10.0 Assurances

10.1 Introduction

NiSource recognizes that circumstances can change during the term of the MSHCP. Those changes, some due to natural events or factors outside the control of NiSource, could merit changes in the MSHCP's operating conservation program. This chapter describes NiSource's obligations in the event of changed circumstances. Specifically, it identifies and defines the circumstances (e.g., climate change, drought, flooding, etc.), the triggers, and the responses that NiSource has planned for and has assured funding for (i.e., funding described in Chapter 8) to address possible effects that a changed circumstance could have on a species or geographic area covered by the MSHCP.

10.2 Federal "No Surprises" Assurances

The Federal "No Surprises" Rule, 63 Fed. Reg. 8859 (Feb. 23, 1998) (codified at 50 C.F.R. §§ 17.3, 17.22(b)(5), 17.32(b)(5)) provides assurances to Section 10 permit holders that, as long as the permittee is properly implementing the HCP, the IA, and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee. The "No Surprises" Rule has two major components: changed circumstances and unforeseen circumstances.

10.2.1 Changed Circumstances

Changed circumstances are defined in the "No Surprises" Rule as "changes in circumstances affecting a species or geographic area covered by [an HCP] that can reasonably be anticipated by [plan] developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events)." (50 C.F.R. § 17.3). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were provided for in the HCP, the permittee will be required to implement such measures. (50 C.F.R. §§ 17.22(b)(5)(i), 17.32(b)(5)(i)). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were not provided for in the HCP, the Service will not require any additional measures beyond those provided for in the HCP, without the consent of the permittee, provided the HCP is being properly implemented. (50 C.F.R. §§ 17.22(b)(5)(ii), 17.32(b)(5)(ii)).

The HCP Handbook notes that "with respect to anticipated and possible changed circumstances, the HCP should discuss measures developed by the applicant and the Service to meet such changes over time, possibly by incorporating adaptive management measures for covered species in the HCP" (HCP Handbook at 3-28). The Handbook further provides that "HCP planners should identify potential problems in advance and identify specific strategies or protocols in the HCP for dealing with them, so that adjustments can be made as necessary without having to amend the HCP."

Consistent with this direction, the MSHCP identifies specific protocols that NiSource will ensure are implemented to address changed circumstances associated with the MSHCP's operating conservation program, which has two main components: (1) the conservation strategies

associated with NiSource's covered activities (e.g., avoidance and minimization measures); and (2) the mitigation projects described in Chapter 6.

10.2.2 Unforeseen Circumstances

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Service at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species. (50 C.F.R. § 17.3).

The Service bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available while considering certain factors. (50 C.F.R. §§ 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C)). In deciding whether unforeseen circumstances exist, the Service shall consider, but not be limited to, the following factors (50 C.F.R. §§ 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C)):

1. The size of the current range of the affected species;
2. The percentage of the range adversely affected by the covered activities;
3. The percentage of the range that has been conserved by the MSHCP;
4. The ecological significance of that portion of the range affected by the MSHCP;
5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the MSHCP; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the species in the wild.

In negotiating unforeseen circumstances, the Service will not require the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of the permittee. (50 C.F.R. §§ 17.22(b)(5)(iii)(A)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Service may require additional measures of the permittee where the HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, and maintain the original terms of the plan to the maximum extent possible. (50 C.F.R. §§ 17.22(b)(5)(iii)(B) and 17.32(b)(5)(iii)(B)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

Notwithstanding these assurances, nothing in the "No Surprises" Rule "will be construed to limit or constrain the [Service], any Federal agency, or a private entity, from taking additional actions, at its own expense, to protect or conserve a species included in a conservation plan." (50 C.F.R. §§ 17.22(b)(6) and 17.32(b)(6)).

10.3 Circumstances Addressed in the MSHCP

NiSource requests regulatory assurances (No Surprises) for those listed and non-listed species that have been "adequately covered" in the MSHCP and for which NiSource seeks take authorization (Table 4-1 for species for which NiSource seeks take authorizations and requests assurances; *see* also, 50 C.F.R. §17.3, defining "adequately covered"). As such, in accordance with the "No Surprises" Rule and the Service's regulations, NiSource will be responsible for implementing remedial measures in response to those changed circumstances addressed in this chapter. If a changed circumstance occurs within a geographic area specified in this chapter, the Service and NiSource will coordinate and determine if additional conservation and mitigation measures are necessary. In such event, the Service may determine that additional measures are necessary. Pursuant to the "No Surprises" Rule and regulations, if such measures are addressed in this MSHCP, implementation is required. If additional measures are deemed necessary to respond to a changed circumstance and such measures are not provided for herein, the Service will not require any additional conservation or mitigation measures without the consent of the Permittee, as long as the MSHCP is being properly implemented. "Properly implemented" means that the commitments and the provisions of the MSHCP, IA, and permit have been or are being fully implemented by NiSource. (50 C.F.R. § 17.3).

The following circumstances, which are addressed later in this chapter, are reasonably anticipated and planned for in this MSHCP: (1) Climate Change; (2) Droughts; (3) Floods; (4) Fires; (5) Tornados; (6) Disease; (7) Invasive Species; (8) Species Range Expansion/Contraction; and (9) Species Listing/Delisting.

Climate change, manifested as water temperature increase, droughts, and floods, may affect not only habitat, but the populations of the aquatic species covered in the MSHCP (sheepnose, northern riffleshell, clubshell, fanshell, James spinymussel, and the Nashville crayfish). The potential impact of the changed circumstances is unknown. In particular, where effects are small, it will likely be difficult to differentiate the effects of a changed circumstance (e.g., droughts) on a mitigation site population from fluctuations related to other factors. Populations of mussels and crayfish will not be static and will vary particularly over short periods based on predation, habitat quality, and other variables (Jones 2009 and Rabeni 1992). NiSource will address the confounding effects of other variables by assessing population change in the presence of a documented occurrence of the changed circumstance and by employing a multi-year evaluation of a mitigation site's population.

For mussels, NiSource will use the average population-growth rate (lamda) to assess the effects of a changed circumstance on a mitigation site population. A threshold of lamda < 1.0 over five years in conjunction with the occurrence of the changed circumstance will be used to determine the need for action on the MSHCP mussel species (lamda of 1.0 indicates a stable mussel population and < 1.0 indicates a declining population). NiSource and the Service would expect in the absence of changed or unforeseen circumstance that the mitigation would lead to an increase in the target mussel population at the mitigation site in a five-year period. This metric incorporates both survival and recruitment of the population and thus provides a useful method for assessing impacts in conjunction with a changed circumstance (*see* Villella et al. 2004). NiSource will use the best available monitoring protocols designed to detect juvenile mussels and mussels occurring at low densities. For Nashville crayfish, NiSource will employ a similar mark-recapture approach (*see* Nowicki et al. 2008). NiSource and the Service would expect

population growth at Nashville crayfish mitigation sites if the population is not impacted by a changed or documented unforeseen circumstance.

When a determination is made that an aspect of the MSHCP's operating conservation program is not meeting its intended objective due to changed circumstances, NiSource will evaluate the causal factors and determine whether or not that change was planned for in the MSHCP. For those circumstances that were planned for in this chapter, unless otherwise stated, NiSource will implement the measures set forth in this chapter (i.e., planned responses) as soon as possible, but no longer than one year from the time NiSource receives notice that a change to a species or geographic area covered by the MSHCP has occurred.

Changed Circumstances and Mitigation Success Criteria

Each mitigation project funded through the Mitigation Fund or directly by NiSource will include specific criteria for determining when the project is deemed successful. NiSource acknowledges that, when the Service approves the funding of a mitigation proposal, it must also approve the specific completion or success criteria that must be achieved for the mitigation proposal so that the substantive success in achieving the expressed goals of the MSHCP can be measured. When the criteria are satisfied for the mitigation project, whether funded through the Mitigation Fund or directly by NiSource, NiSource will have fully compensated for the associated take that the mitigation project was designed to address. At that point, NiSource will not be required to commit any additional funds, beyond the initial funds committed for long-term maintenance of the mitigation project in response to changed circumstances. However, even when the specified success criteria have been met for a mitigation project, NiSource would be willing to enter into discussions with the Service concerning specific issues associated with the scientific data related to a changed circumstance. As a result of such discussions, NiSource might be willing to voluntarily assist with, fund, or otherwise undertake certain remedial actions with the Service and other interested parties that are directed at a particular species or in an area where the change has occurred. On the other hand, for any ongoing mitigation project that had not satisfied its success criteria but where the trigger for implementation of measures in response to the changed circumstance had occurred, NiSource would implement the identified response, even if such response requires additional funds beyond those initially committed for the project.

For example, suppose NiSource funds a mitigation project that involves the restoration of riparian habitat in Year 4 of the permit term and the success criteria for that restoration project would be met by Year 7 of the permit term under normal circumstances. If a flood occurred in Year 6 of the permit triggering implementation of measures in response to a changed circumstance, NiSource would commit the funds necessary to implement the measures identified in this chapter. On the other hand, if a flood occurred in Year 40 of the permit term triggering implementation of measures in response to the changed circumstances some 33 years after the success criteria had been satisfied in Year 7, NiSource would not be obligated to respond to the changed circumstances beyond the funds already committed for long-term maintenance of the mitigation project.

Triggers Indicating Changed Circumstances

This Chapter identifies triggers for changed circumstances resulting from (1) climate change; (2) droughts; (3) floods; (4) fires; (5) tornados; (6) disease; (7) invasive species; (8) species range expansion/contraction; and (9) species listing/delisting. For each of these triggers, the observed change that qualifies the circumstance as a "changed circumstance," e.g., a change

in the bog turtle active periods, must be (1) identified by a qualified professional; (2) confirmed by another, independent qualified professional; and (3) based on objective, scientifically sound data. Also, the time period over which the data are collected must be statistically relevant, i.e., of a sufficient length that scientifically supportable conclusions can be drawn. If NiSource and the Service disagree as to whether a trigger has occurred, they will meet to discuss the issue in an attempt to reach a mutually acceptable solution.

10.3.1 Climate Change

According to the EPA, long-term observations indicate that our climate may be changing. As reported, greenhouse gases are at increased levels in the atmosphere. Global mean temperatures have increased 1.2 to 1.4ºF in the last 100 years according to NOAA and NASA, with most of the warming occurring in recent decades. Other aspects of the climate also appear to be changing, such as rainfall patterns, snow and ice cover, and sea level (EPA 2009). Global and regional climate models predict warming and increased variability in the timing and type of precipitation. As a consequence of these changes, fire regimes are likely to be altered, which, in some parts of the country, may result in increased fire frequency and intensity. Climate change may also have some direct effects on productivity and biogeography as well as indirect effects on vegetation through changes in fire, insect, and disease disturbances (Carroll et al. 2003; Dale et al. 2001; Parry et al. 2007). Some ecological communities are projected to move upward in both elevation and latitude (Walther et al. 2002). Therefore, since climate change is likely to manifest itself through other changed circumstances like flooding (as discussed in detail below), this MSHCP will discuss climate change as it relates to the accelerated rate of warming. Other potential consequences of climate change are discussed as stand-alone issues.

According to the American Meteorological Society, there are local and regional considerations that come into play when trying to project a pattern of global warming onto weather or climate conditions in a specific region. The American Meteorological Society explains that there are regional variations in the signature of climate change, with warming in the western U.S. but little or no annual temperature change occurring in the southeast U.S. in recent decades. Evidence for warming is also observed in seasonal changes with earlier springs, longer frost-free periods, longer growing seasons, and shifts in natural habitats and in migratory patterns of birds (American Meteorological Society 2007).

Most climate change-related impacts to species covered in this MSHCP are likely to manifest through species life history changes. The following criteria are used to help in determining which species may be susceptible to climate change-related impacts:

1. Species with highly specialized habitat needs;
2. Species with narrow environmental tolerances;
3. Species dependent on specific environmental triggers or cues; and
4. Species that lack the ability to disperse and/or colonize new or more suitable areas.

Climate Change – Changed Circumstances

Scientists are working hard to produce reliable models to predict the potential effects of climate change to species and ecosystems at global, regional, and local levels. Although the evidence for global average temperature increases is strong, its effect on a local or regional

climate or ecological conditions is much less certain, and has not provided a clear response to date. The year-to-year variability in weather and climate conditions can and has always been substantial, including seasonal average temperatures and rainfall patterns. As such, until more conclusive information is available on regional and local levels, specific impacts to species and ecosystems (and needed responses) are difficult to determine; therefore, available historic data and trends in combination with available climate change data or a rigorous monitoring and adaptive management strategy must be relied upon. Most projections for future climate impacts are based on a range of low emission and high emission scenarios. Since measured CO2 levels are currently exceeding the projected high emission scenarios (Canadell 2007), it is reasonable to use the high emission scenarios as the basis for evaluation of potential climate change impacts to the covered lands during the 50-year duration of the requested permit (Canadell, 2007). The remedial measures below have been identified to respond to climate change-related impacts (i.e., warming) to species covered by this MSHCP and/or their habitats. Due to the unpredictable nature of effects due to climate change, NiSource will treat all climate-change-related triggers identified below as changed circumstances, as opposed to unforeseen circumstances, that warrant the responses identified below.

Bog Turtle

Habitats and life-requisite activities critical to the survival of bog turtles may be threatened by climate change impacts, primarily through shifts in temperature regimes and hydrological cycles, including changes in precipitation, evaporation, transpiration, runoff, and groundwater recharge and flow (the latter are discussed in their respective sections below). Reptiles are sensitive to and respond strongly to changes in air and water temperature, precipitation, and hydroperiod (length of time and seasonality of water presence) (Carey and Alexander 2003). This is partly because reptiles are ectothermic (their body temperatures and activity cycles are dependent on the presence of optimal environmental conditions). Temperatures outside of their thermal optima cause physiological stresses to reptiles. Some reptile species exhibit temperature-dependent sex determination during egg incubation that could be influenced by changes and variability in global climates (Gibbons et al. 2000, Hawkes et al. 2007). The timing of key ecological events is also influenced by air and water temperatures. The timing of reproduction (breeding/egg laying), metamorphosis, dispersal, and migration may shift in response to higher temperatures and changes in rainfall (Beebee 1995). If changes in reptile activities occur inconsistent with other ecological events (e.g., emergence of primary insect prey), growth and survival could be affected. Changes in climatic regimes are likely to increase pathogen virulence and amphibian and reptile susceptibility to pathogens. Similarly, warm-water invasive species are a concern to native species and may expand their ranges given warming trends.

Bog turtle active periods begin in late March to late April, depending upon latitude, elevation, and seasonal weather conditions and continue to mid-October (Service 2001). The species hibernates from October to April, often just below the upper surface of frozen mud or ice (Service 1997), and generally retreats into more densely vegetated areas to hibernate (Service 2001). Bog turtles have been found to over-winter with spotted turtles and to demonstrate strong fidelity to their hibernacula (Service 2001). Over the long term, the frequency and duration of extreme temperature events may influence the persistence of local bog turtle populations, dispersal capabilities and, consequently, the structure of metapopulations on the landscape. The ability of bog turtles to adapt to changes in climate depends in-part on their ability to move to

more suitable habitat or in human ability to manage sites to respond to alterations in the habitat (e.g., vegetation management or water level management). However, because key habitats and species ranges have already been altered and fragmented by human use and development, the pathways to connect animals with suitable habitats (e.g., upwards in latitude or elevation) may not exist. In summary, bog turtle response to climate change will primarily be influenced by the following factors:

1. Expected changes in local environmental and habitat conditions;
2. The timing of life-requisite activities;
3. Interactions with pathogens and invasive species; and
4. Interactions with other environmental stressors (i.e., toxicity levels of pollutants may decrease, etc).

Climate Change Alters Bog Turtle Active Periods

NiSource has agreed to specific timing restrictions for certain activities to coincide with either active or inactive bog turtle periods (*see* Chapter 6). Climate change (i.e., warming/cooling) may trigger changes to bog turtle active periods.

Trigger - Climate Change Alters a Bog Turtle Active Period

To facilitate implementation of the MSHCP, NiSource and the Service will develop an IPaC module. If and when there is an observed change to any bog turtle active period, NiSource will, in consultation with the Service, update the data in the IPaC to reflect this change.

Response

In response to an identified change in bog turtle active periods, NiSource will adjust the environmental windows in which it operates to accommodate any changes to bog turtle active periods. Corrective action will be implemented immediately upon notification from the Service.

Indiana Bat

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and summers in wooded areas (Service 1999). The key stages in the annual cycle of Indiana bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration and swarming. While varying with weather and latitude, generally bats begin winter torpor in mid-September through late-October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant in mid- to late-July. Migration back to the hibernacula may begin in August and continue through September. Males depart later from the hibernacula and begin migrating back earlier than females (Service 2007a).

To date, very little information is available that assesses potential impacts of climate change on Indiana bats. Humphries et al. (2002) developed a bioenergetic model for hibernating little brown bats. Integrating projections of climate change into the model resulted in the prediction of a pronounced northward range expansion of hibernating little brown bats within the next 80 years. This model may also provide insight into potential winter distribution shifts of Indiana bats that could result from climate change. Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats

that were noted by Clawson (2002). Similarly, climate change could impact the summer range, summer distribution, and reproductive success of the Indiana bat. Reproductive success in mammals is often related to climatic conditions, such as temperature and rainfall (Isaac 2008). Climate change may also directly influence reproductive success through mistiming of reproduction with peak food availability or through effects on prey populations (Isaac 2008). In bats, climate change may also disrupt important annual events, such as mating and migration, by altering the seasonal cues that trigger these behaviors (Weller et al. 2009). For additional discussion of potential effects of climate change on bats, *see* Weller et al. (2009). Assessments of the potential effects of climate change on Indiana bat populations and recommendations for management actions that may buffer negative effects are needed.

Climate Change Alters Indiana Bat Active Periods

NiSource has agreed to timing specific restrictions for certain O&M and new construction activities that coincide with Indiana bat active/inactive periods (i.e., life-requisite activities such as hibernation, spring staging/fall swarming, presence, breeding) (*see* Chapter 6). Climate change (i.e., warming/cooling) may trigger changes to Indiana bat active periods.

Trigger - Climate Change Alters an Indiana Bat Active Period

To facilitate implementation of the MSHCP, NiSource and the Service will develop an IPaC module. If and when there is an observed change to any Indiana bat active period, NiSource will update the data in the IPaC to reflect this change.

Response

In response to an identified change in Indiana bat active periods, NiSource will adjust the environmental windows in which it performs covered activities to accommodate any changes to Indiana bat active periods. Corrective action will be implemented immediately upon notification from the Service.

Climate Change Adversely Affects an Indiana Bat Mitigation Site

One mitigation option available to NiSource is to protect, maintain, and/or restore high-quality Indiana bat winter habitat at select hibernacula (existing and newly restored), including establishing and maintaining protective wooded buffers for impacted Indiana bats. However, as stated above, climate change (i.e., warming) has the potential to adversely impact habitats protected and restored for Indiana bats. Warming as a result of climate change may make some winter habitats (i.e., hibernacula) unsuitable for basic life history requirements by significantly altering the air temperatures inside the hibernacula. If this occurs, some or all of the Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula used by the bats would not be protected from other threats. In response to this potential threat, NiSource will identify habitat mitigation projects that span elevational and altitudinal boundaries, so that in the event existing or restored habitats become unsuitable because of warming, NiSource can relocate mitigation efforts to hibernacula with suitable microhabitat regimes.

Warming could impact the habitat mitigation projects that NiSource establishes for Indiana bats in two ways. First, it could impact the bats at the mitigation site that the mitigation is intended to protect. Should the animals at a NiSource mitigation site be impacted significantly, the mitigation would no longer serve to compensate for the impact of the take because there would be fewer Indiana bats or in extreme cases no bats for the mitigation to

impact. Since the compensatory mitigation is designed to fully compensate for the impact of the take, changes to the Indiana bat population that the mitigation is designed to address, or changes in the effectiveness of the mitigation itself, would both require corrective action. Therefore, it is essential that the Indiana bats and the habitat remain in place and that the habitat functions as designed for the life of the permit. The loss of area or quality as defined below would reduce the effectiveness of the habitat to mitigate impacts to Indiana bats. If those impacts are caused by changed circumstances as defined above, NiSource will replace, restore, or otherwise correct the problems (within one year) so that the habitat continues to provide mitigation.

Trigger – Climate Change Affects Hibernacula Temperature and Indiana Bat Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where a hibernacula temperature increase adversely affects Indiana bats at a NiSource mitigation site is an increase of the average annual and seasonal air temperature within the hibernacula due to climate change, and a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as a sole product of the warming air temperatures and not a product of other impacts to the hibernacula that could result in changes in internal temperatures (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to an increase in hibernacula temperature and confirmed reduction in population at a NiSource mitigation site, NiSource will coordinate with the Service to either develop a hibernacula restoration plan to lower the temperature inside the hibernacula to the level necessary to support hibernating Indiana bats or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take, consistent with the requirements of Section 6.2.1.6.

Mussels

NiSource has agreed to restore and maintain high-quality mussel habitat in select streams including establishing and maintaining protective riparian buffers for impacted mussel species. However, as stated above, climate change (i.e., stream temperature increase) has the potential to adversely impact habitats restored and protected for mussels. Warming as a result of climate change may make some stream habitats less suitable or under extreme conditions, unsuitable for basic life history requirements. If either of these occurs, some mussels may be able to disperse (via host fish) to more suitable habitat, but it is possible that some would be negatively affected by the stress brought on by the effects of rising water temperatures. In response to this potential threat, NiSource will work with the Service and the States to identify habitat mitigation projects that span hydrologic and altitudinal boundaries (within the limits of the species ranges) in the event that existing or restored habitats become unsuitable due to climate change.

Climate Change Adversely Affects a Mussel Mitigation Site

Rising stream water temperatures may have adverse effects to mussels and other aquatic species. The AR4 Report of the IPCC predicts a warming of 0.2o C each decade over the next

20 years with a best estimate increase of from 1.8 to 4o C over 100 years (depending on the model). It also concludes as very likely an increase in "hot extremes and heat waves" (IPCC 2007). Kaushal et al. (2010) found water temperature increases in half of the streams and rivers they examined across the United States. In addition, they found that air temperature and stream temperature are closely correlated, a finding confirmed by (Bartholow 2005) who worked in the Klamath River basin in Oregon and California. Thus, an increase in air temperature and associated water temperature of MSHCP mussel streams of 2°C over the next 50 years is possible.

A sustained increase in water temperature could affect mussels in the following ways. There may be reproductive effects associated with their complex life history. Basic functions in mussels such as metabolic rate and associated functions (heart rate, oxygen uptake rate and feeding rate), although species specific, are controlled by temperature. McMahon and Bogan (2001) found that metabolic rate increases two to ten-fold in some mussels (L. siliquoidea 1.88 to 4.98; P. grandis 1.27 to 10.35) with a 5.0°F temperature increase and that neither of these species has the ability to acclimate its metabolic rate with an increase in temperature. Dimock and Wright (1993) found Pyganodon cataracta metabolic rate (measured as oxygen uptake) varied directly with water temperature. Juvenile metabolism may increase to the point that they cannot survive. Feeding, growth, and burrowing behavior in unionids are temperature dependent and appear affected by both a thermal minimum and maximum. Stuart et al. (2000) found Elliptio complanata's maximum feeding rate to increase between 56.3 to 64.9°F, while Vanderploeg et al. (1995) found L. siliquoidea's maximum feeding rate was at temperatures of 69.8 to 75.2°F. At high temperatures, adult mussels become inactive, stop feeding, and burrow into the substrate.

NiSource did not find any lethal or sublethal upper temperature limits reported in the literature for the mussel species included in this MSHCP. Pandolpho et al. (2009) looked at the effects of water temperature increase on three species (Lampsilis siliquoidea, Potamilus alatus, and Ligumia recta) of juvenile mussels; juveniles are generally regarded as more sensitive to environmental changes. The experiment was complex using three acclimation water temperatures associated with mean and median spring and summer temperatures in the southern and midwestern United States. During the experiment, the water temperature was increased to predetermined levels where the LT 50s (median time to death under the treatment) were calculated both with and without the presence of the harmful contaminant copper. For the three acclimation temperatures of 62.6°F, 71.6°F, and 80.6°F, they tested the LT 50s at the following experimental temperatures respectively: 20, 23, 26, 29 and 32°C; 25, 28, 31, 34, and 37°C; and 30, 33, 36, 39, and 42°C. These represent the upper range of water temperatures to which mussels might be exposed in the southern and midwestern United States. Their results showed that there was not enough mortality using the 17°C starting point even at the highest experimental water temperature of 89.6°F to calculate LT 50s. Without copper, the LT 50s at 96 hours for the other two acclimation temperatures ranged from 90.5°F to 96.1°F with a mean of 93.2°F.

The ecological significance of a 2°C temperature increase and how that increase occurs on streams and MSHCP mussels is not entirely clear, but NiSource and the Service expect that increased temperatures are most likely to impact mussels during times when stream temperatures are already high (summer months). Urbanization in a watershed may exacerbate climate change impacts on stream water temperatures. It is also likely, as discussed above, that impacts to mussels from increased stream temperatures could manifest themselves in a variety of ways and

that many of those manifestations (e.g., increased metabolism) would be difficult to assess in situ. Temperature impacts on MSHCP mussels must be considered in relation to the ecological adaptations of the species. The MSHCP mussels are found primarily in the warm-water streams of the Ohio River basin in Ohio, Kentucky, Tennessee, West Virginia, and southwestern Pennsylvania and in the James River basin in Virginia. Sustained high water temperatures in the upper ranges of the current normal summer temperatures would, based on laboratory experiments, cause mortality in juvenile mussels.

Trigger

The trigger for NiSource to implement corrective action where a water temperature increase affects mussels at a mitigation site is a combination of a global average surface air temperature increase of greater than 1°C for at least two consecutive years (as reported by the IPCC) based on 2011 levels, and an increase in the average afternoon summer (July, August, September) water temperature of at least 2°C for two consecutive years, plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the water temperature increase. The monitoring sequence would be: (1) track official government reports on air temperature until an increase greater than 1°C has occurred for at least two consecutive years relative to 2011 levels; (2) if a mitigation site(s) is in place, NiSource would begin monitoring afternoon summer water temperatures to identify increase over the baseline documented at the time mitigation was implemented – (this could occur every other year until a 2°C increase directly related to climate change is detected then annually to document two consecutive years); and (3) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (see Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Implement additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Reintroduce the affected population of mussel to a more suitable existing site within the species range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the mussel species.

(3) Work with the Service to place the affected population into a captive facility for maintenance until a suitable site for reintroduction into the wild becomes available.

Nashville Crayfish

NiSource has agreed to restore and maintain high-quality Nashville crayfish habitat in select streams including establishing and maintaining protective riparian buffers for impacted Nashville crayfish. However, as stated above, climate change (i.e., stream temperature increase) has the potential to adversely impact habitats restored and protected for Nashville crayfish. Warming as a result of climate change may make some stream habitats less suitable or, under extreme conditions, unsuitable for basic life history requirements. If either were to occur,

Nashville crayfish may be able to move to more suitable habitat, but it is possible that some would be negatively affected by the stress brought on by the effects of rising water temperatures. In response to this potential threat, NiSource will work with the Service and the States to identify habitat mitigation projects that span hydrologic boundaries (within the limits of the species' range) in the event that existing or restored habitats become unsuitable due to climate change.

Climate Change Adversely Affects a Nashville Crayfish Mitigation Site

Rising stream water temperatures may have adverse effects to Nashville crayfish and other aquatic species. As discussed above, the AR4 Report of the IPCC predicts a warming of 0.2°C each decade over the next 20 years with a best estimate increase of from 1.8 to 4°C over 100 years (depending on the model). An increase in air temperature and associated water temperature of Nashville crayfish streams of 2°C over the next 50 years is possible.

Khan et al. (2006) evaluated the effects of water temperature increase on juveniles of the crayfish species (O. immunis) focusing particularly on the interaction of temperature and heavy metals on respiration. They indicated that aquatic contaminants can compromise the ability of poikilotherms, including crayfish, to tolerate natural fluctuations in temperature. The LT 50 at the same sub-lethal level of four contaminants (cadmium, copper, zinc, and lead) declined universally as water temperature was increased from 20 to 27°C. The synergistic effects of increased water temperature and contaminants might be particularly important in an urbanizing watershed like the Mill Creek basin on the edge of Nashville.

Miranda and Dimock (1985) looked at the thermal tolerance of the crayfish Cambarus acuminatus faxon. Their results indicate that thermal tolerance is in part dependent on acclimation temperature. They looked at LT 50 temperatures for times varying from 10 minutes (instantaneous death) to 46 hours. They also identified a Critical Thermal Maxima (CTM), which was a temperature at which the individual could not right itself in 30 seconds. For C. acuminatus, the CTM for individuals acclimated at 22°C was 91.2°F and for individuals acclimated at 30°C, CTM was 96.8°F with standard deviations of plus or minus 1.20 and 0.83°C, respectively.

The ecological significance of a 2°C temperature increase, and how that increase occurs on streams and the Nashville crayfish is not entirely clear, but NiSource and the Service expect that increased temperatures are most likely to impact crayfish during times when stream temperatures are already high (summer months). Urbanization and the previously mentioned associated contaminants might exacerbate climate change impacts on stream water temperatures. Sustained high water temperatures particularly in conjunction with other factors would negatively impact Nashville crayfish.

Trigger

The trigger for NiSource to implement corrective action where a water temperature increase affects Nashville crayfish at a mitigation site is a combination of a global average surface air temperature increase of greater than 1°C for at least two consecutive years (as reported by the IPCC) based on 2011 levels, and an increase in the average afternoon summer (July, August, September) water temperature at the mitigation site of at least 2°C for two consecutive years, plus data indicating an average population growth rate of < 1.0 of the Nashville crayfish population over a five-year period after the advent of the water temperature increase. The monitoring sequence would be: (1) track official government reports on air

temperature until an increase of between 1°C and 2°C has occurred for at least two consecutive years relative to 2011 levels; (2) if a mitigation site(s) is in place, NiSource would begin monitoring afternoon summer water temperatures to identify increase over the baseline documented at the time mitigation was implemented–(this could occur every other year until a 2°C increase due solely to climate change is detected then annually to document two consecutive years); and (3) begin monitoring the Nashville crayfish populations using the best available technology to determine change in the population growth rate over five years (see Nowicki et al. 2008 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Implement additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Reintroduce the affected population of Nashville crayfish to a more suitable existing site within the species range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of Nashville crayfish.

(3) Work with the Service to place the affected population into a captive facility for their maintenance until a suitable site for reintroduction into the wild becomes available.

10.3.2 Drought

Common to all types of drought is the fact that they originate from a deficiency of precipitation resulting from an unusual weather pattern. The Standardized Precipitation Index (SPI) is an index based on the probability of recording a given amount of precipitation, and the probabilities are standardized so that an index of zero indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median). The index is negative for drought and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive (NCDC 2009).

While climate change is expected to increase the amount of precipitation in the Northeast[1] and the amount of land area experiencing drought appears to be decreasing (NAST 2001), droughts are nonetheless anticipated to increase in both frequency and duration into mid-century (NECIA 2007). Short-term droughts are a recurrent feature of climate for the MSHCP planning area.[2] Over the 50-year permit term, these short-term droughts are projected to occur as frequently as once each summer in the Catskill and Adirondack Mountains. These events will exacerbate low flow situations in rivers and streams by extending low flow periods as well as by causing the low flow periods to begin earlier in the season than previously. Seasonal decreases

[1] Defined as CT, NJ, DE, MA, ME, NH, NY and RI (NECIA 2007); PA and WV (USGCRP 2009).

[2] Due to the landscape-based approach to conservation utilized by the MSHCP, the "planning area" referred to in this chapter encompasses all of the states crossed by the MSHCP covered lands because mitigation efforts may be undertaken outside the covered lands to maximize conservation benefits.

in water tables, impacts to wetlands, and decreases in soil moisture also are likely (NECIA 2007).

For the Midwest region,[3] it is predicted that, with increasing temperatures and evaporation rates and longer periods between rainfalls, the likelihood of drought will increase and water levels in rivers, streams, and wetlands are likely to decline (USGCRP 2009).

For the Southeast region,[4] despite the increase in overall precipitation, the percentage of the region experiencing moderate to severe drought increased over the past three decades. Even in the fall months, when precipitation tended to increase in most of the region, the extent of drought increased (USGCRP 2009). Increased temperatures will cause more evaporation and evapotranspiration leading to increases in the frequency, duration, and intensity of droughts (USGCRP 2009).

Drought – Changed vs. Unforeseen Circumstances

Droughts have the potential to impact both NiSource's minimization and mitigation efforts. When a drought occurs and damages or destroys a minimization and/or mitigation effort, NiSource will implement conservation measures appropriate to remediate the circumstance, as described below for each species. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). Based on predictions for drought as described above, and the fact that droughts are a recurrent feature in the MSHCP planning area, NiSource has planned for droughts that could affect species and geographic areas covered by the MSHCP. These include droughts (a negative SPI) lasting less than five consecutive years. Therefore, changed circumstances including droughts that last less than five years. Droughts lasting longer than five consecutive years will be considered unforeseen. Additionally, if a mitigation effort is destroyed by drought three or more times in a five year period, it will be considered an unforeseen circumstance.

Bog Turtle

Drought Adversely Affects a Bog Turtle Mitigation Site

Droughts have the potential to adversely impact the implementation and success of NiSource's operating conservation program for bog turtles. Bog turtles require specialized 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 (Service 1997, 2001). Bog turtle wetlands are a mosaic of micro-habitats that include dry pockets, saturated areas, and areas that are periodically flooded (Service 1997, 2001). Bog turtles depend on a variety of micro-habitats for foraging, nesting, basking, hibernation, and shelter; they utilize shallow water in the spring and return to deeper water in the winter (Service 1997, 2001). Modifications to the hydrology of bog turtle wetlands can change wetland vegetation and many of the micro-habitats that bog turtles rely on. Specifically, droughts or manmade alterations of hydrology that permanently dry out the site would likely result in a transition of the site into closed-canopy, wooded swamplands. Invasive plant species (e.g., purple loosestrife) may more readily expand into bog turtle habitats during periods of drought or as well as during other types of disturbance.

[3] Defined as OH, MI, IN, IL, MO, IA, WI, and MN (USGCRP 2009).

[4] Defined as AL, FL, GA, KY, LA, NC, MS, SC, TN, and VA (USGCRP 2009).

One mitigation option available to NiSource is to protect, restore, and maintain wetland habitat for the benefit of bog turtle populations. As stated above, droughts have the potential to adversely impact bog turtle wetlands and influence the persistence of local bog turtle populations. During short periods of drought, bog turtles are likely to remain at the site with reduced survival and recruitment. During periods of long-term drought, bog turtles are likely to disperse the area in search of suitable habitats or succumb to the stress brought on by the long-term drought. All bog turtle mitigation sites will be monitored for the life of the permit to ensure they are providing suitable habitats for bog turtles.

Triggers - Drought Affects Bog Turtle Habitat at a Mitigation Site

Triggers for NiSource to implement corrective action are:

(1) Reduction in core fen habitat with appropriate hydrology from the acreage restored and/or protected as part of the mitigation; and/or

(2) Reduction in nesting habitat from the acreage restored and/or protected as part of the mitigation.

Response

In the event either the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management).

Trigger – Drought Affects a Protective Upland Buffer at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects establishment and/or maintenance of a protective upland buffer around a bog turtle wetland is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses at any time during the life of the permit.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Mussels

Like many other endangered species, populations of freshwater mussels are often small and isolated from other populations. Even well-protected populations are vulnerable to extinction through loss of genetic variability, chance fluctuations in reproduction and survivorship, and environmental disturbance. Drought is one of the most pervasive forms of environmental disturbance in small stream ecosystems. While large stream ecosystems and their mussel fauna usually escape the severe adverse effects of drought, the impact of drought on small streams can be severe. While NiSource and the Service would expect James Spinymussel populations to be at particular risk from this type of changed circumstance, any species occurring

in a small stream could be particularly vulnerable. Several studies have shown that droughts impact both the overall mussel abundance and species richness in small stream ecosystems. Mussels that typically survive droughts in small streams do so by burying themselves in the substrate and/or finding sections of the stream channel that remain wet. Haag and Warren (2008) found that in some small streams, overall mussel density before and after the drought declined by 65–83%, and the magnitude of the decline did not differ among streams regardless of whether the channel dried or remained wet.

Drought Adversely Affects a Mussel Mitigation Site

Drought could affect the success of the designed compensatory mitigation by killing or stressing mussels. The mechanism would be the dewatering of the stream or reduction in flow. Drought could also affect the establishment and maintenance of protective riparian buffers by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism for this would be the destruction or interference with the growth of the trees, shrubs, and grasses through lack of sufficient water for survival.

Trigger – Drought Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects a mussel population at a mitigation site is documentation of a six-month drought event plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the six-month drought. The monitoring sequence would be: (1) document that six-month drought impacted the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the mussel species is present and deemed secure; and/or

(2) Reintroduce additional mussels to the original mitigation site implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of mussels.

Trigger – Drought Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, drought affects establishment and/or maintenance of a protective riparian buffer for mussels is documentation of a six-month drought event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Indiana Bat

Droughts have the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require wooded habitats for summer as well as spring staging and fall swarming near hibernacula. However, as stated above, droughts have the potential to adversely impact wooded habitats protected and restored for Indiana bats. Droughts may make some restored wooded habitats unsuitable for basic life history requirements by significantly reducing the survival of planted vegetation.

Drought Adversely Affects an Indiana Bat Mitigation Site

One mitigation option available to NiSource is to protect, maintain, and restore high-quality Indiana bat wooded habitat at known summer and staging/swarming areas near hibernacula. Drought can impact the establishment and maintenance of protective herbaceous and wooded habitat.

Trigger – Drought Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the establishment of these wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year of implementation of the MSHCP, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; or

(2) Reestablish the original level of mitigation at a new site for the species.

Trigger – Drought Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the maintenance of the wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the ITP.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Drought Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high quality in-stream habitat for Nashville crayfish, including establishing and maintaining riparian buffers. Droughts have the potential to adversely impact Nashville crayfish and habitat restored for Nashville crayfish. Drying as a result of drought may make some habitat unsuitable for Nashville crayfish survival. If this occurs, Nashville crayfish may either disperse from the area to find more suitable habitat, or potentially succumb to the stress brought on by habitat loss. Drought can also impact the establishment and maintenance of protective herbaceous and forested riparian buffers. The mechanism for this would be the destruction or interference with the establishment and growth of the trees, shrubs, and grasses through lack of sufficient water for survival. In response to this potential threat, NiSource will identify habitat mitigation projects that span hydrologic boundaries (within the limits of the species' range) in the event existing or restored habitats become unsuitable, NiSource can re-establish a riparian buffer elsewhere and/or relocate affected Nashville crayfish to environments with suitable hydrologic regimes.

Trigger - Drought Affects Nashville Crayfish Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects a Nashville crayfish population at a mitigation site is documentation of a six-month drought event plus data indicating an average population growth rate of less than 1.0 of the Nashville crayfish population over a five-year period after the beginning of the drought event. If at the end of five years the average population growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Perform additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Re-establish the original compensatory mitigation (riparian corridor) at another location where the Nashville crayfish are present and deemed secure.

(3) Reintroduce the affected population of Nashville crayfish to a more suitable existing site within the species' range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of Nashville crayfish.

Trigger – Drought Affects a Nashville Crayfish Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the establishment and/or maintenance of a protective riparian buffer during the life of the permit is

documentation of a drought event and survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.3 Floods

Floods are a naturally occurring component of the ecosystems in the MSHCP planning area. Their frequency and magnitude can be anticipated by reviewing historic information on specific bodies of water. Floods can have considerable adverse impacts on several of the MSHCP species and their habitats.

For the Northeast region, precipitation shows strong increases, with trends greater than 20% over the last 100 years occurring in much of the region. Precipitation extremes appear to be increasing under most climate change scenarios and are expected to continue increasing in amount, frequency, and intensity through mid-century. Such are expected to result in increased local and regional flooding events with damage to infrastructure as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007). Additionally, precipitation will increase during winter months in much of the Northeast; however, during the winter, there may be an increasing amount falling as rain, rather than snow, which will affect runoff and infiltration rates. More frequent storm surge flooding and permanent inundation of coastal ecosystems and communities is likely during the 50-year permit term in some low-lying areas in the northeast (USGCRP 2009).

For the Midwest region, annual precipitation has increased, up to 20% in some areas, with much of this coming from more heavy precipitation events (NAST 2001). Similar to the Northeast, these heavy precipitation events will result in increased local and regional flooding events with damage to infrastructure, as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007; USGCRP 2009). Also, the Midwest has experienced two record-breaking floods in the past 15 years (NOAA 2008).

For the Southeast region, annual rainfall trends show very strong increases of 20-30% or more over the past 100 years across Mississippi, Tennessee, and parts of Louisiana, with mixed changes across most of the remaining area. The percentage of the Southeast landscape experiencing severe wetness increased approximately 10% between 1910 and 1997 (NAST 2001). There has been an increase in heavy downpours in many parts of the Southeast region. Similar to the Northeast and Midwest, these heavy precipitation events will result in increased local and regional flooding events with damage to infrastructure as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007) (USGCRP 2009). More frequent storm surge flooding and permanent inundation

of coastal ecosystems and communities is likely during the 50-year permit term in some low-lying areas, particularly along the central Gulf Coast USGCRP 2009).

Flood events that could affect the MSHCP's day-to-day conservation strategies and mitigation projects would likely be temporary in nature. When such floods occur, NiSource could experience a temporary inability to gain access to covered lands (as described within this MSHCP), to conduct covered activities (as also described within this MSHCP). Such covered activities would be postponed until the flood waters diminished and normal activities could resume (unless an activity qualified as an "emergency" as defined by the USDOT that must be carried out under all conditions). These flood events will likely be of duration of less than 30 days.

Floods - Changed Circumstances vs. Unforeseen Circumstances

Severe floods have the potential to damage both minimization and mitigation efforts. When a flood occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). For day-to-day conservation strategies, any inundation of a portion of the covered lands by flood waters that lasts for more than 60 days will be considered an unforeseen circumstance. If a mitigation effort is destroyed by flooding three or more times in a five-year period, it also will be considered an unforeseen circumstance.

Bog Turtle

Flooding Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore, and maintain high-quality wetland habitat and associated upland buffers for bog turtles. Flooding has the potential to adversely impact habitat restored for bog turtle, including the establishment and maintenance of protective vegetative buffers around bog turtle wetlands. Some flood events may cause wetland habitats protected and restored as mitigation for bog turtles to become unsuitable. If this occurs, bog turtles may either disperse the area to find more suitable habitat, or potentially succumb to the stress brought on by habitat loss and/or degradation. In response to this potential threat, NiSource will identify and design bog turtle mitigation projects that are resistant to or least likely to be affected by the adverse impacts caused by flood events. In addition, NiSource will develop management safeguards for maintaining productive bog turtle habitats in the event that mitigation habitats become degraded or destroyed by floods. Were degradation or destruction to occur, NiSource can either relocate affected bog turtles to environments with suitable hydrologic regimes and/or restore the habitat through active habitat management. All mitigation sites will be monitored for the life of the permit to ensure they provide suitable habitat for bog turtles.

<u>Trigger – Flooding Affects a Bog Turtle Wetland at a Mitigation Site</u>

Triggers to initiate a NiSource response are:

(1) Reduction in core fen habitat with appropriate hydrology from the acreage restored as part of the mitigation; and/or

(2) Reduction in nesting habitat from the acreage restored as part of the mitigation.

Response

In the event either of the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management).

Trigger – Flooding Affects a Bog Turtle Protective Upland Buffer at a Mitigation Site

Triggers to initiate a NiSource response are:

(1) Reduction of upland buffer for core fen habitat with appropriate hydrology from the acreage restored as part of the mitigation; and/or

(2) Reduction in upland buffer for nesting habitat from the acreage restored as part of the mitigation.

Response

In the event either of the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site after the flooding is over (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management).

Mussels

Some floods can adversely affect riverine ecosystems by re-arranging river bed habitats, scouring away aquatic/riparian vegetation, and increasing the drift of aquatic invertebrates. This, in turn, can cause mortality by desiccation of mussels stranded when stream water levels fall, crushing of mussels by large deposits of substrata on the river bed and by mussels being washed out to sea. Flooding could affect the establishment of protective riparian buffers by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism for this would be that floodwaters wash away, drown, or severely impact the growth of the trees, shrubs, or grasses planted as part of the restoration. Flooding could also wash away the land on which the mitigation buffer was planted. Flooding could also negatively impact in-stream habitat restored for mussels (i.e., gravel or cobble to enhance or restore habitat in the construction zone of a pipeline crossing or other in-channel work). The mechanism would be the energy of a large flood silting-in or washing away the material placed as a substrate for mussels.

Flooding Adversely Affects a Mussel Site

One mitigation option available to NiSource is to restore and maintain mussel habitat in select streams, primarily by establishing and maintaining protective riparian buffers. As stated above, floods may adversely impact mussels and habitat restored and established for them as part of NiSource's proposed mitigation. Flooding may also destroy new riparian plantings (i.e., trees, shrubs and ground cover), while prolonged inundation of the riparian area may have similar effects. In response to the potential for a large and prolonged flood event to adversely affect mussels and habitat restored for the benefit of mussels, NiSource will identify mussel mitigation projects that span multiple regions (within the limits of the species' ranges). In the event that existing or restored habitats become degraded or destroyed, NiSource can relocate the affected mussels to environments with suitable habitats.

Trigger – Flooding Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding affects a mussel population at a mitigation site is documentation of a flood event plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the flood. The monitoring sequence would be: (1) document that the flood impacted the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Relocate the mitigation to another site where it will positively impact the target mussel species; and/or

(2) Restore habitat mitigation damaged by the flood, if any, and reintroduce the target species to the site by implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the species.

Trigger - Flooding Affects a Mussel Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, flooding affects establishment and/or maintenance of a protective riparian buffer is documentation of a flood event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Acquire easements or fee title to additional area landward of the existing site and restore or replace the riparian buffer on-site;

(2) Restore or replace the riparian buffer on-site; and/or

(3) Acquire sufficient easements or fee titles at a new site to reestablish the original level of mitigation for the target species.

Trigger – Flooding Affects In-Stream Habitat at a Mussel Mitigation Site

The trigger for NiSource to implement corrective action where flooding impacts substrate placed for mussels is documentation of a flood event with greater than 25% of the area of the enhanced or restored habitat either silted-in or washed away from its original placement or where there is a combination of both impacts to greater than 25% of the area of habitat enhancement/restoration. NiSource suggests that, while there is no data indicating the ecological significance of 25% habitat loss, such a loss would likely represent an ecologically significant loss of individuals at the mitigation site, beyond which corrective action would be warranted. Such a quantification also has practical advantages with respect to assessment of impacts to a site

after a flood event (in a large flood event, the actual channel size, location, or morphology could be changed).

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the damaged area of the in-stream enhancement/restoration; and/or

(2) Implement an in-stream enhancement/restoration at another mussel construction site equal to the total area of the one impacted. This will be added on to either the up-stream or downstream end of the mitigation implemented at this new site, whichever would be more beneficial to the species.

Indiana Bat

Floods have the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require stable microclimates inside hibernacula as well as high-quality wooded habitats for summer and spring staging and fall swarming near hibernacula. However, floods have the potential to adversely impact hibernacula and wooded habitats protected and restored for Indiana bats. Floods may destroy protective and/or restoration measures (i.e., air dams, gates, etc.) at hibernacula as well as significantly reduce the survival of protected and/or restored vegetation in wooded habitats, thereby making these habitats unsuitable for basic life history requirements of the species. If this were to occur, some or all Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula and/or wooded habitats used by the bats would not be protected from other threats.

Flooding Adversely Affects an Indiana Bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula.

Trigger – Flooding Affects Indiana Bat Winter Habitat (i.e., hibernacula) at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding at a hibernacula adversely affects Indiana bats at a mitigation site is a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as a sole product of the flooding and not a product of other impacts to the hibernacula that could result in population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

If the preceding trigger occurs, NiSource will either develop a hibernacula restoration plan to correct the damage to the protective and/or restoration measures implemented at the

hibernacula or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take.

Trigger – Flooding Affects Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding affects the establishment of wooded habitats restored and/or managed for the benefit of Indiana bats is survival of fewer than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Response

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Reestablish the original level of mitigation at a new site for the species.

Trigger – Flooding Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding damages or destroys the maintenance of wooded habitats restored and\or managed for the benefit of Indiana bats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Response

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Flooding Adversely Affects a Nashville Crayfish Mitigation Site

As discussed above, large flood events can adversely affect riverine ecosystems by rearranging river bed habitats, scouring away aquatic/riparian vegetation, and increasing the drift of aquatic invertebrates. Like mussel species, flood events have the potential to adversely affect implementation and success of NiSource's operating conservation program for Nashville crayfish. Floods could negatively impact slab rock placed by NiSource to enhance or restore in-stream habitat in the construction zone of a pipeline crossing or other in-channel work. The

mechanism would be the energy of a large flood silting-in or washing away the material placed as cover habitat for crayfish.

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Floods may adversely impact Nashville crayfish and habitat restored and established for the species, including protective riparian buffers. Severe flooding could also wash away the land on which the riparian buffer was planted. In response to this potential threat, NiSource will identify habitat mitigation projects that span hydrologic boundaries, in the event existing or restored habitats become unsuitable for the species. NiSource can re-establish a riparian buffer in such areas and/or relocate affected Nashville crayfish to environments with suitable habitat.

Trigger – Flooding Affects In-Stream Habitat at a Nashville Crayfish Mitigation Site

The trigger for NiSource to implement corrective action where flooding impacts habitat placed to serve as cover habitat for Nashville crayfish is documentation of a flood event with greater than 25% of the enhanced and\or restored area either silted-in or washed away from its original placement, or where there is a combination of both impacts to greater than 25% of the area of habitat enhancement/restoration.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the damaged area of the in-stream enhancement/restoration; and/or

(2) Implement an in-stream enhancement/restoration equal to the total area of the one impacted at another Nashville crayfish construction site. This will be added on to either the up-stream or downstream end of the mitigation implemented at this new site, whichever would be more beneficial to the species.

Trigger – Flooding Affects a Protective Riparian Buffer at a Nashville Crayfish Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, flooding affects establishment and/or maintenance of a protective riparian buffer is documentation of a flood event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Acquire easements or fee title to additional area landward of the existing site and restore or replace the riparian buffer on-site;

(2) Restore or replace the riparian buffer on-site; and/or

(3) Acquire sufficient easements or fee titles at a new site to reestablish the original level of mitigation for the species.

10.3.4 Fire

Fire is a naturally occurring component of the ecosystems in the planning area. In reviewing data on historic natural fire regimes (Fire Sciences Lab 2000), while a fire regime characterized by 0-35 year frequency and low severity predominates, there is a range of historic fire return rates and severity in the MSHCP planning area. In most of Ohio, West Virginia, New York, and part of Kentucky, there was a historic fire regime in which fire frequencies of every 35-100 years and mixed severity were more common. Southern Louisiana and small portions of Tennessee, Indiana, and Pennsylvania historically had more frequent fires (every 0 to 35 years) of stand replacement severity. The IPCC noted in its 2007 report that for the southeast region, there was a higher likelihood that change in forest character could occur as disturbances (e.g., fire and insect outbreaks) may increase in the future.

Fire - Changed Circumstances vs. Unforeseen Circumstances

While fire events can have considerable impact on the local structure and function of vegetation found at a minimization or mitigation site, the likelihood that a fire will occur at a specific site chosen for mitigation is low. Fires do, however, occur and have the potential to destroy both minimization and mitigation efforts. As such, NiSource is anticipating that fires could adversely affect minimization or mitigation projects for several of the species. When a fire occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will treat such fire as a changed circumstance and implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). However, fires that damage or destroy a minimization or mitigation effort three or more times within a five-year period will be considered an unforeseen circumstance and will not require a NiSource response.

Bog Turtle

Fire Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore and maintain wetland habitat for the benefit of bog turtle populations. Fire has the potential to adversely affect a bog turtle mitigation site. Fires may injure or destroy bog turtle nests, hatchlings, and adults, and adversely impact the vegetation within the wetland and any upland vegetative buffers. In response to this potential threat, NiSource may work with landowners and others to protect against potential wildfires occurring within and around bog turtle mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger

The trigger to initiate a NiSource response is notification that a fire has impacted a bog turtle mitigation site during one of the species' active periods.

Response

In the event that a fire goes through a bog turtle site during the species' active period, the site will be surveyed for dead or injured turtles, and any injured turtles will be sent to an appropriate rehabilitation facility. In the event that a fire damages a bog turtle mitigation site, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Mussels

Fire Adversely Affects a Mussel Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Fires have the potential to adversely affect mussel mitigation sites, primarily through damage or destruction to the riparian vegetation established and maintained to protect the species and their habitat. If such were to occur, mussels and the in-stream habitats restored and maintained for their benefit could be adversely affected. To alleviate these potential threats, NiSource may work with landowners and others to protect against potential wildfires occurring within and around mussel mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects a Protective Riparian Buffer

The trigger for NiSource to implement corrective action where fire affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Indiana Bat

Fire Adversely Affects an Indiana Bat Mitigation Site

Fire has the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require stable microclimates inside hibernacula as well as high-quality wooded habitats for summer and spring staging and fall swarming near hibernacula. However, fires have the potential to adversely impact hibernacula and wooded habitats protected and restored for Indiana bats. Fires (i.e., smoke) may injure or kill Indiana bats at hibernacula. Fires may also destroy Indiana bat roosts, pups, and adults in wooded habitats as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species. If such were to occur, some or all Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula and/or wooded habitats used by the bats would not be protected from other threats. Indiana bats could also disperse to less suitable habitats with other threats. To alleviate this potential threat, NiSource may work

with landowners and others to protect against potential wildfires occurring within and around Indiana bat mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where fire affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Fire Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where fire affects the maintenance of the wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Fire Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Fires have the potential to adversely affect a Nashville crayfish mitigation site, primarily through damage or destruction to the riparian vegetation established and maintained to protect the species and its habitat. If such were to occur, Nashville crayfish and the in-stream

habitats restored and maintained for their benefit could be adversely affected. To alleviate these potential threats, NiSource may work with landowners and others to protect against potential wildfires occurring within and around Nashville crayfish mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects a Protective Riparian Buffer Mitigation Site

The triggers for NiSource to implement corrective action where fire affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses .

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.5 Tornados

While tornados are known to occur throughout the MSHCP planning area, it is important to understand the likelihood that any particular place will be struck by a tornado is low. One measure is the annual average number of tornadoes per 10,000 square miles by state. In the fourteen states crossed by the MSHCP planning area, the average number of tornadoes per 10,000 square miles ranged from 0.8 in West Virginia to 6.1 in Indiana. Annual average number of tornados during the same period of time ranged between 1 in Delaware to 27 in Mississippi and Louisiana, with the average number of tornados in the fourteen states being 12.7. On average in the U.S., the frequency that any particular square mile of land may be hit by a tornado is about every thousand years (NOAA 2008).

Tornados – Changed vs. Unforeseen Circumstance

When a tornado occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). NiSource is anticipating and planning for one tornado to adversely affect every mitigation site over the life of the 50-year permit. If a mitigation site is destroyed by a tornado more than once, it will be considered an unforeseen circumstance.

Mussels

Tornado Affects a Mussel Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Tornados could damage or destroy riparian vegetation established and maintained to protect in-

stream mussel habitat. Were such to occur, in-stream habitats restored and maintained for the benefit of mussels could be adversely affected.

Trigger – Tornado Affects a Protective Riparian Buffer at a Mussel Mitigation Site

The triggers for NiSource to implement corrective action where a tornado affects establishment and/or maintenance of a protective riparian buffer for mussels at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Clean-up the mitigation site to allow for normal growth of the newly established trees, shrubs, and grasses.

Indiana Bat

Tornado Adversely Affects an Indiana Bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula. Tornados have the potential to adversely impact habitat restored for Indiana bats. Tornados may destroy protective and/or restoration measures at hibernacula as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species.

Trigger – Tornado Affects Indiana Bats in Winter Habitat (i.e., hibernacula) Mitigation Site

The triggers for NiSource to implement corrective action is where a tornado at a mitigation hibernacula adversely affects the Indiana bat population with a 25% or more reduction in the number of the bats at the site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as resulting solely from the tornados and not a product of other impacts to the hibernacula that cause population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the proposed mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to a confirmed reduction in population as a result of a tornado at a NiSource mitigation site, NiSource will either develop a hibernacula restoration plan to correct the damage to the protective and/or restoration measures already implemented at the hibernacula or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take.

Trigger – Tornado Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that the greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Tornado Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects the maintenance of the wooded habitats is survival at any time during the life of the ITP of fewer than 75% of the planted trees, shrubs, and grasses.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Tornados Affect a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Tornados may adversely impact habitat restored and established for Nashville crayfish, particularly the protective riparian buffers. The mechanism for this would be blowing down or uprooting trees, shrubs, and associated grasses, or distributing debris across the site that interferes with normal growth.

Trigger – Tornado Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects establishment and/or maintenance of riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Clean-up the mitigation site to allow for normal growth of the newly established trees, shrubs, and grasses.

10.3.6 Disease

During the term of the requested permit, it is anticipated that disease may affect some of the MSHCP species or their habitat.

Disease – Changed vs Unforeseen Circumstance

When a disease occurs that adversely affects a NiSource mitigation effort, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). Diseases also have the potential to impact populations of species that extend beyond mitigation sites and result in a changed circumstance. It is not possible to predict with any certainty the frequency of disease outbreaks. However, as a component of this MSHCP, any disease that damages or destroys a minimization or mitigation effort three or more times within a five-year period will be considered an unforeseen circumstance and will not require a NiSource response.

Bog Turtle

Disease Affects a Bog Turtle Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects Bog Turtle Population Numbers at a Mitigation Site

Any confirmed disease outbreak that results in mortality to adult bog turtles at any mitigation site (greater than two adults in one year).

Response

NiSource will promptly inform the Service, assist the Service with transport of bog turtles (dead or injured) to a rehabilitation facility or lab as requested, and identify and implement decontamination protocols, as appropriate.

Trigger – Disease Affects Protective Upland Buffer at Bog Turtle Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective upland buffer around a bog turtle wetland at any time during the life of the permit is survival of less than 75% of the planted trees and shrubs or less than 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Mussels

Disease Adversely Affects a Mussel Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective riparian buffer for mussels at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Indiana Bat

White-nose syndrome

White-nose syndrome (WNS) was first documented in a cave in New York in early 2006 and was named for an apparent white fungus present predominantly on the noses of hibernating bats. It has been suggested the presence of this previously unidentified, cold-loving fungus is linked to the recent unprecedented bat mortality occurring in northeastern states. It is estimated that greater than one million bats have perished from Vermont to Tennessee. In caves where the fungus is confirmed, mortality of bats appears to range from 80 percent to 100 percent of hibernating bats based on winter surveys. Affected bats include Indiana bat, little brown bat, big brown bat, tri-colored bat (Eastern pipistrelle), northern long-eared bat, and small-footed bat (Service 2009f, USGS 2009).

It is not clear whether the fungus associated with WNS is lethal, but observations indicate it is definitely associated with the death of congregating bats (e.g., bats that winter together in close proximity in hibernacula). The fungus observed on bats in affected caves may represent an overgrowth of one or more normal fungal colonizers of bat skin during the hibernation period and could be an indicator of overall poor health, rather than a primary pathogen. Investigations into the cause of the morbidity, including underlying environmental factors, potential secondary microbial pathogens, and/or toxicants, are ongoing.

As of April 2010, WNS has been identified (or is likely) in caves/mines in New York, Vermont, New Hampshire, Massachusetts, Connecticut, New Jersey, Pennsylvania, Virginia, West Virginia, Tennessee, Missouri (likely), Quebec, and Ontario. In an effort to better understand WNS and eventually control the widespread bat mortality, the Service, USGS, state agencies, and bat conservation groups have been investigating the geographical extent of the outbreak, revisiting sites to determine the amount of mortality, providing bat specimens to laboratories throughout the United States for analysis to help determine the cause of bat deaths, issuing cave closures and requirements for decontamination procedures for cavers and bat handlers, and educating the public about WNS (Service 2009f, USGS 2009).

As stated above, Indiana bat populations are affected by WNS throughout the northeastern part of its range which overlaps with multiple states in NiSource covered lands; therefore, impacts associated with WNS are part of the baseline when considering the effects of NiSource covered activities. However, WNS is also considered a changed circumstance as it is reasonable to assume that WNS will continue to spread to other states and potentially impact Indiana bats throughout all states in NiSource covered lands.

As WNS continues to impact Indiana bats, the likelihood of NiSource encountering Indiana bats may decrease but the importance of protecting Indiana bats that may be resistant to WNS (if any exist) increases. Fortunately, NiSource has developed many avoidance and minimization measures to reduce the impact of activities addressed in the MSHCP on the Indiana bat.

It should be noted that other diseases may also impact NiSource's operating conservation program for Indiana bats. NiSource and the Service would expect triggers and responses similar to those provided below to be implemented for WNS.

Trigger – Disease Affects Indiana Bat Populations within Recovery Units and/or Range-wide

Avoidance and minimization measures, as well as mitigation measures, may need to be reevaluated should impacts from WNS result in the reduction of any proposed recovery unit's population or the reduction of the species' overall range-wide population to determine whether NiSource covered activities may jeopardize the continued existence of the species. The Service is currently developing a demographic model to assist its evaluations. It is premature, however, to arbitrarily assign a percentage reduction to be used in the evaluation.

Responses

In response to an identified change in Indiana bat populations within the recovery units and/or range-wide as a result of WNS, NiSource and the Service will reevaluate NiSource's operating conservation program for Indiana bats (e.g., avoidance and minimization as well as mitigation measures) and, if possible, implement agreed upon revisions in order to ensure adequate compensation for the impact of take incurred as well as to remedy any inconsistency with Section 1539(a)(2)(B)(iv) of the ESA.

Disease to vegetation

Disease could also affect the establishment of a wooded habitats used by Indiana bats in summer and/or during spring staging/fall swarming near hibernacula by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of this wooded habitat by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or could be the result of synergistic effects with drought or flooding.

Trigger – Disease Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action under this scenario is when there is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that the greater than 50% will be permanently impaired (e.g., inordinately subject to future disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Disease Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action under this scenario is survival of less than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Disease Adversely Affects a Nashville Crayfish Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen or the result of a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.7 Invasive Species

During the term of the requested permit, it is likely that a non-native plant or animal species may occur or be introduced in areas that could affect species or the suitability of their habitats. In addition, aggressive native species can be considered invasive in certain situations. The mitigation strategy is designed to take in new information and evaluate mitigation proposals such that the best available sites are selected and protected. While invasive-species control

would be a part of management funding (provided as part of mitigation projects), there may be certain invasive species characteristics that present particular challenges.

In the event that an invasive species affects a mitigation site to the point where it is not performing as designed, NiSource will implement the following corrective actions:

1. Prepare a damage report;

2. Identify remedial actions to address the threat; and

3. Respond in ways that are consistent with permit obligations and with the consent of the Service.

Invasive Species – Changed vs. Unforeseen Circumstance

Large infestations (e.g., affecting greater than 50% of the mitigation site) of a new or existing exotic plant or animal can become extremely expensive to control and heavily tax the operating budget of the MSHCP. For instance, the invasion of the zebra mussel poses a significant threat to other mussel species in many regions of the U.S., and species extinctions are expected as a result of its continued spread in the eastern United States. For the purposes of this MSHCP, an infestation of a new invasive species or the spread of an existing invasive species that results in the mitigation site not accomplishing its designed purpose for more than three out of five years is considered an unforeseen circumstance.

Bog Turtles

Invasive Species Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore, and maintain wetland habitat for the benefit of bog turtle populations. Invasive plant species (e.g., purple loosestrife, phragmites, reed canary grass), which pose a threat to the majority of known bog turtle sites, are likely to be present at mitigation sites that would be established and maintained. NiSource's mitigation measures, which include habitat restoration and management to reduce the presence of invasive species in bog turtle wetlands, are addressed in Chapters 6 (Section 6.2.2.6) and 7 (Adaptive Management).

Trigger – Invasive Species Affects Establishment and Maintenance of Bog Turtle Mitigation Site

The trigger for NiSource to implement corrective action where invasive plant species affects establishment and/or maintenance of a protective riparian buffer is encroachment of more than an estimated 25% of the area at the bog turtle mitigation site.

Response - Follow measures described in Chapter 7.

Mussels

Invasive Species Adversely Affects a Mussel Mitigation Site

A number of invasive species or nonnative species of aquatic organisms are firmly established in the range of mussel species. Zebra mussels attach to the shells of native mussels in great masses, effectively smothering them. The mechanisms by which zebra mussels impact native mussels have been reviewed in detail (Service 2002a). The invasion of the zebra mussel and its congener the quagga mussel (Dreissena rostriformis bugensis) pose a significant threat to

mussel species in many regions, and species extinctions are expected as a result of their continued spread in the eastern United States.

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Invasive species, particularly zebra mussels, could significantly affect mussel populations at NiSource mitigation sites. The mechanism would be direct impacts to native mussels (e.g., zebra mussels) or competition for food, space, or other resources. Invasive species could also affect establishment and maintenance of the protective riparian buffers at mussel mitigation sites by killing or interfering with growth of vegetation (e.g., trees or native grasses) that is planted as part of the mitigation. The mechanism would be the direct destruction (e.g., defoliation) of the vegetation by some invasive species.

Trigger – Invasive Species Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects a mussel population at a mitigation site is the documented presence of an invasive species plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after occupation by the invasive species. The monitoring sequence would be: (1) document that invasive species occur in the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the mussel species is present and deemed secure; and/or

(2) Correct the invasive species problem at the mitigation site and reintroduce mussels to the original mitigation site following all Service and other applicable protocols for augmentation, enhancement, or reintroduction of mussels.

Trigger – Invasive Species Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects establishment and/or maintenance of riparian buffer at any time during the life of the permit is the documented presence of an invasive species affecting the mitigation site and the survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the riparian buffer on-site;

(2) Destroy the invasive species and restore or replace the riparian buffer on-site; and/or

(3) Acquire easement or fee title to a new site to reestablish the original level of mitigation for the target species.

Indiana Bat

Invasive Species Adversely Affects an Indiana bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula. Invasive species have the potential to adversely impact habitat restored for Indiana bats. Invasive species may destroy protective and/or restoration measures at hibernacula as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species.

Trigger – Invasive Species Affects Indiana Bat Winter Habitat (i.e., hibernacula) at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species adversely affects Indiana bats at an hibernacula on a mitigation site is a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as the sole product of the invasive species and not as a product of other impacts to the hibernacula that could result in population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to the confirmed reduction in population as a result of invasive species at a mitigation site, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Invasive Species Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure, and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Invasive Species Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species affects the maintenance of wooded summer and/or spring staging/fall swarming habitat at a mitigation site is survival of less than 75% of the planted trees, shrubs, and grasses at any time during the life of the ITP.

Response

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Invasive Species Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. An alien invasive crayfish species, like rusty crayfish (Orconectes rusticus) or one of the other resident Orconectes species in the Mill Creek watershed (O. placidus or O. durrellii), could adversely affect Nashville crayfish populations by causing mortality or stress in the Nashville crayfish for which the mitigation is designed (inter-specific competition with other crayfish). Other invasive species could also affect establishment and maintenance of the protective riparian buffers at Nashville crayfish mitigation sites by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the direct destruction (e.g., defoliation) of the vegetation by some invasive species.

Trigger – Invasive Species Affect Nashville Crayfish Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species (e.g., rusty crayfish) affects Nashville crayfish at a mitigation site is the documented presence of an invasive species plus data indicating an average population growth rate of less than 1.0 of the Nashville crayfish population over a five-year period after the occupation of the invasive

species. If at the end of five years the average population growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the Nashville crayfish is present and deemed secure; and/or

(2) Correct the invasive species problem at the mitigation site and reintroduce Nashville crayfish to the original mitigation site following all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the species.

Trigger – Invasive Species Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects the maintenance of riparian buffer at any time during the life of the permit is the documented presence of an invasive species that is affecting the mitigation site and survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the riparian buffer on-site;

(2) Destroy the invasive species and restore or replace the riparian buffer on-site; and/or

(3) Acquire easement or fee title to a new site to reestablish the original level of mitigation for the species.

10.3.8 Newly-identified Species Occurrences/Range Expansion/Contraction

Trigger

Identification of MSHCP species in new locations or habitat. For the purpose of this trigger, new locations includes newly discovered occurrences or habitat, as well as historical occurrences that are later shown to be extant or reoccupied. It may also include newly-discovered occurrences or habitat outside the covered lands, but only to the extent that their proximity indicates species presence or habitat suitability on covered lands

Response

NiSource will implement AMMs to avoid and minimize adverse effects and take of new occurrences of habitat. To the extent that take cannot be avoided, NiSource will mitigate for the impact of any take consistent with Chapter 6. If it is determined that the amount of authorized take will be exceeded and that the impacts to the species are greater than anticipated, the provisions of Chapter 9 will apply.

10.3.9 Species Listing/Delisting

MSHCP Species

If unlisted species that are "adequately covered" (as defined in 50 C.F.R. §17.3) in the MSHCP, i.e., "MSHCP species," are listed subsequent to issuance of the requested permit, the permit will afford NiSource protection against take liability for such species under Section 9 of the ESA and the Service's implementing regulations as of the effective date of such listing. No further conservation measures or other action will be required of NiSource under the ESA. NiSource has requested that all adequately covered "MSHCP species," whether listed or unlisted, be named on the requested permit. Under the terms of the permit, permit coverage for any unlisted MSHCP species will become effective upon the listing of such species under the ESA provided NiSource is properly implementing the MSHCP, permit conditions and IA.

Non-MSHCP Species

Unlisted species that are neither addressed as "MSHCP species" in the MSHCP nor "adequately covered" (50 C.F.R. §17.3) will not be included in the permit. The Service will notify NiSource of the potential listing of any unlisted species that is not covered by the MSHCP but that could be affected by NiSource activities within the covered lands, including, but not limited to, those activities listed as "covered activities" herein. The Service also will notify NiSource upon the listing of any such species. Upon receipt of such notice, NiSource may enter into negotiations with the Service regarding amending the MSHCP, ITP, and associated documents, in accordance with Chapter 9 of this MSHCP to obtain take coverage for the newly listed species. In the alternative, NiSource may consult with the Service under Section 7 of the ESA.

Species Delisting

In the event that any MSHCP species is delisted during the term of the ITP, NiSource and the Service will confer on a case-by-case basis to determine how such delisted MSHCP species will be addressed thereafter under the MSHCP and ITP. NiSource will continue all conservation measures specific to any delisted MSHCP species until such discussions are complete. In those cases, and for those species where NiSource's conservation activities may contribute to the recovery of the species, NiSource will complete its ongoing mitigation projects.