HABITAT RESTORATION

EW-6

3 POINTS

GOAL

Offset the destruction and deterioration of natural habitat caused by road construction. Restore and protect natural habitat beyond regulatory requirements.

CREDIT REQUIREMENTS

Complete Option A or B.

Option A – For projects required to mitigate habitat impacts through restorative practices (3 points)

Implement a restoration/preservation plan that restores and/or preserves more area by 5% beyond what is required such that one of the following metrics below is met:

1. Total area of restored and/or preserved habitat equals or exceeds 105% of total required mitigation area
2. Total restoration and/or restoration cost equals or exceeds 105% of total cost required for restoration/preservation due to the roadway project

Option B - For projects not required to mitigate habitat impacts through restorative practices (3 points)

Conduct a biological assessment of the pre-development condition of the project site and surrounding ecosystem or watershed and implement a restoration plan that includes all seven items below:

1. Restores an area equal to the total disturbed surface area of the roadway project.
2. States quantifiable goals regarding at least one of the performance metrics outlined below.
3. Describes ecological design or engineering elements that are expected, with reasonable professional certainty, to meet the goals stated above.
4. Lists responsible parties for restoration activities and subsequent monitoring efforts.
5. Lists sources of funding for restoration activities and subsequent monitoring efforts.
6. Completes restoration activities prior to the roadway facility opens to traffic, ideally during project planning.
7. Is signed and approved by the responsible parties or the project ecologist.

Details

Disturbed surface area includes all cut and fill soils for pavement areas, shoulders, embankments, bridge abutments and construction staging areas. In other words, any earthwork area that is required for the road itself is included, but the area designated for habitat creation or restoration is not.

The total required surface area can be made up of multiple types of restoration and preservation efforts, so long as the project team can show that the total restored and preserved areas meet the above requirements.

Preserved habitat areas may not be previously designated open space. Preservation designations must be directly associated with the project and be in place by 40

RELATED CREDITS

- ✓ EW-2 Runoff Flow Control
- ✓ EW-3 Runoff Quality
- ✓ EW-5 Site Vegetation
- ✓ EW-7 Ecological Connectivity
- ✓ EW-8 Light Pollution

SUSTAINABILITY COMPONENTS

- ✓ Ecology
- ✓ Equity
- ✓ Extent
- ✓ Experience

BENEFITS

- ✓ Restores Habitat
- ✓ Creates Habitat
- ✓ Reduces Manmade Footprint
- ✓ Increases Aesthetics

years after the end of construction, the expected design lifetime of the project, or local regulations, whichever is longest. Preservation areas must also be:

- Formally designated permanent as open space according to the definitions of the governing agency or zoning authority.
- Clearly and publicly attributed to the work done for the roadway project.
- Compliant with all applicable zoning requirements of the jurisdiction.
- Appropriately vegetated for the location and context.

The following performance metrics are considered suitable for achieving credit where a restoration plan is developed:

- For roadways with watersheds receiving stormwater runoff from the roadway, determine the predevelopment Index of Biological Integrity (IBI) as part of the biological assessment. **Predevelopment IBI** (for purposes of this credit only) means the reference condition for this metric that is established exclusively for restoration work for the roadway project, measured within a reasonable amount of time prior to groundbreaking of construction. Set a target IBI that meets or exceeds predevelopment conditions.
- For roadway projects including stream restoration, set a target limit on unstable slopes. This target should not exceed predevelopment conditions. In addition, establish a minimum riparian buffer width for the stream.
- For forest restoration, maintain areas of interior habitat equal to predevelopment conditions. Interior habitat requirements (distance to forest edge) should be defined in the biological assessment.
- Restoration of Brownfield sites must result in removal of Brownfield status. This should result in land that is suitable for development. Note that this includes Brownfield land used for the roadway corridor.
- If a specific species is the target of a restoration plan, set population goals for the target species. Plant and animal species are both acceptable, but must be native to the project region.
- Other restoration goals as recommended by the project ecologist, biologist, or other restoration expert. Justification of this goal should be included in the restoration plan.

While these metrics represent important performance indicators, the overall goal of the restoration project should be promotion of biodiversity and creation of dynamic, functioning habitat.

DOCUMENTATION

- Copy of the executive summary from the biological assessment.
- Copy of the restoration/preservation plan, highlighting the boundaries of the restored areas and the roadway project. If offsite, provide separate plans showing both areas.
- Copy of the schedule of restoration activities or preservation efforts demonstrating that the completion of all restoration activities and preservation efforts coincides with or occurs prior to opening to traffic.

APPROACHES & STRATEGIES

- Follow the guidelines for habitat restoration outlined in the Federal Highway Administration Eco-logical: An Ecosystem Approach to Developing Infrastructure Projects (Brown, 2006). Eco-logical can also be used for guidance in development of regional ecological frameworks. This document is available at: http://www.environment.fhwa.dot.gov/ecological/eco_index.asp
- Involve an ecologist or other biological professional early in the planning phase of the project to determine feasibility of restoration work.
- Coordinate with land use management agencies early in the planning phase of the project to determine scope and significance of potential restoration activities.
- Coordinate with water management agencies early in the planning phase of the project to determine IBI for the biological assessment, especially in the cases where stormwater runoff from roadways is not treated.

- Use geographic information systems (GIS) mapping software to determine calculations for disturbed and restored surface areas.
- Anticipate that restoration activities take a significant amount of thoughtful planning, and are best started prior to the construction of the roadway project.
- Start a community stream monitoring effort. Most bioindicator species can be identified by amateurs and those willing to learn well enough to establish at least a family taxonomic level. (University of Washington, 2001)
- Collaborate with adjacent governing agencies to create mutually beneficial (and potentially mutually funded) restoration projects in conjunction with the roadway.
- Coordinate with water resources professionals early in the planning phase of the project to develop and implement a watershed management plan in tandem with a habitat conservation plan (Brown, 2006). Roadway projects can be integrated into both types of plans, including establishing minimum goals for treatment of stormwater impacts on water quality for receiving water bodies and preservation of aquatic habitat.
- Avoid introduction of invasive species through landscaping activities. See also Credit EW-5 Site Vegetation.

Example: Off-Site Mitigation - Springbrook Creek Wetland & Habitat Mitigation Bank

The Springbrook Creek Wetland & Habitat Mitigation Bank was a combination of wetland enhancement and restoration covering 130 acres in Renton, Washington. These efforts were aimed at mitigating the increased runoff caused by construction of additional lanes on Interstate 405 and future regional transportation projects, as well as creating wildlife habitat. The project site is located in an area surrounded by heavy development and two major freeways. An emphasis was placed on the planting of a large variety and number of native plants, enhancing the attractiveness of the site to local fauna. In addition, a boardwalk was constructed through the site to raise public awareness of the importance of wetland habitat. Construction was completed in June, 2009. Figures EW-6.2 and EW-6.3 show the restored wetland and boardwalk, as well as local wildlife.

More information on this project is available at: http://www.wsdot.wa.gov/Projects/i405/Springbrook/

Figure EW-6.2: Geese family in the Springbrook Creek wetland (Photo by WSDOT)

Figure EW-6.3: Great blue heron perched on boardwalk (Photo by WSDOT)

Example: Management Tools for Habitat Restoration

There are several guidance documents available for roadway projects on watershed assessment and habitat restoration from many public agencies.

- State Wildlife Action Plans. Comprehensive wildlife conservation strategies are mandated by the federal government and managed by the states. These strategies offer broad reaching wildlife goals tailored to each state. Helpful resources, including sample plans, are available through the Association of Fish & Wildlife Agencies: http://www.wildlifeactionplans.org
- EPA's Handbook for Developing Watershed Plans to Protect and Restore Our Waters. EPA provides a wealth of informational resources on watershed planning: http://water.epa.gov/polwaste/nps/handbook_index.cfm
- The National Action Plan to Implement the Hydrogeomorphic Approach to Assessing Wetland Functions. This action plan provides ways to measure watershed functions: http://water.epa.gov/lawsregs/guidance/wetlands/hgm.cfm

Example: Indiana Department of Transportation and Indiana Bat Habitat

The need for highway improvements near the Indianapolis International Airport brought together several agencies, including the Indiana Department of Transportation and the local Federal Highway Administration, to develop a plan to protect and conserve local habitat for the Indiana bat, an endangered species. The plan, called the HCP (Habitat Conservation Plan) has the following features that would help meet this credit:

- 3,600 acres protected (approximately 10% existing bat habitat)
- 346 acres of newly planted habitat
- A public outreach program
- A 15-year monitoring program

The HCP was completed in conjunction with approximately $1.5 billion in highway improvements in an area forecasted for high urban growth. More information about the HCP can be found in *Eco-Logical* (Brown, 2006).

POTENTIAL ISSUES

1. Ecologists and environmental engineers are not always aware of all biological or habitat needs of all species that may be targeted for a habitat, nor can all of the resources to meet these needs be acquired in all cases. Thus, there is a large amount of uncertainty underlying many ecological assumptions made.

2. Restored or engineered wetland and habitat areas may function well, but placement within a largely developed area can severely limit interaction of species within the site.
3. Adjacent habitat can influence whether a target species can use a site because many species use multiple habitats as part of their lifecycle. In particular, most large species also do not live in one habitat during their entire life.
4. Habitat age can influence the degree to which species use an area. Created sites are always ecologically young.
5. Completing restoration activities in tandem with roadway construction may not be optimal. Mitigating activities such as restorations often function best when completed prior to the start of construction so that the newly mitigated habitat can stabilize and be fully functional. Specificity of design does not necessarily dictate successful use by particular species of wildlife. Detailed targeting efforts do not always work, even if species-specific design features of a habitat are incorporated.
6. During the lifetime of a habitat, all targeted species may use the site, but not necessarily all at the same time. Monitoring expectations should therefore be set accordingly.
7. Some habitats cannot be fully restored to predevelopment conditions.
8. Loss of biodiversity or species diversity is difficult, if not impossible, to replace.
9. Many newly restored habitats, especially sensitive or critical ones, may not function as efficiently or effectively as planned and intended. Only some of the functions may be successfully replaced or improved artificially.
10. Planners and designers should be taken to avoid locating or creating potentially sensitive habitat near edges and boundaries of roadway projects. Where possible, the roadway clear zone should be maintained to preserve safety and visibility.
11. Monitoring and data collection efforts should be tied to performance metrics determined during the planning stage of restoration projects to make them meaningful.

RESEARCH

Natural ecosystems provide a variety of important services to both human and non-human life, and rely on a wide array of complex interactions to function. Inevitably, the change of land use by human development can disrupt these delicate processes, or eliminate important areas of ecosystem altogether. Habitat restoration is the process of retaining the natural functionality of a given impacted ecosystem, through local improvement or the creation of analogous ecosystem elsewhere. In practice, many restoration projects are aimed at restoring watershed management activities, known as "wetland restoration". However, restoration can apply to damaged non-aqueous ecosystems as well, which are not always regulated to similar standards. While restoration efforts are often oriented towards a particular ecosystem function, it is recognized that ecosystems function most effectively under natural conditions (EPA, 1994). Restoration is a delicate process requiring significant knowledge of the specific ecosystem at hand, and monitoring efforts are usually required to ensure the continuing success of a restored habitat. Legal mandates (primarily the Clean Water Act) and or political directives generally dictate the type and method of most watershed restoration processes, as well as monitoring requirements.

Roads and Habitat Loss

Roads and highways can negatively impact natural habitat in a number of ways. These impacts have traditionally been divided into destruction, fragmentation, and degradation of habitat (EPA, 1994; Ament et al, 2008). Destruction refers to the actual replacement of habitat by roadway placement. This includes the roadway itself as well as any substantially altered corridor. Fragmentation is the breaking up of remaining habitat and elimination of critical migration pathways. In addition, fragmentation of habitat area increases the proportion of "edge" habitat exposed to the outside environment, which can have significantly different characteristics from interior habitat (Fuentes-Montemayor et Al, 2009). Degradation involves disturbances to surrounding habitat due to factors such as noise, pollutant contamination, and other secondary impacts. Road construction, for example, can introduce invasive species, alter soil properties, increase erosion, etc. (Forman and Alexander, 1998).

A particularly important degradation effect of roads is the creation of polluted runoff. As a result of the range of these various impacts, road construction disturbs habitat in an area much greater than the actual roadway corridor. Because roads cover approximately one percent of the United States, their ecological effects have widespread impacts (Forman and Alexander, 1998).

The Importance of Habitat Loss

Natural ecosystems provide a variety of important services to both human and non-human life, and rely on the presence of suitable habitat to function. Loss of habitat disrupts the important benefits of these ecosystems. Natural processes have important functions: maintaining air and water quality, regulating climate, production of goods, and other important processes (Wilson, 2002). The global value of these services has been estimated to be between 16 and 54 trillion dollars annually (Constanza et al, 1997).

In a roadway setting, preservation of surrounding habitat can aid in stormwater control, a function made increasingly important by the extra runoff created by the roadway itself (NCHRP, 2006). In addition, habitat destruction leads to the reduction of biodiversity (Wilson, 2002). Societal acceptance of the value of biodiversity in the U.S. has been exemplified explicitly in legislation such as the Endangered Species Act (1973), which states that "species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people". In addition, biodiversity is often considered an economic good based on its importance in science, industry, and medicine. Therefore, preservation of biodiversity is vital to both to ecosystem health and human health (Wilson, 2002).

Precedent for Restoration

Most of the required habitat restoration in the United States is mandated by Section 404 of the Clean Water Act, which regulates activity in U.S. waters including wetlands. To obtain a permit under this act, the developer must show that measures have been taken to avoid and reduce wetland impacts, and that any necessary impacts have been compensated for (EPA, 2009a). Habitat restoration can be considered a form of compensation through the creation of new wetland environments. Construction of wetlands has also traditionally been used as a "best-management practice" for acquisition of a permit under the National Pollutant Discharge Elimination System (NPDES), which is generally required by the Clean Water Act when construction will cause pollutant discharge to surface waters (NCHRP, 2006).

In addition, habitat restoration can be employed to meet the requirements of the Endangered Species Act. Actions which would cause incidental harm to a conserved species (including habitat loss) require submittal of a Habitat Conservation Plan (HCP). These HCP's must show that "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of the taking". Similar to the provisions of the clean water act, restoration of previously disturbed habitat can satisfy requirements for mitigation efforts. (U.S. FWS, 2009)

Brownfield Restoration

The term **brownfield** refers to an area in which development or use has been complicated by a threat of contamination. This is commonly a result of previous industrial use but is caused by other activities as well. Remediation of these areas, which usually involves soil and groundwater cleanup, can convert the land back to usable condition. This increases the value of the property and can help preserve undeveloped land. Private developers are often reluctant to remediate brownfields due to financial risks and liability issues, however many different government agencies incentivize these activities (Opp, 2009). The Environmental Protection Agency (EPA) has created a Brownfields Program that provides funding to brownfield revitalization projects, which has in turn contributed to higher levels of owner investment, creation of jobs, and increases in nearby property values (EPA, 2009). In addition, each state has their own brownfield program, providing varying levels of funding and liability protection for cleanup efforts (Opp, 2009).

A number of treatment methods exist for the removal of hazardous pollutants from soil and groundwater. These can be broken down into techniques that remove contaminants through biological, chemical, or physical processes (Hamby, 1996). Bioremediation refers to the use of microorganisms that can break down or transform dangerous chemical compounds through their own metabolic pathways. When appropriate, this can be a low-cost alternative to other remediation options (Hamby, 1996, EPA, 1991). Phytoremediation, another example of a biological approach, uses plants to clean soil and groundwater through sorption and water uptake. Chemical methods rely on the introduction of compounds that can destroy, transform, bind to, or otherwise render contaminants harmless. Finally, physical techniques include treatments such as stripping, pumping, and washing of the soil or water in question (Hamby, 1996). Both of these categories are to numerous and varied to be discussed in detail here.

Index of Biological Integrity

The **Index of Biological Integrity** (IBI) is a multi-metric assessment tool that characterizes the biological functionality of a water body based on a number of sensitive biological measures. Specifically, IBI (and other derivatives of this metric) measures the impacts of human activities on biological communities. Integrity of living systems within a water body is required to perform necessary ecosystem services (Karr and Chu, 1997). Thus, "biological integrity" is the "ability to support and maintain a balanced, integrated adaptive assemblage of organisms having species composition, diversity, and functional organization comparable to that of natural habitat of the region" (Karr and Dudley, 1981). As a result, the IBI provides important information about the condition of a water body relative to surrounding levels of human influence. A key point is that determination of the IBI requires trained biologists familiar with the specific aquatic ecosystem.

Additionally, since it is a relative measure, use of the IBI requires determining a reference condition for the area. The EPA (2006) describes the reference condition for biological integrity, RC(BI), as "the natural biological condition of a water body, undisturbed by human activity. As a conceptual aid, it is useful to think of an absolute 'natural' or pristine condition that could exist in the absence of all historical and current human disturbances. This definition recognizes the need for a reference condition term reserved for 'naturalness' or 'biological integrity' even though we might only approximate it in most parts of the world." It also requires some level of data collection, some of which may already be established via continuous monitoring. Data for computing IBI scores is based on the "lowest practical taxonomic level" which means to the furthest taxonomic extent allowed by current science (University of Washington, 2001) for local "bioindicator species" (EPA, 2009b) for purposes of this credit. Examples of common bioindicator species are macroinvertebrates, which are aquatic insects ("benthos," hence, the Benthic-IBI).

GLOSSARY

Benthos	Greek for macroinvertebrates
B-IBI	Benthic Index of Biological Integrity
Biodiversity	Total number of species present
Bioindicator	See "indicator species"
Biological Integrity	The ability to support and maintain a balanced, integrated adaptive assemblage of organisms having species composition, diversity, and functional organization comparable to that of natural habitat of the region (Karr and Dudley, 1981).
Brownfield	An area made unsuitable for development by previous use, commonly industrial.
Ecosystem Services	Natural processes that provide benefits for humankind
Fragmentation	Division of a single population or disruption of migration routes between smaller populations
IBI	Index of Biological Integrity
Indicator species	A species which responds predictably to stressors from human disturbance (EPA, 2009b)
RC(BI)	Reference condition for biological integrity
Reference condition	The natural biological condition of a water body, undisturbed by human activity. As a conceptual aid, it is useful to think of an absolute 'natural' or pristine condition that could exist in the absence of all historical and current human disturbances (EPA, 2006)
Total disturbed area	Any area disturbed for construction activities including construction staging areas and cleared or stripped plant life, but not including any areas designated for restoration or habitat creation purposes

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