BLACKSTONE RIVER FEASIBILITY STUDY
TASK A FINAL REPORT

1.0 Introduction and Purpose

The US Army Corps of Engineers, New England District (USACE/NAE) is conducting a multi-year feasibility study to identify watershed restoration opportunities in the Blackstone River Basin in Massachusetts. The goals of this study are to identify environmental restoration needs and opportunities in the basin, develop plans and cost estimates for restoration projects, assess benefits and costs of alternative restoration plans, select a recommended watershed restoration plan, and prepare appropriate NEPA documentation.

Epsilon Associates, Inc. has been subcontracted by Battelle to perform Task A as identified in the Scope of Work (SOW) for the Blackstone River Feasibility Study (USACE/NAE July 20, 1999). As defined by USACE/NAE, Task A includes a comprehensive inventory of wetlands, riparian areas, streams, and ponds to identify and assess restoration opportunities within the Blackstone River Basin. Ponds were included as part of Task A, however, the field component for ponds was completed separately and the results are provided in the Task A Addendum.

2.0 Study Area

The Task A study area includes 18 municipalities that make up the central and southern portion of the Blackstone River Basin located in Massachusetts. For the purpose of this evaluation, the Task A study area is assumed to include all or a portion of the following municipalities: Attleboro, Bellingham, Blackstone, Douglas, Franklin, Hopedale, Hopkinton, Mendon, Milford, Millville, North Attleboro, Northbridge, Oxford, Plainville, Upton, Uxbridge, Webster, and Wrentham.

The northern portion of the Blackstone River basin was excluded from Task A because the MA Department of Environmental Protection is conducting an investigation in this area to identify similar wetland restoration opportunities. As a result the following 12 municipalities have been excluded from Task A: Auburn, Boylston, Grafton, Holden, Leicester, Millbury, Paxton, Shrewsbury, Sutton, Westborough, West Boylston, and Worcester.

3.0 Site Selection Criteria

The SOW for Task A identifies five resource types that have been targeted for potential restoration opportunities in the Blackstone River Basin. The SOW has identified specific site selection criteria for each of these resources which are described below.

1. Wetlands: The identification of potential restoration opportunities will be focused on previously disturbed wetlands such as filled wetlands, wetlands with altered hydrology, and wetlands that have been invaded by invasive species such as phragmites (*Phragmites australis*), European buckthorn (*Rhamnus frangula*), Japanese knotweed (*Polygonum cuspidatum*), and purple loosestrife (*Lythrum salicaria*). In addition, the possibility of constructing new wetlands will be evaluated in highly disturbed areas (e.g., gravel pits). Only restoration sites greater than 0.5 acres will be identified and field visits will only be conducted at sites greater than 1 acre in size.

2. Riparian Buffers: Opportunities will be identified to restore wooded buffers greater than 50 feet wide along the Blackstone River, its perennial tributaries, and impoundments greater than 5 acres in size. Potential restoration sites will be defined as lengths of riparian area where a 50-foot wide buffer is lacking for a linear distance of more than 250 feet. Disturbed land in undeveloped to moderately developed areas of the watershed will be targeted for analysis (as discussed with USACE/NAE). Site visits will be conducted at all riparian areas where the potential exists to restore a vegetated buffer along an area greater than 1,000 feet in length.

3. Riparian Habitat: Opportunities will be identified to restore large (greater than 2 acres) continuous tracts of riparian habitat along the Blackstone River, its perennial tributaries, and impoundments greater than 5 acres in size (as discussed with USACE/NAE). Disturbed land in undeveloped or lightly developed areas of the watershed will be targeted for analysis. Likely restoration sites include agricultural land, junkyards, borrow pits, and unnecessary parking lots. Field visits will be conducted for all sites greater than 5 acres in size.

4. Streams: Perennial streams where the potential exists for instream habitat restoration and streambank stabilization/erosion control projects will be identified and documented. Restoration opportunities will typically include streams that have been

channelized, have eroded banks, or exhibit excessive sedimentation of the substrate. Stream restoration opportunities associated with removal of dams on tributary streams will also be documented in conjunction with Task B of the SOW.

5. Ponds: Ponds greater than 1 acre in size (as discussed with USACE/NAE) within the study area that would benefit from habitat enhancement, invasive species control, and eutrophication reduction through the use of dredging will be identified and documented.

4.0 Methodology

In identifying potential restoration sites in the Blackstone River Basin, a three phased approach has been used. The first phase involved the procurement of existing information from a variety of sources. The second phase involved analyzing this information to identify potential restoration sites as defined by the criteria outlined in Section 3.0. Aerial photography played an important role in this phase of the project. The third phase involved field visits to each site for the purpose of collecting additional information and evaluating sites as potential restoration opportunities. The activities included in these three work phases are described below.

4.1 Information Procurement

In this initial phase of the study, existing information on the Blackstone River Basin that is applicable to this project was collected and catalogued. Government agencies, academic institutions and non-profit organizations were contacted to identify information sources for the project, such as resource maps, watershed studies, aerial photography and other ongoing studies and projects. Some of the information sources used on the project include the following:

- Massachusetts Executive Office of Environmental Affairs, Blackstone Basin Team
- Blackstone River Watershed Association
- Massachusetts GIS Program
- Massachusetts Department of Environmental Protection (DEP) Bureau of Waste Site Cleanup
- Massachusetts DEP Wetlands and Waterways Program
- Massachusetts Division of Fisheries and Wildlife (MDFW) Riverways Program

- Massachusetts Natural Heritage and Endangered Species Program (MNHESP)
- Massachusetts Wetlands Restoration and Banking Program
- National Park Service (NPS) Blackstone National Heritage Corridor
- U.S. Army Corps of Engineers (USACE/NAE)
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)
- University of Massachusetts Earth Science Information Office
- USDA Natural Resource Conservation Service (NRCS)
- U.S. Geological Survey (USGS)

Refer to Attachment A for a primary list of reference information used in identifying potential restoration sites for this project.

In addition to the sources described, a variety of aerial photographs and maps have been obtained and analyzed. The most recent aerial photographs that were evaluated included color infrared aerial photographs (1:40,000) taken in the spring of 1992. These photographs provided stereoscope coverage of the entire Blackstone River Basin and were used in conjunction with NRCS county soil surveys, U.S Fish & Wildlife Service National Wetland Inventory (NWI) maps, and other resource maps and reports. The use of a stereoscope provided important information on the topography and other physiographic features of the river basin. Acetate covers were overlayed on each photograph to facilitate the labeling of information directly onto the photo. The proposed labeling scheme included an abbreviation of the site type (e.g., W, wetlands; RB, riparian buffer; RH, riparian habitat; S, streams; P, ponds), and will follow a simple numbering sequence (e.g., W-1, W-2, etc.).

NRCS soil survey maps provided detailed information on the locations of disturbed and hydric (wetland) soils. The presence of hydric soils was determined by looking at the soil drainage class and/or consulting the National List of Hydric Soils. The study area encompasses portions of the Worcester South, Middlesex, Norfolk, and Bristol North county soil surveys.

National wetland inventory maps provided useful wetland information on a small scale basis. These maps assisted in the identification of wetlands and wetland types in the river basin and also assisted in providing information on wetland cover types.

4.2 Information Interpretation and Analysis

The second phase of the project involved the interpretation of the data collected in the first phase (Section 4.1). Once potential sites were identified, their locations were placed on a base map consisting of USGS topographic quadrangles. This base map presented all potential restoration sites identified, including those to be visited in the field.

The final stage of data interpretation was preparing the field packets for the site evaluation phase. Each field packet contained useful information that helped the field staff confirm wetland restoration sites. Each packet included enough information to allow the field staff to visit and evaluate sites over a 3 to 5-day time period. The field packet included: a USGS map with potential restoration sites plotted; the aerial photograph with sites identified, blank field form; a copy of a road map locating all sites to be visited; and an assortment of natural resource information on the region including fisheries information and soil surveys. The purpose of the field packet was to provide the field team with the information it needed to locate the site quickly and efficiently, review known information gathered during earlier phases, and conduct the field evaluation and site ranking.

Potential restoration sites in the Blackstone River Basin have been identified through a synthesis of existing information. Restoration opportunities were identified using a USGS quadrangle-based evaluation.

The methodology took advantage of the manner in which the aerial photography is sequenced. The flight lines of the aerial photography corresponded to the north-south axis of each USGS topographical quadrangle. There are 10 photos positioned on each topographic quadrangle. This photo layout facilitated a logical progression from quadrangle to quadrangle. The northernmost quadrangle in the study area acted as the starting point. After evaluating all aerial photographs within this quadrangle, the adjacent quadrangle to the east will be evaluated. This west-east progression continued until the eastern edge of the basin was reached, at which point the evaluation moved south to the next row of topographic maps, and continued in the same west-east direction. In this way the entire river basin was covered in an efficient and organized manner, while moving in an overall north-south direction.

4.3 Site Evaluation

Site evaluations have been conducted at each identified potential restoration site that met the selection criteria listed in Section 3.0. A field data form created for each resource restoration type was completed at each site. The completion of a field data form required the compilation of data associated with each restoration goal, general site characteristics, and site location information.

The site evaluation phase (Phase III) coincided with the information interpretation phase (Phase II) of the project. That is, as information interpretation was completed for each USGS Quadrangle study unit, the site evaluation for that unit commenced.

The site evaluation entailed visiting sites identified during the information interpretation phase and was conducted by a two-person field team. The field team was equipped with a field packet (maps, field forms, directions, etc.) prepared for the specific area to be visited in a given day. The field team also carried copies of a letter signed by the USACE/NAE describing the purpose of the project. A copy of the letter was provided to anyone who inquired about the field program.

Additional equipment used in the field included a differential global positioning system (dGPS) receiver, field manuals, and a digital camera. The GPS equipment used on this project included a Garmin GPS 12XL unit and a Differential Corrections Inc. (DCI), RDS 3000 differential GPS receiver. Differential GPS service to 10-meter accuracy was provided by DCI. Once on site, the field data forms were completed and a GPS point was recorded. The GPS information was used to produce geographic information system (GIS) maps showing each restoration site in the Blackstone River Basin.

When it was not possible for the field team to directly access a site to collect information, field data was recorded from a distance to the extent possible. The field team spent approximately 45 minutes to 1 hour at each site. Approximately 4 to 6 sites were visited per day. While conducting site evaluations of the previously identified restoration sites, other potential restoration sites meeting selection criteria not previously identified were discovered. These sites have been included in the inventory. Additional potential sites that did not meet size criteria were not evaluated in detail but were simply listed as a potential opportunity.

4.4 Site Ranking Methodology

A scoring and ranking methodology was developed using other wetland, wildlife, and water habitat assessment methodologies (see reference list in Attachment A). Rankings have been developed for four separate attributes of each identified restoration opportunity. These attributes included impairments, benefits, negative impacts, and costs. Following development, the scoring and ranking system was included in the Site Analysis section of the field form. This allowed field staff to gather site information and score and rank various characteristics of the potential restoration opportunity while at the site.

Impairment scores were recorded on the field form for a variety of impairment factors observed at each potential restoration site. Possible impairment factors varied among resource types, however, examples that were common among all resource types included percentage of adjacent area developed, erosion and sedimentation, illegal dumping, and coverage of exotic species. Each observed factor was ranked on a scale of 1 to 3 with 1 indicating a low impairment and 3 indicating a high degree of impairment. The impairment scores were then tallied and the total impairment score was used to rank impairments as low, medium or high based on the range of scores that might be recorded.

Potential benefits of the restoration project were evaluated and scores recorded on the field form for a variety of benefits that could be expected as a result of actual site restoration. Examples of potential benefit indicators included improvements to water quality, fisheries/wildlife habitat, flood control recreation, and groundwater recharge/discharge. The total number of indicators of potential benefits observed on the site were tallied and then ranked as low, medium or high based on the range of scores that might be recorded.

Indicators of potential negative impacts were evaluated and scores recorded on the field form for a variety of impacts that could be expected as a result of restoration. Examples of potential negative impact indicators included impact to fisheries or rare species habitat, loss of agricultural land, and negative impacts to commercial uses. The total number of possible negative impacts potentially resulting from restoration were ranked as low, medium or high based on the range of scores that might be recorded.

Potential indicators of cost to restore a potential restoration site were evaluated and scores recorded on the field form. Examples of

potential indicators of cost included ownership, re-grading, fill removal, and revegetation. Because the cost of a restoration project is a factor of its size, the total number of indicators of cost was weighted by a size factor. The size factors used range from 1 to 3 and were based on the anticipated range of site sizes that could be encountered. Scores were tallied and then ranked as low, medium or high based on the range of scores that might be recorded.

A final score quantifying the quality of the restoration opportunity was tallied based on the calculated ranks for potential benefits, potential negative impacts, potential costs, and size of the restoration site. The calculated ranks were scored based on a scale of 1 to 3. The scores were then added together to produce a total score for the quality of the restoration opportunity. The total score was used to rank the site as low, medium or high based on the range of possible scores that might be recorded.

5.0 Discussion and Results

Field work for Task A was initiated during October of 1999 and completed during January of 2000. Because of the late starting date, identification of potential pond restoration opportunities was postponed until June 2000. As part of the completed field work, a total of 97 restoration opportunities have been identified and visited. Of this total, 15 were riparian buffer, 40 riparian habitat, 15 stream, and 27 wetland restoration opportunities. Information collected for the 97 sites is summarized in the final site list provided in Attachment B. Locations of these sites are identified on the orthophoto base GIS maps provided in Attachment C. Photographs of each site are included in Attachment D. Other potential restoration sites that have been identified, but either did not meet the size criteria or could not be accessed, are identified on a list provided in Attachment E. These sites are located on a USGS base provided in Attachment F.

Upon completion of all field work and site ranking, it was necessary to modify the ranking system. Because the ranking methodology was originally based on potentially observed scores and not on observed scores, a disproportionate number of sites ranked as medium on a low, medium and high scale. The primary reason for this is that the actual observed scores do not exhibit the range of potential scores and are more central to that range. To correct this problem, two modifications to the scoring/ranking system have been made. First, sites were ranked using a system based on actual scores rather than potential or

hypothetical scores. Second, the scoring/ranking system was modified to provided for a better separation of sites by using a scoring scale of 1-5 rather than 1-3. The new ranking scale employed five levels of rank -- low, low+, medium, medium+, and high -- rather than a scale of low, medium and high. Details of the modified scoring/ranking system used for each resource type are provided in Attachment G. Blank field forms are provided as Attachment H. The completed field forms are included as Attachment I.