## Introduction

Erosion is the process by which soil or rock material is loosened and removed. Soil erosion causes environmental degradation where the water quality of the receiving water source is reduced because of increased turbidity and chemical loadings such as nitrogen, phosphorous and organic compounds contained in the soil. In addition, the heavier sediments glut stream channels and reservoirs, thereby decreasing their carrying and holding capacities.

The primary factors affecting erosion losses are soil characteristics, topography, climate, and vegetative cover. How these factors affect the erosion potential is described as follows:

### Soil Characteristics

The soil’s infiltration capacity and resistance to detachment from flowing water will impact the erosion potential. Soils composed of fine sands and silt are typically the most erodible. Soils with high clay and organic matter content have low erosion potential due to the soil’s binding capabilities and permeability, respectively.

### Topography

The size, shape, and slope characteristics of a watershed influence the amount and rate of runoff. Slopes that are both steep and long tend to produce the greatest erosion because they generate runoff that is high in both velocity and mass.

### Climate

The frequency, intensity, and duration of rainfall are fundamental in determining the amount of runoff in the watershed area. The erosion potential is increased as a result of increased volume and velocity of the runoff. The frequency, intensity, and duration of the storms also impact the erosion rate on a watershed. Higher erosion risk will typically occur during the spring where the vegetated cover is less capable of intercepting rainfall and the ground is still partially frozen.

### Vegetative Cover

Vegetative cover is the most important single control on soil erosion. The vegetative cover is instrumental in reducing the erosion potential by shielding the soil surface from the impact of precipitation, binding the soil particles to limit detachment, maintaining the soil’s capacity to absorb water, and decreasing the runoff velocity. The heavier the cover density on the watershed, whether groundcover and/or tree cover, the lower the soil loss to runoff.

The original Watershed Resource Protection Plan in May 1991 assessed the risk of soil erosion in each of the three active watershed areas. A brief description of the risk assessment conducted in 1991 is presented below:

### Tighe-Carmody Reservoir Watershed

Refer to Figure 9-1 for the soil erosion potential within the watershed. The soils overlay for the Tighe-Carmody Reservoir watershed indicates that a relatively small portion of the watershed has a potential for erosion of disturbed soils. Few of those soil units are directly adjacent to the shores of the reservoir, which affords greater opportunity to control sediment loads entering the surface source. In these areas, activities causing disturbance of soils or soil cover should be avoided. Current land use practices and soil cover conditions are not causing discernible erosion or significant sediment loads in the tributaries to the Tighe-Carmody Reservoir.

Although some soils within the watershed have high erosion potential, they are covered by vegetation, and the lack of development decreases the risk from naturally occurring soil erosion due to rainfall, floods, and winds. Since there is presently significant vegetative cover and minimal activity within the watershed, the risk assigned to natural soil erosion is low to moderate.

### McLean Reservoir Watershed

Refer to Figure 9-2 for the soil erosion potential within the watershed. As shown, all of the land within the McLean Reservoir watershed has a high potential for erosion of disturbed soils. However, the existing soil cover is forest vegetation, which is effective at minimizing erosional soil losses. In addition, forestry within the areas owned by HWW is conducted according to best management practices including soil erosion/sedimentation control. Most of the land within the watershed is unsuitable for most other activities that could cause disturbance of soils due to the steep slopes and shallow bedrock conditions. The current risk from natural erosion is low due to the vegetative cover and very low human activity in the watershed.

### Ashley Reservoir Watershed

Refer to Figure 9-3 for the soil erosion potential within the watershed. As evident on the figure, all of the soils located on the Holyoke Range were found to be highly erodible soils located on steep or rolling topography. The entire northern headwaters of the drainage area and the steep western margin are therefore indicated as having a relatively high potential for erosion. The remaining area in the lowlands is classified as having moderate or low erosion potential.

The existing soil cover in the areas of highly erodible soils is forest with good vegetative cover, which is effective at minimizing erosional soil losses. In addition, forestry within areas owned by HWW is conducted according to a forest management program. Most of the land in the highly erodible northern area is unsuitable for most other activities that could cause disturbance of soils due to the steep slopes and shallow bedrock conditions. The current risk from natural erosion is low due to the limited activity and vegetative cover.

According to the original 1991 Watershed Resource Protection Plan, the risk associated with natural erosion on the watershed is low due primarily to vegetative cover. It is in HWW’s best interest to strictly control and monitor activities that may increase the potential for soil erosion.

## Erosion Control Program Goals

The erosion control program goals for the HWW watersheds are summarized as follows:

1. Ensure that soil erosion/sedimentation controls are in place during detrimental activities such as construction and/or forestry
2. Prohibit high soil erosion activities, if possible, within the watershed area
3. Limit the soil/vegetation disturbance
4. Review submitted erosion control plans by developers and foresters

Given that the Whiting Street Reservoir is an emergency source, erosion control in the Whiting Street Reservoir watershed is not included as part of the overall erosion control program.

## Holyoke Ordinances

Currently, two means are available for HWW to enforce erosion and sedimentation control for activities that may cause or exacerbate the potential for erosion.

1. Revised Ordinance of the City of Holyoke, Massachusetts, 1972 - Chapter 8 1/2 with amendments, “Grading and Soil Erosion Control”, was established to prevent soil erosion and sedimentation from occurring as a result of nonagricultural development within the City. The minimum design standards for erosion and sediment control shall be in accordance with the United States Agriculture Soil Conservation Service. The erosion control plans are required to be submitted to the City Engineer for approval. Refer to Appendix A for the “Grading and Soil Erosion Control” chapter in the Holyoke Code.
2. City of Holyoke Wetlands Protection Ordinance Regulations (effective October 25, 2001) - The Wetlands Protection Ordinance Regulations were established by the Holyoke Conservation Commission pursuant to the authority granted to the Commission under Section 2-2 of the Holyoke Wetlands Protection Ordinance. Under Section V of this Ordinance, applicants are required to submit for approval a siltation and erosion control plan to be implemented during and after the work. In addition, stabilization and maintenance of embankments facing any wetland are required prior to Conservation Commission approval. Refer to Appendix B in Section 6 of this document for the City of Holyoke Wetlands Protection Ordinance Regulations.

HWW utilizes the Revised Ordinance of the City of Holyoke and the Wetland Protection Ordinance to enforce activities on watershed property to minimize erosion risk from these activities.

## Identification of Areas Susceptible to Soil Erosion

Areas susceptible to soil erosion are depicted in the figures. In areas where soils are considered to have high potential for erosion, activities causing disturbance of soils or soil cover should be avoided. If such activities take place, an erosion control program should be prepared describing measures to minimize erosion, methods to intercept eroded soils, and vegetated cover restoration to disturbed areas. Either the City Engineer or the Conservation Commission will review these erosion control programs, thereby allowing HWW to also comment on the submitted program.

## Erosion and Sediment Control Principles

A proper erosion and sediment control program will minimize environmental degradation during construction activities. The following erosion and sedimentation principles, formulated by the Soil Conservation Service, are guidelines that assist HWW in their review of work that is conducted in the watersheds.

1. Minimize land disturbance - Plan the stages of development such that only the areas that are actively being developed are exposed. All other areas should have natural vegetation preserved, a temporary vegetated cover, or be heavily mulched.
2. Stabilize disturbed areas - Permanent structures, temporary or permanent vegetation, and mulch, or a combination of these measures, should be employed as quickly as possible after the land is disturbed. Temporary vegetation and mulches can be most effective where it is not practical to establish permanent vegetation.
3. Maintain low runoff velocities - The removal of existing vegetative cover and the resulting increase in impermeable surface area during development will increase both the volume and velocity of runoff. The increase of runoff must be considered during the development of an erosion control program. Maintain short slope lengths, low gradients, and vegetative cover to assist in reducing the storm water velocities.
4. Protect disturbed areas from storm water runoff - Install erosion control or storm water management measures to prevent water from entering and flowing over disturbed areas, and to prevent erosion damage from downstream facilities.
5. Install perimeter control - Effectively isolate the construction site from surrounding areas. Retain sediment by filtering runoff as it flows through an area or impound the sediment-laden runoff for a period of time to allow for particle settling.
6. Implement a thorough maintenance and follow-up program - A site cannot be effectively controlled without thorough periodic checks of the erosion and sediment control practices.
7. Assign responsibility for maintenance program - Responsibility for the implementation and the maintenance of erosion and sediment control measures should be assigned to one person at the construction site.[[1]](#footnote-1)

The erosion control plan that is submitted for a construction activity should include the following:

1. Vicinity map, including project location, roads, streets, north arrow, scale, major drainage ways, and major land uses of surrounding areas.
2. Project features, including property lines, development acreage, disturbed area acreage, north arrow, scale, legend, planned and existing roads and buildings with their elevations, land use of surrounding area, and access roads.
3. Natural features, including soils, rock outcrop, seeps, wetlands, floodplains, waterbodies, existing vegetation, and natural features of adjacent land.
4. Topographic features, including existing and proposed contours, areas of cut or fill, and planned grades and slope steepness.
5. Drainage system, including existing and planned drainage patterns, drainage area map, size of drainage area, size and location of culverts and storm sewers, design calculations and construction details for culverts, storm sewers, etc., size and location of existing and planned channels or waterways with design calculations and construction details to control erosion of the waterway, existing and planned peak flows with calculations, changes in peak flow, off-site effects of increased peak flows, survey and soil information below culverts and storm sewer outlets, measures with design calculations and construction details to control erosion below culverts and storm sewer outlets, and measures with design calculations and construction details to control groundwater.
6. Utility system, including location of existing and planned septic system; location and size of existing and planned sanitary system; and location of other existing and planned utilities, telephone, electric, gas, etc.
7. Clearing, grading, and vegetative stabilization, including areas to be cleared; staging and sequence of clearing; disposal of cleared material; areas to be graded; areas to be vegetatively stabilized; planned vegetation; temporary erosion protection of disturbed areas; and temporary erosion protection when time of year or weather prohibit establishment of permanent vegetative cover.
8. Erosion control measures, including construction drawings and details for temporary and permanent measures, design calculations, maintenance measures during construction of project, person responsible for maintenance, and maintenance requirements of permanent measures when project is complete.
9. Narrative, including nature, purpose and description of project; potentially serious erosion or sediment problems; the stages of development; the sequence of major operations on the land; the time required for the major operations; and the planned dates for the project.

All of the aforementioned items may not be incorporated into a specific project, but this outline serves as a general guideline for the information, as it pertains to a project, that should be included in the erosion control plan. HWW utilizes these erosion and sediment control guides in the review of any proposed construction activity on watershed property.

## Best Management Practices/Implementation Schedule

HWW’s “Best Management Practices” associated with the erosion control program are summarized as follows:

* Communicate with local and out-of-town departments – HWW actively communicates with the City’s Conservation Commission and the City Engineer with regards to site plan reviews.
* Watershed maintenance – During routine patrolling, HWW inspects the watershed property to determine whether erosion is problematic in any area. Periodically, HWW conducts site work on watershed land and includes the necessary erosion and sediment control measures throughout the course of the project.
* Enforce BMPs for forestry activity – HWW follows the Massachusetts Forestry Best Management Practices Manual to ensure that the proper erosion control measures are in-place.

The implementation schedule for the erosion control program is summarized as follows:

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| --- | --- |
| **Action Item** | **Implementation Schedule** |
| Communicate with in-City departments | Ongoing; HWW works with the Conservation Commission as well as the City Engineer with site plan reviews. |
| Communicate with out-of-town authorities | Ongoing – HWW communicates with the Towns surrounding the Tighe-Carmody Reservoir. |
| Enforce BMPs for forestry activity | Ongoing |

1. Soil Conservation Service. *Erosion and Sediment Control in Site Development*. Massachusetts Conservation Guide. Volume 1. September 1983. [↑](#footnote-ref-1)