed and riparian disturbance (including minimization of tree clearing within 25 feet of the crossing [Figure 24, ECS]), preventing downstream sedimentation (including redundant erosion and sediment control devices, which would be designed to protect mussel resources as appropriate), and weather monitoring by the Environmental Inspector to ensure work is not begun with significant precipitation in the

[14] However, NiSource may implement some of these measures if appropriate to protect potentially suitable habitat.

forecast. The plan will comprehensively address all activities needed to complete the work and minimize take of mussels in occupied habitat including crossing the streams during dry periods when practical and using dry-ditch crossing techniques for all James spinymussel streams and intermittent streams leading to mussel habitat. The EM&CP will include the frac-out avoidance and contingency plans described in AMM #3 below. The EM&CP will also include a sediment control component for uplands that drain to and impact occupied habitat. Detailed erosion control plans will be developed specific to slopes greater than or equal to 30 percent leading directly to occupied habitat. These plans will include techniques such as hard or soft trench plugs, temporary sediment barriers, a wider trench at the slope base, and/or temporary slope drains (plastic). In areas with less than a 30 percent slope, ECS and AMM erosion control measures protective of mussels will be implemented. The plan will be approved in writing by NiSource NRP personnel prior to project implementation and will include a tailgate training session for all on-site project personnel to highlight the environmental sensitivity of the habitat and any mussel AMMs that must be implemented.

Streambed Construction

3. For activities in occupied habitat, install new or replacement pipelines and major repairs under the river bottom using HDD or other trenchless methods rather than open trenching unless the crossing evaluation report prepared in accordance with Section 5.2.1.1 and Appendix J of the MSHCP indicates otherwise. Drilling should be carefully undertaken and a plan should be in place to minimize and address the risk of in-stream disturbance due to frac-outs. The plan should also specifically reference mussel resources in the vicinity of the crossing as a key conservation concern and include specific measures identified in the NGTS ECS, from standard industry practices, or other mutually agreed-upon practices to protect this resource. The plan will also include a frac-out impact avoidance plan which will evaluate the site in terms not only of feasibility of conducting HDD, but the likelihood of large scale frac-out and its effects on mussels, and actions to address a large scale frac-out in occupied habitat. The plan should also consider the potential effects on mussels if drilling fluids are released into the environment. The plan must contain all information required for a FERC Section 7c filing at a minimum. If, after detailed engineering studies (e.g., geotechnical, physiological, topographical, and economic), it is determined (and agreed to by NRP personnel) that an HDD is not feasible, a report will be prepared and included in the annual report submitted to the USFWS. However, due to the potentially significant amount of take that might occur for Ohio River crossings, open trenching in this river is not a “covered activity” as part of the NiSource MSHCP.

4. Install pipeline to the minimum depth described in the ECS and maintain that depth at least 10 feet past the high water line to avoid exposure of pipeline by anticipated levels of erosion based on geology and watershed character. Additional distance may be required should on-site conditions (i.e., outside bend in the waterbody, highly erosive stream channel, anticipated future upstream development activities in the vicinity, etc.) dictate a reasonable expectation that the stream banks could erode and expose the pipeline facilities. Less distance may be utilized if terrain or geological conditions (long, steep bank or solid rock) will not allow for a 10-

foot setback. These conditions and the response thereto will be documented in the EM&CP and provided as part of the annual report to the USFWS.

5. For repairs in occupied habitat, do not install in-channel repairs (bendway weirs, hardpoints, concrete mats, fill for channel relocation, or other channel disturbing measures) except when measures in AMM #3 above are not feasible from an engineering design perspective, and then, only in conjunction with a stream restoration plan based on Rosgen (*see* Wildland Hydrology 2009 http://www.wildlandhydrology.com/html/references_.html) or other techniques mutually agreed upon by NiSource and the USFWS that result in no direct or lethal take of listed mussels.

6. Conduct replacements/repairs from a lay barge or temporary work bridges of the minimum length necessary to conduct the replacements/repairs rather than operating heavy equipment (e.g., backhoes, bulldozers) in-stream. Temporary construction and equipment bridges are not to be confused with stone or fill causeways with pipe structures, which should not be employed in known or presumed occupied waterbodies.

7. Remove equipment bridges as soon as practicable (this is typically interpreted to be a few days to a few weeks unless there are extenuating circumstances) after repair work and any site restoration is completed

8. As part of the routine pipeline inspection patrols, visually inspect all stream crossings in occupied habitat at least yearly for early indications of erosion or bank destabilization associated with or affecting the pipeline crossing that is resulting, or would before the next inspection cycle, likely result in sediment impacts to mussel habitat beyond what would be expected from background stream processes. If such bank destabilization is observed, it will be corrected in accordance with the ECS. Follow-up inspections and restabilization will continue until the bank is stabilized (generally two growing seasons).

<u>Stream Bank Conservation</u>

9. Do not construct culvert and stone access roads and appurtenances (including equipment crossing) across the waterbody or within the riparian zone. Temporary equipment crossings utilizing equipment pads or other methods that span the waterbody are acceptable provided that in-stream pipe supports are not needed.

10. For equipment crossings of small streams, use half pipes of sufficient number and size that both minimize impacts to stream bed and minimize flow disruption to both upstream and downstream habitat (ECS, Figure 22).

11. *Reserved.*

Pipeline Abandonment

12. Abandon pipelines in place to avoid in-stream disturbance that would result from pipeline removal unless the abandonment would be detrimental to endangered mussels.

Contaminants

13. As described in the ECS section on "Spill Prevention, Containment and Control," site staging areas for equipment, fuel, materials, and personnel at least 300 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted occupied habitat:

a. follow spill response plan; and
b. call the appropriate USFWS Field Office to report the release, in addition to the National Response Center (800-424-8802).

14. Ensure all imported fill material is free from contaminants (this would include washed rock or other materials that could significantly affect the pH of the stream) that could affect the species or habitat through acquisition of materials at an appropriate quarry or other such measures.

15. For storage well activities, use enhanced and redundant measures to avoid and minimize the impact of spills from contaminant events into known or presumed occupied streams. These measures include, for example, waste pit protection, redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials, and a spill response plan provided to the USFWS as part of the annual report. These measures will be included in the EM&CP prepared for the activity.

16. Do not use fertilizers or herbicides within 100 feet of known or presumed occupied habitat. Fertilizer and herbicides will not be applied if weather (e.g., impending storm) or other conditions (e.g., faulty equipment) would compromise the ability of NiSource or its contractors to apply the fertilizer or herbicide without impacting presumed occupied mussel habitat. The EM&CP prepared for this activity (AMM# 2 above) will document relevant EPA guidelines for application.

Withdrawal and Discharge of Water

17. Hydrostatic test water and/or water for storage well O&M will not be obtained from known or presumed occupied habitat unless other water sources are not reasonably available. To prevent desiccation of mussels, water from known or presumed occupied habitat will be withdrawn in a manner that will not visibly lower the water level as indicated by water level height on the stream channel bank. Employ appropriately sized screens, implement withdrawal

rates, and maintain withdrawal point sufficiently above the substrate to minimize impacts to the species.

18. Do not discharge hydrostatic test water directly into known or presumed occupied habitat. Discharge water in the following manner (in order of priority and preference):

a. Discharge water down gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
b. If those circumstances occur, discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
c. If those circumstances occur, discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices (Figures 6A&B, 7, 8, 14A&B; ECS) to minimize effects to the waterbody.

Travel for O&M Activities

19. Do not drive across known or presumed occupied streams – walk these areas or visually inspect from bank and use closest available bridge to cross stream.

Zebra Mussels and Other Invasives

20. Clean all equipment (including pumps, hoses, etc.) that have been in a perennial waterbody for more than four hours within the previous seven days and will work in occupied or potential federally listed mussel habitat; following established guidelines to remove zebra mussels (and other potential exotic or invasive species) before entering a known or presumed occupied stream for a federally listed mussel, which is not known to be infested with zebra mussels (MSHCP, Appendix L). Do not discharge any water for other sources that might be contained in equipment (e.g. ballast water, hoses, sumps, or other containment). It is important to follow these guidelines even if work is not occurring in the immediate vicinity of these mussels since, once introduced into a watershed, invasive species could move and eventually affect the federally listed mussels.

IMPACTS TO INDIVIDUALS (ALL MSHCP MUSSELS)

Activities Having No Effect or Not Likely to Adversely Affect Species

A number of the covered activities will have no detectable effects on the MSHCP mussels (Table C5, Appendix C). In general, several O&M activities involving vegetation management and disposal, pipeline and storage well abandonment related activities, minor ground disturbing O&M activities (e.g., bell holes) and inspection activities are not expected to have an impact on these species because the animals will not be exposed to their effects. Similarly, new construction activities involving vehicle operation (impacts from vehicles in new construction are evaluated as part of the specific new construction activity for mussels), vegetation disposal, pipe stringing, activities related to compression and communication facilities, stream crossing

structures (these will occur within already disturbed areas), and activities in wetlands are not expected to affect mussels.

The following O&M activities: management of vegetation with herbicides, ROW repair in wetlands, and well abandonment; and new construction activities related to: trenching, trenching and grading for wetland crossings, and activities related to storage well waste pits are all not likely to adversely affect the MSHCP mussels because one or more AMMs will minimize or avoid potential effects.

AMM 2 requires that a detailed plan be prepared for any activity with the potential to affect the MSHCP mussels or their habitat. The plan will focus the applicant's attention to the potential presence of MSHCP mussels, and outline measures to avoid impacts (e.g., sediment and erosion control, avoidance of impacts to the riparian zone, avoidance of contaminant impacts, and minimization of stream channel impacts). In addition, the plan will require a training session for on-site personnel to highlight the potential sensitivity of the project area. AMM 2 is used in conjunction with many of the other AMMs and alone as a key component of NiSource's avoidance and minimization strategy for MSHCP mussels.

AMM 15 relates to storage well activities and requires the use of enhanced and redundant measures to avoid and minimize the impact of spills in known or presumed occupied streams. Examples of measures include redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials, and a spill response plan provided to the USFWS as part of the required annual report.

AMM 16 prohibits the use of fertilizers or herbicides within 100 feet of known or presumed occupied habitat. In addition, fertilizer and herbicides will not be applied if weather (e.g., impending storm) or other weather event would compromise the ability to apply the fertilizer or herbicide without impacting presumed occupied mussel habitat.

<u>Activities Likely to Adversely Affect Species</u>

Effects on MSHCP mussels are grouped into two categories, O&M activities and new construction activities. A number of O&M covered activities, including facilities presence and maintenance, components of vegetation management, ROW repair, access road maintenance, and cathodic protection; and new construction activities including vegetation management, ROW repair (instream and uplands), access road construction, pipeline abandonment (removal), and well abandonment activities are expected to adversely affect MSHCP mussels (Table X) although in many cases AMMs will be implemented that will minimize those effects. In some cases, the O&M and new construction activities are similar (e.g., grading to install a new pipeline versus re-grading of an existing pipeline corridor after repair). Both could impact MSHCP mussels.

Operation and Maintenance

Facilities (Vehicle Traffic and Sediment Impacts of the Pipeline Corridor)

The stressors associated with facilities are an altered landscape characterized by the indefinite presence of maintained pipeline corridors. Maintenance of the pipeline facilities requires regular inspection using vehicles (typically pick-up trucks) that drive the pipeline corridor and regularly ford streams at or near the pipeline crossing, where feasible. The potential for crushing mussels is therefore present, but because vehicle crossing would generally occur at existing fords or at sites where the area is typically already being disturbed by construction activities, the amount of take would be limited. For larger river species, where fording occupied streams is impractical, there would be no direct take from this activity.

The primary stressor pathway related to the presence of the pipeline corridor is through the contribution of sediment to occupied streams. Mussels are particularly sensitive to sedimentation in part because of their predisposition to burrow into the substrate. Excessive sediments can fill the interstitial spaces in sand and gravel and preclude normal biological processes. Sediments can affect mussels by degrading habitat, interfering with feeding and reproduction, and transporting contaminants. There are at least three pathways for sediment to enter mussel habitat due to the presence of the pipeline corridor: 1) erosion within the stream channel around the pipeline; 2) the 50 to 100-foot wide corridor (s) crossing watersheds (usually managed in non-native grasses); and 3) the related absence of natural vegetation at the point where the pipeline crosses the stream (this latter could also impact shade and input of organic material). Erosion around the pipeline (within the channel) and erosion at the point where the pipe crosses the channel (bank slough-off) are episodic and not easily predictable. Both have the potential to cause acute and significant localized impacts. Sediments from the presence of one or more pipeline corridors within the watershed is a long-term impact, but AMMs 2 (discussed above), 4, 8, and 19 along with the BMPs NiSource employs routinely (e.g., seeding, and other sediment control measures as described in detail in NiSource's Environmental Construction Standards document) should reduce the likelihood of an acute sediment event and limit the chronic sediment impacts of the pipeline corridor (s) to aggregate levels.

AMM 4 requires installation of pipeline to the minimum depth described in the ECS (a minimum of 48 inches or 24 inches in consolidated rock) and maintenance of that depth for a sufficient distance landward of the bank (a minimum of 10 feet past high-water line) to minimize the chances of the pipeline being exposed by erosive forces and thereby, adding additional sediment to the stream.

AMM 8 requires annual inspections of existing pipeline crossing sites to identify potential erosion problems early and make repairs before erosion can cause significant affects to MSHCP mussels.

Non-mandatory AMM 19 prohibits driving across known or presumed occupied streams and requires these streams be walked or visually inspect from the bank using the closest available bridge to cross streams.

Vegetation Management

Vegetation management primarily involves maintenance of the existing pipeline corridor, which focuses on herbaceous vegetation management (mowing) and brush management (brush-hogging or selective herbicide application). The scope of this activity is large and includes the linear component of the covered lands, because virtually all of NiSource's ROWs will be managed on a regular basis. In some instances, primarily in situations where the ROW has not been adequately maintained, some tree clearing, including clearing using bulldozers or other heavy equipment, may occur (NiSource has indicated that any maintenance tree clearing will occur in the first five to seven years of the permit). This has the potential to be in close proximity to some MSHCP mussel streams. Tree clearing affects MSHCP mussels by increasing sediments and by reducing the riparian corridor (minimizing shading of the stream) as natural vegetation is permanently removed.

The stressors and impact of sediments from vegetation management are virtually identical and may overlap to some extent with those described above under the heading Facilities. Delivery would be similar in that areas denuded of natural vegetation (or managed vegetation) would lose sediment to streams primarily during rain events.

AMM 2 (described above), in addition to various NiSource BMPs, minimizes the impacts from vegetation management. Most vegetation management will entail mowing and other activities (e.g., brush-hogging) with little or no significant impact to MSHCP mussels.

Upland ROW Re-Grading

Re-grading of the ROW removes the vegetative cover (often grasses) from portions of the ROW for short periods of time. Across the entire watershed, over the life of the permit, this activity would contribute small amounts of sediment to MSHCP mussel habitat. This activity is limited to the existing pipeline ROW, but unlike vegetation management, only a relatively small portion of the pipeline ROW would likely have to be re-graded over the life of the permit. Sediment delivery, stressors, and impact would be similar to that for vegetation management where heavy equipment is used.

AMM 2 would be used to provide awareness of MSHCP mussels in the watershed and help ensure they are considered in the re-grading plan, and that all relevant BMPs are implemented toward MSHCP mussel protection.

AMM 16 prohibits the application of fertilizer (during restoration of the re-graded corridor) within 100 feet of occupied habitat or during inclement weather.

Instream ROW Stabilization or Fill

This activity involves manipulation of the stream channel and stream bank often in response to erosion around or near a pipeline crossing. Bank re-contouring or reconstruction and the placement of hard points and reticulated mats in the channel are examples of possible stabilization actions. Instream channel stabilization and instream fill projects, if conducted in MSHCP mussel habitat at all, would be extremely limited in number and scope. These actions are primarily in response to specific problems that NiSource will try to preclude (see AMM 8) or solve by other less-invasive methods.

Significant impacts to MSHCP mussels resulting in both direct and indirect take could occur if multiple AMMs were not in place. The impacts could include crushing or burying mussels, alteration of flow, contaminants, and sediment. The pathway for these impacts would be through equipment operating along the bank and in the stream channel, spills of fuel or other contaminants from construction equipment, contaminants introduced with fill material, and scarring or denuding of stream banks that result in sediment impacts near the site of the stabilization project. NiSource would implement AMMs 2, 3, 5, 7, 8, 13, 14, and 20. AMM 11 will be employed for James spinymussel (JSM), which would result in these activities causing aggregate take of MSHCP mussels (AMMs 2 and 8 are described above).

AMM 3 requires NiSource to evaluate the use of HDD for major repairs and pipeline replacements and implement HDD in mussel habitat where HDD is likely to be successful based on that evaluation. Although not applicable or feasible in many cases, HDD offers one option to significantly limit the impacts (by replacing the pipeline at the stream crossing) where stabilization might be necessary.

AMM 5 requires that instream impacts (e.g., weirs, concrete mats, fill for channel relocation) would not occur in most cases, and when implemented would be in conjunction with a stream restoration plan. These instream impacts could not rise to the level where take of MSHCP mussels would occur.

AMM 7 requires that equipment bridges used for repair be removed as soon as practicable after work is completed.

AMM 13 requires staging areas be a minimum distance (300 feet unless additional contaminant control measures are in place) from MSHCP mussel streams to avoid contaminant impacts.

AMM 14 requires that any fill material imported for repairs is free of contaminants that could affect the species or its habitat.

AMM 20 requires the cleaning of equipment working in contact with the stream to reduce the likelihood of introduction of invasive species to MSHCP mussel habitat.

AMM 11 implements a time of year restriction on in-stream activities between 15 May and 31 July for designated watersheds within the range of the James spinymussel.

Access Road Maintenance (grading, graveling, culvert replacement)

Access road maintenance typically involves re-grading the roads, occasionally adding gravel, and replacing culverts as necessary. Individually, impacts would be minor, but the scope of this category of impact could be geographically large occurring virtually anywhere in the covered lands (note this activity is not confined to the pipeline corridor ROW). A reasonable worst case scenario, however, would still result in only a few of these actions in any occupied watershed in any year.

The primary pathway for impacts from this activity is through culvert replacement, which would nearly always involve soil disturbance in a drainageway, and thus, the potential release of sediment into an occupied stream reach. For the most part sediment stressors and impacts would be similar to those described as chronic (aggregate take) under the Facilities heading. Culvert replacement, especially if near an occupied stream, could also result in acute sediment impacts as previously described.

AMM 2 (previously described) would be employed to minimize chronic impacts and avoid and minimize acute impacts from these activities.

Cathodic Protection

Cathodic protection involves constructing a small trench (typically less than 30 cm wide and up to a few hundred meters long) to install a charged wire to inhibit pipeline rust and deterioration. This practice is ubiquitous along the NiSource system and therefore is likely to occur throughout MSHCP mussel occupied watersheds over the life of the permit.

Although widespread, the minimization measures and the minor nature of the ground disturbance would result in only aggregate level sediment impacts to MSHCP mussel habitat. The pathway is increased sediment to MSHCP mussel streams because of ground disturbance outside of the construction corridor (cathodic protection trenches are often perpendicular to the pipeline). The stressors and impacts are similar to those already discussed.

NiSource will employ AMM 2 (described above) and appropriate BMPs to minimize impacts from this activity.

Pipeline Abandonment and Removal

Pipeline abandonment and removal has the potential to cause direct lethal impacts to MSHCP mussels. The scope of this activity is the entire covered lands where pipelines exist because damage or degradation to a section of pipe could occur anywhere. It would be rare, however, and may not be necessary at all to abandon and remove a pipeline from an occupied mussel

stream during the life of the permit because abandonment is not common and the applicant's preference is to abandon in place.

The pathways for impacts from this activity are construction equipment working in and near the stream and construction related leaks or spills. The stressors would include crushing of mussels, displacement of mussels, sediment impacts, and contaminant impacts resulting in both lethal and sub-lethal take of MSHCP mussels. Take of MSHCP mussels (including possible lethal take) would occur even with all mandatory AMMs in place. Under a reasonable worst case scenario this take could be substantial where a pipeline removal project intersected occupied habitat. It is likely that there would be no impact to a species if non-mandatory AMM 12 were implemented (abandonment in place). We do not know how often this could be employed because it can be beyond the control of the applicant (i.e., landowners may insist on pipe removal).

A number of mandatory AMMs would be employed to minimize impacts including AMMs 2, 6, 7, 8, 9, 10, 12, 13, and 20 (AMM 11 described above would be mandatory in JSM habitat). Non-mandatory AMMs 6, 9 and 12 would be employed where technically and otherwise feasible. AMMs 2, 7, 8, 13, and 20 are described above.

AMM 6 directs replacements/repair be conducted from a lay barge or temporary work bridges rather than operating heavy equipment instream.

AMM 9 prohibits construction of culvert and gravel access roads and appurtenances (including equipment crossings) across waterbodies or within riparian zones.

AMM 10 specifies use of half pipes (where access roads or equipment bridges are employed) of sufficient number and size that both minimize impacts to stream bed and minimize flow disruption to upstream and downstream habitat.

AMM 12 requires abandonment in place, which would result in no proximal impacts (erosion around the abandoned pipe could still be an issue).

Well Abandonment Site Restoration

This activity involves restoration of an abandoned storage well-head site. This would typically involve removal of structures, re-grading, and re-vegetating the site. Well-head sites are typically small (400 feet x 400 feet). They are limited to the storage well counties listed in Table 1. The stressor pathway for this activity is heavy equipment operating on and around the well-head. The primary stressor is sediment input to MSHCP mussel habitat. Well abandonment site restoration does not affect JSM because no storage well counties intersect JSM habitat.

We would expect the effects of well abandonment site restoration to be a minor component of aggregate sediment impacts.

AMM 2 described above would be implemented to minimize the minor sediment impacts expected to occur as the result of site restoration on small well abandonment sites.

New Construction

Vegetation Clearing

Clearing vegetation (herbaceous, shrubs, or trees) using mechanical means (e.g. bulldozers) for a new construction project (typically outside the ROW within the one-mile corridor) is a stressor with the potential to contribute additional sediments to MSHCP mussel habitat. We would expect these impacts to have a large geographic scope since new construction could occur anywhere within the covered lands. Except in those cases where the species is confined to one or a very few stream reaches, vegetation clearing for new construction would likely impact only a small number of occupied streams by any MSHCP mussel in any given year.

The stressor pathways and impacts of these sediments are essentially the same as described above under the heading Facilities. Vegetation clearing for new construction will result in aggregate level sediment impacts to MSHCP mussel habitat. In the case of tree clearing, there could also be impacts to riparian corridors of occupied streams.

NiSource will employ AMM 2 and other relevant BMPs (e.g., reducing the corridor width at stream crossings) to minimize the effects of this activity.

Vegetation Disposal

Vegetation disposal involves the dragging, chipping, hauling, piling, and stacking of cleared herbaceous vegetation, trees, and brush. The stressor pathway is primarily crushing individuals as heavy vehicles ford streams to haul the cleared vegetation to suitable storage sites. The scope of this activity is small, confined to very specific situations, and expected to be rare in MSHCP mussel habitat. It might occur, for example, where cleared vegetation has to be moved from a steep slope on one side of a fordable stream to a comparatively flat storage area on the opposite bank. This activity could result in lethal take, but the impact area (where trucks crossed the stream) and the amount of take would be small.

AMM 2 and non-mandatory AMM 19 both previously described are available to minimize impacts. If implemented, AMM 19 would eliminate impacts from this activity.

Grading and Erosion Control Installation

Grading and installation of erosion control devices would likely occur on essentially the same footprint as vegetation clearing. Grading and erosion control installation, because they would produce additional ground disturbance and would extend the time period of potential impacts, have the potential to result in additional sediments entering MSHCP mussel habitat. The

pathway, stressors, impacts, and scope of these activities would closely match those of vegetation clearing described above. The level of effect would be aggregate sediment impacts.

NiSource will employ AMM 2 (previously described) and other relevant BMPs to minimize the effects of this activity.

Hydrostatic Testing (water withdrawal and discharge)

Hydrostatic testing involves pumping water (in some cases millions of gallons) under pressure into new or existing pipelines (sometimes several miles long) in order to evaluate the integrity of the pipeline section. This water can be drawn from and discharged into streams. Hydrostatic testing is a standard practice within the pipeline industry and could occur multiple times over the life of the permit and could occur anywhere within the covered lands that pipeline exists.

Water withdrawal has the potential to entrain small life stages of MSHCP mussels, alter flow, and expose MSHCP mussels and their habitat to contaminants or invasive species (through introduction of infected equipment into the stream). The primary stressor pathway is the introduction of invasive species, the introduction of sediments and contaminants, and the entrainment of gametes, glochidia, or small juvenile mussels that would be in the immediate vicinity of the withdrawal pipe. Hydrostatic test water withdrawal could result in lethal take of young mussels.

NiSource will employ AMMs 2, 17, 18, and 20 (AMMS 2 and 20 are discussed above) to avoid and minimize impacts from this activity (AMM 11 will be mandatory in JSM habitat). AMMs 18 and 20 should effectively minimize the risk of contaminants and invasive species. AMM 2 will direct NiSource to avoid water withdrawal from mussel streams and where there is no other option, AMM 17 should greatly reduce potential take of vulnerable life history stages of MSHCP mussels.

AMM 17 dictates that hydrostatic test water will not be obtained from known or presumed occupied habitat unless other water sources are not reasonably available. To prevent desiccation of mussels, water from known or presumed occupied habitat will be withdrawn in a manner that will not visibly lower water levels as indicated by water level heights on the stream banks. Finally, appropriately sized screens, withdrawal rates, and water intakes elevated above the stream beds will be employed to minimize direct impacts to mussels.

AMM 18 prohibits discharge of hydrostatic test water directly into known or presumed occupied habitat. Water will be discharged in the following sequence: down-gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge; then discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (as indicated above) prevent such discharge; then discharge water as far from occupied habitat as practical and utilize additional

sediment and water flow control devices to minimize effects to the waterbody. Hydrostatic test water discharge would produce aggregate amounts of sediment over the life of the permit.

Re-grading and Stabilization of the Corridor

Re-grading and stabilization of the pipeline corridor has the potential to result in additional sediments and possibly contaminants, (e.g., fertilizers) entering MSHCP mussel habitat. The pathway, stressors, and impacts would be similar to upland ROW re-grading discussed in the O & M section above. This activity would occur within the same footprint as the grading and erosion control activity, but would occur on a much smaller scale because this activity would primarily involve comparatively small sections of the corridor where repairs, removed in time from the original grading, become necessary. We would expect the AMMs to minimize further what would likely be minor additional inputs of sediment and contaminants to MSHCP mussel habitat.

NiSource will employ AMMs 2 and 16 (both previously described) to minimize the impacts.

Access Road Construction and Upgrade

Constructing new and upgrading existing access roads has the potential for direct and indirect impacts to MSHCP mussels. A worst case scenario would involve a new access road constructed across an occupied stream at a different time from or outside the construction ROW of a stream crossing or pipeline removal. The scope of these impacts is the entire covered lands because access roads could be constructed anywhere in the watershed. How many miles of access roads NiSource would construct in the watershed of any occupied mussel stream is unknown, but likely the number would be very small since most access roads (whether public roads or those constructed by NiSource) already exist to serve the pipeline corridor. Moreover, a permanent access road that actually crosses a stream would be unlikely because of the cost of constructing a permanent bridge.

The pathway, stressors, and impacts, including level of direct take, of this activity would be similar to those of pipeline removal (i.e., crushing or dislocating from heavy equipment, contaminants, and sediment). Temporary roads would often be in place for months resulting in additional long-term impacts associated with alteration of flows and sediments. Access roads could result in lethal take if constructed across occupied streams. The construction of new access roads is also a potential source of sediment similar to ROW clearing. Direct impacts from access road construction should be rare, but could be locally significant to an MSHCP mussel population. AMM 9, if implemented, would prohibit the construction of access roads within the riparian zone and across occupied streams and preclude lethal take.

NiSource will employ mandatory AMMs 1, 2, 7, 10, and 20, and where technically feasible non-mandatory AMM 9 (all previously described) to minimize the impacts from access roads. AMM 11 will be mandatory in JSM habitat.

Stream Crossings

Stream crossing is the term used to describe how NiSource will repair pipeline, replace pipeline or install a new pipeline under a streambed. Stream, as defined here, includes waterways from the size of headwater streams to the Mississippi River. There are three main methodologies used to cross streams. They are wet-ditch or open cut crossings, dry-ditch, and horizontal directional drill (HDD). In general, wet-ditch crossings are used to cross medium-sized streams, but it is the most versatile of the methods and can be used to cross all but the largest rivers. Dry-ditch is primarily a tool for crossing small to medium–sized streams. HDD is typically used to cross large rivers, but can be used for medium-sized or small streams in certain situations.

Stream Crossing Wet-Ditch

Installing pipeline across occupied streams using the wet-ditch crossing methodology is one of the most invasive activities NiSource conducts along with pipeline removal and the construction of access roads across occupied streams. Wet-ditch stream crossings involve heavy equipment working in the water or from a barge to excavate a trench in the substrate. The wet ditch procedure is carried out in the flow (without coffer dams). Typical construction practice would involve constructing the crossing during low water season (i.e., late summer and early fall). NiSource BMPs dictate that stream crossings are implemented by a designated stream-crossing construction crew and are completed quickly (usually in less than 48 hours but could be significantly longer for a wide/deep or difficult crossing). Wet-ditch crossings have similar pathways, stressors, and impacts to those of other instream activities (i.e., crushing or dislocating mussels and introduction of contaminants and sediment). The main difference is that unlike many other actions, wet-ditch crossings do not use coffer dams to contain sediment generated by the construction. The scope of these impacts is nearly the entire covered lands because wet-ditch stream crossings could occur anywhere within the covered lands except within JSM habitat, where it would be precluded under the MSHCP. Unlike pipeline abandonment and removal and access road construction, the crossing of MSHCP mussel streams for repair, replacement, or installation of new pipeline is expected to occur within occupied habitat of all of the MSHCP mussels during the life of the permit. Pipelines could cross the same occupied stream reach more than once, and more than one stream or stream reach, occupied by one or more of the MSHCP mussel species, could be crossed; therefore multiple populations could be impacted.

A wet-ditch crossing of an occupied stream reach would nearly always result in lethal impacts to mussels in the immediate vicinity of the crossing, as well as, harm to downstream mussels through acute sediment impacts and habitat alteration (lethal impacts would typically be minimized by moving MSHCP mussels out of the immediate construction area, although this may not occur in every instance). Some impacts would be immediate and some, like habitat alteration, would be longer-term.

NiSource would avoid and minimize some impacts through implementation of mandatory AMMs 2, 4, 5, 10, and 20 and where feasible, non-mandatory AMM 9 (all of which have

previously been described). While these AMMs would in many cases reduce the overall impact of a stream crossing, there are no AMMs available that will entirely eliminate take from a wet-ditch crossing.

Stream Crossing Dry Ditch (dam and culvert, steel dam and culvert, and dam and pump)

We would expect there to be both direct and indirect impacts from all dry-ditch crossing methods. The pathway and stressors from this activity would be similar to those from pipeline removal and construction of access roads across a stream. All three activities typically involve construction of temporary coffer dams that delimit the construction area and require pumping or bypassing stream water under or around the enclosed construction zone. All three dry-ditch methods would dewater an approximately 75-foot length of stream and disturb some or all of the streambed within the coffer dams. Sediment impacts are also possible downstream of the work zone, although the combination of coffer dams and re-routing flow around the construction area would reduce sediment levels downstream compared to a wet-ditch crossing. The scope of this activity would be anywhere within the covered lands, however, dry- ditch methods are typically confined to comparatively shallow streams less than 100 feet wide. Because dry-ditch crossings would typically have less impact (particularly downstream sediment impacts) this method would be preferred to a wet-ditch crossing, where feasible, in MSHCP mussel occupied streams.

Dry-ditch crossings would nearly always result in mortality and harm to mussels within the immediate project area (75-feet within the coffer dams). Unlike wet-ditch crossings, we would not expect additional harm and mortality downstream of the downstream coffer dam. Minor sediment impacts are anticipated outside the coffer dams, but these are not expected to impact mussels beyond 100 feet downstream of the downstream coffer dam. This understanding of the effectiveness of dry-ditch crossings to limit impacts will be evaluated in the adaptive management component of the MSHCP.

Impacts would be minimized by the employment of mandatory AMMs 2, 4, 5, 10, and 20 and where feasible, non-mandatory AMMs 1 and 9 (all previously described). AMM 11 (described above) would be mandatory in JSM habitat.

Stream Crossing using HDD

HDD involves drilling under the stream (often 50-100 feet beneath the stream bed) and then pulling the welded sections of pipe through the bore hole. It is often the only feasible method to cross very large rivers. It is also the most limited of the crossing methods because it requires a significant amount of space on either side of the channel and specific geological conditions beneath the streambed to be successful. HDD is often requested by resource agencies when sensitive streams must be crossed because when successful, there are essentially no impacts to the aquatic environment. Significant impacts, however, can occur in the form of frac-out when HDD is unsuccessful. The scope of HDD is anywhere within the covered lands, but as previously stated, it is typically reserved for large rivers. HDD may also be employed anywhere where

wet-ditch or dry-ditch methods would be particularly destructive, and where the geology and other factors indicate HDD could be completed successfully.

The stressor is principally fine sediments (bentonite) from frac-out, although there is the potential for small amounts of other contaminants to be present. Frac-out is the unintentional escape of drilling muds into the stream from a breach in the earth surrounding the bore hole. Stream crossings using HDD have the potential for both large-scale and minor frac-out. Large-scale frac-outs usually result when the geologic conditions under the streambed permit a rupture in the earth between the bore hole and the stream bed. Drilling muds (primarily bentonite with small amounts of other substances) and the surrounding earth are then pushed under high pressure through this breach into the stream. A large volume of material can escape into the water body during a large-scale frac-out. Minor frac-outs occur as a result of the same processes, but only small amounts of drilling muds escape into the stream – they are more common, but much less harmful, in part because HDD is typically implemented in larger streams where small-scale frac-outs are quickly dispersed by the flow. We expect that the AMMs employed in association with this activity should cause major frac-outs to be extremely unlikely; therefore HDD would result in only minor, aggregate-level impacts to MSHCP mussels and their habitat.

NiSource will employ AMMs 2, 3, and 13 to minimize the effects of small frac-outs and the occurrence of large-scale frac-outs.

AMM 3 requires an HDD plan that explicitly considers mussel resources. It encompasses geophysical and other data designed to ensure that HDD is appropriate at any given site and that frac-out potential, in particular, major frac-out potential is minimized.

Storage Wells Clearing and Drilling

Storage wells are large underground sites confined to areas where natural formations (hundreds and more commonly thousands of feet below the surface) are conducive to storing natural gas. The primary impact from these sites on MSHCP mussels relates to the construction and operation of the well-heads (typically dozens per well) used to introduce and withdraw the natural gas. Storage wells occur in the counties listed in Table 1.

Storage well expansion is expected to occur in the following counties: Hocking, Fairfield, Ashland, Knox, and Richland counties, Ohio; Bedford County, Pennsylvania; Allegany County, Maryland; and Kanawha, Jackson, Preston, Marshall, and Wetzel counties, West Virginia. Table 2 indicates the overlap of storage well and storage well expansion counties and counties where there is occupied habitat for MSHCP mussels.

There is habitat for clubshell, northern riffleshell, fanshell, and sheepnose in Jackson and Kanawha Counties, West Virginia and possibly habitat for the clubshell in Fairfield County,

Ohio). [15] Drilling requires the temporary (one to three months is typical) location of drilling equipment on the drilling pad, the drilling operation itself, sediment and water containment, and ingress and egress of vehicles.

The primary impact of storage well drilling on MSHCP mussels is minor aggregate-level sedimentation. There is the potential for a major spill that could impact one or more populations of MSHCP mussels. Major spills, like major frac-outs discussed earlier, are not covered under the MSHCP, but must be evaluated here. A major spill event at a site close to an occupied stream could contaminate the stream and cause take and potential extirpation of local populations.

AMMs 2, 13, and 15 are mandatory to avoid impacts from this activity. AMMs 2 and 13 have been described above.

AMM 15 requires the use of enhanced and redundant measures to avoid and minimize spill impacts from contaminant events in known or presumed occupied streams. These measures include, for example, waste-pit protection, redundant spill containment structures, and on-site staging of spill containment/clean-up equipment and materials.

Storage Well Reconditioning

Within the storage well counties, well-heads can occur virtually anywhere (i.e., wetlands, uplands and floodplains). Storage well clearing involves clearing and contouring some or part of a drilling pad. A typical cleared pad is approximately 400 feet x 400 feet, however, the final area maintained is typically smaller. Clubshell, fanshell and sheepnose all occur in non-expansion storage well counties - clubshell in Coshocton County, Ohio; fanshell in Muskingum County, Ohio, and Wood County, West Virginia; and sheepnose in Columbiana, Coshocton, and Muskingum counties, Ohio, and Wood County, West Virginia (see Table 2).

Enhancement or reconditioning activities for storage wells (reconditioning, acidizing, coil-tubing clean-out, drilling to deepen the well, hydraulic fracturing, re-perforating, and well-bore stabilization) may be required at existing well-heads to increase efficiency or return the well to previous levels of deliverability. This primarily involves activities similar to drilling in that equipment must be transported to the work site, the well pad re-disturbed to some extent, and reconditioning fluids would be present on the site. This could occur within any of the 33 counties in which NiSource maintains storage wells. Table 2 indicates the overlap of storage well and storage well expansion and counties where there is occupied habitat for MSHCP mussels. There is habitat for the following MSHCP mussels within the five storage well counties that overlap occupied MSHCP mussel habitat: clubshell, fanshell, northern riffleshell, and sheepnose.

[15] Identified on the Ohio Field Office website as an occupied county.

The AMMs are expected to avoid all but minor aggregate-level sediment impacts from this activity. As with well drilling, there is the potential for a major spill. The consequences for a large spill entering into MSHCP mussel habitat would be similar to those of a drilling spill.

NiSource will implement AMMs 2, 13, 15 and 17 (all previously described) to avoid impacts from this activity.

Individual Impacts Summary

The following O&M activities are likely to affect the MSHCP mussel species: facilities, vegetation management, upland ROW re-grading, instream ROW stabilization or fill, access road maintenance, cathodic protection, pipeline abandonment and removal, and well abandonment site restoration. Of these only facilities (vehicle traffic) and pipeline abandonment and removal have the potential to cause lethal take of mussels with the mandatory AMMs in place. The take amount from vehicle traffic is expected to be very small. Pipeline abandonment and removal is expected to occur very rarely within MSHCP mussel-occupied habitat, but be potentially significant if it occurs. The chronic effects of comparatively small influxes of sediment from all O&M activities (aggregate sediment impacts), on the other hand, are likely minor, but nearly certain to impact all of the MSHCP mussels during the life of the permit. Chronic sedimentation at levels that would be expected from most O&M activities may degrade habitat and could over time disrupt mussel biology (e.g., feeding) or ecological relationships (e.g., host fish).

New Construction activities that are likely to affect MSHCP mussels include: vegetation clearing, vegetation disposal, grading and erosion control installation, hydrostatic testing (water withdrawal and discharge), re-grading and stabilization of the corridor, access road construction and upgrading, stream crossings (wet-ditch, dry-ditch, and HDD), storage well clearing and drilling, and storage well reconditioning. Of these, vegetation disposal, hydrostatic testing (withdrawal), access roads (new construction), and stream crossings are expected to cause lethal take of mussels (there is a small potential for large-scale frac-out and spills to cause additional lethal take). Lethal take from vegetation disposal is expected to be very small because driving across MSHCP mussel streams outside the existing construction zone to dispose of vegetation is unlikely. Should it occur, the footprint and the potential for take would be small. Similarly, take from the withdrawal of hydrostatic test water is significantly limited by mandatory AMMs, but certain life history stages (e.g., gametes, glochidia, and small juveniles) could be susceptible. This is expected to be very minor and is further ameliorated by the fact that these life history stages have a very low survival rate under natural conditions.

The construction of new access roads outside the construction footprint of a stream crossing (note that if it occurs within that footprint the mussels would already be impacted) is expected to occur rarely, but would result in take comparable to crossing a stream with a pipeline. This action could have significant impact on the mussels in the immediate vicinity of the access road. Stream crossing is the most widespread and common NiSource activity that causes lethal take of mussels. The reasonable worst case scenario predicts stream crossings for pipeline repair,

replacement, or for a looping (new) pipeline would occur at every stream crossing in the NiSource system over the life of the permit and would impact every MSHCP mussel species.

Take from these activities could be locally significant causing lethal impacts and harm and harassment to nearly all mussels within the immediate vicinity of the pipeline crossing. We used a model similar to one used in the MSHCP to establish a reasonable worst case scenario take estimate for each species from ground-disturbing covered activities. The model used here, however, is refined using density estimates from primarily non-quantitative evaluations of density (e.g., species is very rare) from 5-Year Reviews and other relevant documents. Those take estimates are: 33,796 clubshells (166 acres of habitat), take of 12,502 northern riffleshells (165.3 acres of habitat), take of 49,846 fanshells (283.2 acres of habitat), take of 3,883 JSMs (12.8 acres of habitat), and take of 4,648 sheepnose (229.6 acres of habitat) over the 50-year life of the permit. For all of the MSHCP mussel species, the habitat area impacted is estimated as the (length of the stream reaches impacted) x (average width of the streams). [16] The numbers for take of animals (except for JSM) are based on the use of the wet-ditch or dry-ditch crossing technique depending on the width of the stream (streams less than 100 feet wide are assumed to be crossed using dry-ditch methods). All JSM crossings will be dry-ditched. The sediment transport model estimates a lethal impact area covered by 0.236 inches of sediment. A sediment plume is predicted to extend further downstream corresponding to a harm/harassment area having a 600 mg/l concentration of suspended sediment (Ellis 1936; Aldridge et al. 1987). The dry-ditch model estimates a 75-foot lethal zone within the coffer dams and a 100-foot harm/harassment zone downstream of the coffer dams.

In conclusion, although we do not know the precise locations where pipeline removal, access road construction, looping projects, or other activities will occur within the covered lands, it is likely that at least a portion of these projects will occur within the occupied habitat of all of the MSHCP mussels. The number of individuals impacted over the 50-year life of the permit represents the effect of multiple pipeline crossings over each stream with a known population of one or more of the MSHCP mussels, and estimated populations of those species at each site. Based on the information available, NiSource will cause lethal take of some number of animals of each MSHCP mussel species. The actual number of animals taken will depend not only on the number and location of NiSource projects and which non-mandatory AMMs they choose to implement (e.g., survey and relocate or HDD), but also the number of animals present in the area of impact at the time of the project.

Impacts to Populations and Species Rangewide

Building on the on the assessment of impacts to individual animals, we will now evaluate how these individual responses affect the populations to which these mussels belong.

Impacts of Mitigation (all MSHCP mussels)

This sections discusses NiSource's commitments to mitigate for the anticipated impacts to the MSHCP mussels, and the expected effects of this mitigation on the affected mussel populations.

Where take of mussels cannot be avoided, NiSource will employ mitigation to fully compensate for the impact of the take. For impacts to habitat wherever HCP mussels occur, NiSource will restore the disturbed stream bed and riparian area within its ROW resulting from its activities. Restoration will occur during the same construction season (next appropriate planting season for riparian restoration) as impacts unless there are extenuating circumstances and the USFWS is informed of those issues. The basic restoration will be conducted in accordance with standard industry specifications as defined in the ECS and required by FERC and other relevant regulatory agencies. This will involve, at a minimum, restoration of any impacts to the depth, flow, channel bottom, and/or banks as nearly as practical back to the pre-activity condition. Vegetation restoration must be with site-appropriate native species. As the initial step in compensatory mitigation, NiSource will enhance the restored stream substrate within the construction zone to habitat that is optimal for the mussel species. This would typically involve either replacement or importation of clean, appropriately sized material for mussel re-colonization. NiSource will also enhance, where feasible, any pre-construction deficiencies associated with the depth, flow, bank stability, or riparian vegetation that would be detrimental to mussel recolonization, survival, and reproduction. This enhancement serves as one component of NiSource's overall mitigation program.

A second step in mitigation for mussel impacts is mitigation to compensate for sediment producing and other indirect impact producing activities (Aggregate Take). Mitigation for Aggregate Take will take the form of habitat protection/restoration. The protection or restoration of riparian habitat is designed to reduce the sediment impacts to mussel species by buffering occupied streams. The USFWS expects this to result in improved survival and reproduction of mussels in the mitigation area.

Last, for all species, NiSource has the option described in AMM #1 to relocate mussels as part of a stream crossing project. If the relocation is successful, as discussed in AMM #1, the following mitigation is required in addition to the enhancement and aggregate take mitigation described above. Find, relocate, and monitor the impacted species and other mussels within the assemblage impacted by the project to a suitable site upstream or downstream of the impact zone, and restore riparian habitat at the site of relocation, or at an upstream location as near to the mussel relocation site as possible, at a 1:1 ratio of the acreage amount of in-stream habitat impacted.

We conclude that these mitigation actions will serve to compensate for the impacts to the mussel populations expected from NiSource activities. The mitigation will serve to further reduce pressures and impacts on this species by alleviating threats (e.g., sedimentation) and improving habitat (e.g., enhancement of riparian habitat).

4.1.5.1 Clubshell

Impacts to Populations

The reasonable worst case scenario developed for the MSHCP suggests the potential for comparatively large numbers of clubshell to be taken over the course of 50 years from a small number of ground disturbing activities. In addition, aggregate sediment impacts from several O&M activities could marginally reduce habitat quality and possibly, directly and indirectly affect reproduction - clubshell may be particularly susceptible to sedimentation. While the MSHCP are almost certainly over-estimates take, and the impacts would be spread out over time, population-level effects are possible.

This species occurs at a few locations in very large numbers and high densities (USFWS 2008). For sites having more robust populations of clubshell, the impacts to the population are expected to be comparatively minor and temporary. Conversely, clubshell continues to decline in half of the streams where it was present when listed as endangered in 1993. In some of these streams, such as Fish Creek, Hackers Creek, Pymatuning Creek, and Conneaut Outlet, the species appears to be nearly extirpated (USFWS 2008). Impacts from NiSource activities at sites like the Meathouse Fork, where clubshell may already occur at very low densities, could be significant, but even in streams with small populations, clubshell may be widely dispersed throughout the length of the stream (Bob Anderson 2009, pers. comm.). This would make extirpation of this species from a NiSource crossing less likely.

The following is a discussion of potential NiSource impacts to known populations of clubshell.

<u>Allegheny River (Pennsylvania)</u>

The NiSource pipeline crosses the Allegheny River at one location north of Pool 7, north of the Town of East Brady, Pennsylvania. This is a reach of the Allegheny where clubshell populations are discontinuous, but the overall population in the upper 52 kilometers of the Allegheny may number over 1,000,000 animals (USFWS 2008). The population status at the pipeline is unknown. Under terms and conditions for other species (northern riffleshell), the USFWS will require NiSource to cross the Allegheny River using HDD and therefore limited or no impacts to the clubshell population there are expected.

<u>Big Darby Creek (Ohio)</u>

NiSource pipelines make multiple crossings of Big Darby Creek. One clubshell was found in Big Darby Creek in 2000 and one additional live clubshell was found in 2006 which may indicate a range expansion from Little Darby Creek (USFWS 2008). They were found near the Madison – Franklin County and Madison – Union County lines (Angie Boyer, pers. comm.). One NiSource crossing of Big Darby Creek occurs near the Madison – Franklin county line, the others are several miles downstream from the mussel locations and therefore not likely to result in take in Big Darby at this time. Under terms and conditions for other species, the USFWS will require

NiSource to cross the Big Darby Creek using HDD if practicable, if not NiSource will employ dry-ditch techniques with survey and relocation of mussels. Take may still be possible from loss of relocated animals, but this should be limited.

Elk River (West Virginia)

The Elk River population of clubshell covers approximately 84 km beginning approximately 68 km upstream from the confluence with the Kanawha River. This population appears to be successfully reproducing (USFWS 2008). NiSource pipelines primarily cross the Elk River immediately downstream of the most downstream extent of this population, but NiSource does have the potential to impact the Elk at one location (two crossings in close proximity to one another) just upstream of Clendenin near the downstream end of the population. NiSource activities reviewed in the MSHCP do not have the capability to impact 84 km of stream, but impacts at the downstream end of the mussel assemblage would likely cause take. There is the possibility that NiSource could cross the Elk using a dry-ditch methodology. The Elk River is approximately 150 wide in this area. With an impact zone of 200 linear feet and a clubshell density estimated at $0.1/m^2$ over 50% of the stream bottom, take would be approximately 140 clubshells per action, or approximately 280 clubshell over the life of the permit (two actions). Under terms and conditions, the USFWS will require NiSource to cross the Elk River using HDD if practicable, if not NiSource will employ dry-ditch techniques with survey and relocation of mussels. Take may still be possible from loss of relocated animals, but this should be limited.

Little Darby Creek (Ohio)

The 5-Year Review (USFWS 2008) states that the Little Darby Creek population covers a 13 mile (21 km) stretch of river. It is reproducing and is termed “significant”. The NiSource pipeline only crosses Little Darby Creek at one location near its confluence with Big Darby Creek. Little Darby Creek is a small stream and it is likely that NiSource would cross it with a dry-ditch. Using an average width of approximately 50 feet and take of clubshell over 200 linear feet (coffer dam plus downstream impacts) would equal 929 m^2. Assuming a clubshell density of $1.0/m^2$ (for a robust population) over 50% of the stream bottom, take would equal approximately 465 clubshells per action or approximately 929 clubshells over the life of the permit. Therefore, even with AMMs in place, there is the possibility for significant take at this location. Because of the population’s extent, however, it is unlikely that population-level effects would occur. Under terms and conditions, the USFWS will require NiSource to HDD if practicable or dry-ditch with survey and relocation all crossings of Little Darby Creek. There would likely be some take of clubshell (with dry-ditch from relocation mortality) but this would be limited.

Meathouse Fork (West Virginia)

The status of the Meathouse Fork population in West Virginia is unknown – scattered individuals have been found there. The NiSource pipeline crosses Meathouse Fork in east central Doddridge County at three separate locations. Under terms and conditions, the USFWS will require NiSource to make all crossings of Meathouse Fork using a dry-ditch methodology.

Dry-ditch crossings would limit impacts to a maximum of approximately 200 linear feet of stream at each crossing (Meathouse Fork is estimated to be approximately 50 feet wide at the crossings). For purposes of this analysis a population density of $0.1/m^2$ is assumed for clubshell in Meathouse Fork over 50% of the streambed, which would result in a worst case scenario loss of approximately 140 mussels per crossing (six actions) or 840 clubshell over the 50 year life of the permit.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the rangewide survival and recovery of the clubshell. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

The Clubshell - Northern Riffleshell Recovery Plan (USFWS 1994) requires viable populations in 10 drainages extensive enough to survive a single adverse event and those drainages must be sufficiently protected. The drainages listed for clubshell include the Tippecanoe River (IN), East Fork West Branch St. Joseph River (MI and OH), Fish Creek (IN), Green River (KY), Little Darby Creek (OH), Elk River (WV), French Creek (PA), and Allegheny River (PA), plus two other drainages.

There are 17 known populations of clubshell. Of these, there are eight reproducing or stable populations: Tippecanoe River, Middle Branch North Fork Vermillion River, Green River, Little Darby Creek, Elk River, Allegheny River, French Creek and tributaries, and Shenango River (Fish Creek in Indiana is unknown) along with eight small and less stable populations. Most of the latter are isolated and may not recover without augmentation (USFWS 2008). It is possible, however, that even small apparently non-viable populations could begin to reproduce after a number of years and are potentially important components in the conservation of the species (Bob Anderson 2009, pers. comm.).

As discussed in the population-level analysis, NiSource has the potential to affect five populations; three of which are considered stable/reproducing (Allegheny River, Little Darby Creek, and Elk River) and two (Meathouse Fork and Big Darby Creek) are unknown. The Allegheny and Elk River populations cover many river miles and it is unlikely that NiSource activities would significantly affect these populations. NiSource crosses near the mouth of Little Darby Creek and we would not expect population level effects there. NiSource crosses near one of the animals found in Big Darby Creek. There are potential impacts to this apparently very small population and to the population from crossings of Meathouse Fork. The likelihood of any population being extirpated is small and we would not expect NiSource actions to preclude the survival and recovery of the species.

4.1.5.2 Northern Riffleshell

Impacts to the Population

The reasonable worst case scenario developed for the MSHCP suggests the potential for large numbers of northern riffleshell to be taken over the course of 50 years. Lethal take of northern riffleshell would occur as a result of impacts from NiSource stream crossings and other ground-disturbing activities. Because NiSource activities have the potential to affect only two populations with significant numbers, the Allegheny and the restored/augmented Big Darby Creek populations (recent augmentation efforts have restored a population of several thousand northern riffleshell to Big Darby Creek (Smith-Castro 2009, pers. comm.). Sediments from wet-ditch crossings, however, could harm or harass mussels or degrade habitat for one or more reproductive seasons. Aggregate sediment impacts from O&M activities could marginally reduce the habitat quality and possibly, directly and indirectly affect reproduction of northern riffleshell. Since the species was listed as endangered, populations in Fish Creek, Detroit River, Green River, and Tippecanoe River have undergone severe declines and recent surveys failed to locate living specimens. Although additional surveys are ongoing, northern riffleshell may have been extirpated from these systems (note that the Indiana Department of Natural Resources believes northern riffleshell to already be extirpated in Indiana). All known populations within the project area outside the Allegheny River system (and possibly Big Darby Creek) are small and are likely declining with limited or no recruitment.

The following is a discussion of potential NiSource impacts to known populations of northern riffleshell.

<u>Allegheny River (Pennsylvania)</u>

As with clubshell, this species occurs in very large numbers and at high densities within reaches of the Allegheny River in Pennsylvania. The total population of northern riffleshell in the Allegheny River may exceed 6,500,000 animals (Villella 2007). The NiSource pipeline crosses the middle Allegheny River near the town of East Brady, Pennsylvania. Northern riffleshell populations are known from scattered locations in the middle Allegheny (*e.g.*, near the towns of Kennerdell, Foxburg, Oil City, Parker, East Brady, and downstream to RM 58), where population densities are generally less than $0.1/m^2$. There is the potential for take but no potential for NiSource activities to impact the larger Allegheny River population of northern riffleshell, which is centered miles upstream of the only NiSource crossing. Under terms and conditions, the USFWS will require NiSource to HDD the Allegheny River or survey and translocate mussels if HDD is not practicable to limit take of northern riffleshell.

<u>Big Darby Creek (Ohio)</u>

In 2006, an approximately 8-year-old female northern riffleshell was found during a survey of the lower 20 miles of Big Darby Creek in Pickaway County, Ohio. No other living or freshly dead shells of northern riffleshell have been found during recent surveys of Big Darby Creek. The

draft 5-Year Review (USFWS 2008b) cautions that populations with densities near or below the detection rate may not be practically assessed with quantitative techniques, but concludes that the species may now be extirpated. The NiSource pipeline crosses Big Darby Creek in Pickaway County and if the northern riffleshell persists there in very low numbers, there is potential for NiSource to impact that population. In 2008, the USFWS translocated 1,700 northern riffleshell from the Allegheny River into Big Darby Creek (Battelle Darby Creek Metro Park) in Franklin County, Ohio. In 2010, another translocation of approximately 1,500 northern riffleshell took place in Prairie Oaks Metro Park, also in Franklin County, about eight km upstream of the 2008 augmentation. Monitoring in the spring of 2009 indicated the mussels were still present at Battelle Darby Creek Metro Park, and there were indications that mussels were attempting to reproduce. The NiSource pipeline also crosses Big Darby Creek in Franklin County between U.S. 40 and Interstate 70 near the north (upstream) extent of Battelle Darby Creek Metro Park and about 4.5 km downstream of Prairie Oaks Metro Park. There is some potential, therefore, for impacts to the Battelle Darby Creek Metro Park restored populations, but not the Prairie Oaks Metro Park population unless it expands downstream. NiSource will be required under terms and conditions to HDD Big Darby Creek or dry-ditch, survey and translocate mussels if HDD is not practicable.

Elk River (West Virginia)

The Elk River population is probably extant, but recruitment has not been documented recently. NiSource activities affecting the Elk River in West Virginia could result in take if the Elk River population persists. No northern riffleshell were found during non-quantitative surveys in 2007 and 2008 (Barb Douglas, pers. comm.). The last two live individuals were found in 1993 (USFWS 2008b). The NiSource pipeline crosses the river at multiple locations in the same stream reach, including at one location where the last two live individuals were found. The effect on a population that may already be below a level where it is viable is uncertain. Although few animals would potentially be taken, even a low level of take could be significant relative to the size of the population. Under terms and conditions for other species, the USFWS will require NiSource to cross the Elk River using HDD if practicable, if not NiSource will employ dry-ditch techniques with survey and relocation of all mussels. Take may still be possible from loss of relocated animals, but this should be limited.

Impacts to the Species Rangewide

There is some potential for population-level impacts to northern riffleshell from NiSource activities and the following evaluates the likely impact on the survival and recovery of the species rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs. The Clubshell - Northern Riffleshell Recovery Plan (USFWS 1994) requires viable populations in 10 drainages extensive enough to survive a single adverse event and those drainages must be sufficiently protected. The drainages listed are: Tippecanoe River (IN), Detroit River (MI and

Ontario), Fish Creek (OH), Green River (KY), Big Darby Creek (OH), Elk River (WV), French Creek (PA), Allegheny River (PA) and two additional populations.

The draft 5-Year Review (USFWS 2008b) describes the overall status of the species in the remaining drainages where it is known to occur. There are 13 populations currently identified and of those, there are four, successfully recruiting populations in the Ohio and St. Lawrence River basins, specifically the East Branch Sydenham River, Allegheny River, French Creek, and Ausable River populations. As discussed above, NiSource would potentially affect only one of the four known reproducing populations (the large Allegheny River population). Two other reproducing populations are completely outside of the covered lands. NiSource has the potential to affect one re-introduced population (Big Darby Creek) and one population that may or may not be extant (Elk River). Local impacts are possible to the Allegheny River population, but not to the larger population of millions of animals - the persistence and reproductive potential of this population should not be affected. The Elk River population is apparently very small and may already be extirpated, the last live specimens having been found 20 years ago. Impacts to the two augmented populations (two release sites) of Big Darby Creek in Franklin County, Ohio are not likely to affect populations that cover several miles of stream (in part upstream of the NiSource crossing). Therefore the USFWS does not expect NiSource activities under the MSHCP to preclude the survival and recovery of the northern riffleshell.

4.1.5.3 Fanshell

Impacts to Populations

The reasonable worst case scenario developed for the MSHCP suggests the potential for large numbers of fanshell to be taken over the course of 50 years from a small number of ground disturbing activities. Estimates in the MSHCP almost certainly over-estimate take given that at least two populations (Tygarts Creek - Lick Branch and Barren River both in Kentucky) and possibly the Muskingum River population in Ohio are small. Aggregate impacts over the life of the ITP could reduce the suitability of some occupied fanshell habitat and habitat that could be colonized naturally or through enhancement and reintroduction.

Good range-wide population estimates for the fanshell mussel do not exist, but this species appears to be restricted to 14 known populations; five of these are thought to be reproducing populations, and nine are thought to be small and possibly non-reproducing. The five successfully recruiting populations occur in the Clinch River in Virginia and Tennessee, the Muskingum River in Ohio, and the Licking River, Green River, and Rolling Rock River in Kentucky (USFWS 2009c). There are non-reproducing populations in four additional states. Fanshell has continued to decline even in one of its stronghold populations in the Clinch River; although that population extends over about 138 km, a 1998 Tennessee Valley Authority survey reported that the fanshell comprised less than one percent of the mussels collected at 11 Clinch River quantitative sampling sites in 1979 and 1988 (USFWS 1991a). The fanshell population in the Green River is likely the best of the three remaining reproducing populations. A reproducing population of the fanshell in the Licking River is supported only in the lower portion of the

drainage, however fanshell is present in significant numbers and covers upwards of 161 km of the Licking (Lee Andrews, 2011, Kentucky Field Office pers. comm.).

The following is a discussion of potential NiSource impacts to known populations of fanshell.

Barren River (Kentucky)

If fanshell persist in the Barren River in Kentucky, it is likely as a relic population (USFWS 1991a). The NiSource pipelines makes one crossing of the Barren River (triple pipeline) near the Kentucky-Tennessee state line. The pipelines cross the stream in close proximity to each other. The Barren River is a small stream at this location, and it should be feasible to use dry-ditch crossings. There is the possibility of take even with AMMs in place. The probability of take given the size of the Barren river population and because NiSource makes just one crossing, although with a triple pipeline, is likely small, but the effect on this relic population is uncertain.

Licking River and Unnamed Tributary (Kentucky)

The lower portion of the Licking River in Kentucky supports a reproducing population of fanshell and is one of the strongholds for this species. Fanshell is present in significant numbers and covers approximately 100 miles (161 km) of the Licking River (Lee Andrews, 2011, pers. comm.). In 2010, translocation of fanshell began from the Licking to the Kanawha River in West Virginia. Suitable and possibly occupied habitat for the fanshell may exist in the vicinity of the project in Bracken, Pendleton, Nicholas, and Robertson Counties, Kentucky.

NiSource pipelines cross the Licking River six times, but three of these are located in Rowan and Bath Counties, well upstream of potential habitat. The remaining three cross the Licking River at the Nicholas – Robertson County Line within 1,000 feet (300 m) of each other. In addition, there is one crossing of an unnamed tributary in the same reach. Within these three crossings, there are actually five pipelines that cross the River (two crossings are double lines) - the unnamed tributary crossing is also a double line. The double lines in all cases are approximately 100 feet (30 m) apart or less. NiSource activities could result in significant take in this area because of the size of the population and because of the number of pipelines. The Licking River along the line between Nicholas and Robertson Counties is approximately 100 feet wide and would be a candidate for dry-ditch crossing. Estimating the impact zone as 1,000 linear feet (all of the crossings) multiplied by a 100 foot wide stream equals 9290 m^2 of impact area. An average of the density data available for the Licking is 1.64 fanshell / m^2. Assuming 50% coverage of available habitat yields an estimated take of 7,618 fanshell per crossing action for a total of 15,236 fanshell over the 50 year permit term. Although this reasonable worst case level of take is very large, because of the extent of the population (100 RMs) and the close proximity of the pipeline crossings to each other, concentrating impacts in one area, we would not expect population-level impacts. In order to limit the amount of take, under terms and conditions, the USFWS will require NiSource to cross the downstream Licking River (Nicholas-Robertson Counties) using HDD if practicable, if not NiSource will employ dry-ditch techniques with survey

and relocation of all mussels. Take may still be possible from loss of relocated animals, but this should be limited.

The Muskingum River (Ohio)

There is a small population of fanshell in the Muskingum River likely confined to the reach in Washington County, Ohio with the greater portion of it below the Devola Lock and Dam where a fanshell reintroduction project occurred in 2010 (Angie Boyer, pers. comm.).

There are three NiSource pipeline crossings of the Muskingum River spread out over several miles in Washington County. Because of the number and position of river crossings, which don't overlap and affect a larger total area, and because the Muskingum is too large in this area to cross using dry-ditch methodologies, there could be impacts to the population of fanshell from NiSource activities over the life of the permit. Downstream impacts of an open-cut crossing are estimated at 5,178 feet. Using an estimated river width of 341 feet results in a total impacted area of 82,049 m^2 (50% occupied habitat). The fanshell population is considered small in the Muskingum, therefore an estimated density of 0.01 fanshell / m^2 was used yielding a take of 821 fanshells for each crossing. We assume only one major impact for large rivers so the reasonable worst case scenario take over the 50 year life of the permit would be 2,463 fanshells. This potential level of take indicates that NiSource activities could have population-level impacts in the Muskingum River, however, because the most downstream NiSource crossing is still approximately five miles upstream of Devola Lock and Dam (and the other two crossings are further upstream), it is unlikely that the more robust populations downstream, and especially downstream of the structure would be impacted. Under terms and conditions for another species, the USFWS will require NiSource to make the downstream crossings of the Muskingum River using HDD if practicable. If not, NiSource will survey and relocate all mussels. Take may still be possible from loss of relocated animals, but this should be limited.

Ohio River and Smith Branch, Little Sandy River, Coal Branch (Multiple States)

Multiple crossings of the Ohio River have the potential to affect the fanshell. The size and exact location of the Ohio River populations is largely unknown. NiSource crosses the River seven times between West Virginia and Ohio and between Kentucky and Ohio: once between Lawrence County, OH and Wayne County, WV; once between Lawrence County, OH and Boyd County, KY; once between Brown County, OH and Mason County, KY; once between Lawrence County, OH and Greenup County, KY; once between Scioto County, OH and Greenup County, KY; once between Gallia County, OH and Mason County, WV; and once between Meigs County, OH and Jackson County, WV. In addition, there are three crossings of tributaries to the Ohio (Smith Branch; Little Sandy River; and Coal Branch all in Greenup County, Kentucky) that have the potential to affect an Ohio River population.

NiSource impacts to Ohio River fanshell populations would be limited because NiSource will employ HDD for any pipeline replacement or any new lines across the Ohio. Because of the volume of water flowing in the Ohio, sediments from tributary crossings would be unlikely to

have a significant impact on mussels in the mainstem, but the USFWS recommends that all tributary streams (crossed within a mile of the mainstem) be crossed using dry-ditch techniques or included in the HDD crossings of the mainstem. We do not expect NiSource to affect the persistence or reproductive potential of the entire Ohio River population.

Tygart's Creek and Lick Branch (Kentucky)

Lick Branch is a tributary of Tygart's Creek. The fanshell population in Tygart's Creek has been classified as relic by the USFWS (USFWS 1991a). If extant, this population is likely small and non-reproducing. NiSource pipelines make one crossing of Tygart's Creek (triple line) all within an approximately 150 foot (45 meter) reach of stream. Tygart's Creek is a relatively small stream in this area and there is potential to use a dry-ditch methodology to cross the stream. The NiSource pipeline crosses Lick Branch near its confluence, making impacts from the Lick Branch crossing a potential source of impacts on mussels in Tygart's Creek. Under terms and conditions, the USFWS will require NiSource to cross Tygart's Creek using a dry-ditch methodology to limit potential impacts to this population. Depending on the location and number of mussels in Tygart's Creek, NiSource activities could still result in take. The effect of that take on a relic population is uncertain.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the fanshell rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

The recovery plan for the fanshell (USFWS 1991a) identifies the following as population goals for de-listing: protection of existing populations and identifying or establishing a total of 12 viable populations that would be unlikely to be significantly impacted by a single event. Of the 12 populations, two should be in the upper Tennessee River system, two in the middle to lower Tennessee system, one in the Cumberland River system, three in a Kentucky tributary to the Ohio River other than the Cumberland River, one in the Allegheny River system, one in the lower Muskingum or Walhonding River system, one in the Kanawha River system, and one in the Wabash River system.

As discussed above, NiSource has the potential to affect two of the stable, reproducing populations (Muskingum River in Ohio and Licking River in Kentucky), two small, possibly non-reproducing populations (Tygart's Creek and Barren River), and the population in the Ohio River where the status is largely unknown. NiSource activities would potentially affect five of the approximately 13 known populations including one of the strongholds of the fanshell mussel in the Licking River. NiSource will not affect the persistence or reproduction of the fanshell population of the Ohio River because all crossings will be made using HDD. The recovery plan

indicates the need for three Ohio River tributary populations in Kentucky. In 1991, the Tygart's Creek and Barren River populations were considered small and non-reproducing and may now be extirpated. NiSource activities are not expected to cause serious degradation of habitat, so while there could be limited take in these streams, it does not seem likely that NiSource will have a determining effect there. A comparatively large amount of take is possible in the Licking River, but it would occur within a geographically small area and while locally significant, would not affect a population that extends for 100 miles of river. NiSource crosses the Muskingum River at three sites several miles apart within known occupied habitat for the fanshell. Some take is likely from NiSource activities, but we do not expect population-level impacts. NiSource activities have the potential to affect multiple fanshell populations, but will not preclude the survival or recovery of this species.

4.1.5.4 James Spinymussel

Impacts to Populations

This section evaluates the effects of the proposed action on the James spiny mussel Table C6 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for the above species and was intended to be read in concert with and support this effects analysis section.

The reasonable worst case scenario developed for the MSHCP indicates take of several thousand JSM from a comparatively large number of NiSource ground-disturbing activities (approximately 79 stream crossings). Aggregate impacts over the life of the ITP could further reduce the suitability of both occupied habitat and habitat that could be colonized naturally or through enhancement and reintroduction. Although the draft 5-Year Review (USFWS 2008c) states that JSM habitat in all occupied watersheds has been modified by the input of sediments to some extent, it is possible that the relatively large number of crossings within the James River watershed make aggregate impacts more problematic. Estimates of take are likely inflated because the estimates assume a JSM population at every NiSource stream crossing; it is likely that only a small fraction of streams at those crossing sites harbor JSM. The recovery plan for the JSM (USFWS 1990) requires populations throughout the Craig Creek drainage (including Johns Creek) and 80% of all other known populations to be stable or expanding with evidence of recent recruitment. Populations in at least four streams must be distributed widely enough to avoid extirpation by a single adverse event. In order to delist, re-establishment or discovery of viable populations in two additional rivers or three river segments within the James River drainage, each having at least three population centers, will be necessary.

There are no reliable population estimates for the JSM. Based on the draft 5-Year Review, there are 20 known populations (USFWS 2008). Limited knowledge of abundance and range at the time of listing makes it difficult to determine whether the JSM populations, over the long

term, are increasing, stable, or declining. Data suggest that seven of the known populations may be extirpated, three (possibly four) appear to be reproducing, and reproductive status of an additional five known populations is undetermined. Current records submitted by surveyors, however, suggest reproduction throughout much of the known range (USFWS 2008c). It is clear that this species typically occurs at low densities (often less than 10 individuals per assemblage) and that even populations that are considered stable, such as those in Johns Creek, Mill Creek, South Fork Potts Creek, and the South Fork Mayo Rivers in Virginia support only about 300-800 individuals (USFWS 2008c). A large population of JSM was discovered in 2010 in Dicks and Little Oregon creeks in Virginia and is estimated to harbor more than 700 animals (Kimberly Smith, personal comm.). Likely the largest known population of JSM, it would not be directly impacted by NiSource activities.

The following is a discussion of potential NiSource impacts to known populations of JSM.

NiSource ground disturbing activities would affect four known JSM populations in the James River watershed in Virginia: Swift Run, Buck Mountain Creek, Rocky Creek, and Ward's Creek. Buck Mountain Creek, Rocky Creek, and Ward's Creek are thought to be small, possibly non-reproducing populations. Under terms and conditions, NiSource will survey Swift Run (Virginia) and translocate all mussels including JSM if it is found.

NiSource pipelines make an additional 79 perennial stream crossings in the watershed where the status of the JSM (including the Swift Run population) is largely unknown. Seven of those populations are considered extirpated: Patterson Creek, James River mainstem, Calfpasture River, Little Calfpasture River, Maury River, Pott's Creek mainstem, and Catawba Creek. The remaining streams are potential suitable habitat for JSM. Under terms and conditions, NiSource will survey any newly discovered populations of JSM during the life of the permit within the impact zone of a NiSource project where the status of the population (size, stability, reproductive status) has not already been determined. Populations that are stable or reproducing will be translocated.

Virtually all of the extant JSM streams are small. Representative is the recently discovered population in Dick's and Little Oregon creeks, which occupies a stream that is only a few meters wide. NiSource is bound by the MSHCP to cross all potential JSM streams using dry-ditch techniques and not to do in-stream work during the reproductive period of JSM (15 May to 31 July). In the small streams typically harboring JSM, we would expect this approach to be very successful at confining impacts to within the 75-foot length between the coffer dams.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the JSM rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives,

and criteria may describe those conservation needs. The recovery plan (USFWS 1990c) has the following goal and objectives. The goal is to remove the species from the Federal list of endangered and threatened species by maintaining and restoring viable populations of JSM within its historic range by protecting and enhancing habitat containing JSM populations and establishing or expanding populations within rivers and river corridors which historically contained this species. The first objective of reclassifying JSM as threatened requires: populations of JSM throughout the Craig Creek drainage with 80% of all other known populations stable or expanding with evidence of recent recruitment; populations in at least four rivers (or creeks) distributed widely enough to avoid extirpation by a single adverse event; and adequate protection of these populations. Delisting JSM moreover requires re-establishment or discovery of viable populations in two additional rivers or three river segments within the James River drainage.

JSM has a limited range, confined to the James and Roanoke River watersheds (Dan and Mayo Rivers) in Virginia and North Carolina. NiSource would potentially affect three known populations (considered small, isolated, or non-reproducing) and one population of unknown status, therefore potentially affecting four of the 21 known populations. NiSource would not directly impact any of the most robust remaining populations (Johns Creek, South Fork Potts Creek, Mill Creek, and the Roanoke River drainage), nor the large, recently discovered population at Dicks Creek/Oregon Creek. With 79 stream crossings within the Covered Lands in the James watershed, it is possible that at least some of the un-surveyed streams contain populations of JSM evidenced by the discovery in 2010 of the Dicks Creek/Oregon Creek population. Therefore, some potential exists for NiSource activities to affect currently unknown JSM populations. We expect NiSource's agreement to implement all stream crossings using dry-ditch methodology and a mandatory time of year restriction to avoid population-level impacts. This in conjunction with NiSource's lack of impact on known stable populations will ensure that NiSource activities do not preclude the survival or recovery of the species.

4.1.5.5 Sheepnose

Impacts to Populations

The reasonable worst case scenario developed for the MSHCP suggests the potential for comparatively large numbers of sheepnose to be taken over the course of 50 years from NiSource ground disturbing activities. It is reasonable to conclude that there would be some level of lethal take of sheepnose over the life of the permit, because NiSource activities have the potential to impact multiple populations. Even the more robust sheepnose populations typically contain few animals and thus, while the number of animals taken will likely be much smaller than the reasonable worst case scenario estimates, population-level impacts could still occur. Aggregate sediment impacts from O&M activities could also marginally reduce habitat quality where there is a concentration of NiSource facilities.

Although widely distributed in the Mississippi River system, historical and archaeological evidence indicates that the sheepnose was an uncommon species well before the severe declines of the last 100 years. Based on the sheepnose Final Rule (USFWS 2012a), sheepnose

populations occur in 25 rivers in 14 states. Of these 25 populations, 11 are considered stable or improving: Ohio River (Ohio, Kentucky, West Virginia), Green River (Kentucky), Kanawha River (West Virginia), Allegheny River (Pennsylvania), Clinch River (Virginia and Tennessee), Powell River (Virginia), Tennessee River (Tennessee), Tippecanoe River (Indiana), Kankakee River (Illinois), Meramec River (Missouri), and the Chippewa/Flambeau Rivers (Wisconsin). Because the sheepnose has only recently been listed as federally endangered, no recovery plan has been written. However, the status assessment recommends that streams, stream reaches, and watersheds should be prioritized for protection in order to preserve the best existing populations and stream reaches. NiSource activities would impact the following known populations of sheepnose, most of which exist in low numbers or are restricted to small stream reaches, or both.

The following is a discussion of potential NiSource impacts to known populations of sheepnose.

Allegheny River (Pennsylvania)

The NiSource pipeline crosses the Allegheny River at one location in the middle Allegheny River north of Pool 7, north of the Town of East Brady, Pennsylvania. The sheepnose population is extant only in the middle portion of the river (likely north of Pool 9) and is considered improving there with good evidence of recent recruitment (USFWS 2012a). Sampling between 2006 and 2008 found sheepnose at 18 of 63 sites over 78 RMs (USFWS 2012a). While it is unlikely that the one NiSource crossing would have population-level impacts, significant take could occur. Under terms and conditions for another species, the USFWS will require NiSource to cross the Allegheny using HDD. If not practical, they will survey and relocate all mussels.

Big Sunflower River (Mississippi)

NiSource crosses the Big Sunflower River in Mississippi with three pipelines (all within approximately 300 feet of each other) at one site approximately 27 river miles downstream of Indianola. The once abundant sheepnose population in the Big Sunflower is now considered small and declining although there is some evidence of recruitment (USFWS 2012a). It may inhabit a 12-15 mile reach upstream of Indianola, however, the Mississippi Field Office confirms that the NiSource crossing is potential sheepnose habitat (David Felder, pers. comm.). Even though the population is centered well upstream of the NiSource crossings, under terms and conditions, the USFWS will require NiSource to cross the Big Sunflower River using HDD or survey and translocate mussels if HDD is not practicable. Whatever the crossing method, it is unlikely that NiSource activities would have population-level impacts on this species.

Kanawha River (West Virginia)

The Kanawha River is a major southern tributary of the Ohio River draining much of West Virginia with headwaters in Virginia and North Carolina. The Kanawha River harbors a small and reach-limited, but recruiting population of sheepnose in Fayette County, West Virginia (USFWS 2012a). The Kanawha population appears to be limited to 5 river miles (8 km) immediately

below Kanawha Falls (USFWS 2012a). No impacts to this population are anticipated because NiSource crossings all occur downstream of the occupied reach of the Kanawha River.

Kentucky River (Kentucky)

Sheepnose in the Kentucky River are considered rare and available habitat is of poor quality because nearly the entire length of the river is pooled behind 14 locks and dams that have been in place for approximately 100 years – the earliest ones well over 150 years (USFWS 2002). The only sheepnose known was discovered in the mid-1990s in the middle reaches of the mainstem (Palisades region). The population is characterized as declining and possibly nearing extirpation (USFWS 2012a). NiSource crosses the Kentucky River four times. Three crossings are within approximately 300 feet (90 m) of each other, and one crossing occurs at an existing bridge. The Kentucky River averages about 250 feet (75 m) wide at the crossing sites and would likely have to be crossed by wet-ditch or HDD. Because of the small population size, paucity of available habitat, and because three of the four NiSource crossings occur in the same area, it seems unlikely that NiSource activities would cause significant take in the Kentucky River, although impacts to the population are uncertain.

Licking River and Unnamed Tributary (Kentucky)

The three downstream crossings and the crossing of the unnamed tributary to the Licking River discussed previously in relation to fanshell are the same crossings that have the potential to affect sheepnose. The situation for sheepnose in the Licking River, however, is much different than that for fanshell. The sheepnose is known from the lower half of the Licking River, but it is considered very uncommon with no recent evidence of recruitment (USFWS 2012a). Under terms and conditions for another species, the USFWS will require NiSource to make the downstream Licking River crossings (Nicholas-Robertson Counties) using HDD if practicable or a dry-ditch methodology if not, which would along with the position of the NiSource crossings, all within approximately 2,500 feet (800 m) of each other, make it unlikely NiSource activities would have significant impacts on sheepnose in the Licking River.

Muskingum River (Ohio)

Sheepnose was historically found throughout the Muskingum River, and in 2002 was considered rare and likely confined to the lower reaches of the River and possibly absent, except for the lower 12 miles (19 km) (USFWS 2002). The Final Rule identifies the Muskingum River as within the current range and distribution of sheepnose, but the population is characterized as declining and possibly nearing extirpation (USFWS 2012a). NiSource crosses the Muskingum River three times (all single pipelines) in this lower section; at least one of these crossings is within the 12 mile reach where sheepnose may remain. The other two crossings are further upstream and outside of the area likely occupied by sheepnose (the second crossing is 14 miles (22.5 km) from the confluence and the third a few miles upstream of that). Some take from open-ditch crossings is possible even with the sheepnose population likely concentrated further downstream. Although population impacts are unlikely, under terms and

conditions, the USFWS will require NiSource to make the downstream (Washington County, Ohio) crossings of the Muskingum River using HDD. If this is not practical, survey and translocation of all MSHCP and non-HCP mussels must be implemented. Take should not rise to a level that will threaten the persistence or reproductive status of this population

Ohio River and Smith Branch, Little Sandy River, and Coal Branch (Multiple States)

There are seven Ohio River crossings and crossings of three tributaries (Smith Branch, the Little Sandy River, and Coal Branch) that have the potential to impact sheepnose populations. These are the same crossings as discussed above under fanshell. The sheepnose comprised on average only 0.2 % of the mussels collected in survey efforts across the upper Ohio River pools between 1969 and 1999 (USFWS 2002). Although the highest number of live individuals collected was only 22 (Belleville Pool), the population is considered viable. As discussed above, NiSource would employ HDD for new pipelines or pipeline replacements in this section of the Ohio River, further reducing the likelihood of impacts. The persistence or reproductive status of sheepnose in the Ohio River would not be affected by NiSource activities. The USFWS recommends that tributary streams be crossed using dry-ditch techniques or included in the HDD of the mainstem.

Impacts to the Species Rangewide

Given that the NiSource project has some potential to cause population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the sheepnose rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

The sheepnose is widely distributed with stable or improving populations in Wisconsin, Illinois, Missouri, Indiana, and Virginia outside of the NiSource impact area (USFWS 2012a). There are additional strong populations within the general area of NiSource covered lands (e.g., Green River and Tennessee River) that would not be impacted by NiSource because of agreements to HDD these streams or the location of crossings relative to the populations. In all, of the 11 populations thought to be stable or improving, six are completely outside of the NiSource covered lands. There is the possibility for take in the Allegheny, Muskingum, and Big Sunflower Rivers should HDD not be practical and should those populations extend into the crossing areas, but we would not expect population-level impacts. Take is likely from two declining populations (Kentucky and Licking Rivers) and there is some potential for NiSource to have population-level impacts on sheepnose in the Kentucky River, depending on the exact location and number of animals, and the actual level of impacts. Because this population is likely to be of limited importance to the species, NiSource activities will not preclude survival or recovery of the sheepnose.

4.1.6 American Burying Beetle

This section evaluates the effects of the proposed action on the American burying beetle (ABB). Table C7 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

The MSHCP prescribes a number of AMMs that NiSource will implement to avoid and minimize impacts on the ABB. Implementation of these AMMs as proposed in the MSHCP is essential to this effects analysis and determinations made within. Specifically, these AMMs reduce impacts to ABB by (1) identifying areas where the species is known (e.g., via surveys) ore presumed to be present (AMMs 1 and 2) and (2) identifying specific actions that will minimize the potential for direct take, particularly death and injury, of ABBs (AMMs 3 and 4). It is important to note that the AMMs in standard font are required where they are applicable, whereas the AMMs in *italic* font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

<u>Determining ABB Habitat Suitability within the Wayne NF Release Site</u>

AMM 1: As previously indicated, the only area of the covered lands where ABB may be present is on the Wayne NF Release Site. NiSource will consider all habitats within 10 miles of the Wayne NF Release Site as suitable for ABBs unless one of the following criteria is satisfied. We concluded that subactivities implemented in areas meeting one or more of these criteria are unlikely to adversely impact ABBs and NiSource can proceed without the need to employ ABB AMMs.

- Total land disturbance of 1.2 acres or less in size.
- Soil that is greater than 70% sand.
- Soil that is greater than 70% clay.
- Land where greater than 80% of the soil surface is comprised of rock.
- Land where greater than 80% of the subsurface soil structure within the top four inches is comprised of rock.
- Land that has already been developed and no longer exhibits surficial topsoil or leaf litter.
- Agricultural land that is tilled on at least an annual basis.
- Land in an existing right-of-way or along an existing roadway.
- Urban areas.
- Stockpiled soil.

- Wetlands (defined as sites exhibiting hydric soils and vegetation)

Surveys to Evaluate the Presence of ABBs within Suitable Habitat

AMM 2: NiSource may otherwise choose to surveys to determine presence or absence within the Wayne NF Release Site. NiSource will conduct surveys to determine presence or probable absence of ABBs within suitable habitat for site-specific new construction projects. The "American Burying Beetle *Nicrophorus americanus* Survey Guidance for Oklahoma - Updated May 20, 2009" provided in Appendix L should be applied. Results of completed surveys will be submitted to the USFWS as part of the annual report. The USFWS will accept the results of these surveys for the purposes of determining whether take must be addressed as provided in the NiSource MSHCP.

Measures to Avoid and Minimize Impacts to ABBs in Known or Presumed Occupied Habitat

Where NiSource is operating in known or presumed occupied ABB habitat, the following AMMs will apply to their activities.

AMM 3: NiSource will implement the USFWS's "American Burying Beetle Nicrophorus americanus Baiting Away Guidance For Projects in Oklahoma - Updated May 20, 2009" (HCP Appendix L) to avoid and minimize impacts to ABBs in documented or presumed occupied habitat within the Wayne NF Release Site by using bait to lure ABBs out of the impact area. Landowner permission is required to complete this avoidance and minimization measure because application of this measure would take place outside of the immediate project footprint.

AMM 4: If implementation of #3 is not possible, NiSource will implement the USFWS's "American Burying Beetle Nicrophorus americanus Trapping and Relocating Guidance in Oklahoma - Updated May 20, 2009" (HCP Appendix L) within the construction work area to avoid and minimize impacts to ABBs in documented or presumed occupied habitat within the Wayne NF Release Site by relocating ABBs collected within or adjacent to the construction work area to protected areas on within the Future old forest management area on the Wayne NF within the 10-mile release unit. The exact location of relocation would be determined on a case-by-case basis in consultation with the Wayne NF and the Ohio Field Office.

IMPACTS TO INDIVIDUALS

Subactivities Having No Effect on the Species

The vast majority of the proposed subactivities will have no effect on the ABB (see Table C7, Appendix C; NE subactivities). Most of these activities are not expected to occur in ABB habitat. For example, streams and wetlands are not ABB habitat and thus, activities in those areas will not affect the species. Other activities that could impact the individual ABBs, such as vegetation management, but NiSource has agreed not to perform those activities during the

ABB active period in Ohio (April 15 – August 1). Activities involving access road management could impact the ABB, including herbicide use and general habitat loss from road development; however, these activities are expected to occur within the existing disturbance of roadways which do not provide suitable habitat and thus, will not affect the species.

Subactivities Not Likely to Adversely Affect the Species

There are a few subactivities that may affect, but are not likely to adversely affect the ABB (see Table C7, Appendix C; NLAA subactivities). Herbicide use for vegetation management could adversely impact ABBs through habitat loss or lethal exposure to individuals, but NiSource has agreed not to perform those activities during the ABB active period in Ohio (April 15 – August 1), making exposure unlikely that there would be no detectable impacts to the species. Storage well waste pits and abandonment of pipelines and well sites all could impact ABBs through exposure to chemical contaminants and habitat loss (vegetation removal). However, these activities are expected to occur only occasionally in ABB habitat making effects or take from these impacts very unlikely, especially given the low density of beetles present. Further, the habitat in the immediate vicinity of storage will and pipeline facilities tends to be disturbed and unlikely to provide suitable ABB habitat.

Subactivities Likely to Adversely Affect the Species

There are a total of six subactivities primarily within New Construction that are expected to adversely impact the ABB (see Table C7, Appendix C; LAA subactivities). The type and magnitude of these impacts are discussed below.

Take of ABBs from NiSource activities would occur primarily from impacts from the installation of pipeline across occupied habitat. Individuals may experience direct impacts that range from minor nuisance (e.g., short-term nearby noise) to death (e.g., clearing of occupied habitat while beetles are present). While implementation of AMMs should significantly reduce the likelihood of direct take (i.e., mortality) occurring, it is still possible at low levels.

The ABB is a habitat generalist and the fragmentation from the construction of pipelines should not be a barrier to movement. We expect, however, that the clearing of occupied habitat will displace all beetles within the area. This includes ABBs, as well as all other carrion reliant beetles that are present. These displaced beetles are expected to move into the remaining suitable habitat present immediately adjacent to the action area. It is likely that displaced individual beetles will experience lower survival rates (i.e., harm) when competing against other beetles that have already established territories and are familiar with the area. The displaced beetles will need to increase energy expenditures since they will be required to increase commuting distances to traditional foraging areas, and/or expend additional energy seeking new foraging sites.

Actions involving vegetation removal could affect ABB habitat. Tree trimming, along with other vegetation clearing actions, may increase the amount of edge habitat favored by other carrion-

reliant beetles that share the area, thus increasing competition for ABB. The feeding habits of ABBs are similar to those of other carrion reliant beetle species known to exist within the covered lands. Therefore, competition between those species may be pronounced as all species move quickly into adjacent habitat. Vegetation removal may also destroy habitat for the populations of species that the beetle uses as a carrion resource ABBs are known to be reliant upon larger animals (100 to 200 grams) in order to meet their reproductive needs. These animals, such as woodcock and turkey poults, are more sensitive to habitat destruction due to their dependence on more mature forest. Destruction of prey habitat will make it difficult for the ABB to compete with other beetles that use smaller carrion in order to meet their needs.

Impacts to Populations

We expect that the population-level impacts from NiSource activities to this release population will be small, only impacting a small percentage of the ABB release population in this area annually. It is expected that the population, given no other major perturbations, will recover from a NiSource impact within one year assuming that the released beetles continue to reproduce and overwinter. Similarly, habitat impacts are small compared to the overall amount of habitat available. It is expected that the population level impacts to ABB to be within the range of normal disturbance and temporary.

Impacts of Mitigation

The MSHCP outlines NiSource's mitigation commitments for the ABB (MSHCP, Chapter 6, ABB section). The ABB mitigation packages includes a one-time contribution of $15,000 to be used for funding of the existing ABB captive propagation and reintroduction programs.

We conclude that this mitigation action will serve to compensate for the impacts to the ABB expected from NiSource activities. The mitigation will serve to reduce pressures and impacts on this species by increasing overall population size.

Overall, we do not expect any population-level impacts, therefore our effects analysis for the ABB is complete.

4.2 Non-MSHCP Species

4.2.1 Non-MSHCP Mussels

This section evaluates the effects of the proposed action on the non-HCP mussels: dwarf wedgemussel, pink mucket, rabbitsfoot, rayed bean, spectaclecase, and snuffbox. Table C8 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for

this species and was intended to be read in concert with and support this effects analysis section.

In the first section, we focus on the impacts to individuals and then look at how these individual responses affect the populations to which these individuals belong. We then assess how the anticipated changes, if any, at the population level will affect the fitness of the species rangewide. The AMMs developed for MSHCP mussels, which NiSource has agreed to implement for all non-HCP mussel species, reduce exposure and responses. The mussel AMMs are listed in Section 4.1.5 MSHCP Mussels of this BO.

Individual Level Analysis

Activities Having No Effect or Not Likely to Adversely Affect Species

A number of the covered activities will have no detectable effects on the non-HCP mussels (Table C8). In general, several O&M activities involving vegetation management and disposal, pipeline and storage well abandonment related activities, minor ground disturbing O&M activities (e.g., bell holes) and inspection activities are not expected to have an impact on these species because animals will not be exposed to their effects. Similarly, new construction activities involving vehicle operation (impacts from vehicles in new construction are evaluated as part of the specific activity for mussels), vegetation disposal, pipe stringing, activities related to compression and communication facilities, stream crossing structures (these will occur within already disturbed areas), and activities in wetlands are not expected to affect non-HCP mussels.

The following O&M activities: management of vegetation with herbicides, ROW repair in wetlands, and well abandonment; and new construction activities related to: trenching, trenching and grading for wetland crossings, and activities related to storage well waste pits are all not likely to adversely affect the non-HCP mussels because one or more AMMs will minimize or avoid potential effects.

AMM 2 requires that a detailed plan be prepared for any activity with the potential to affect the MSHCP mussels or their habitat. The plan will focus the applicant's attention on the potential presence of non-HCP mussels, and outline measures employed to avoid impacts (e.g., sediment and erosion control, avoidance of impacts to the riparian zone, avoidance of contaminant impacts, and minimization of stream channel impacts). In addition, the plan will require a training session for on-site personnel to highlight the potential sensitivity of the project area. AMM 2 is used in conjunction with many of the other AMMs and alone as a key component of NiSource's avoidance and minimization strategy for non-HCP mussels.

AMM 15 relates to storage well activities and requires the use enhanced and redundant measures to avoid and minimize the impact of spills in known or presumed occupied streams. Examples of measures include redundant spill containment structures, on-site staging of spill

containment/clean-up equipment and materials, and a spill response plan provided to the USFWS as part of the annual report.

AMM 16 prohibits the use of fertilizers or herbicides within 100 feet of known or presumed occupied habitat. In addition, fertilizer and herbicides will not be applied if weather (e.g., impending storm) would compromise the ability to apply the fertilizer or herbicide without impacting presumed occupied mussel habitat.

Activities Likely to Adversely Affect Species

Effects on non-HCP mussels are grouped into two categories, O&M activities and new construction activities. A number of O&M covered activities, including facilities presence and maintenance, components of vegetation management, ROW repair, access road maintenance, and cathodic protection; and new construction activities including vegetation management, ROW repair (in stream and in uplands), access road construction, pipeline abandonment (removal), and well abandonment activities are expected to adversely affect non-HCP mussels (Table C8) even though in many cases AMMs will be implemented that will minimize those effects. In some cases, the O&M and new construction activities are similar (e.g., grading to install a new pipeline versus re-grading of an existing pipeline corridor after repair). Both could impact non-HCP mussels.

Operation and Maintenance

Facilities (Vehicle Traffic and Sediment Impacts of the Pipeline Corridor)

Maintenance of the pipeline facilities requires regular inspection using vehicles (typically pick-up trucks) that drive the pipeline corridor and regularly drive across streams at or near the pipeline crossing where feasible. The potential for crushing mussels is therefore present, but because for the most part vehicle crossing would occur at existing fords or at sites where the area is typically already being disturbed by construction activities, the amount of take would be limited. For larger river species, where fording occupied streams is impractical, there would be no direct take from this activity.

The presence of the pipeline corridor affects non-HCP mussels primarily through contribution of sediment. Mussels are particularly sensitive to sedimentation because of their predisposition to burrow into the substrate (snuffbox and spectaclecase are especially known for this). Excessive sediments can fill the interstitial space in the sand and gravel and preclude normal biological processes. Sediments can affect mussels by degrading habitat, interfering with feeding and reproduction, and importing contaminants. There are at least three pathways for sediment to enter mussel habitat because of the presence of the pipeline corridor: 1) erosion within the stream channel around the pipeline; 2) the 50-100 foot wide corridor (s) crossing watersheds (usually managed in non-native grasses); and 3) the related absence of natural vegetation at the point where the pipeline crosses the stream (this latter could also impact shade and input of organic material). Erosion around the pipeline (within the channel) and

erosion at the point where the pipe crosses the channel (bank slough-off) are episodic and not easily predictable. Both have the potential to cause acute and significant localized impacts. Sediments from the presence of one or more pipeline corridors within the watershed is a long-term impact, but should be minor given the small percentage of the watershed affected and the following AMMs.

AMMs 2, 4, 8, and 19 along with the BMPs NiSource employs routinely (e.g., seeding, and other sediment control measures as described in detail in NiSource's ECS document) should reduce the likelihood of an acute sediment event and limit the chronic sediment impacts of the pipeline corridor (s) to aggregate levels. AMM 2 is discussed above.

AMM 4 requires installation of pipeline to the minimum depth described in the ECS and maintenance of that depth for a sufficient distance landward of the bank to minimize the chances of the pipeline being exposed and thereby adding additional sediment to the stream.

AMM 8 requires annual inspections of existing pipeline crossing sites to identify potential erosion problems early and make repairs before erosion significantly affecting non-HCP mussels can occur.

Non-mandatory AMM 19 prohibits driving across known or presumed occupied streams and requires these streams be walked or visually inspect from the bank using the closest available bridge to cross streams.

Vegetation Management

Vegetation management primarily involves the maintenance of the existing pipeline corridor, which focuses on herbaceous vegetation management (mowing) and brush management (brush hogging or selective herbicide application). The scope of this activity is large and includes the linear component of the covered lands since virtually all of NiSource's extant ROWs will be managed on a regular basis. In some instances, primarily in situations where the ROW has not been adequately maintained, some maintenance tree clearing including clearing using bulldozers or other heavy equipment may occur (NiSource has indicated that any maintenance tree clearing will occur in the first five to seven years of the permit). This has the potential to be in close proximity to non-HCP mussel streams in some cases. Tree clearing affects non-HCP mussels by increasing sediments and by reducing the riparian corridor (minimize shading of the stream) as natural vegetation is permanently removed.

The stressors and impact of sediments from vegetation management are virtually identical and may overlap to some extent with those described above under the heading Facilities. Delivery would be similar in that areas denuded of natural vegetation (or managed vegetation) would lose sediment to streams primarily during rain events.

AMM 2 (described above), in addition to various NiSource BMPs, minimizes the impacts from vegetation management. Most vegetation management will entail mowing and other activities (e.g., brush hogging) with little or no significant impact to non-HCP mussels.

Upland ROW Re-Grading

Re-grading of the ROW removes the vegetative cover (often grasses) from portions of the ROW for short periods of time. Across the entire watershed, over the life of the permit, this activity will contribute small amounts of sediment to non-HCP mussel habitat. This activity is limited to the existing pipeline ROW, but unlike vegetation management, only a relatively small portion of the pipeline ROW would likely have to be re-graded over the life of the permit. Sediment delivery, stressors, and impact would be similar to that for vegetation management where heavy equipment is used.

AMM 2 would be used to provide awareness of non-HCP mussels in the watershed and help ensure they are considered in the re-grading plan, and that all relevant BMPs are implemented toward non-HCP mussel protection.

AMM 16 prohibits the application of fertilizer (during restoration of the re-graded corridor) within 100 feet of occupied habitat or during inclement weather.

In-Stream ROW Stabilization or Fill

This activity involves manipulation of the stream channel and stream bank often in response to erosion around or near a pipeline crossing. Bank re-contouring or reconstruction and the placement of hard points and reticulated mats in the channel are examples of possible stabilization actions. In-stream stabilization and fill projects, if conducted in non-HCP mussel habitat at all, would be extremely limited in number and scope. These actions are primarily in response to specific problems that NiSource will try to preclude (see AMM 8) or solve by other less-invasive methods.

Significant impacts to non-HCP mussels resulting in both direct and indirect take could occur if multiple AMMs were not in place. The impacts could include crushing or burying, alteration of flow, contaminants, and sediment. The pathway for these impacts would be through equipment operating along the bank and in the stream channel, spills of fuel or other contaminants from construction equipment, contaminants imported with fill material, and scarring or denuding of stream banks that result in sediment impacts near the site of the stabilization project. NiSource would implement AMMs 2, 3, 5, 7, 8, 13, 14, and 20, which would result in these activities causing aggregate take of non-HCP mussels (AMMs 2 and 8 are described above).

AMM 3 requires NiSource to evaluate the use of horizontal directional drill (HDD) for major repairs and pipeline replacements and implement HDD in mussel habitat where HDD is likely to be successful based on that evaluation. Although not applicable or feasible in many cases, HDD

offers one option to significantly limit the impacts (by replacing the pipeline at the stream crossing using HDD) where stabilization might be necessary.

AMM 5 requires that in-stream impacts (e.g., weirs, concrete mats, fill for channel relocation) would not occur in most cases, and when implemented would be in conjunction with a stream restoration plan. These in-stream impacts could not rise to the level where take of non-HCP mussels would occur.

AMM 7 requires that equipment bridges used for repair be removed as soon as practicable after work is completed.

AMM 13 requires staging areas be a minimum distance from non-HCP mussel streams to avoid contaminant impacts.

AMM 14 requires that any fill material imported for repairs is free of contaminants that could affect the species or its habitat.

AMM 20 requires the cleaning of equipment working in contact with the stream to reduce the likelihood of introduction of invasive species to non-HCP mussel habitat.

Access Road Maintenance (grading, graveling, culvert replacement)

Access road maintenance typically involves re-grading the roads, occasionally adding gravel, and replacing culverts as necessary. Individually, impacts would be minor, but the scope of this category of impact could be geographically large occurring virtually anywhere in the covered lands (note this activity is not confined to the pipeline corridor ROW). A reasonable worst case scenario, however, would still result in only a few of these actions, including culvert replacements in any occupied watershed in any year.

The primary pathway for impacts from this activity is through culvert replacement, which would nearly always involve soil disturbance in a drainageway, and thus the potential release of sediment into an occupied stream reach. For the most part sediment stressors and impacts would be similar to those described as chronic (aggregate take) under the Facilities heading. Culvert replacement, especially if near an occupied stream, could also result in acute sediment impacts as previously described.

AMM 2 (previously described) would be employed to minimize chronic impacts and avoid and minimize acute impacts from these activities.

Cathodic Protection

Cathodic protection involves constructing a small trench (typically less than a pipeline width trench) to install a charged wire to inhibit pipeline rust and deterioration. This practice is

ubiquitous along the NiSource system and therefore is likely to occur throughout non-HCP mussel occupied watersheds over the life of the permit.

Although widespread, the minimization measures and the minor nature of the ground disturbance (trenches are typically a few inches wide and a few hundred meters long) would result in only aggregate level sediment impacts to non-HCP mussel habitat. The pathway is increased sediment to non-HCP mussel streams because of ground disturbance outside of the construction corridor (cathodic protection trenches are often perpendicular to the pipeline). The stressors and impacts are similar to those already discussed.

NiSource will employ AMM 2 (described above) and appropriate BMPs to minimize impacts from this activity.

Pipeline Abandonment and Removal

Pipeline abandonment and removal has the potential to cause direct lethal impacts to non-HCP mussels. The scope of this activity is the entire covered lands as the necessity to remove a section of pipe because of damage or degradation could occur anywhere. It would be rare, however, and may not be necessary at all to abandon and remove a pipeline from an occupied mussel stream during the life of the permit because abandonment itself is not common and because of the applicant's preference to abandon in place.

The pathways for impacts from this activity are construction equipment working in and near the stream and construction related leaks or spills. The stressors would include crushing, displacement, sediment impacts, and contaminant impacts resulting in both lethal and sub-lethal take of non-HCP mussels. Take of non-HCP mussels (including possible lethal take) would occur even with all mandatory AMMs in place. Under a reasonable worst case scenario this take could be substantial where a pipeline removal project intersected occupied habitat. It is likely that there would be no impact to this species if non-mandatory AMM 12 were implemented (abandonment in place). We do not know how often this could be employed since it can be outside the control of the applicant (i.e., landowners may insist on pipe removal).

A number of mandatory AMMs would be employed to minimize impacts including AMMs 2, 6, 7, 8, 9, 10, 12, 13, and 20. Non-mandatory AMMs 6, 9 and 12 would be employed where technically and otherwise feasible. AMMs 2, 7, 8, 13, and 20 are described above.

AMM 6 directs replacements/repair be conducted from a lay barge or temporary work bridges rather than operating heavy equipment in-stream.

AMM 9 prohibits construction of culvert and stone access roads and appurtenances (including equipment crossing) across the waterbody or within the riparian zone.

AMM 10 specifies use of half pipes (where access roads or equipment bridges are employed) of sufficient number and size that both minimize impacts to stream bed and minimize flow disruption to upstream and downstream habitat.

AMM 12 requires abandonment in place, which would result in no proximal impacts (erosion around the abandoned pipe could still be an issue).

Well Abandonment Site Restoration

This activity involves restoration of an abandoned storage well-head site. This would typically involve removal of structures, re-grading, and re-vegetating the site. Well-head sites are typically small (400 feet x 400 feet). They are limited to the storage well counties. The stressor pathway for this activity is heavy equipment operating on and around the well-head. The primary stressor is sediment input to MSHCP mussel habitat. Well abandonment site restoration does not affect rayed bean and dwarf wedgemussel because no storage well counties intersect their habitat.

We would expect the effects of well abandonment site restoration to be a minor component of aggregate sediment impacts.

AMM 2 described above would be implemented to minimize the minor sediment impacts expected to occur as the result of site restoration on small well abandonment sites.

New Construction

Vegetation Clearing

Clearing vegetation (herbaceous, shrubs, or trees) using mechanical means (e.g. bulldozers) for a new construction project (typically outside the ROW within the one-mile corridor) has the potential to contribute additional sediments to non-HCP mussel habitat. We would expect these impacts to have a large geographic scope since new construction could occur anywhere within the covered lands. Except in those cases where the species is confined to one or a very few stream reaches, even worst case scenario new construction vegetation clearing would likely impact only a small subset of occupied streams for any mussel in any year.

The pathway, stressors, and impacts of these sediments are similar to those described above. Vegetation clearing for new construction will result in aggregate level sediment impacts to non-HCP mussel habitat. In the case of tree clearing, there could also be impacts to the riparian corridors of occupied streams.

NiSource will employ AMM 2 and other relevant BMPs (e.g., reducing the corridor width at stream crossings) to minimize the effects of this activity.

Vegetation Disposal

Vegetation disposal involves the dragging, chipping, hauling, piling, and stacking of cleared herbaceous vegetation, trees, and brush. The stressor pathway is primarily crushing individuals as heavy vehicles ford streams to haul cleared vegetation to suitable storage sites. The scope of this activity is small, confined to very specific situations, and is expected to be rare in non-HCP mussel habitat. It might occur, for example, where cleared vegetation has to be moved from a steep slope on one side of a fordable stream to a comparatively flat storage area on the opposite bank. This activity could result in lethal take, but the impact area (where trucks crossed the stream) and the amount of take would in most cases be small.

AMM 2 and non-mandatory AMM 19 both previously described are available to minimize impacts. If implemented, AMM 19 would eliminate impacts from this activity.

Grading and Erosion Control Installation

Grading and installation of erosion control devices would likely occur on essentially the same footprint as vegetation clearing. Grading and erosion control installation, because it would produce additional ground disturbance and would extend the time period of potential impacts, has the potential to result in additional sediments entering non-HCP mussel habitat. The pathway, stressors, impacts, and scope of these activities would closely match those of vegetation clearing described above. The level of effect would be aggregate sediment impacts.

NiSource will employ AMM 2 (previously described) and other relevant BMPs to minimize the effects of this activity.

Hydrostatic Testing (water withdrawal and discharge)

Hydrostatic testing involves pumping water (in some cases millions of gallons) into new or existing pipelines and putting that water under pressure within a section of pipeline (sometimes several miles long) in order to evaluate the integrity of the pipeline section. This water can be drawn from and discharged into streams. Hydrostatic testing is a standard practice within the pipeline industry and could occur multiple times over the life of the permit and could occur anywhere within the covered lands that pipeline exists.

Water withdrawal has the potential to entrain small life stages of non-HCP mussels, alter flow, and expose non-HCP mussels and their habitat to contaminants or invasive species. The primary stressor pathway is the introduction of invasive species, the introduction of sediments and contaminants, and the entrainment of gametes and small juvenile mussels that would be in the immediate vicinity of the withdrawal pipe. Hydrostatic test water withdrawal could result in lethal take of young mussels. Hydrostatic test water discharge would produce aggregate level amounts of sediments over the life of the permit.

NiSource will employ AMMs 2, 17, 18, and 20 (AMMS 2 and 20 are discussed above) to avoid and minimize impacts from this activity. AMMs 18 and 20 should effectively minimize the risk of contaminants and invasive species. AMM 2 will direct NiSource to avoid water withdrawal from mussel streams and where there is no other option, AMM 17 should greatly reduce potential take of vulnerable life history stages of non-HCP mussels.

AMM 17 dictates that hydrostatic test water will not be obtained from known or presumed occupied habitat unless other water sources are not reasonably available. To prevent desiccation of mussels, water from known or presumed occupied habitat will be withdrawn in a manner that will not visibly lower the water level as indicated by water level height on the stream channel bank. Finally, appropriately sized screens, withdrawal rates, and a withdrawal point sufficiently above the substrate will be employed to minimize direct impacts to mussels.

AMM 18 prohibits discharge of hydrostatic test water directly into known or presumed occupied habitat. Water will be discharged in the following sequence: down gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge; then discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (as above) prevent such discharge; then discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices to minimize effects to the waterbody.

Re-grading and Stabilization of the Corridor

Re-grading and stabilization of the pipeline corridor has the potential to result in additional sediments and possibly contaminants, (e.g., fertilizers) entering non-HCP mussel habitat. The pathway, stressors, and impacts would be similar to upland ROW re-grading discussed in the O&M section above. This activity would occur on the same footprint as the grading and erosion control activity, but would occur on a much smaller scale as this activity would primarily involve comparatively small sections of the corridor where repairs, removed in time from the original grading, become necessary. We would expect the AMMs to minimize further what would likely be minor additional inputs of sediment and contaminants to non-HCP mussel habitat.

NiSource will employ AMMs 2 and 16 (both previously described) to minimize the impacts.

Access Road Construction and Upgrade

Constructing new and upgrading existing access roads has the potential for direct and indirect impacts to non-HCP mussels. A worst case scenario would involve a new access road constructed across an occupied stream at a different time from, or outside the construction ROW of a stream crossing or pipeline removal. The scope of these impacts is the entire covered lands since access roads could be constructed anywhere in the watershed. How many miles of access roads NiSource would construct in the watershed of any occupied mussel stream is unknown, but likely the number would be very small since most access roads (whether public roads or those constructed by NiSource) already exist to serve the pipeline corridor. Moreover,

a permanent access road that actually crosses a stream would be unlikely because of the need to construct a permanent bridge.

The pathway, stressors, and impacts, including level of direct take, of this activity would be similar to those of pipeline removal (i.e., crushing or dislocating from heavy equipment, contaminants, and sediment). Temporary roads would often be in place for months resulting in additional long-term impacts associated with alteration of flow and sediments. Access roads could result in lethal take if constructed across occupied streams. The construction of new access roads is also a potential source of sediment similar to ROW clearing. Direct impacts from access road construction should be rare, but could be locally significant to a non-HCP mussel population. AMM 9, if implemented, would prohibit the construction of access roads within the riparian zone and across occupied streams and therefore preclude lethal take.

NiSource will employ mandatory AMMs 1, 2, 7, 10, and 20, and where technically feasible non-mandatory AMM 9 (all previously described) to minimize the impacts from access roads.

Stream Crossings

Stream crossing is the term used to describe how NiSource will repair pipeline, replace pipeline or install a new pipeline under a stream. Stream as defined here runs the gamut from headwater streams to the Mississippi River. There are three main methodologies used to cross streams. They are wet-ditch or open cut crossings, dry-ditch, and HDD. In general, wet-ditch crossings are used to cross medium sized streams, but it is the most versatile of the methods and can be used to cross all but the largest rivers. Dry-ditch is primarily a tool for crossing small to medium–sized streams. HDD is typically used to cross large rivers, but can be used for medium-sized or even small streams in certain situations.

Stream Crossing Wet-Ditch

Installing pipeline across and occupied stream using the wet ditch crossing methodology is one of the most invasive activities NiSource conducts along with pipeline removal and the construction of access roads across occupied streams. Wet-ditch stream crossings involve a backhoe and other heavy equipment working in the water or from a barge to dig a trench in the substrate. In the wet-ditch procedure, this is carried out in the flow (without coffer dams). Typical construction practice would be to conduct the crossing during a low water time of the year (e.g., late summer) and NiSource BMPs dictate that stream crossings are done by a designated stream crossing construction crew and are completed quickly (usually in less than 48 hours). Wet-ditch crossings have similar pathway, stressors, and impacts to those of other in-stream activities (i.e., crushing or dislocating from heavy equipment, contaminants, and sediment). The main difference is that unlike many other actions, wet-ditch crossings do not use coffer dams to contain the sediments generated from the construction. The scope of these impacts is the entire covered lands since wet-ditch stream crossings could occur anywhere. Unlike pipeline abandonment and removal and access road construction, the crossing of non-HCP mussel streams for repair, replacement, or installation of new pipeline is reasonably

expected to occur within occupied habitat of all of the non-HCP mussels during the life of the permit. Pipelines could cross the same occupied stream reach more than once, and more than one stream or stream reach occupied by one or more of the non-HCP mussel species could be crossed and therefore multiple populations impacted.

A wet ditch crossing of an occupied stream reach would nearly always result in lethal impacts to mussels in the immediate vicinity of the crossing, as well as, harm to additional animals through acute sediment impacts and habitat alteration (lethal impacts would typically be minimized by moving non-HCP mussels out of the immediate construction area although this may not occur in every instance). Some of the impacts would be immediate and some, like habitat alteration, would be longer term.

NiSource would avoid and minimize some impacts through employment of mandatory AMMs 2, 4, 5, 10, and 20 and where feasible, non-mandatory AMM 9 (all of which have previously been described). While these AMMs would in many cases reduce the overall impact of a stream crossing, there are no AMMs available that will entirely eliminate take from a wet-ditch crossing.

Stream Crossing Dry-Ditch (dam and culvert, steel dam and culvert, and dam and pump)

We would expect there to be both direct and indirect impacts from all dry-ditch crossing methods. The pathway and stressors from this activity would be similar to those from pipeline removal and the construction of access roads across a stream. All three activities typically involve the construction of temporary coffer dams that delimit the construction area and pumping or otherwise bypassing stream water under or around that zone. All three dry-ditch methods would dewater an approximately 75 foot reach of stream and disturb some or all of the streambed within the coffer dams (75 feet). Sediment impacts are also possible downstream of the work zone although the combination of coffer dams and re-routing flow around the construction area would result in much less sediment downstream than a wet-ditch crossing. The scope of this activity would be anywhere within the covered lands, however, dry-ditch methods are typically confined to streams less than 100 feet wide. Because dry-ditch crossings would typically have less impact (particularly downstream sediment impacts) this method would be preferred where feasible in non-HCP mussel occupied streams.

Dry-ditch crossings would nearly always result in mortality and harm to mussels within the immediate project area (75 feet within the coffer dams). Unlike wet-ditch crossings, we would not expect additional harm and possible mortality downstream resulting from an acute sediment event. Minor sediment impacts are likely downstream, but these are not expected to cause significant take of mussels.

Impacts would be minimized by the employment of mandatory AMMs 2, 4, 5, 10, and 20 and where feasible, non-mandatory AMMs 1 and 9 (all previously described).

Stream Crossing using HDD

HDD involves drilling under the bottom of the stream (often 50-100 feet below the stream bed) and then pulling the welded sections of pipe through the bore hole. It is the preferred and sometimes the only feasible method to cross very large rivers. It is also the most limited of the crossing methods, because it requires a significant amount of space on either side of the channel and specific geological conditions under the stream to be successful. HDD is often requested by resource agencies when crossing sensitive streams since when successful, there are essentially no impacts to the aquatic environment. Significant impacts, however, can occur in the form of frac-out when HDD is unsuccessful. The scope of HDD is anywhere within the covered lands, but as previously stated, it is typically reserved for large rivers. HDD may also be employed anywhere where wet-ditch or dry-ditch methods would be particularly destructive and where the geology and other factors indicate HDD could be completed successfully.

The stressor is principally fine sediments (bentonite) from frac-out, although there is the potential for small amounts of other contaminants to be present. Frac-out is the unintentional escape of drilling muds into the stream from a breach in the earth surrounding the bore hole. Stream crossings using HDD have the potential for both large-scale and minor frac-out. Large-scale frac-outs usually result when the geologic conditions under the stream permit a rupture in the earth between the bore hole and the stream bed. Drilling muds (primarily bentonite with small amounts of other substances) and the surrounding earth are then pushed through this breach under high pressure into the stream. A large volume of material can escape into the water body during a large-scale frac-out. Minor frac-outs occur as a result of the same processes, but only small amounts of the drilling muds escape into the stream – they are more common but much less harmful, in part because HDD is typically implemented in larger streams where small-scale frac-outs are quickly dispersed by the flow. We expect that the AMMs employed in association with this activity should significantly reduce the potential for a major frac-out making it extremely unlikely to occur, therefore HDD would result in only minor aggregate-level impacts to non-HCP mussels and their habitat.

NiSource will employ AMMs 2, 3, and 13 to minimize the effects of small frac-outs and the occurrence of large-scale frac-outs.

AMM 3 requires an HDD plan that explicitly considers mussel resources. It encompasses geophysical and other data designed to ensure that HDD is appropriate at any given site and that frac-out potential, in particular, major frac-out potential is minimized.

Storage Wells Clearing and Drilling

Storage wells are large underground sites confined to areas where the natural formations hundreds and more commonly thousands of feet below the surface are conducive to hold natural gas. The primary impact from these sites on non-HCP mussels relates to the construction and operation of the well-heads (typically dozens per well) used to insert and withdraw the natural gas. Storage wells occur in the counties listed in Table 1.

Storage well expansion is expected to occur in the following subset of counties: Hocking, Fairfield, Ashland, Knox, and Richland counties, Ohio; Bedford County, Pennsylvania; Allegany County, Maryland; Kanawha, Jackson, Preston, Marshall, and Wetzel counties, West Virginia. Table 2 indicates the overlap of storage well expansion counties (and storage well counties) where there is occupied habitat for non-HCP mussels.

There is habitat for the spectaclecase (Kanawha River), pink mucket (Kanawha and Elk Rivers), rayed bean (Elk River) and snuffbox (Elk River, Big Sandy Creek, and Fishing Creek) within three storage well expansion counties (Kanawha, Marshall, and Wetzel Counties, West Virginia). Drilling requires the temporary (one to three months is typical) location of drilling equipment on the drilling pad, the drilling operation itself, sediment and water containment, and ingress and egress of vehicles.

The primary impact of storage well drilling on non-HCP mussels is minor aggregate-level sedimentation. There is the potential for a major spill that could impact a subset of non-HCP mussels. Major spills, like major frac-outs discussed earlier, are not covered under the MSHCP, but must be evaluated here. A major spill event at a site that was close enough to an occupied stream to contaminate it could cause take and even extirpation of the local population of mussels.

AMMs 2, 13, and 15 are mandatory to avoid impacts from this activity. AMMs 2 and 13 have been described above.

AMM 15 requires the use enhanced and redundant measures to avoid and minimize the impact of spills from contaminant events in known or presumed occupied streams. These measures include, for example, waste pit protection, redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials.

Storage Well Reconditioning

There is habitat for rabbitsfoot (Walhonding River and Muskingum River), spectaclecase (Kanawha River), and snuffbox (Kanawha, Little Kanawha, and Muskingum Rivers) in the following storage well counties: Coshocton, Holmes, Medina, Muskingum, and Wayne Counties, Ohio; and Putnam, Wirt, and Wood Counties, West Virginia. Within the storage well counties well-heads can occur virtually anywhere (i.e., wetlands, uplands and floodplains). Storage well clearing involves clearing and contouring some or part of a drilling pad. A typical cleared pad is approximately 400 feet x 400 feet, however, the final area maintained is typically smaller.

Enhancement or reconditioning activities for storage wells (reconditioning, acidizing, coil tubing cleanout, drilling to deepen the well, hydraulic fracturing, re-perforating, and wellbore stabilization) may be required at existing well-heads to increase the efficiency or return the well to previous levels of deliverability. This primarily involves activities similar to drilling in that equipment must be brought in, the well pad re-disturbed to some extent, and the presence of

reconditioning fluids on the site. This could occur within any of the 33 counties in which NiSource maintains storage wells. Table 2 indicates the overlap of storage well counties (and storage well expansion counties) and counties where there is occupied habitat for non-HCP mussels.

The AMMs are expected to avoid all but minor aggregate-level sediment impacts from this activity. As with well drilling, there is the potential for a major spill. The consequences for a large spill entering into non-HCP mussel habitat would be similar to those of a drilling spill.

NiSource will implement AMMs 2, 13, 15 and 17 (all previously described) to avoid impacts from this activity.

Individual Impacts Summary

The following O&M activities are likely to affect the non-HCP mussel species: facilities, vegetation management, upland ROW re-grading, in-stream ROW stabilization or fill, access road maintenance, cathodic protection, pipeline abandonment and removal, and well abandonment site restoration. Of these only facilities (vehicle traffic) and pipeline abandonment and removal have the potential to cause lethal take of mussels with the mandatory AMMs in place. The take amount from vehicle traffic is expected to be very small. Pipeline abandonment and removal is expected to occur very rarely within MSHCP mussel occupied habitat, but potentially significant if it occurs. The chronic effects of comparatively small influxes of sediment from all O & M activities (aggregate sediment impacts), on the other hand, are likely minor in effect but nearly certain to impact all of the non-HCP mussels during the life of the permit. Chronic sedimentation at levels that would be expected from most O&M activities may degrade habitat and could over time disrupt mussel biology (e.g., feeding) or ecological relationships (e.g., host fish).

New Construction activities that are likely to affect non-HCP mussels include: vegetation clearing, vegetation disposal, grading and erosion control installation, hydrostatic testing (water withdrawal and discharge), re-grading and stabilization of the corridor, access road construction and upgrade, stream crossings (wet-ditch, dry-ditch, and HDD), storage well clearing and drilling, and storage well reconditioning. Of these, vegetation disposal, hydrostatic testing (withdrawal), access roads (new construction), and stream crossings are expected to cause lethal take of mussels (there is a small potential for large-scale frac-out and spills to cause additional lethal take). Lethal take from vegetation disposal is expected to be very small driving across non-HCP mussel streams outside the existing construction zone to dispose of vegetation is unlikely. Should it occur, the footprint and therefore the potential for take would be small. Similarly take from the withdrawal of hydrostatic test water is significantly limited by mandatory AMMs, but certain life history stages (e.g., gametes and small juveniles) could be susceptible. This is expected to be very minor and is further ameliorated by the fact that these life history stages have a very low survival rate under natural conditions.

The construction of new access roads outside the construction footprint of a stream crossing (note that if it occurs within that footprint the mussels would already be impacted) is expected to occur rarely, but would result in take comparable to crossing a stream with a pipeline. This action could have significant impact on the mussels in the immediate vicinity of the access road. Stream crossing is the most widespread and common NiSource activity causing lethal take of mussels. The reasonable worst case scenario predicts stream crossings for pipeline repair, replacement, or for a looping (new) pipeline will occur at every stream crossing in the NiSource system over the life of the permit and thus will impact every non-HCP mussel species.

Take from these activities could be locally significant causing lethal impacts and harm and harassment to nearly all of the mussels within the immediate vicinity of the pipeline crossing. We used a model similar to that used to establish a reasonable worst case scenario from ground-disturbing activities in the MSHCP to estimate take for MSHCP species. The model used here, however, is refined using density estimates from for the most part non-quantitative estimates of density (e.g., species is very rare) from 5-Year Reviews and other relevant documents. Those estimates are: take of approximately 42,184 rabbitsfoot (253.5 acres of habitat), take of approximately 108,283 rayed bean (146.7 acres of habitat)[17], take of approximately 5,813 spectaclecase (287.2 acres of habitat), take of approximately 3,809 dwarf wedgemussel (38.4 acres of habitat), take of approximately 18,978 pink mucket (109.7 acres of habitat), and take of approximately 37,942 snuffbox (356 acres of habitat) over the 50-year life of the permit. For all of the non-HCP mussel species, the habitat area impacted is estimated as the length of the stream reaches impacted x average width of the streams. [18] The numbers for take of individuals are all based on the use of both the wet-ditch and dry-ditch crossing methodologies depending on the size of the stream (streams less than 100 feet wide are assumed to be crossed using dry-ditch methods). The sediment transport model estimates a lethal impact area covered by 0.236 inches of sediment. A sediment plume is predicted to extend further downstream corresponding to a harm/harassment area having a 600 mg/l concentration of suspended sediment (Ellis 1936; Aldridge et al.1987). The dry-ditch model estimates a 75-foot lethal zone within the coffer dams and a 100-foot harm/harassment zone downstream of the coffer dams.

In conclusion, although we do not know the precise locations where pipeline removal, access road construction, looping projects, or other activities will occur within the covered lands, at least a portion of these projects will likely occur within the occupied habitat of all of the non-HCP mussels. The number of individuals estimated to be impacted over the 50 year life of the permit represents the effect of multiple pipeline crossings over each stream with a known population of one or more of the non-HCP mussels, and estimated populations of those species at each site. It seems likely based on the information available that NiSource will cause lethal take of each of the non-HCP mussel species. The actual number of animals taken will depend

[17] Take would be reduced to approximately 8,000 animals and 120 acres of habitat with complete avoidance of impacts to the Allegheny River population.

not only on the number and location of NiSource projects and on which non-mandatory AMMs they choose to implement (e.g., survey and relocate or HDD), but also the numbers of animals present in the area of impact at the time of the project.

4.2.1.1 Dwarf Wedgemussel

The reasonable worst case scenario indicates some take of dwarf wedgemussel from a limited number of NiSource ground disturbing activities is reasonably likely to occur. Aggregate impacts over the life of the ITP could further reduce the suitability of both occupied habitat and habitat that could be colonized naturally or through enhancement and reintroduction. Estimates of take based on the model used to develop a reasonable worst case scenario likely over-estimate the take that would occur. The recovery plan for the dwarf wedgemussel (USFWS 1993b) requires at least 10 rivers including some or all of the following: Connecticut, Ashuelot, Neversink, Upper Tar, Little, Swift Creek, and Turkey Creek, must support widely dispersed and viable populations. These should be dispersed throughout the species' range and all must be protected in order for the dwarf wedgemussel to be delisted. The 5-Year Review (USFWS 2007) indicates that because of new information on species occurrence and impacts to some of the drainages identified for conservation, the recovery criteria as stated in 1993 will likely never be met.

The following is a discussion of potential NiSource impacts to known populations of Dwarf wedgemussel.

<u>Blue Run (Unnamed Tributary)</u>

NiSource makes one crossing (triple pipeline) of Blue Run in Albemarle County, Virginia near the Albemarle – Orange County Line. The same pipeline also makes one crossing of an unnamed tributary to Blue Run near its confluence. The 5-Year Review (USFWS 2007c) indicates the dwarf wedgemussel population within a nine mile (14.5 km) reach of Blue Run immediately downstream of the NiSource crossing in Orange County, Virginia is based on a questionable record. Blue Run and its tributary are small streams at this site and it is likely that NiSource would cross them using a dry-ditch methodology which would limit downstream sediment and other impacts in large part to the 75 feet construction area within the coffer dams.

<u>Delaware River (Basket Creek and Unnamed Tributaries)</u>

NiSource crosses the mainstem Delaware River between Pike County, Pennsylvania and Orange County, New York, which is a reach of stream where dwarf wedgemussel is not known to occur (USFWS 2007c). NiSource makes five crossings with a single pipeline of tributaries to the Delaware near their confluences, upstream in Sullivan County, New York. The 5-Year Review (USFWS 2007c) indicates that 72 live dwarf wedgemussels were found at four sites in 2002 in the Wayne/Sullivan/Delaware Counties reach of the Delaware River.

Because there is no crossing of the Delaware River mainstem in this area, impacts would all be from sediment making its way down the tributaries into occupied habitat. All of the tributary crossings are a minimum of 2,500 feet from their confluences with the Delaware, therefore we would expect the impacts to be minor. Under terms and conditions, the USFWS will, however, require NiSource to cross all tributaries to Delaware River in Sullivan County, New York using dry-ditch techniques.

Mountain Run

NiSource makes one crossing of Mountain Run near its headwaters in Culpepper County, Virginia. There is one early (1919) and questionable record of dwarf wedgemussel from this stream. It seems unlikely that the species is present and therefore we would not expect impacts from this crossing.

Neversink River (Unnamed Tributary)

The NiSource pipeline makes one crossing of the Neversink River (crosses two channels at the upstream end of an island) and one unnamed tributary near its confluence, both in Orange County, New York. The 5-Year Review (USFWS 2007c) indicates that dwarf wedgemussel persists in this area in low numbers. Significant take and impacts to this population are unlikely, but because this population may ultimately be important to the recovery of the species, the USFWS will require NiSource under terms and conditions to analyze the Neversink for the appropriateness of HDD (as per the AMMs in the MSHCP) and implement HDD if the analysis indicates that it is practicable to do so. If not, NiSource must survey and translocate dwarf wedgemussel and any other MSHCP and non-HCP mussels according to guidelines in the MSHCP or as provided by the USFWS.

Nottoway River

The NiSource pipeline crosses the Nottoway River where it forms the boundary between Sussex and Greensville Counties, Virginia. The 5-Year Review (USFWS 2007c) indicates that one live mussel was found in this reach in 1996. This population is apparently very small, if extant. The NiSource crossing is downstream from the other known population in the Nottoway River (Luxemburg – Nottoway Counties). The Nottoway River is a small stream at this location and NiSource would likely employ a dry-ditch crossing method and thereby minimize potential take. Some take is possible depending on the NiSource action and exact location of the remaining mussels.

South Anna River (Tributaries)

The NiSource pipeline makes two crossings of the South Anna River mainstem in Louisa County, Virginia and multiple crossings of tributaries near their confluences. Tributaries include Lasley Creek and Rock Creek, and six crossings of unnamed tributaries. The upstream crossing of the mainstem is by a triple pipeline and the rest of the crossings are by a double pipeline. The 5-

Year Review (USFWS 2007c) suggests the population in the South Anna River in Louisa County is marginal at best. Records are from 1972 and 1991 and include two midden shells and one relic shell – the data include no live dwarf wedgemussels. Strayer, Sprague and Claypool (1996) list the status of this species in the South Anna River as poor and occupying only a 0.8 km reach. Although NiSource makes multiple crossings of the South Anna River and its tributaries in Louisa County, the status of the population suggests that NiSource is not likely to have significant individual or population impacts.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the dwarf wedgemussel rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

The dwarf wedgemussel recovery plan has not been updated since release in 1993, but lists the following criteria for down listing: the mainstem Connecticut River, Ashuelot River, Neversink River, upper Tar River, three sites in the Neuse River system, as well as at least six other rivers must be viable based on monitoring results over a 10-15 year period. To delist, populations must be dispersed widely enough within at least 10 of these rivers such that a single event is unlikely to eliminate a population from a given river reach. These populations must be distributed throughout the species' range, and must be permanently protected from foreseeable threats (USFWS 1993b). The 5-Year Review states that some of the criteria have been met (viable populations in the Connecticut and Ashuelot Rivers), some likely never can be (multiple populations within the Neuse River watershed) because of development (USFWS 2007c).

The dwarf wedgemussel is doing better in the northern part of its range where some large populations still exist (Connecticut River). The populations in the south are declining. NiSource could affect four populations in Virginia (Blue River, Mountain Run, Nottoway River, and South Anna River) all of which appear to be very small or possibly extirpated. The Neversink River in New York appears to have had a robust population in the mid-1990s, but the 5-Year Review (2006) indicates the dwarf wedgemussel has declined there. NiSource has the potential to cause take where it crosses the mainstem and one tributary stream. The Delaware River on the Pennsylvania – New York state line may have a stable population of dwarf wedgemussel. NiSource does not cross the mainstem but has some potential to take dwarf wedgemussels with multiple crossings of tributary streams. The populations of the Nottoway and South Anna Rivers are apparently very small and the potential for take there is uncertain. Some take seems reasonably likely to occur over the life of the permit in one or more of these streams, but the take would likely be minimal. Because NiSource would not impact any of the best remaining populations in New Hampshire, Massachusetts, and Connecticut and because impacts to

potentially effected populations and their habitats will be limited, the USFWS does not expect NiSource activities to preclude the survival or recovery of the dwarf wedgemussel.

4.2.1.2 Pink Mucket Pearlymussel

It is reasonable to conclude that there would be some lethal take of pink mucket from impacts of NiSource stream crossings and other ground disturbing activities over the life of the permit, since NiSource has the potential to impact multiple populations. The draft 5-Year Review (Butler pers. comm. November 2011) states that pink mucket may have always been an uncommon species with small populations. It continues to be a very rare species today having lost thousands of miles of large river habitat - only 11 of 232 Ohio State University Museum of Zoology (OSUM) records contain more than 10 individuals. The number of pink mucket, therefore, taken by NiSource activities will likely be much smaller than the reasonable worst case scenario estimates. Aggregate sediment impacts from O&M activities could marginally reduce the habitat quality and possibly directly and indirectly affect reproduction of pink mucket where there is a concentration of NiSource facilities.

The following is a discussion of potential NiSource impacts to known populations of pink mucket.

<u>Barren River</u>

NiSource crosses the Barren River approximately 100 miles upstream from the known population of pink mucket in the lower 15 miles (24 km) of the River, therefore we would not expect any impact from NiSource activities to this population.

<u>Cumberland River</u>

The Cumberland River has among the best remaining pink mucket populations. Suitable Pink mucket habitat is apparently limited to a roughly 35 RM reach in the middle river below Cordell Hull Lock and Dam at RM 313.5 (Butler, pers. comm.). The NiSource trunk line crosses the Cumberland downstream of the dam between RMs 254 and 250, which is also downstream of the known population which ends at approximately RM 280. We do not expect that NiSource activities will impact the Cumberland River pink mucket population.

<u>Elk River</u>

The NiSource pipeline makes six crossings of the Elk River and one of a tributary stream (Big Creek) in the downstream reach near its confluence, all in the northeastern part of Kanawha County, West Virginia. All of the crossings occur within 10 miles (16 km) of each other. One crossing near the easternmost extent of the area impacted by NiSource is a double pipeline. Butler (pers. comm.) considers the occurrence of the pink mucket in the Elk River to be occasional with the center of the population in the downstream reach covering greater than 20 miles (32 km). Surveys in 2004, however, located seven individuals in the middle section of the

River (in five shoals out of 38 sampled). NiSource pipelines are located in the lower section of the Elk River in the apparent center of the known occupied habitat. The population is deemed stable (Butler pers. comm.) but is vulnerable to among other impacts, spills from a railroad that parallels the stream. Because NiSource makes multiple crossings of the Elk and these crossings are spread over several miles, there is the potential for significant take of mussels and population-level impacts in the Elk River. Under terms and conditions for another species, the USFWS will require NiSource to implement HDD at Elk River crossings if practicable, if not survey and coordinate with WV Field Office on avoiding impacts to introduced population, use dry-ditch techniques and translocate mussels.

Green River

NiSource crosses the Green River within a pool in Adair County, Kentucky established by the Green River Lake Dam located approximately 306 miles above the River's mouth. The pink mucket is considered sporadic and rare in the Green River; because of the location of the NiSource crossings, there would be no impact on this species in the Green River.

Kanawha River

NiSource crosses the Kanawha River at two distinct reaches, one near its confluence with the Ohio in Mason County and another near the Kanawha – Putnam County Line. NiSource also crosses three tributaries to the Kanawha (Rock Branch, Simmons Branch, and an unnamed tributary) and an unnamed tributary to Rock Branch. These are all crossings of small streams that would be dry-ditched. Rock Branch and its tributary (Putnam County) and the unnamed tributary to the Kanawha (Mason County) are all are more than 1,000 feet from the River. Simmons branch flows within an industrialized area for more than 1,000 feet before its confluence. It is likely that Simmons Branch is enclosed within a pipe or in a concrete channel through some or all of this area and not impacted by the gas pipeline. The pink mucket is known from an approximately nine mile reach of the Kanawha River below Kanawha Falls from approximately RM 95 to RM 86. This population although threatened by the short reach it occupies, its isolation, and significant threats from development is considered stable and significant. The NiSource crossings are both a number of miles downstream of the currently occupied reach and should not impact the pink mucket.

Licking River (unnamed tributary)

NiSource makes six crossings of the Licking River; three downstream crossings between Robertson and Nicholas Counties, Kentucky and three upstream crossings between Bath and Rowan Counties, Kentucky. NiSource also crosses one unnamed tributary to the Licking near the upstream crossings. The status of the pink mucket in the Licking River is unknown. Only one live or fresh dead animal has been located about 22 RMs below Cave Run Dam (Butler pers. comm.) since the drafting of the recovery plan in 1985. This is in the general area but downstream of the Rowan–Bath County (upstream) NiSource crossings. Given the apparently very small population of this species in the Licking River, with a live animal not found in nearly

30 years, the impact from NiSource activities is uncertain, but not likely to this population. Under terms and conditions for another species, NiSource will make the downstream crossings of the Licking River using HDD, or survey and translocate mussels.

Muskingum River

Butler (pers. comm.) does not list pink mucket in the Muskingum River, but the Ohio Field Office (Angie Boyer pers. comm.) states the distribution of the pink mucket in Ohio is limited to the lower Muskingum River and the Ohio River. It is considered known from the reach of the Muskingum within Washington County and considered potential from the reach within Morgan County. NiSource crosses the lower Muskingum River three times (all single pipelines) in Washington County. The most downstream crossing is within 12 miles (19 km) of the confluence with the Ohio. The second is approximately 14 miles (22.5 km) upstream and the third a few miles upstream of that. Although there are no recent records of the pink mucket in the Muskingum River, because NiSource crosses it at three different sites within this lower reach, there is the potential for NiSource to take this species. It is unlikely that NiSource activities would threaten the persistence or reproductive status of this population, since it is likely comprised of a small number of widely scattered individuals. Under terms and conditions for another species, NiSource will cross the Muskingum using HDD or survey and relocate mussels if this is not practical.

Ohio River (Coal Branch, Little Sandy River, and Smith Branch)

NiSource makes multiple crossings of the Ohio River mainstem. NiSource also crosses three tributaries near their confluences with the Ohio. Coal Branch, the Little Sandy River and Smith Branch all in Greenup County, Kentucky. Butler (pers. comm.) indicates the pink mucket occurs in two population clusters throughout the length of the Ohio River covering approximately 125 RMs. One is upstream between Ohio and West Virginia sporadically occurring in the upper tailwaters of the pools of three Locks and Dams (Belleville, Byrd, and Greenup). The total available habitat is approximately 75 RMs, but the available habitat is not fully occupied. The upstream population is considered to be recruiting. The downstream cluster occurs in the lower Ohio River near Metropolis, Illinois, well outside the NiSource Covered lands. It may be the more stable. One other documented occurrence not associated with either cluster is a 1989 record from RM 443. As discussed above, NiSource would employ HDD for new pipelines or replacements in the Ohio River making impacts from these actions very unlikely. Impacts to tributary streams close to where they empty into the Ohio will be crossed by HDD where practical. Because of the number of occupied river miles, the size of the Ohio River, and AMMS limiting the effects of tributary impacts, and because one population center will not be impacted, neither the persistence nor reproductive status of pink mucket in the Ohio River would be affected by NiSource activities.

Tennessee River

The pink mucket persists in most of the tailwaters of the nine mainstem dams on the Tennessee (Butler pers. comm.). NiSource has agreed to avoid impacts to the Tennessee River at the one location where the NiSource trunk line crosses the river below Pickwick Lock and Dam. Major tributaries including the Holston River, French Broad River, and the Clinch River; and the smaller tributaries Paint Rock River and Bear Creek all likely have small populations of pink mucket. These populations would not be affected by NiSource activities.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the pink mucket rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. The pink mucket recovery plan was released in 1985 and has not been updated. The plan states, however, that because of the number of populations (only 15 were known at that time) and their wide distribution, the species could be considered for down listing to threatened status. Since that time, two have become extirpated, but 16 additional populations have been identified as extant (Butler, pers. comm.).

NiSource would potentially take pink mucket in the Licking, Muskingum, and Elk Rivers. The populations in the Muskingum and Licking are likely very small and composed of widely scattered individuals. The Ohio River population is widely dispersed and NiSource has agreed to HDD all Ohio River crossings. With AMMs in place, the likelihood of impacts to these populations is small. The Elk River population is centered in the area of multiple NiSource pipeline crossings, but covers greater than 20 RMs and therefore extends well beyond the zone of expected effects from NiSource activities. Pink mucket has also recently been discovered upstream of the NiSource pipeline crossings. Depending on the specific actions and the location of the mussels, even with AMMs in place take could be significant, but would likely not reach the level of population impacts.

The pink mucket occurs in a number of streams completely outside the NiSource area of operation. The Missouri, Mississippi, White River, and Black River, and Red River systems and Saline River all have populations of pink mucket and lie outside the NiSource covered lands. These include among the best remaining pink mucket populations some of them covering more than 100 river miles. Important populations also occur in the Cumberland and Tennessee Rivers within the NiSource area of operations, which are not expected to be impacted. NiSource activities under the MSHCP will not preclude the survival or recovery of the pink mucket.

4.2.1.3 RABBITSFOOT

The reasonable worst case scenario suggests the potential for significant take of rabbitsfoot over the course of 50 years from a small number of ground disturbing activities. In addition, aggregate sediment impacts from several O&M activities could marginally reduce the habitat quality and possibly directly and indirectly affect reproduction. There is no recovery plan for the rabbitsfoot mussel, but the species assessment and listing priority assignment form (USFWS 2012b) recommends protecting existing populations and restoring or augmenting populations as important conservation measures.

Based on historical and current data, the rabbitsfoot is declining rangewide and is now extant in only in 51 of 140 streams where it historically occurred, which represents a decline of 64% - many of the small and marginal populations are in decline (USFWS 2012b).

The Final Rule (USFWS 2012b) identifies 11 stable or improving populations of rabbitsfoot: Ohio River (IL, IN, KY, OH, PA, and WV), French Creek (PA), Green River (KY), Tippecanoe River (IN), Tennessee River (AL, KY, TN, and MS), Duck River (TN), Paint Rock River (AL), White River (AR and MO), Middle Fork Little Red River (AR) , Ouachita River (AR), and Little River (AR and OK). Some of these populations extend through long reaches of the host stream (e.g., 80 RMs of French Creek and 100 RMs of the Green River). Butler classified 18 additional streams as having small populations having doubtful or limited viability: Muddy Creek, Walhonding River, Little Darby Creek, North Fork Vermilion River, Middle Branch North Fork Vermilion River, Bear Creek, St. Francis River, Big Sunflower River, Big Black River, Buffalo River, Spring River (White River system), South Fork Spring River, Middle Fork Little Red River, Neosho River, Spring River (Arkansas River system), Verdigris River, Ouachita River (since reclassified as stable), and Saline River (USFWS 2012b) . He classified 19 additional populations as marginal (doubtful viability and possibly on the verge of extirpation): Fish Creek, Allegheny River, LeBoeuf Creek, Conneautee Creek, Big Darby Creek, South Fork Kentucky River, Barren River, Rough River, Eel River, East Fork Stones River, Red River, Elk River (TN), Illinois River, War Eagle Creek, Current River, Glover River, Cossatot River, Little Missouri River, and Bayou Bartholomew.

The following is a discussion of potential NiSource impacts to known populations of rabbitsfoot.

<u>Allegheny River (Birch Run and Dunlap Creek)</u>

The NiSource pipeline makes one crossing of the Allegheny River and crosses two tributaries (Birch Run and Dunlap Creek) near their confluences north of Pool 7, north of the Town of East Brady. Allegheny River and French Creek likely represent a metapopulation because no barriers exist between the streams, but the Alleghany population is considered marginal (USFWS 2012b). Because there is only one crossing and population is small and sporadically distributed, it is unlikely that the NiSource pipeline would impact the Allegheny–French Creek metapopulation (no impacts to French Creek) although some take in the Allegheny is probable over the life of the permit. Under terms and conditions for another species, NiSource will HDD the Allegheny River or survey and translocate mussels.

Big Darby Creek

Rabbitsfoot is extant at two sites within Big Darby Creek where it is classified by Butler as marginal (USFWS 2012b). No live or fresh-dead individuals were found in surveys conducted in 1990 or 1996 (Angie Boyer, pers. comm.). The NiSource pipeline makes three crossings of Big Darby, one on the Franklin – Madison County line and two in Pickaway County. The impact of NiSource activities on this population is uncertain given the small population in Big Darby Creek. Under terms and conditions for another species, the USFWS will require NiSource to HDD crossings of Big Darby Creek or survey and translocate mussels.

Duck River

NiSource crosses the Duck River in Maury County, Tennessee. It is a three pipeline trunk line at this location. In addition, the trunk line crosses Snow Creek and three unnamed tributaries of the Duck near their confluences at this crossing location. The trunk line also crosses Big Bigby Creek, a tributary of the Duck and another unnamed tributary near their confluences at a second crossing location several river miles downstream, also in Maury County (in total there are seven crossings of unnamed tributaries near their confluences). The Rabbitsfoot is considered extant and concentrated between RM 130 and RM 179, which includes the two crossing locations. NiSource has agreed to avoid impacts to the Duck River, including impacts from tributary crossings, therefore we don't expect impacts to this species at these crossing locations.

Green River

The NiSource pipeline corridor follows and impounded section of the Green River and crosses three tributaries, including Casey Creek, one unnamed tributary to the Green River, and one unnamed tributary to White Oak Creek near their confluences with the Green River all in Adair County, Kentucky. The rabbitsfoot is considered extant through approximately 100 RMs of the Green River. It is considered extirpated in the area of the NiSource crossing locations, but extant downstream. There is virtually no potential for impacts from these NiSource crossings on the rabbitsfoot because they are located in a pool upstream of a dam. We would therefore not expect take in the Green River.

Little Darby Creek

The NiSource pipeline corridor crosses Little Darby Creek at one location in Madison County, Ohio. It also crosses two tributaries near their confluences with Little Darby Creek in the same corridor. According to the USFWS Ohio Field Office (Angie Boyer pers. comm.) the rabbitsfoot is known from this reach of the Little Darby. It is termed stable across approximately 20 RMs where it is present (USFWS 2012b). The most recent records of rabbitsfoot are from the mid-1990s and are upstream of where NiSource crosses Little Darby Creek (Angie Boyer, pers. comm.). The USFWS does not expect one crossing location, with AMMs in place, to threaten

this population, which occurs sporadically over 20 miles (32 km) of stream. Under terms and conditions for another species, however, the USFWS will require that NiSource cross the Little Darby using HDD or dry-ditch if HDD is not practical and survey and translocate mussels.

Muskingum River

In 2007, three live rabbitsfoot were found in the Muskingum River in Muskingum County, Ohio during bank searches (Angie Boyer, pers. comm.). All three were found in less than two inches (5 cm) of water around woody debris near the Dresden electric plant. NiSource makes a single crossing of the Muskingum very near this site and makes a second single crossing further downstream also in Muskingum County. In addition, the NiSource pipeline crosses the Muskingum upstream (Coshocton County) of the site where rabbitsfoot was found. An exhaustive survey of the Muskingum River has not been performed in recent years and therefore there is no information on the size, distribution, or viability of this population. The Ohio Field Office assumes presence of rabbitsfoot throughout this reach of the river (Coshocton through Muskingum counties). Because the exact location and extent are unknown and because of the number of crossings, there is the potential for NiSource to take individuals and impact this population. The Muskingum River population is classified as marginal, but the USFWS will require NiSource under terms and conditions to make the upper crossings (Coshocton and Muskingum Counties) of the Muskingum River using HDD. If not practical, NiSource must survey for rare species prior to in-stream work and if found, translocate rabbitsfoot and any other MSHCP and non-HCP mussels according to guidelines in the MSHCP or as provided by the USFWS.

Tennessee River

The NiSource pipeline is a three pipeline trunk line across the Tennessee River (one of the three trunk lines is itself a double line across the Tennessee). It makes one crossing of the Tennessee and one of Hatley Creek, a tributary near its confluence. The rabbitsfoot is extant in the tailwaters below Pickwick Dam and Kentucky Dam encompassing approximately 25 RMs and the populations are classified as sizeable. NiSource has agreed to HDD the Tennessee (we would expect the HDD to also cross Hatley Creek) and therefore no impacts to this population are expected.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the rabbitsfoot rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species.

According to the species assessment form (USFWS 2012b) all of the populations classified as sizeable and small are important to conserving the species at its current level and many will be

essential to recovery. Several of the marginal populations are represented by one live or fresh dead animal and will likely not be important to recovery without significant habitat conservation and augmentation efforts.

Of the 11 known sizeable populations of rabbitsfoot, three are within the NiSource project area (Green River, Duck River, and Tennessee River). We do not expect NiSource to impact any of these because of agreements to HDD related to the Tennessee and Duck Rivers and because the crossing location of the Green River (impounded reach) makes impacts to mussels in that river extremely unlikely. Of the 18 populations classified as small by Butler (USFWS 2012b), NiSource has the potential to impact only the Little Darby Creek population although recent records are from upstream of NiSource facilities. The Muskingum River has a recently discovered population of rabbitsfoot, with individuals found near one of three upstream locations where the NiSource pipelines cross. The extent of this population is unknown, but the Ohio Field Office assumes presence at all three of the upstream NiSource crossing locations. NiSource also has the potential to affect rabbitsfoot in in two other streams where it is classified as marginal, Big Darby Creek in Ohio and the Allegheny River in Pennsylvania. Most of the sizeable and small populations important to the survival and recovery of the rabbitsfoot are outside the NiSource covered lands. NiSource activities will not preclude the survival or recovery of the rabbitsfoot mussel.

4.2.1.4 Rayed Bean

The reasonable worst case scenario suggests the potential for take of a very large number of rayed bean over the course of 50 years. Lethal take of rayed bean would occur as a result of impacts from NiSource stream crossings and other ground disturbing activities. NiSource activities have the potential to affect only one population with significant numbers, the Allegheny River population. The estimates presented above for take, therefore likely over-estimate take that will occur. Sediments from wet-ditch crossings could also harm or harass mussels or degrade existing or potential habitat. Aggregate sediment impacts from O&M activities could marginally reduce the habitat quality and possibly directly and indirectly affect reproduction of rayed bean. There is currently no Recovery Plan for the rayed bean identifying populations essential to the conservation of this species. It is assumed, however, based on the recovery strategies for other mussel species, that the larger, viable populations would be most important to the species' conservation.

Based on historical and current data, the rayed bean has declined significantly rangewide. Of the 115 know historical populations, it is now known from only 31 streams and one lake, a 73 percent decline. It has been eliminated from hundreds of miles of the Maumee, Ohio, Wabash, and Tennessee Rivers and from numerous stream reaches and their tributaries (USFWS 2012c).

The following is a discussion of potential NiSource impacts to known populations of rayed bean.

Allegheny River (Dunlap Creek and Birch Run)

The Allegheny River population of rayed bean is large, reproducing and considered stable. It currently occurs in Pennsylvania throughout 100 river miles downstream of Allegheny (Kinzua) Reservoir in Warren County to the pool of Lock and Dam 8 in northern Armstrong County. The Allegheny River population is one of the most important remaining rangewide (USFWS 2012c). The NiSource pipeline makes one crossing of the Allegheny on the line between Clarion and Armstrong Counties near the downstream known extent of the rayed bean population. The pipeline could also affect two tributaries to the Allegheny near their confluences - one, Dunlap Creek, a short distance upstream of the main crossing and Birch Run in the immediate vicinity of the main crossing.

Because of the size and extent of the Allegheny River rayed bean population and because NiSource makes only one crossing of the river downstream of much of the known population, while take is likely, population-level effects are unlikely. Under terms and conditions for another species NiSource will HDD the Allegheny River or survey and translocate all MSHCP and non-HCP mussels in accordance with guidance provided in the MSHCP or by the USFWS.

Big Darby Creek

In 2006, one live rayed bean was found at the U.S. Highway 42 bridge replacement site in Union County, Ohio and was relocated to a site upstream out of the impact zone of the bridge project. Nine additional live individuals were subsequently found at the relocation site in 2006. In 2007, three live animals were found there. A researcher visiting the same relocation site in 2008, in a pers. comm. to the USFWS, reported finding “numerous living specimens” of the rayed bean (USFWS 2012c). The status of this population remains unknown.

NiSource crosses Big Darby Creek in three locations: one in west-central Franklin County; one in northern Pickaway County (double pipeline); and one in central Pickaway County. The Ohio Field Office recommends assuming presence of the rayed bean at NiSource’s most upstream crossing of Big Darby Creek in Franklin County between U.S. 40 and Interstate 70 (Angie Boyer, pers. comm.). It is possible that some animals would be taken, but based on the known distribution in Big Darby Creek (the NiSource crossing is more than 10 RMs downstream of the individuals documented since 2006) the Franklin County crossing is not likely to impact the population. Under terms and conditions for another species, NiSource will HDD Big Darby Creek and if that isn’t practical dry-ditch and survey and translocate mussels.

Blanchard River

One of the best populations of the rayed bean rangewide occurs in the Blanchard River. It is restricted to an approximately 25 to 30 mile (40-48 km) reach in the upper portion of the stream in Hardin and Hancock Counties upstream of Findlay (USFWS 2012c). Based on two recent survey reports of the Blanchard River in the vicinity of the NiSource covered lands, the NiSource crossing is several miles downstream from where rayed bean occurs (Angie Boyer,

pers. comm.). It does not appear likely that NiSource would affect the rayed bean in the Blanchard River.

Elk River (Big Creek and Unnamed Tributaries)

In 2006 and 2007, approximately 600 adult rayed bean mussels were reintroduced into the Elk River above Clendenin (Kanawha County, West Virginia). Two live individuals were relocated in 2008 during an abbreviated monitoring survey. In 2010, none of the individuals released in 2006 were found, but an additional 200 individuals were released. These translocated adults are thought to persist in the stream (USFWS 2012c). NiSource makes six crossings of the Elk River (one is a double pipeline) in the area assumed as potentially occupied by the reintroduced population.

The actual status (size, geographic extent, and reproductive status) of the small reintroduced population of rayed bean remains unknown, but impacts from NiSource stream crossings could negatively affect the establishment of mussels in this section of the Elk. Under terms and conditions for another species, the USFWS will require NiSource to HDD the Elk River crossings if practicable, if not survey for rare mussels (including the rayed bean) based on guidelines provided in the MSHCP prior to any in-stream work at the six potentially occupied crossing sites. If located, NiSource will work with the West Virginia Field Office of the USFWS to determine the appropriate action to minimize impacts to this translocated population.

Little Miami River

NiSource crosses the Little Miami River near the Clark-Greene County line and again in southern Greene County a few miles upstream of the Greene-Warren County line. The rayed bean appears to be very rare in the Little Miami, having been found extant at only one of 46 mainstem sites in Warren County (USFWS 2012c). The Ohio Field Office (Angie Boyer, pers. comm.) does not consider the rayed bean to be extant in the Little Miami River, and therefore it does not appear that NiSource would impact the rayed bean there.

St. Joseph River (Buck Creek and Chridtoffel Ditch)

The rayed bean may persist at a limited number of sites in the lower St. Joseph River in Allen and DeKalb Counties, Indiana. Fresh dead individuals were found in the late 1990s, but a survey in 2007 did not encounter rayed bean (USFWS 2012c). A survey in 2012 found one live individual in the St. Joseph River in Williams County, Ohio (Angie Boyer, pers. comm.). NiSource crosses the St. Joseph River and two of its tributaries (Buck Creek and Chridtoffel Ditch) near the Indiana – Ohio state line (DeKalb County, Indiana and Defiance County, Ohio). It is uncertain whether or not the rayed bean persists in the Indiana portion of the St. Joseph River. There is the potential, however, for take to occur from the NiSource crossing of the mainstem and tributaries. The St. Joseph River is a comparatively small stream in this area and existing AMMs and BMPS including dry-ditch crossing, should avoid impacts to this population.

Consideration should be given to employing HDD, if site evaluation under AMM # 3 indicates it as appropriate.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the rayed bean rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species.

There are 31 streams and one lake with known extant populations of rayed bean, eight of which are considered to have high viability; six of these are considered large populations (USFWS 2012c). Of the populations that are both viable and large, two are completely outside of the NiSource area of operation (Sydenham and Thames Rivers in Ontario) and the French Creek and Swan Creek populations are within the NiSource area of operations, but are not intersected by NiSource covered lands. NiSource activities would potentially impact only the large, viable Allegheny River population, but this population extends many miles upstream of the NiSource crossing. NiSource activities also have the potential to take rayed bean in Big Darby Creek, however, crossings occur far downstream from known populations. Two populations where reproduction is uncertain, the St. Joseph River and the reintroduced population in the Elk River, could also be impacted. The level of impacts on the St. Joseph River population, like the population itself, are uncertain, but existing AMMs should limit impacts. The USFWS will require NiSource to avoid and minimize impacts to the translocated Elk River population if it is found to persist. Therefore, while some take is possible from smaller populations, NiSource activities will not preclude the survival or recovery of the rayed bean.

4.2.1.5 Spectaclecase

The reasonable worst case scenario suggests the potential for take of a comparatively small number of spectaclecase over the course of 50 years from a small number of ground disturbing activities. The estimated take is almost certainly an overestimate because of various factors discussed below. Aggregate impacts over the life of the ITP could reduce the suitability of some occupied spectaclecase habitat and habitat that could be colonized naturally or through enhancement and reintroduction. There is currently no range-wide plan for the spectaclecase that provides goals for its recovery. Based on plans for other mussels species, specifying the protection of multiple reproducing populations that are large and spread-out enough to be safe from a single stochastic destructive event, and that exist across the current range of the species would be included.

The spectaclecase originally inhabited the Mississippi, Missouri, and Ohio River drainages and was known from at least 44 streams in 14 states, but has suffered an approximately 55 percent decline with only 20 known extant populations. The Final Rule lists these as: the Tennessee River (AL), Mulberry and Ouachita Rivers (AR), Mississippi and Ohio Rivers (IL), Mississippi River

(IA), Ohio and Green Rivers (KY), Mississippi and St. Croix Rivers and Rush Creek (MN), Mississippi, Meramec, Bourbeuse, Big, Gasconade, Sac, Big Piney Rivers, and Osage Fork (MO), Tennessee, Clinch, Nolichucky, and Duck Rivers, and Caney Fork (TN), Clinch River (VA), Kanawha River (WV), and the Mississippi, St. Croix and Chippewa Rivers (WI) (USFWS 2012a). Six of the known populations are documented by only one or two recent specimens - these are unlikely to be viable. This species has strongholds in three river systems completely outside of the NiSource covered lands including the Meramec River population cluster and Gasconade River (MO), and the St. Croix River (MN/WI) (USFWS 2012a).

The following is a discussion of potential NiSource impacts to known populations of spectaclecase.

Duck River (Big Bigby Creek, Snow Creek, and Unnamed Tributaries)

The NiSource trunk line (three pipelines) makes one crossing of the mainstem of the Duck River in Maury County, Tennessee at the confluence of Snow Creek, and multiple crossings of tributaries including Snow Creek and Big Bigby Creek near their confluences. NiSource has agreed to avoid impacts to the Duck River by conducting stream crossing using HDD .

Green River (Casey Creek and Unnamed Tributaries)

One live animal and a small number of fresh dead shells have been collected in the upper Green River from below Lock and Dam 5 upstream through Mammoth Cave National Park (MCNP) in Edmonson County and Hart County, Kentucky. This small population is thought to be most concentrated in the upstream section of this reach (MCNP to western Hart County). NiSource makes multiple crossings of the Green River and its tributaries, but these all occur in an impounded section of the River approximately two counties upstream in Adair County. Because the crossing site is an impoundment and therefore upstream of a dam and because its location significantly upstream of the known population, it is extremely unlikely that NiSource activities would impact spectaclecase in the Green River.

Kanawha River

In 2002, one very old spectaclecase was found near Glasgow, Kanawha County, West Virginia approximately 20 miles downstream of Kanawha Falls. Another live individual was found in the same vicinity in 2005, as well as two additional weathered shells in 2006; a recruiting spectaclecase population likely does not exist in the Kanawha River (USFWS 2012a). NiSource crosses the Kanawha River at two distinct reaches, one near its confluence with the Ohio in Mason County and another near the Kanawha – Putnam County Line. NiSource also crosses three tributaries to the Kanawha (Rock Branch, Simmons Branch, and an unnamed tributary) and an unnamed tributary to Rock Branch. The confluence of Simmons Branch is in the general vicinity of the discovered spectaclecase, but the stream flows within an industrialized area for more than 1,000 feet (300 m) before its confluence. It is likely that Simmons Branch is enclosed within a pipe or concrete channel through some or all of this area and not impacted

by the gas pipeline. Because of the likely status of the population of spectaclecase in the Kanawha and the nature of the NiSource crossing site near the one known species location, and with AMMs in place, we would not expect NiSource activities in the Kanawha River to cause take of spectaclecase.

Ohio River (Multiple Tributary Streams)

NiSource pipelines make numerous crossings of the Ohio River and multiple tributary streams between West Virginia, Kentucky, and Ohio.

Prior to 1900, the spectaclecase was documented in the Ohio River from the vicinity of Cincinnati, Ohio, to its mouth, which is essentially downstream of the NiSource facilities. There has been one recent record of a live individual downstream of the NiSource project along the Illinois shoreline. It is unlikely that a viable population of spectaclecase persists in the Ohio and it seems particularly unlikely in the more upstream portions where NiSource activities could impact the river. Moreover, because the Ohio is a very large river at all of the crossings (between 1,000 and 2,000 feet wide) NiSource will use HDD for any pipeline replacement or any new lines.

Tennessee River (Hatley Creek)

The NiSource trunk line (three pipelines including one double line) makes one crossing of the Tennessee River in the tailwaters of the Pickwick Landing Dam and one crossing (three pipelines) of Hatley Creek, a tributary near its confluence - both in Hardin County, Tennessee. The spectaclecase is only occasionally found below Pickwick Landing Dam. Two live animals were found in Hardin County (river mile 170) in 1998 (USFWS 2012a). NiSource has agreed to use HDD to avoid impacts to the Tennessee River and we would not expect impacts to this population of spectaclecase.

Impacts to the Species Rangewide

NiSource would have limited impacts on the spectaclecase across the NiSource covered lands and would not impact any of the strongholds of this species in Missouri or Minnesota/Wisconsin. In the occupied streams that NiSource does cross, a combination of agreements to avoid impacts using HDD, and to employ other AMMs and BMPs will ensure that NiSource will not preclude survival or recovery of the spectaclecase.

4.2.1.6 Snuffbox

The reasonable worst case scenario suggests the potential for comparatively large numbers of snuffbox to be taken over the course of 50 years from a small number of ground disturbing activities. In addition, aggregate sediment impacts from several O&M activities could marginally reduce the habitat quality and possibly directly and indirectly affect reproduction. There is no Recovery Plan for the snuffbox mussel, but the Final Rule listing the species as

endangered (USFWS 2012c) identifies impacts to habitat and the probability that most populations have very low densities as key components affecting the species recovery.

The snuffbox historically occurred in 210 streams and lakes in 18 States and one Canadian province with extant populations known from 79 streams in 14 States and one Canadian province representing a 62 percent decline in occupied streams (USFWS 2012c). In some cases multiple streams comprise a single population and 25 of the 79 known occupied stream populations are documented by only one or two animals (USFWS 2012c). Butler classified populations of snuffbox into stronghold (sizeable populations distributed over a more or less contiguous length of stream (30 or more RMs with ample evidence of recent recruitment), significant (small, generally restricted populations with limited recent recruitment and viability), and marginal (very small and highly restricted populations with no evidence of recent recruitment). Under this system there are there are seven stronghold populations, 24 significant populations, and 48 marginal populations of snuffbox (USFWS 2012c).

The following is a discussion of potential NiSource impacts to known populations of snuffbox.

Allegheny River (Birch Run)

The snuffbox is currently known from three disjunct sites over a 42 RM reach around Venango County. The lower Allegheny River and lower French Creek occurrences could be considered a single population segment. This is a small population and its viability is unknown. NiSource crosses the Allegheny River one time on the line between Clarion and Armstrong Counties, Pennsylvania downstream of the known population of snuffbox. It also crosses a tributary, Birch Run, very near its confluence. Depending on the extent of the population, the single NiSource crossing could result in take at one site, but it is unlikely that one crossing could impact more than one part of this population if the sites are far enough apart to be considered disjunct. Under terms and conditions for another species, NiSource will HDD the Allegheny River crossing or survey and relocate mussels.

Big Darby Creek

NiSource crosses Big Darby Creek at three locations, one in west-central Franklin County, one in northern Pickaway County (double line), and one in central Pickaway County (approximately five miles from Big Darby Creek's confluence with the Scioto River). The two northern most crossings (Franklin County and northern Pickaway County) are within the range of the snuffbox documented in 1990 from RM 11.5 to RM 42.5 (USFWS 2012c). The overall population trend over the past 40 years has been downward. A population decline was documented in the late 1980s when its distribution declined from 17 to eight sites. In more recent surveys, two fresh-dead snuffbox were found at sites in Franklin County in 1996 and Pickaway County in 2000. The population is classified as marginal and its viability is questionable (USFWS 2012c).

Two NiSource stream crossings in the area of the most recently found fresh dead snuffbox in Big Darby Creek could cause take of this species if the population there persists. Because it may

already be on the verge of extirpation, it is unclear what effects NiSource activities might have. Under terms and conditions for another species, the USFWS will require NiSource to employ HDD or dry-ditch, survey and translocate mussels.

Buckeye Creek

NiSource makes three crossings of Buckeye Creek within approximately two miles of each other in Doddridge County, West Virginia. The status of this population of snuffbox is unknown, but the USFWS recommends NiSource cross this small creek with a dry-ditch methodology to limit potential impacts to mussels in this area. With AMMs, we would expect take to be minimal.

Cedar Creek

The Final Rule does not list Cedar Creek as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes four crossings of Cedar Creek and one crossing of Leatherbark Run, a tributary near its confluence in Gilmore County, West Virginia. All of the crossings are within approximately three miles (5 km) of each other. The status of this snuffbox population is unknown. We would expect AMMs to limit takebut under terms and conditions, the USFWS will require NiSource to make these crossings with a dry-ditch methodology to limit potential impacts to mussels in this area.

Duck River (Unnamed Tributaries)

One live snuffbox was found in Maury County, Tennessee during survey work in 2000-2003 sampling 72 sites. Snuffbox was not found at 11 lower sites surveyed in 2000. The snuffbox is very rare in the Duck River, and its viability is uncertain (USFWS 2011)

NiSource makes four crossings of unnamed tributaries to the Duck River near their confluences. NiSource, however, has agreed to avoid impacts to the Duck including impacts to tributaries that might result in sediment or other impacts. We do not expect any impacts to the snuffbox in the Duck River.

Elk River and Big Creek (West Virginia)

The Final Rule (USFWS 2011) indicates that the Elk River population of snuffbox is medium-sized and extends over approximately 30 RMs. Live individuals were collected in 1991 and 16 live snuffbox were collected in a 13 RM reach in Kanawha County, West Virginia in 2002, and also further upstream in 2004. The Elk River population is considered viable.

NiSource makes six crossings of the Elk River and one crossing of Big Creek, a tributary near its confluence all in Kanawha County. Because this population does not appear widely scattered over the 30 RMs where it has been found and because NiSource makes six crossings of the Elk and one of a tributary stream within the known distribution, there is the potential for significant take and impacts to this stable population. Under terms and conditions for another

species, the USFWS will require NiSource to HDD the Elk River crossings or survey and translocate snuffbox and all other listed species.

Fink Creek (West Virginia)

The Final Rule does not list Fink Creek as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes one crossing of Fink Creek in Gilmore County, West Virginia. The status of this snuffbox population is unknown, but under terms and conditions, the USFWS will require NiSource to cross this small creek with a dry-ditch methodology to limit potential impacts to mussels in this area. With AMMs, we would expect take to be minimal.

Fish Creek (West Virginia)

The Final Rule does not list Fish Creek as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes four crossings of Fish Creek in Marshall County, West Virginia. All of the crossings occur within approximately three miles (5 km) of each other. The status of this population is unknown and potential impacts are therefore uncertain. Under terms and conditions, the USFWS will require NiSource to cross Fish Creek with a dry-ditch methodology to limit potential impacts to mussels in this area.

Fishing Creek (West Virginia)

The Final Rule does not list Fishing Creek as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes four crossings of Fishing Creek in Wetzel County, West Virginia. All of the crossings occur within approximately five miles (8 km) of each other. The status of this population of snuffbox is unknown and potential impacts are therefore uncertain. Under terms and conditions, the USFWS will require NiSource to cross Fishing Creek with a dry-ditch methodology to limit potential impacts to mussels in this area.

Kanawha River

NiSource makes two crossings of the Kanawha River, one in eastern Putnam County, West Virginia (double pipeline) and one in Mason County, West Virginia very near the Kanawha's confluence with the Ohio River. The Kanawha is a large river at both crossings and an unlikely candidate for dry-ditch crossing. NiSource also crosses three tributaries to the Kanawha (Rock Branch, Simmons Branch, and an unnamed tributary) and an unnamed tributary to Rock Branch. These are all crossings of small streams that would be dry-ditch crossed. Rock Branch and its tributary (Putnam County) and the unnamed tributary to the Kanawha (Mason County) are all are more than 1,000 feet (300 m) from the River. Simmons Branch flows within an industrialized area and it is likely that it is enclosed within a pipe or concrete channel through

some or all of this area and not crossed by the gas pipeline. With AMMs in place, we would expect no impacts to this population.

Leading Creek

The Final Rule does not list Leading Creek as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes three crossings of Leading Creek in Gilmore County, West Virginia, all within approximately three miles of each other. The status of this population is unknown and therefore the potential impacts are uncertain. Under terms and conditions, the USFWS will require NiSource to cross Leading Creek with a dry-ditch methodology to limit potential impacts to mussels in this area.

Licking River (Unnamed Tributary)

The snuffbox occurred at 13 of 60 historical mainstem sites in the Licking River below Cave Run Reservoir for approximately 50 river miles in the early 1990s. Few individuals have been found in the intervening years. The snuffbox is now very rare and sporadically distributed. Its viability in the Licking River is questionable (USFWS 2011).

NiSource makes six crossings of the Licking River and one crossing (double pipeline) of an unnamed tributary near its confluence. Three crossings (two are double pipeline crossings) occur in the on the Nicholas-Robertson County Line (downstream), and three (one is a triple pipeline crossing) plus the unnamed tributary crossing occur on the Rowan-Bath County Line (upstream). The Rowan-Bath County Line crossings are downstream of the Cave Run Reservoir dam where snuffbox was located in the 1990s. The Nicholas-Robertson County Line crossings are more than 50 RMs downstream of the dam. Under terms and conditions, the USFWS will require NiSource to make the Rowan-Bath County Line crossings using HDD if practicable, if not a dry-ditch methodology will be used with survey and translocation of mussels.

Little Darby Creek

NiSource makes one crossing of Little Darby Creek in east-central Madison County approximately 10 miles (16 km) from the Little Darby's confluence with Big Darby Creek. The Final Rule (USFWS 2011) suggests that the Little Darby population of snuffbox may be nearing extirpation, however, it may be most likely to occur near the confluence with Big Darby Creek. Although some take is possible, we would not expect impacts to the snuffbox population of Little Darby Creek.

Under terms and conditions for another species, the USFWS will require NiSource to HDD Little Darby Creek if practicable and if not to survey, use dry-ditch techniques, and translocate snuffbox and any other listed species to a suitable location established in coordination with the USFWS.

Little Kanawha River

Snuffbox was documented in the Little Kanawha River during a 2010 survey in which four live animals, including at least one young snuffbox, were found at a site in Gilmer County (USFWS 2011). Fresh-dead snuffbox were also found in 2010 below Wells Dam in Wirt County, West Virginia. The Little Kanawha population may be recruiting and recent discoveries occur in the same county as the NiSource pipeline.

NiSource crosses the Little Kanawha River once with a triple pipeline in Gilmore County, West Virginia. All lines are within an approximately 250 foot (76 m) area. Although there is only one crossing the size of the crossing area and its location suggest take of snuffbox is likely in the Little Kanawha. The Little Kanawha is approximately 70 feet wide in this area and suitable for a dry-ditch crossing. Because the impacts would be from a triple pipeline the length of impact is estimated at 400 feet, which gives a total impact area of 1,301 m^2 (assuming 50% occupied habitat). The population density is unknown, but because it is reproducing, we use 0.1 snuffbox / m^2. This equates to take of 130 animals per action, or 260 snuffbox over the life of the permit. The population impacts of this level of take are uncertain. Because this appears to be a recruiting population about which little is known, the USFWS will require NiSource to cross the Little Kanawha River using HDD if practicable, if not NiSource will survey and translocate any snuffbox and other listed species to a suitable location established in coordination with the USFWS.

Little Miami River

The snuffbox has been known from the Little Miami since the mid-1800s, but most collections are relative recent. Fresh dead snuffbox were found at four mainstem sites (out of 47 surveyed) over approximately 20 RMs mostly in Warren County in the early 1990s. The population is considered small and its viability is unknown (USFWS 2011).

NiSource makes one crossing (single pipeline) of the Little Miami River in Greene County, Ohio. The Little Miami River is a small stream at the crossing site and would likely be crossed using a dry-ditch technique. Because the population likely extends over twenty miles and there is only one crossing three to five RMs upstream of Warren County, with the mandatory AMMs in place, it seems unlikely that NiSource would affect this population.

Meathouse Fork

The Final Rule does not list Meathouse Fork as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes three crossings of Meathouse Fork in Doddridge County, West Virginia, all within less than three miles of each other. The status of this population of snuffbox is unknown and therefore the potential impacts are uncertain. Under terms and conditions for another species, the USFWS will require NiSource to cross Meathouse Fork with a dry-ditch methodology to limit potential impacts to mussels in this area.

Muskingum River

NiSource makes six crossings of the mainstem of the Muskingum and crosses one tributary stream (Moxahala Creek). From upstream, the first mainstem crossing occurs in southern Cochocton County; there is a crossing of the mainstem in northern Muskingum County and another mainstem and the Moxahala Creek crossing in central Muskingum County; last, there are three crossings within ten miles of each other in northern Washington County, Ohio.

One live snuffbox was found in 2005 near Dresden on the Muskingum-Coshocton County Line. Prior to that, the last live individuals (two) were found in 1979. The viability of this population is unknown (USFWS 2011). The closest NiSource crossing is several RMs upstream of the most recently located live animals. Under terms and conditions for another species, the USFWS will require NiSource to make the upstream crossings of the Muskingum using HDD. Whatever the crossing method, it seems unlikely that with AMMs in place, NiSource would significantly impact this population.

Ohio River (Tributaries)

One fresh-dean and one live snuffbox were found below Belleville Lock and Dam in the Ohio River on the line between Ohio and West Virginia in 1995 and 2001. It is possible that this is an indication that the small population in the Ohio River mainstem exhibits a low level of viability (USFWS 2011). NiSource will make all crossings of the Ohio River using HDD and therefore we do not expect impacts to the snuffbox in the mainstem. NiSource also crosses a number of tributaries near their confluences with the Ohio within the likely range of the snuffbox. These include Buffalo Creek (Brooke County, West Virginia), Coal Branch (Greenup County, Kentucky), the Little Sandy River (Greenup County, Kentucky), Smith Branch (Greenup County, Kentucky), McMahon Creek (Belmont County, Ohio), and Opossum Creek (Monroe County, Ohio). No impacts are anticipated to Snuffbox from the NiSource activities affecting the Ohio River or the aforementioned tributaries.

Olentangy River

NiSource crosses the Olentangy River twice (one is a double pipeline) within a few miles from each other in east-central Marion County, Ohio. The Olentangy is a comparatively small river in eastern Marion County where the NiSource pipeline crosses.

The snuffbox was reported from about half of mainstem sites surveyed in 1960-61 and was classified as “fairly common” in the lower river. In 1989, only one live specimen was found in Delaware County and two fresh-dead in eastern Marion County (30 sites surveyed). The population is considered to be small and its viability is unknown (USFWS 2011) and therefore the potential impacts are uncertain. Under terms and conditions the USFWS will require NiSource to cross the Olentangy River with a dry-ditch methodology to limit potential impacts to mussels in this area.

Red River

NiSource makes five crossings of the Red River all within approximately 5 linear miles of each other in a sinuous reach of the river in western Powell County, Kentucky. All of the crossings are triple pipelines.

Surveys of the Red River in the 1980s and early 1990s did not encounter the snuffbox. More recent surveys have found small numbers. Mostly males have been found since 2002, but evidence suggests that a small population persists over an approximately 10-mile reach of the river in the lower section of the Red River Gorge Geological Area in Wolfe, Menifee, and Powell Counties. The viability of this population is unknown (USFWS 2011).

NiSource crossings are downstream of the known population of snuffbox in the Red River. It is unlikely that NiSource activities would impact the species in this river.

Slate Creek

NiSource makes six crossings of Slate Creek (two are triple pipeline crossings) and two crossings of Cook's Branch (one a triple pipeline crossing) a Slate Creek tributary in Menifee and Montgomery Counties, Kentucky.

Historically, the snuffbox was considered "extremely abundant" throughout Slate Creek. Since 1992, when 12 live animals were found, no additional live or fresh-dead snuffbox have been found. It is questionable whether or not this population is extant and if extant, it would be considered a marginal population and not likely viable (USFWS 2011). Slate Creek is a small stream at all of the NiSource crossings and should be crossed using dry-ditch techniques. Because of the status of the population, impacts are uncertain.

Tygart's Creek

NiSource crosses Tygart's Creek once (triple pipeline crossing) in the upper reaches of the stream in Carter County, Kentucky. The NiSource pipeline also crosses Lick Branch (single pipeline), a tributary stream near its confluence, and near Tygart's Creek's confluence with the Ohio River in Greenup County, Kentucky. The pipeline across the tributary occurs within a small impounded area of Lick Branch.

Both live and fresh-dead snuffbox have been reported from Tygart's Creek from the mid-1970's to the mid-1990's. The small snuffbox population, however, has declined and its viability is unknown (USFWS 2011). Impacts to this population are uncertain, but Tygart's Creek is a small stream in the upper reaches, and under terms and conditions, the USFWS will require NiSource to cross it using dry-ditch methodology.

West Fork Little Kanawha River

The Final Rule does not list West Fork Little Kanawha as an occupied stream for snuffbox (USFWS 2012c), but it is considered a potential snuffbox stream (KC Love, pers. comm.). NiSource makes five crossings of the West Fork Little Kanawha River within a five to 10 mile reach near its headwaters in Calhoun County, West Virginia. The status of this population is unknown, and therefore the potential impacts are uncertain. Under terms and conditions the USFWS will require NiSource to cross the West Fork Little Kanawha River using dry-ditch techniques to limit potential impacts to mussels in this area.

Impacts to the Species Rangewide

Given that the NiSource project could result in population-level effects, we must next consider whether those effects are likely to impact the survival and recovery of the snuffbox rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species.

The snuffbox occurs in a comparatively large number of streams, however, most of these populations are small and of questionable viability – there are proportionally few "strongholds" for this species. Of the eight strongholds identified based on the criteria outlined by Butler, none is impacted by NiSource activities. These include: Wolf River (Wisconsin); Bourbeuse River (Missouri); Clinch River (Tennessee and Virginia); Tennessee River (Alabama); Paint Rock River (Alabama); French Creek (Pennsylvania); Ausable River (Ontario, Canada); and the Sydenham River (Ontario, Canada). Of the 24 populations classified as significant, NiSource activities impact only two: the Little Kanawha River (West Virginia) and the Elk River (West Virginia) – NiSource crosses the Red River (Kentucky) but downstream of the known population. To avoid potential impacts to a number of populations having unknown status, the USFWS will require NiSource to limit impacts by crossing these streams using dry-ditch methodologies. It seems likely that NiSource will take snuffbox mussels based on the number of occupied streams crossed, but will not preclude survival or recovery of this species.

Impacts of Mitigation (All Non-MSHCP Mussels)

This sections discusses NiSource's commitments to mitigate for the anticipated impacts to the MSHCP mussels, and the likely impacts of this mitigation on the affected mussel populations.

Where take of mussels cannot be avoided, NiSource will employ mitigation to fully compensate for the impact of the take. For impacts to habitat wherever HCP or non-HCP mussels occur, NiSource will restore the disturbed stream bed and riparian area within its ROW resulting from its activities. Restoration will occur during the same construction season (next appropriate planting season for riparian restoration) as impacts unless there are extenuating circumstances

and the USFWS is informed of those issues. The basic restoration will be conducted in accordance with standard industry specifications as defined in the ECS and required by FERC and other relevant regulatory agencies. This will involve, at a minimum, restoration of any impacts to the depth, flow, channel bottom, and/or banks as nearly as practical back to the pre-activity condition. Vegetation restoration must be with site-appropriate native species. As the initial step in compensatory mitigation, NiSource will enhance the restored stream substrate within the construction zone to habitat that is optimal for the mussel species. This would typically involve either replacement or importation of clean, appropriately sized material for mussel re-colonization. NiSource will also enhance, where feasible, any pre-construction deficiencies associated with the depth, flow, bank stability, or riparian vegetation that would be detrimental to mussel recolonization, survival, and reproduction. This enhancement serves as one component of NiSource's overall mitigation program.

A second step in mitigation for mussel impacts is mitigation to compensate for sediment producing and other indirect impact producing activities (Aggregate Take). Mitigation for Aggregate Take will take the form of habitat protection/restoration. The protection or restoration of riparian habitat is designed to reduce the sediment impacts to mussel species by buffering occupied streams. The USFWS expects this to result in improved survival and reproduction of mussels in the mitigation area.

Last, for all species, NiSource has the option described in AMM #1 to relocate mussels as part of a stream crossing project. If the relocation is successful, as discussed in AMM #1, the following mitigation is required in addition to the enhancement and aggregate take mitigation described above. Find, relocate, and monitor the impacted species and other mussels within the assemblage impacted by the project to a suitable site upstream or downstream of the impact zone, and restore riparian habitat at the site of relocation, or at an upstream location as near to the mussel relocation site as possible, at a 1:1 ratio of the acreage amount of in-stream habitat impacted.

4.2.2 Northeastern Bulrush

This section evaluates the effects of the proposed action on the northeastern bulrush. Table C9 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

NiSource has agreed to the following measures to avoid and minimize impacts to this species.

1) Avoid all activities in known and presumed occupied habitat. If the area cannot be avoided, consultation will need to be reinitiated for this species.
   a) Conduct surveys in modeled suitable habitat for northeastern bulrush prior to construction of new alignment or ground disturbing (e.g., pipeline replacement) activities within wetlands within identified counties. Survey protocols should be coordinated with the local FWS field office and survey results provided to the local FWS field office. If suitable habitat is absent, adverse effects would be avoided and that area could be excluded from any future consultation. If suitable habitat is present but the species is absent, the survey would be valid for 5 years and further consultation would not be required for that period.
   b) Avoid impacts to newly discovered populations or further consultation with the USFWS will be needed.

Impacts to Individuals

Subactivities Having No Effect on the Species

Some of the subactivities are expected to have no detectable effects on northeastern bulrush (see Table C9, Appendix C; NE subactivities). Most of these subactivities are not expected to occur in their habitat. For example, upland areas are not northeastern bulrush habitat and thus, activities with all effects in those areas will not directly affect the species. In place pipeline abandonment, transfer of pipeline ownership, pipe stringing, compression facility noise, and communication facility operation would also have no effect on northeastern bulrush.

Subactivities Likely to Adversely Affect the Species

There are many subactivities that are expected to adversely impact northeastern bulrush, should they occur where the species are present (see Table C9, Appendix C; LAA subactivities). The type and magnitude of these impacts are discussed below.

The subactivities completed in northeastern bulrush habitat may result in direct and indirect impacts to the exposed individuals. Direct impacts may cause individuals to experience temporary stress or decreased reproductive success (e.g., from minor physical damage or habitat disturbance) to death (e.g., from crushing, cutting, poisoning). These direct impacts to northeastern bulrush would occur primarily from the replacement, removal, or installation of pipeline and building of new access roads across occupied habitat. Mowing, herbicide use, and vegetation disposal for pipeline O&M may also directly affect northeastern bulrush. In-stream work and stream crossings may cause sedimentation that may bury plants and alter their habitat. Vegetation management with chainsaw and mechanical tree clearing, as well as tree side trimming by bucket truck or helicopter may degrade habitat by altering sun/shade requirements. Individuals may suffer decreased fitness resulting from indirect effects, such as introduction of invasive exotic plant competitors. Activities involving heavy equipment and machinery in or near species habitat may spread seeds of invasive plant species.

Impacts to Populations

The only know occurrences of northeastern bulrush within the action area are in Pennsylvania, with one occurrence in ROW in Centre County and two additional occurrences within the covered lands in Centre and Franklin Counties. In addition, this species may occur on the NiSource covered lands in portions of Adams, Bedford, Cambria, Centre, Clinton, Cumberland, Franklin, Fulton, Lehigh, Monroe, and Northampton Counties, Pennsylvania; Washington County, Maryland; Alleghany, Augusta, Botetourt, Rockbridge, Rockingham, and Shenandoah Counties, Virginia; and Hardy County, West Virginia. There are no known occurrences in the ROW proper or the entire covered lands in Maryland, Virginia, or West Virginia.

Overall the covered lands intersect with 1,043 acres of mapped suitable habitat in West Virginia and several hundred acres in Virginia. There are no similar estimates available at this time in Pennsylvania. Due to (1) incomplete surveys, (2) the presence of at least one population within the existing ROW and (3) the other occurrences in close proximity to the covered lands, we conclude that it is likely that populations may occur within the covered lands, particularly within Centre, Clinton, Bedford, Franklin, and Fulton Counties, Pennsylvania.

NiSource has agreed to conduct surveys prior to construction of ROWs in new alignment or during ground disturbing activities (e.g., pipeline replacement) within wetlands in existing ROW and covered lands and to avoid impacts to those populations. However, despite this, NiSource is likely to impact the one known population that occurs in the ROW because clearing and other disturbing activities are necessary within the ROW. Further, due to lack of survey information for this species, we expect that there are more unknown populations within the ROW that NiSource could not completely avoid impacting.

Although there may be a number of unknown Northeastern bulrush populations that occur on the NiSource covered lands, we believe that NiSource will impact the Northeastern bulrush populations only infrequently. NiSource has agreed to survey for the species within its potential habitat prior to initiating project activities and avoiding impacts to any populations documented by those surveys. This significantly limits potential impacts to the species, focusing most impacts on populations within the existing ROW. There is one known occurrence within the existing ROW in Centre County, Pennsylvania and two additional occurrences within the covered lands in Centre and Franklin Counties, Pennsylvania. We believe that it is likely that other populations may occur within the covered lands in Virginia and West Virginia. Because there is one known and likely other unknown occurrences within the ROW, NiSource is likely to adversely affect the species.

Given the type and extent of activities that NiSource must perform in the ROW and the small size of many northeastern bulrush populations, we conclude that NiSource could result in the extirpation of small populations. Given that the NiSource project could result in population-level effects (e.g., loss of small populations in Pennsylvania), we must assess the potential for effects to the species as a whole. The first step is to estimate the number of populations that may be affected.

NiSource will be conducting field surveys in suitable habitat to identify and avoid impacts to unknown populations prior to initiation of individual projects. For this programmatic analysis we must estimate the prevalence of any undocumented occurrences of the species within the covered lands and the potential for NiSource to encounter and impact those populations. Within the MSHCP, NiSource estimates that it will work on approximately 10 percent of the covered lands over the 50-year duration; only a small portion of the covered lands will be suitable for the northeastern bulrush and smaller portion of that habitat will be occupied by the species. Although we do not have estimated acreage of suitable habitat for all states for this species at this time, we conclude that NiSource surveys will detect and subsequently avoid most populations.

Given this analysis, we estimate that only one new population may occur in a location that cannot be fully avoided and therefore, will be impacted or completely extirpated. We also conclude that NiSource will impact the one current population within the ROW in Pennsylvania.

Impacts to the Species Rangewide

We must next consider whether the loss of two populations is likely to impact the survival and recovery of the northeastern bulrush rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

Upon reviewing the Northeastern Bulrush Recovery Plan (USFWS 1993c) and the ecology of the species, the conservation needs for this species are to secure protection of at least 20 stable or increasing populations and to increase our understanding of life history and ecological requirements to allow for effective protection, monitoring and, as needed, management. When the northeastern bulrush was first listed, there were only 33 extant populations known. As of 2007, there were 113 extant populations range-wide, most of which were found in Pennsylvania and Vermont (USFWS 2009d).

In 2011, the USFWS considered the status of the species to be stable (from 2010-2011) (USFWS unpublished data, 2011). In August 2010, a new population was discovered in the State of New York. New populations have been discovered in 2011 in Pennsylvania as well. Some of these discoveries are associated with surveys due to proposed projects. These populations are most likely newly-discovered occurrences that were already present on the landscape, rather than novel populations indicating population growth or expansion.

The number of currently known populations appears to meet the conservation needs of the species. Further, the potential loss of one known and one unknown population of northeastern bulrush would not measurably reduce our ability to continue to meet the conservation needs of

the species. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the Northeastern bulrush.

4.2.3 Diamond Darter

Because so little is known about the life history requirements of the diamond darter, and because techniques to efficiently conduct surveys for diamond darters during all time periods, flow levels, and habitat types have not been developed, there is significant uncertainty regarding habitat use and distribution of the species during certain life stages and time periods. As a result, the following assumptions have been made about diamond darter distribution and habitat use for this analysis:

1. Diamond darters primarily use shoal habitats for foraging, resting, and spawning/egg laying.
2. All shoals within the lower 28 miles of the Elk River (downstream of King Shoals) are occupied by diamond darters, and are high quality habitat.
3. With the exception of larvae and adults that are migrating between habitats, all other diamond darter life stages are less likely to be present in pools than in shoals, and that in general pools are lower quality habitat.
4. All diamond darters within the Elk River comprise a single population. Diamond darters may move within and between habitat areas in the Elk River to breed, feed, or shelter.

These assumptions are based on the best information available at this time, as described in the Species Background and Habitat section above. Effects from NiSource's potential activities within the Elk River watershed may be over or under-estimated as a result of these assumptions and areas of uncertainty. The conclusions in this analysis may be revised as new information becomes available, and are predicated on NiSource's commitment to gather additional information to help reduce the current level of uncertainty, and validate, reject, or refine the assumptions listed above. If new information, developed over the life of this project, indicates that we have significantly under-estimated potential impacts, the jeopardy and/or adverse modification analysis may need to be revised. Project-specific decisions and conclusions will use the best available information at the time that those individual projects are initiated.

MEASURES TO AVOID AND MINIMIZE IMPACTS

NiSource has agreed to the following measures to avoid and minimize impacts to this species (Lowe 2013). As with the MSHCP species, measures in *italicized font* are non-mandatory with measures in standard font are mandatory. For purposes of this analysis, we presume that non-mandatory BMPs will <u>not</u> be performed.

Evaluating Presence of Species in NiSource Action Areas

1. Due to the rarity of the species and the difficulty associated with documenting species presence even in known occupied areas, all areas of the Elk River within the covered lands will be assumed to be occupied by the diamond darter and all AMMs will be followed.

Coordination with the US Fish & Wildlife USFWS (USFWS)

2. Prior to any activity that could directly affect diamond darters or their habitat (such as a pipeline replacement or stabilization of the river banks) NiSource will prepare a detailed EM&CP as described below and consult with the USFWS.

Pre-Construction Planning: Preparation of an EM&CP

3. A detailed EM&CP will be prepared for any activity with potential effects (e.g., stream bank disturbance, impacts to riparian habitat, activities causing sediment) within 100 feet of the ordinary high water mark of occupied habitat. The plan will incorporate the relevant requirements of the NGTS ECS and include site-specific details particular to the project area and potential impact. The Elk River will be considered "high-quality" (as defined in the ECS) for the purpose of preparing this plan regardless of the actual classification. The plan will avoid streambed disturbance if possible and be strongly oriented towards minimizing any riparian disturbance (including minimization of tree clearing within 25 feet of the ordinary high water mark of the Elk River), preventing downstream sedimentation (including redundant erosion and sediment control devices, which would be designed to protect aquatic resources as appropriate), and weather monitoring by the Environmental Inspector to ensure work is not begun with significant precipitation in the forecast. This detailed site-specific and engineered plan will also include any realignment to avoid impacts to high quality foraging and spawning habitats. The EM&CP will identify the full-time Environmental Inspector for the project and include his qualifications relevant to aquatic and fisheries ecology. The plan will comprehensively address all activities needed to complete the work and minimize take of diamond darters in occupied habitat including using dry-ditch crossing techniques for intermittent streams leading to diamond darter habitat. The plan will include planting native, riparian woody vegetation in all disturbed areas within 25 feet of the ordinary high water mark of the Elk River after construction is completed. The EM&CP will also include a sediment control component for uplands that drain to and impact occupied habitat. Detailed erosion control plans will be developed specific to slopes greater than or equal to 30 percent leading directly to occupied habitat. In areas with less than a 30 percent slope, ECS and AMM erosion control measures protective of fish and mussels will be implemented. The USFWS's West Virginia Field Office will be notified at least five days prior to the initiation of activities in or under the Elk River. The plan will be approved in writing by NiSource NRP personnel prior to project implementation and will include a tailgate training session for all on-site project personnel to highlight the environmental sensitivity of the habitat and any diamond darter AMMs that must be implemented.

Streambed Construction

4. For activities in occupied habitat, install replacement pipelines and major repairs under the river bottom using HDD or other trenchless methods rather than open trenching unless the crossing evaluation report prepared in accordance with MSHCP Section 5.2.1.1 and Appendix J indicates otherwise. Drilling should be carefully undertaken and a plan should be in place to minimize and address the risk of in-stream disturbance due to frac-outs. The plan should also specify diamond darters in the vicinity of the crossing as a key conservation concern and include specific measures identified in the NGTS ECS, from standard industry practices, or other mutually agreed-upon practices to protect this resource. The plan will also include a frac-out impact avoidance plan which will evaluate the site in terms not only of feasibility of conducting HDD, but the likelihood of large scale frac-out and its effects on diamond darters, and actions to address a large scale frac-out in occupied habitat. The plan should also consider the potential effects on diamond darters if drilling fluids are released into the environment and include measures to immediately minimize and remediate any adverse effects. No in-stream (or under stream) activities will be conducted between January 1 and July 31. The plan must contain all information required for a FERC Section 7c filing at a minimum. The plan will specify that the USFWS's West Virginia Field Office will be immediately notified in the event of a frac-out.

If, after detailed engineering studies (e.g., geotechnical, physiological, topographical, and economic), it is determined (and agreed to by NRP personnel) that an HDD or other alternative methods that avoid instream impacts are not feasible, a report will be prepared and included in the EM&CP to be submitted to the USFWS during the consultation process. If other alternative are not feasible, NiSource will utilize a dry-ditch crossing technique as described in the ECS beginning on page 15 and Figures 18 and 19. The dry crossing will be designed to minimize the amount of instream habitat that will be disturbed and will be installed in the following manner:

a. Install pumps or flumes to transport water past the construction site.
b. Install upstream dam.
c. Commence water transport past the construction site.
d. Install downstream dam.
e. Relocate (to the extent practical) mussels and fish to upstream location.
f. Pump water from construction site to upland area.
g. Dig trench, install pipe, and backfill.
h. Remove downstream dam.
i. Remove upstream dam.
j. Remove water transport equipment.

No in-stream activities will be conducted between January 1 and July 31. Clean 1 to 2-inch gravel will be used for the final one-foot of fill in the backfilled trench. The EM&CP will also include results from discussions with the US Army Corps of Engineers regarding flow minimization from Sutton Dam during in-stream construction activities.

5. Install pipeline to the minimum depth described in the ECS and maintain that depth at least 10 feet past the high water line to avoid exposure of pipeline by anticipated levels of erosion based on geology and watershed character. Additional distance may be required should on-site conditions (i.e., outside bend in the waterbody, highly erosive stream channel, anticipated future upstream development activities in the vicinity, etc.) dictate a reasonable expectation that the stream banks could erode and expose the pipeline facilities. Less distance may be utilized if terrain or geological conditions (long, steep bank or solid rock) will not allow for a 10-foot setback. These conditions and the response thereto will be documented in the EM&CP and provided as part of the annual report to the USFWS.

6. All repair activities that have the potential to cause turbidity in the Elk River will be done using dry techniques typically consisting of placing a coffer dam (typically sand bags) around the area requiring repair, pumping the water out of the coffer dam, and completing the repair.

7. As part of the routine pipeline inspection patrols, visually inspect all stream crossings in occupied habitat at least yearly for early indications of erosion or bank destabilization associated with or affecting the pipeline crossing that is resulting, or would before the next inspection cycle, likely result in sediment impacts to diamond darter habitat beyond what would be expected from background stream processes. If such bank destabilization is observed, it will be corrected in accordance with the ECS. Follow-up inspections and restabilization will continue until the bank is stabilized (generally two growing seasons).

<u>Stream Bank Conservation</u>

8. Do not construct culvert and stone access roads and appurtenances (including equipment crossing) across the Elk River or within its riparian zone.

9. For equipment crossings of small streams that are tributaries of and within ½ mile of the Elk River, use half pipes of sufficient number and size that both minimize impacts to stream bed and minimize flow disruption to both upstream and downstream habitat (ECS, Figure 22).

<u>Pipeline Abandonment</u>

10. Abandon pipelines in place to avoid in-stream disturbance that would result from pipeline removal unless the abandonment would be detrimental to the diamond darter.
Contaminants

11. As described in the ECS section on “Spill Prevention, Containment and Control,” site staging areas for equipment, fuel, materials, and personnel at least 300 feet from any waterway within the Elk River watershed, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted

occupied habitat: a). follow spill response plan, b). call the USFWS West Virginia Field Office (304-636-6586) to report the release; and c). call the National Response Center (800-424-8802).

12. Ensure all imported fill material to be used in projects in the vicinity of the Elk River are free from contaminants (this would include washed rock or other materials that could significantly affect the pH of the stream) that could affect the species population or habitat through acquisition of materials at an appropriate quarry or other such measures.

13. For storage well activities, use enhanced and redundant measures to avoid and minimize the impact of spills from contaminant events within the Elk River watershed. These measures include, for example, waste pit protection, redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials, and a spill response plan provided to the USFWS as part of the annual report. These measures will be included in the EM&CP prepared for the activity.

14. Do not use fertilizers or herbicides within 100 feet of the Elk River. Fertilizer and herbicides will not be applied if weather (e.g., impending storm) or other conditions (e.g., faulty equipment) would compromise the ability of NiSource or its contractors to apply the fertilizer or herbicide without impacting presumed occupied diamond darter habitat. The EM&CP prepared for this activity (AMM# 2 above) will document relevant EPA guidelines for application.

<u>Withdrawal and Discharge of Water</u>

15. Do not draw hydrostatic test water and/or water for storage well O&M from or discharge water directly into the Elk River.

Discharge water in the following manner (in order of priority and preference):

a. Discharge water down gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
b. If those circumstances occur, discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.
c. If those circumstances occur, discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices (Figures 6A&B, 7, 8, 14A&B; ECS) to minimize effects to the waterbody.

<u>Travel for O&M Activities</u>

16. Do not drive across the Elk River – walk these areas or visually inspect from bank and use closest available bridge to cross stream.
Invasive Species

17. Clean all equipment (including pumps, hoses, etc.) that has (1) been in a perennial waterbody for more than four hours within the previous seven days and (2) will work in occupied habitat; following established guidelines to remove exotic or invasive species before entering the Elk River. Do not discharge any water for other sources that might be contained in equipment (e.g. ballast water, hoses, sumps, or other containment). It is important to follow these guidelines even if work is not occurring in the immediate vicinity of this species since, once introduced into a watershed, invasive species could move and eventually affect the diamond darter. If Japanese knotweed is found within any construction areas in the Elk River watershed, take measures to treat and control the species so that it does not spread.

Impacts to Individuals

NiSource's proposed action could affect the entire currently occupied range of the diamond darter and all occupied critical habitat for the diamond darter in the Elk River, in Clay and Kanawha Counties, West Virginia. The proposed action could directly affect the mainstem Elk River which is occupied by the diamond darter, and could also affect tributaries of the Elk River and upland habitats in the Elk River watershed, both of which contribute to maintaining the health and condition of the mainstem Elk River. Table C10 (Appendix C) identifies types of project activities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), the environmental impacts resulting from each type of activity, and the general types of anticipated responses of individuals. The analysis in Table C10 and was intended to be read in concert with and support this effects analysis section.

Stream Crossings

The most significant and direct potential adverse effects to the diamond darter from the proposed action are from stream crossings associated with pipeline repairs or replacements. Pipeline stream crossings can affect fish habitat, food availability, and fish behavior, health, reproduction, and survival. Direct disturbances to the habitat containing diamond darters could also kill or injure adults, juveniles, young, or eggs. One of the most immediate effects of instream construction is the creation of short-term pulses of highly turbid water and total suspended solids (TSS) downstream of construction (Levesque and Dube 2007). Although these pulses are usually of relatively short duration and there is typically a rapid return to background conditions after activities cease, instream construction has been shown to have considerable effects on stream substrates and benthic invertebrate communities that persist after construction has been completed (Levesque and Dube 2007). Commonly documented effects include substrate compaction, as well as silt deposition within the direct impact area and downstream that fills interstitial spaces and reduces water flow through the substrate, increasing substrate embeddedness and reducing habitat quality (Reid and Anderson 1999, Levesque and Dube 2007, Penkal and Phillips 2011). Construction also directly alters stream channels, beds, and banks resulting in changes in cover, channel morphology, and sediment transport dynamics. Stream bank alterations during construction of pipeline crossings can lead to increased water velocities, stream degradation, and stream channel migrations. Removal of

vegetation from the banks can change temperature regimes and increase sediment and nutrient loads (Penkal and Phillips 2011).

These instream changes not only directly affect the suitability of fish habitat, but also affect the availability and quality of fish forage by altering the composition and reducing the density of benthic invertebrate communities within and downstream of the construction area (Reid and Anderson 1999, Levesque and Dube 2007, Penkal and Phillips 2011). Various studies have documented adverse effects to the benthic invertebrate community that have persisted for between 6 months and 4 years post-construction (Reid and Anderson 1999, Levesque and Dube 2007).

Stream crossings have also been shown to affect fish physiology, survival, growth, and reproductive success (Levesque and Dube 2007). Studies have found decreased abundance of fish downstream of crossings, as well as signs of physiological stress such as increased oxygen consumption and loss of equilibrium in fish remaining downstream from crossings (Reid and Anderson 1999, Levesque and Dube 2007). Increased sediment deposition and substrate compaction from pipeline crossing construction can degrade spawning habitat, result in the production of fewer and smaller fish eggs, impair egg and larvae development, limit food availability for young-of-the-year fish, and increase stress and reduce disease resistance of fish (Reid and Anderson 1999, Levesque and Dube 2007).

The duration and severity of these potential effects depends on factors such as the duration of disturbance, the length of stream segment directly impacted by construction, and whether there are repeated disturbances (Yount and Niemi 1990). Most studies documented recovery of the affected stream reach within 1 to 3 years after construction (Yount and Niemi 1990, Reid and Anderson 1999). However, Yount and Niemi (1990) cite an example of one study that made a preliminary determination of stream recovery within 1 year, but when the site was reexamined 6 years later, fish biomass, fish populations, macroinvertebrate densities, and species composition were still changing. It was suspected that shifts in sediment and nutrient inputs to the site as a result of construction in and around the stream contributed to the long-term lack of recovery. In another study, alterations in channel morphology, such as increased channel width and reduced water depth, were evident 2 to 4 years post-construction at sites that lacked an intact forest canopy (Reid and Anderson 1999).

There is also the potential for aggregate effects. While a single crossing may have only short-term or minor effects, multiple crossings or multiple sources of disturbance and sedimentation in a watershed can have cumulative effects on fish survival and reproduction that exceed the recovery capacity of the river, resulting in permanent detrimental effects (Levesque and Dube 2007). Whether or how quickly a stream population recovers depends on factors such as the life-history characteristics of the species and the availability of unaffected populations upstream and downstream as a source of organisms for recolonization (Yount and Niemi 1990). Species such as the diamond darter that are particularly susceptible to the effects of siltation and resulting substrate embeddedness, and that have limited distribution and population

numbers, are likely to be more severely affected by instream disturbances than other more common and resilient species.

Finally, although techniques such as HDD can be used to avoid many of these potential effects, there is a risk of frac-outs associated with HDD. Frac-outs are fractures in the rocks and sediments overlying the drill area that allow discharges of fine bentonite clays and other materials used during the drilling process to enter the stream or land surface above. These fine materials can smother stream substrates, kill benthic macroinvertebrates and fish present in the affected area, and cause impacts similar to those described above for instream disturbances. Due to the fine particle size of bentonite clays, impacts from major frac-outs can be more severe and long-lasting that those described for instream construction. Removal and clean-up of frac-out material can further disturb substrates, benthic macroinvertebrates, and fish within and downstream of the discharge area. Careful planning, site-selection, and spill-prevention preparedness is needed to minimize the potential for frac-outs when using HDD techniques.

In order to better quantify the potential level of effects from instream disturbances from pipeline repair and replacements and other potential activities conducted within and around diamond darter habitats, and to assist in developing appropriate avoidance and minimization measures, NiSource drafted a Plan for Construction, Operation, and Maintenance Near the Elk River (Elk River Plan; see Appendix D). Based on this plan, NiSource determined that their proposed action does not include the need for any new stream crossings of the Elk River. NiSource currently has six existing pipeline crossings on the Elk River. Three of these crossings (referred to as Lines X52MI, SM-1027, and SM-79) are relatively new and NiSource does not anticipate the need for repairs or replacement of these lines in the foreseeable future. The remaining three lines (referred to as Lines M-11, S and N) are all more than or close to 100 years old and may require one repair and one replacement each over the life of the permit.

NiSource Line M-11 is located at the head of an approximately 800-foot long shoal near Walgrove, West Virginia. Diamond darter surveys were conducted in this shoal late in the summer of 2012. Diamond darters were foraging and concentrated at the head of this shoal (glide habitat) in an area that was approximately 130 feet long. Twenty diamond darters were counted at this location, which is the largest number of diamond darters ever counted at one site. The area where this line is currently located is considered high quality diamond darter habitat and is likely used for feeding, breeding, and sheltering.

NiSource Line S is located at the lower end of a long pool near Reamer, West Virginia. The area where this line is located has not been surveyed for the presence of diamond darters or assessed for habitat suitability. Surveys conducted in the late summer or fall of 2011 and 2012 documented a total of 18 diamond darters in a 164-foot long reach of river located in the upper half of an approximately 1,780-foot long shoal located approximately 700 feet downstream of the current location of this line. This downstream shoal is considered high quality diamond darter habitat and is likely used for feeding, breeding, and sheltering. However, based on the best available information at this time as described in Species Background and Habitat and

Uncertainty sections above, the pool habitat where this line is directly located is less likely to be used for diamond darter feeding or breeding. This is because overall pools naturally have higher levels of fine silts and clays and lower levels of sand and gravel and these substrates are not as conducive to diamond darter foraging, resting, or breeding. However, additional surveys and habitat assessments are needed to validate this assumption.

NiSource Line N is located at the lower end of a shoal that is approximately 1,700 feet long. This shoal has not been surveyed for the presence of diamond darters using the most current survey methods, but coarse scale habitat assessments indicate that it has habitat characteristics similar to other shoals that are known to support the species (Osier 2005). In addition, the next two shoals downstream from this site have been found to be consistently occupied by diamond darters through many years of surveys and have produced about 30 percent of all diamond darters ever captured. It is therefore, likely that the shoal in which Line N is located is also frequently used by diamond darters and contains high quality habitat for diamond darter feeding, breeding, and sheltering.

Table D1 details the types of adverse effects that may occur to each life stage of the diamond darter as a result of one repair and one replacement at each of these three pipelines, as well as the required BMPs that have been developed to avoid and minimize each type of effect. Pipeline repairs typically consist of activities such as repairs to the pipeline coating, installing clamps over small leaks, repair/restoration of eroded stream banks, or replacing washed out covers over the pipeline. As described in the diamond darter BMPs, NiSource will use dry techniques to conduct any maintenance activity that has the potential to cause significant turbidity within the Elk River. The dry techniques will typically consist of placing a coffer dam (typically sand bags) around the area requiring repair, pumping the water out of the coffer dam, and completing the repair. These repairs will typically be completed within 24 hours. The repair area is typically less than 30 feet by 15 feet. Leak clamp installation will consist of excavating a small hole (usually 3-foot wide and 3-foot deep) by hand around the leak, fastening the clamp around the pipe, and backfilling the hole. Planned repair work will not be conducted between January 1 and July 31.

Pipeline replacements consist of installing an entirely new line to replace the old, existing line. Replacements may be installed by using HDD, inserting a smaller diameter plastic pipe into the existing pipeline, or constructing a trench across the Elk River and installing a new pipeline. Any trenching would be conducting using dry techniques similar to those described above for repairs. For these replacements the area directly dewatered for the construction would be approximately 75 feet wide and would extend across the entire Elk River. NiSource estimates that all in-stream activities will typically be completed within 4 days.

The Elk River Plan and associated Compliance Flowchart outline potential alternatives that have been developed for each line. For all repairs and replacements of these lines, NiSource would evaluate and select the least damaging construction alternative using the Compliance Flowchart that specifies first avoiding impacts to critical habitat in the Elk River, then selecting HDD or other instream avoidance options, or relocating the construction to an area where HDD or

other instream avoidance options were feasible. NiSource's preliminary evaluations of these three lines indicate that instream avoidance options may be practicable for Lines M-11 and S. The preliminary evaluation did not identify any practicable instream avoidance options for Line N.

Relocation options are also available for all lines that would allow the lines to be moved out of high quality habitat. Evaluations would be done to ensure sites selected for HDD would have a low potential for frac-outs, and response and prevention plans would be developed for each site where HDD would be used.

Instream construction would only be used when no other options were available and would only occur in after habitat evaluations were conducted to ensure the proposed impact area was low quality diamond darter habitat so that prime foraging and breeding areas would not be affected. All instream and understream construction would be conducted and in a manner so that the duration and extent of direct and indirect impacts would be minimized. All instream construction will be conducted using the dry ditch method, which would minimize the potential for downstream sedimentation, and resulting adverse effects to habitat and forage availability (Reid *et al*. 2002). Time of year restrictions will be used so that no instream or understream construction will occur during diamond darter spawning season or when eggs or larvae are expected to be present. Instream construction would be sequenced in a manner so that the potential for trapping, killing, or crushing any diamond darters potentially present within the direct construction zone would be minimized. Sediment and erosion control measures and spill prevention measures would be enacted to minimize adverse effects to habitat and water quality, and benthic macroinvertebrates that diamond darters feed on. Alterations and removal of riparian vegetation will be minimized and construction will be designed to avoid and minimize alterations to the stream banks. Disturbed areas would be replanted with native, woody, riparian vegetation.

These measures should ensure that the total number of direct disturbances related to pipeline repair and replacements, and thus potential cumulative effects, will be minimized. When direct disturbances do occur, adverse effects will be avoided to the maximum extent practicable and when not avoided, impacts will only occur in those areas that have low habitat suitability for the diamond darter and are therefore not likely to be frequently used by diamond darters for foraging, breeding, or spawning. These measures will also reduce the potential that diamond darters will be present within the affected areas. While we cannot completely exclude the potential that adult diamond darters may be present in these lower quality habitats, if they are present it would likely be in low numbers (single individuals), as they move between foraging and resting sites. No breeding or spawning adults, eggs, or larva will be affected.

<u>Pipeline Abandonment</u>

Potential adverse effects associated with instream disturbances could also potentially occur as a result of pipeline abandonment and removal activities. BMP 10 requires that pipelines within the range of the diamond darter be abandoned in place unless this would be detrimental to the

diamond darter. This should ensure that additional instream impacts or impacts associated with increased sedimentation, erosion, and water quality degradation from pipeline abandonment will be avoided. Abandoned pipelines that were improperly installed, or that are subject to extreme flooding or other major disturbance events may become exposed and create hydraulic controls, barriers to fish movement, or sources of stream substrate and bank instability and erosion that could adversely affect the diamond darter. If such situations are noted, the same BMPs that address other instream work and construction activities in the Elk River watershed would be applied to reduce the effects of construction and ensure that disturbances to habitat and adverse effects from sedimentation and water quality degradation are minimized, and that any disturbed areas of the stream and river banks are properly reclaimed. Removal of abandoned pipelines that are having an adverse effect on the diamond darter would be a long-term beneficial effect.

Hydrostatic Testing (water withdrawal and discharge)

Hydrostatic testing involves pumping water (in some cases millions of gallons) under pressure into new or existing pipelines (sometimes several miles long) in order to evaluate the integrity of the pipeline section. This water can be drawn from and discharged into streams. Hydrostatic testing is a standard practice within the pipeline industry and could occur multiple times over the life of the permit and could occur anywhere within the covered lands that pipeline exists.

Water withdrawal has the potential to entrain and kill diamond darter eggs, larvae, or adults present in the immediate vicinity of the withdrawal pipe; alter flows; or expose diamond darters and their habitat to contaminants or invasive species. Hydrostatic test water discharge could also produce aggregate amounts of sediment over the life of the permit. Entrainment of diamond darters and alteration of flows in the Elk River will not occur from the proposed action because BMP 15 requires that NiSource not withdraw or discharge hydrostatic test water directly from or to the Elk River. It also specifies how far away from the Elk River withdrawals or discharges can be conducted, how discharges will occur, and that sediment and erosion control measures will be applied. BMP 17 includes measures to ensure that invasive aquatic species will not be introduced into the Elk River and that measures will be taken to control Japanese knotweed and other invasive riparian species if they are noted within any construction areas. Implementation of the BMPs should reduce the potential for adverse effects from hydrostatic testing activities so that they will only result in insignificant or discountable impacts to the diamond darter.

Storage Well Activities

Existing storage wells and storage well expansions are expected to occur within the Elk River watershed in Kanawha County. Storage wells are large underground sites where natural formations (hundreds and more commonly thousands of feet below the surface) are conducive to storing natural gas. Within the storage well counties, well-heads can occur virtually

anywhere (i.e., wetlands, uplands and floodplains). Activities associated with storage wells include drilling, clearing, and enhancement or reconditioning.

Drilling includes the temporary (typically one to three months) location of drilling equipment on the drilling pad, the drilling operation itself, sediment and water containment, and ingress and egress of vehicles. One primary activity at these sites relates to the construction and operation of the well-heads (typically dozens per well) used to introduce and withdraw the natural gas. Storage well clearing involves clearing and contouring some or part of a drilling pad. A typical cleared pad is approximately 400 feet x 400 feet, however, the final area maintained is typically smaller. Enhancement or reconditioning activities for storage wells (reconditioning, acidizing, coil-tubing clean-out, drilling to deepen the well, hydraulic fracturing, re-perforating, and well-bore stabilization) may be required at existing well-heads to increase the efficiency or return the well to previous levels of deliverability. This primarily involves activities similar to drilling in that equipment must be transported to the work site, the well pad re-disturbed to some extent, and reconditioning fluids would be present on the site.

The primary impact of storage well activities on diamond darters is sedimentation. There is also the potential for a major spill that could impact the diamond darter. Major spills, like major frac-outs discussed earlier, are not covered under the proposed action, but the potential must be evaluated here. A major spill event at a site close to the Elk River could contaminate the stream and cause take and potential localized extirpation or extinction of the species.

BMPs 11 and 13 require the use of enhanced and redundant measures during storage well activities to avoid and minimize the chance of spills and contamination within the range of the diamond darter. These measures include waste-pit protection, redundant spill containment structures, and on-site staging of spill containment/clean-up equipment and materials. BMP 11 also requires that site staging areas for equipment, fuel, materials, and personnel be located at least 300 feet from any waterway within the Elk River watershed, if available, to reduce the potential for sediment and hazardous spills entering the waterway. These measures should significantly reduce the potential for both major and minor spills within the Elk River watershed. BMPs 2, 3, 9, 12, and 17 would be used to ensure that the diamond darter was considered in planning any storage well activities within the Elk River watershed, and that NiSource would implement measures to control sedimentation and erosion, avoid and minimize disturbances to the Elk River and its tributaries and associated stream banks, and avoid the introduction and spread of invasive species. The BMPs are expected to avoid all but minor sedimentation impacts from this activity. More information on the potential effects of sedimentation is provided below.

<u>Other Project Activities</u>

A number of other project activities could have adverse effects on the diamond darter including: vegetation management and clearing; ROW repair and maintenance; access road construction and maintenance; grading and stabilization of corridors; cathodic protection; and replacement, repair, or new construction of pipelines located outside the Elk River mainstem

but within the Elk River watershed. Effects associated with these activities are primarily related to either removal of riparian vegetation and aggregate-level sedimentation associated with ground disturbance from maintenance or new construction of multiple projects. There is also the potential water quality degradation associated with equipment and chemical use in and around the Elk River and for introductions of, or increases of invasive species, into the Elk River watershed.

Healthy, functioning, riparian forests are an essential to maintaining water and habitat quality in streams, and streams are adversely affected when riparian vegetation is removed (Urgenson 2006). Loss of streambank vegetation causes increased water temperatures and changes in light regimes, that can affect dissolved oxygen levels, and the health, fitness and survival of adults fish and their eggs. Riparian vegetation is also the primary source of leaf litter entering the stream which provides food for the benthic macroinvertebrates that the diamond darter feeds on (Urgenson 2006). Removal of riparian vegetation can also increase streambank erosion, increase sedimentation in streams, and alter channel morphology.

Excess sediment in streams can degrade fish habitat by altering the stability of the stream channel, scouring streambanks and substrates, and destabilizing the substrates and habitats that fish such as the diamond darter rely on (Waters 1995, USEPA 2013). Siltation which often results from excess sediment in streams, has long been recognized as a pollutant that alters aquatic habitats by reducing light penetration, changing heat radiation, increasing turbidity, and covering the stream bottom (Ellis 1936 in Grandmaison *et al.* 2003). Increased siltation has also been shown to abrade and suffocate bottom-dwelling organisms, reduce aquatic insect diversity and abundance, and, ultimately, negatively impact fish growth, survival, and reproduction (Berkman and Rabeni 1987). Siltation directly affects the availability of food for the diamond darter by reducing the diversity and abundance of aquatic invertebrates on which the diamond darter feeds (Powell 1999), and by increasing turbidity, which reduces foraging efficiency (Berkman and Rabeni 1987). Research has found that when the percentage of fine substrates increases in a stream, the abundance of benthic insectivore fishes decreases (Berkman and Rabeni 1987). Siltation also affects the ability of diamond darters to successfully breed by filling the small interstitial spaces between sand and gravel substrates with smaller particles. Diamond darters lay their eggs within the interstitial spaces of sand and gravel substrates. The complexity and abundance of interstitial spaces is reduced dramatically with increasing inputs of silts and clays. Siltation also results in an increase in substrate embeddedness. As substrates become more embedded by silts and clays, the surface area available to fish for shelter, spawning, and egg incubation is decreased (Barbour *et al*. 1999, Sylte and Fischenich 2007). Consequently, the amount and quality of breeding habitat for species such as the diamond darter is reduced (Bhowmik and Adams 1989, Kessler and Thorp 1993, Waters 1995, and Osier and Welsh 2007 all in USFWS 2008). Because the diamond darter spends much of its time buried in stream substrates or foraging immediately on top of stream substrates, this species is particularly susceptible to the effects of siltation (Grandmaison *et al*. 2003).

NiSource has incorporated a number of measures, specifically BMPs 1, 2, 3, 5, 7, 8, 9, 12, 14, 16, and 17, to ensure that potential effects from removal of riparian vegetation, sedimentation, water quality degradation, and invasive species are avoided and minimized. BMPs 1 and 2 will ensure that the diamond darter is considered during planning of all activities that could affect the Elk River. BMP 3 requires the development of a site-specific environmental plan for all activities conducted in and around the Elk River. This plan will include measures to avoid erosion and sedimentation in the Elk River, avoid disturbances of riparian vegetation, and replant native, woody vegetation in areas where disturbances cannot be avoided. BMP 5 specifies that pipelines will be installed using methods to avoid streambank erosion both during construction and over the life of the pipeline. BMP 7 requires NiSource to visually inspect all pipeline crossings annually for indications of erosion or bank destabilization and to quickly correct these problems. This measure provides increased protection for the Elk River over the current baseline and should reduce the potential amount of sedimentation, bank erosion, and riparian habitat loss that will be experienced in the Elk River over the life of the project from NiSource facilities. BMP 8 specifies that access roads and equipment crossings will be constructed so they will not affect the Elk River or its riparian habitat, and BMP 9 specifies that equipment crossings of Elk River tributaries will be constructed in a manner to minimize sedimentation and erosion, and alterations of stream flow. BMP 12 will ensure that any fill material used in the vicinity of the Elk River is clean and will not cause water quality degradation. BMP 14 will ensure that no herbicides are used in the vicinity of the Elk River so that water quality degradation and loss of riparian habitat is avoided. BMP 16 will ensure that no equipment will enter the Elk River during any operation and maintenance activities which will reduce the potential for both sedimentation and water quality degradation. BMP 17 includes measures to ensure that invasive species will not be introduced into the Elk River and that actions will be taken to control Japanese knotweed and other invasive riparian species if they are noted within any construction areas.

In addition to these species-specific BMPs, NiSource has developed ECS that will be applied to all their actions throughout the range of this HCP. These ECS include detailed measures to minimize sedimentation, erosion, and water quality degradation during all construction and maintenance activities. Although the construction of new facilities will occur under this HCP, creating opportunities for new sources of sedimentation in the range of the diamond darter, the large-scale adoption and consistent use of these enhanced sediment and erosion control and other protective measures at all existing and future NiSource activities in the Elk River watershed should reduce the amount of sedimentation and riparian habitat loss occurring within the range of the diamond darter over the long-term. For example, oil and gas access roads have been identified as a source of “high” sediment contributions to the Elk River (USEPA 2001b). Lack of road maintenance, improper construction, and subsequent use by the timber industry and all-terrain vehicles can increase the amount of sedimentation and erosion associated with these roads (WVDEP 2008b). Construction of properly designed access roads and maintenance of existing access roads and ROWs using NiSource ECS has the potential to reduce the current amount of sedimentation being experienced in the Elk River.

In conclusion, the application of the diamond darter BMPs and adherence to the ECS for all NiSource's proposed activities within the range of the diamond darter will greatly avoid and minimize potential impacts from sedimentation and water quality degradation so that individual projects are not likely to adversely affect the species; however some aggregate adverse effects from sedimentation and water quality degradation remain likely. It is difficult to estimate the extent of potential impacts that will result from NiSource's proposed activities over the 50 year life of this permit. NiSource currently has approximately 320 miles of pipeline, 7 compressor stations, and 5 storage fields containing approximately 161 wells in Kanawha County which is the portion of the action area within the range of the diamond darter. These facilities were constructed over the last 136 years, and operation and maintenance of them is ongoing. These facilities, which are spread throughout the range of the diamond darter, are currently estimated to cover a total of 6,526 acres or 0.67 percent of the Elk River watershed. In Appendix A of the HCP, NiSource attempted to quantify the reasonably expected maximum amount of annual disturbance from both expansion of new facilities and maintenance of old facilities within Kanawha County. They estimate that a maximum of approximately 787 acres could be disturbed annually and that of this, up to 454 acres of disturbance could occur on previously undisturbed lands. They further expect that no more than 3,000 acres of new disturbance would occur over the life of the permit. The scope and extent of impacts resulting from these activities will depend on the proximity of the individual proposed actions to the Elk River and its direct tributaries, and the development of appropriate project-specific avoidance and minimization measures (as required by BMP 3). Projects that are located farther away from the Elk River mainstem and direct tributaries, farther up in the headwaters, or are entirely within upland areas, will have a minimal potential for adverse effects. Larger-scale projects, or multiple smaller projects all conducted in close proximity to the Elk River or its direct tributaries have an increased potential for causing aggregate adverse effects.

Impacts of Mitigation and other Beneficial Actions

NiSource has agreed to fund additional diamond darter survey and research work as part of their commitment to avoid and minimize adverse effects to the diamond darter. This work will test and refine methods to locate individual diamond darters in both pool and shoal habitats and will evaluate how habitat use may differ across seasons. This work will focus on locations in the vicinity of NiSource's existing pipeline crossings and potential relocation alternatives and will allow the USFWS and NiSource to validate or refine the assumptions used in this consultation, and ensure that pipeline repair and replacements occur in areas that are low quality habitat for the diamond darter. However, the results of this effort will also increase our understanding of the species' ecology and will help further define what types of habitats are important to the survival and recovery of the diamond darter. This work will therefore also benefit the overall conservation and management of the diamond darter.

In order to mitigate for aggregate adverse effects from sedimentation and water quality degradation that may occur from NiSource's activities throughout the Elk River watershed, NiSource will protect or restore 6.1 acres of riparian habitat either along the Elk River mainstem or its primary tributaries within the range of the diamond darter. Preserving and restoring

riparian habitat should reduce the amount of erosion and siltation within the Elk River and increase both water and habitat quality. As described above, siltation from eroding stream banks, the lack of intact riparian vegetation, or the presence of invasive species within riparian areas, have been noted as threats to the diamond darter. Implementation of riparian protection and restoration should reduce the overall significance of this threat.

Summary of Effects to Individuals

The primary and most significant potential impacts to the diamond darter from the proposed action are related to instream construction of pipeline repairs or replacements in the Elk River. Pipeline repairs (no more than three) will typically be completed within one day, and will involve minimal disturbance to the river bed. As a result of the BMPs incorporated into the project up front, instream disturbances from any of the three potential pipeline replacements will not occur within high quality diamond darter foraging or breeding habitats. In addition, we expect the time of year restrictions to ensure that no eggs, larvae, or breeding or spawning adults are directly affected. Impacts will be restricted to the disturbance and degradation of lower quality habitat from sedimentation and water quality degradation and to individual adult diamond darters that may be present within the direct impact area during instream work. The BMPs that minimize the amount of instream habitat that will be disturbed and the potential that diamond darters would be crushed or killed during any instream work have been developed. While we cannot completely exclude the potential that adult or juvenile diamond darters may be present in these lower quality habitats and will be harmed during instream work, if they are present it would likely be limited to very few individuals moving between foraging and resting sites. These types of impacts would occur no more than three times each over the life of the project.

Based on this analysis, direct lethal take of individuals from all other project types is not expected. Other project types may have adverse effects in the form of sedimentation and water quality degradation that can reduce fitness of individuals; reduce habitat suitability for breeding, feeding, and sheltering; and reduce abundance of prey. As a result of the avoidance and minimization measures incorporated into the project up front, the potential for sedimentation and water quality degradation has been reduced, so that most individual projects are not likely to adversely affect the diamond darter. However, over the life of the project, there is the potential for low-level aggregate effects from multiple projects being conducted in the watershed. There could be reduced fitness of individuals or slight degradation of breeding, foraging, and resting habitat. Because these impacts will be dispersed throughout the watershed and spread out over time, adverse effects are not expected to be severe or concentrated in any one area. In order to offset these adverse effects, NiSource has agreed to protect and restore riparian habitat along the Elk River mainstem or its primary tributaries which should reduce the amount of siltation directly entering habitat occupied by the diamond darter and remove invasive riparian species that are noted to be a threat to the diamond darter.

Impacts to Populations and the Species Rangewide

In this next step of our analysis, we evaluate the aggregated consequences of the reductions in the fitness of individual diamond darters to the fitness of the population to which those individuals belong. Since there is only one remaining population of the diamond darter, all individuals affected will belong to this single population within the Elk River. In addition because the Elk River population encompasses the entire current range of the species, impacts to this populations' fitness will automatically translate into rangewide effects to the diamond darter.

Specifically, in this step, we are analyzing how the reductions in individual fitness affect the population's numbers, reproduction, or distribution to make inferences about the population's future reproductive success and viability and thus its ability to recover. The availability and quality of diamond darter spawning and larval habitat can be used as a surrogate to evaluate reproductive success. If a great enough number of individuals experience reductions in their reproductive success or if such individual responses are expected to disrupt the population's distribution or numbers, we would expect a reduction in the reproductive success of the population. A population's survivorship (viability) is a function of its abundance, growth rates, and variance in these metrics. Population abundance is influenced by individual egg, larva, juvenile, and adult survivorship. Population growth is a function of abundance, survivorship, and reproduction.

Whether a population can withstand the anticipated reductions in fitness depends upon its current baseline status (i.e., whether it is already stressed as indicated by population numbers or existing habitat degradation). This is especially relevant for the diamond darter, as smaller, isolated populations are less equipped to compensate for additive mortality or losses in reproductive contribution from individuals and even impacts to a small number of individuals or a small amount of habitat can have appreciable adverse effects on the population. Population level impacts to the diamond darter could occur if a proposed project significantly reduces the ability of individual diamond darters to successfully complete key portions of their life cycle (i.e. reproduction), or if significant impacts will occur within habitat areas where multiple diamond darters may be present. For example, similar to foraging areas, diamond darters likely concentrate in specific habitat types during breeding and the availability of these habitats is likely limited due to the small range of the species. If one of these breeding areas is significantly degraded, this could affect the breeding success of a large percentage of the population. Furthermore, because diamond darters have a relatively short life span (estimated to be about 4 years) and therefore may only have 3 spawning seasons to attempt to successfully reproduce, even "short-term" but severe impacts that reduce spawning success or egg survival for one breeding season could measurably (appreciably) reduce the lifetime recruitment of those individuals. Because of the small size of the population, this could thus also affect population viability. For these reasons, assessing whether a proposed project will have population-level and thus rangewide effects is best done by determining whether key life functions of multiple individuals or key habitat areas used by multiple individuals will be significantly degraded.

As previously described, the most significant and severe impacts from the proposed project will occur from instream construction. Because of the BMPs and NiSource's commitment to validate current assumption regarding habitat usage, these impacts are not expected to occur in high quality breeding or foraging habitats, so key habitat areas used by multiple individuals will not be significantly degraded. The BMPs regarding time of year restrictions should ensure that eggs, larvae, and breeding adults will not be affected, so reproduction should not be appreciably impaired. There is a slight potential that adult or juvenile diamond darters could be present and harmed or killed during instream construction associated with pipeline replacements and repairs, but BMPs are expected to limit impacts to single individuals, and these impacts should occur no more than three times each over the life of the permit, and should not result in an appreciable reduction in the overall number of diamond darters.

We also anticipate low-level aggregate effects in the form of increased sedimentation and water quality degradation due to NiSource activities in the Elk River watershed. The Elk River is already threatened by sedimentation and water quality degradation and, when considered in conjunction with baseline conditions, these additional impacts could cause additional degradation of breeding, foraging, and resting habitat, or fitness of individuals. Because the entire range of the species is encompassed by the action area, these impacts could affect the entire range of the species and all individuals in the population. However, the BMPs will ensure that sedimentation and water quality impacts from individual projects are minimized and should be negligible in most cases. Specifically, we anticipate these low-level impacts to occur in a dispersed fashion over the entire life of the project and throughout the watershed, so that at any one time or at any particular habitat area, their effects are expected to be small. We do not expect that these effects will displace diamond darters from any key habitat areas or cause any long-term degradation of those habitat areas. Therefore overall distribution of the diamond darter should not be affected. In addition, in order to offset these potential effects, NiSource has agreed to complete 6.1 acres of riparian protection and restoration within the Elk River and its primary tributaries, which should directly improve water and habitat quality within the areas of the Elk River directly occupied by the diamond darter. As a result, these aggregate-level effects are not expected to significantly degrade the ability of individuals to complete key life functions, or significantly impair any particular key habitat area and no appreciable reductions in reproduction, numbers, or distribution are expected to occur. The proposed project should therefore, not cause any population-level or rangewide effects.

Finally, the survey and research work being funded by NiSource will increase our understanding of diamond darter ecology and habitat use and will allow for the development of more informed conservation and management actions that will benefit the survival and recovery of the species as a whole.

Impacts to Critical Habitat

This section evaluates the effects of the proposed project on each of the PCEs associated with diamond darter critical habitat. As previously noted, because the diamond darter spends all

phases of its life cycle within one contiguous stream reach, the health and fitness of the diamond darter is closely tied to the health of its habitat. Activities that affect individual diamond darters are also likely to affect critical habitat PCEs, and therefore, the type and extent of impacts to the PCEs are similar to those discussed above. Correspondingly, measures designed to avoid and minimize adverse effects to individual diamond darters are in most cases also going to reduce adverse effects to critical habitat PCEs. Please refer to the discussion above for more detailed discussion on the potential effects of the proposed action and the associated conservation measures that have been incorporated into the project that will reduce adverse effects to individual diamond darters and therefore also the critical habitat PCEs. Destruction or adverse modification to critical habitat occurs when there is an appreciable reduction in the function and conservation role of the PCEs contained within that critical habitat unit.

1) A series of connected riffle-pool complexes with moderate velocities in moderate to large-sized (fourth to eighth order), geomorphically stable streams within the Ohio River watershed.

The proposed action will not affect the abundance or distribution of connected riffle-pool complexes in the Elk River, nor will it alter velocities of those habitats. Instream construction of up to three pipeline replacements in the Elk River may create temporary barriers to fish passage and connectivity between riffle and pool areas, but these barriers are only expected to remain in place for a very short time (approximately four days each), and will not be present during breeding or spawning periods, or when larval diamond darters may be present, which is when larger movements through riffle-pool complexes are expected. Pipeline repairs would not create barriers to fish passage because they would only span a small section of the river (no more than 30 feet by 15 feet) and would only be in place for one day or less. Fish could still move between other unaffected portions of the river during pipeline repair activities. As a result, these temporary localized barriers to connectivity should not appreciably alter the intended conservation function of this PCE. Implementation of the NiSource's BMPs and ECS, as described for each project activity type above, should ensure that the proposed action should not increase erosion of Elk River streambanks or beds in a manner that would degrade or alter the geomorphic stability of the critical habitat. As a result, the proposed action should not appreciably reduce the function and conservation role of this PCE.

2) Stable, undisturbed sand and gravel stream substrates, that are relatively free of and not embedded with, silts and clays.

The proposed action could have localized impacts that would disturb and destabilize some Elk River stream substrates. These impacts are primarily associated with the instream construction of no more than three pipeline replacements in the Elk River. However, in all cases, instream construction will only occur when there is no other practicable alternative, and would only occur in areas that are considered low quality diamond darter habitat. Low quality habitat areas typically will occur in areas of the Elk River, such as pools, that naturally have higher levels of fine silts and clays and lower levels of sand and gravel; or will be areas that have bedrock outcrops, large boulders, or other substrates that are not conducive to diamond darter

foraging, resting, or breeding. BMPs have been developed so that the amount of stream substrate directly disturbed will be limited, and so that the amount of sedimentation and turbidity downstream of construction areas will be minimized. Instream construction of up to three pipeline repairs may also occur. These impacts would be restricted to a small (30x15 foot area) and would likely be completed within one day.

The combined effect of all proposed actions could result in some aggregate-level sedimentation over the life of the permit that could increase levels of silts and clays throughout the Elk River. However, the large-scale and consistent implementation of BMPs and ECS on all NiSource actions within the range of diamond darter critical habitat should reduce existing sources of sedimentation and erosion in the watershed, and will ensure that minimal effects occur as a result of new construction activities. Aggregate low-level impacts are expected to occur in a dispersed fashion over the entire life of the project and throughout the watershed, so that at any one time or at any particular habitat area, the effects are not likely to be appreciable. As a result, the proposed action should not appreciably reduce the function and conservation role of this PCE.

3) An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) that is relatively unimpeded by impoundment or diversions such that there is minimal departure from a natural hydrograph.

The proposed action will only have minor, temporary effects on the instream flow regime. Instream construction of up to three pipeline replacements in the Elk River using dry-ditch techniques may temporarily (approximately four days) divert water in the Elk River, but natural instream flow regimes will return immediately after construction. Instream construction of up to three pipeline repairs may also occur, but these activities would be restricted to a small area (no more than 30 feet by 15 feet) and would be completed within one day. BMPs will ensure that water withdrawals for hydrostatic testing will not occur within the Elk River, so that the flow regime will not be altered. As a result the proposed action should not appreciably reduce the function and conservation role of this PCE.

4) Adequate water quality characterized by seasonally moderated temperatures, high dissolved oxygen levels, and moderate pH, and low levels of pollutants and siltation. Adequate water quality is defined as the quality necessary for normal behavior, growth, and viability of all life stages of the diamond darter.

The proposed action will only have minor effects on water quality. BMPs have been developed to avoid and minimize removal of riparian vegetation that shades the river and moderates water temperatures. BMPs have also been developed to avoid the operation of equipment in the Elk River and its tributaries, and to store chemicals and other items that have the potential to degrade water quality away from the river. When activities will be conducted in close proximity to diamond darter critical habitat, enhanced and redundant spill control and prevention measures will be used to minimize the potential for, and the impacts of, any spills or discharges. See the discussion for PCE 2 above regarding the potential for siltation. As a result

of these measures, water quality degradation from the proposed action should be minimal and the function and conservation role of this PCE should not be appreciably reduced.

5) A prey base of other fish larvae and benthic invertebrates including midge, caddisfly, and mayfly larvae.

The principal ways the proposed action could affect this PCE are through direct crushing or smothering of benthic macroinvertebrates present on the stream substrates during instream construction, or through reduction in prey populations caused by increased sedimentation. As discussed above for PCE 1 and 2, direct disturbance is not anticipated to occur in high quality foraging areas that provide a prey base for the diamond darter, and impacts from sedimentation have been avoided and minimized. In addition, BMPs have been developed so that instream construction will not occur during periods when most fish eggs and larvae will be present, so reductions in other fish larvae that diamond darters may use as prey items will not occur. As a result of these measures, the proposed action should not appreciably affect the prey base of the diamond darter or reduce the function and conservation role of this PCE.

Summary of Effects to Critical Habitat

Impacts to PCEs 1 and 3 will consist of minor, temporary (no more than four days) barriers to connectivity between riffle-pool complexes and alterations of instream flows. Some disruption of stream substrates is expected that could affect PCEs 2 and 5, but disruption will occur in areas that are not expected to be conducive to diamond darter foraging, resting, or breeding, so the role and conservation function of these PCEs should not be reduced. Some aggregate-level sedimentation and water quality degradation could occur affecting PCEs 2 and 4, however these effects are expected to occur in a dispersed fashion over the entire life of the project and throughout the watershed, so that at any one time or at any particular habitat area, the effects are not likely to be appreciable. Based on this analysis, no appreciable reductions in the function and conservation role of any of the PCEs contained within the Elk River critical habitat unit are expected, and we conclude that the proposed project should not result in the destruction or adverse modification of critical habitat for the diamond darter.

4.2.4 Roanoke Logperch

This section evaluates the effects of the proposed action on the Roanoke logperch. Table C11 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

NiSource has agreed to the following measures to avoid and minimize impacts to this species. It is important to note that the AMMs in standard font are required where they are applicable, whereas the AMMs in *italic* font are discretionary and will be applied on a case-by-case basis, depending on the requirements of the activity.

Surveys to Evaluate the Presence of Roanoke logperch

1. Conduct a detailed habitat assessment of each stream that will be affected by NiSource activities, and conduct surveys for Roanoke logperch within all suitable habitat in the action area using a qualified surveyor. A list of qualified surveyors is available at: http://www.fws.gov/northeast/virginiafield/endspecies/surveyors.html.

Measures to Avoid and Minimize Impacts to Roanoke logperch in Known or Presumed Occupied Habitat

2. A detailed Environmental Management & Construction Plan (EM&CP) will be prepared for any activity with potential effects within 100 feet of the ordinary high water mark of known or presumed habitat. The plan will incorporate the relevant requirements of the NGTS ECS and include site-specific details particular to the project area and potential impact. The waterbody crossing will be considered as "high-quality" for the purpose of preparing this plan regardless of the actual classification. The plan will be strongly oriented towards minimizing stream bed and riparian disturbance (including minimization of tree clearing within 25 feet of the crossing [Figure 24, ECS]), preventing downstream sedimentation (including redundant erosion and sediment control devices which would be designed to protect resources as appropriate), and weather monitoring by the Environmental Inspector to ensure work is not begun with significant precipitation in the forecast. The plan will comprehensively address all activities needed to complete the work and strive to avoid the take of these species in occupied habitat. The EM&CP will include the frac-out avoidance and contingency plans described in AMM #3 below. The EM&CP will also include a sediment control component for uplands reasonably likely to drain to and impact occupied habitat. Emphasis will be placed on developing detailed erosion control plans specific to slopes greater than 30 percent leading directly to occupied habitat. The plan will be approved in writing by NiSource NRP personnel prior to project implementation and will include a tailgate training session for all on-site project personnel to highlight the environmental sensitivity of the habitat and any BMPs that must be implemented.

Stream Bed Construction

3. For activities in known or presumed occupied habitat, install new or replacement pipelines and utility lines and perform major repairs under the river bottom using horizontal directional drilling (HDD) or other trenchless methods rather than open trenching whenever feasible. Drilling should be carefully undertaken and a plan should be in place to minimize and address the risk of in-stream disturbance due to frac-outs. The plan should also specifically reference

Roanoke logperch in the vicinity of the crossing as a key conservation concern and include specific measures identified in the ECS, from standard industry practices, or other mutually agreed upon practices to protect this resource. The plan will also include a frac-out impact avoidance plan which will evaluate the site in terms not only of feasibility of conducting HDD, but likelihood of large scale frac-out and its effects on the species, and actions to address a large scale frac-out in occupied habitat. If, after detailed engineering studies (e.g., geotechnical, physiological, topographical, and economic studies), it is determined (and agreed to by NRP) that HDD is not feasible, a report will be prepared and included in the annual report submitted to the USFWS.

4. Install pipeline to the minimum depth described in the ECS and maintain that depth at least 10 feet past the high water line to avoid exposure of pipeline by anticipated levels of erosion based on geology and watershed character. Additional distance may be required should on-site conditions (i.e., outside bend in the waterbody, highly erosive stream channel, anticipated future upstream development activities in the vicinity, etc.) dictate a reasonable expectation that the stream banks could erode and expose the pipeline facilities. Less distance may be utilized if terrain or geological conditions (long, steep bank or solid rock) will not allow for a 10-foot setback. These conditions and the response thereto will be documented in the EM&CP and provided as part of the annual report to the USFWS.

5. For major repairs in known or presumed occupied habitat, do not install in-channel repairs (bendway weirs, hardpoints, concrete mats, fill for channel relocation, or other channel disturbing measures).

6. Conduct replacements/repairs from a lay barge or temporary work bridges of the minimum length necessary to conduct the replacements/repairs rather than operating heavy equipment (e.g., backhoes, bulldozers) in-stream.

7. Remove equipment bridges as soon as practicable after repair work and any site restoration is completed.

8. As part of the routine pipeline inspection patrols, visually inspect all stream crossings in known or presumed occupied waterbodies for indications of significant erosion or bank destabilization associated with or affecting the pipeline crossing. If such bank destabilization is observed, it will be corrected in accordance with the ECS. Follow-up inspections and restabilization will continue until the bank is stabilized (generally two growing seasons)

<u>Stream Bank Conservation</u>

9. Do not construct culvert and stone access roads and appurtenances (including equipment crossing) across the waterbody or within the riparian zone. Temporary equipment crossings utilizing equipment pads or other methods that span the waterbody are acceptable provided that in-stream pipe supports are not needed.

10. For equipment crossings of small streams, use half pipes or spans of sufficient number and size that both minimize impacts to stream bed and minimize flow disruption to both upstream and downstream habitat.

Travel for O&M Activities

11. Do not drive across known or presumed occupied streams – walk these areas or visually inspect from bank and use closest available bridge to cross stream.

Pipeline Abandonment

12. Abandon pipelines in place to avoid in-stream disturbance that would result from pipeline removal.

Contaminants

13. As described in the ECS section on "Spill Prevention, Containment and Control," site staging areas for equipment, fuel, materials, and personnel at least 300 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials).

14. Ensure all imported fill material is free from contaminants that could affect the species population or known or presumed occupied waterbody habitat.

15. Prepare a site specific stormwater management plan and spill pollution prevention plan to reduce the potential for non-point source pollution entering occupied streams.

Withdrawal and Discharge of Water

16. Do not draw hydrostatic test water from or discharge water directly into occupied habitat.

17. Use best available water withdrawal/discharge impact avoidance techniques (low rate, screens, avoid known or presumed occupied areas to extent practical, do not vacuum up sediments, low rate of discharge to avoid scouring or erosion, discharge into upland area that does not allow water to flow overland into occupied streams or tributaries).

Exotic Species

18. Clean all equipment (including pumps, hoses, etc.) that have (1) been in a perennial waterbody for more than four hours within the previous seven days and (2) will work in occupied or potential federally listed habitat; following established guidelines to remove exotic or invasive species before entering a known or presumed occupied stream for a federally listed

species which is not known to be infested with invasive species. It is important to follow these guidelines even if work is not occurring in the immediate vicinity of this species since, once introduced into a watershed, invasive species could move and eventually affect the federally listed species.

Impacts to Individuals

Subactivities Having No Effect on the Species

The vast majority of the proposed subactivities will have no effect on the Roanoke logperch (see Table C11, Appendix C; NE subactivities). There are no storage wells in the vicinity of Roanoke logperch sites; therefore, Roanoke logperch will not be exposed to any associated impacts. Activities involving non-earth disturbing vegetation management (e.g., mowing, tree side trimming, and vegetation disposal) and wetland crossings are expected to have no effect on the species because individuals will not be exposed to them or their impacts are expected to be neutral on the species.

Subactivities Not Likely to Adversely Affect the Species

There are a few subactivities that may affect, but are not likely to adversely affect the Roanoke logperch (see Table C11, Appendix C; NLAA subactivities). Other activities will only result in insignificant or discountable impacts to the Roanoke logperch. In addition, NiSource has committed to applying several AMMs developed for mussels (listed in section 3.1) to areas of Roanoke logperch habitat. These AMMs serve to reduce and avoid potential adverse impacts from several activities. NiSource is also expected to conduct all activities in accordance with their Environmental Construction Standards (ECSs) described for the project (Columbia Gulf Transmission, 2008).

Subactivities Likely to Adversely Affect the Species

Certain covered activities are expected to adversely affect the Roanoke logperch (see Table C11, Appendix C; LAA subactivities). Although the application of the mussel AMMs and adherence to the ECS will greatly minimize potential impacts, some adverse effects remain likely. These activities include:

- Vegetation Management that changes riparian vegetation
- ROW repair, regrading, revegetation (upland)
- Access Road Maintenance and construction
- General Appurtenance and Cathodic Protection Construction - off ROW clearing
- Pipeline Abandonment - removal
- Clearing of vegetation
- Vegetation Disposal (upland)
- Stream Crossings

Adverse effects to Roanoke logperch from NiSource activities would occur primarily from impacts from the installation of pipeline across occupied habitat. Individuals may experience direct impacts that range from behavioral disturbance to injury or death. If blasting is needed for any crossings, fish in the immediate blast area may be killed and fish in the vicinity will be temporarily stunned and/or permanently injured; some of the fish will recover, while others will have spinal injuries. Temporary loss of instream habitat will occur during stream crossings involving cofferdams. Installation and dewatering of cofferdams may injure or kill Roanoke logperch through crushing during placement of cofferdams and through stranding or entrainment as cofferdams are dewatered. Instream work will also result in siltation and turbidity. Adjacent upland ground-disturbing activities can also create sediment loads into Roanoke logperch habitat. Moderately silted and high turbidity areas will be unusable to the logperch for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items. If instream work occurs during warm months, fish will not be able to forage in and near work areas due to instream construction, siltation, and turbidity. If the work occurs during spawning, the fish will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur. In cold months, the construction activity may displace logperch from areas of otherwise suitable habitat, resulting in death or injury.

While implementation of AMMs should significantly reduce the likelihood of direct take (i.e., mortality) occurring, it is still possible at low levels. Actions involving vegetation removal could affect Roanoke logperch habitat. Loss of stream bank vegetation is anticipated to result in increased water temperatures and changes in light regime in small areas. For work along existing ROWs, riparian vegetation will be replanted. New alignments will result in permanent reductions in riparian vegetation.

Impacts to Populations

We expect that the population-level impacts from NiSource activities to the Roanoke logperch will be relatively small because the proposed action only affects a small portion of the Roanoke logperch within the Nottoway River watershed and would be unlikely to prevent population recovery. Consequently, following completion of each action that results in adverse effects to logperch, it is expected that the logperch population, given no other major perturbations, will recover from a NiSource impact within one to three years assuming that logperch from outside the action area will be able to recolonize the affected areas. Similarly, habitat impacts are small compared to the overall amount of habitat available. It is expected that the population level impacts to the Roanoke logperch would be small and temporary, and logperch populations and habitat will recover quickly.

4.2.5 Eastern Massasauga

This section evaluates the effects of the proposed action on the EMR. Table C12 (Appendix C) identifies the pipeline activities and subactivities, as previously identified in the Description of the Proposed Action section ("Covered Actions"), and the environmental impacts resulting from

each subactivity, and the anticipated responses of individuals and populations exposed to those impacts. This table provides the complete record of the effects analysis for this species and was intended to be read in concert with and support this effects analysis section.

Measures to Avoid and Minimize Impacts

NiSource has agreed to the following measures to avoid and minimize impacts to this species. As with the MSHCP species, measures in italicized font are non-mandatory with measures in standard font are mandatory. For purposes of this analysis, we presume that non-mandatory BMPs will not be performed.

NiSource has agreed to the following measures to avoid and minimize impacts to this species (Lowe 2013). As with the MSHCP species, measures in *italicized font* are non-mandatory with measures in standard font are mandatory. For purposes of this analysis, we presume that non-mandatory BMPs will <u>not</u> be performed.

<u>Surveys/Pre-Construction Planning: Preparation of an Environmental Management & Construction Plan</u>

These BMPs outline the survey process for NiSource to use for determining the presence of EMR habitat or habitat use. These will inform NiSource about the level of anticipated effects that covered activities may have on the species. Once a determination is made whether the species or its habitat are present within the proposed covered activity's action area and the type and extent of effects are identified, the relevant BMPs will be implemented.

1. Eastern massasauga rattlesnake (EMR) presence will be assumed in areas where it has been previously detected and those locations will be classified as Occupied Habitat. In identified habitat (known and modeled) where EMR have not been previously detected surveys can be conducted to determine if suitable habitat is present and/or the presence/absence of the species. If onsite habitat is determined to be wholly unsuitable via desktop analysis (e.g., entirely mowed lawn, row crop, graveled Metering & Regulation/Compressor Station lot, and industrial site[19]), then it can be classified as unoccupied and the BMPs will not be mandatory. Persons conducting this analysis do not need to be a Service-approved herpetologist but they must have a natural resources background with a general understanding of the habitat requirements for the EMR. Surveys will follow the most current FWS-approved protocol and will be coordinated in advance with the local FWS office. If an adequate survey effort does not identify suitable habitat, the BMPs will not be mandatory. Habitat suitability surveys will expire in 10 years, but may be used for potentially longer based on site-specific evaluation by the USFWS. If an adequate presence/absence survey effort does not indicate EMR presence, the

[19] Industrial Site is defined as an area that is fenced and is mostly (>75%) graveled and/or paved with the sole purpose of being used for manufacturing, production, or distribution of goods and or services. There could be grass or lawn areas interspersed within the industrial site, as are typical of Columbia compressor stations and similar areas, but not containing large vegetated areas suitable for wildlife habitat. These areas are regularly inhabited by and used by humans on a weekly or more frequent basis, and not conducive to wildlife habitation.

site will be classified as unoccupied habitat and the BMPs will not be mandatory. Negative presence/absence surveys will expire in 10 years, but may be used for potentially longer based on site-specific evaluation by the USFWS. A copy of the survey outcome and reports will be included in the annual report submitted to the USFWS.

2. A detailed Environmental Management and Construction Plan (EM&CP) will be prepared for any project potentially impacting occupied EMR habitat. The plan will incorporate the relevant requirements of the ECS and include site-specific details particular to the project area and potential impacts. Waterbody crossings will be considered as "high-quality" for the purpose of preparing this plan regardless of the actual classification. The plan will be strongly oriented towards minimizing stream bed and riparian disturbance (including minimization of tree clearing within 50 feet of the crossing), preventing downstream sedimentation (including redundant E&S devices as appropriate), and weather monitoring by the Environmental Inspector to ensure work is not begun with significant precipitation in the forecast. The EM&CP will include plans to minimize impacts to wetlands, including the potential use of HDD for new pipelines. Wetland construction/restoration plans will include measures necessary to prevent invasive species establishment unless the wetland is already infected with invasives. These measures include those described in detail in the ECS, Section III *Stream and Wetland Crossings* pp. 15 – 24 (*see* especially B.8. *Restoration*) and Section V *Maintenance* pp. 27-29. The plan will further focus on minimizing and avoiding impacts to the upland areas, including all relevant BMPs to minimize and avoid physical disturbance and direct injury/harm of individuals (e.g., weather, vehicle use). In areas of known multiple massasauga road kills, the plan will consider the need for seasonal activity restrictions. The plan will be approved in writing by NiSource Natural Resources Permitting (NRP) personnel prior to project implementation and will include a tailgate training session for all onsite project personnel to highlight the environmental sensitivity of the habitat and any BMPs (e.g., overall awareness, minimizing vehicle activity and speed control, etc.) which must be implemented.

<u>Timing of Actions and Associated Generic BMPs Related to Vehicle/Heavy Machinery Use, Water Alteration, & Earth Disturbance</u>

This set of BMPs addresses potential impacts to EMRs from vehicle use, heavy machinery, water alterations, and earth disturbance. Potential adverse impacts from these activities include direct crushing of individuals by vehicles and machinery, loss of hibernacula and hibernating individuals due to water alterations. Water alterations impacts involve death or reduced survival of EMRs in hibernation (desiccation, freezing) and reduced reproduction and survival due to loss of habitat (habitat flooding or desiccation). These impacts could cause direct injury or harm of individuals. However, we expect that implementation of these BMPs will greatly reduce all potential for these adverse impacts. Specifically, the BMPs will render most impacts insignificant or discountable by restricting the potentially disturbing activities near EMR habitat and hibernacula, making most of the anticipated adverse impacts extremely unlikely to occur or reducing the impacts to a level that will not measurably impact any individuals (note that BMPs 17 and 18 are also important to reducing these impacts). With

these BMPs in place, we anticipate that the only remaining adverse impact is that a very small number of individuals may be injured or killed by NiSource vehicles on access roads.

3. *Operate vehicles/equipment, clearing trees, etc., in known/presumed occupied EMR habitat between October 31 - March 15 and when (1) the ground is frozen and (2) air temperatures are less than 45°F. During this time, under these conditions, EMR are most likely underground and will not be impacted by these activities.*

4. Do not use large equipment or perform earth-moving activities, water withdrawal and discharge for hydrostatic testing, or other activities that substantially affect the ground or water levels in potential EMR hibernacula areas. This requires a site evaluation to delineate likely hibernation areas. Avoidance measures may include, but are not limited to, re-routing of pipeline and appurtenance facilities, boring or drilling, and timing/weather-related restrictions. Measures will be set on a site-specific basis, based on local habitat conditions (in site specific EM&CP).

5. Strictly control and minimize vehicle activity of NiSource staff in known/presumed occupied EMR habitat. Speed limits at NiSource facilities and access roads should be <10 MPH (should be set in the EM&CP).

6. *Conduct patrols, vegetative maintenance, etc., by foot whenever possible. Do not drive across streams or in wetlands areas. Do not drive across known or presumed occupied streams or wetlands – walk these areas or visually inspect from bank and use closest available bridge to cross stream.*

7. In known/presumed occupied EMR habitat, ensure that upland work (including access roads) does not result in impacts (altered hydrology) to adjacent wetlands.

<u>Mowing & Vegetation Removal</u>

This set of BMPs addresses potential impacts to EMRs from vegetation management. Potential adverse impacts include burning of individuals in brush pile fires and the death of individuals from mowers. These BMPs serve to greatly reduce these potential impacts. Potential burning of individuals is completely eliminated with BMP #8. Individuals may be harassed by mowing, but potential death or injury of EMRs is reduced greatly by BMPs 9 and 10, with potential injury or death of up to two individuals anticipated only in undocumented populations within the covered lands.

8. Do not burn brush piles along ROW within known/presumed EMR habitat during the active season (March 15-October 30). Where possible, leave brush piles in place or transport them off-site for disposal. If they must be burned, burn on the same day they are created if during the active season or they can be burned anytime during the hibernation season.

9. Attempt to mow ROWs in presumed occupied EMR habitat during the hibernation season between October 31 - March 15 and when air temperatures are less than 45°F. Herbicides can be used during any time of the year. If mowing must be done during the active season, implement the following:

a. An open platform mower, sickle mower, or flail mower are recommended because they create little if any suction that can increase the risk of mower-related snake mortality. Blade height must be set at a minimum of 6 inches.

b. A qualified individual must walk and roughly "clear" the area before mowing begins. This individual must also walk the area following mowing to check the area for EMR. If an EMR is found, the FWS must be notified and the snake must be moved from the area. This person must be qualified, and approved by the USFWS, to search an area for snakes. If this person is not also permitted to handle massasaugas, a qualified person, with necessary state and federal permits for capturing and handling EMR, must be called to the site to do so. If two (2) harmed EMR are found during follow-up walkovers anywhere in the covered lands, implement requirements of BMP #10 for mowing ROWs for all presumed habitat. As an alternative to BMP #10, NiSource can implement additional pre-activity surveys as agreed to in writing by the USFWS.

c. Conduct mowing in accordance with the attached schedule (Figure 4) developed by the Ohio DNR as much as reasonably practical.

10. Mow ROWs in known occupied EMR habitat during the hibernation season between October 31 - March 15 and when air temperatures are less than 45°F. Herbicides can be used during any time of the year. The mowed area will be reduced to 10 feet centered on the pipeline. If mowing must be done during the active season, implement the following:

a. Spot mow, as opposed to full-site mowing, wherever possible.

b. Use a sickle mower with a height setting of not less than 12 inches.

c. A qualified individual must walk and roughly "clear" the area before mowing begins. This individual must also walk the area following mowing to check the area for EMR.

d. Timing and daytime conditions must minimize the potential for EMR to be active, with mowing done according to the attached schedule (Figure 4).

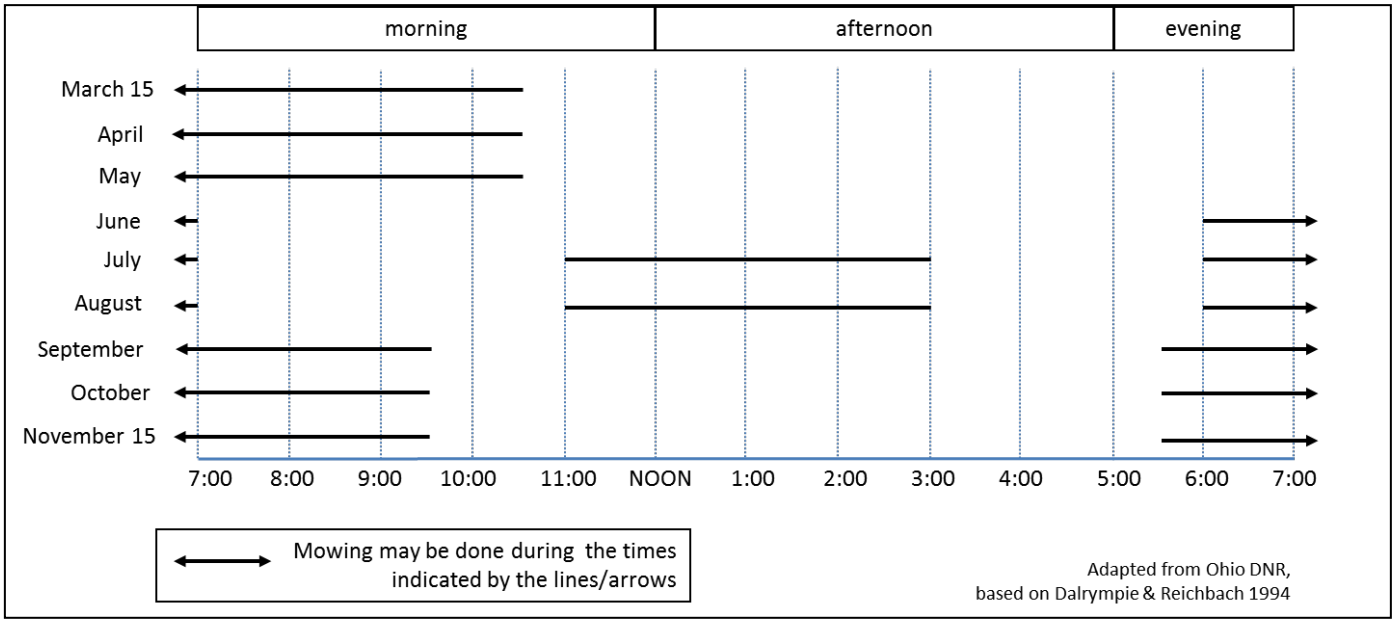

Figure 4. EMR Active Season Mowing Schedule

Routing Criteria (replacements, loops, new ROWs, access roads)

This set of BMPs addresses potential impacts to EMRs from construction of new pipeline in the covered lands. Adverse impacts from these activities include direct harassment, injury, or death individuals during construction, primarily from operation of machinery, human activity, and trenching. Activities may also alter or destroy habitat, particularly wetland habitats important for hibernation. These BMPs serve to greatly reduce these potential impacts, however. These BMPs will greatly reduce the level of human activity and project footprint and direct that HDD be used to avoid under most circumstances to reduce the use of open-trenching in waterways and wetlands that provide habitat for EMRs. With these BMPs, along with BMPs 17 and 18, we expect only short-term disturbance of individuals due to these activities.

11. *Do not route new construction projects, such as pipelines, appurtenant facilities, or access roads, through known/presumed occupied habitat.*

12. Where activities in known/presumed occupied habitat cannot be avoided, install new or replacement pipelines and utility lines and performing major repairs under the wetlands and streams using horizontal directional drilling (HDD) or other trenchless methods rather than open trenching. Drilling should be carefully undertaken and a plan should be in place to minimize and address the risk of in-water disturbance due to frac-outs. The plan should also specifically reference species resources in the vicinity of the crossing as a key conservation concern and include specific measures identified in the ECS, from standard industry practices, or other mutually agreed upon practices to protect this resource. The plan will also include a frac-out impact avoidance plan which will evaluate the site in terms not only of feasibility of

conducting HDD, but likelihood of large scale frac-out and its effects on this species and actions to address a large scale frac-out in occupied habitat. If, after detailed engineering studies (e.g., geotechnical, physiological, topographical, and economic studies), it is determined (and agreed to by NRP) that HDD is not feasible, a report will be prepared and included in the annual report submitted to the USFWS. If wetland or waterbody avoidance through rerouting or HDD is not feasible, all guidelines for open trench wetland crossings found in the NiSource ECS must be strictly adhered to.

13. Install pipeline to the minimum depth described in the ECS and maintain that depth at least 10 feet past the high water line to avoid exposure of pipeline by anticipated levels of erosion based on geology and watershed character. These conditions and the response will be documented in the EM&CP and provided as part of the annual report to the USFWS.

14. For known or presumed occupied waterbodies, pipeline replacement projects (non FERC 7c) shall be done in the following manner (in order of priority/preference):

a. Abandon line in place and conduct HDD or horizontal bore to install pipe under known/presumed occupied wetlands between September 15 - May 15 to avoid any potential impact to snakes during the active season. Route to avoid potential hibernacula areas.

or

b. Use conventional construction practices in known/presumed occupied wetlands between May 15 - September 15 to avoid impacts to hibernating snakes. Narrow or reconfigure the work area (uplands/wetlands) to avoid impacts to active snakes. Follow all applicable active-season BMPs.

15. For known or presumed occupied habitat, new construction projects (FERC 7c storage wells, looping projects, etc.) shall be done in the following manner (in order of priority/preference):

a. Route projects to avoid known/presumed occupied habitat. If site-specific analysis indicates that site restoration or enhancement could compensate for the impacts from new facilities then they may be considered.

or

b. Conduct HDD or horizontal bore to install pipe under known/presumed occupied wetlands between September 15 - May 15 to avoid any potential impact to snakes during the active season. Route to avoid potential hibernacula areas.

or

c. Use conventional construction practices in known/presumed occupied wetlands between May 15 - September 15 to avoid impacts to hibernating snakes. Narrow or reconfigure the work area (uplands/wetlands) to avoid impacts to active snakes.

Measures to minimize direct impacts to massasaugas during the active season

These BMPs address potential direct impacts to EMRs from NiSource construction activities. Individual EMRs may be directly harmed, harassed, or killed during construction projects by heavy machinery and vehicles (crushing, killing) or may become entrapped in trenches or holes in the ground to access or install pipelines. These BMPs, however, greatly reduce these potential impacts. We expect that onsite snake monitors will greatly lower the potential for EMRs to be killed by these activities and reduce impacts to primarily harassment and minor harm of individuals. These BMPs are critical to reducing direct impacts of human activities from a variety of NiSource actions in EMR habitat.

16. *Before initiating any activity within an area of extreme sensitivity for EMR, including but not limited to earthmoving and/or construction within the project limits, all potential EMR habitat must be encircled with a snake-proof barrier (silt fencing or metal flashing, at least 30 inches high above ground) that prevents snakes from crossing over or under the barrier. [DO NOT use synthetic mesh material in construction of the snake-proof barrier.] The barrier should be buried at least 6 inches below the surface and the trench backfilled to support the barrier and prevent animals from burrowing under the barrier. The integrity of this barrier must be ensured throughout the period of activity, and breaches of the barrier must be repaired promptly. The snake-proof barrier must be in place at least 15 days prior to any activities occurring on the site. The snake-proof barrier can only be in place between April 15 and September 15 to ensure that access to their hibernacula and seasonal migratory movements are not impeded. Any EMR found within the area enclosed by the snake-proof barrier are to be captured using cover boards (sheet metal) placed within the area and/or funnel traps placed along the fencing. Captured EMR are to be moved to the outside of the project limits, but no further than 1,000 feet from their point of capture. The capture-removal of EMR should be conducted several times daily for a minimum of 14 days prior to initiating any activity within the project limits. After 14 days of EMR capture-removal, activities may begin in the area enclosed by the snake-proof barrier, so long as the integrity of the barrier is maintained. The 14 day EMR capture-removal does not have to be completed on consecutive days, but must be done over a period of less than 28 days. The barrier should only be breached for a few minutes at a time to move equipment into and out of the area; the barrier must then be immediately put back in place. Should the integrity of the barrier be compromised for more than 24 hours, it will be necessary to repeat the 14 days of snake capture-removal. Furthermore, on the ground outside of the snake-proof barrier, cover boards (sheet metal) must be placed around the perimeter as protection for EMR trying to access the project area. The cover boards should be placed parallel to the fence with no more than 25 feet between each sheet. This work must be done by a FWS approved contractor and all work must be approved by FWS prior to initiation.*

17. Employ a snake monitor[20] when working in known/presumed occupied areas for projects that will require earth moving or use of large equipment. The number of monitors required will be in proportion to the size of the active work area. If EMR are found in the work area, construction activities in the vicinity will cease and the monitor will mark their locations on a topographic map and record GPS coordinates. A qualified EMR surveyor[21] will be promptly engaged to survey the construction area and confirm that EMR are no longer present. If the EMR is found, the surveyor will take basic physical measurements of the handled snakes, and potentially insert PIT tags. The surveyor will then move the snake, unharmed outside the work limits. All work within the vicinity should temporarily cease until the snake is moved to ensure the safety of the snake and workers. The appropriate land manager and FWS office must be notified immediately.

18. Minimize the time required for activities in known/presumed occupied EMR habitat during the active season (March 15-October 31). Projects should be designed to be completed as quickly as possible. All measures regarding expedited water body crossings will be fully implemented in known/presumed EMR habitat.

Contaminants

These BMPs address potential direct impacts to EMRs from potential contamination due to NiSource actions. Primary impacts involve death or reduced exposure of EMRs and crayfish to toxic levels spills of gasoline and oils from equipment, storage and removal of pipeline and facilities waste products, and use of fertilizers. These BMPs reduce these potential impacts by restricting the use and handling of these products in EMR habitat. This will reduce exposure of EMRs to potential toxins and also reduce impacts to a level where adverse effects on individuals are unlikely.

19. As described in the ECS section on "Spill Prevention, Containment and Control," site staging areas for equipment, fuel, materials, and personnel at least 100 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted occupied habitat:

a. follow spill response plan;
b. call the appropriate USFWS Field Office to report the release, in addition to the National Response Center (800-424-8802).

[20] Snake monitors must have a letter of reference from a qualified and permitted EMR surveyor confirming rattlesnake field identification capabilities. The snake monitor will not handle, collect, or attempt to relocate any EMR.
[21] A qualified EMR surveyor must have necessary state and federal permits for capturing and handling EMR.

20. Ensure all imported fill material is free from contaminants (this would include washed rock or other materials that could significantly affect the pH of the stream) that could affect the species or habitat through acquisition of materials at an appropriate quarry or other such measures.

21. For storage well activities, use enhanced and redundant measures to avoid and minimize the impact of spills from contaminant events in known or presumed occupied streams. These measures include waste pit protection and a spill response plan. These measures will be included in the EM&CP prepared for the activity.

22. Do not use fertilizers within 100 feet of known or presumed occupied habitat. Fertilizer will not be applied if weather (e.g., impending storm) or other conditions (e.g., faulty equipment) would compromise the ability of NiSource or its contractors to apply the fertilizer without impacting presumed occupied EMR habitat. The EM&CP prepared for this activity (BMP #2 above) will document relevant EPA guidelines for application.

23. Concrete coating activities will not take place within 300 feet of any wetland.

<u>Water Withdrawal/Discharge</u>

These BMPs address impacts to EMRs from water alterations due to NiSource hydrostatic testing of their pipelines. Water alterations impacts involve death or reduced of EMRs in hibernation (desiccation, freezing) and reduced reproduction and survival due to loss of habitat (habitat flooding or desiccation). These BMPs reduce these potential impacts by restricting the use and handling of these products in EMR habitat. This will reduce exposure of EMRs to potential toxins and also reduce impacts to a level where adverse effects on individuals are unlikely.

24. Do not withdraw water from wetlands in known/presumed EMR habitat for hydrostatic testing. Hydrostatic test water and/or water for storage well O&M will not be obtained from known or presumed occupied streams unless other water sources are not reasonably available. Water from known or presumed occupied streams will be withdrawn in a manner that will not visibly lower the water level as indicated by water level height on the stream channel bank. Employ appropriately sized screens, implement withdrawal rates, and maintain withdrawal point sufficiently above the substrate to minimize impacts to the species.

25. Do not discharge hydrostatic test water directly into known or presumed occupied habitat. Discharge water in the following manner (in order of priority and preference):

a. Discharge water down gradient of occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.

b. If those circumstances occur, discharge water into uplands >300 feet from occupied habitat unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.

c. If those circumstances occur, discharge water as far from occupied habitat as practical and utilize additional sediment and water flow control devices (Figures 6A&B, 7, 8, 14A&B; ECS) to minimize effects to the waterbody.

Restoration & Invasive species

These BMPs ensure that, following disturbance and construction activities, sites are restored in a manner that reduces long-term physical disturbance and minimizes potential spread of invasive species.

26. Re-vegetate all disturbed EMR habitat with appropriate native species. Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary.

27. *Ensure that all measures for the conservation of topsoil from the ECS are fully implemented in EMR habitat.*

28. *Clean all equipment following established guidelines to remove exotic or invasive species before entering a watershed. It is important to follow these guidelines even if work is not occurring in the immediate vicinity of this species since, once introduced into a watershed; invasive species could move and eventually affect the federally listed species. During hydrostatic testing, do not draw water from another source (wetland or waterbody) and discharge it into wetlands or waterbodies in occupied or presumed habitat.*

29. Ensure that all fill material is free from exotic or invasive species.

Other measures

30. Abandon pipelines in place to avoid in-stream disturbance that would result from pipeline removal unless the abandonment would be detrimental to EMR.

31. Due to the high threat of persecution/collection, do not advertise the presence of EMR other than to NiSource staff and its contractors. All NiSource staff will be educated about the EMR prior to beginning work at a site and will be given instructions on what to do if they encounter a snake.

32. Any activities, including but not limited to erosion control and revegetation, will not use any synthetic mesh material or due to the danger of trapping EMR.

33. From March 15-October 31, use tanks to store waste fluids to ensure no loss of EMR by entrapment or exposure to toxins in waste pits within known/presumed occupied EMR habitat.

IMPACTS TO INDIVIDUALS

Subactivities Having No Effect on the Species

There are a few subactivities that are anticipated to have no effect on the EMR (see Table C12, Appendix C; NE activities). These are activities that either will not directly impact its habitat or involve types of disturbance or stressors that do not affect EMRs. These include activities that will not have any on-site physical activity (e.g., pipeline abandonment in-place, ownership transfer) or activities that result in stressors, such as noise or light disturbance, that EMRs are not known to be sensitive to (e.g., compression facility noise, communication facility guy lines, noise, lights).

Subactivities Not Likely to Adversely Affect the Species

There are several subactivities that may affect, but are not likely to adversely affect the EMR (see Table C12, Appendix C; NLAA subactivities). Most of these activities involve types of vegetation management, such as tree and brush clearing, along with upland vegetation disposal via brush pile management and burning, and herbicide and contaminant use.

We conclude that small area of vegetation clearing required for O&M activities (e.g., 75 foot ROW) will not remove enough habitat to measurably impact EMRs (Note: vegetation removal for new construction and mowing for O&M and new construction are not included here). Potential injury or death of snakes by burning in brushpiles is avoided by BMP #8, which restricts brushpile the timing of burning in occupied habitat so that snakes are extremely unlikely to be injured, killed, or disturbed. The potential for adverse effects to both EMRs and crayfish from exposure to herbicides and potential contaminants is reduced or avoided by BMPs #19-23 and #33 and ECS measures that govern chemical use in occupied habitat. These measures avoid and reduce impacts by setting application/use buffers in sensitive areas and requiring redundant and enhanced spill prevention measures, including in EMR habitat. The potential for significant water fluctuations in occupied habitat from hydrostatic testing and other projects is greatly limited by BMPs #4, 24-25. These BMPs required that NiSource plan and perform such activities, in a manner that minimizes or avoids impacts to water levels, and we conclude that water impacts from NiSource projects will not have measurable impacts on snakes.

Subactivities Likely to Adversely Affect the Species

The remaining subactivities are expected to have some level of adverse effect on EMRs (see Table C12, Appendix C; LAA subactivities). These subactivities involve the following types of stressors: vehicle traffic, use of heavy machinery, earth disturbance/direct habitat disturbance,

and mowing. We anticipate adverse impacts to individual EMRs to these stressors will range from temporary nuisance or disturbance (e.g., short-term habitat loss) to injury or death.

There are few key BMPs that will reduce the potential for take of EMRs from all of these stressors. First, BMP #2 requires NiSource to develop a site-specific plan when operating occupied habitat that reduces potential impacts by identifying EMR issues and specific sensitive areas and planning and applying necessary avoidance measures. This BMP will heighten the staff awareness to EMR for projects and ensure that the necessary BMPs are implemented. Second, BMP #17 requires that qualified EMR monitors be onsite during construction projects in occupied habitat to help identify sensitive EMR areas and carefully handle/remove any EMRs that are encountered. The monitors will significantly reduce the potential for injury or death of EMRs. Lastly, BMP #18 requires that projects in occupied habitat be conducted as quickly as possible to minimize exposure of EMRs to these activities.

These protective measures, in addition to the BMPs discussed previously (NLAA activities), are critical to significantly reducing potential impacts to EMRs. However, we still expect adverse impacts to EMRs from the following NiSource activities.

Vehicle traffic

Massasaugas are known to be highly susceptible to vehicle collisions, with individuals being killed or injured by moving vehicles while crossing roadways. Massasaugas typically rely on their cryptic behavior to avoid detection and thus are less likely to flee approaching threats, making them especially susceptible to direct mortality from vehicles (Lipps 2005). Further, massasaugas are known to bask in open areas such as roadways. Vehicle-caused mortality and injury have been shown to increase as suitable habitat becomes fragmented by transportation corridors (Szymanski 1998).

There are a few BMPs that will greatly reduce the potential for injury of EMRs by NiSource vehicle and equipment. NiSource has agreed to limit the speed of its vehicles in occupied habitat to less than 10 miles per hour (BMP #5), which will increase the drivers' ability to see and avoid snakes, reducing potential vehicle strikes. Next, BMPs #2 and #31, requiring site-specific planning and education of NiSource staff about the presence of EMRs, will raise staff awareness of EMRs, helping them be on guard to avoid them. We expect that these BMPs together will significantly reduce, but will not completely avoid, potential injury, harassment, or death of EMRs from vehicle traffic.

Heavy machinery

Heavy machinery operating in occupied habitat may crush individuals in their hibernacula and may disturb, injure, or kill massasaugas moving above ground during the active season. Heavy equipment may also impact EMRs when earth-moving or digging destroy hibernation burrows in wetlands or alters site hydrology. Massasaugas typically rely on their cryptic behavior to

avoid detection and thus are less likely to flee approaching threats, which makes them especially susceptible to direct mortality from vehicles and machinery (Lipps 2005).

There are a few BMPs that will greatly reduce the potential for heavy machinery to impact massasaugas. With BMPs #4, 14, and 15, projects using heavy machinery will follow appropriate seasonal restrictions to avoid direct encounters with snakes, and will follow protocols that prioritize techniques that minimize disturbance and the need for equipment. As described above, BMPs #17 and 18 will further minimize potential negative impacts to EMRs by the use of the onsite qualified snake monitor and shortened construction times in occupied habitat. We expect that these BMPs together will significantly reduce potential injury, harassment, and death of EMRs.

Earth disturbance/direct habitat disturbance

Direct earth disturbance may result from a variety of NiSource subactivities, primarily involving the construction of new facilities and construction or replacement of pipelines. This physical disturbance could impact EMRs by reducing habitat suitability and function. These activities could impact EMRs in any habitat type they occupy, including upland, wetland, and stream habitats.

In upland areas, EMRs may be trapped in temporary trenches or holes dug for new construction or accessing underground facilities. Implementation of BMP #17 will require a snake monitor be onsite during these operations to ensure that any entrapped EMRs are carefully removed are moved to a safe location, thus reducing this impact to temporary harassment. Upland areas will be restored according to BMPs #26-29 and we do not expect any long-term or permanent habitat loss.

In wetland and stream habitats, snakes may also become entrapped in temporary trenches and holes. But as with uplands, we expect that the onsite snake monitor (BMP #17) will ensure that no individuals are seriously injured or killed. Habitat impacts are potentially more severe in aquatic areas, with impacts to water levels and flow possible. In addition, EMRs hibernacula sites may be impacted in these areas. There are several measures, however, that will significantly reduce these potential impacts.

NiSource's ECS specifies that, during the construction of new pipelines, staging areas will generally be located at least 50 feet from the wetland edge, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land and must further be limited to the minimum necessary to construct the crossing. NiSource will also limit construction equipment operating in wetland areas to that needed to clear the construction work area, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the ROW. Construction equipment will also use access roads located in upland areas to the maximum extent practicable. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the

construction work area. NiSource implements similar restrictions in and near stream habitats. We expect that these measures will reduce and minimize impacts to aquatic EMR habitat.

Further, NiSource agreed to several BMPs to limit impacts to aquatic EMR habitat. BMPs #4 and 7 require NiSource to delineate EMR potential hibernation areas, and then avoid any earth moving (wetland or upland) that would directly or indirectly affect those areas. The routing criteria specified in BMPs #12-15 direct any activity, O&M and new construction, be planned and completed in a manner that places priority on avoidance of impacts to EMR habitat. This includes a preference for trenchless construction methods, abandonment in-place, and complete avoidance. These BMPs will work to greatly reduce the number of earth-moving projects in EMR habitat

Based on this analysis, we expect that these BMPs and NiSource standard ECS operating methods together will significantly reduce impacts to EMRs. We conclude that the remaining potential for adverse effects includes a small level of temporary harassment of EMRs in occupied habitats whenever a project occurs.

Mowing

Snakes, including EMRs, with are often injured or killed by mowers. Massasaugas typically rely on their cryptic behavior to avoid detection and thus are less likely to flee approaching threats, making them especially susceptible to direct mortality from mowers and heavy machinery. This could occur anytime NiSource is mowing vegetation in EMR habitat when the snakes are above ground. BMPs 2 and 31 will help reduce these impacts to EMR by requiring site-specific planning and education of NiSource staff about the presence of EMRs, which will raise staff awareness of EMRs, helping them be on guard to avoid them. However, BMPs 9 and 10 were also necessary to more significantly reduce or avoid harm and mortality from mowing in presumed and known occupied EMR areas.

BMP #10 directs NiSource mowing in known occupied EMR habitat. In these areas, NiSource must first attempt to complete mowing during the hibernation season, which would completely avoid all impacts to EMRs. If the area must be mowed when EMRs are active, mowing must be done in a manner that minimizes encounters with EMRs or minimizes potential injury of EMRs. This requires more focused spot mowing (versus the entire site), reduction of the mowed ROW from 75 feet to 10 feet (less mowing), use of a sickle mower (no suction) set to a height of at least 12 inches (reduces blade injury of EMRs), and seasonal time-of-day mowing windows that require mowing be completed at times when EMRs are most active. In addition to these restrictions on the type and timing of mowing, NiSource must use a qualified snake monitor to search for EMRs prior to mowing, so that any snake detected may be moved outside of the area. We conclude that these measures, taken together, will completely avoid potential injury and death of EMRs due to mowing. However, to evaluate this conclusion, the snake monitor will also search the area following mowing. Although not anticipated, if any EMRs are found to have been harmed or killed as a result of mowing under these conditions, this consultation must be reinitiated to reevaluate impact to EMR based on this new information.

BMP #9 takes a similar approach to mowing in presumed modeled EMR habitat. In these areas, NiSource must first attempt to complete mowing during the hibernation season, which would completely avoid all impacts to EMRs. If the area must be mowed when EMRs are active, mowing must be done in a manner that minimizes potential injury of EMRs. This means use of an alternative, low/no suction mower (open platform, flail, sickle mower) with a blade height set to at least 6 inches (reduces blade injury of EMRs). In addition to these restrictions on the type of mowing, as also directed under BMP #10, NiSource must use a qualified snake monitor to search for EMRs prior to mowing, so that any snake detected may be moved outside of the area.

We expect that these measures will avoid nearly all direct impacts to EMRs; however, in areas with overgrown vegetation where it may be more difficult to clear the area of snakes, it is possible that EMRs may still be in the area and impacted. To evaluate this, the snake monitor will also search the area after mowing to detect any EMRs that are harmed or killed. If two or more EMRs are found harmed or killed, then NiSource must implement the more restrictive measures in BMP #10 for all EMR habitat, known or presumed occupied.

Impacts to Populations

As described above, individual EMRs may experience some adverse impacts from NiSource activities. Although there are several BMPs and restrictions from NiSource's ECS that greatly limit these effects, we expect that some EMRs will be taken during the life of the project. We expect this take to occur primarily as temporary disturbance and harassment that due to either direct encounters with NiSource staff and equipment or indirectly due to temporary habitat impacts. This harassment is expected to temporarily affect their ability to feed and shelter, although only over a short time period.

We further anticipate some very limited lethal take. For most projects, the BMPs will reduce potential lethal take to a level where it is not reasonably certain to occur, as previously described. However, we anticipate that a few individuals may be killed by mowers. These would be EMRs in undocumented populations (i.e., EMRs were not know to be present) that were not detected by the snake monitors prior to mowing. However, with all of the precautions that will be taken when mowing (BMPs #9 and 10), expect that this take will be unusual and less than two (2) individuals over the life of the project.

NiSource has further made commitments to actions that will benefit EMRs and reduce potential population-level impacts, as discussed here.

> <u>EMR Surveys</u>: NiSource has agreed to fund one EMR survey per year (on average) for any year where its activities have either direct or indirect effects on EMR. For example, ROW mowing during the EMR active season would trigger the survey requirement (even with the use of the other ROW mowing BMPs for blade height, walkover, etc.), mowing during the inactive season would not. To fulfill this commitment, NiSource will either conduct its own

EMR survey in accordance with USFWS standards or contribute to the mitigation account $25,000 - the current cost for such survey – to survey for new EMR populations within the covered lands. Preference will be given to the existing NiSource ROW and adjacent area with suitable habitat. The surveys must be approved by the FWS in advance and will be performed by FWS staff or other qualified contractors. These surveys will benefit the species by improving our ability to detect currently undocumented EMR populations prior to any NiSource work undertaken in that area. This will help reduce the potential for EMRs to be injured or killed due to NiSource activities.

Mitigation: NiSource has also agreed to fund mitigation to compensate for the adverse impacts of actions, lethal and non-lethal impacts, as previously described. To determine how much mitigation would be applied, we first calculated the expected amount of adverse impacts. For specific calculations of take, we used the EMR populations as identified in the recent rangewide population modeling by Faust et al. (Faust et al., 2011). Based on this, we are currently aware of 16 occurrences of EMR in or near the covered lands in Ohio; we expect NiSource to directly impact 8 of those known populations. There are currently 29 documented EMR occurrences statewide in Indiana (Faust et al. 2011), none of which occur in the NiSource covered lands. Given the lack of surveys in that area of Indiana (Andy King, pers. comm. 2013), however, we must anticipate unknown populations of EMR primarily in Indiana. To calculate impacts to currently unknown populations in the covered lands in Indiana, we are making the following assumptions:

- Impacts to populations in Indiana will be similar level of impact to populations expected in Ohio.
- The ratio of total populations identified in the Faust rangewide population modeling to the actual total number of populations statewide is the same in both states.
- The proportion of total populations likely to be impacted by NiSource is the same in both states.

Given these assumptions, we estimate impacts by looking at the ratio of populations expected to be impacted in Ohio and the number of Ohio populations identified in the Faust model. This is equal to 8 known pops directly impacted by NiSource in Ohio to 16 total populations in the Faust model in Ohio, which equal 8/16, or 0.5. We then using this ratio of 0.5 to estimate the number of populations potentially impacted in Indiana. Based on the 29 total known populations from the Faust model, 29 x 0.5= 14.5 populations. We round this number up to 15 total populations and conclude that 15 populations would be impacted by NiSource in Indiana.

We then need to calculate the acres of habitat potentially impacted in these populations. The 8 impacted populations in Ohio have a mean of approximately 150 acres in the existing ROW (range of 35 to 298 acres). We then calculate that 15 potentially impacted populations in Indiana will be impacted will also have an average of 150 acres of habitat in the ROW, which comes to 2250 acres of impact (15 populations x 150 acres). In Ohio, this calculation leads to 1200 acres of impact (8 populations x 150 acres). Taken together, we

estimate that NiSource will have a total of up to 3450 acres of impact and that any EMRs present on those areas would experience the anticipated harassment.

We further anticipate some very limited lethal take. For most projects, the BMPs will reduce potential lethal take to a level where it is not reasonably certain to occur, as previously described. However, we anticipate that some individuals may be killed by mowers. These would be EMRs that were not detected by the snake monitors prior to mowing. However, with all of the precautions that will be taken when mowing (BMPs #9 and #10), expect that this take will be unusual and no more than two (2) individuals over the life of the project.

NiSource will mitigate for the estimated 2250 acres of habitat impacted in Indiana and the 1200 acres of impact in Ohio, for a total of up to 3450 acres of impact. Mitigation for these impacts will be in the form of habitat protection and/or restoration, determined on a site-by-site basis. This mitigation will be governed by the mitigation panel set-up by the MSHCP.

We conclude that mitigation at a ratio of 1/10 per acre is appropriate to adequately compensate for the effect of the anticipated take. We conclude this ratio for the following reasons:

1) The take is expected to be primarily in the form of harm and harassment, with very little mortality expected (up to 2 individuals at currently unknown populations).
2) The take is expected to be temporary. Individual harassment will be short-term for the duration of the project. Habitat impacts are further expected to be temporary, with most areas returning to suitability in less than a year.

Based on this analysis, NiSource will fund up to 345 acres of mitigation for EMR (1/10 of 3450 acres). This mitigation will be applied under the following circumstances:

- Off-ROW new construction projects, in known/presumed occupied upland areas considered to be suitable EMR habitat, where actions to completely avoid impacts (i.e., HDD) are not used
- Projects that cause direct impacts to wetlands in known/presumed occupied habitat (e.g., open trenching for replacements or new alignment)
- Mowing during the active season, if/when an EMR is killed

Overall, we expect the anticipated adverse impacts to be infrequent and spatially and temporally over the affected populations. However, given NiSource ROW maintenance schedule (5-7 years), and the relative infrequency of new construction at any one location, we do not anticipate that these impacts occur at a frequency in any given population to cause any losses in population abundance, reproduction, or growth rates. We conclude that the impact to EMR populations will be small and temporary, and the affected populations will recover quickly. The mitigation implemented by NiSource will further reduce potential impacts by providing habitat improvements that should increase survival and reproduction in EMR populations.

Because we do not expect any adverse population-level impacts, our effects analysis for the EMR is complete and does not warrant further analysis at the species-level.

5 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. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

As stated in the Environmental Baseline section of this BO, the action area is spatially diverse, including a variety of topographic, geologic, ecological, and land-use features. Portions of the action area have undergone extensive urban or industrial development, while other portions are primarily agricultural and natural lands that have experienced little development. Collectively, these past and present activities have had profound impacts to the landscape, the most notable being the loss and/or conversion of native landscapes to intensive agricultural production lands, urban and rural development, mining and timber operations, energy development, and transportation infrastructure.

There are a number of activities addressed in detail in the Environmental Baseline that will continue to impact the species within action area. The magnitude of these effects over the 50-year term of the project is unknown. Any analysis of these effects at this time is complicated by the lack of specific information on actual projects that raises questions on the reasonable certainty of occurrence. Although it is difficult to predict the precise location, magnitude, and duration of these impacts, these effects have occurred within the action area in the past and are likely to continue, resulting in varying degrees of adverse effects to one or more of the species addressed in this BO.

There is consensus within the scientific community that warming trends will continue to alter current weather patterns and patterns of natural phenomena that are influenced by climate, including the timing and intensity of extreme events such as heat-waves, floods, storms, and wet-dry cycles. Oceanographic models project a weakening of the thermohaline circulation resulting in a reduction of heat transport into high latitudes of Europe, an increase in the mass of the Antarctic ice sheet, and a decrease in the Greenland ice sheet, although the magnitude of these changes remain unknown (Schmittner et al. 2005, Levermann et al. 2007). As ice melts in the Earth's polar regions in response to increases in temperature, increases in the distribution and abundance of cold water are projected to influence oceanic currents, which would further alter weather patterns.

Although the precise nature and scale of these changes would vary regionally, climate change is projected to have substantial direct and indirect effects on individuals, populations, species,

and the structure and function of both aquatic and terrestrial ecosystems in the foreseeable future (McCarthy et al. 2001, Parry et al. 2007), including those within the action area.

6 CONCLUSIONS

After reviewing the current status of the species the environmental baseline for the action area including additional effects from actions in the baseline that would occur over the period covered by this consultation, the effects of issuing an incidental take permit, effects of the associated federal actions, and cumulative effects, this section presents our biological opinion on whether the proposed actions are not likely to jeopardize the continued existence of these species.

6.1 MSHCP SPECIES

6.1.1 INDIANA BAT

In considering the aggregate, long-term impacts to individuals, we expect that the overall level of take of Indiana bats will be relatively low and will not result in significant population-level impacts. Given the avoidance and minimization measures developed for the MSHCP, take of Indiana bats in winter hibernacula or take of the winter habitat is not anticipated. NiSource and the USFWS also do not anticipate take to occur to immobile Indiana bats (i.e., pups) within the covered lands (i.e., within known and suitable summer habitat). No direct take is anticipated to occur in known summer maternity habitat and known spring staging/fall swarming habitat of Priority 1 and 2 hibernacula.

NiSource has also proposed mitigation for their impacts to Indiana bats in the MSHCP. The mitigation package includes: the purchase (i.e., fee title or easement) and protection (i.e., gating) of either 126 or 252 acres surrounding one or two P1 or P2 hibernacula and the protection (i.e., fee title or easement) of between 8,907 and 10,960 acres of known maternity colony habitat. The protection of hibernaculum also includes the development and implementation of a Hibernaculum Protection Plan to address threats (e.g., gating). This will compensate for the impact of the take from NiSource's activities on populations within the covered lands.

We conclude that the proposed impacts from NiSource activities do not pose a significant risk to the viability of the Indiana bat and will not result in measurable population declines or losses in the action area. Therefore, because we do not expect the impacts to have population-level effects, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole. *After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, we conclude that the proposed action is not likely to jeopardize the continued existence of the species. There is no designated Indiana bat critical habitat within the action area; therefore, none will be affected.*

6.1.2 Bog Turtle

In considering the aggregate, long-term impacts to individuals, we expect that the overall level of take of bog turtles will be relatively low. In addition, NiSource vegetation management activities are expected to result in beneficial effects to bog turtles. However, there is the potential for population-level impacts at small bog turtle sites from ground-disturbing activities. NiSource has proposed mitigation for their impacts to bog turtle in the MSHCP in the form of permanent protection and management of 25 bog turtle sites or off-ROW restoration and management of 5 sites and permanent protection and management of 20 bog turtle sites. These activities will result in significant contributions to the conservation needs of the species and offset the losses at any given site, including the potential extirpation of very small, isolated sites. Impacts to bog turtles are spread throughout 2 RUs and we do not anticipate any effects at the RU-level.

Therefore, because we do not expect the impacts to have effects to bog turtles at the RU-level, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole. *After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, we conclude that the proposed action is not likely to jeopardize the continued existence of the species*. *No critical habitat has been designated for this species; therefore, none will be affected.*

6.1.3 Madison Cave Isopod

In considering the aggregate, long-term impacts to individuals, we expect that the overall level of take of MCI will be relatively low. There are no known MCI sites within the existing ROWs or covered lands and only one MCI site, Limekiln Cave, within 0.5 mile of the covered lands. One additional new MCI site is anticipated to occur within the covered lands. We anticipate that these two MCI sites (one known/one unknown) may be impacted during the life of the permit.

We do not anticipate that impacts will significantly affect the Limekiln Cave population, given its distance from the covered lands. However, we anticipate that take of individuals from the unknown population assumed to be present in the action area may occur in close proximity to the existing or future ROW. We conclude that there is therefore potential for extirpation to this one unknown population.

Based on our analysis of the conservation needs of the species, we conclude that the loss of one unknown population would not measurably reduce our ability to continue to meet the conservation needs and Recovery Criteria of the species. We conclude that this project will not reduce the likelihood of survival and recovery of the MCI rangewide.

Therefore, because we do not expect the impacts to have effects to MCI rangewide, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole. *After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, we conclude that the proposed action is not likely to jeopardize the continued existence of the species*. *No critical habitat has been designated for this species; therefore, none will be affected.*

6.1.4 Nashville Crayfish

We do not anticipate population level impacts to the mainstem and six tributary streams known to support Nashville crayfish within the Mill Creek Watershed. Because NiSource has agreed to cross all streams within the range of the Nashville crayfish using dry-ditch techniques, impacts to individuals and habitat should be limited to small reaches of stream at the crossings. Moreover, the reasonable worst case scenario predicts take would occur in a few "spikes" during major stream crossing actions (or access road or pipeline abandonment and removals) over the 50-year life of the permit. Providing other impacts do not cause Nashville crayfish populations to crash, there would likely be recovery between NiSource impacts. Based on our estimation of the current population sizes, our assumptions concerning the reproductive potential of Nashville crayfish, and the expected minimal long-term impacts to habitat, it seems unlikely that the persistence of either the mainstem or tributary populations would be negatively affected by NiSource activities over the life of the permit.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Nashville crayfish. No critical habitat has been designated for this species; therefore, none will be affected.

6.1.5 Mussels

Clubshell

Of the 17 known populations of clubshell, including eight stable/reproducing populations, NiSource has the potential to affect five; three of which are considered stable/reproducing populations (Allegheny River, Little Darby Creek, and Elk River) and two (Meathouse Fork and Big Darby Creek) are unknown. Because the status of the Meathouse Fork population is unknown and because NiSource crosses Meathouse Fork multiple times upstream of where the remaining clubshell population is likely located, the USFWS will require NiSource to implement dry-ditch techniques when working in Meathouse Fork to significantly limit downstream sediments. The Allegheny and Elk River populations cover many river miles and it is unlikely that NiSource activities would significantly affect these populations. NiSource crosses near the mouth of Little Darby Creek and downstream of the one individual found in Big Darby Creek - population level impacts in these streams are therefore also unlikely. The likelihood of any

population being extirpated outright is small given the USFWS required actions, and the AMMs and BMPs implemented by NiSource.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the clubshell. No critical habitat has been designated for this species; therefore, none will be affected.

Northern Riffleshell

In summary, there are 13 northern riffleshell populations currently identified and four known reproducing populations. NiSource would potentially affect only one of the four known reproducing populations (the large Allegheny River population). Two other reproducing populations are completely outside of the covered lands. NiSource has the potential to affect one population where reproduction is uncertain (Big Darby Creek) and one population that may or may not be extant (Elk River). Local impacts are possible to the Allegheny River population, but not to the larger population of millions of animals - the persistence and reproductive potential of this population should not be affected. The Elk River population is apparently very small and may already be extirpated. If, however, that population exists at a very low density in the vicinity of the pipeline, NiSource activities could result in significant impacts. NiSource activities may affect northern riffleshell in Big Darby Creek in Ohio. There are two augmented populations (two release sites) in Big Darby Creek in Franklin County, Ohio. They cover several miles of stream (in part upstream of the NiSource crossing) where it is unlikely that there would be population level impacts. The distribution of the northern riffleshell, which is focused in Pennsylvania, Ohio, and Kentucky within the NiSource Covered Lands has an additional population center in Canada/Michigan. The Elk River population in West Virginia may already be extirpated, but significant impacts could occur from multiple crossings of the Elk River if the population is extant, although impacts to the habitat would be minor and of short duration. The recovery plan (USFWS 1994) documents the Elk River drainage as necessary for recovery of the species. The 5-Year Review (USFWS 2008) indicates, however, that it is doubtful that this criterion can be met because of a lack of understanding of the reasons for decline in the Elk River population of northern riffleshell.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the northern riffleshell. No critical habitat has been designated for this species; therefore, none will be affected.

Fanshell

For fanshell, NiSource has the potential to affect two of the stable, reproducing populations (Muskingum River and Licking River in Kentucky), two small, possibly non-reproducing populations (Tygart's Creek and Barren River), and the population in the Ohio River where the

status is largely unknown. NiSource activities would potentially affect five of the approximately 13 known populations. It is possible that NiSource activities could impact one of the strongholds of the fanshell mussel in the Licking River in Kentucky. The extent of the fanshell in the lower Licking River suggest population level impacts would be unlikely. NiSource has the potential to impact a downstream segment of the fanshell population in the Muskingum River. NiSource will not affect the larger population that extends miles upstream of the NiSource crossings. NiSource makes seven crossings of the Ohio River between Ohio and Kentucky and Ohio and West Virginia. Populations of fanshell are known to persist in the Ohio, but population levels and densities are largely unknown. Although there will be multiple crossings, NiSource would affect the persistence or reproduction of the fanshell population of the Ohio River. The recovery plan indicates the need for three populations in Kentucky tributaries to the Ohio. In 1991, the Tygart's Creek and Barren River populations were considered small and non-reproducing and may now be extirpated. Since the impacts to these populations and their status are both uncertain, and since NiSource activities are not expected to cause serious degradation of habitat, while NiSource activities could cause take in these streams, it does not seem likely that NiSource activities will impede recovery of this species.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the fanshell. No critical habitat has been designated for this species; therefore, none will be affected.

James Spinymussel

In summary, the JSM has a limited range, confined to the James and Roanoke River watersheds (Dan and Mayo Rivers) in Virginia and North Carolina. NiSource would potentially affect three known populations (considered small, isolated, or non-reproducing) and one population of unknown status, therefore potentially affecting four of the 21 known populations. NiSource would not directly impact any of the most robust remaining populations (Johns Creek, South Fork Potts Creek, Mill Creek, and the Roanoke River drainage, nor the large, recently discovered population at Dicks Creek/Oregon Creek). NiSource makes 79 stream crossings within the Covered Lands in the James watershed. It is possible that some of the un-surveyed streams contain populations of JSM as evidenced by the discovery in 2010 of the Dicks Creek/Oregon Creek population. NiSource activities therefore could affect some currently unknown JSM populations, however, NiSource's agreement to implement all stream crossings using dry-ditch methodology and a mandatory time of year restriction (15 May to 31 July) designed to avoid the peak reproductive period would minimize population level impacts.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the JSM. No critical habitat has been designated for this species; therefore, none will be affected.

SHEEPNOSE

There are multiple stable or improving sheepnose populations outside of the NiSource impact area and two stable or improving populations within the general area of NiSource covered lands that would not be impacted by NiSource because of agreements to HDD these streams or because of the location of crossings relative to the populations. Of the 11 populations thought to be stable or improving, six are completely outside of the NiSource covered lands. There is the possibility for take in the Allegheny, Muskingum, and Big Sunflower Rivers should HDD not be practical and should those populations extend into the crossing areas, but we would not expect population-level impacts. Take is likely from two declining populations (Kentucky and Licking Rivers) and there is some potential for NiSource to have population-level impacts on sheepnose in the Kentucky River, depending on the exact location and number of animals, and the actual level of impacts. Because this population is likely to be of limited importance to the species, NiSource activities will not preclude survival or recovery of the sheepnose.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the sheepnose. No critical habitat has been designated for this species; therefore, none will be affected.

6.1.6 AMERICAN BURYING BEETLE

In considering the aggregate, long-term impacts to individuals, we expect that the overall level of take of ABBs will be relatively low and will not result in significant population-level impacts. Following the existing impacts of prior vegetation clearing and land alterations, most of the existing pipeline facilities (e.g., ROW, compressor stations, appurtenant facilities) within the population's range is currently not suitable habitat for ABB. Thus, most ongoing activities (i.e., O&M) in these areas will not affect the beetle. Further, there is a very low density of beetles within the occupied habitat (Godwin and Minich 2005; one beetle per 189 acres), which is anticipated to remain low even with ongoing population releases (Boyer 2008a, 2008b). This low density reduces the potential for NiSource to directly (and unknowingly) encounter and harm individuals during their activities. It further reduces the potential harm to displaced individuals because there should be sufficient unaffected habitat available to replace any lost habitat. NiSource has also proposed mitigation for their impacts to ABB in the MSHCP in the form of a $15,000 contribution to the ABB reintroduction program. This contribution will help bolster the reintroduction program and reduce the impact of the take from NiSource's activities on this population. Therefore, we conclude that the proposed impacts from NiSource activities do not pose a significant risk to the viability of the ABB and will not result in measurable population declines or losses in the action area.

Therefore, because we do not expect the impacts to have population-level effects, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and

recovery of the species as a whole. We conclude that the proposed action is not likely to jeopardize the continued existence of the species.

6.2 Non-MSHCP Species

6.2.1 Mussels

Dwarf Wedgemussel

The dwarf wedgemussel is doing better in the northern part of its range where some large populations still exist (Connecticut River). The populations in the south are declining. NiSource could affect four populations in Virginia (Blue River, Mountain Run, Nottoway River, and South Anna River) all of which appear to be very small or possibly extirpated. Some take of individuals could occur over the life of the permit in the Neversink and Delaware Rivers, but with AMMs and BMPs in place long-term impacts to either population are unlikely. NiSource would not impact any of the best remaining populations in New Hampshire, Massachusetts, and Connecticut and the USFWS does not expect NiSource activities to affect the likelihood of survival or recovery of the dwarf wedgemussel.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the dwarf wedgemussel. No critical habitat has been designated for this species; therefore, none will be affected.

Pink Mucket Pearlymussel

A number of pink mucket populations including several that are strong-holds for the species are completely outside the NiSource area of operation. Some cover more than 100 river miles. Important populations also occur in the Cumberland and Tennessee Rivers within the NiSource area of operations, which are not expected to be impacted. NiSource would potentially take pink mucket in the Licking, Muskingum, and Elk Rivers. There is some potential for NiSource activities to impact these populations, depending on the exact location and numbers of individuals, but with AMMs and BMPs in place, the likelihood of population level impacts is small.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the pink mucket. No critical habitat has been designated for this species; therefore, none will be affected.

Rabbitsfoot

NiSource has the potential to impact only three (Green River, Duck River, and Tennessee River) of the 11 known sizeable populations of rabbitsfoot, however, because of agreements to avoid impacts to the Duck and Tennessee and because of the location of the NiSource crossing of the Green River, no impacts are expected. NiSource has the potential to impact two populations classified as small (Little Darby Creek population even though recent records are from upstream of NiSource facilities) and the Muskingum River, which has a recently discovered population of rabbitsfoot. NiSource also has the potential to affect rabbitsfoot in in two streams where it is classified as marginal, Big Darby and the Allegheny River. Although some take of rabbitsfoot is likely, most of the sizeable and small populations most important to the survival and recovery of the rabbitsfoot are outside the NiSource covered lands.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the rabbitsfoot. Critical habitat has been proposed, but no critical habitat has been designated for this species.

RAYED BEAN

NiSource activities could have local impacts only the large Allegheny River population (the population extends far upstream) of the four known reproducing populations. There is potential for take of two populations where reproduction is uncertain in the St. Joseph River and the reintroduced population in the Elk River. There is some potential for take of rayed bean in Big Darby Creek, however, the crossings occur far downstream from known populations. NiSource covered lands overlap the center of the current distribution of the rayed bean, but populations likely essential to the survival and recovery of the species are not directly impacted.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the rayed bean. No critical habitat has been designated for this species; therefore, none will be affected.

SPECTACLECASE

NiSource would not impact any of the strongholds of this species in Missouri or Minnesota/Wisconsin. In the occupied streams that NiSource does cross, some take is likely, but measures including agreements to avoid impacts using HDD, and to employ other AMMs and BMPs will limit impacts.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the

spectaclecase. No critical habitat has been designated for this species; therefore, none will be affected.

SNUFFBOX

The snuffbox occurs in a comparatively large number of streams, however, most of these populations are small and of questionable viability. Of the eight populations considered strongholds, none is impacted by NiSource activities. NiSource activities impact only two of the 24 populations classified as significant, the Little Kanawha River (West Virginia) and the Elk River (West Virginia). It seems likely that NiSource will take snuffbox mussels based on the number of occupied streams crossed, but these impacts should be limited with AMMs and BMPs in place.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the snuffbox. No critical habitat has been designated for this species; therefore, none will be affected.

6.2.2 NORTHEASTERN BULRUSH

Overall the covered lands intersect with 1,043 acres of mapped suitable habitat in West Virginia and several hundred acres in Virginia. Due to (1) incomplete surveys, (2) the presence of at least one population within the existing ROW and (3) the other occurrences in close proximity to the covered lands, we conclude that it is likely that populations may occur within the covered lands, particularly within Centre, Clinton, Bedford, Franklin, and Fulton Counties, Pennsylvania.

NiSource has agreed to conduct surveys prior to construction of ROWs in new alignment or during ground disturbing activities (e.g., pipeline replacement) within wetlands in existing ROW and covered lands and to avoid impacts to those populations. However, despite this, NiSource is likely to impact the one known population that occurs in the ROW because clearing and other disturbing activities are necessary within the ROW. Further, due to lack of survey information for this species, we expect that there are more unknown populations within the ROW that NiSource could not completely avoid impacting.

Although there may be a number of unknown Northeastern bulrush populations that occur on the NiSource covered lands, we believe that NiSource will impact the Northeastern bulrush populations only infrequently. NiSource has agreed to survey for the species within its potential habitat prior to initiating project activities and avoiding impacts to any populations documented by those surveys. This significantly limits potential impacts to the species, focusing most impacts on populations within the existing ROW. Because there is one known and likely other unknown occurrences within the ROW, NiSource is likely to adversely affect the species.

Given the type and extent of activities that NiSource must perform in the ROW and the small size of many northeastern bulrush populations, we conclude that NiSource could result in the extirpation of small populations. Given that the NiSource project could result in population-level effects (e.g., loss of small populations in Pennsylvania), we must assess the potential for effects to the species as a whole. The first step is to estimate the number of populations that may be affected.

NiSource will be conducting field surveys in suitable habitat to identify and avoid impacts to unknown populations prior to initiation of individual projects. For this programmatic analysis we must estimate the prevalence of any undocumented occurrences of the species within the covered lands and the potential for NiSource to encounter and impact those populations. Within the MSHCP, NiSource estimates that it will work on approximately 10 percent of the covered lands over the 50-year duration; only a small portion of the covered lands will be suitable for the northeastern bulrush and smaller portion of that habitat will be occupied by the species. Although we do not have estimated acreage of suitable habitat for all states for this species at this time, we conclude that NiSource surveys will detect and subsequently avoid most populations. Given this, we estimate that only one new population may occur in a location that cannot be fully avoided and therefore, will be impacted or completely extirpated. We also conclude that NiSource will impact the one current population within the ROW in Pennsylvania.

We must next consider whether the loss of two populations is likely to impact the survival and recovery of the northeastern bulrush rangewide. To do this, we must evaluate how the population-level effects from the proposed action will influence the likelihood of progressing towards or maintaining the conservation needs of the species. For species with current, updated recovery plans, the recovery strategy, objectives, and criteria may describe those conservation needs.

Upon reviewing the Northeastern Bulrush Recovery Plan (USFWS 1993c) and the ecology of the species, the conservation needs for this species are to secure protection of at least 20 stable or increasing populations and to increase our understanding of life history and ecological requirements to allow for effective protection, monitoring and, as needed, management. When the northeastern bulrush was first listed, there were only 33 extant populations known. As of 2007, there were 113 extant populations range-wide, most of which were found in Pennsylvania and Vermont (USFWS 2009d).

In 2011, the USFWS considered the status of the species to be stable (from 2010-2011) (USFWS unpublished data, 2011). In August 2010, a new population was discovered in the State of New York. New populations have been discovered in 2011 in Pennsylvania as well. Some of these discoveries are associated with surveys due to proposed projects. These populations are most likely newly-discovered occurrences that were already present on the landscape, rather than new populations.

The number of currently known populations appears to meet the conservation needs of the species. Further, the potential loss of one known and one unknown population of northeastern bulrush would not measurably reduce our ability to continue to meet the conservation needs of the species. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the Northeastern bulrush.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the northeastern bulrush. No critical habitat has been designated for this species; therefore, none will be affected.

6.2.3 Diamond Darter

After considering the status of the diamond darter within the action area, the effects of the proposed action, and the cumulative effects that are anticipated to occur, we do not expect population-level impacts will result from the proposed action. NiSource has incorporated significant measures to avoid and minimize potential adverse effects to the diamond darter. Over the life of this project, the aggregate effect of NiSource activities in upland areas of the Elk River watershed, and in and around tributaries to the Elk River, has the potential to cumulatively result in sedimentation and water quality degradation in the Elk River itself, but implementation of the BMPs required for this species should reduce the potential scope and severity these effects so that individual projects have minimal to no adverse effects. As a result of the avoidance and minimization measures incorporated into this project up front, we do not anticipate that population-level effects to the diamond darter will occur. Therefore, we conclude that the proposed impacts from NiSource activities do not pose a significant risk to the diamond darter and will not result in an appreciable reduction in numbers, reproduction, or distribution of the diamond darter or an appreciable reduction in the role or conservation function any critical habitat PCEs.

It is therefore, our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the diamond darter. We have also concluded that the action, as proposed, is not likely to result in the adverse modification or destruction of diamond darter critical habitat.

6.2.4 Roanoke Logperch

After considering the status of the Roanoke logperch within the action area, the effects of the proposed action, and the cumulative effects that are anticipated within to occur, and considering the aggregate, long-term impacts to individuals, we expect that the effects of the proposed action on Roanoke logperch will not result in significant population-level impacts. Despite the fact that the abundance of logperch and suitability of habitat within the action area is not known, we expect the action area to support a relatively small portion of the habitat for

logperch within the Nottoway River watershed, and rangewide. The effects of the proposed action are expected to be primarily temporary impacts, and in general, logperch habitat will recover to a suitable condition following temporary impacts, and logperch are expected to continue to occupy waterways within the action area. Therefore, we conclude that the proposed impacts from NiSource activities do not pose a significant risk to the Roanoke logperch and will not result in permanent population declines or permanent reduction in the amount or suitability of habitat.

Because we do not expect the impacts to have population-level effects, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole. *Therefore, after reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, we conclude that the proposed action is not likely to jeopardize the continued existence of the species*. *No critical habitat has been designated for this species; therefore, none will be affected.*

6.2.5 Eastern Massasauga

We expect that the overall level of take of EMRs will be relatively low and will not result in significant population-level impacts. We expect this take to occur primarily as temporary disturbance and harassment that due to either direct encounters with NiSource staff and equipment or indirectly due to temporary habitat impacts, resulting in short-term, temporary impacts to their ability to feed and shelter. Lethal impacts are expected to be even less frequent, with less than two (2) individuals over the life of the project from mowing.

NiSource has committed to ongoing surveying for EMRs in action area, which will help reduce potential impacts to currently undocumented populations. NiSource has also agreed to mitigation for their impacts to EMR in the form of habitat restoration that should improve survival and reproduction in those populations.

Therefore, we conclude that the proposed impacts from NiSource activities do not pose a significant risk to the viability of the species and will not result in measurable population declines or losses in the action area. Because we do not expect the impacts to have population-level effects, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole. *We conclude that the proposed action is not likely to jeopardize the continued existence of the EMR*.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species, respectively, without 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 defined (50 CFR 17.3) 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 (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(3)(B)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this incidental take statement (ITS).

The portions of this ITS that address unlisted species, including the EMR and rabbitsfoot mussel, do not become effective until those species are listed and the conference opinion is adopted as the biological opinion issued through formal consultation.

Overall Design and Approach of this ITS

This ITS is organized into two parts:

Part 1: The first part addresses the species covered in the MSHCP and the associated ITP (MSHCP species). This part of the ITS is designed for a standard 'one-time' consultation approach.

Part 2: The second part of this ITS addresses the species that are present in the action area, but were not covered in the MSHCP and ITP (non-MSHCP species). This part of the ITS is designed with a programmatic tiered-consultation approach.

Where necessary and appropriate, this ITS will include those reasonable and prudent measures (RPMs) that the USFWS concludes required to minimize the impacts of incidental take (50 CFR 402.02). Terms and conditions (TACs) will establish the specific methods by which the RPMs are to be accomplished. Where established, such TACs are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. If the permittee or federal agency fails to adhere to those TACs, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse.

1 MSHCP SPECIES

This section addresses the MSHCP species covered in the USFWS's ITP. For each species, the mitigation, minimization, avoidance, survey, monitoring, and reporting measures provided in the MSHCP are part of the proposed action, per section 2.1 of the attached BO. As such, those measures must be implemented as described in the MSHCP, the Implementing Agreement (IA), or the ITP for any of the actions considered in the BO and ITS to be lawful. Further, the finding of no jeopardy for each species in the BO is predicated on compliance with and full implementation of those measures. Therefore, there is no need to incorporate those measures in this ITS.

For the MSHCP species, we have sufficient information to complete an incidental take analysis and determine the amount or extent of take that is reasonably certain to occur, and will complete a one-time consultation for the MSHCP/ITP through the biological opinion (See the BO Section 1 Consultation Approach).

1.1 INDIANA BAT

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The MSHCP provides the following estimation of take numbers (Chapter 6, Indiana bat section), which we endorse and incorporate here:

The implementation of NiSource's covered activities are anticipated to result in impacts to known and suitable summer habitat resulting in the incidental taking of an immeasurable percentage of 2,400 individuals within 20 Indiana bat maternity colonies. Similarly, NiSource's covered activities are anticipated to result in impacts to known spring staging/fall swarming habitat resulting in the incidental taking of an immeasurable percentage of 184 individual Indiana bats. Thus, take is requested for a total of 2,584 Indiana bat individuals represented by no more than 69,900 acres of Indiana bat habitat loss over the life of the permit

Although the take is estimated in numbers of individuals for the purpose of analysis of a reasonable worst-case scenario, NiSource and the USFWS are unable to accurately estimate the percentage of these individuals that will actually be taken as a result of the covered activities. However, the maximum acreage of suitable Indiana bat habitat (i.e., 69,900 acres) that will be removed over the life of the permit is known and the estimates of take, through modeling, have been calculated as a subset of that total acreage. For this reason, NiSource and the USFWS have used habitat as a surrogate to the number of individuals taken to ensure the mitigation is commensurate with the impact of the take.

In the MSHCP, NiSource anticipates incidental take of "a low, but immeasurable percentage of the 2,584 total Indiana bat individuals estimated to be present within no more than 69,900 acres of summer and/or spring staging/fall swarming habitat impacts over the life of the

permit". NiSource states that their incidental take calculation describes the reasonable worst-case estimate of take in individuals and also the maximum estimated acreage of known and suitable Indiana bat habitat impacted by NiSource, with most of this take is anticipated in the form of harm and harassment, and very little lethal take expected over the 50-year timeframe.

The MSHCP provides the following estimation of take numbers (Chapter 6, p.257-259), which we endorse and incorporate here:

The calculation of incidental take was derived utilizing the following assumptions and operating facts:

Covered Lands:

(1) There are approximately 5,700,000 acres of suitable summer habitat within the covered lands; estimated using the methodology outlined in the modeling section (3,272,400 linear and 2,427,600 storage fields);

(2) There are 310,573 acres of known summer habitat within the covered lands; estimated using the methodology outlined in the modeling section (60,131 linear and 250,442 storage fields);

Covered Activities:

(3) O&M activities within the existing ROW and storage fields would impact 0.07% or approximately 3,900 acres of the total suitable habitat acreage present within covered lands;

(4) New pipeline construction would impact 1.9% or 63,000 acres of the total acreage of assumed suitable habitat present within the one-mile-wide corridor covered lands;

(5) New construction within storage fields would impact 0.12% or 3,000 acres of assumed suitable habitat present within storage field county covered lands;

(6) Clearing of forested habitat on existing pipeline facilities during O&M could occur at any time within the 50-year permit term (thereafter, the facilities area, including ROWs, would be maintained in a non-forested state for required safety patrols);

(7) After clearing occurs for new construction projects, the pipeline would be maintained in a vegetative state unsuitable for roosting by Indiana bats but potentially used as a travel corridor or for foraging;

Avoidance & Minimization Measures:

(8) For the purpose of calculating a reasonable worst-case take of Indiana bats, it is assumed that non-mandatory AMMs listed in the previous section will not be implemented;

(9) No lactating females and immobile bats (i.e., pups) will be impacted due to implementation of AMMs;

(10) No direct or indirect impacts to known or presumed Indiana bat hibernacula will occur from covered activities due to implementation of AMMs;

(11) No direct or indirect take would occur to wintering bats (in the hibernacula) with the implementation of the AMMs for this species;

(12) All direct impacts from covered activities to known spring staging/fall swarming roosts within 10 miles of P1 and P2 hibernacula are avoided due to implementation of AMMs;
(13) All direct impacts to known summer roosts from covered activities are avoided due to implementation of AMMs;
(14) No direct take would occur to summering bats in known maternity colonies with the implementation of the AMMs for this species;
(15) NiSource will maintain and update known Indiana bat maternity colony and hibernacula location information annually to use in implementing the MSHCP;
(16) NiSource will assume presence of Indiana bats within identified suitable winter habitat a maximum of ten times – i.e., five linear (ROW) and five storage field county covered lands – throughout the life of the permit. These "presumed" hibernacula are considered as P2 hibernacula for the purposes of calculating take to the associated presumed spring staging/fall swarming habitat.

Species Biology:

(17) Indiana bats are evenly distributed in suitable habitat;
(18) An even 50:50 sex ratio exists in the population (Thomson 1982);
(19) The range of maternity colony sizes observed for the Indiana bat is 20-100 adult females (Kurta 2004). NiSource and the USFWS have assumed 60 adult females and their 60 pups occur per maternity colony within the covered lands. This assumption is based on the fact that the covered lands do not overlap areas of the species summer range documented to have the highest densities of adult females in colonies but the covered lands do overlap a significant portion of the species' summer range; therefore, using the average of the overall variability observed was appropriate;
(20) Home range of a maternity colony is the area within a 2.5-mile radius (i.e., 12,560 acres) around documented roosts or within a 5-mile radius (i.e., 50,265 acres) around capture location of a reproductive female or juvenile Indiana bat or a positive identification of Indiana bat from properly deployed acoustic devices (unless NiSource conducts further site specific studies);
(21) The absolute minimum amount of suitable summer habitat required for a maternity colony to exist at a given point on the landscape (i.e., 10%) was based on data provided in the draft revised Indiana bat recovery plan (USFWS 2007a);
(22) 5% of disturbed adult bats would not escape from felled roost trees during implementation of covered activities between April 1 and November 14 (Belwood 2002);
(23) Effects on adult male Indiana bats in summer habitat (beyond the protection afforded to them from suitable summer maternity colony, spring staging/fall swarming, and winter habitat AMMs) is considered insignificant due to the dispersed nature of males and the minimal type and amount of impact anticipated;
(24) Fall swarming and spring staging habitat occurs within a 10-mile radius (i.e., 201,062 acres) of a hibernaculum;

(25) Due to extensive survey data collected in New York (Niver 2009), covered lands in the State of New York that are greater than 900 feet in elevation will not be considered as meeting the definition of suitable Indiana bat summer habitat. For all other states, sufficient evidence does not exist to suggest that elevation plays a key role for determining suitable maternity colony habitat. Therefore, sites at any elevation will be considered as suitable habitat in all other states;

(26) Lands covered by the MSHCP within the states of Louisiana and Mississippi will not be considered as meeting the definition of suitable summer habitat (as defined below) for Indiana bats. Similarly, land covered by the MSHCP within the states of Indiana, Mississippi, and Louisiana will not be considered to have winter habitat for Indiana bats. These assumptions are based on the survey data available to the USFWS within these areas;

(27) The NLCD classifications outlined in the swarming, staging, and maternity habitat identification methodology are representative of suitable summer habitat for this species (refer to the modeling section); and

(28) The 2009 population estimates for Indiana bat were used for estimating maternity habitat and hibernacula populations;

The calculation of incidental take was separated into the different types of covered lands and activities [i.e., Linear (ROW) vs. Storage Fields and O&M vs. New Construction] as these activities may impact Indiana bats differently in these covered lands. A two-step process was used to calculate incidental take within each covered lands group. First, modeling results were used to calculate the number of Indiana bats (i.e., maternity colonies or individuals) estimated to be present within the covered lands group. These estimates were then incorporated into a calculation of take that considered the assumptions provided above, information provided in Appendix A of the NiSource MSHCP (Annual Acreage Disturbance Estimates and the amount of suitable Indiana bat habitat available within the covered lands group) to quantify the reasonable worst-case take over the 50-year permit term.

<u>MATERNITY COLONIES</u>:

A. The following numbers are derived from the modeling discussed in the MSHCP and are used below to quantify take within the linear (ROW) Covered Lands (in non-storage field counties):

- 60,131 acres of linear (ROW) covered lands (except in storage field counties) contain known maternity colony habitat with a total of 14 known maternity colonies; and
- 3,212,269 additional acres of linear (ROW) covered lands in total modeled suitable Indiana bat summer habitat with a total of 240 estimated colonies.

It is difficult to approximate the number of colonies present within the linear (ROW) covered lands because (a) Indiana bats, even when thought to be present, are difficult to capture using currently accepted survey techniques (Robbins, unpublished data, 2001; Murray et al. 1999); (b) survey efforts have not been consistent throughout the species' range; and (c) the geographic locations of the majority of Indiana bat maternity colonies (i.e., 89-93% of the estimated 2,455 to 3,912 maternity colonies throughout the range) remain unknown (USFWS, unpublished data,

2009e). Based on the preliminary 2009 range-wide population estimate of 391,163 bats, and assuming a 50:50 sex ratio, and an average maternity colony size of 60 adult females within the covered lands, it is estimated that a total of 3,260 maternity colonies exist range-wide, which falls within the range calculated in the recovery plan of 2,455 to 3,912 colonies.

As stated above, there are 14 known colonies with home ranges that cross the linear (ROW) covered lands. Using a modeling exercise (*see* the Modeling Section, above), the estimated maximum number of additional maternity colonies that may occur along the NiSource linear (ROW) covered lands could be 1,455 colonies. The maximum number of colonies was calculated by developing a grid of maternity colony home ranges (i.e., 2.5-mile radius circles) throughout and adjacent to the linear (ROW) covered lands. Next, each colony home range was evaluated using the suitable Indiana bat habitat model to determine the number of colonies that had a minimum of 1,256 acres (i.e., 10% of the potential home range; assumption 14) of modeled suitable habitat present. A maximum of 12,560 acres of habitat exists within a 2.5 mile home range.

Should 1,455 maternity colonies exist along the linear (ROW) covered lands, they would represent 45% of the range-wide estimate of 3,260 maternity colonies. Given that the covered lands intersect 2.8% of the total Indiana bat range, NiSource could estimate that a minimum of approximately 93 maternity colonies exist within the covered lands of the NiSource MSHCP. Therefore, the estimated 1,455 colonies appeared highly unlikely as a broader distribution of colonies throughout the species range is expected.

A habitat modeling exercise was also conducted to establish a reasonable number of maternity colonies along the linear (ROW) covered lands. NiSource and the USFWS calculated the total number of theoretical Indiana bat maternity colonies if they were common and regularly dispersed (using a 5-mile triangular grid) across the species range. Colonies were considered viable if their potential 2.5-mile home range contained at least 10% suitable habitat (1,256 acres). The Indiana bat range-wide data were modified to remove any areas above 900 feet in elevation in New York State. This method produced an estimate of 19,823 viable colony sites across the entire range. This number is not a realistic estimate of the number of Indiana bat colonies range-wide, but rather was created to identify an occupation adjustment to apply to the similar analysis that was conducted to estimate colonies impacted in the NiSource MSHCP. NiSource then compared the total number of viable colony sites modeled rangewide (19,823) with the estimate of colonies rangewide (3,260; *see* the discussion above) to calculate a 16.45% adjustment factor (3,260 ÷ 19,823 = 0.1645).

The adjustment factor was then applied to the number of modeled maternity colonies along the linear (ROW) covered lands to estimate that there would be 240 colonies along the linear (ROW) covered lands (1,455 x 0.1645 = 239.28). This number includes both colonies that would be centered within the linear ROW of the covered lands, and colonies that would be centered outside of the covered lands but close enough that their home ranges could be impacted by activities within the covered lands.

This is a reasonable estimate of the number of colonies that are likely to occur within the NiSource linear (ROW) covered lands and 254 total colonies (240 modeled plus 14 known) will be used for the rest of the calculations. Since a conservative approach has been used to estimate take throughout this analysis, NiSource and the USFWS assume that each of the 14 known colonies would be impacted and individuals within the colonies taken by new construction within the linear (ROW) covered lands even though the modeling was designed to estimate all colonies impacted by activities within the covered lands.

1. O&M

Given the assumptions above, information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates and the amount of suitable Indiana bat habitat available within the covered lands), O&M activities that have been identified to potentially cause take of Indiana bats will only occur on up to 3,900 acres (*see* Assumption 3 above) of the overall 3,272,400 acres of linear (ROW) covered lands that are also suitable Indiana bat summer habitat over the 50-year permit term. Therefore, NiSource and the USFWS estimate a total of two colonies (one known and one additional) would be impacted and individuals within the colonies taken (i.e., kill, harm, harass) by O&M activities within the existing ROW covered lands (3,900 acres of O&M impact ÷ 3,272,400 acres of linear (ROW) covered lands in suitable Indiana bat summer habitat = 0.119%; 0.00119 x 240 colonies = 0.29 maternity colonies [rounded up to one]; 0.00119 x 14 known colonies = 0.02 known maternity colonies taken [rounded up to one]). However, there are 14 known colonies with home ranges that cross the linear (ROW) covered lands and a conservative approach has been used to estimating take throughout this analysis. Therefore, NiSource and the USFWS assume that each of these 14 colonies, as opposed to the two colonies modeled above, would be impacted and 1,680 individuals [i.e., 14 maternity colonies x 120 (60 adult females + 60 pups = 120) = 1,680 individuals] within the colonies taken by O&M within the existing ROW covered lands.

2. New Construction

Given the assumptions above, information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates and the amount of suitable Indiana bat habitat available within the covered lands), NiSource has determined that new construction (capital expansion projects) activities that have been identified to potentially cause take of Indiana bats will only occur on up to 63,000 acres (*see* Assumption 4 above) of linear (ROW) within the covered lands over the 50-year permit term. Therefore, NiSource and the USFWS estimate a total of six colonies (one known and five additional) would be impacted and individuals within the colonies taken (i.e., kill, harm, harass) by new construction within linear (ROW) covered lands (63,000 acres of new construction impact ÷ 3,272,400 acres of linear (ROW) covered lands in suitable Indiana bat summer habitat = 1.9%; 0.019 x 240 colonies = 4.62 maternity colonies [rounded up to five]; 0.019 x 14 known colonies = 0.27 known maternity colonies taken [rounded up to one]). However, there are 14 known colonies with home ranges that cross the linear (ROW) covered lands and a conservative approach has been used to estimating take throughout this analysis. Therefore, NiSource and the USFWS assume that each of these 14 colonies, as opposed to the six colonies modeled above, would be impacted and 1,680 individuals [i.e., 14 maternity colonies x 120 (60 adult females + 60 pups = 120) = 1,680 individuals] within the colonies taken

by new construction within the linear (ROW) covered lands. Note that these are the same colonies as described in the O&M calculation above and thus will not be additive to the overall amount of take requested by NiSource.

B. The following numbers are derived from the modeling discussed in the MSHCP and are used below to quantify take within the SF Counties:

- 250,442 acres of storage field counties intersect with known maternity colony habitat with a total of four known colonies; and
- 2,177,158 additional acres of storage field covered lands in total modeled suitable Indiana bat habitat with a total of 71 estimated colonies.

A total of 4,187,926 acres exist within the 12 storage field counties and are considered covered lands. Using a modeling exercise (*see* the Modeling Section, above), NiSource estimated the maximum number of additional maternity colonies that may occur within the NiSource storage field covered lands to equal 426 colonies [number includes 173 colonies within 2.5 miles of a storage field county (not near a pipeline buffer) and 253 colonies within 2.5 miles of both a pipeline buffer and a SF county]. The maximum number of colonies was calculated by developing a grid of maternity colony home ranges (i.e., 2.5-mile radius circles) throughout and adjacent to the storage field covered lands. Next, each colony home range was evaluated using the suitable Indiana bat habitat model to determine the number of colonies that had a minimum of 1,256 acres (i.e., 10% of the 12,560 acres within a 2.5 mile maternity colony home range) of modeled suitable habitat present within their potential home range.

The rationale provided above for the ROW (non-storage field counties) generally applies to storage field counties as well. NiSource and the USFWS would not expect that 13% (426 storage field colonies ÷ 3,260 rangewide colonies = 0.13) of the estimated range-wide 3,260 maternity colonies exist within the storage field covered lands counties. In order to establish a reasonable number of maternity colonies assumed to exist within the storage field covered lands, NiSource and the USFWS calculated the total number of theoretical Indiana bat maternity colonies if they were common and regularly dispersed (using a five-mile triangular grid) across the species range. Colonies were considered viable if their home range contained at least 10% suitable habitat (1,256 acres). The Indiana bat range-wide data were modified to remove any areas above 900 feet in elevation in New York State. This method produced an estimate of 19,823 viable colonies across the entire range. This number is not a realistic estimate of the number of Indiana bat colonies range-wide, but rather was created to identify an occupation adjustment (i.e., 16.45%) to apply to the similar analysis that was conducted to estimate colonies impacted in the NiSource MSHCP (3,260 ÷ 19,823 = 0.1645).

The percentage of viable modeled colonies occupied was applied to the number of modeled maternity colonies along the storage field covered lands to estimate that there would be 71 additional colonies along the storage field covered lands (426 x 0.1645 = 70.08). This number includes both colonies that would be centered within the storage field covered lands, and colonies that would be centered outside of the covered lands but close enough that their home ranges could be impacted by activities within the covered lands. Thus a total of 75 (four known

and 71 modeled) colonies will be used for following calculations. Since a conservative approach has been used to estimate take throughout this analysis, NiSource and the USFWS assume that each of the four known colonies would be impacted and individuals within the colonies taken by new construction within the storage field covered lands even though the modeling was designed to estimate all colonies impacted by activities within the covered lands.

1. O&M

While O&M activities specific to storage field operations may cause take of Indiana bats (i.e., construction and operation of waste pits associated with well reconditioning and abandonment), the majority of O&M activities anticipated to cause take are those that occur within the linear ROW, some of which cross storage field counties. Those impacts and resulting take were analyzed above. Because portions of the ROW are coextensive with the storage field counties, they are not double counted in this section. The take from the construction and operation of waste pits associated with reconditioning and abandonment has been accounted for in the storage field new construction covered lands analysis.

2. New Construction

Given the assumptions above, information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates, and the amount of suitable Indiana bat habitat available within the covered lands), new construction (capital expansion projects) activities that have been identified to potentially cause take of Indiana bats will only occur on up to 3,000 acres (*see* Assumption 5 above) of storage field counties within the covered lands over the 50-year permit term. For the purpose of this analysis, NiSource and the USFWS have assumed that all new construction will occur within suitable Indiana bat habitat.

Estimating the take of maternity colonies is not straightforward for new construction in storage field covered lands. While the entire 3,000-acre expected area of construction could fit within a single maternity colony home range (a home range encompasses 12,560 acres), storage fields are constructed in a network, not in a single large patch. New storage field networks are made up of small patches distributed across the landscape. These networks have very small landscape footprints in acreage, but have a large extent because of the way the patches are distributed. The locations of new storage fields cannot be described in more specificity than to the county (for business and homeland security reasons), so they cannot be geographically modeled.

A model of a storage field network indicates a maximum worst-case scenario of 540 acres of disturbance within a single 2.5-mile radius home range (Figure 5). If storage fields were constructed as densely as possible, they would intersect at least six modeled colony home ranges (3,000 acres ÷ 540 acres per colony = 5.56 maternity colonies [rounded up to six]). If storage field expansion activities are more dispersed, as many as four known and 71 modeled maternity colonies could be impacted by storage field expansion on a significantly reduced scale. In other words, as the acreage of disturbance within a single 2.5-mile radius home range decreases, the likelihood of impacting additional maternity colonies increases.

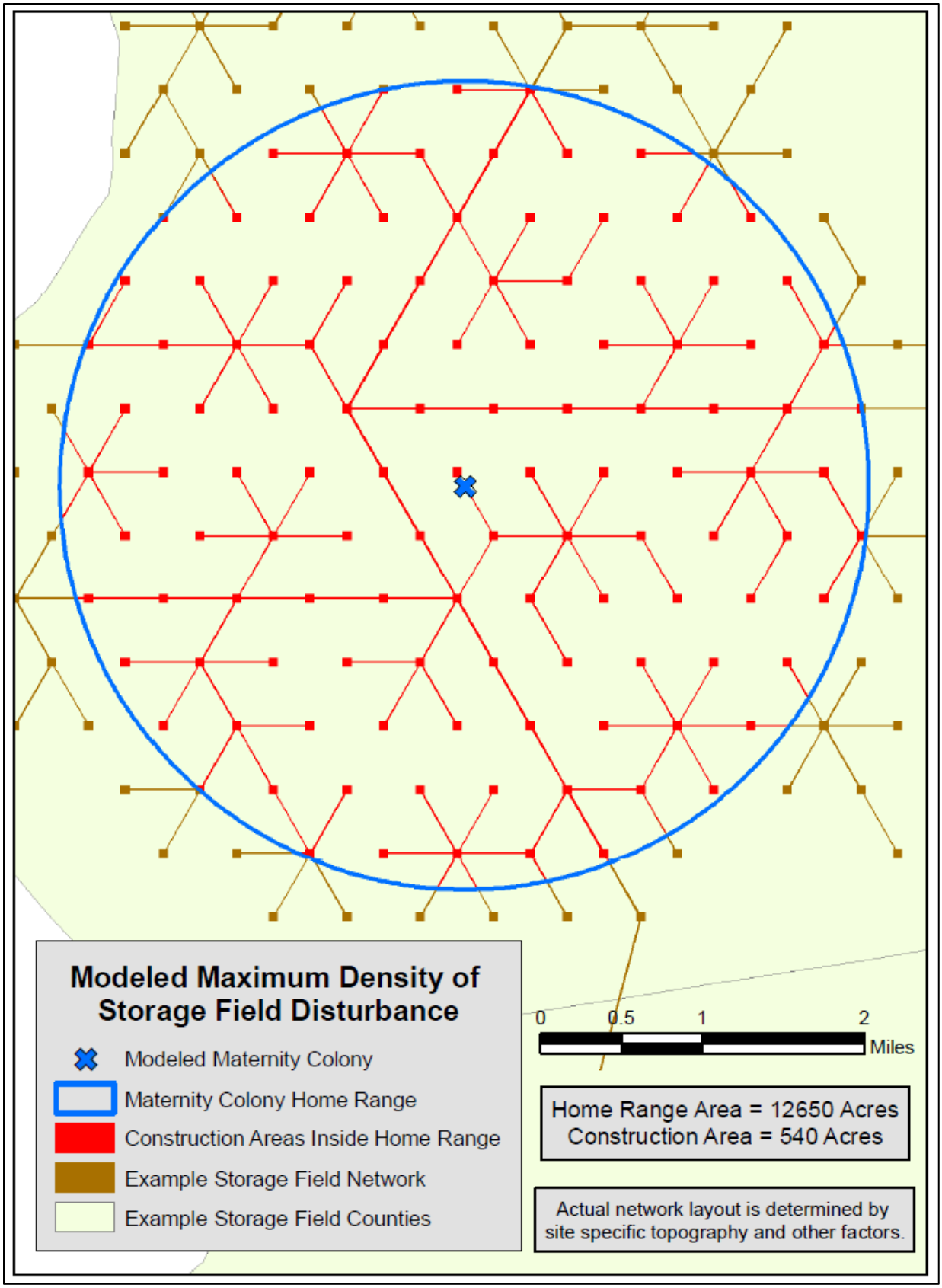

Figure 5. Modeled Maximum Density of Storage Field Disturbance

This wide range of potential take (from four to 75 maternity colonies) and construction amounts per colony (from 0.11-4.3%) cannot be resolved without describing in more detail the locations of storage field projects. However, the reasonable worst-case scenario would be the intensely developed network impacting 540 acres/colony. Therefore, take is calculated for new construction in storage field counties as 3,000 acres which represents impacts to six maternity colonies or 720 individuals [i.e., six maternity colonies x 120 (60 adult females + 60 pups = 120) = 720 individuals] within the colonies taken by new construction within the storage field covered lands.

<u>SPRING STAGING/FALL SWARMING BATS:</u>

A. The following numbers are derived from the modeling discussed in the MSHCP and are used below to quantify take within the linear (ROW) covered lands (in non-storage field counties):

- 240,300 acres of linear (ROW) covered lands through known spring staging/fall swarming habitat for 75 known hibernacula.
  - 52,000 acres of linear (ROW) covered lands through spring staging/fall swarming habitat for 10 Priority 1 & 2 hibernacula; and
  - 188,300 acres of linear (ROW) covered lands through spring staging/fall swarming habitat for 65 Priority 3 & 4 hibernacula.
- 16,000 acres of linear (ROW) covered lands through presumed spring staging/fall swarming habitat for 5 presumed Priority 2 hibernacula.

Similar to maternity colonies, NiSource and the USFWS are capable of reaching a supportable conclusion on an estimate of the number of Indiana bats taken (i.e., killed, harmed, harassed) by covered activities within the linear (ROW) covered lands. The USFWS and states have surveyed populations of Indiana bats occupying these hibernacula for decades in many cases and have defined the importance of each hibernaculum by defining them into one of four priority groupings. Priority groups (P) are defined as follows: P1 hibernacula typically have a current and/or historically observed winter population of greater than or equal to 10,000 Indiana bats; P2 have a current or observed historic population of 1,000 or greater but fewer than 10,000; P3 have current or observed historic populations of 50 to 1,000 bats; and P4 have current or observed historic populations of fewer than 50 bats. The following discussion outlines the two step process used to calculate the reasonable worst-case scenario for take of Indiana bats in spring staging/fall swarming habitat.

First, a reasonable worst-case scenario take of Indiana bats was estimated, using the priority groupings and making the assumption that the maximum number of Indiana bats allowed for each priority grouping occupies the hibernaculum with the only deviation being for P1 hibernacula (i.e., P2 = 10,000 Indiana bats; P3 = 1,000 bats, P4 = 50 bats). Because P1 hibernacula are defined as having greater than 10,000 bats occupying them, the sum of the three P1 hibernacula spring staging/fall swarming populations intersected by the covered lands was calculated to determine the worst-case scenario take of Indiana bats at P1 hibernacula. The total sum 2009 population estimate for these three P1 hibernacula is 38,081 bats.

Once this reasonable worst-case scenario take was calculated, NiSource was then able to refine this estimate by incorporating the average percentage of the hibernacula's spring staging/fall swarming zone intersected by linear (ROW) and Storage Field covered lands to calculate the reasonable worst-case take for impacts to spring staging/fall swarming habitat.

1. O&M

Based on the results of modeling of spring staging/fall swarming impacts, the O&M of ROW covered lands may cause take of Indiana bats within spring staging/fall swarming habitat of 75 hibernacula (three P1, seven P2, 19 P3, and 46 P4 hibernacula) over the 50-year permit. Following the process outlined above, the maximum worst-case scenario of take from O&M of ROW covered lands would total 129,381 Indiana bats across 75 known hibernacula.

Given the assumptions above, information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates, and the amount of suitable Indiana bat habitat available within the covered lands), NiSource has estimated that O&M activities that have been identified to potentially cause take of Indiana bats will occur on up to 3,900 acres (*see* Assumption 3 above) of suitable Indiana bat habitat over the 50-year permit term. For the purpose of this analysis, NiSource and the USFWS have assumed that O&M of existing ROW covered lands will occur once within the 240,300 acres (from above) of suitable Indiana bat spring staging/fall swarming habitat. Once this habitat has been cleared, the pipeline ROW would be maintained in a vegetative state unsuitable for roosting by Indiana bats (*see* assumption 7 above). An additional step was added to account for the fact that only 3,900 of the 240,300 acres of suitable spring staging/fall swarming habitat would be impacted by construction within the existing ROW covered lands, reducing the estimate to 2,200 Indiana bats (3,900 acres ÷ 240,300 acres = 0.017; 0.017 x 129,381 bats = 2,200 bats).

However, this is not a supportable conclusion of take because only 0.17% (the average percentage of known hibernaculum range covered by existing ROW, i.e. 331 acres per hibernaculum) of the spring staging/fall swarming habitat available to Indiana bats at each hibernacula could be impacted by O&M activities. NiSource and the USFWS used the assumption that Indiana bats in spring staging/fall swarming habitat surrounding the hibernacula are evenly distributed throughout that habitat and used the average percentage of this habitat intersected by the covered lands to estimate the reasonable worst-case take of Indiana bats from O&M activities in spring staging/fall swarming habitat intersecting existing ROW covered lands to be a total of four individuals over the 50-year permit term (2,200 bats x 0.0017 = 3.74 bats [rounded up to four]).

2. New Construction

Based on the results of modeling of spring staging/fall swarming impacts, new construction within linear (ROW) covered lands could cause take of Indiana bats within spring staging/fall swarming habitat of 75 known hibernacula (three P1, seven P2, 19 P3, and 46 P4) over the 50-year permit term. Impacts could also occur to currently unknown hibernacula. NiSource additionally estimates five sites with potential to be hibernacula could be impacted by new construction activities (*see* AMM #2 in Section 6.2.1.3 and Assumption 16 above). NiSource and

the USFWS assumed all such sites will be presumed to be P2 hibernacula because it is highly unlikely that a P1 hibernacula would remain unknown given the range-wide population monitoring program in place. Following the process outlined above, the maximum worst-case scenario of take from new construction in linear (ROW) covered lands would total 179,381 Indiana bats (129,381 across 75 known hibernacula + 50,000 at five currently unknown presumed P2 hibernacula).

Given the assumptions above, information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates, and the amount of suitable Indiana bat habitat available within the covered lands), NiSource has estimated that new construction (capital expansion projects) activities that have been identified to potentially cause take of Indiana bats will occur on up to 63,000 acres (*see* Assumption 4 above) of linear ROW within the covered lands over the 50-year permit term. For the purpose of this analysis, NiSource and the USFWS have assumed that all new construction will occur within suitable spring staging/fall swarming Indiana bat habitat. An additional step was added to account for the fact that only 63,000 of the 256,300 acres of suitable spring staging/fall swarming habitat would be impacted by new construction within the linear (ROW) covered lands, reducing the estimate to 44,846 Indiana bats (63,000 acres ÷ 256,300 acres = 0.25; 0.25 x 179,381 bats = 44,846 bats).

However, this is not a supportable conclusion of take because only 0.22% (the average percentage of known hibernaculum range covered by existing ROW, plus a 33% increase for the larger width of a new construction ROW, i.e. 441 acres per hibernaculum) of the spring staging/fall swarming habitat available to Indiana bats at each hibernacula is likely to be impacted by new construction activities. NiSource and the USFWS used the assumption that Indiana bats in spring staging/fall swarming habitat surrounding the hibernacula are evenly distributed throughout that habitat. NiSource and the USFWS estimate the reasonable worst-case take of Indiana bats from new construction activities in spring staging/fall swarming habitat intersecting linear (ROW) covered lands to be a total of 99 individuals over the 50-year permit term (44,846 bats x 0.0022 = 98.66 bats [rounded up to 99]).

B. The following numbers are derived from the modeling discussed in the MSHCP and are used below to quantify take within the Storage Field Counties:

- 616,800 acres of storage field counties covered lands through known spring staging/fall swarming habitat for 11 known hibernacula.
    - All 616,800 acres of storage field counties covered lands through spring staging/ fall swarming habitat for 11 Priority 3 & 4 hibernacula.
- 280,400 acres of storage field counties covered lands through presumed spring staging/fall swarming habitat for five presumed Priority 2 hibernacula.

1. O&M

While O&M activities specific to storage field operations may cause take of Indiana bats (i.e., construction and operation of waste pits associated with well reconditioning and abandonment), the majority of O&M activities anticipated to cause take are those that occur within the linear ROW, some of which cross storage field counties. Those impacts and resulting

take were analyzed above. Because portions of the ROW are coextensive with the storage field counties, they are not double counted in this section. The take from the construction and operation of waste pits associated with reconditioning and abandonment has been accounted for in the storage field new construction covered lands analysis.

2. New Construction

Based on the results of modeling of spring staging/fall swarming impacts, new construction within storage field covered lands could cause take of Indiana bats at two P3 and nine P4 hibernacula over the 50-year permit term. Impacts could also occur to currently unknown hibernacula. NiSource additionally estimates five sites with potential to be hibernacula could be impacted by new construction activities (*see* AMM #2 in Section 6.2.1.3 and Assumption 16 above). NiSource and the USFWS assumed all such sites will be presumed to be P2 hibernacula because it is highly unlikely that a P1 hibernacula would remain unknown given the range-wide population monitoring program in place. Following the process outlined above, the maximum worst-case scenario of take from new construction activities within storage field covered lands would total 52,450 Indiana bats (2,450 across 11 known hibernacula + 50,000 at five currently unknown presumed P2 hibernacula).

Given the assumptions above, and information provided in Appendix A of the MSHCP (Annual Acreage Disturbance Estimates), NiSource has determined that new construction (capital expansion projects) activities that have been identified to potentially cause take of Indiana bats will only occur on up to 3,000 acres (*see* Assumption 5 above) of storage field counties within the covered lands over the 50-year permit term. For the purpose of this analysis, NiSource and the USFWS have assumed that all storage field new construction will occur within suitable spring staging/fall swarming Indiana bat habitat. An additional step was added to account for the fact that only 3,000 of the 897,200 acres of suitable spring staging/fall swarming habitat would be impacted by new construction within the storage field covered lands, reducing the estimate to 179 Indiana bats (3,000 acres ÷ 897,200 acres = 0.0034; 0.0034 x 52,450 bats = 179 bats).

However, this is not a supportable conclusion of take because only 45% (the average percentage of known hibernaculum range covered by existing ROW, i.e. 90,315 acres per hibernaculum) of the spring staging/fall swarming habitat available to Indiana bats at each hibernacula is likely to be impacted by new construction activities. NiSource and the USFWS used the assumption that Indiana bats in spring staging/fall swarming habitat surrounding the hibernacula are evenly distributed throughout that habitat. NiSource and the USFWS estimate the reasonable worst-case take of Indiana bats from new construction activities in spring staging/fall swarming habitat intersecting storage field covered lands to be a total of 81 individuals over the 50-year permit term (179 bats x 0.45 = 80.55 bats [rounded up to 81]).

Effect of the Take

We expect that the population-level impacts from NiSource activities to both summer and winter populations will be small, only impacting a small percentage of the Indiana bats annually. It is expected that populations, given no other major perturbations, will recover from a NiSource impact within one year; however the future impact that WNS may have on these same populations will be continually monitored to ensure longer term effects do not occur. Similarly, habitat impacts are small compared to the overall amount of habitat available. It is expected that the population level impacts to Indiana bats to be within the range of normal disturbance and short-lived. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.

1.2 Bog Turtle

Amount or Extent of Take Anticipated

Take of bog turtles from NiSource activities would occur primarily from impacts directly associated with the new construction of pipeline and related facilities across occupied habitat.

As discussed in the accompanying BO, the MSHCP provides the following estimation of take numbers (Chapter 6, p. 73-78), which we endorse (after slight modification) and incorporate here:

For looping (10 sites), conventional replacement (5 sites), and new construction (5 sites) projects, a small number of turtles (0-5 per site) may be missed during pre-construction surveys and wounded or killed. All turtles at the sites are expected to experience harassment/harm in the form of a temporary reduction in reproductive success due to disturbance during construction and habitat loss/degradation.

In addition, during O&M over the life of the project bog turtles at 25 sites may be impacted as follows:

- general vehicle use may result in 0-2 turtles wounded or killed per site;
- mowing may result in one turtle wounded or killed per round of vegetation management for every 20 sites mowed (every seven years for a total of 9 bog turtles spread across 25 sites)
- herbicide use may result in one turtle harassed/harmed (non-lethal) per round of vegetation management (every seven years for a total of 7 turtles/site);
- and all bog turtles at one site may be harassed or harmed (non-lethal) during a minor spill event.

For the 5 sites with no anticipated ground-disturbing work, a total of 0-3 bog turtles are anticipated to be wounded or killed and an additional 7 bog turtles harassed or harmed (non-lethal) over the life of the project.

For the 20 additional sites with ground-disturbing work anticipated, a total of 0-8 bog turtles may be wounded or killed over the life of the project and all turtles at the sites will experience a temporary reduction in reproductive success.

Effect of the Take

We expect that the population-level impacts from NiSource activities at most sites will be small, only impacting a very small number of turtles over the life of the project. It is expected that these populations, given no other major perturbations, will recover from harassment/harm within one year given that habitat impacts are anticipated to be small compared to the overall amount of habitat available. However, if the ROW provided the core nesting habitat and was impacted during ground-disturbing activities, it is possible that bog turtles will experience reduced reproductive success until adjacent habitat is restored and managed. For a small population that experience higher numbers of bog turtle mortality during construction and/or experience long-term reductions in reproductive success, extirpation of the site is possible. However, extirpation of one small, isolated population is unlikely to reduce the likelihood of successfully achieving the conservation needs of the species. In addition, we anticipate a significant contribution to those needs from the proposed mitigation.

Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.

1.3 Madison Cave Isopod

Amount or Extent of Take Anticipated

Take of MCI from NiSource activities would occur primarily from impacts associated with the new construction or replacement of pipeline or new construction of access roads across occupied habitat. Take anticipated will be in the form of death (smothering, desiccating, poisoning), harm, harassment, and in association with surveys for MCIs, there may be temporary collection (any take associated with surveys would be covered under individual scientific collector's permits). However, the AMMs should significantly reduce the likelihood of take occurring.

The MSHCP provides the following estimation of take numbers (MSHCP, Chapter 6, MCI section), which we endorse and incorporate here.

The USFWS anticipates incidental take of the MCI will be difficult to detect for the following reasons:

1. The individuals are small and occupy underground habitats where they are difficult to find;
2. Finding dead or injured specimens during or following project implementation is unlikely;
3. The lack of information about the existence or nature of hydrological connections; and
4. The extent and density of the species within its habitat in the action area is unknown.

Because of the difficulty in determining a level of take based on the number of MCIs that will be adversely affected, the USFWS has decided that it is appropriate to base the level of authorized incidental take on the number of known and likely occurrences (representing populations) within 0.5 (or one half) mile of the covered lands.

Since it will be difficult to assess impacts to these populations, take will be expressed in terms of the area of surface ground disturbance (easily measurable) and estimated associated subsurface impacts (based on distances sediments and contaminants are anticipated to disperse) within the mapped distribution of the species. It is important to understand that while MCIs may occur anywhere throughout the mapped range that overlaps with the NiSource covered lands, NiSource and the USFWS currently estimate that one known population and one additional (currently unknown) population will be impacted by NiSource activities. However, should additional information on the number of occurrences (and estimated populations) become available, NiSource will revisit this species, through changed circumstances (MSHCP Chapter 10.3.8).

As discussed above, take is expressed in terms of two MCI populations anticipated to be impacted by covered activities conducted along 76 miles of pipeline above mapped MCI potential habitat.

- Two different sets of activities will occur within 76 miles of the one-mile-wide corridor:
    - Activities associated with replacement/repair of existing pipelines within the existing 50-foot ROW and an additional 25- to 50-foot temporary work area around ROWs (total of 100-foot surface disturbance width).
    - Activities associated with the construction and the subsequent replacement/repair of two possible new pipelines (e.g., loops) within two new 50-foot ROWs and two associated 25- to 50-foot temporary work areas around each of the new ROWs. (Total of an additional 200-foot surface disturbance width).

The total maximum area for surface impacts = 300-foot wide disturbance area for 76 miles or 4.3182 mi2 or 2,764.6 acres.

- Take is expressed in terms of the 2,764.6 acres of ground surface and vegetation disturbance above MCI potential habitat.

- Surface or subsurface activities may result in contaminants/sediments traveling through openings into phreatic waters up to 0.5 mile from the area of input totaling in 76 mi2 or 48,640 acres of potentially affected subsurface area.
- The currently estimated distribution of the species encompasses 865,415 acres.
- For the purposes of this MSHCP, it is assumed that one unknown MCI population occurs within the area of effect.

Because little is known about extent of indirect effects resulting from the covered activities or the extent of MCI populations throughout the covered lands, impacts to karst features within all of the covered lands are considered equally likely to result in take to the one assumed unknown population. As part of an adaptive management strategy, NiSource will evaluate this assumption as directed in the MSHCP.

Given this analysis, we estimate there is potential take to one known and one unknown population, but because there is no way to currently quantify how that take manifests itself or monitor the impacts to these populations, surface and subsurface habitat is being used as a surrogate.

Effect of the Take

In considering the aggregate, long-term impacts to individuals, we expect that the overall level of take of MCI will be relatively low. There are no known MCI sites within the existing ROWs or covered lands and only one MCI site, Limekiln Cave, within ½ mile of the covered lands. One additional new MCI site is anticipated to occur within the covered lands. We anticipate that these two MCI sites (one known/one unknown) may be impacted during the life of the permit.

We do not anticipate that impacts will significantly affect the Limekiln Cave population, given its distance from the covered lands. However, we anticipate that take of individuals from the unknown population assumed to be present in the action area may occur in close proximity to the existing or future ROW. We conclude that there is therefore potential for extirpation to this one unknown population.

Based on our analysis of the conservation needs of the species, we conclude that the loss of one unknown population would not measurably reduce our ability to continue to meet the conservation needs of the species. We conclude that this project will not reduce the likelihood of survival and recovery of the MCI rangewide.

Therefore, because we do not expect the impacts to have effects to MCI rangewide, we do not expect that the proposed action will appreciably reduce the likelihood of both the survival and recovery of the species as a whole.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.

1.4 Nashville Crayfish

Amount or Extent of Take Anticipated

Incidental take for Nashville crayfish was calculated using the following algorithm:

- Stream Width x Impact Length (lethal and sub-lethal dry-ditch model) x Percent Suitable Habitat = Acres of Habitat Impacted; Acres of Habitat Impacted x Nashville crayfish Density = Impacts to Individuals.

The dry-ditch model estimates a 75-foot lethal zone (within the coffer dams) and a 100-foot harm/harassment zone downstream of the coffer. The entire area that would be impacted by covered activities (e.g., where multiple pipelines are in close proximity and impact zones overlap each other) was identified and used for the total acreage calculation. A density (animals per square meter) for Nashville crayfish was determined based on the best available data. Take was calculated using the estimate that Nashville crayfish occupy 100% of the stream bottom in suitable habitat at the estimated density.

Aggregate impact provides an index of how prevalent NiSource pipelines are in the affected watersheds and estimates the sediment and associated impacts on Nashville crayfish habitat. It is calculated using a simple formula taking into account the number of miles of NiSource

pipeline corridor (using a 50-foot average width) overlapping the range of the species. This calculation is the total area of NiSource pipeline ROW in the impacted watershed (acres), multiplied by the average of the percentage of area the pipeline impacts in the watershed (%), divided by the number of impacted watersheds.

The take calculation for Nashville crayfish estimates impacts to approximately four acres of habitat, which translates into take of approximately 23,171 animals (14,006 from the mainstem and 9,165 from tributary streams) over the 50-year life of the permit. In addition, aggregate impacts from various sediment-causing activities could result in minor degradation of 0.4 additional acres.

Take of Nashville crayfish would occur from O&M and new construction activities implemented by NiSource over the life of the permit. O&M activities would for the most part cause harassment and in rare cases and at certain sites, harm to this species. Impacts from O&M result from minor contamination and chronic sediment transport to streams including related habitat impacts with degradation of instream habitat being the key stressor. New construction activities are expected to have more acute effects causing harassment and harm and lethal impacts. Nashville crayfish could be crushed or displaced by new construction activities (within the coffer dams). New construction has the potential to affect a large number of animals should they be present within the impact zone, but in most cases, animals are likely to occur at lower densities or occupy less than 100 % of the available habitat as estimated in the reasonable worst-case scenario. Therefore, fewer animals are likely to be taken. Sediment impacts from new construction could directly affect Nashville crayfish, but with dry-ditch techniques required and time-of-year restrictions in-place, these impacts should be limited.

Effect of the Take

An important consideration in evaluating the effect of the taking from NiSource activities is that Nashville crayfish is unknown outside of the Mill Creek drainage. Extrapolation of data from sampling efforts suggests a large, stable population occupies Mill Creek and its tributaries. The species is at additional risk, however, because it is confined to this single drainage.

The one-mile corridor, encompassing the existing NiSource pipeline, bisects the range of this species. The pipeline makes five crossings of the mainstem within Nashville crayfish habitat (survey sites 5 through 8 in Carpenters 2002 survey). NiSource could directly impact nine streams tributary to the mainstem, although the pipeline would cross only six of the 12 mainstem tributaries documented as having populations of Nashville crayfish. Of those six tributary streams that fall within the one-mile corridor, only one (Indian Creek) was identified by Withers (2009) as a high priority for conservation. It is unknown, but possible that the tributary populations may be independent of the mainstem population (they are also likely smaller), making them more susceptible to adverse impacts. However, potential impacts of new crossings (the subactivity with the greatest potential for damage) would be minimized, as in the mainstem, by the use of dry-ditch techniques and the relocation of individuals within

coffer dams prior to beginning excavation. Under RPMs, the USFWS will require NiSource to avoid direct impacts to Indian Creek.

NiSource impacts would occur a maximum of seven times over a 50-year period. NiSource and the USFWS estimate that the reasonable worst case scenario take of Nashville crayfish would be approximately 23,000 animals. Crossings and other activities would occur irregularly over the 50 year period, making take at any one point in time a small fraction of the total population. Moreover, habitat impacts because of the universal use of dry-ditch techniques and the predominately bedrock substrate in the Mill Creek Watershed, are expected to be short-lived. Considering that Nashville crayfish inhabits miles of the Mill Creek mainstem and its tributaries, it is unlikely that NiSource impacts would preclude re-colonization. Given no other major perturbations, we would expect Nashville crayfish populations to recover from the proposed NiSource activities within a few years.

In summary, because the Nashville crayfish is an endemic species, the risks from impacts are inherently greater. Nevertheless, the NiSource MSHCP activities would potentially affect only a fraction of the estimated population. Take would be distributed across multiple sites and over the life of the permit. Impacts to habitat would be limited geographically and be comparatively minor in nature. The majority of habitat disturbance would be temporary. Because we do not expect significant or long-term impacts to habitat, and because of their reproductive potential, Nashville crayfish populations are expected to be resilient to the proposed level of take in the accompanying BO. The USFWS has determined that the anticipated take is not likely to result in jeopardy to the Nashville crayfish.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

These RPMs are what the USFWS concludes to be necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02); and actions unique to various MSHCP species as outlined in this BO and summarized below. The terms and conditions (TACs) set out the specific methods by which the RPMs are to be accomplished. These RPMs and TACs are non-

discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.
2) The USFWS and other federal agencies shall take actions that minimize the take of animals within the affected populations and limit impacts to the species and habitat from NiSource activities.	2a) Do not authorize or permit the construction of looping or other projects, or the implementation of O&M activities that directly or indirectly impact Indian Creek in the Mill Creek Watershed.

1.5 MUSSELS

This section will address the individual incidental take analyses for the MSHCP mussels (Clubshell, Fanshell, Northern Riffleshell, James Spinymussel, and Sheepnose Mussels). At the end of these analyses, the necessary reasonable and prudent measures and terms and conditions will be addressed for all of these species in a single section.

CLUBSHELL

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Take of the clubshell mussel will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. O&M activities will for the most part cause harassment, and in rare cases and at certain sites, harm to clubshell mussels as a result of long-term, chronic sediment impacts, minor contaminants, and limited loss of habitat (aggregate take). Degradation of instream habitat is the key stressor. This is expected to be minor in terms of impact, but could be widespread. New construction activities are expected to have more acute effects causing harassment and harm, but also in some cases lethal impacts. Sediment impacts from new construction could directly affect most aspects of mussel biology (e.g., feeding, respiration, and reproduction). Severe sediment impacts could be lethal. Mussels could also be crushed or displaced by new construction activities. New construction has the potential to affect a large number of animals should a large population exist within the impact zone, but in most cases, with rare mussels, animals are at very low densities (much lower than the estimated average density) and limited numbers of animals would be taken.

NiSource has a variety of AMMs in place to reduce impacts from both O&M and new construction activities. The following take calculation represents a reasonable worst case scenario impact with all mandatory AMMs in place. The take calculation for clubshell mussel estimates impacts to approximately 166 acres (67 ha) of habitat. This translates into take of

approximately 34,000 clubshell over the 50-year life of the permit. In addition, aggregate impacts from various sediment-causing activities would likely affect additional area distant from the immediate stream crossing sites. The estimated aggregate impacts for clubshell are calculated as (86,791 acres) x (0.279%) / (30) = 8.1 acres (3.3 ha).

Effect of the Take

As discussed in the population-level and species-level analysis, NiSource has the potential to affect five populations; three of which are considered stable/reproducing and two of which the status is unknown. The Allegheny and Elk River populations cover many river miles and it is unlikely that NiSource activities would significantly affect these populations. NiSource crosses near the mouth of Little Darby Creek and we would not expect population level effects there. NiSource crosses near one of the animals found in Big Darby Creek. There are potential impacts to this apparently very small population and to the population from crossings of Meathouse Fork. The likelihood of any population being extirpated is small and we would not expect NiSource actions to preclude the survival and recovery of the species.

Northern Riffleshell

Amount or Extent of Take Anticipated

Take of the northern riffleshell mussel will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. As with other species there will be harassment, harm, and lethal take of northern riffleshell. Sediment impacts from O&M activities will typically be minor in nature and new construction activities will likely cause direct lethal take, as well as, acute sediment impacts. The reasonable worst case scenario take calculation for northern riffleshell estimates impacts to approximately 165 acres (67 ha) of habitat. This translates into take of approximately 12,500 northern riffleshell over the 50-year life of the permit. In addition, aggregate impacts from various sediment causing activities could impact an additional 6.1 acres (2.5 ha).

Effect of the Take

As discussed above, NiSource would potentially affect only the large Allegheny River population of the four known reproducing populations, with two others outside of the NiSource area of operations. The USFWS will require RPMs to ensure NiSource activities will have limited impact on the known reproducing population in the Allegheny River. NiSource has the potential to cause take, but not to affect the larger population of millions of animals. NiSource has the potential to affect one re-introduced population (Big Darby Creek) and one population that may or may not be extant (Elk River). RPMs will be implemented to limit impacts to augmented Big Darby Creek populations in Franklin County, which cover several kilometers of stream, including reaches upstream of the NiSource crossing. The Elk River population is apparently very small

and may already be extirpated, the last live specimens having been found 20 years ago. It seems unlikely with AMMs, BMPs and RPMs in place that there would be population level impacts from NiSource activities. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to affect the recovery or survival of the northern riffleshell mussel.

Fanshell

Amount or Extent of Take Anticipated

Similar to both northern riffleshell and clubshell, take of fanshell will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. As with the previous two species, there will be harassment, harm, and lethal take of this species. O&M activities will primarily result in minor sediment impacts and new construction in lethal take and acute sediment impacts. The reasonable worst case scenario take of fanshell equates to approximately 283 acres (115 ha) of habitat and approximately 50,000 fanshell over the 50-year life of the permit. The estimate of aggregate impacts to fanshell is 11.1 acres (4.5 ha).

Effect of the Take

NiSource activities would potentially affect five of the 14 known populations and potentially, two of the five known stable/reproducing populations (Muskingum River and Licking River). The USFWS will require NiSource adopt the measures outlined above and summarized in the RPMs section below to avoid or limit impacts to these two populations. Population-level impacts are not expected since both populations extend beyond the area of potential NiSource effect. Populations of fanshell are known to persist in the Ohio River, but population levels and densities are largely unknown. NiSource will not affect the persistence or reproduction of the fanshell population in the Ohio River because all crossings will be made using HDD. There is potential for NiSource activities to impact relic populations of fanshell assumed to be in Tygart's Creek and the Barren River in Kentucky. Those populations were considered small and non-reproducing over 20 years ago and may now be extirpated. NiSource activities are not expected to cause serious degradation of habitat, so while there could be limited take in these streams, it does not seem likely that NiSource will have a decisive effect there. The USFWS determined in the accompanying BO that with AMMs and BMPs in place, the anticipated take is not likely to affect the recovery or survival of the fanshell mussel.

James Spinymussel

Amount or Extent of Take Anticipated

Similar to other mussel species, lethal take, harm, and harassment of JSM will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. O&M activities will primarily result in minor sediment impacts and new construction in lethal

take, but because NiSource will only cross streams using the dry-ditch methodology within the range of the JSM, sediment impacts from stream crossings should be limited. The reasonable worst case scenario indicates impacts to approximately 13 acres (5.2 ha) of habitat. This translates into take of approximately 4,000 JSM over the 50-year life of the permit. In addition, aggregate impacts from various sediment-causing activities are estimated to impact another 1.5 acres (0.6 ha).

Effect of the Take

The JSM is confined to the James and Roanoke River watersheds (Dan and Mayo Rivers) in Virginia and North Carolina. NiSource will not directly impact any of the strongest remaining populations, but could impact four of the 21 known populations - three are considered small, isolated, or non-reproducing, and one population has unknown status. A comparatively large population of JSM was discovered in 2010, which NiSource will not impact. It is possible that at least some of the 79 crossings of un-surveyed streams within the covered lands could cause take. The USFWS will require RPMs be applied to the one population with unknown status, and similar measures will be required should NiSource encounter any populations not discussed in this MSHCP when the status of those populations is undetermined at the time a NiSource project is implemented. NiSource's agreement to implement all stream crossings using dry-ditch methodology reduces the impact area to approximately 75 feet (23 m) per crossing and should, along with a time-of-year restriction and other AMMs, limit the take of JSM. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to affect recovery or survival of the JSM.

Sheepnose

Amount or Extent of Take Anticipated

Take of sheepnose will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. As with the other species, take will occur as harassment, harm, and lethal impacts to sheepnose. The reasonable worst case scenario take of sheepnose equates to approximately 230 acres (93 ha) of habitat. This translates into take of approximately 5,000 sheepnose over the 50-year life of the permit. The estimate for aggregate impacts to sheepnose is 15.1 acres (6.1 ha).

Effect of the Take

The sheepnose is widely distributed with stable or improving populations in Wisconsin, Illinois, Missouri, Indiana, and Virginia, which are not impacted by NiSource activities. In all, of the 11 populations thought to be stable or improving, six are completely outside of the NiSource covered lands. There is the possibility for take in the Allegheny, Muskingum, and Big Sunflower Rivers should HDD not be practical and should those populations extend into the crossing areas, but we would not expect population-level impacts. Take is likely from two declining

populations (Kentucky and Licking Rivers). There is some potential for NiSource to have population-level impacts on sheepnose in the Kentucky River, depending on the exact location and number of animals, and the actual level of impacts, but AMMs and BMPs should minimize impacts. Because this population is likely to be of limited importance to the species, in the accompanying BO, the USFWS determined that anticipated take is not likely to affect recovery or survival of the sheepnose.

Reasonable and Prudent Measures/Terms and Conditions (All Mussel Species)

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

These RPMs include both general actions that apply to all MSHCP mussels, which the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02); and actions unique to various MSHCP species as outlined in this BO and summarized below. The terms and conditions (TACs) set out the specific methods by which the RPM is to be accomplished. These RPMs and TACs are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	<u>All mussel species</u>: 1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.
2) The USFWS and other federal agencies shall take actions that minimize the take of animals within the affected populations and limit impacts to the species and habitat from NiSource activities.	<u>Clubshell</u>: 2a) Implement HDD at the Elk River (West Virginia) crossings if practicable, if not implement dry-ditch techniques and survey and translocate mussels 2b) Implement HDD at Little Darby Creek (Ohio) if practicable, if not, survey and implement dry-ditch crossing and translocate mussels 2c) Make all Meathouse Fork (West Virginia) crossings using dry-ditch methodology
	<u>Northern Riffleshell</u>: 2d) Implement HDD at the Allegheny River (Pennsylvania) crossing if practicable, if not, survey and

RPMs	TACs
	translocate mussels 2e) Implement HDD at Big Darby Creek (Ohio) if practicable, if not, survey and implement dry-ditch crossing and translocate mussels
	Fanshell: 2f) Implement HDD at the downstream crossings (Nicholas-Robertson County Kentucky area) of the Licking River if practicable, if not, survey implement dry-ditch crossing and translocate mussels 2g Make crossings of Tygart's Creek and Lick Branch using dry-ditch methodology
	James spinymussel: 2h) Survey Swift Run (Virginia) and translocate JSMs if present 2i) Survey any newly discovered populations of JSM during the life of the permit within the impact zone of a NiSource project where the status of the population (size, stability, reproductive status) has not already been determined - populations that are stable or reproducing will be translocated
	Sheepnose: 2j) Implement HDD at Big Sunflower River (Mississippi) crossing if practicable, if not, survey and translocate mussels 2k) Implement HDD at the downstream (Washington County, Ohio) Muskingum River crossings if practicable, if not, survey and translocate mussels

1.6 American Burying Beetle

Amount or Extent of Take Anticipated

Take of ABBs from NiSource activities would occur primarily from impacts directly associated with the new construction of pipeline and related facilities across occupied habitat. Clearing of occupied habitat will displace all beetles within the project area. This includes ABBs, as well as all other carrion reliant beetles. These displaced beetles are expected to move into the remaining suitable habitat present immediately adjacent to the action area. Interspecific and intraspecific competition between displaced beetles and beetles within adjacent undisturbed areas may increase as the displaced beetles attempt to locate new foraging areas. It is likely that displaced individual beetles will experience lower survival rates (i.e., harm) when competing against other beetles that have already established territories and are familiar with the area. Specifically, we expect that the displaced beetles will need to increase energy expenditures since they will be required to increase commuting distances within traditional foraging areas, and/or expend additional energy seeking new foraging sites.

Take anticipated will be in the form of harm via increased energy expenditures of displaced individuals reducing fitness and reproductive success. It is possible that some activities may kill individuals (e.g., clearing of occupied habitat while beetles are present). However, AMMs 3 and 4 should significantly reduce the likelihood of direct take (i.e., mortality) occurring.

The MSHCP provides the following estimation of take numbers (see Chapter 6), which we endorse and incorporate here:

> The take estimate was derived from the following factors: (1) intersection of the covered lands with the assumed presence of the beetle release location area (45,488 acres); (2) assumption that existing pipeline ROW, compressor stations, and other appurtenant facilities that would not be allowed to revert to natural vegetation are not suitable habitat for ABB (3,838 acres); (3) percentage of covered lands likely to be impacted over the permit term (9.92 percent); (4) density estimate utilizing study results from a comprehensive capture program at an occupied location (Godwin and Minich 2005; one beetle per 189 acres); and (5) information provided by the USFWS on the very low anticipated density (assumed to be 10% of the density of a viable population in #4) of the release population (Boyer 2008a, 2008b).
>
> The take estimate was calculated as follows:
> 1) 45,488 acres – 3,838 acres = 41,650 acres of suitable habitat in covered lands within 10-mile radius of release site
> 2) 41,650 acres x 9.92% = 4,132 acres of suitable habitat likely to be impacted over the life of the permit
> 3) (4,132 acres)[(1 ABB)/(189 acres)] = 22 ABBs
> 4) 22 ABBs x 10% = 2.2 ABBs
>
> Because take is estimated on the basis of individuals, and 0.2 individuals is not possible, 2.2 ABBs were rounded to three individuals. Since releases always occur as pairs in order to ensure the possibility of reproduction, and both individuals contribute to the rearing of offspring, these three individuals were rounded to two pair in order to allow for future reproductive success.
>
> Given this analysis, we estimate that a total of four individual ABBs will be taken over the 50 year period of the project.

EFFECT OF THE TAKE

We expect that the population-level impacts from NiSource activities to this release population will be small, only impacting a small percentage of the ABB release population in this area annually. It is expected that the population, given no other major perturbations, will recover from a NiSource impact within one year assuming that the released beetles continue to

reproduce and overwinter. Similarly, habitat impacts are small compared to the overall amount of habitat available. It is expected that the population level impacts to ABB to be within the range of normal disturbance and short-lived. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures/Terms and Conditions

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). However, we conclude that the AMMs, survey, monitoring, and reporting measures provided in the MSHCP, the IA, or the ITP do not encompass all reasonable measures necessary to reduce the impact of take. Thus, we include the following RPMs and TACs here.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.

2 NON-MSHCP SPECIES

This section addresses the non-MSHCP species, or those species not covered in the USFWS's ITP. For each species, the AMMs, survey, monitoring, and reporting measures provided in the MSHCP are part of the proposed action, as appropriate, per section 2.1 of the attached BO. As such, those measures must be implemented as described in the MSHCP, the IA, or the ITP for any of the actions considered in the BO and ITS to be lawful. Further, the finding of no jeopardy for each species in the BO is predicated on compliance with and full implementation of those measures. Therefore, there is no need to incorporate those measures in this ITS.

For the non-MSHCP species, we are lacking the necessary information to complete a full take analysis for non-MSHCP species; therefore, we will address take and conservation measures programmatically (i.e., tiered consultation; see the BO Section 1 Consultation Process). This section of this ITS, including the RPMs and TACs contained within, will be carried out in that tiered consultation process.

Under this approach, the Level 1 programmatic BO establishes guidelines and conditions that each individual future project must adhere to and operate within. These future projects will be subject to Level 2 consultations. The Level 1 programmatic opinion and incidental take statement (ITS) will estimate the level of incidental take that is anticipated to occur from future

Level 2 projects. Due to the temporal and spatial uncertainty that exists at the programmatic level regarding the anticipated incidental take, however, incidental take will be evaluated in the Level 2 biological opinions for site-specific actions as they are proposed, consulted on, and appended to the programmatic opinion. The associated Level 2 ITSs will provide exemption for some incidental take in accordance with the RPMs and TACs provided in the Level 1 programmatic incidental take statement, *plus any additional project-specific measures required to minimize effect of the incidental take deemed necessary*.

Future projects that are likely to adversely affect listed species or critical habitat, and do not adhere to the guidelines and conditions evaluated during the programmatic consultation, or any future projects that are considered to be outside the scope of the proposed action (e.g., actions not contemplated in the MSHCP), may require separate formal consultations. NiSource is not authorized for take of non-MSHCP species that may occur during activities not permitted or funded by the federal agencies.

2.1 MUSSELS

Incidental take for all species of mussels was calculated using the same basic approach. In summary, the following simple algorithm was used:

- Stream Width x Impact Length (lethal and sub-lethal wet-ditch or dry-ditch model) x Percent Suitable Habitat = Acres of Habitat Impacted; Acres of Habitat Impacted x non-HCP mussel Density = Impacts to Individuals.

For all of the non-HCP species this calculation was based on the wet-ditch stream crossing method for large streams (over 100 feet in width) except the Ohio River (only HDD is included as a covered activity) and the dry-ditch method for remaining streams. Where the wet-ditch method calculation was necessary, the impact area was calculated using a sediment transport methodology. Because of the large number of streams within the project area, ENSR hydrologists and biologists with input from the USFWS and NiSource developed a simplified procedure to formulate and quantify the three processes of: (1) suspended sediment supply to a stream from site disturbance, (2) instream transport and dispersion of the sediment by representative size fractions, and (3) sediment deposition on the streambed. The model estimates a lethal impact area covered by 0.236 inches of sediment and a sediment plume extending further downstream corresponding to a harm/harassment area having a 600 mg/l concentration of suspended sediment. The dry-ditch model estimates a 75-foot lethal zone (area within the coffer dams) and a 100-foot harm/harassment zone downstream of the coffer dams. The entire area that would be impacted by covered activities (e.g., where multiple pipelines are in close proximity and impact zones overlap each other) was identified and used for the total acreage calculation. A density (individuals per square meter) for each species was determined based on the best available data. Take was calculated using the estimate that all non-HCP species occupy 50% of the stream bottom at the estimated density.

Aggregate impacts were estimated from an average of those calculated for MSHCP species.[22] Aggregate impacts represent a small, indirect impact to habitat and are not expected to bear upon a jeopardy determination. The aggregate impact estimate for each non-HCP species is estimated at 8.4 acres.

Dwarf Wedgemussel

Amount or Extent of Take Anticipated

Take of dwarf wedgemussel will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. As with the previous species, there will be harassment, harm, and lethal take of this species. The reasonable worst case scenario indicates impacts to approximately 38 acres of habitat. This translates into take of approximately 4,000 dwarf wedgemussel over the 50-year life of the permit.

Effect of the Take

Based on the 5-Year Review, dwarf wedgemussel is currently found in 15 major drainages in the northeast and mid-Atlantic. Large populations still exist in the north with northern populations generally appearing stable, while those further south are declining. NiSource would not impact any of the best remaining populations in New Hampshire, Massachusetts, and Connecticut. NiSource could affect four populations in Virginia all of which appear to be very small or possibly extirpated. There is also the potential to impact one stable population on the border of New York and Pennsylvania where impacts are likely to be limited because only tributaries upstream of the population are crossed. The USFWS will require reasonable and prudent measures to further reduce the potential for take. One population in New York, the status of which is uncertain, could also be affected, but again the USFWS will require reasonable and prudent measures. Because key populations of this species are outside the area of possible NiSource impacts and with AMMs in place, the USFWS does not expect NiSource activities to affect the likelihood of survival or recovery of the dwarf wedgemussel.

Pink Mucket Pearlymussel

Amount or Extent of Take Anticipated

Both O&M and new construction activities implemented by NiSource over the life of the permit will impact pink mucket. As with the other species, there will be harassment, harm, and lethal take. O&M activities will primarily result in minor sediment impacts and new construction in lethal take and acute sediment impacts. The reasonable worst case scenario take of pink

mucket equates to approximately 110 acres of habitat. This translates into take of approximately 19,000 pink mucket over the 50-year life of the permit.

Effect of the Take

The pink mucket is comparatively widely distributed and occurs in a number of streams completely outside the NiSource area of operation, however, it may have always been, and is unquestionably a rare mussel today. There is one population center in the Ohio River drainage and another in Missouri and Arkansas. The Elk River, Kanawha River, Tennessee River, and Cumberland River populations are considered stable with the Tennessee population below Pickwick Dam among the best remaining. NiSource has agreed to avoid impacts where the trunk line crosses the Tennessee below Pickwick Lock and Dam. NiSource would potentially take pink mucket in the Licking, Muskingum, and Elk Rivers. The Elk River population covers greater than 20 RMs and extends upstream of NiSource activities. NiSource will likely take a small number of pink mucket in the Licking and Muskingum Rivers, although these are likely small populations of widely scattered individuals. With AMMs and BMPs, NiSource is not expected to cause population level impacts in these rivers. In summary, because there is no potential for NiSource impacts to key populations outside the NiSource area of operation and impacts to key populations of pink mucket within the NiSource covered lands will be avoided or minimized, we do not expect NiSource to interfere with the persistence or recovery of this species.

Rabbitsfoot

Note that because the rabbitsfoot is not currently listed, the terms of this ITS will not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation.

Amount or Extent of Take Anticipated

Take of the rabbitsfoot mussel will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. O&M activities will for the most part cause harassment and in in rare cases and at certain sites harm to rabbitsfoot mussels as a result of long-term, chronic sediment impacts, minor contaminants, and limited loss of habitat (aggregate take). The reasonable worst case take calculation for rabbitsfoot mussel estimates impacts to approximately 254 acres of habitat. This translates into take of approximately 42,000 rabbitsfoot over the 50-year life of the permit.

Effect of the Take

NiSource has the potential to affect five of 49 known populations. The USFWS does not expect impacts to any of the 11 populations classified as sizeable. Of the 18 populations classified as small by Butler (USFWS 2012b), NiSource has the potential to impact only the Little Darby Creek

population although recent records are from upstream of NiSource facilities. The Muskingum River has a recently discovered population of rabbitsfoot, the extent of which is unknown. NiSource has the potential to affect this population. Reasonable and prudent measures will be required to avoid or minimize impacts to the Muskingum River population. NiSource also has the potential to affect rabbitsfoot in in two other streams where it is classified as marginal, Big Darby Creek in Ohio and the Allegheny River in Pennsylvania. Most of the sizeable and small populations important to the survival and recovery of the rabbitsfoot are outside the NiSource covered lands. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to affect the recovery or survival of the species resulting in jeopardy to the rabbitsfoot mussel.

Rayed Bean

Amount or Extent of Take Anticipated

Take of the rayed bean mussel, will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. Sediment impacts from O&M activities will typically be minor in nature, but present throughout the life of the permit. Degradation of in-stream habitat is the key stressor. New construction activities will likely cause lethal take from excavating, crushing, and displacing, as well as, acute sediment impacts causing harassment and harm. The take calculation for rayed bean mussel represents a reasonable worst case scenario take from impacts to approximately 147 acres of habitat. This translates into take of approximately 108,000 rayed bean primarily from the Allegheny River population over the 50-year life of the permit.

Effect of the Take

Of the 31 known populations of rayed bean, five are considered to be both large and have high viability. NiSource activities would potentially impact only one of these, the large Allegheny River population. NiSource activities also have the potential to take rayed bean in Big Darby Creek, however, crossings occur far downstream from known populations. Two populations where reproduction is uncertain, the St. Joseph River and the reintroduced population in the Elk River, could also be impacted. The level of impacts on the St. Joseph River population, like the population itself, are uncertain, but existing AMMs should limit impacts. The USFWS will require NiSource to avoid and minimize impacts to the translocated Elk River population if it is found to persist. Some take is possible from smaller populations, but NiSource activities will not preclude the survival or recovery of the rayed bean.

Spectaclecase

Amount or Extent of Take Anticipated

Similar to other non-HCP species take of spectaclecase will occur from both O&M and new construction activities implemented by NiSource over the life of the permit. As with the other species, there will be harassment, harm, and lethal take of this species. O&M activities will primarily result in minor sediment impacts and new construction in lethal take and acute sediment impacts. The reasonable worst case scenario take of spectaclecase equates to approximately 287 acres of habitat or approximately 6,000 spectaclecase over the 50-year life of the permit.

Effect of the Take

NiSource would have limited impacts on the spectaclecase across the NiSource covered lands and would not impact any of the strongholds of this species in Missouri or Minnesota/Wisconsin. In the occupied streams that NiSource does cross, a combination of agreements to avoid impacts using HDD, and to employ other AMMs and BMPs will ensure that NiSource will not preclude the survival or recovery of the spectaclecase.

Snuffbox

Amount or Extent of Take Anticipated

Take of snuffbox will occur from same NiSource activities implemented over the life of the permit that affect other non-HCP mussels. We anticipate that there will be harassment, harm, and lethal take of this species. O&M activities will primarily result in minor sediment impacts and new construction in lethal take and acute sediment impacts. The reasonable worst case scenario take of snuffbox equates to 356 acres of habitat or approximately 38,000 snuffbox over the 50-year life of the permit.

Effect of the Take

The snuffbox occurs in a comparatively large number of streams, however, most of these populations are small and of questionable viability. There are eight stronghold populations for this species, 24 significant populations, and about twice that many marginal populations. Of the strongholds identified, none is impacted by NiSource activities. NiSource impacts only two of the 24 populations classified as significant: the Little Kanawha River (West Virginia) and the Elk River (West Virginia). To avoid potential impacts to a number of populations having unknown status, the USFWS will require NiSource to limit impacts by crossing these streams using dry-ditch methodologies. NiSource will likely take snuffbox mussels over the course of the permit even with AMMs, BMPs and reasonable and prudent measures in place because of

the number of occupied streams crossed, however, population level impacts are not expected and NiSource activities will not preclude survival or recovery of the snuffbox.

Reasonable and Prudent Measures/Terms and Conditions (All non-MSHCP Mussels)

These RPMs include both general actions that apply to all non-HCP mussels, which the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02); and actions unique to various non-HCP species as outlined in this BO and summarized below. The terms and conditions (TACs) set out the specific methods by which the RPM is to be accomplished. These RPMs and TACs are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	All mussel species: 1a) The USFWS and other federal agencies shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the MSHCP.
2) The USFWS and other federal agencies shall take actions that minimize the take of animals within the affected populations and limit impacts to the species and habitat from NiSource activities.	Dwarf Wedgemussel: 2a) Cross all tributaries to Delaware River in Sullivan County, New York using dry-ditch techniques 2b) Implement HDD at the Neversink River crossing if practicable, if not survey and translocate mussels.
	Pink Mucket: No Terms and conditions specific exclusively to pink mucket.
	Rabbitsfoot: 2c) Implement HDD at the upstream Muskingum River crossings (Coshocton and Muskingum Counties), if not practicable, survey and translocate mussels
	Rayed Bean: 2d) Implement HDD at Elk River crossings if practicable, if not survey and coordinate with WV Field Office on avoiding impacts to introduced population, use dry-ditch techniques and translocate mussels.
	Spectaclecase: No Terms and conditions specific exclusively to pink mucket.
	Snuffbox:

RPMs	TACs
	2e) Implement HDD at the upstream crossings of the Licking River if practicable, if not survey and translocate mussels 2f) Implement HDD at Little Kanawha River crossings if practicable, if not survey and translocate mussels 2g) Implement dry-ditch crossings of Cedar Creek, Fink Creek, Fish Creek, Fishing Creek, Leading Creek, Olentangy River, Tygart's Creek, and West Fork Little Kanawha River

2.2 Diamond Darter

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Incidental take is anticipated in the form of death or injury of adult or juvenile diamond darters from crushing or injury of individuals present in direct instream construction areas; or in the form of harassment and injury from increased sedimentation and water quality degradation which reduces habitat suitability, and fitness of individuals.

The USFWS anticipates that incidental take of the diamond darter will be difficult to detect due to the species' small body size, cryptic coloring, and tendency to be inactive and buried in the substrate during the day. Finding a dead or impaired specimen is unlikely because the species occurs in a flowing stream where carcasses or injured individuals may be rapidly carried downstream from areas they occupied. In addition, currently available survey methods do not allow for accurate estimates of species abundance or density during all times of year or in all habitat types that could be affected. Therefore incidental take is most accurately estimated using amount of habitat affected as a surrogate.

Incidental take for diamond darter habitat was calculated using the same basic approach as was used for all species of mussels as described above. The algorithm used for estimating acres of diamond darter habitat impacted by pipeline crossings was:

Maximum Number of Stream Crossings x Stream Width x Impact Length (dry-ditch model) = Acres of Habitat Impacted.

Based on these calculations, we estimate that a maximum of 1.5 acres of diamond darter habitat may be affected by a maximum of three pipeline crossing replacements. The 125-foot stream width for the Elk River was estimated by averaging all the stream widths measured during the most recent diamond darter habitat assessments (Welsh *et al*. 2013). The dry ditch model estimates a total direct and indirect impact length of 175 feet. It should be noted that this model was developed to address potential adverse effects to mussels; diamond darters may be more, or less, sensitive to modeled impacts. However, this model is the best available information at this time to estimate downstream indirect effects. As part of this HCP, NiSource will be conducting testing and validation of this model (see the MSHCP, Chapter 7, section

7.6.4.4.1). The length of estimated stream impacts to the diamond darter due to dry-ditch crossings, and the potential significance of those impacts, may be revised in the future based on these model validation efforts.

NiSource estimates the area directly impacted by pipeline repairs will typically be 30 feet by 15 feet. Repairs will typically be completed in 24 hours and by placing temporary coffer dams around the repair area so that instream sedimentation during construction should be minimized. Therefore, if a maximum of three repairs are conducted over the life of the permit, this will result in 0.03 acres of diamond darter habitat being affected due to a maximum of three pipeline repairs.

Thus, a maximum total of 1.53 acres of diamond darter habitat in the Elk River may be affected by a maximum of three pipeline repairs and three pipeline crossing replacements. This is likely an over-estimate because NiSource's preliminary evaluation, as detailed in their Elk River Plan, indicates that alternative construction methods that would avoid instream impacts may be available for two of the three potential crossing replacements. Incidental take from pipeline repairs and replacements is anticipated in the form of death or injury of adult or juvenile diamond darters from crushing or injury of individuals present in direct instream construction areas. We further expect this to be limited to very few individuals (likely single) individuals as they move between foraging and resting sites during each instream construction event. No breeding or spawning adults, eggs, or larva will be affected. Incidental take is also anticipated in the form of harassment and injury from increased sedimentation and water quality degradation which reduces habitat suitability, and fitness of all individuals using the affected areas.

In addition to estimating take of diamond darter habitat in the Elk River, we also estimated aggregate impacts from construction, operation, and maintenance of facilities within the Elk River watershed that could be a source of increased sedimentation and/or water quality degradation to the Elk River. Take from aggregate impacts is anticipated to be in the form of harassment of all individuals in the affected areas. Aggregate impacts for the diamond darter were calculated the same method as described for mussels and involved measuring the number of miles of NiSource pipeline corridor (using a 100-foot average width) and facilities overlapping the Elk River watershed. This calculation resulted in estimated of 6,526 acres of aggregate habitat impacts to the diamond darter from operation and maintenance of existing facilities. In addition, NiSource estimates that there may be disturbance of up to 787 acres annually in the Elk River watershed for expansion or construction of new facilities, resulting in no more than 3,000 acres of new disturbance over the life of the permit.

EFFECT OF THE TAKE

Over the 50 year life of this project, NiSource has the potential to affect a maximum of three locations in the Elk River within the range of the one remaining diamond darter population. The implementation of the BMPs required for this species, the NiSource Elk River plan, and the additional habitat assessments used to validate our assumptions, will ensure that pipeline

replacement impacts will be limited to those areas that have low habitat suitability for the diamond darter and are therefore not likely to be frequently used by diamond darters for foraging, resting, breeding, or spawning. While diamond darters may be present in the affected areas, we expect that they may be present only occasionally as adults move between foraging and resting sites, or that adults may only be present in very low numbers (single individuals). Over the life of this project, the aggregate effect of NiSource activities in upland areas of the Elk River watershed, and in and around tributaries to the Elk River, has the potential to cumulatively result in sedimentation and water quality degradation in the Elk River itself, but implementation of the BMPs required for this species should reduce the potential scope and severity these effects so that individual projects have minimal to no adverse effects. As a result of the avoidance and minimization measures incorporated into this project up front, we do not anticipate that population-level effects to the diamond darter will occur. The USFWS has therefore determined that the anticipated take is not likely to jeopardize the recovery and survival of the diamond darter. We have also determined that the proposed action would not result in the destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES/TERMS AND CONDITIONS

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished. The analysis in the accompanying BO and finding of no jeopardy for the diamond darter is predicated on compliance with and full implementation of the BMPs, survey, monitoring, and reporting requirements provided in the MSHCP. These RPMs and TACs are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other Federal agencies shall ensure that any activities that they authorize or permit are consistent with the NiSource Elk River Plan, all the diamond darter BMPs, and other survey, monitoring, and reporting requirements provided in the HCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the HCP.
2) The USFWS and other federal agencies shall take actions that minimize the take of animals within the affected populations and limit impacts to the species and habitat from NiSource activities.	2a) Prior to conducting any pipeline replacement or repairs involving direct disturbance to the Elk River, conduct and review diamond darter habitat assessments sufficient to determine, in coordination with the USFWS, where high quality diamond darter foraging, spawning, or resting areas may be located in the vicinity of the proposed project, and develop measures to avoid impacts to these areas. 2b) Work with the USFWS to develop and implement compensation actions that serve to minimize the impact

RPMs	TACs
	of the take anticipated including both direct disturbances to the Elk River and aggregate effects from disturbances within the Elk River watershed.

2.3 Roanoke Logperch

Amount or Extent of Take Anticipated

The USFWS anticipates that incidental take of the Roanoke logperch will be difficult to detect because of the species' small body size and cryptic coloring. In addition, finding a dead or impaired specimen is unlikely. Based on the 161,176 meters of perennial stream within the action area, and assuming that approximately 25 percent of these streams represent potential habitat for the Roanoke logperch, take of logperch will occur within 40,294 meters of stream. Take will be in the form of harassment, harm, injury, and death of logperch.

Effect of the Take

We expect that the population-level impacts from NiSource activities to the Roanoke logperch will be small, only impacting a small percentage of the Roanoke logperch rangewide. It is expected that the population, given no other major perturbations, will recover from a NiSource impact within one to three years assuming that logperch from surrounding areas will be able to move into the action area. Similarly, habitat impacts are small compared to the overall amount of habitat available. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The analysis in the accompanying BO and finding of no jeopardy for the Roanoke logperch is predicated on compliance with and full implementation of the AMMs, survey, monitoring, and reporting requirements provided in the MSHCP.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other Federal agencies shall ensure that any activities that they authorize or permit are consistent with the Roanoke logperch BMPs, and other survey, monitoring, and reporting requirements provided in the HCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the HCP.
2) The USFWS and other federal agencies shall take actions that minimize the take of animals within the affected populations and limit impacts to the species and habitat from NiSource activities.	2a) No instream work between March 15 – June 30 of any year. Instream work will be conducted during the low flow period of any year, August 1 through October 31, when possible. 2b) Work with the USFWS to develop compensation actions that serve to minimize the impact of the take anticipated.

2.4 Eastern Massasauga

Note that because the EMR is not currently listed, the terms of this ITS will not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation.

Amount or Extent of Take Anticipated

In the accompanying BO, we conclude that individual EMRs may experience some adverse impacts from NiSource activities. Although the BMPs and restrictions from NiSource's ECS greatly limit these effects, we expect that some EMRs will be taken during the life of the project. We expect this take to occur primarily as temporary disturbance and harassment that due to either direct encounters with NiSource staff and equipment or indirectly due to temporary habitat impacts. This harassment is expected to temporarily affect their ability to feed and shelter, although only over a short time period.

We then must calculate the amount of this non-lethal take we anticipate occurring over the life of the project. These calculations rely in part on the EMR populations as identified in the recent rangewide population modeling by Faust et al. (Faust et al., 2011). We are currently aware of 16 occurrences of EMR near the covered lands in Ohio and we expect NiSource to directly impact 8 of those known populations. There are currently 29 documented EMR occurrences statewide in Indiana (Faust et al. 2011), none of which occur in the NiSource covered lands. We must further calculate, however, impacts to potential unknown populations within the covered lands. We anticipate unknown populations of EMR primarily in Indiana, because of the lack surveys for the species in that area of the state (Andy King, pers. comm. 2013).

To calculate impacts to currently unknown populations, we are making the following assumptions:

- there will be a similar level of impact to populations in both Indiana and Ohio
- the ratio of total populations identified in the Faust rangewide population modeling to the total number of populations statewide is the same in both states
- the ratio of total populations likely to be impacted by NiSource is the same in both states

Given these assumptions, we estimate impacts by looking at the ratio of populations expected to be impacted in Ohio and the number of Ohio populations identified in the Faust model. This is equal to 8 known pops directly impacted by NiSource in Ohio to 16 total populations in the Faust model in Ohio, which equal 8/16, or 0.5. We then using this ratio of 0.5 to estimate the number of populations potentially impacted in Indiana. Based on the 29 total known populations from the Faust model, 29 x 0.5= 14.5 populations. We round this number up to 15 total populations and conclude that 15 populations would be impacted by NiSource in Indiana.

We then need to calculate the acres of habitat potentially impacted in these populations. The 8 impacted populations in Ohio have a mean of approximately 150 acres in the existing ROW (range of 35 to 298 acres). We then calculate that 15 potentially impacted populations in Indiana will be impacted will also have an average of 150 acres of habitat in the ROW, which comes to 2250 acres of impact (15 populations x 150 acres). In Ohio, this calculation leads to 1200 acres of impact (8 populations x 150 acres). Taken together, we estimate that NiSource will have a total of 3450 acres of impact and that any EMRs present on those areas would experience the anticipated harassment.

We further anticipate some very limited lethal take. For most projects, the BMPs will reduce potential lethal take to a level where it is not reasonably certain to occur, as previously described. However, we anticipate that some individuals may be killed by mowers. These would be EMRs that were not detected by the snake monitors prior to mowing. However, with all of the precautions that will be taken when mowing (BMPs #9 and #10), expect that this take will be unusual and no more than two (2) individuals over the life of the project.

Effect of the Take

We expect that the overall level of take of EMRs will be relatively low and will not result in significant population-level impacts. We expect this take to occur primarily as temporary disturbance and harassment that due to either direct encounters with NiSource staff and equipment or indirectly due to temporary habitat impacts, resulting in short-term, temporary impacts to their ability to feed and shelter. Lethal impacts are expected to be even less frequent, with less than two (2) individuals over the life of the project from mowing. The mitigation implemented by NiSource will further reduce potential impacts by providing habitat improvements that should increase survival and reproduction in EMR populations. NiSource has committed to ongoing surveying for EMRs in action area, which will help reduce potential impacts to currently undocumented populations. NiSource has also agreed to mitigation for

their impacts to EMR in the form of habitat restoration that should improve survival and reproduction in those populations.

We conclude that the proposed impacts from NiSource activities do not pose a significant risk to the viability of the species and will not result in measurable population declines or losses in the action area. Therefore, in the accompanying BO, the USFWS determined that the anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures/Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions (TACs) set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The analysis in the accompanying BO and finding of no jeopardy for the EMR is predicated on compliance with and full implementation of the BMPs, survey, monitoring, and reporting requirements provided in the MSHCP.

RPMs	TACs
1) Ensure that all NiSource activities are completed as described in the BO, the MSHCP, the IA, and the ITP.	1a) The USFWS and other Federal agencies shall ensure that any activities that they authorize or permit are consistent with the EMR BMPs, and other survey, monitoring, and reporting requirements provided in the HCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the HCP.

3 MONITORING AND REPORTING REQUIREMENTS

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)].

The reporting requirements to document the implementation of RPMs and TACs will occur along with the monitoring process set out in the MSHCP, the IA, and the ITP. This overall monitoring approach is outlined in Chapter 7 of the MSHCP and includes detailed monitoring, reporting, and adaptive management requirements that will be implemented over the term of the ITP. The goal is to provide a reliable basis for documenting compliance, effectiveness, and implementation of the MSHCP and ITP. NiSource is also specifically bound to monitor, report, and assess the impacts of the take of MSCHP species that will result from covered activities over the term of the ITP.

The federal agency reporting of impact of the take as outlined in this ITS will occur in cooperation with NiSource as they track their implementation of the MSHCP. The FWS will be the lead federal action agency, taking on the primary responsibility for monitoring and reporting on the ITS. The monitoring and reporting will occur with the annual monitoring report produced by NiSource and an annual meeting for the MSHCP. This report and meeting will provide a means for (1) assessing progress, compliance, and effectiveness of the terms of the MSHCP over the year prior and (2) planning for the upcoming year to ensure that the take anticipated in this ITS will not be exceeded. As a part of this annual reporting, the FWS will report on the federal action agency monitoring of the implementation of this ITS. This federal report will document and assess the impact of the takings for both MSHCP and non-MSHCP species. For the non-MSHCP species, FWS will report on all tier II, project-specific consultations that occurred over the previous year.

4 CONSERVATION RECOMMENDATIONS

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

We recommend that the following conservation measures be implemented:

- The FWS and other federal agencies should seek opportunities to contribute to the recovery of the species, including providing funding, research, habitat enhancement and acquisition, identification of mitigation, and other actions and opportunities within the action area and elsewhere in the species ranges.

5 REINITIATION OF CONSULTATION

Reinitiation of formal consultation is required and shall be requested by the federal agency or by the Service, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Thank you for the information and cooperation provided by your offices in this consultation. Please refer any questions to Jessica Hogrefe (612-713-5346) of this office.

Sincerely,

Lynn Lewis

Lynn Lewis
Assistant Regional Director, Ecological Services

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APPENDICIES