Department of Conservation and Recreation

Trails Guidelines and Best Practices Manual

The Metacomet-Monadnock trail to Mt. Norwottock

The health and happiness of people across Massachusetts depend on the accessibility and quality of our green infrastructure - our natural resources, recreational facilities, and great historic landscapes. The Department of Conservation and Recreation (DCR) provides vital connections between people and the environment with over 4,000 miles of trails and 200 miles of paved bikeways and rail trails. Consistent and clearly defined trail policies, procedures, and program guidelines can provide inspiration and direction for managing, enhancing, and developing a successful and sustainable trail system for Massachusetts.

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Implementation Schedule (Revised 2014)

The initial edition of the DCR Tails Guidelines and Standards Manual was completed, approved and distributed at the 2008 DCR Trail School.

The Manual is reviewed and revised by the DCR Trail Team on an annual or bi-annual basis.

Some elements of the Manual will require years to fully implement. The following table proposes a timeline for implementation.

Element	Implementation Date	Comments
Trail Regulations	2012 (revised 2014)	DCR CMRs were finalized in 2014
Trail Team	January 1, 2008	DCR Trail Team was established in January 2008 and meets approximately 3 times each year.
Trail Planning and Development Standards	October 21, 2008	Trail planning and development guidelines and standards for different uses and classes of trail were complete in the 2008 edition
Complete Trail Inventory	2012 (revised 2014)	The trail inventory was completed for former State Parks in 2013, and is on-going for former urban parks.
Implementation of Trail Maintenance Standards	On-going	Maintenance standards implementation for all trails is dependent on staffing levels and DCR priorities; however, maintenance standards will establish a benchmark for basic levels of trail management.
Trail Signage	- 2008 for new trails and new signs - 2012 for main intersections -Full implementation by 2016, all parks and trails	Implementation should follow the prioritization outlined in the Signage section
Maps	Unknown	Final standards to be developed in cooperation with DCR Graphics and GIS staff
Partners and Volunteers	2013	Procedures for engaging partners and volunteers in trail maintenance or development will be finalized in 2013

Definitions

Compaction

The downward force that compresses soil caused by trail use.

- Heavier modes of travel and higher amounts of trail use cause greater compaction.
- Some compaction is desirable to harden tread and reduce displacement, but
- Highly compacted soils cause trail tread to sink, reducing natural infiltration and the ability for soils to drain.

Displacement

The sideways movement of soils caused by inevitable kicking, grinding, and acceleration of feet, hooves and wheels.

- Amount of displacement is a function of grade and force exerted on tread.
- The steeper the grade the faster soil particles move downhill.
- Displacement tends to increase erosion by loosening soil particles.
- Reduce displacement by limiting trail grade or modes of travel.

Erosion

The movement of soil caused by the forces of water or sometimes wind moving with enough force to transport soil particles. Erosion is a natural process, so expect it and learn how to accommodate it.

Grade

The slope of the trail. Measured as a percentage, it is the rise of the trail divided by the horizontal distance of that rise.

- Percent grade formula = rise over run multiplied by 100.
- The steeper the grade, the more likely it is to erode.
- Avoid the shortest route down a hill (fall line) and flat areas that do not drain.
- Generally, average trail grade of 10% or less is most sustainable.
- Half rule – a trail's grade should not exceed half the grade of the side slope that the trail traverses. *For example if the side slope is 30% the trail grade should not exceed 15%.*

Trails

Trails are designated, marked and signed routes that people use recreationally for such activities as walking, running, hiking, biking, horseback riding, off-highway vehicle use, snowmobile riding, cross-country skiing and snowshoeing. Other special uses include wheelchairs or similar "mobility devices," carriages, dogsleds, and in-line skaters. Trails may or may not serve other, non-recreational forest purposes such as forest management, fire control, and emergency access. Other special types of trails include accessible trails, water trails, historic trails, educational, or interpretive trails.

Trail System

A Trail System is the sum of all of the recreationally used, designated, and marked routes in and connecting to a continuous area - park, forest, reservation or management unit. Trail systems are usually managed cohesively.

Trail Corridor

A Trail Corridor contains the traveled pathway (tread), and surrounding land that protects and enhances the trail experience. Trail Corridors are often associated with long-distance trails traveling through diverse landscapes and multiple land owners. For example, the Appalachian Trail, a long-distance trail of 2174 miles that traverses the

peaks and valleys from Georgia to Maine, is protected by a corridor with an average of 500 feet on each side. This corridor protects the footpath as well as the natural setting of the trail experience.

Tread Watershed
The trail tread between a local high point (crest) and local low point (dip), plus the land area that drains into this tread segment.

- Tread watershed is a function of topography and location of trail on the landscape.
- The larger the tread watershed, the more water it collects from rain or snow and the greater potential for erosion.
- Small tread watersheds help limit how much water reaches and stays on the trail.
- Design trails to reduce the length of the tread watershed – take advantage of rolling contours and build in grade reversals.

Tread Texture
The composition of soil, rock and other tread materials.

- Knowing tread texture helps you to predict how a tread accommodates physical forces in wet and dry conditions.
- The most erosion-resistant treads have a well-compacted mix of all textures including gravel and larger particles.
- More soil separates (clay, silt, sand, loam, gravel, stones…) the tread has, the stronger it is.

Tread Width
The cleared traveled surface.

- Varies depending on trail types and allowed uses.
- On multi-use trails, clear tread for maximum width standard.
- However, the wider the tread, the more surface exposure and potential to generate run-off and tread erosion.

The following definitions are drawn generally from the USDA Forest Service Trail Planning and Management Fundamentals (See Appendix A for more detail).

Trail Type
Is the fundamental trail category (only one per trail segment) that indicates the predominant trail surface or trail foundation, and the general mode of travel.

Four fundamental trail types within DCR include:

- ***Standard Natural Surface Trail:*** The predominant surface is ground, and the trail is designed and managed for ground-based travel.
- ***Paved Surface Trail:*** The surface is paved, and the trail design and managed for multiple uses including mechanized wheeled uses. (This type is added to the Forest Service definitions).
- ***Snow Trail:*** The foundation is snow, and the trail is designed and managed for snow-based travel.
- ***Water Trail:*** The foundation is water, and the trail is designed and managed for water-based trail use. There may be portage segments of water trails.

The DCR Road and Trail Inventory classified roads / trails along the following types:

- ***Administrative Road:*** A road accessible to DCR administrative vehicles, but not open to the public.

- ***Forest Way / Trail:*** A route that potentially serves as both a trail and as access for forest management activities.
- ***Trail:*** A pathway that is used for recreational trail use.

Trail Class
Is the prescribed level of trail development, representing the intended design and management standards of the trail. Five trail class categories are defined in terms of tread, obstacles, constructed elements, signs and typical recreation experience:

- *Class 1 Trails:* Minimal/undeveloped trails
- *Class 2 Trails:* Simple/minor development trails
- *Class 3 Trails:* Developed/improved trails
- *Class 4 Trails:* Highly developed trails
- *Class 5 Trails:* Fully developed trails

These general categories are used to identify applicable trail design, management, and maintenance standards and appropriate managed uses. Section III includes a more detailed table of trail classes and their management attributes. Appendix E includes tables on trail design parameters by class and use.

Trail Condition
The DCR Road and Trail Inventory has classified all roads and trails by "condition" as good, fair or poor. "Good" trails have no or only very minor maintenance needs. "Fair" trails have management and maintenance needs of a typical nature. "Poor" trails have areas of significant trail damage and repair needs.

Managed Use
Managed Uses are the modes of travel that are actively managed and appropriate, considering the design and management of the trail. There may be multiple Managed Uses for any given trail segment. Managed Use represents a *management decision or intent* to accommodate or encourage a specific type of trail use.

Designed Use
Designed Use is the intended use that controls the design of the trail, and determines the subsequent maintenance standards for the trail. There is only one designed use of any given trail segment. Of the multiple Managed Uses of a trail, the Designed Use is the single use that drives the design and maintenance standards. The Designed Use is often the Managed Use that requires the highest level of development. Types include:

- Walking
- Hiking
- Mountain Biking
- Equestrian
- OHV
- Snowmobile
- Cross-country Ski
- Snowshoe
- On-road bike
- Accessible Trails
- Paddling
- Motorized water craft

Design Parameters
Design Parameters are the technical specifications for trail construction and maintenance, based on the Designed Use and Trail Class. The national Trail Design Parameters represent a standardized set of commonly expected construction and maintenance specifications based on Designed Use and Trail Class. Design Parameters include technical specifications regarding:

- Tread Width
- Surface
- Grade
- Turns
- Cross-Slope
- Clearing

Section I: Introduction

Trail Policy and Program Mission

The Mission of the Department of Conservation and Recreation (DCR) is *to protect, promote and enhance our common wealth of natural, cultural and recreational resources.*

The DCR's Trails Program seeks to provide a safe, quality recreation experience for a diverse range of trail users while practicing sound stewardship of the Commonwealth's natural and cultural resources. This "Trails Guidelines and Best Practices Manual" meets this responsibility by providing a consistent set of trail management policies, guidelines, procedures, and best practices in sustainable trail development.

Specific goals of this document are to:

- Promote state-wide consistency in how trails are classified, planned, designed, developed, managed, and maintained
- Enhance the management of our trails to serve the diverse needs and capabilities of visitors
- Ensure that trail experiences are safe and enjoyable
- Reduce costs through the use of practical and sustainable methods for developing and maintaining trails

Importance of Trails

Trails contribute significantly to the Commonwealth's health, economy, resource protection, and education.

- **Trails connect people to the natural environment:** place to place, person to person, and neighbor to neighbor. Trails connect us to scenic landscapes, natural wonders, and cultural resources.
- **They make our communities more livable:** improving the economy through tourism and civic improvement, and building support for land protection and stewardship.
- **Trails provide opportunities for multiple-use recreation:** promoting physical activity to improve fitness and mental health. They provide access for other recreational opportunities such as hunting or rock-climbing.
- **They enhance educational opportunities:** providing opportunities to improve and test skills, to be challenged, or to learn about our natural or cultural environment. Trails present opportunities for observation, enjoyment, and exploration.
- **Trails strengthen each of us:** offering opportunities for solitude, contemplation, and inspiration. To some, trails provide a sense of freedom, personal accomplishment, self-reliance, and self-discovery.
- **Trails can even help protect rare habitats and sensitive resources:** by concentrating use on designated, sustainable pathways.

For the DCR, trails are the intersection of conservation and recreation. They are one of our most used facilities. They deserve a high level of attention.

Striving for Sustainable Trails

Trails offering a rich and enjoyable experience don't just happen. Creating a sense of place and a sequence of events that add interest and offer challenge are essential to good trail design.

Moreover, the placement of any trail on the landscape has an ecological impact. The challenge is to keep impacts to a minimum while providing the desired experience. To be sustainable, a trail must serve the needs of users for generations to come, while preserving the sense of place and protecting the quality of the surrounding environment.

Sustainable trails begin with thoughtful planning, good design, and meticulous layout. Many of our trails suffer from lack of planning and poor design. Many are user created pathways, or leftover routes from historic farm roads and logging activities that are not appropriate for long-term recreational use. Improperly planned and constructed trails need frequent maintenance, can require significant investment in time and money, and still may not meet the needs of the user or protect the surrounding natural resources. A sustainable trail will require little rerouting and minimal maintenance over extended periods of time. A successfully designed trail will entice visitors back time and again.

To be successful, a trail must be designed to be physically, ecologically, and economically sustainable.

Physical Sustainability

Designing trails to retain their structure and form over years of use and under forces of humans and nature is a key factor in sustainability. Trail use promotes change, so trails must be designed in anticipation of change to ensure that they remain physically stable with appropriate maintenance and management.

Ecological Sustainability

Minimizing the ecological impacts of trails, and protecting sensitive natural and cultural resources is fundamental in sustainable trail design and development.

Economic Sustainability

For any trail, the implementing agency or advocacy group must have the capacity to economically support it over its life cycle. Developing and committing to a long-term maintenance strategy is a critical aspect of a successful trail program.

Promoting Stewardship

Instilling users and the public with a sense of ownership and responsibility for stewardship of trails is a key element of a sustainable trail system.

Education and Information

Education and information can and should be an integral part of any strategy to improve the quality of outdoor recreation experiences, and must be expanded and tailored to encompass a wide variety of age groups, learning abilities and special needs. Information, especially emphasizing the appreciation and careful stewardship of natural resources, will help to ensure the public's long-term enjoyment of, and support for, conservation and recreation.

Partnerships and Volunteerism

Trails, in particular, offer a powerful avenue for encouraging volunteerism and stewardship in our parks. People love to volunteer on trails, and trail management can greatly benefit from volunteers. User groups can help create, maintain, restore, or close trails. Friends groups can raise money and advocate for funding. Individuals and organizations can adopt trails. However, for volunteerism to be effective, it must be guided, directed, and managed (see Section III for a further discussion).

Past Trail Practices with the Agency

DCR was created by the merger of two separate agencies. As such, different operations divisions have, in the past, undertaken trail design, development, management, and maintenance using differing standards. For example, Urban Parks, given their location in the Boston metropolitan region and the types of uses that they see, have never allowed motorized trail recreation. They are also not actively managed for forest products. Urban Parks tend to have a greater number of hard surfaced trails and may have experienced some different management issues, such as levels of trail use and vandalism. On the other hand, the State Parks, may have a larger percentage of natural surface trails, and lower levels of use. Some state parks allow various types of motorized trail use. Facilities designated as "Woodlands" are managed for forestry, and they have had to accommodate some different kinds of recreational uses such as hunting. In addition, these divisions operated and in some cases, continue to operate with different sets of regulations, with different sets of resources and under different management frameworks. The result, from the trails management point of view, is that a variety of trail designation, marking, and management standards are currently in place across the agency.

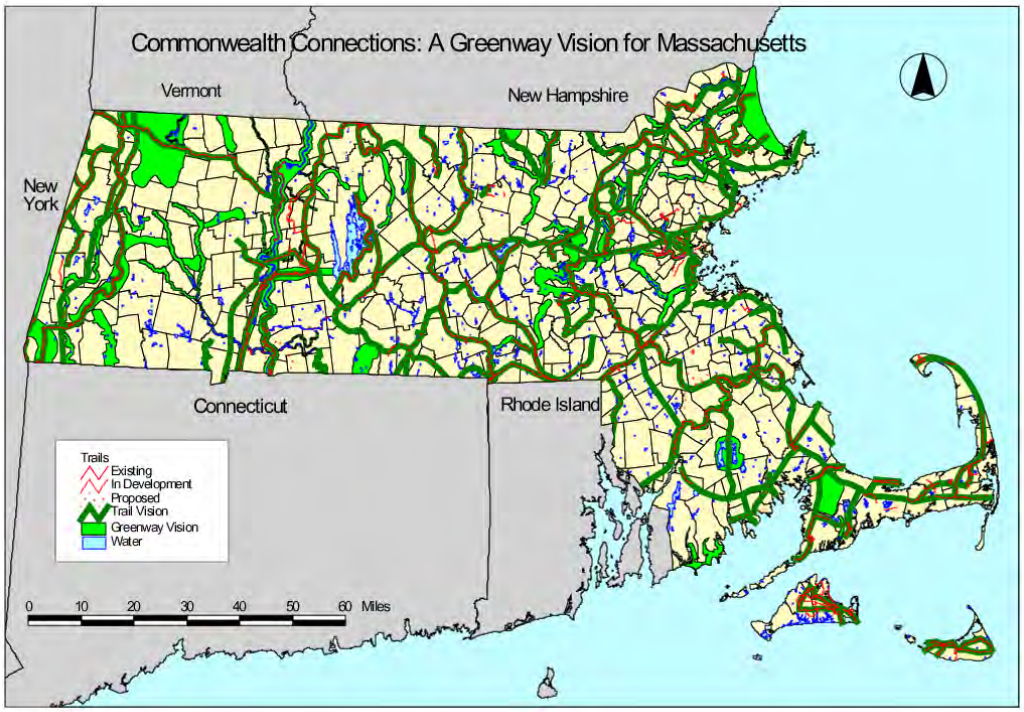
This can be confusing for users and staff alike. This document establishes a consistent set of trail guidelines and standards which DCR can apply across all of its State Parks Properties. However, these guidelines also provide flexibility that can accommodate different recreational settings, resources, and mandates.

DCR's Division of Water Supply lands are primarily managed to provide clean water, and trails and recreational uses are secondary and restricted in some areas as defined by public access policies. It is important to note the guidelines, policies, procedure and regulations outlined in this manual are intended to guide trail design, development and management on State Parks properties, and may not reflect the policies, procedures or regulations on DCR Division of Water Supply Lands.

Consistency with other plans, guidelines and regulations

Trails are not just recreational facilities, they are an integral component of our forests, parks, reservations and the communities within which they are located. Planning, developing, and managing a trail system must therefore be consistent with the mission, goals, plans, and regulations of our department, surrounding communities, and the Commonwealth.

> **Massachusetts Greenway and Trail Vision:** ***Commonwealth Connections*** is a vision for a coordinated network of greenways and trails in Massachusetts, and includes specific steps for making this vision a reality. It was developed in 2001 by DCR in partnership with the Appalachian Mountain Club, the National Park Service and a broad group of stakeholders from across Massachusetts.



Commonwealth Connections reflects the collective priorities of the greenway and trail community. The plan includes seven statewide recommendations and regional priorities for securing the Greenway Vision that can help shape the future of trails in Massachusetts. *Commonwealth Connections* is available at http://www.mass.gov/dcr/stewardship/greenway/connections.htm.

Resource Management Plans (RMP)s

Resource Management Planning forms the framework for land management based upon an inventory and assessment of environmental and recreational resources, an identification of the unique characteristics of a property or management unit, the development of management goals and objectives, and recommendations to guide the short and long-term actions. Management plans include guidelines for operations and land stewardship, provide for the protection of natural and cultural resources, and ensure consistency between recreation, resource protection, and sustainable forest management.

Trail development and management should be consistent with the agency's RMPs. For facilities where an RMP does not currently exist, trail development and management should be consistent with this guidelines manual.

Specific Trails Plans (see Section II of this manual) may also be developed prior to, as a part of, or following an RMP. Such trails plans should consider available environmental, cultural, social and recreational information; may recommend significant changes to existing trail systems; and will guide trail development and management at that facility.

Reserves, Parklands and Woodlands

In 2012, DCR completed its process for designating all of its facilities as Reserves, Parklands or Woodlands. For each of these designations, DCR has developed guidelines for management. Designations and guidelines are available at http://www.mass.gov/dcr/ld/landscapedesignations.htm.

Reserves: Recreational activities that are compatible with Reserves include dispersed, non-motorized activities, including hiking, hunting, fishing, cross-country skiing, snowshoeing, mountain biking and horseback riding. Management needed to maintain those activities (e.g., trail maintenance) will be permitted, subject to agency guidelines and policies and existing property specific regulations.

New trail construction is permitted only after the trail has been reviewed by DCR staff using the guidance and procedures established by the DCR Trails Guidelines and Best Practices Manual. Trail density and use levels will be evaluated to see how they may affect the values of the Reserve.

Trail relocations to reduce adverse impacts to critical resources will be prioritized. DCR will strive to maintain a low density of trails (ideally less than 3 kilometers per square kilometer) that are not highly developed (class 1–3) within Reserves to protect their ecological and recreational intent. DCR may close trails to achieve the values of Reserves.

Parklands: A diverse mix of recreational activities will be allowed in the wide range of Parklands properties. While not every activity will be appropriate in every location, the range across the system could include athletic field uses such as baseball and soccer, intensive uses such as swimming pools, downhill ski areas and golf courses and dispersed recreational activities such as motorized and non-motorized trail uses. Agency policies, resource protection, public safety, and recreational goals will continue to determine activities that are encouraged and/or allowed in individual properties.

DCR will strive to maintain a density and diversity of trails within Parklands that protects the natural and cultural resources of each property and meets the recreational intent for the property. Proposals for new trail development need to follow the existing process established through the DCR Trails Guidelines and Best Practices Manual. Creating loop trails that enhance recreational experiences while supporting the other values of the Parklands will be encouraged. DCR may close trails to achieve the values of Parklands.

Woodlands: The most common types of recreation in Woodlands will include dispersed recreational uses such as hiking, mountain biking, hunting, fishing, horseback riding, primitive camping, snowmobiling, and OHV use (where compliant with DCR OHV siting criteria). Property specific regulations and policies apply.

DCR will strive to maintain a moderate to low density and diversity of trails within Woodlands (ideally less than 6 kilometers per square kilometer) that protects the objectives of each property as well as recreational access. Proposals for new trail development will be evaluated through the process established in the DCR Trails Guidelines and Best Practices Manual. Creating loop trails that enhance recreational experiences while supporting the other values of the Woodlands will be encouraged. Creating small vistas along trails may be allowed. DCR may close trails to achieve the values of Woodlands.

Recreation Opportunity Spectrum

A model for decision-making, the Recreation Opportunity Spectrum (ROS) recognizes that land managers provide "experiences" to users not simply "activities" such as hiking, camping, or boating. A recreation experience is determined not only by the activity itself but, more importantly by the environment or "setting" within which the activity takes place, and this setting is defined by physical attributes such as topography and vegetation; social attributes such as visitor volumes and behaviors;

and management attributes such as the fees, facility maintenance, signage, or staffing. It is the combination of these factors that truly determine the quality and character of the recreational experience.

The ROS recognizes that the DCR system encompasses settings ranging from primitive to highly developed/urban. Accordingly, we provide and should manage for a "spectrum" of recreational experiences.

ROS Class	Primitive	Semi-primitive	Semi-developed Natural	Developed Natural	Urban
Setting	Setting appears unmodified environment of large size. Evidence of other users is minimal. Area free from management controls.	A medium to large natural appearing environment. Interaction between users is low. Management controls are subtle.	Area is natural appearing, but sights and sounds of people and interactions with others are moderate. May include more developed areas.	Area is substantially modified. Interaction with others is moderate to high. Includes facilities designed for many people.	Substantially developed area, with urban elements common. Vegetation is often manicured. Large numbers of users present.
Experience	Users experience a high degree of isolation, independence, and self-reliance. Opportunities for challenge and risk are high.	Users experience a moderate degree of isolation, independence, self-reliance. Opportunities for challenge and risk present.	Equal degree of isolation and encountering others. Opportunities for interaction with nature. Challenge and risk are not important.	Encounters with others are common. Access is convenient. Physical setting is less important than the activities provided.	Presence of others is expected and desired. Observing natural appearing elements is important.

The ROS can also provide standards for management across the spectrum that are appropriate for each park's setting and resources. It can provide critical information for addressing recreational use conflicts and become an essential ingredient in the agency's expanding resource management planning and forest management planning efforts. ROS can provide a framework for managing trails across a spectrum of settings and experiences.

Trail Corridors and Forest Management Activities

Many of our existing trails exist on ways that were historically developed and are currently managed, at least partly, for forest management. Many of these ways also offer valuable recreational experiences to users and those users understandably become attached to the sights, sounds and character of the trail environment. Dramatic changes to the trail corridor, such as harvesting, may therefore be met with public concern and resistance. In order to minimize public concern, within woodlands, DCR Foresters and Facility Managers should take extra care and coordinate information when trail development or forest management activities are planned to occur. The forester/facility manager team should:

- Assess the potential for trail recreation impacts or conflicts, before any marking of trees occurs.

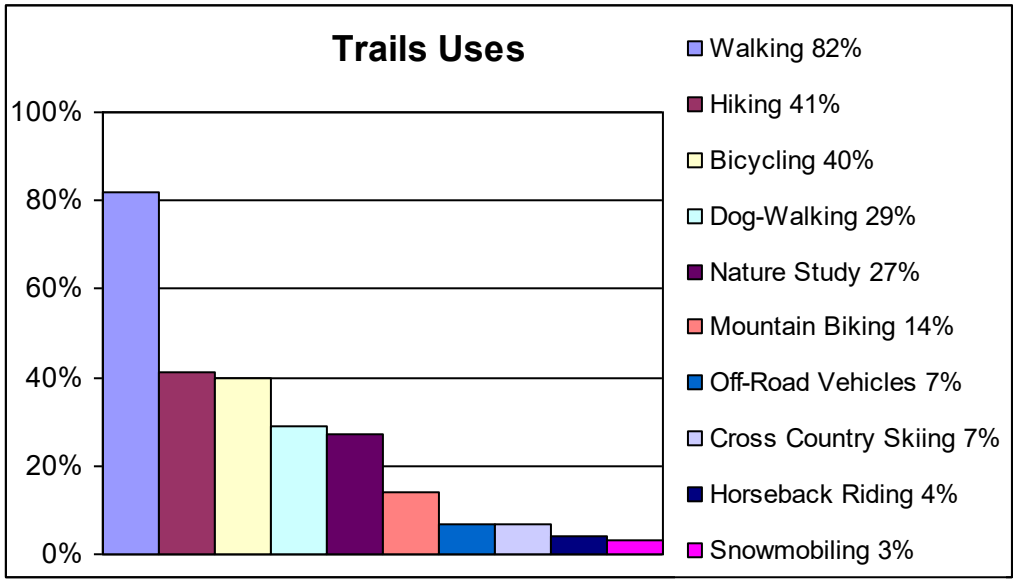
- Distinguish between forest roads and recreational trails. Forest roads which have been adopted for recreational use should be expected to experience a higher level of forest management activity than a trail.
- Ensure that any new trail development is consistent with forest management plans.
- Integrate a trail corridor protection into the cutting plan. Trail corridors may vary in width depending on the significance of the trail; however, within the designated corridor, extreme care should be applied to ensure that the trees and other landscape features which serve as "gateways" or "anchors" or otherwise significantly contribute to the character or flow of the trail are protected.
- Require in the plan that harvesters do not use the trail as a skid path or forwarding route and require that trees harvested from within the corridor (if any) are removed in a manner which minimizes disturbance to the trail.
- Discuss any concerns or anticipated conflicts with District or Regional Managers.
- Consider scheduling a public meeting to discuss the plan and reach out to friends groups, neighbors, trail volunteers and other stakeholders to participate in the meeting. The Forestry Bureau already has established procedures for public outreach on cutting plans. This outreach plan may be the ideal opportunity to invite trail interests to participate in the discussion. Utilize the opportunity to educate stakeholders about the benefits of forest management in maintaining a healthy forest and ecosystem diversity.
- Ensure that adequate signage or warnings are provided at the trail head or key intersections to protect the public during harvesting operations.

Ideally, forest management and trails management can be integrated to support each other. New sustainable trails could be developed through forestry management, and unsustainable trails closed. Trails signage and interpretation can be used to support education of the benefits of forest management. And forest ways can support both forest management and recreational trail activities.

Trends in Recreational Trail Demand and Uses

It is important to recognize and anticipate changes in trail use patterns, demand, and types of activities to ensure that trails remain relatively stable with appropriate maintenance and management. Recognizing and accommodating these changes can also help to promote safety and reduce conflicts.

A 2004 survey of Massachusetts park users - *The Public's Use of Outdoor Resources in Massachusetts* showed that 54% of contacted households had used a park, recreational area, or public space at least once in the past 12 months. This figure represents a statistically significant increase from the 42% reported in the previous study in 1994. Of that 54% of households, 52% visited public trails. Among all the activities that respondents participate in, those that can be associated with the use of trails are shown below. Most visitors participate in non-motorized recreational uses of public lands and clearly these figures can help to guide future decisions in trail management and development.



In terms of usage of parks/recreational facilities, 64% of the respondents indicated that the opportunity for healthful experiences was very important and trails are among the most popular places that command repeat use.

Trail Regulations

DCR is currently reviewing and revising its CMR's to integrate regulations promulgated under the DEM and MDC. Once finalized, the regulations pertaining to trail activities will be included in this manual.

DCR Approved Trail Uses

Approved trail uses on DCR State Parks lands include walking, running, hiking, mountain biking, horseback riding, cross-country skiing, and snowshoeing. Snowmobile use is allowed in some State Parks in designated areas and trails.

Other special uses allowed on some trails include interpretive uses, wheelchairs or similar mobility devices, carriages, dogsleds, bicycles, rollerblades, and roller skis.

Currently, eight state forests include All Terrain Vehicle (ATV) or Off Highway Motorcycle (OHM) trails. Recognizing the potential impacts, conflicts and maintenance challenges

associated with these uses, DCR has adopted a special policy and procedure for designating trails which are open to these vehicles. The procedures include evaluating the property and specific trails according to more than thirty environmental, design and management criteria through a coarse and fine filter process. The DCR web site includes the agency policy for siting ATV and OHM trails at http://www.mass.gov/dcr/recreate/ohv_policy.pdf. For further information regarding these uses, contact DCR's Bureau of Recreation.

Additional Types of Trails

Long Distance Trails

Massachusetts' Long-Distance Trails are the primary spine of our greenway and trail system. Massachusetts' Long-Distance Trails include:

- Taconic Crest Trail
- National Scenic Appalachian Trail
- Mahican – Mohawk Trail
- Metacomet – Monadnock- Mattabesett Trail
- MidstateTrail
- Mass Central Rail Trail
- Warner Trail
- Bay Circuit Trail
- SAM (Snowmobile Association of Massachusetts) Corridor

Long-Distance Trails provide important long-distance recreational opportunities. They connect communities, features, and parks and forests along their route. They serve as destinations for trails that connect to them, and they bind together critical elements of our scenic landscapes. Of these, only the Appalachian Trail is permanently protected. All of the others, approximately 700 miles in all, are in danger of fragmentation as unprotected segments are lost to development or closed to the public. Protecting and promoting these resource will require a coordinated effort by multiple stakeholders, but within DCR, we should take the lead in promoting, connecting to, managing and protecting these trails as the backbone of our greenway and trail system.

Bikeways and Rail Trails

Bikeways are generally hard surfaced trails developed for multiple uses, but with on-road bicycling as a main designed use. Rail Trails specifically refer to bikeways that have been developed on former rail corridors. DCR currently manages several rail trails including the Cape Cod, Norwottuck, Ashuwillticook, and Nashua River Rail Trails. These trails often connect communities and provide a particular kind of developed trail experience that is becoming increasing popular.

Water Trails

Water trails are designated routes, features and access points along rivers, streams, estuaries, coastal areas, and ponds. Water trails do not usually require the development of the trail itself, as the designation, user information and interpretation that assists users in enjoying them. They can provide a special and scenic trail experience for users of both motorized and non-motorized watercraft. Examples of existing water trails include the Connecticut River Water Trail and the Great Marsh Coastal Water Trail network.

Historic Trails

Historic trails often involve the designation of a route along or past various features of historic or cultural importance. These trails may make use of existing roads, sidewalks or walkways, and usually include self-guided users information on the features. Examples might include the Freedom Trail in Boston or the Knox Trail through Western Massachusetts.

Interpretive/Nature Trails
Often short trails are specifically designed to provide natural or cultural interpretation of an area. These types of trails included signage, brochures or other kinds of written information to provide this interpretation. New formats of interpretation include pod-casts or cell phone interpretation. Some examples of these kinds of trails may include self-guided nature trails, "discovery" trails, or interpreter guided trails.

Accessible Trails
We discuss accessibility guidelines elsewhere in this manual. However, some trails are specifically developed to provide an accessible trail opportunity. These are specifically sited, designed, constructed and marketed for this purpose. Examples of these within DCR include the accessible trails at DAR State Forest, Dunn State Park and the Pittsfield State Forest's Tranquility Trail.

DCR Trail Team

In 2008, several DCR staff from across the agency assembled to review the first draft of the Trails Guidelines and Standards Manual. This group proved invaluable in identifying best practices in place across the management divisions and steering the development of this document. This group has come to be known as the DCR Trail Team. It has become clear that the Trail Team will continue to play a role in the ongoing implementation of these guidelines, future revisions, and trail-related training associated with them. The Bureau of Recreation in conjunction with the Greenways and Trails Program will coordinate the ongoing activities of the Trails Team and ensure that the group includes the various interests from across the agency and that their work is integrated with other related agency initiatives.

Section II: Trail System Planning and Development

Instead of considering each trail individually, the trails in and around DCR facilities should be viewed as components of an integrated system or network. Trails are integral to the activities and services, and resources we are protecting at each facility.

Each ***Trail System*** should effectively contribute to three primary goals:

- Highlighting ecological, scenic, and cultural features within our facilities
- Providing specific, enjoyable recreational experiences to users
- Connecting important trail corridors, destinations, and population centers both within and outside of our facilities

Each ***Trail System*** should effectively achieve the above goals while simultaneously:

- Avoiding sensitive areas
- Meeting the expectations of users
- Minimizing ecological impacts
- Minimizing maintenance requirements

Assessing and Planning an Existing Trail System

Trail system planning does not need to take a lot of time or resources. With a few good maps, knowledgeable staff, and some strategic decision-making, we can make a great deal of progress in planning for more effective trail systems.

A more formal Trail Plan can also be developed using a public process.

Below are the basic steps to trail system planning.

Get to Know Your Trails

1. Walk Your Trails: The most important piece of information to have when assessing an existing trail system is a first hand knowledge of the trails. While out on the trail, examine and document existing conditions, problem areas, types and number of users, available parking, signage and marking, etc.

2. Gather Maps: Compile appropriate maps. Ideally, you will want to compile or request maps that depict:

- Existing trails, developed areas, roads, facilities, park boundaries, etc.
- Rare and endangered species habitats
- Streams and wetlands
- Steep slopes
- Historic/cultural resources
- Special management areas/zones
- Soils restricted for trail development

You may already have much of this information available on existing maps, or be able to request these maps from DCR's GIS program.

3. Identify Forest Management Ways: Recognize that many of the forest roads or ways that exist within a facility may have been developed to support forest management activities. While an area may not have been cut for many years, it may be due for active forest management at some point in the future. Consult your management forester and identify segments of your trail system that coincide with forest

management ways and that may be used for that purpose from time to time. See page 7 for additional information regarding trail corridors and forest management activities.

4. Describe Use Patterns and Demand: Identify which trails are designated for which uses, and what types of use you specifically want to manage for. Identify what types of trail uses currently exist within and around your facility and the use types wherein unmet demand lies. This could be done by formal observation, informal interviews, or by user surveys. Local community Open Space and Recreation Plans can also provide valuable information on community needs and desires. It is helpful to then prioritize the uses you want to manage for and identify key characteristics of each use.

Identify Features and Experiences

5. Identify Scenic, Recreational and Cultural Features: On your map(s), highlight the scenic, recreational and cultural features within your park that you want to draw visitors to, such as water resources, ridge lines, summits, vistas, long-distance trails, notable environments, historic structures, cultural landscapes, geologic features, etc.

6. Identify Your Main Parking and Access Points: The trail system needs to have appropriate parking and access points. Both too few and too many access points will result in management difficulties. In addition, parking and access points need to be designed appropriately for the given managed uses of the trail system. For example, for a trail system that allows motorized use, parking will need to be provided that can accommodate trailers and motorized trail vehicles, but you may also want to provide separate access points for non-motorized trail users.

7. Identify Recreational Experiences: Based on the features of your facility and the types of use you want to manage for, describe some of the high priority recreational experiences you hope to provide. For example, if there is a demand for mountain biking at your facility and sufficient space, you may want to provide the experience of a range of distances and challenges for mountain bikers. Or, if you have a large number of day users seeking a short but educational pedestrian experience, you may want to provide some short, fully accessible, nature trail experiences.

Keep in mind that different users may be seeking a range of experiences from shorter, safer, more developed settings to more remote and isolated settings. Also remember that different user groups will require different trail distances and be able to handle different levels of challenge. See the section above on "types of trails" for some general guidelines and the "Minnesota Trail Planning, Design and Development Guidelines" for a more complete discussion of user needs and expectations.

8. Identify Connections: Identify main destinations within your facilities (such as day use areas, and campgrounds), main trail corridors that you want to link to (such as long-distance trails, or community trails), and nearby communities, neighborhoods, or population centers that you could connect to.

Remember that it is important to look beyond our borders and think about how we can connect people to our parks through more than just roads and parking lots.

Also remember that too many connections between trails make trail systems confusing and difficult to patrol.

Identify Constraints, Issues and Problem Areas

9. Highlight Sensitive Areas: Now using the maps and existing knowledge, identify (draw a red circle around perhaps) areas where existing trails intersect sensitive areas

such as priority habitats, steep slopes, and wet areas. In addition, highlight specific trails or trail segments that have become persistent maintenance issues.

10. Highlight Problem Areas and Redundant Trails: Highlight trails or trail areas that are in poor condition or have become persistent maintenance problems. Many of these might be "fall-line" trails, those that go directly down the slope. You should also identify trails or trail segments that are redundant.

11. Involve Stakeholders: At this stage, it is useful to involve various stakeholders – park users, trail groups, advocates, etc. For example you might hold a public meeting on trail issues, or attend a "Friends" group meeting. These individuals and groups can help you identify features, use patterns, demand, opportunities, and connections.

Make a Plan

12. Designate Trail Use: Each trail should be designated for a certain use or uses, and these designations should be clearly identified at trailheads, intersections and on trail maps. Keep in mind that different modes of travel may impact other trail users, treadway, and resources; and often require different levels of trail maintenance and management. Review trail use designations to ensure that each makes sense.

13. Identify Potential Closures: In many DCR facilities, new trails have been developed over time without careful planning and/or adequate construction. These trails often have persistent maintenance and safety issues, user conflicts, or unacceptable environmental impacts. Considering the existing trails and highlighted areas of concern, identify trail segments that could be closed without significantly impacting the user experience, interrupting the trail corridor, or compromising the trail system.

14. Re-route and Restore Trails: At the same time, you may identify trails that are maintenance sinks or in areas of concern, but that are also critical for connections, or providing a user experience. These may be candidates for re-routes (i.e., moving the trail up-slope) or restoration (i.e., adding drainage structures) so that they can become more sustainable. Identifying and prioritizing these projects is an important step in developing maintenance and capital improvement plans.

15. Highlight Potential New Trails: Given the features you want to highlight, connections you want to make, and experiences you hope to provide, identify potential opportunities for new trails. This will be your guide in assessing future trail requests and additions. However, before one can consider new trail construction, it is essential to correct existing trail problems.

16. Identify Stewardship Partners: Lastly, within your trail system, you may be able to identify particular user groups, friends groups, scout troops, or other stakeholders who will be able to assist in the stewardship, monitoring and maintenance of particular types or sets of trails. It will be helpful to identify these groups in your trail plan.

Ideally, with a simple trail plan that includes maintenance priorities, closures, re-routes, potential new trail opportunities, and potential adopters, we will be able to effectively improve our trails system, access resources for improved trail development, and respond appropriately to requests for new trails.

Assessing Requests for New Trails or Changes in Trail Designation

Unfortunately, we are often faced with requests for new trails or new allowed uses from advocacy groups before we have had the opportunity to carefully consider the trail system needs in a Trail Plan or a Resource Management Plan. Before considering new uses or new trail development, we should ensure that the existing trail system is working to its full potential and that the new trail will, in fact, contribute to the goals of our network.

In addition, given the agency's limited ability for maintenance, we should ensure that we have the capacity to build and maintain a new trail over its entire life cycle. Developing and committing to a long-term maintenance strategy is a critical aspect of initial trail planning and fundamental to successful trail system management.

Important basic questions to ask before developing a new trail include:

- Why do you need a new trail? How does it contribute in a new way to the user experience or how does it offer a critical connection?
- What will the trail's designated uses be and what is the demand?
- Will this trail be designed to the accessibility standards?
- Who will design and build the trail?
- Who will fund the trail?
- Who will maintain the trail?

If, in planning your new trail, we find that we cannot answer these questions or balance these components, it is probably not wise to build the trail at all.

If we find that we can easily answer these questions and provide the commitment to sustainably design, build, and maintain a new trail then proceed to *Trail Proposal and Evaluation Form* (Appendix B). The *Trail Proposal and Evaluation Form* is the next step for gathering important information and seeking approval for a new trail proposal. The information in this form will then be used by facility supervisors, managers, and foresters to evaluate and either approve or disapprove the request.

In cases where a significant change in the trail system is being proposed (for example changes that might affect 25% or more of a trail system), then DCR will likely want to engage in a Trail System Planning or Resource Management Planning process to fully assess the proposed changes.

Additional Trail Development Concepts

Multiple-Use versus Single-Use Opportunities: Trails that are designed and managed for multiple uses differ somewhat from those that are designed and managed for single uses. Certain uses are more compatible with each other than others. See further discussion in Section III.

Multiple-use trails will likely be more expensive to develop in a sustainable manner, but given that more uses can be accommodated on fewer trail miles, may lead to lower long-term maintenance costs. They will also be able to provide recreational opportunities to more diverse users, but the user experience may be more uniform. On the other hand, some single-use trails may be easier to maintain per mile and may provide a more rewarding user experience to particular users.

Ultimately, you may want to consider developing a mixture of multiple-use and single-use trails at your facility depending on the features you wish to highlight and the user experiences you want to provide. For example, a particular park may want to specialize in offering opportunities for cross-country skiing or mountain biking and thus develop some longer single use trails to provide quality experiences in backcountry areas of the park, but may maintain a number of multiple use trails in the park's core area.

Trail Density and Diversity: All trails have impacts to natural resources. They lead to vegetation trampling and soil compaction, and can contribute to erosion and sedimentation, wetland degradation, wildlife disturbance and even wildlife mortality. As such, DCR seeks to strike a balance between providing recreational access and protecting natural and cultural resources. Considering the density of a trail network, can help provide guidelines to achieve this balance.

As identified in the DCR Landscape Designation Guidelines, DCR will strive to achieve a low density of trails in Reserves, a low to moderate density of trails in Woodlands, and may allow up to a high density of trails in Parklands. Based on our existing trail networks and experiences across the state, we identify the following targets:

Density	Metric	Examples
Low	0 – 3 km/sqkm	Middlefield SF (1.0 km/sqkm) Mohawk Trail SF (1.4 km/sqkm) Mt Greylock (2.3 km/sqkm)
Moderate	3 – 6 km/sqkm	Pittsfield SF (3.8 km/sqkm) Mt Tom SR (5.3 km/sqkm) Harold Parker (6.0 km/sqkm)
High	6 – 9 km/sqkm	Wompatuck SP (6.5 km/sqkm) Nickerson SP (7.9 km/sqkm) Blue Hills SR (8.6 km/sqkm)
Excessive	Greater than 9 km/sqkm	Middlesex Fells (16.7 km/sqkm)

As discussed above, DCR trail systems should largely be developed and managed for multiple recreational uses, but some single-use opportunities may be appropriate. In general, not more than 25% of a trail system should be single-use. In Reserves, trail systems should generally by managed for a variety of non-motorized users.

Of course, every DCR facility is different, and the above targets are guidelines to help guide thinking, not hard standards.

Core Area versus Backcountry Trail Opportunities: Most DCR facilities have core area(s) with significantly higher usage and more developed facilities, as well as back country area(s). Trails in the core area should be more accessible, and designed,

marked, and maintained to a higher Trail Class standard as they are likely to see higher usage. Backcountry area may be appropriate for longer distance trail opportunities, single use trails, and a lower level of management. Trails in backcountry areas offer a more intimate experience with fewer visitors, a greater challenge, and sometimes higher risk. Risk is associated with difficulty and remoteness of a trail, the probability of meeting others, and the level of management.

Trail Management along the Recreational Opportunities Spectrum: The Recreational Opportunities Spectrum (ROS, see Section I for more details) recognizes that the user experience and expectations will vary along a continuum from primitive facilities to semi-developed sites to urban areas. Some DCR facilities are naturally going to provide a more urban or sub-urban recreational experience and some a more natural or even semi-primitive experience. The facilities (including trail facilities) across this spectrum will obviously be managed differently, with different standards and different levels of management.

The ROS helps provide management guidelines across this continuum. In urban and sub-urban settings: Accessible, multi-use hard surfaced paths may be more appropriate with a relatively high level of use, and greater signage and management presence.

In developed and semi-developed natural settings: Users may expect a diversity of trail types and experiences from woodland only pedestrian trails to mountain biking trails to soft-surface multi-use trails, but they will also expect to encounter a variety of users, especially in core areas.

In semi-primitive settings: Expectations will vary depending on whether the facility allows motorized use or not. In non-motorized areas, trails will tend to be narrow and more rugged with a minimum of management presence. Users will expect to find a certain level of solitude and may not expect many other users.

Connecting to Neighboring Communities: Where feasible and appropriate, consider using trails to connect state parks and forests to neighboring communities. Trail connections beyond our borders are important as recreational opportunities and as transportation alternatives. They also allow us to expand the numbers of miles and types of user experiences we can provide and help strengthen ties to local user and advocacy groups.

Trails connecting outside of our borders should be carefully developed only in partnership with a local community or trail group, with that group taking the lead. Important considerations before any new connecting trail is developed include property ownership, landowner permission, maintenance responsibility, and issues around controlled access.

Principles of Ecologically Sustainable Trails

(This section is drawn and adapted from the Minnesota DNR Trails and Waterways Trails Planning, Design and Development Guidelines with additional information relevant for Massachusetts.)

Trails are our most important tool for linking conservation and recreation. As such, they must be developed and maintained in ways that avoid negative impacts to the ecological resources of the Commonwealth, especially those that the DCR directly stewards.

All development, including trails, has direct and indirect impacts to the environment. To help minimize these impacts, we propose the following **"guiding principles"** when developing and maintaining trail systems:

1. **Avoid Sensitive Ecological Areas**
2. **Develop Trails in Areas Already Influenced by Human Activity**
3. **Provide Buffers to Protect Sensitive Ecological and Hydrologic Systems**
4. **Develop Appropriately when Trails Do Intersect with Sensitive Areas**
5. **Use Natural Infiltration and Best Practices for Stormwater Management**
6. **Limit tread erosion through design and construction**
7. **Provide Ongoing Stewardship of the Trails**
8. **Ensure Trails Remain Sustainable**
9. **Formally Decommission and Restore Unsustainable Trail Corridors**

1. Avoid Sensitive Ecological Areas

When developing and maintaining trails, avoid sensitive ecological systems or take sufficient steps to minimize impacts on these systems. Ecologically sensitive systems include:

- Known and estimated locations of rare and endangered species and their habitats as identified by the Massachusetts Natural Heritage and Endangered Species Program,
- Priority Natural Communities and vernal pools as identified by the Massachusetts Natural Heritage and Endangered Species Program,
- Wetlands, lakes, rivers and streams,
- Public water supplies,
- Forest Reserves and Wildlands,
- Steep slopes and soils that are identified as restricted for trail or road development as defined by the Natural Resources Conservation Service,
- Unique or important geologic features, formations, and designated state geologic waysides, and
- Cultural and historic resources as determined by the DCR archeologist in consultation with Massachusetts Historic Commission.

2. Develop Trails in Areas Already Influenced by Human Activity

Consistent with the first guiding principle, where feasible, it makes most sense to site and maintain trails in areas that have already been influenced by human activity provided that you can meet your other objectives while doing so. These include:

- Already existing trails,
- Existing or historic wood roads and logging roads,
- Abandoned railroad corridors, often make appropriate multi-use trail corridors,
- Previously developed or disturbed areas.

3. Provide Buffers to Protect Sensitive Ecological and Hydrologic Systems

Maintaining buffers between trails and adjacent sensitive natural areas is essential to ensuring their long-term ecological quality, diversity, and habitat value. Irrespective of how well they are aligned and designed, trails have an impact, including habitat fragmentation, soil compaction, increased runoff and erosion, and introduction of non-

native plant species. For these reasons, the use of buffers is an essential part of trail planning and design.

Recommended buffer widths, however, will vary in response to a number of conditions, including:

- Sensitivity of the ecological systems being impacted,
- Extent of the natural open space or greenway corridor being traversed,
- Type of trail being proposed and its potential for creating ecological impacts,
- Grade and soils types, and
- Desired trail experience.

Recommended buffer widths may range from 50-200 feet depending on conditions. For a more detailed discussion see the Minnesota DNR Trails and Waterways *Trails Planning, Design and Development Guidelines*

Consult with MNHESP to determine appropriate buffer to rare, threatened and endangered species. Consult with Historic Resources to determine appropriate buffer to historic/cultural resource. Activities within wetland resource buffer areas are regulated by Massachusetts Wetland regulations and local conservation commissions. Projects within 100 feet of a wetland or within 200 feet of a perennial stream will require the submission of a Request for Determination of Applicability form to the local conservation commission.

4. Develop Appropriately when Trails Do Intersect with Sensitive Areas
The above discussion notwithstanding, trail development and maintenance across, along, and within sensitive areas is often desirable and justifiable. Streams need to be crossed, slopes traversed, and features interpreted.

Allowing controlled access to sensitive ecological areas may be an integral part of educating the public about the value of protecting them. Most often, this takes the form of routing a corridor trail on the periphery of a sensitive area (with adequate buffers) and allowing more direct access to specific settings only in very select locations, and with appropriate trail forms (such as boardwalks and bridges) for closer observation. This approach provides reasonable access while limiting the potential for environmental impact and can also be developed in conjunction with an environmental education program. In addition, any trail development should also be consistent with Resource Management Plans.

5. Use Natural Infiltration and Best Practices for Stormwater Management
Whether paved or natural trails, one of the most critical components of trail design and management is to keep the trail away from the water and the water off the trail.

On highly developed trails, the use of natural, dispersed infiltration systems such as vegetated swales and "rain gardens" offers advantages over engineered stormwater control structures such as storm drains and catch basins.

6. Limit Tread Erosion through Design and Construction
To minimize trail erosion and impacts to water resources use sustainable trail design and construction techniques such as: reducing the "tread watershed", "outslope" the trail (slope it away from the bank) to facilitate natural drainage across the trail, and provide appropriately spaced waterbars and drainage dips. See the *Elements of Design* section for more details.

7. Provide Ongoing Stewardship of the Trails

Trail stewardship begins with an appropriate, sustainable design, and continues with ongoing maintenance and monitoring, and if necessary restoration or closure.

Historically, DCR has put too few resources into trail stewardship, and this has to change. Trails are one of our most important recreational assets. Trail stewardship generally involves providing a safe and satisfying trail experience, minimizing trail conflicts, maintaining a stable, dry and firm trail tread, maintaining clearance zones, signing and marking trails, and insuring that there are no impacts to adjacent natural systems.

Stewardship of DCR trail resources will need to encompass a three-pronged approach:

- Ongoing trail monitoring and basic maintenance by DCR staff,
- Ongoing trail monitoring and basic maintenance by user and other stakeholder groups, and
- Capital trail restoration and closure projects to either make trails sustainable or close unsustainable trails.

8. Ensure Trails Remain Sustainable

A sustainable trail is one that can be indefinitely maintained for its intended purposes, assuming routine management and stewardship is provided consistent with the type of trail. If a trail is well designed and appropriately used, site impacts will stay within acceptable limits.

Over time, all trail treads will change shape with use and forces of nature. Anticipating and reacting to this change before significant damage occurs, is key to maintaining a sustainable trail system.

A trail becomes unsustainable when its physical condition passes a threshold where site impacts are no longer acceptable. Under these circumstances, action is required to avoid continued degradation of the trail and adjoining ecological systems.

In practice, all natural trail types tend to exhibit similar physical signs of being either sustainable or unsustainable, as reflected by rutting, erosion, by-passing, and impacts to adjoining ecological systems and hydrology.

In general, trails are considered sustainable if the following conditions are found:

- Trail tread is stable and compacted, with a constant outsloped grade preferred (the depression on a well-worn trail should average less than 3 inches in most soil types),
- Displacement of soils from the trail tread is minimal relative to the use and soil type (only limited berming on the outside of curves),
- Tread drains well with minimal to no signs of ongoing erosion,
- Tread does not restrict site hydrology and impact surface- or ground-water quality, and
- Impacts to surrounding ecological systems is limited to the trail tread and directly adjacent clearance zone, with no bypassing and cross-country travel occurring.

When a trail becomes unsustainable, there are three options. Re-design and restore the trail, restrict use/re-classify the trail, or decommission the trail.

9. Formally Decommission Unsustainable Trail Corridors

Closing or decommissioning is often necessary to ensure an effective and sustainable trail system and reduce maintenance costs and user conflicts. Decommissioning a trail involves more than just a sign or barrier. When a trail is closed or a trail segment is rerouted, at a minimum the visible ends of the old trail should be re-graded back to the

original slopes, the eroded soil there should be replaced, and the trail end should be replanted with native plants. The use of a physical barrier and reducing the visibility of the old trail tread are both necessary to effectively close a trail. Experience has shown that relying solely on fences and gates to block entrances of decommissioned trails is not very effective.

The Minnesota Department of Natural Resources' *Trail Planning, Design, and Development Guidelines* provides guidance on different methods of closing trails including using dense planting at entrances, creating closure berms to block access, using slash to reinforce closures, ways to re-naturalize corridors after closure, and public information and education. In many cases, these closures can be done in conjunction with forest management and integrated into a forest management plan.

Building Sustainable Trails

In the previous section we discussed broad principles of planning sustainable trails. But how do these translate on the ground?

While there are many factors that can influence the sustainability of trails, when you get to actually putting them or managing trails on the ground, they should achieve the following objectives.

- **Connect positive, and avoid negative, control points**
  A sustainable trail will lead users to desired destinations such as water features, historic sites, vistas, interesting landforms and user facilities; while avoiding wet areas, steep slopes, critical habitats, and other culturally or environmentally sensitive areas.

- **Keep water off the trail**
  As we have noted, erosion is the number one problem for sustainable trails. It damages trails, is expensive to repair and diminishes the user experiences. In New England, water is the primary erosive force. Trails that collect water or channel water will be both environmentally and economically un-sustainable.

- **Follow natural contours**
  Trails lie on the land in three ways – along a fall-line (in the direction of the slope), on flat ground, or along the contour (perpendicular to the slope). Of these types of trails, **only the contour trail** on the side-slope easily sheds water and is thus sustainable.

- **Keep users on the trail**
  When users leave the trail tread, they widen it, create braided trails, and create social trails. These can cause environmental damage and raise maintenance costs. Users leave the trail when it becomes eroded or wet, or when the trail does not meet their needs or expectations.

- **Meet desired user experiences**
  Sustainable trails and trail systems must meet different users' needs and expectations. If they do not, users may abandon the trails and / or create their own, less sustainable trails.

Ultimately, a sustainable trail design will most often be a trail that connects desired control points by roughly contouring along the sides of slopes.

Designing Sustainable Contour Trails

The contour trail is the most sustainable design, but how does one specifically lay out and create these trails so that they do not collect or channel water? A sustainable contour trail should conform to the following five "rules:"

1. Outslope: The trail tread should be outsloped (sloped away from the hillside) by 5%. This will allow water that comes on to the trail to flow off downhill and not be channeled down the trail.

2. Grade Reversals: While the trail will generally follow the contour of the land, it will also most likely either be climbing or descending slightly. However, a sustainable trail should also reverse its grade often (from down to up and vice versa, "surfing the hillside"). This will reduce the watershed of any given section of trail, prevent water from collecting and running down the trail, and reduce any erosion potential. Most trails should include grade reversals every 20 to 50 feet.

3. Half Rule: A trail's grade (percent slope) should not be any greater than half the grade of the hillside that it contours along. For example, if the slope of the hill the trail runs along is 16%, than the grade of the trail should be no more than 8%. This will allow water to flow across the trail, off the trail and continue down the slope. This is especially important along gentle slopes.

4. Ten Percent Average Grade: An average trail grade of 10% or less will be most sustainable, on most soils and for most users. This does not mean that shorter sections can't be steeper.

5. Maximum Sustainable Grade: The maximum sustainable grade is the steepest grade the trail will attain, and should be determined early in the planning process. Typical maximum grades may vary from 15% to 25%, but this is site specific and depends on factors such as soils, rainfall, the half rule, grade reversals, user type, desired difficulty level, and number of users.

Building an Enjoyable Trail Experience

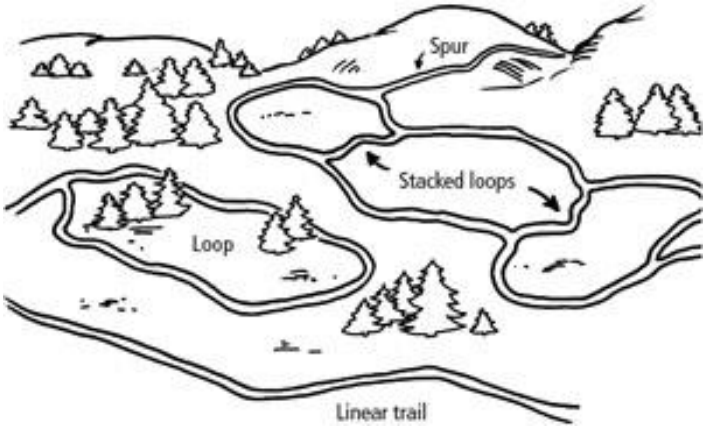
Beyond the issue of trail sustainability, the most successful trails are a reflection of the settings and landscapes they traverse. People purposefully choose specific settings for the experience they seek, and the trail should reflect those expectations. The more natural the setting, the more the trail needs to be shaped by nature. The more urban the setting, the more the trail needs to highlight local landmarks and points of interest and provide a social atmosphere.

Well-designed trails will also use natural and built elements to create sequences of visual, physical, and emotional experiences that are pleasing to the trail user. All aspects of a site – its topography, viewsheds, water features, ecological communities, cultural sites, developed areas, roads, and trails – should be perceived as part of the sequence of events that give the trail its character. To be successful, the collective sequence must also meet the expectations of the visitor in terms of desired mode of travel, setting, level of difficulty, and length of trail.

Managing Viewsheds: Managing the views as one progresses along a trail is an important consideration. Taking advantage of compelling views and downplaying those that detract from the trail is all part of controlling the sequence of events that enhances the trail's recreational value. Managing viewsheds is also an ongoing maintenance issue and may, at times, conflict with vegetation management. In these instances, it is important to define which viewsheds are important to the trail experience and how those will be preserved over time as part of the vegetative management program for the trail.

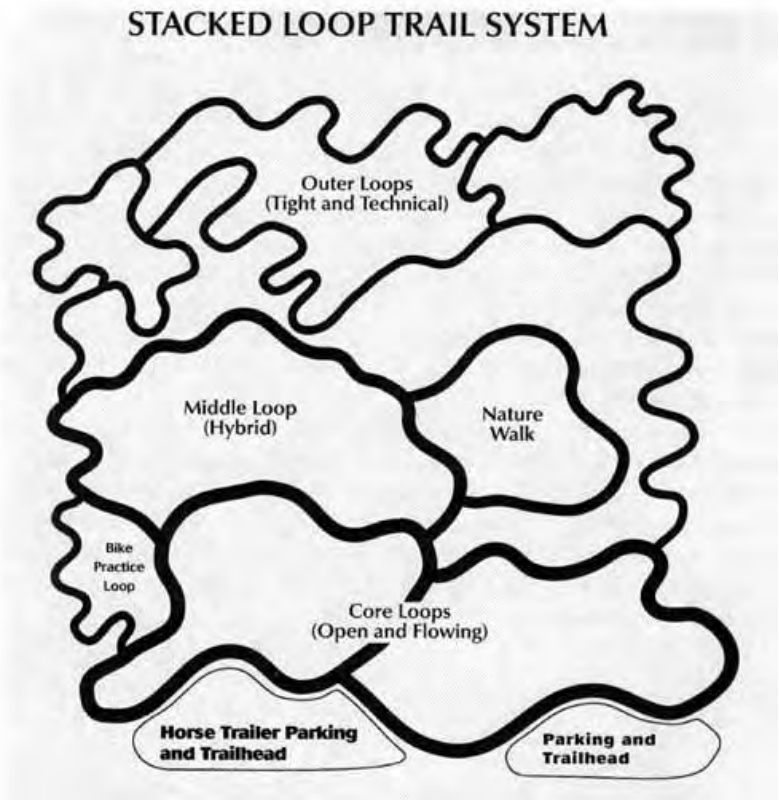
Trails "Shapes" and Layouts: Trail "shapes" are defined by their purpose and topography, but they also help to create a recreational experience relative to the trail's setting. Understanding the emotional response that various shapes induce is critical to designing trails that successfully mesh with the larger landscape experience.

Bikeways often follow old rail lines, and are therefore straight with little grade change. This provides a particular type of linear trail experience, and often meshes with more urbanized settings. Long-distance trails tend to be fairly linear as they connect features and destinations over a long distance, and will tend to follow ridgelines and river corridors. Spurs take the user to a particular destination and back. Loop trails allow for users to end up where they started without repeating any part of the trail.



(Graphic from "Trail Design for Small Properties" www.extension.umn.edu/distribution/naturalresources/DD8425.html#1)

Within DCR's parks, stacked loop trails (a series of loops that build upon each other or a large loop with different cut-offs along the way) can be an efficient design that allows you to offer a variety of trail distances and experiences in a relatively compact area.



(Graphic from NEMBA www.nemba.org/digitalnemba/images/StackedLoopTrails2.jpg)

Taking Advantage of Landscape Features:
In addition to the broader concepts of trail layout, good trail design also takes advantage of landscape features along the way that help to create the sequence of events and define the user experience. The four primary design elements are listed below.

Terminus and Destinations: Every trail should have a clear beginning and ending. Loop trails may just have a single beginning and ending, but may also have "destination" points along them. Terminus points should give the user a clear sense of initiation and accomplishment. Destinations should be features that entice the user on, and should leave the user with a sense of having achieved a goal.

Gateways: Gateways occur when natural or human structures constrain the trail and thus create a sense of "entrance." A bridge, a passage between two large trees, or a railroad cut into a ledge, all create a visual gateway. Ideally, gateways will also occur or be created at or near trailheads to give a sense of trail entrance.

Anchors: Landscape anchors are any vertical feature (a tree, boulder, wall, hill, valley, sign, etc.) that visually help to tie the landscape scene together and give it interest and balance. Anchors can also serve as stand alone points of interest that draw attention and provide continuity from one visual sequence to the next. Designing the trail to take advantage of natural landscape anchors and wrapping the trail from one anchor to the next, provides the trail with a sense of flow and purpose.

Edges: Edges are borders between landscape features or between ecological zones. The trail itself creates edges within the site (one along each side). Examples include borders between:

- land and water,
- steep slopes and level ground,
- woodlands and grasslands,
- forest types or habitats, and
- human created linear features like fence lines and roadways.

Edges often offer rich opportunities for trails. Following or crossing edges enables the user to experience different aspects of a site in unison. Edges are also often ecologically rich and provide habitats for diverse plants and wildlife.

Constraints: Within each property there are also constraints and obstacles around which trails need to be designed. Streams, property lines, wetlands, steep slopes – all form constraints that define where the trail can go.

For a more detailed discussion, see the Minnesota Department of Natural Resources' *Trail Planning, Design, and Development Guidelines.*

Building Accessible Trails

Trails are about providing people access to the land. Our facilities offer a wide range of recreational opportunities, settings and experiences. DCR is committed to integrating accessibility into the range of recreation opportunities while protecting natural resources and settings so that all people, including people who have disabilities, have the opportunity to enjoy and experience what our public lands have to offer.

How does accessibility fit into the range of settings we provide? We certainly don't want to pave the wilderness, nor do people with disabilities only wish to experience highly developed settings. When the decision is made to construct or alter a trail or other facility, we must ask, "Will a person with a disability have an equal opportunity to use this trail?" Are there existing conditions that may limit a trail's ability to meet accessibility standards (see Accessible Trail Standards Conditions for Departure)? The key is to ask these questions before the trail has been designed and built. Then we can provide trails for use by all people.

To achieve this goal, DCR proposes to adopt the Forest Service Trail Accessibility Guidelines (FSTAG) available at http://www.fs.fed.us/recreation/programs/accessibility/FSTAG.doc.

These guidelines provide accessibility standards for trails, but they will only apply to:

- New or altered (re-designed or re-developed) trails that;
- Have a Designed Use of pedestrian/hiker, and
- Connect directly to a currently accessible trail or trailhead.

Trail maintenance is not subject to these guidelines, although, through regular maintenance, we should attempt to enhance accessibility. For example, if an opening in a downed tree needs to be cut, we should make sure we cut it at least 32" wide, or if a bog bridge is installed, we should attempt to make it 32" wide.

In addition, there are several conditions under which trail designs may depart from the standards in the accessibility guidelines. There are also general exceptions and several existing trail conditions which may be "limiting factors" in a trail's ability to meet the design standards. The FSTAG provides a flow chart which guides trail managers through the process of determining whether and which of the accessibility guidelines apply, and DCR's Universal Access Program can assist trail managers in determining the application and implementation of these guidelines.

For those trails or trail segments that do apply, they should be designed and maintained to meet the general standards in the chart on the following page.

Examples:
Imagine you wanted to create a new walking trail, from a day use area, around a pond. This is envisioned as a class 3 (improved) trail, and construction to the accessibility standards would not harm any cultural, historical or significant environmental resources. In this case, you would likely need to construct the trail to the below standards.

Imagine you needed to develop a new access trail from a road to the Appalachian Trail. This is envisioned as a class 2 (simple) hiking trail. The terrain climbs steeply, and the soils are not firm in many places with natural obstacles. Constructing this trail to the accessibility standards with substantially change the physical setting and the trail class, and would be impractical due to terrain. This would lead to conditions for departure and you would not need to build this trail to the full standards.

Massachusetts DCR Universal Access Program's
SUMMARY OF GUIDELINES FOR ACCESSIBLE TRAILS
(Based on Forest Service Trail Accessibility Guidelines, May, 2006)
This chart should be used as a guide only. Contact DCR's Universal Access Program for assistance in evaluating, designing and developing new or altered trails.

ACCESSIBLE TRAIL STANDARDS

Trail Grade (max) (*1)	**w/ resting intervals** (*2)	**Cross Slope (max)**	**Obstacle Height (max)**	**Trail Tread**
• 5% max. for any distance • 8.3% for 200 'max. • 10% for 30' max. • 12.5% for 10' max.	N/A, not required @ 200' max. @30' max. @ 10' max.	5% (*2)	2" height max.	Firm & stable

Clear Width	**Openings**	**Passing Space Interval**	**Edge Protection**	**Protruding Objects**	**Signs**
36" (*3)	½" max. diameter	Every 1000' when clear width less than 60". 60"x60" min. or T-shape min. 48"	3" min. height (where edge protection provided)	80" min. clear head space (or provide barrier to warn blind)	At trailhead; identify total length of trail & first point of departure

*1 No more than 30% of the trail shall exceed 8.3%
*2 Resting interval: 60" minimum in length by minimum width of trail width, 3% max. grade. For routes: 5% max. cross slope allowed for proper drainage.
*3 May be reduced to 32" or less with allowable exceptions.
*4 May be no less than 32" for a distance of 24" max. with one of four conditions

There are several "Conditions for Departure," "Limiting Factors" and "Exceptions" that will affect the degree to which these standards are applicable.

Conditions for Departure:
The following four conditions for departure allow deviation from the standards where exceptions apply.

1. Where compliance would cause substantial harm to cultural, historic, religious, or significant natural features or characteristics.
2. Where compliance would substantially change the physical or recreation setting or the trail class, designed use, or managed uses of the trail or trail segment, or would not be consistent with the applicable land management plan.
3. Where compliance would require construction methods or materials that are prohibited by federal, state, or local law, other than state or local law whose sole purpose is to prohibit use by persons with disabilities.
4. Where compliance would be impractical due to terrain or prevailing construction practices.

Exceptions and Limiting Factors:
Where one or more limiting factor exists and one or more conditions for departure exist, then there may be exceptions from following the guidelines. Limiting factors include:

a) The combination of trail grade and cross slope exceeds 20% for over 40 feet (6100 mm).
b) The surface is not firm and stable for a distance of 45 feet or more.
c) The minimum tread width is 18 inches or less for a distance of at least 20 feet.
d) A trail obstacle of at least 30 inches (770 mm) in height extends across the full width of the trail.

Permitting

Any disturbance to the natural environment has impacts, and trails are no exception. When we construct or maintain trails, we should make every effort to do no harm. As discussed above, ideally trails should be routed to avoid sensitive resources such as streams and wetlands, rare species habitats, and sensitive cultural sites. However, trail development within or alongside of sensitive areas is often necessary and justifiable. Streams need to be crossed, steep slopes traversed, and unique features interpreted. Allowing controlled access to sensitive ecological or cultural areas may also be an integral part of educating the public about the value of protecting these resources. When sensitive areas cannot be avoided we, as trail builders, have legal and ethical obligations to minimize our impacts by going through the proper regulatory procedures. Below are some of the state regulations and permits that you need to consider when you develop a trail.

Streams, Rivers and Wetlands: In Massachusetts, activities occurring within 100-feet of a coastal or inland wetland or within 200-feet of a perennial stream or river are governed by the Wetlands Protection Act. Among the many activities regulated by this act are changing run-off characteristics, diverting surface water, and the destruction of plant life – activities commonly associated with trail building and maintenance. If your trail building activities will occur within 100-feet of a wetland or 200-feet of stream or river you ***must*** file a "Request for Determination of Applicability" (RDA) form (http://www.mass.gov/dep/water/approvals/wpaform1.pdf) with you local conservation commission. Your local Conservation Commission can explain the state regulations and local bylaws; they can also provide guidance on completing your RDA.

How do you know if your trail project will occur near a wetland? A good starting point is the wetlands on-line viewer, which is available at http://maps.massgis.state.ma.us/WETLANDS12K/viewer.htm. If your project occurs near a wetland identified on this map, you will need to submit an RDA. Be advised that not all wetlands are indicated on this map, so an RDA may be required even if no wetlands are indicated on the on-line viewer.

Threatened and Endangered Species: Over 440 species of plants and animals are protected under the Massachusetts Endangered Species Act (MESA). MESA protects state-listed rare species and their habitats by prohibiting the "Take" of any species that is listed as Endangered, Threatened, or of Special Concern. A "Take" is any activity that directly kills or injures a MESA-listed species, as well as ***activities that disrupt rare species behavior and their habitat.***

Trail building activities are subject to review by the Massachusetts Natural Heritage and Endangered Species Program (http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm) if they occur in areas that have been delineated as "Priority Habitat." You can determine if your project will occur within Priority Habitat with the help of the Priority Habitat on-line viewer (http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/online_viewer.htm). If your trail project is located within priority habitat, you ***must*** file a MESA project review checklist. This checklist may be found at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/pdf/mesa_proj_review_check_elect.pdf.

Archeological and Cultural Resources: Any soil disturbance activities, such as trail building, that are on state property or funded ***through state or federal funds*** (including Recreational Trails Grants) require review from the Massachusetts Historic Commission (MHC; http://www.sec.state.ma.us/mhc/) and you ***must*** file a Project Notification Form. This form may be found at http://www.sec.state.ma.us/MHC/mhcform/formidx.htm. If the project is not in an area

with archeological and/or cultural resources, the MHC will not require anything further. If the project is in such an area, the MHC may request an archaeological survey, and you will need to hire a private archaeologist complete this.

Historic Landmarks: In certain cities and town, all or some of the parks have been designated as local historic landmarks. Chestnut Hill Reservation for instance, is considered a Boston Landmark. Any work in the area, design and construction, has to be reviewed by the local historic landmark board before work can begin.

Note that these review processes treat trail construction and alteration similarly. Alterations include significantly changing the trail's grade, width, or surface, adding bridges, adding a spur to serve a new destination, and changing the trail's use, such as from horses to hikers. The following checklist will help you determine if your trails project requires regulatory review.

Massachusetts Regulatory Review Checklist

☐ Yes ☐ No	Will any work occur within 200 feet of a stream or river or within 100 feet of a wetland? If yes, contact your local conservation commission for help preparing an RDA.
☐ Yes ☐ No	Does the project area intersect with any Priority Habitat Area? If yes, file a MESA Project Review Checklist with the NHESP.
☐ Yes ☐ No	Will the project disturb any soil and will it occur on state property or be funded with state and/or federal funds? If yes, file a Project Notification Form with the MHC.

On the Ground; Putting It Together

With a basic understanding of sustainable, enjoyable, and accessible trails concepts, it is now time to put that knowledge to work on the ground. A brief, but good description of these steps is also included in the USDA Forest Service *Trail Construction and Maintenance Notebook* at http://www.fhwa.dot.gov/environment/fspubs/00232839/index.htm.

1. Scouting the Trail:

Scout the potential trail corridor in the trail's primary season of use. To clearly see landscape details, scout when deciduous trees have lost their leaves. If possible, scout in all seasons to reveal attractive features and hazards that may affect location, construction, or maintenance. Look for:

- Spring: high water, ephemeral ponds, flowers
- Summer: dense foliage, normal water level
- Fall: foliage color
- Winter: icicles, snow scenes, frozen water

Note existing trails and roads, control points, obstacles, points of interest, and anchor points. Take notes and mark locations on a map or record GIS coordinates.

2. Establishing Your Trail Design Standards:

After exploring the trail corridor, but before flagging the exact trail location, establish your design standards. Design standards are based on the trails Designed Use and Trail Class. These will be affected by your desired managed uses; the setting; the quality of experience you want to offer, including the level of risk; and your construction resources, including budget and expertise.

Consider these aspects of the trail design such as trail configuration, trail length, tread surface, tread width, obstacles, clearing width, clearing height, grade, cross slopes, turning radius, sight distance, water crossings, and special requirements.

USDA Forest Service trail design parameters are included in Appendix C.

Recommended trail design standards are also suggested in the University of Minnesota *Recreational Trail Design and Construction Manual* at www.extension.umn.edu/distribution/naturalresources/DD6371.html#trail1.

3. Flagging Your Trail:

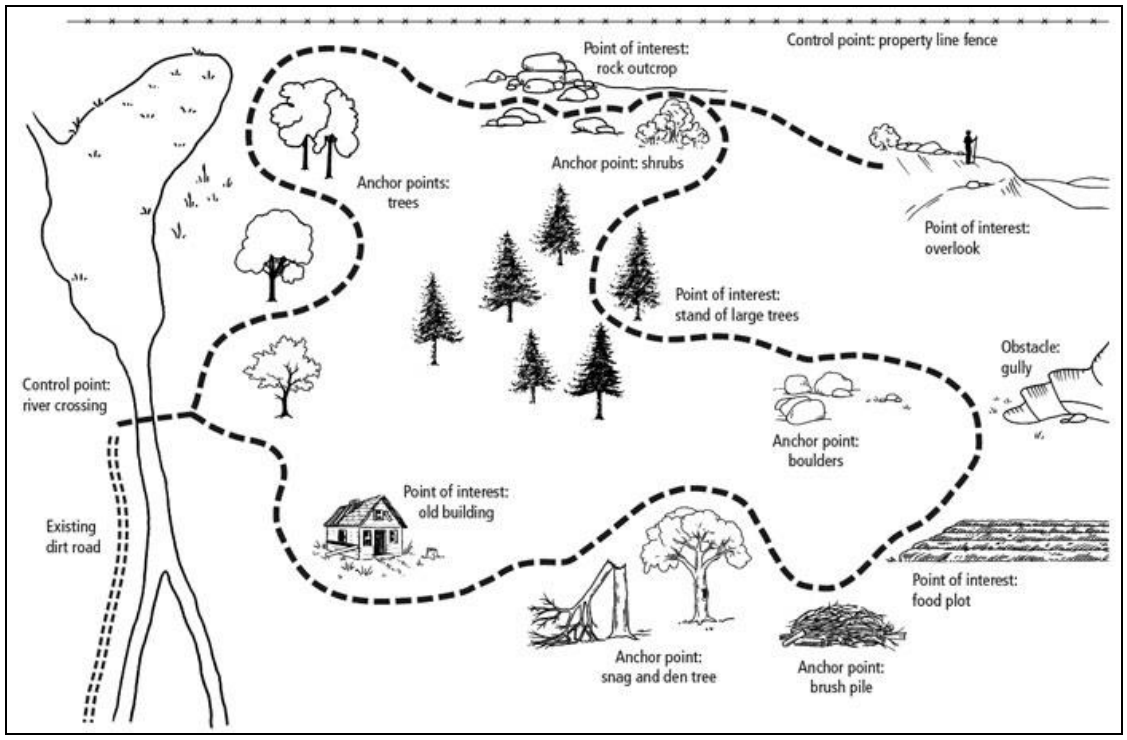
Now it is time to flag your trail on the ground. A trail that follows natural contours, gently curving and bending around obstacles, and that disturbs the site as little as possible, is aesthetically pleasing and more enjoyable to travel. Mark the route with brightly colored plastic flagging tape tied to trees and shrubs. Use a clinometer to maintain desired trail grade and GPS to help locate and connect trails. You may want to revisit and revise your marking more than once or with more than one person. Remember one of the principle rules of sustainable trails, "keep the trail away from water and the water off the trail."

4. Putting It All Together:

The graphic below illustrates how you can put these design elements together to create a sequence of events and a more satisfying trail experience.

- This design uses the trailhead at the end of the dirt road to create a single access point that can be monitored and controlled, and also provides a single trail terminus. The trail also provides an overlook as a destination about half way along.
- The bridge over the stream at the beginning of the trail will serve as a trail gateway. An additional gateway is created as the trail moves between the boulders in the north section.

- You can see how this trail makes use of anchors and points of interest along the way, both curving around and away from various elements to create a sequence of trail events.
- Finally, the trail makes use of edges in a couple ways. It goes along the edge of the wetland and fence line in north-west of the property, and along the edge of the food plot in south-west. It also crosses in and out of the stand of evergreens in the middle to create a set of transitions between forest types.



Trail Design and Construction Resources

- The USDA Forest Service "**Trail Construction and Maintenance Notebook**" at http://www.fhwa.dot.gov/Environment/fspubs/00232839/index.htm includes excellent descriptions and diagrams of various trail construction and maintenance techniques from tread maintenance to grade dips to switchbacks to bridges.

- Appalachian Mountain Club's **- The Complete Guide to Trail Building and Maintenance** 3rd Edition by Carl Demrow and David Salisbury. Includes the essentials for creating environmentally sound trails: how to plan, design, build, and maintain trails; protective gear; choice of tools for each job; building ski trails, bridges, stiles, and ladders. Updated techniques focus on stonework, drainage, and erosion control, and working with private landowners. Photos and illustrations are also included.

- The Appalachian Trail Conservancy's **- A.T. Design, Construction, and Maintenance** by William Birchard, Jr., Robert D. Proudman, and the Regional Staff of the Appalachian Trail Conservancy. Second edition (2000) of the definitive handbook on trail work, from landscape values to the nitty-gritty of moving rock.

- Student Conservation Association's **Lightly On The Land**: The SCA Trail Building and Maintenance Manual, 2nd Edition by Bob Birkby. For half a century, the Student Conservation Association (SCA) has inspired people of all ages to take part in projects that enhance the environment. In settings from city parks to backcountry wilderness, the practical skills presented in its pioneering handbook have been tested in the field by volunteer and professional work crews throughout the nation. Their input enriches every chapter of the new edition with fresh approaches, new ideas, and modern applications of traditional skills.

- **Minnesota Department of Natural Resources'** ***Trail Planning, Design, and Development Guidelines*** manual provides guidelines for developing sustainable motorized and nonmotorized trails. Extensive attention is given to developing trails that are physically, ecologically, and economically sustainable. A newly-developed trail classification system is described to enhance consistency in how different types of trails are planned and designed. The principles of trail design emphasize the art of designing trails to make them more visually appealing and enjoyable. Technical design guidelines for various types of trails are also extensively considered in the manual. Click the link below to download--CAUTION! This is a very large file, almost 700 MB. http://www.bestpracticesmn.org/presentations/NRW9-20-06/FULL%20DOCUMENT%20no%20cover.pdf

- **USDA Forest Service Accessibility Guidebook for Outdoor Recreation and Trails** is a guidebook intended to help users apply the Forest Service Outdoor Recreation Accessibility Guidelines and Forest Service Trail Accessibility Guidelines. Available at: www.fs.fed.us/recreation/programs/accessibility/htmlpubs/htm06232801/index.htm

- **University of Minnesota** ***Trail Design for Small Properties*** provides simple, inexpensive solutions for designing, building, and maintaining sustainable trials—trails for hiking, horseback riding, bicycling, cross-country skiing, snowmobiling, off-highway motorcycles (OHMs), and all-terrain vehicles (ATVs). http://www.extension.umn.edu/distribution/naturalresources/DD8425.html

- **University of Minnesota** ***Recreational Trail Design and Construction Manual*** is a guide for private woodland owners, organizations, and businesses (including nature centers, youth groups, schools, conservation clubs, and resorts) that are interested in designing and constructing trails. It describes step-by-step construction methods, ways

to handle trail obstacles, and recommended standards for the most common types of trails. http://www.extension.umn.edu/distribution/naturalresources/DD6371.html

- **American Trails Resource Library on Trails Design and Construction** http://www.americantrails.org/resources/trailbuilding/index.html

- **International Mountain Bike Association's - Trail Solutions** IMBA's Guide to Building Sweet Singletrack. This book combines trailbuilding techniques with proven fundamentals in a colorful, easy-to-read format. The new book expands greatly on IMBA's popular 2001 handbook "Building Better Trails" and breaks new ground by providing detailed advice on banked turns, rock armoring, mechanized tools, freeriding, downhilling, risk management, and other pioneering techniques.
  The book is divided into eight sections that follow the trailbuilding process from beginning to end. Readers will be guided through the essential steps of trail planning, design, tool selection, construction, and maintenance.

- **Natural Surface Trails by Design** by Troy Scott Parker Physical and Human Design Essentials of Sustainable, Enjoyable Trails. This first book in a series captures much of the detailed knowledge of skilled trail designers. It presents eleven generative concepts as the foundation for a concise process that explains, relates, and predicts what actually happens on all natural surface trails. The concepts cover the essential physical and human forces and relationships that govern trails—how we perceive nature, how trails make us feel, how trail use changes trails, how soils and trail materials behave, and how water, drainage, and erosion act.

Section III: Trail System Management, Maintenance and Monitoring

Trail Classification

The DCR Road and Trail Inventory classified roads / trails along the following types:

- ***Administrative Road:*** A road accessible to DCR administrative vehicles, but not open to the public.
- ***Forest Way / Trail:*** A route that potentially serves as both a trail and as access for forest management activities.
- ***Trail:*** A pathway that is used for recreational trail use.

Identifying and distinguishing between forest ways, which may serve a forest management as well as a recreational function and recreational trails will be important in determining how we manage, protect and educate users on each type of trail.

Each trail should also be classified into one of five trail classes. Trail class is the prescribed scale of trail development, representing the intended design and management standards of the trail. The five categories classify trails along a spectrum of development and are defined in terms of tread, obstacles, constructed elements, signs and typical recreation experience.

These prescriptions (adapted from the USDA Forest Service) take into account user preferences, setting, protection of sensitive resources, and other management activities. The general criteria in the table below define each trail class and are applicable to all system trails. Appendix C provides additional Criteria specific to motorized trails, equestrian trails, snow trails, and water trails.

Trail Class descriptions define "typical" attributes, and exceptions may occur for any attribute. Apply the Trail Class that most closely matches the managed objective of the trail.

Trail Class Attributes

Trail Attributes	Trail Class 1 *Minimal/ Un developed Trail*	Trail Class 2 *Simple/ Minor Development Trail*	Trail Class 3 *Developed/ Improved Trail*	Trail Class 4 *Highly Developed Trail*	Trail Class 5 *Fully Developed Trail*
General Criteria					
Tread & Traffic Flow	◆ Tread intermittent and often indistinct ◆ May require route finding ◆ Native materials only	◆ Tread discernible and continuous, but narrow and rough ◆ Few or no allowances constructed for passing ◆ Native materials	◆ Tread obvious and continuous ◆ Width accommodates unhindered one-lane travel (occasional allowances constructed for passing) ◆ Typically native materials	◆ Tread wide and smooth with few irregularities ◆ Width may consistently accommodate two-lane travel ◆ Native or imported materials ◆ May be hardened	◆ Width generally accommodates two-lane and two-directional travel, or provides frequent passing turnouts ◆ Commonly hardened with asphalt or other imported material
Obstacles	◆ Obstacles common ◆ Narrow passages; brush, steep grades, rocks and logs present	◆ Obstacles occasionally present ◆ Blockages cleared to define route and protect resources ◆ Vegetation may encroach into trailway	◆ Obstacles infrequent ◆ Vegetation cleared outside of trailway	◆ Few or no obstacles exist ◆ Grades typically <12% ◆ Vegetation cleared outside of trailway	◆ No obstacles ◆ Grades typically <8%
Constructed Features & Trail Elements	◆ Minimal to non-existent ◆ Drainage is functional ◆ No constructed bridges or foot crossings	◆ Structures are of limited size, scale, and number ◆ Drainage functional ◆ Structures adequate to protect trail infrastructure and resources ◆ Primitive foot crossings and fords	◆ Trail structures (walls, steps, drainage, raised trail) may be common and substantial ◆ Trail bridges as needed for resource protection and appropriate access ◆ Generally native materials used in Wilderness	◆ Structures frequent and substantial ◆ Substantial trail bridges are appropriate at water crossings ◆ Trailside amenities may be present	◆ Structures frequent or continuous; may include curbs, handrails, trailside amenities, and boardwalks ◆ Drainage structures frequent; may include culverts and road-like designs
Signs	◆ Minimum required ◆ Generally limited to regulation and resource protection ◆ No destination signs present	◆ Minimum required for basic direction ◆ Generally limited to regulation and resource protection ◆ Typically very few or no destination signs present	◆ Regulation, resource protection, user reassurance ◆ Directional signs at junctions, or when confusion is likely ◆ Destination signs typically present ◆ Informational and interpretive signs may be present	◆ Wide variety of signs likely present ◆ Informational signs likely ◆ Interpretive signs possible ◆ Trail Universal Access information likely displayed at trailhead	◆ Wide variety of signage is present ◆ Information and interpretive signs likely ◆ Trail Universal Access information is typically displayed at trailhead
Typical Recreation Environs & Experience	◆ Natural, unmodified ◆ ROS: Often Primitive setting, but may occur in other ROS settings ◆ WROS: Primitive	◆ Natural, essentially unmodified ◆ ROS: Typically Primitive to Semi-Primitive setting ◆ WROS: Primitive to Semi–Primitive	◆ Natural, primarily unmodified ◆ ROS: Typically Semi-Primitive to Semi-Developed Natural setting ◆ WROS: Semi-Primitive to Transition	◆ May be modified ◆ ROS: Typically Semi-Developed Natural to Developed Natural setting ◆ WROS: Transition	◆ Can be highly modified ◆ ROS: Typically Developed Natural to Urban setting ◆ Commonly associated with Visitors centers or high-use recreation sites

Operation and Maintenance Considerations by Class

Trail operation and maintenance considerations (adapted from the USDA Forest Service) are intended to complement the trail class general criteria. These considerations can be regarded as general guidelines to assist in developing trail prescriptions, and subsequent program management, operations and maintenance.

Trail Attributes	***Trail Class 1*** **Minimal/Undeveloped Trail**	***Trail Class 2*** **Simple/Minor Development Trail**	***Trail Class 3*** **Developed/Improved Trail**	***Trail Class 4*** **Highly Developed Trail**	***Trail Class 5*** **Fully Developed Trail**
Trail Management	Typically managed to accommodate: ◆ Low use levels. ◆ Highly skilled users, comfortable off-trail. ◆ Users with high degree of orienteering skill. ◆ Some travel modes and ability levels may be impractical or impossible, and may not be encouraged. ◆ Water Trails: Users require high level of navigation/orientation and paddling skills.	Typically managed to accommodate: ◆ Low-to-moderate use levels ◆ Mid-to-highly skilled users, capable of traveling over awkward condition/obstacles ◆ Users with moderate orienteering skill. ◆ Trail suitable for many user types, but challenging and involves advanced skills. ◆ Water Trails: Moderate to high level of navigation/orientation and paddling/piloting skills required.	Typically managed to accommodate: ◆ Moderate to heavy use. ◆ Users with intermediate skill level and experience. ◆ Users with minimal orienteering skills . ◆ Moderately easy travel by managed use types. ◆ Random potential for accessible use. ◆ Water Trails: Basic to moderate navigation and paddling/piloting skills required.	Typically managed to accommodate: ◆ Very heavy use. ◆ Users with minimal skills and experience. ◆ Users with minimal or no orienteering skills. ◆ Easy/comfortable travel by managed use types ◆ May be (or has potential to be made) accessible. ◆ Water Trails: Basic navigation and paddling/piloting skills required.	Typically managed to accommodate: ◆ Intensive use. ◆ Users with limited trail skills and experience. ◆ Trail typically meets agency requirements for accessibility ◆ Includes “Pedestrian Trails”.
Maintenance Frequency & Intensity	◆ Infrequent or no scheduled recurring maintenance. ◆ Maintenance interval is typically 5 or more years, or in response to reports of unusual resource problems requiring repair.	◆ Maintenance scheduled to preserve the trail facility and route location. ◆ Maintenance interval typically 3-5 years, or in response to reports of unusual problems.	◆ Trail cleared to make available for use early in use season, and to preserve trail integrity. ◆ Maintenance interval typically 1-3 years, or in response to reports of trail or resource damage or significant obstacles to managed use type and experience level.	◆ Trail cleared to make available for use at earliest opportunity in use season. ◆ Typically, maintenance performed at least annually.	◆ Maintenance performed weekly, or as needed to meet posted conditions. ◆ Major damage or safety concerns typically corrected or posted <24 hours of notice.

Trail Maintenance

Trail maintenance comes in two forms, routine or periodic maintenance performed as a regular duty of park staff, seasonal staff or some form of trail crew or volunteers; and larger capital trail repair or reconstruction.

Routine Maintenance

High-quality and timely maintenance will greatly extend the useful life of a trail. The primary tasks of routine maintenance are to:

- Direct water off the tread / Maintain drainage structures
- Remove debris and obstacles
- Maintain clearances
- Maintain clear trail edges
- Replace and maintain trail signs and route markers
- Keep users on the trail
- Monitor and report conditions and serious problems

Of course, there is always too much work for the time you have to spend. How do you decide what to do? To prioritize, it's important to:

- Monitor the trail conditions closely
- Decide what can be accomplished as basic maintenance
- Determine what can be deferred
- Identify what area will need major work

This 'trail triage' is critically important if your maintenance dollars are going to be spent keeping most of the tread in the best possible condition.

Trail Recommendation Implementation Prioritization

Trail recommendations / proposals should be implemented in the following priority order, provided that the proposed work activities are consistent with DCR Trails Guidelines and Best Practices (as updated), and comply with the Wetlands Protection Act, Massachusetts Endangered Species Act and Massachusetts Historic Commission, permitted as necessary, and provided that the field staff have adequate operational resources:

1. Maintain appropriate existing trails and fire roads.
2. Close or improve existing trails with known public safety hazards.
3. Close or relocate existing trails that adversely impact documented state-listed species, in consultation with DCR Bureau of Planning and Resource Protection and NHESP staff.
4. Close, relocate or improve existing trails that impact vernal pools.
5. Close, relocate or improve wetland crossings on existing trails that impact wetlands, streams or ponds.
6. Close redundant, dead end and unauthorized trails.
7. Close, relocate or improve existing eroded and poor condition trail segments.
8. Construct new trail connections to enhance desired authorized recreational experiences, create additional loop opportunities and form new connections between access points and important features.

Trail Crews

Trail Crews may be regular park staff, season staff, special season crews such as the Western Region Trail Crew funded by the Recreational Trail Program Grants, SCA – Mass

Parks Crews, or hired professional crews such as the AMC Pro-Crew. Professional crews can assist in larger and more technical trail projects.

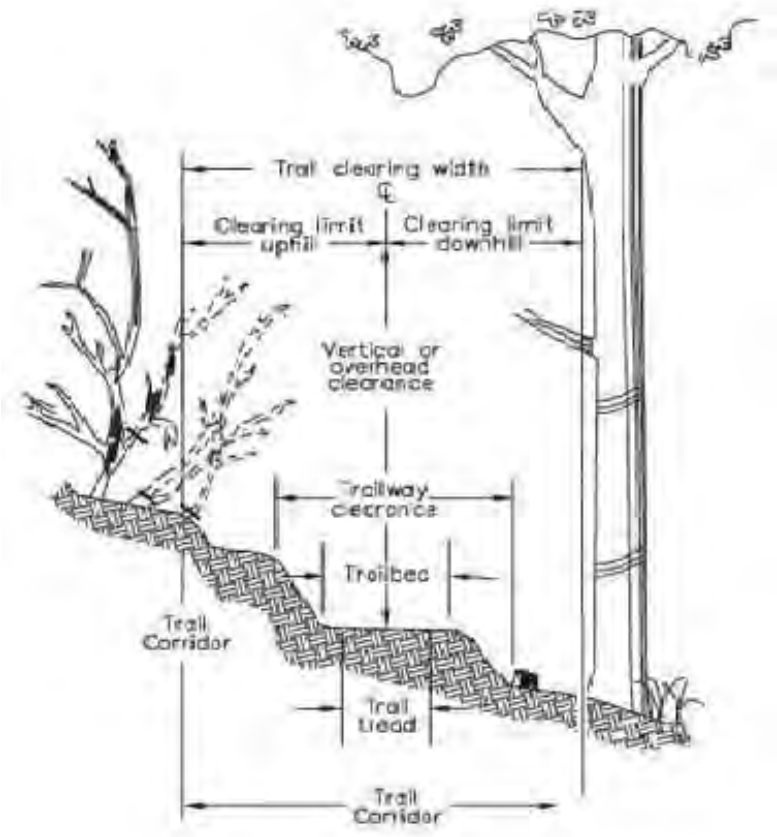
The best trail maintainers are those with "trail eye," the ability to anticipate physical and social threats to trail integrity and to head off problems.

Repair and Maintenance Activities

Trail maintenance activities on DCR's natural surface trails fall into the following categories:

- Trail Corridor Vegetation Clearance
- Trail Tread Maintenance
- Simple Drainage Structure Installation and Maintenance
- Moderate Drainage Structure Installation
- Steep Slope Structure Installation
- Trail Closures
- Trail Re-routes
- Wet Area Crossings
- Minor Stream Crossings (<20')

Trail Cross Section and Terms



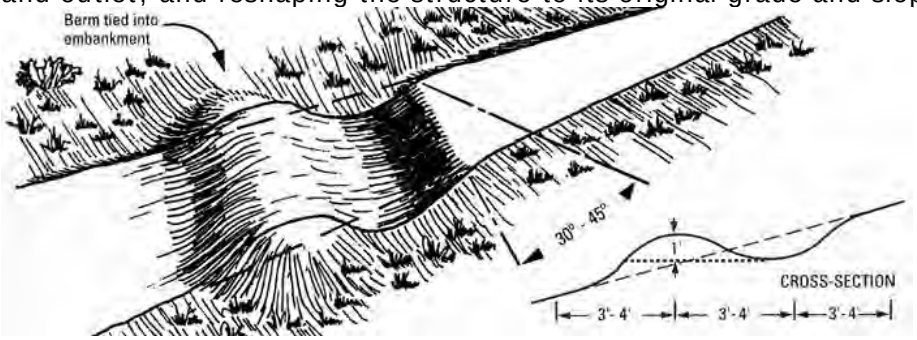
Trail Cross Section

Trail Corridor Vegetation Clearance
As vegetation falls or grows into the trail corridor, it must periodically be trimmed or removed to maintain a trail corridor clear or obstacles. This activity includes cutting, trimming and removal of vegetation within up to 18" of the existing trailbed width, and up to a vertical height of 6'to 9'. Tree branches that grow into the trail corridor are pruned back to the nearest larger branch or trunk.

Tread Maintenance
Occasionally, the existing trail tread requires maintenance to remove obstacles, and maintain proper grading and outslope for drainage. This activity includes removal of obstacles such as stones, roots or small stumps in the existing tread, reshaping the existing tread with hand tools such as shovels and rakes, and bringing in fill to cover exposed roots and rocks and fill mudholes. It does not involve work outside of the existing trailbed. (See Appendix I for further specifications.)

On Class 4 and 5 improved surface trails, which include paved pathways, tread maintenance may include the removal of existing pavement; excavation of roots and other material up to 8" under the paved surface; re-paving with asphalt, stone dust aggregate, or stabilized soils up to a width of 10 feet; clearing up shoulders up to 2 feet on either side. Work would be done with mechanized equipment, and would not involve work outside of the trailbed.

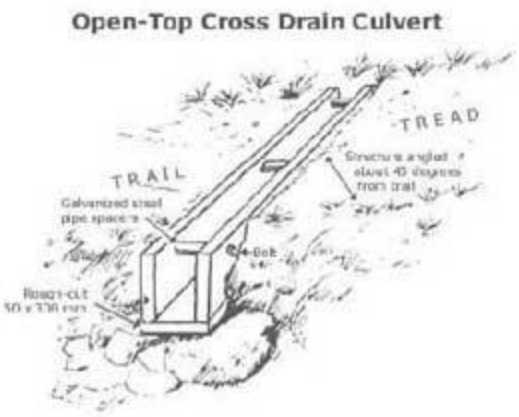
Simple Drainage Structures (drain dips and water bars)
This activity includes the maintenance of existing and installation of new simple drainage structures within existing trailbed. This may involve digging within the existing tread to a depth of no more than 12 inches to create a drainage dip, and / or the installation of logs, stones or other natural or imported materials to create a water bar. Most work is within the existing tread, but this activity may involve some digging and soil removal within 3' of the existing tread, particularly on the downslope side. Rock water bars may also involve the collection and moving of large stones from the immediate area. Native wood structures may include felling and utilizing local timber. Maintenance involves clearing debris from within the drainage structure and outlet; and reshaping the structure to its original grade and slope.

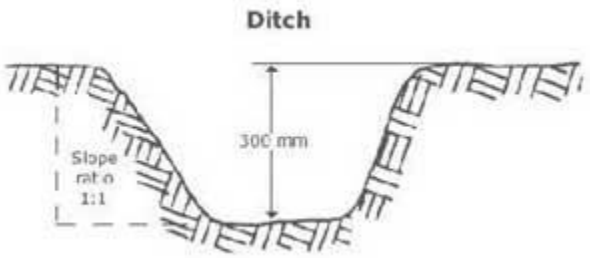


Trail drain dip

Moderate Drainage Structures (ditches, culverts and turnpikes)
Ditches and culverts may be installed and maintained to move water from one side to another and keep water off the trail. Ditches may be dug to a depth of 12" within 2' of the trail tread. Open cross ditches may be dug across the existing tread and within 3' on either side. Culverts (typically 9" to12") may be installed digging into the tread (up to 15") and digging and installing rock headers on either end within 3' of the existing tread. Turnpikes lift the trail tread above saturated soil. They are

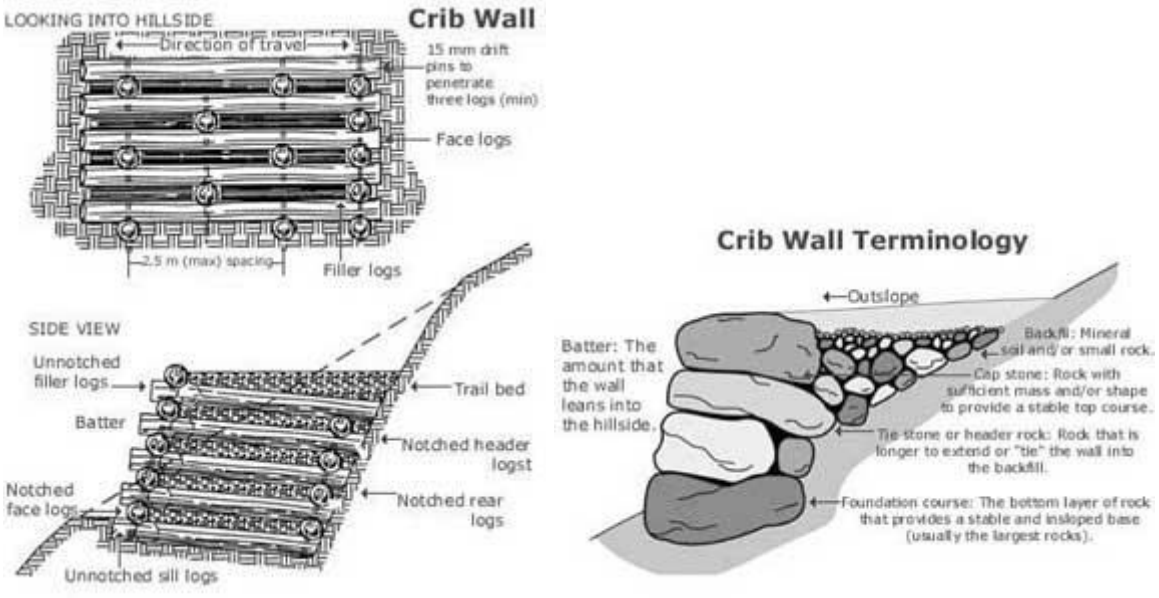
often combined with ditches and culverts to relieve a trail of water from seeps and streams, reduce erosion and provide dry footing. Building a turnpike involves digging a trench on either side of the trail (usually 24-48′ apart) and setting stone or logs securely in each trench. Length of turnpike depends on local conditions. After the parallel rows of rock or logs are in place, the area between is filled with small stones and crushed rock. A layer of mineral soil may be added to the top. Material to build turnpikes may be found from adjacent trail corridor or imported to site.





Steep Slope Structures (crib or retaining walls, check dams and steps)

On steeps slopes, retaining walls, check dams and steps are occasionally required to stabilize the trail tread, keep users on the trail and reduce erosion. Retaining walls can help to support turning platforms on switchbacks, shore up trails across rough terrain and steep side slopes, and reinforce the outer edge of a partial bench. Retaining walls may be constructed of either wood or rock. Some excavation will be required establish a footing for the rock or wood. Depth of excavation depends on the slope and size of material used to build retaining wall. Excavated soil may be used for back fill. Rocks and peeled logs are then securely layered to the desired height to create wall. The back of the wall is filled with small stones or crushed rock and mineral soil. Check dams help to slow the flow of water in gullies, allowing silt to build up behind structures and prevent futher erosion. They are effective tools for salvaging badly eroded tread and for restoring closed trails and damaged slopes. Check dams are built from large rocks or peeled logs securely installed perpendicular to the tread. Some excavation is necessary to secure rock or logs into the tread way. Filling behind the rock or logs with small stones or mineral soil will allow check dams to be used as steps. Large rocks (weighing from 40-100 lbs), timber and fill material may be obtained locally (see diagrams).



Trail Closures

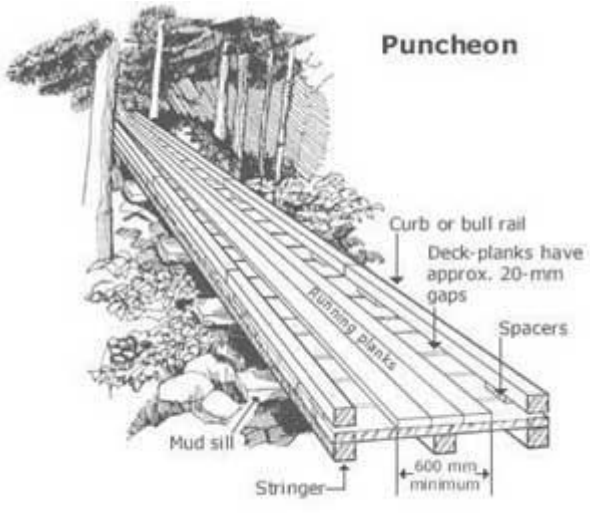
Trails that are seriously eroded, difficult to maintain, and poorly located can impact natural resources values and the user experience. Best management practices may call for closing these trails. Closing an existing trail to prevent future use may involve blocking or disguising the trail with available fallen wood or the felling of nearby trees. Brushing in the closed trail helps to retain leaf litter and soil. Closing may also involve some re-grading of the tread to a more natural grade or re-vegetation using local plant material. Closing a trail may even involve installation of check dams to restore damaged slopes.

Trail Maintenance in Potential Wetland Resources Areas

Any trail maintenance activities that result in an alteration of a wetland resource area will use Best Management Practices for controlling erosion and sedimentation, will be submitted to the local Conservation Commission for review, and/or shall be in compliance with an approved MOU with DEP.

Wet Area Crossings (bog bridges, puncheons)

Trails occasionally cross areas that have seasonally saturated soils or wet areas. In order to minimize impacts to vegetation and soils, and keep trail users dry, a number of different types of structures can be installed and maintained. Stepping stones are simple low-maintenance ways for trails to cross through wet areas. Installation of stepping stones includes excavation of 12’ of soil and setting of a large stone(s) for stepping. Large rocks will most likely be collected from along or nearby the trail corridor. Bog bridges and puncheon are simple wooden boardwalk structures. Stone or wooden sills are place on top of or dug into the soils to a depth of no more than 6” and a width of 18-36”. Side by side planks, peeled logs or stringers with decking are laid on top of the sills. These structures are no more than the existing tread width. Maintenance typically involves replacement of rotted sections.



Minor Stream Crossings (culverts and minor bridges (<20'))
Trails typically cross streams on fords, bridges or culverts. The size of such structures depends on the size of the stream and the surrounding terrain. Installation of bridges may include excavation of soils adjacent to the stream to install stone or timber abutments. Bridge stringers are then securely attached to the abutments and then the top is decked. Stone and or timber may be collected from the immediate area. Culverts may be wood, stone, metal or plastic and will be laid in the stream. Maintenance will involve cleaning debris from culverts and may involve replacement of rotted materials. (See Appendix I for further specifications.)

Capital Project Repairs
Major trail repairs and reconstruction that cannot be performed through routine maintenance or trail crews will need to be planned in conjunction with the Bureau of Engineering and funded through the capital budget process or by grants.

Alternative Funding Sources

Federal Sources
- Recreational Trails Program
- NPS Rivers, Trails and Conservation Assistance Program
- Transportation Enhancements

State Sources
- State Natural Resource or Park Agency Grant Programs
- State Transportation Agency Grant Programs
- Land and Water Conservation Funds
- State Public Health Grant Programs
- Conservation Trust Fund
- Parks Trust Fund

Trail Signage

"Signs are probably the quickest and easiest way to leave the trail user with a positive impression. If the signs are high quality, well maintained, and properly located, other trail problems are often over-looked. Consistent signs are the quickest way to increase the trail's identity and the public's support for the trail."
(National Park Service)

Past DCR Trail Signage and Marking
DCR properties and divisions have historically used a variety of different types of trail signage and marking systems from plastic blazes that designate trail uses, to painted or routed trailhead signs, to aluminum trail rules signs, to numbered intersections. These guidelines standardized trail signage and marking standards across the agency to improve trail management and user safety, enhance the users' recreational experience, and help create a positive agency trails identity.

Why Consistent Signage is Critical
Appropriate trail signs and markings provide information, keep people from getting lost, and contribute to a positive user experience. Trail signage is perhaps our most important form of communication with our users, as signs are the message they see every time they visit. Consistent signage, both within DCR facilities and between similar types of facilities, enhances safety, creates a positive trail identity, helps meets user expectations, and contributes to the public's support for trails.

The broad objectives of DCR's trail signage are to:

1. Provide consistent positive exposure of the trail system to attract users
2. Educate the user about trails, rules, etiquette and destinations
3. Reassure / ensure that the user is on the right trail and will not get lost
4. Control trail usage, reduce conflicts, and create safer, more enjoyable, and environmentally friendly recreational experiences

However, these objectives must be balanced with aesthetic considerations to **avoid "sign pollution."**

We accomplish these objectives through the consistent use of the following different kinds of trail marking:

- Trailhead signage
- Intersection directional signs
- Reassurance markers and blazes
- Safety and Rules Signage

It is important to consider the different purposes of each type of sign and use them appropriately.

General Trail Signage Standards
The following are DCR's general trail sign standards:

- Signage within a single DCR facility should be consistent with respect to colors, materials, and look. Ideally, adjacent facilities will also be consistent.
- The ideal trail signage standard for DCR should be ***brown signs*** with ***white lettering***.
- For simple trailheads and intersection signage, routed ColorCore signs are preferred as they are aesthetically appealing and resistant to damage and vandalism.

- Aluminum and plastic trail signs are only recommended for Rules and Safety Signage.
- Sign "Pollution" should be reduced. Remove all old, out-of-date or redundant signs.

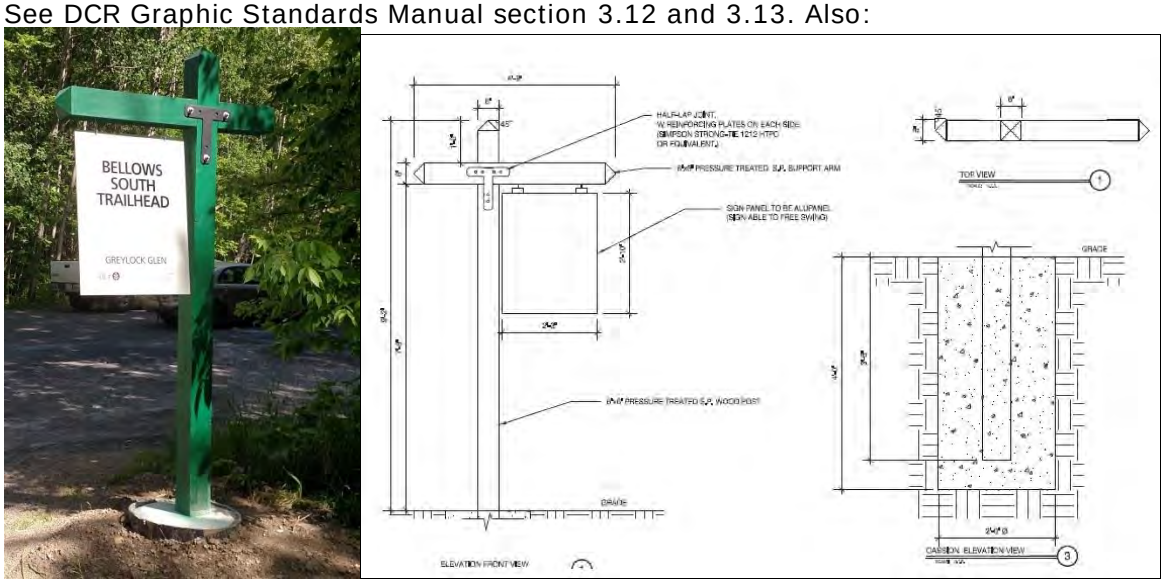
Naming Trails
Trail names can be an important element of the outdoor experience and can help draw visitors onto the trail. The "Blue Heron Trail," "Skyline Trail" or the "Round the Mountain Trail" convey to the user information about the wildlife, destination, or experience that lies ahead. Trails named for blaze colors, memorializing a trail advocate or designating a DCR management component may not be as appealing, functional, or memorable for users. Whenever possible, utilize trail names that suggest an attractive destination; introduce natural, cultural or historical context for the trail; or otherwise capture the imagination and experience of the intended user. Please keep in mind that not all trails need to be or should be named.

High Profile Trailheads / Park Entrances:
DCR has hundreds of "high profile trailheads" that are not accessed through the main park entrance, but serve as de facto park entrances, (i.e. pullouts, small parking areas, back gates, connections from town properties, etc.).

It is important to clearly identify these as DCR trailheads/entrances and provide users with basic welcome, orientation, and user guidelines information.

You should consult the DCR Graphic Standards Manual, Trail Section and Interpretive Services to develop signage for these situations. However, some examples of treatments include:

Cantilevered Identity Signage:
See DCR Graphic Standards Manual section 3.12 and 3.13. Also:



Welcome Waysides:
Welcome waysides are important to provide the user with a DCR welcome, general orientation (map), user guidelines and basic information. These should be integrated into High Profile Trailheads when possible and appropriate. The example on the below is consistent with DCR Interpretive Services template. Work with your Regional Interpretive Coordinator!

WELCOME TO

Fountain Pond State Park

dcr Massachusetts

Threemile Hill Trail & Community Health Center Walking Trail

Fountain Pond State Park offers easy access, rich landscape history and a diverse forest habitat that attracts all types of wildlife.

This walking trail is a gentle one-mile loop trail through field habitat, pine-hardwood forest, and protected wetlands.

Discover a variety of birds, amphibians, turtles, beaver, deer, bear, bobcat and other wildlife. Flowering shrubs, wildflowers and fall foliage are plentiful. Take time to stop along the way and listen for bird songs and animal calls.

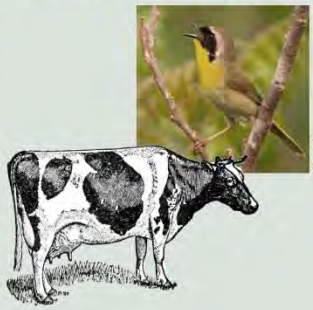
Look for clues to this once working landscape including the remnants of the former Henry Steven's dairy farm, the trolley line and the Fountain Pond Lodge. Now the landscape is managed by DCR and neighboring land trusts for grassland-field habitat.

As you cross into neighboring properties, look for changes in the type of forest. A keen eye may notice circular earthen platforms, evidence of 1800s charcoals kilns used to make charcoal from harvested hardwoods for use in firing the local iron furnaces.

Be a good steward and share rule and regulation information with others who may need a gentle reminder. We all share this landscape, let's care for it together.

Follow the blue trail blazes.

- ***CHP Walking Trail** loop is an easy 1-mile walk with an 80-foot elevation gain.*
- ***Threemile Hill Trail** is a 2-mile distance between Fountain Pond and Berkshire South Regional Community Center. A moderate hike with 330 foot elevation gain; consider spotting a car at one end if you wish to hike it one way.*
- ***Housatonic Flats Path**, nearby, is an easy, level, half-mile loop trail along the Housatonic River.*



***Top:** scenic panorama from the top of the meadow. **Left middle:** Look for Chestnut Oaks in the woods. **Right middle:** a common yellowthroat is among many songbirds you will hear and see on your hike. **Bottom:** look for remnants of the former dairy farm formerly here in the late 1800s and early 1900s.*

Visitor Guidelines

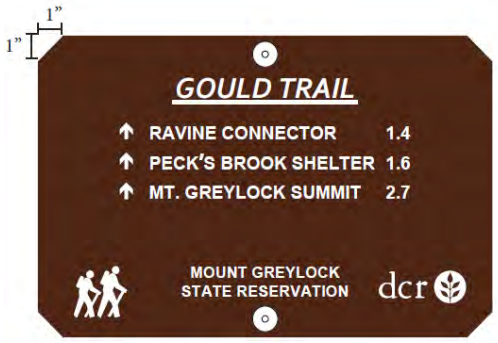
For the safety and enjoyment of all visitors please refer to the following:

- Foot traffic only.
- Stay on designated or marked trails, blazed in blue
- "LEAVE NO TRACE" - carry-in, carry-out all your trash
- Pets on leash only; clean up after your pets
- Enjoy watching wildlife from a distance; don't feed
- Be aware of hunting seasons and wear blaze orange
- Be aware of ticks, mosquitoes, and poison ivy
- Prevent the spread of invasive plants - check your boots, pets, & clothing for "*hitch hiker*" seeds and remove on site.

These trails are made possible through collaboration with: DCR, Great Barrington Trails & Greenways, Berkshire Natural Resources Council, CHP, Greenagers, Great Barrington Land Conservancy, Berkshire South Regional Community Center, Fields Pond Foundation, and partially funded though the Great Barrington Community Preservation Act (CPA)

Low Profile Trailheads:
Low profile trailheads occur through each park, wherever a named trail begins. We assume that the user at these trailheads has already encountered Park entrance / welcome information.

Low Profile Trailheads, like key trail intersections, should be marked with a routed ColorCore signs. These should be:



- A sign board of approximately 18″ wide by 11.75″ in height
- Beveled corners.
- Main text should be ¾″ to 1″
- Trail name in capital letter, underlined″
- Key trail destinations and distances, may be ½″ to ¾″ lettering
- All text shall be routed with a ¼″ veining bit with a minimum depth of 1/8″ and a maximum depth of ¼″
- State Park Name in caps at the bottom
- "dcr" or dcr plus logo in the lower right corner
- Symbols showing primary recommended uses (use or difficulty symbols may also be in 3″x3″square signs mounted on the post below the sign)
- Sign should be affixed with timberlok screws to a single 4x4 pressure treated wood post planted 24-36″ in the ground. Top of sign should be installed 1″ down from top of 4x4. Post should be the same color brown as sign.
- The top of the 4x4 pressure treated post should be beveled 45 degrees to back with 1 inch flat on top (same side as sign).
- Top of sign board should be approximately 40″ to 48″ inches from the ground.

Intersection Directional Signs
Intersection directional signs are the most important source of information for users, and can serve to enhance safety, avoid bad user experiences, and increase use of under-used sections of the trail. If someone knows that there is a waterfall, lake, or other attraction down the trail, they may be tempted to hike to it and thus become intrigued with the trail idea.

Directional signs should be placed at key trail intersections, decision points, and spur junctions. Ideally, intersections signs should be mounted on 4″x4″ wood posts. Post type should be consistent within the site. In areas with vandalism or other issues, intersection signs **may** be mounted high on trees.

Intersection signs **should** include the following information:

- A sign board of 18″ wide by 11.75″ in height (3:2 ratio landscape orientation)
- Routed ¾″ ColorCore
- 1″ Beveled corners

- Trail Name in capital letter, underlined, at .8″ to 1″
- Key trail destinations and distances, may be ½″ to ¾″ lettering
- Park Name text at .45″
- All text shall be routed with a ¼″ veining bit with a minimum depth of 1/8″ and a maximum depth of ¼″
- Destination references should include an arrow, indicate the next trail intersection/major destination and mileage rounded to the nearest tenth.
- Total number of directional references shall not exceed four
- "DCR" or dcr and logo in the lower right corner
- One to three Trail Use Symbols routed in the lower left corner
- Sign should be affixed with lag bolts to a single 4x4 pressure treated wood post planted 24-36″ in the ground. Top of sign should be installed 1″ down from top of 4x4. Post should be the same color brown as sign.
- The top of the 4x4 pressure treated post should be beveled 45 degrees to back with 1 inch flat on top (same side as sign).
- Top of sign board should be approximately 30″-48″ from the ground.
- Where two (2) signs are used at an intersection, they should be mounted perpendicularly on the same post.

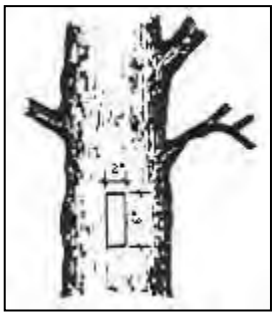
The sign or post **may** also include:
- markings for allowed or restricted uses
- trail difficulty
- intersection number in the lower left corner on sign

Location Identification (LID) Markers:
In some complex trail systems with numerous intersections, intersection numbering with LID markers can be helpful for user orientation when these numbers listed on an accompanying trail map. Numbers should not be used instead of directional signage, but can be used in conjunction and can be placed on the intersection directional sign in the lower left corner.

If LIDs are used, they should follow the standard:
- 5″ by 7″ brown plastic with white lettering
- 2″ vinyl numbers can by affixed to the center
- Emergency contact number can be included at the bottom

Reassurance Markers/Blazes

Trail blazes are important trail elements that provide a sense of reassurance to users, but also communicate authorized and stewarded trails. The recommended guidelines are consistent with best management practices for trail marking.

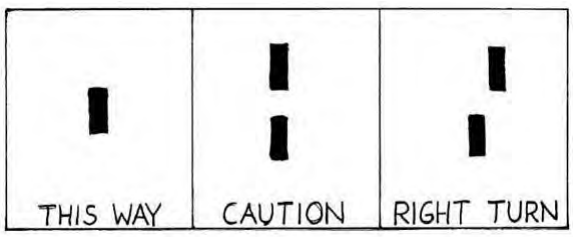


Official DCR trails **should** be blazed with vertical ***painted blazes***. Plastic blazes should be avoided and replaced when trails are re-blazed, upgraded of maintained. Painted blazes are more vandal resistant, do less damage than nail-on blazes, and are easier to alter.

Blazing Dos: ***One well-placed attractive blaze is worth twenty of the rest.***

- Paint crisp, clean edged, 2″ by 6″ rectangular blazes
- Blaze sparingly! One should never be able to see more than one blaze
- Take time to pick the right tree and paint a nice blaze (show you care)
- On rough bark, scrape the surface first with a scraper or draw knife
- Use quality, glossy, exterior acrylic paint such as Sherman Williams Metalatex or Nelson Boundary Paints
- At intersections, sharp turns, confusing sight lines, etc. make sure to have the next blaze readily visible.
- Blaze in one direction at a time
- Blaze at about 6′ in height

Directional Change Indicators



Double blazes should be used in places that require extra user alertness (e.g. important turns, junctions with other trails, and other confusing locations). They should be used sparingly so that they do not become meaningless or visually obtrusive. They are unnecessary at gradual turns and well-defined trail locations such as switchbacks. A reassurance marker should be placed so that it can be seen from the direction indicator. Be sure to mark confusing areas to guide users coming from both (or all) directions. Avoid arrows.

Colors and Shapes

In most cases, blazes should be 2″ by 6″ rectangles.

The general recommended standard for blaze colors should be:

- White for designated Long-Distance Trails (such as the AT or NET)
- Blue and green for non-motorized trails
- Orange or yellow for designated ATV and Off Highway Motorcycle trails

Many trails within DCR have specific colors and/or shapes associated with their identity. For example the "Blue Herron Trail" is identified by a blue triangle, the "Midstate Trail" by a yellow triangle and the "Red Dot Trail" by a red circle. This manual does not recommend changing these.

In more complex trail systems loops blazed in a specific color can guide users on a particular user experience. However, efforts should be made to avoid multiple colors and shapes of blazes on any particular segment of trail.

Blazing Don'ts!

- Don't Overblaze (you never want to see more than one blaze)
- Don't paint drippy, splotchy, uneven, or any other messy blaze
- Don't paint a blaze on rocks
- Don't paint a blaze on a dead or dying tree
- Don't leave old trail markers up
- Don't paint arrows

Safety and Rules Signage:
In certain instances it is appropriate to install safety and / or rules signage to warn users and clearly communicate expectations of appropriate behavior.

The DCR Graphic Standards Manual provides guidelines for most of these types of signs.

Multi-use pathways and motorized trails generally include safety signs such as:

- Stop Ahead
- Stop
- Caution Bridge Ahead

Multi-use trails or trail systems may also display rules / regulatory signs. These include:

- Trail / Park Name
- Three-Four Visitor Guidelines
- Three-Four Prohibited Use Symbols
- Number to call
- DCR logo

Mile Markers
Rail trails and long-distance trails may have mile markers posted at each mile from their origin.

Identification Markers for Identity Trails
Certain trails may have specific identities or official logos associated with them. For example, the Blue Heron Trail has a heron logo and the Mid-State Trail has a yellow triangle. These distinctive logos or identity markers should be placed at all road crossings (even drivable woods roads), on intersection signs, and periodically along the trail to assure users. Generally they should be about 1/2 mile apart, but frequency should increase in areas where there are numerous roads and intersections. They should not be continuous. These markers may be made of plastic or aluminum for nailing to trees or posts. Stickers may be used for intersection signs. They can be used in conjunction with mile markers. A larger emblem (8″-10″ diameter) for identity trails is typically used at trailheads, major roads, and other locations where more visibility is desired.

Sign Maintenance
Sign maintenance is critical to the operation of a quality trail system. Well maintained signs that are repaired promptly convey a sense of pride and reduce further vandalism. Signs are a highly visible representation of the quality of the trail. Their maintenance or lack of maintenance leaves the visitor with a positive or negative impression about the trail. Signs convey many kinds of information and it is critical that they be in good shape. Special attention should be given to those that are damaged from shooting and other factors, those that are faded or brittle from long exposure, and those that are simply missing. All signs that are damaged or weathered no longer convey a good impression or serve the intended purpose, and should be repaired or replaced. Periodic maintenance is a necessity and will prolong the life of a sign.

Standards in Primitive Areas

Some of the trail sign standards will be different in those forest and park areas classified as "Primitive" or "Semi-Primitive" under the Recreational Opportunities Spectrum. These differences include:

- Minimizing signage in primitive areas and forest reserves while still providing for user safety
- Continuously blazing is not necessary or desired
- Directional signage may only occur at major intersections and may not include distances or trail names, but should include directions and major destinations
- Interpretive waysides should not be used

Temporary Trail Signage and Blazing

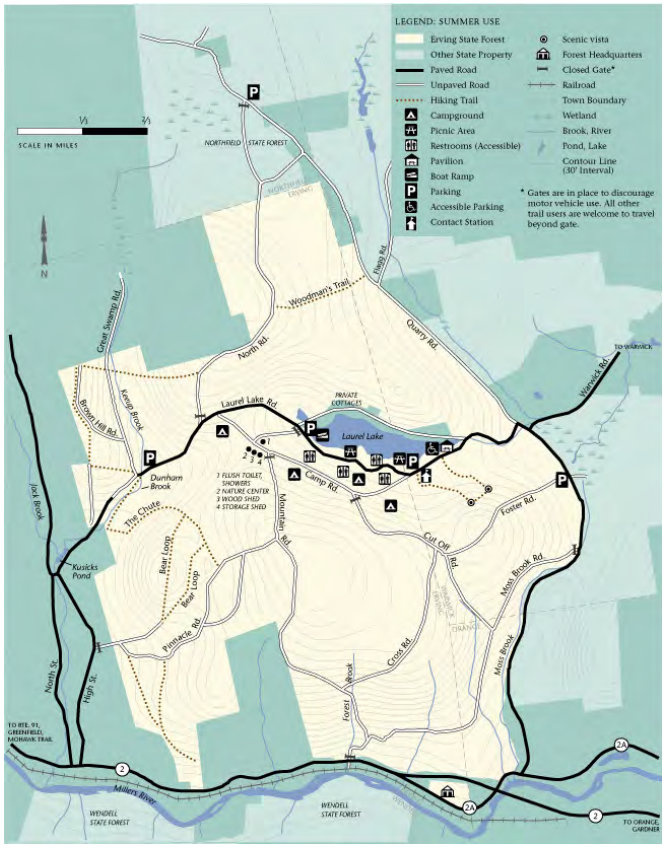
Some uses such as seasonal snowmobiling or special events may require temporary trail blazes and signs. Temporary signs installed by DCR partners should be allowed under a Special User Permit or MOA and should follow these guidelines.

- Temporary signs shall be approved by the facility supervisor
- They should be installed on posts rather than nailed to trees
- They shall not advertise specific vendors
- They shall be removed when the seasonal or temporary use is over
- Temporary signs shall not be inconsistent with these DCR standards

Trail Mapping

Trail maps are one of the most important tools we have for providing quality user information, managing user expectations, minimizing conflict, and promoting safe and appropriate trail use. DCR has a standard set of trail maps for most facilities (the "green maps"). DCR trail maps should show

- trail layouts
- trail use designations (if necessary)
- terrain (contours and hydrology)
- connections to other trails, trail systems or roads off of DCR property
- access points such as campgrounds, parking and trailheads
- features such as summits, vistas, and important cultural or natural sites
- a scale for distances
- key of symbols



DCR trail maps can also provide information about allowed uses, rules and regulations, trail etiquette, and cultural or natural interpretation including photos and graphics. Examples include the Cape Cod Rail Trail and the Blue Hills Mountain Biking maps.

Maps can be provided to the public on trailhead signs, in paper form at park entrances and trailheads, and on the internet for download. However, if maps present too much information, are poorly designed, or are not available where the public wants them, they are not useful to the public.

Presenting excellent maps, in standard forms but multiple formats, will greatly enhance the public's use and appreciation of DCR and our trail systems.

Additional trail map standards will be developed in the future in coordination with DCR Trails and Graphics Teams.

Digitally Mapping Trails

Currently, DCR Bureau or Forestry is in the process of digitally mapping all of our existing trails and roads with Global Positional System (GPS) technology and creating a Geographic Information Systems (GIS) layer of trails. This data will be extremely valuable for assessing our existing trail systems, planning trail system improvements, and creating excellent trail maps and signs. In conjunction with this effort, DCR GIS Program staff recently developed a protocol for mapping roads and trails. Having a standardized method is essential for collecting complete, high-quality data that is consistent across the park system. The protocol consists of a method for the fieldwork

and office-work portions of data collection, plus a GPS application for collecting standard information about roads, trails, and other conditions in the field.

The application consists of forms for collecting line and point GPS data. Lines represent trails and roads, while points can be collected for a large number of features such as trail intersections, bridges, culverts, damaged areas, vistas, parking areas, and many other point types related to forestry, recreation, and infrastructure.

This methodology was developed based on several years of experience mapping trails in DCR's system, plus detailed input from Forestry and Trails program staff. The document "Mapping Trails the DCR Way" (Appendix G) contains a set of guidelines for choosing walking routes and determining completeness of the road and trail mapping. The document "DCR Road and Trail metadata" (Available on Request from the DCR GIS Program) contains a list of the line and point types that can be collected with GPS and the attributes that need to be recorded for each type.

Partnerships, Friends and Volunteers

Trails offer the DCR a powerful avenue for encouraging volunteerism in our parks. People love to volunteer on trails, and trail management can greatly benefit from volunteers. User groups can help create, restore, or close trails. Friends groups can raise money and advocate for funding. Individuals and organizations can adopt trails. Volunteer teams can help clean-up, improve, or beautify them.

As our agency moves into the future, volunteerism is only going to become a more important avenue for accomplishing our goals. However, for volunteerism to be effective, it must be guided, directed, and managed. In fact, some of the trails problems we have today may, in part, be due to the unplanned and unmanaged volunteer enthusiasm of the past. Ideally, this manual will provide some of the guidance necessary to make most effective use of volunteers.

Why Use Volunteers?

- Often land managers lack the resources and staff to adequately monitor and maintain trails
- Trail volunteers make better trail users
- Trail stewardship can foster land protection and generate funds for trail development and maintenance

Types of Trail Partnerships

Partnerships and volunteer activities related to trails come in many forms. Here are a few examples of the types that exist in our system and that might be useful to encourage or create.

Friends of: The DCR has many friends groups, and in some cases these include "Friends of" a particular trail. Friends groups are formally (or informally) established groups whose propose is to promote the park or the trail. They generally can be effective in four areas – organizing volunteers, raising funds, advocacy, and/or running programs. Friends groups tend to be self-directed and bring a lot of ideas and energy. They can be effective at recruiting and managing volunteers, and occasionally bring their own trail building and managing expertise. However, to be most effective, the energy of friends groups should be channeled into needed projects, and they often need hands-on training, technical assistance, and oversight.

Activity Oriented Groups: Massachusetts has a number of activity oriented or user groups that are organized to promote recreational opportunities around a specific use such as mountain biking or snowmobiling. User groups are often effective in mobilizing volunteers and even in-kind donations, and often bring a high level of their own technical expertise. However, user group's efforts need to be guided and channeled into completing projects that are needed from the point of view of the park supervisor and trail system plan. User groups will often want to create new trails, when, from the park's point of view, trail rehabilitation or even closures may be more important to the overall system. In some cases, user groups can also be effective in completing needed regular maintenance, such as trail grooming.

Community Trail Committees: A growing number of communities are establishing trail committees at the local level. These groups tend to be focused on creating new trail opportunities on community lands, but may want to create connections to state parks and forests. While these connections are valuable, they should be established and laid out in ways that contribute to the park's goals and trail system plan. Too many connections and inappropriate connections need to be avoided.

Adopters: Adopters can be individuals, organizations, or businesses who agree to beautify or provide regular monitoring and maintenance to a particular section of trail. For example, adopters along bikeways may regularly clean a section, mow a section, or maintain a flower bed. Along hiking trails, adopters periodically hike, clear, and perform routine maintenance. Adopter programs can be effective ways to channel volunteer interest, but they require a certain level of formality and some training and monitoring. There are two types of Adopt-a-Trail Program approaches that may occur in association with state land:

Massachusetts Adopt-A-Trail Program: This is a program which is facilitated by a member of the DCR staff who serves as "Supervisor" and will organize work details with individual volunteers or groups who choose to take responsibility for regular trail maintenance and enhancement on a section of trail. This program is defined, organized and facilitated by the state, in conjunction with an individual or group. Appendix E includes a brief description of the DCR Adopt-A-Trail Program.

Organizational Adopt-A-Trail Program: Adopt-A-Trail Programs may also be organized and overseen by parks friends groups or other similar organizations. For example, the Friends of Blue Hills has established a model Adopt-A-Trail program. They organize adopters, provide training, and oversee the program. It is the responsibility of the volunteer organization to stay in close communication with a member of the DCR staff in order to determine the trail work that is needed and permitted, but it is ultimately the organization which facilitates the program. To view the Friends of the Blue Hills Adopt-A-Trail Handbook and other information please visit their website or contact the Blue Hills Reservation Supervisor.

Volunteer Trail Patrols/Ambassadors: Like adoption programs, individuals and organizations may agree to regularly patrol and serve as "ambassadors" on a trail. These types of programs are particularly useful on multi-use trails. Like adopter programs, they require a certain level of formality and training to ensure that the patrols are equipped with the knowledge and materials to perform the task.

Guiding Volunteer Efforts

As noted above, in partnering with volunteers in our parks, it is vital that their energy be guided into projects that are truly needed, that they are accomplished to our trail building and maintenance standards, and that they either have or are given the appropriate tools and technical training to accomplish the goals.

Strategies for insuring this include:

- DCR has a (draft) policy for working with volunteers in parks. This policy should be followed, including procedures for project approval.
- All volunteers must fill out and sign a "Volunteer Agreement and Release Form."
- New trails should not be created unless the a Trail Proposal Evaluation Form (Appendix B) has been submitted, reviewed, and approved by the appropriate people., and the new trail fits into the facility's trail system plan.
- The facility supervisor should be aware of and formally approve all volunteer trail work.
- Volunteers should adhere to the guidance included in this document including trail design, development, and maintenance standards and signage standards.
- DCR should develop formal Adopter and Ambassador programs with training and written agreements to ensure that volunteers have the necessary tools and training to effectively contribute to trails management.

Attracting and Keeping Volunteers

Reach out to your prospective work crew

- Use the local media, start a website
- Contact local clubs and enthusiasts
- Solicit for volunteers in parks, on trails or where they congregate

Be prepared
- Develop clear goals, objectives and strategies
- Train crew leaders in advance
- Prepare for any kind of turnout and a variety of skill levels
- Have tools necessary for the job

Manage your volunteers
- Brief your crew, complete waiver (if required), sign in and out volunteers,
- Assign crew leaders to projects
- Promote safe and proper tool use and maintenance techniques
- Care for your crew – provide snacks, water…

Keep them coming back
- Provide sense of accomplishment
- Make it enjoyable
- Show your appreciation
- Stay in touch

Potential Trail Partners
- Appalachian Mountain Club
- Student Conservation Association
- New England Mountain Bike (NEMBA)/ International Mountain Bike (IMBA)
- National Off Highway Vehicle Conservation Association (NOHVCC)
- Snowmobile Association of Massachusetts (SAM)
- Bay State Trail Riders
- Local User & Community Groups
- Friends Groups
- Rails To Trails Conservancy
- American Trails
- National Hiking Society
- Local, State and National non-profit organizations

Understanding and Managing Conflicts

Conflicts on multiple-use trails have been described "as problems of success-an indication of the trail's popularity" (Ryan 1993, 158). In fact, the vast majority of trail users are satisfied, have few complaints, and return often. However, conflicts among trail users do occur, including conflicts between trail users and animals, trail users and trail managers, and even trail proponents and private landowners. If not addressed, conflicts can spoil individual experiences and threaten to polarize trail users who could be working together rather than at odds with one another. As the number of trail users grows and diversity of trail activities increases, the potential for conflict grows as well. It is the responsibility of managers and trail users to understand the processes involved in recreational conflicts and do everything possible to avoid and minimize them on multiple-use trails.

Conflict in outdoor recreation settings (such as trails) can best be defined as "goal interference attributed to another's behavior" (Jacob and Schreyer 1980, 369). As such, trail conflicts can and do occur among different user groups, among different users within the same user group, and as a result of factors not related to users' trail activities at all. In fact, no actual contact among users need occur for conflict to be felt. Trail conflict has been found to be related to

- activity style (mode of travel, level of technology, environmental dominance, etc.)
- focus of trip
- user expectations
- attitudes toward and perceptions of the environment
- level of tolerance for others
- different norms held by different users.

Conflict is often asymmetrical (i.e., one group resents another, but the reverse is not true). The following 12 principles for minimizing conflicts on multiple-use trails are recommended. Adherence to these principles should help improve sharing and cooperation on multiple-use trails.

1. **Recognize Conflict as Goal Interference:** Do not treat conflict as an inherent incompatibility among different trail activities, but goal interference attributed to another's behavior. For example, if a user's goal is to few wildlife, a group of screaming teens can interfere with that goal.
2. **Provide Adequate Trail Opportunities to Minimize Contacts:** Offer adequate trail mileage and provide opportunities for a variety of trail experiences. This will help reduce congestion and allow users to choose the conditions that are best suited to the experiences they desire.
3. **Establish Appropriate User Expectations:** If users expect to find the conditions and uses that they actually encounter, they are more likely to be tolerant of them. On the other hand, if a user expects to find a wilderness experience and finds multiple users, conflict may arise. Use signage, interpretive information, and trail design to establish appropriate expectations.
4. **Involve Users as Early as Possible:** Identify the present and likely future users of each trail and involve them in the process of avoiding and resolving conflicts as early as possible, preferably before conflicts occur. For proposed trails, possible conflicts and their solutions should be addressed during the planning and design stage with the involvement of prospective users. New and emerging uses should be anticipated and addressed as early as possible with the involvement of participants. Likewise, existing and developing conflicts on present trails need to be faced quickly and addressed with the participation of those affected.
5. **Understand User Needs:** Determine the motivations, desired experiences, norms, setting preferences, and other needs of the present and likely future users

of each trail. This "customer" information is critical for anticipating and managing conflicts.

6. **Identify the Actual Sources of Conflict:** Help users to identify the specific tangible causes of any conflicts they are experiencing. In other words, get beyond emotions and stereotypes as quickly as possible, and get to the roots of any problems that exist.
7. **Work with Affected Users:** Work with all parties involved to reach mutually agreeable solutions to these specific issues. Users who are not involved as part of the solution are more likely to be part of the problem now and in the future.
8. **Promote Trail Etiquette:** Minimize the possibility that any particular trail contact will result in conflict by actively and aggressively promoting responsible trail behavior. Use existing educational materials or modify them to better meet local needs. Target these educational efforts, get the information into users' hands as early as possible, and present it in interesting and understandable ways (Roggenbuck and Ham 1986).
9. **Encourage Positive Interaction Among Different Users:** Trail users are usually not as different from one another as they believe. Providing positive interactions both on and off the trail will help break down barriers and stereotypes, and build understanding, good will, and cooperation. This can be accomplished through a variety of strategies such as sponsoring "user swaps," joint trail-building or maintenance projects, filming trail-sharing videos, and forming Trail Advisory Councils.
10. **Favor "Light-Handed Management":** Use the most "light-handed approaches" that will achieve area objectives. This is essential in order to provide the freedom of choice and natural environments that are so important to trail-based recreation. Intrusive design and coercive management are not compatible with high-quality trail experiences.
11. **Plan and Act Locally:** Whenever possible, address issues regarding multiple-use trails at the local level. This allows greater sensitivity to local needs and provides better flexibility for addressing difficult issues on a case-by-case basis. Local action also facilitates involvement of the people who will be most affected by the decisions and most able to assist in their successful implementation.
12. **Monitor Progress:** Monitor the ongoing effectiveness of the decisions made and programs implemented. Conscious, deliberate monitoring is the only way to determine if conflicts are indeed being reduced and what changes in programs might be needed. This is only possible within the context of clearly understood and agreed upon objectives for each trail area.

Source: *Conflicts on Multiple-Use Trails Synthesis of the Literature and State of Practice*, sponsored by the Federal Highway Administration and National Recreation Advisory Committee, https://www.fhwa.dot.gov/environment/conflicts/conf1.htm

Special Trail Uses

DCR's trails offer extensive opportunities for special events such as:

- guided hikes,
- educational programs,
- volunteer work days,
- races and rallies,
- outfitted activities, and
- commercial activities.

Any organized, special activity should be coordinated with the facility's supervisor and may require a "special use permit." Any commercial activity, race or rally, or event which might be expected to significantly affect the public use or enjoyment or the general environmental quality of any of the lands or waters of the Department will require a "special use permit."

Overnight Activities on DCR Trails

Trails, especially long distance trails, offer a unique opportunity for overnight recreational experiences such as backpacking and back-country camping. Currently, DCR offers some limited designated site camping opportunities along the Appalachian Trail. However, opportunities for developing overnight opportunities also exists along other long-distance trail corridors such as the MMM trail and Mid-State Trail, and along important greenways such as the Connecticut River Greenway.

A process for designating and managing overnight areas or facilities in other parks or along other trails will need to be established with the Bureau of Recreation.

Off Trail Activities

Trails also contribute to and intersect with various off-trail activities that occur within our parks, forests and reservations such as geocaching, orienteering, bird-watching, and hunting.

Geocaching: Is a questing activity in which individuals or organizations use GPS (Global Positioning Systems), compasses, and maps to find caches located within public spaces. The Department of Conservation and Recreation supports and permits geocaching in keeping with its mission to protect, promote, and enhance the Commonwealth's natural, cultural, and recreational resources. DCR has established a policy to provide management guidelines for geocaching, so as to encourage safe geocaching practices and minimize impact on the natural and cultural resources managed by the Department. This policy is available at R:\DCR Policies\DCR Policy Files\Geocache.

Hunting: Hunting is permitted in most state forests and parks. Hunting seasons are established by the Massachusetts Division of Fisheries and Wildlife and licenses are required. For more information, see. http://www.mass.gov/dcr/recreate/hunting.htm.

Appendix A

USFS

Trail Planning and Management Fundamentals

Trail Type ▪ Trail Class ▪ Managed Use ▪ Designed Use ▪ Design Parameters

Updated: 1/2004

In FY02, with the national introduction of the Infra 5.0 Trails Module Linear Events and TRACS (Trail Assessment and Condition Surveys), five fundamental concepts were introduced as cornerstones of Forest Service trail planning and management:

- Trail Type
- Trail Class
- Managed Use
- Designed Use
- Design Parameters

Although not entirely new, these revised concepts provide an updated and expanded means to consistently record and communicate the intended design and management guidelines for trail design, construction, maintenance and use. Before completing documentation for TRACS Trail Management Objectives (TMO), editing these Linear Events in the Infra Trails Module, or applying these concepts in trail management, it is essential that their intent is clearly understood.

Trail Type

A fundamental trail category that indicates the predominant trail surface or trail foundation, and the general mode of travel the trail accommodates.

Trail Types are exclusive, that is there can only be one Trail Type assigned per trail or trail segment. This allows managers to identify specific trail Design Parameters (technical specifications), management needs and the cost of managing the trail for particular uses and/or seasons by trail or trail segment.

When one Trail Type "overlaps" another, identify each trail or trail segment with its respective Trail Type as a separate route, with its own Trail Name and Trail Number. The "Shared System" data attribute in the Infra Trails Module will allow you to flag the route as also being used as a different type of route or Trail Type, (presumably during a different time of the year). For example, Canyon Ridge Trail 106 may be categorized as a Standard/Terra Trail from MP 0.0 to its end termini at MP 7.4. The first three miles of that same route may also function as a Snow Trail during the winter, in which case a separate record would be established for Canyon Creek Snow Trail #206 from MP 0.0 to MP 3.0. The actual naming and numbering of trails (i.e. Standard/Terra Trails versus Snow Trails) should be consistent with local unit identification protocols.

The three fundamental Trails Types include:

Standard/Terra Trail: *The predominant foundation of the trail is ground (as opposed to snow or water); and that is designed and managed to accommodate ground-based trail use.*

Snow Trail: *The predominant foundation of the trail is snow (as opposed to ground or water); and that is designed and managed to accommodate snow-based trail use.*

Water Trail*: The predominant foundation of the trail is water (as opposed to ground or snow); and that is designed and managed to accommodate trail use by water craft. There may be ground-based Portage segments of Water Trails.*

Trail Class

The prescribed scale of trail development, representing the intended design and management standards of the trail.

- There is only one Trail Class identified per trail or trail segment.
- The National Trail Classes provide a chronological classification of trail development on a scale ranging from Trail Class 1 to Trail Class 5 (see Attachment A: Trail Class Matrix):
  - Trail Class 1: Minimal/Undeveloped Trail
  - Trail Class 2: Simple/Minor Development Trail
  - Trail Class 3: Developed/Improved Trail
  - Trail Class 4: Highly Developed Trail
  - Trail Class 5: Fully Developed Trail
- Each Trail Class is defined in terms of applicable Tread and Traffic Flow, Obstacles, Constructed Feature and Trail Elements, Signs, Typical Recreation Environment and Experience.
- Trail Class descriptions define "typical" scenarios or combined factors, and exceptions may occur for any factor. In applying Trail Classes, choose the one that most closely matches the managed objective of the trail.
- Trail prescriptions describe the desired management of each trail, based on Forest Plan direction. These prescriptions take into account actively managed trail uses, user preferences, setting, protection of sensitive resources, and other management activities. To meet prescription, each trail is assigned an appropriate Trail Class.
- There is a direct relationship between Trail Class and Managed Use (defined below), and one cannot be determined without consideration of the other.
- These general categories are used to identify applicable Trail Design Parameters (defined below) and to identify basic indicators used for determining the cost to meet national quality standards.
- Trail Classes represent a refinement and expansion of the previously used Forest Service Management Classes: Mainline/Primary, Secondary and Way Trails.

Managed Use

Modes of travel that are actively managed and appropriate, considering the design and management of the trail.

- There may be more than one Managed Use per trail or trail segment.
- Managed Use indicates a management decision or intent to accommodate and/or encourage a specified type of trail use.

Designed Use

The intended use that controls the desired geometric design of the trail, and determines the subsequent maintenance parameters for the trail.

- There is only one Designed Use per trail or trail segment.
- Although the trail may be actively managed for more than one use, and numerous uses may be allowed, only one use is identified as the critical design driver. The Designed Use determines the technical specifications for the design, construction and maintenance of the trail or trail segment. For each Designed Use and applicable Trail Class, there is a corresponding set of nationally standardized technical specifications or Design Parameters.
- Of the actively Managed Uses that the trail is developed and managed for, the Designed Use is the single design driver that determines the technical specifications for the trail. This is somewhat subjective, but the Designed Use is most often the Managed Use that requires the highest level of development. (ie: Pack & Saddle stock require higher and wider clearance than a trail designed for Hikers). In addition to Designed Use, managers must also determine the desired development scale or Trail Class, with Trail Class 1 being the lowest level of development and Trail Class 5 the highest. On a Trail Class 1 Hiker trail, the trail is basically a deer path and in places may disappear and be reacquired later. Trail Class 5 is most often paved, or at least hardened, and is associated with a highly developed Recreation Opportunity Spectrum classification (ROS).

Designed Use / Managed Use Types

- All Terrain Vehicle
- Snow All Terrain Vehicle
- Bicycle
- Dogsled
- Hiker / Pedestrian
- Motorcycle
- Pack and Saddle
- Snowmobile
- Snowshoe
- Watercraft
- Motorized Watercraft
- Non-Motorized Watercraft
- Cross Country Ski

Design Parameters

Technical specifications for trail construction and maintenance, based on the Designed Use and Trail Class.

- The national Trail Design Parameters represent a standardized set of commonly expected construction and maintenance specifications based on Designed Use and Trail Class.

- Local deviations to the Design Parameters may be established based on specific trail conditions, topography and other factors, providing that the variations continue to reflect the general intent of the national Trail Classes.

- Design Parameters are a refinement and expansion of the previously used “Easiest, More Difficult, and Most Difficult” trail categories for communicating Forest Service construction, maintenance and management specifications.

Design Parameters include technical specifications regarding:
- Tread Width
- Surface
- Grade
- Cross-Slope
- Clearing
- Turns

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Conservation and Recreation
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Appendix B

Massachusetts *Department of Conservation and Recreation*
Trail Proposal and Evaluation Form

1. Requester's Information and Contact

2. DCR Contact and/or Park Supervisor

3. Location of Proposed Trail (Specify the location or the proposed trail as exactly as possible. Also attach a topographic map showing location)

4. ***Objective of trail***
If the trail exists, who does the trail serve?

Who will the new or improved trail serve?

Please explain the significance, need or value of this trail and the reason(s) for the proposed change:

5. Description of Proposed Trail
Upgrade of existing ( ) Relocation of existing ( ) New trail ( ) Change in Use ( )

Length: _____
What is the Class of the Proposed Trail? And the Designed Use Parameter? (See DCR Trail Guidelines Manual, Section III, Trail Classification, page 35, and Appendix F)

6. Support and Success of Trail Project
Who supports this initiative?

What is the evidence for the demand for this project?

Who will build, or improve this trail?

What costs are associated with this project and how will this project be funded

Who will maintain this trail project for future use

DCR Review of Proposed Trail Project
(To be filled out by DCR staff)

1. ***Is this project supported by existing DCR plans? Is it embodied in an RMP or Trail Plan? If not, is ti supported by operations and planning staff? Should it be pursued?***

2. What are the potential short and long term management issues associated with this project?

Design, construction and maintenance issues

Management issues (abutter concerns, user conflicts, safety, resource impacts):

3. Would this trail need to meet FSTAG accessibility standards?
Yes/No? Why? List Conditions for Departure

4. Site Evaluation

Description of topography :
0-15% slope ( ) 15-30%slope ( ) > 30% slope ( )
Soil description:_____

Historic, Cultural or Archeological resources/ impacts:

Forestry management resources/ impacts:

Rare, Endangered and Threatened species or natural community resources / impacts: Is it in NHESP Priority Habitat?

Other critical wetland, natural resource or wildlife habitat resources/impacts:

Other potential impacts or conflicts:

Permitting: **Massachusetts Regulatory Review Checklist**

☐ Yes ☐ No Will any of the work require digging, pulling or scaring of ground surfaces?

If yes, DCR shall have project reviewed by DCR Archeologist. Proponent shall file permits with MHC is such as required after initial archeological review. All permits shall be reviewed by DCR prior to submittal.

☐ Yes ☐ No Will any work occur within 200 feet of a stream or river or within 100 feet of a wetland resource area?

If yes, contact your local conservation commission for help preparing an RDA or NOI. All permits shall be reviewed by DCR prior to submittal.

☐ Yes ☐ No Does the project area intersect with any Priority Habitat Area?

If yes, DCR shall send a project review request to NHESP. Proponent shall file permits if such are required by NHESP. All permits shall be reviewed by DCR prior to submittal.

*For additional information on permitting, please see DCR Trail Guidelines Manual.

Approval:

Facility Supervisor Approve ( ) Disapprove ( )
Comments / Recommendations:

Signature:_____ Date:_____

Management Forester Approve ( ) Disapprove ( )
Comments / Recommendations:

Signature:_____ Date:_____

Trail Coordinator Approve ( ) Disapprove ( )
Comments / Recommendations:

Signature:_____ Date:_____

Regional Director / District Manager Approve ( ) Disapprove ( )
Comments / Recommendations:

Signature:_____ Date:_____

Within One Month of the Date Submitted, please finalize approval or disapproval and forward copy of completed form to: Paul Jahnige, Greenways and Trails Program, 136 Damon Road, Northampton, MA 01060 or Paul.jahnige@state.ma.us.

Appendix C

Appendix D

MA Department of Conservation and Recreation
Office of Regional Planning
Best Management Practices

Closing and Restoring Trails

Contacts: Paul Jahnige, Greenways & Trails Program;
(413) 586-8706 x 20; paul.jahnige@state.ma.us

Goal: Halt resource damage; reduce maintenance costs; and enhance the trail users' experience.

Guidelines:

All trails impact the natural environment and require on-going maintenance. But some trails, usually as a result of poor layout, illegal use or sensitive soils, cause more environmental damage than others, require excessive maintenance and diminish the users' experience. While 'trail hardening' can solve some problems, rather than try to maintain trouble trails over and over, in many cases, closing and restoring poor condition, 'fall-line' and redundant trails is the best solution for your trail system – environmentally, economically, and socially.

However, as anyone who has tried to close a trail knows, simply putting up a sign or piling brush at the trail entrance does not work. The compacted soils of the trail tread can resist naturalization for many years, and as long as open sight lines persist, users will continue to use the trail. In most cases, successfully closing and restoring trails takes as much planning and effort as constructing new trails. The following Best Practices can help successfully restore problem trails.

General

- Provide a Better Option: The most important component of successfully closing a trail is to make sure there is a more appealing and obvious alternative. This includes ensuring that the new route is well designed and marked, and flows seamlessly from existing trails. For more information on laying out sustainable trails, see the DCR Trails Guidelines and Best Practice Manual (link below).

- Educate Users: Users who do not understand why a trail is being closed may undo all your efforts. Reach out to key users, post 'what,' 'why' and 'Contact' information on trailheads and recruit volunteers to assist. Education should focus on the benefits of closing trails including wildlife habitat and water quality protection, along with a better trail experience.
- Halt Ongoing Erosion: Some trails requiring closure will be fall-line trails that channelize water and experience continuing erosion. In order to naturalize these trails, active, on-going erosion must be stopped. Check dams and slash should be used to stem water flow and stabilize soils while naturalization occurs.

- Close Sight Lines: Trails people can see are trails people will use. Even though barriers, signs and slash have been used to close the trail, the open sight lines still invite users to explore. The most effective way to close off sight lines is to transplant native vegetation in the trail corridor, especially any place a trail is visible from another trail. In other places along the closed trail, slash can be used to disguise the trail tread.

- Consider Breaking Up Tread and Re-contouring the Land: Compacted trail tread will likely resist naturalization. Have you ever come across an old road in the woods that has not been used for years? Breaking up the soil with pulaskis and pick-mattocks, and scarifying the soil will allow natural regeneration to take hold. Re-contouring the land, particularly for eroded trails, will help remove evidence of old trails. This technique should not be used in place with a potential for below-ground archaeological resources.

- Block the Corridor: As a last resort, you can block the beginning and end of the trail with a fence and signs. The fence will look out of place, and could draw more attention to the closure. Be prepared to answer questions by posting signage explaining the closure on, or near, the fence. When the trail has been closed for a while the fence can be removed. This strategy may be needed especially at locations where users are looking for views and water access.

- Don't Introduce or Spread Exotic Plants: Use local soils and non-invasive plants in your trail reclamation project if possible. If outside materials are used, make sure they are certified weed-free, native, and ideally, growing locally. Clean tools and work boots before bringing them from other sites to ensure that invasive seeds are not transported.

- Update your map to reflect the closure.

- In high volume parks, contact your web manager so that she can post information about the trail closure on the parks' main page.

Monitor Your Closure

- Return periodically to monitor the success of your closure. Ascribe to the "broken window" theory of trail maintenance. If your closure is vandalized or damaged, fix it immediately!

- Engage your "Adopt –A-Trail" partners in the closure effort if available.

- Adapt your methods to the site and the community.

Resources

- DCR Trails Guidelines and Best Practices Manual is at: http://www.mass.gov/eea/docs/dcr/stewardship/greenway/docs/dcrguidelines.pdf
- Closing and Reclaiming Damaged Trails webpage by IMBA is at http://www.imba.com/resources/trail_building/reclaiming_trail.html
- Naturalizing Abandoned Trail from the FHWA Trail Maintenance and Construction Notebook is at: http://www.fhwa.dot.gov/environment/fspubs/00232839/page12.htm
- The Minnesota Department of Natural Resources "Trail Planning, Design and Development Guidelines" (http://www.dnr.state.mn.us/publications/trails_waterways/index.html) includes a section of decommissioning and restoring unsustainable trails.
- DCR Trails Dataviewer: (https://maps.massgis.state.ma.us/dcr/trails/ (username: dcr_trails password: dcr_trails) Please note that the Dataviewer works in Explorer not Chrome.

Appendix E

Massachusetts Department of Conservation and Recreation

Volunteer Information

DCR's Volunteers in Parks Program

There are virtually limitless volunteer opportunities at DCR parks across the state. In addition, DCR recognizes that volunteers often seek out these opportunities as individuals, as members of Nonprofit Organizations, or other types of community, corporate, educational, recreational, and civic organizations. However you volunteer, we are grateful for your service and appreciate your time.

To learn more about volunteering or proposing volunteer projects on DCR property, you should take moment to review our Volunteers in Parks Program Guide . This guide provides all the information you should need to understand the process and well as the Agency's expectations and standards.

Under certain circumstances, organizations may also use DCR's Volunteers in Parks Program to propose volunteer special event activities on DCR property. To learn more about this, please refer to the Volunteers in Parks Program Guide .

If you have any questions about DCR's Volunteers in Parks Program please speak with staff at the park where you are interested in volunteering, or call 617-626-1250.

Friends Groups

Friends groups are organizations dedicated to supporting specific DCR properties through volunteer work, fundraising, providing programs and events, and advocacy. More than 70 groups are working across the state to enhance our forests and parks system.

DCR Volunteer in Parks Program Guide

DCR Volunteers in Parks Program Guide

Volunteer in Parks Program Guide Printable PDF

http://www.mass.gov/eea/docs/dcr/volunteer/volunteer-guide-2014.pdf

DCR Volunteer/Stewardship Agreement Form

http://www.mass.gov/eea/docs/dcr/volunteer/volunteer-stewardship-agreement-form-4-2014-2a.doc

DCR Volunteer Release Form (single signature)

http://www.mass.gov/eea/docs/dcr/volunteer/volunteer-release-form1.pdf

DCR Volunteer Release Form (multiple signature)

DCR Volunteer Service Log

DCR Parent/Guardian Permission Form for Volunteer Activities Involving Minors

http://www.mass.gov/eea/agencies/dcr/get-involved/volunteer-ops/dcr-volunteer-in-parks-program-guide.html

Appendix F:
USFS Trail Design Parameters

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use HIKER-PEDESTRIAN		**Trail Class 1**	**Trail Class 2**	**Trail Class 3***	**Trail Class 4***	**Trail Class 5***
Design Tread Width	**Wilderness**	0" – 12"	6" – 18"	12" – 24" Exceptions: May be 36-48" at switchbacks, turnpikes, fords and steep side slopes.	24" Exceptions: May be 36-48" at switchbacks, turnpikes, fords and steep side slopes.	Not applicable
	Non-Wilderness	0" – 12"	6" – 18"	18" – 48"	32" – 96"	36" – 120"
Design Surface	**Type**	Native, un-graded. Intermittent, rough.	Native with limited grading. Continuous, rough.	Native with some on-site borrow or imported materials.	Imported materials or hardening is common.	Uniform, firm, and stable.
	Obstacles	Roots, rocks, logs, steps to 24".	Roots, rocks and log protrusions to 6"; steps to 14".	Generally clear. Protrusions to 3"; steps to 10".	Smooth, few obstacles. Protrusions 2-3"; steps to 8".	Smooth, no obstacles. Protrusions <2".
Design Grade**	**Target Range** (>90% of Trail)	< 25%	< 18%	< 12%	< 10%	< 5%
	Short Pitch Max (Up to 200' lengths)	40%	35%	25%	15%	10%
	Max Pitch Density***	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	**Target Range**	Not applicable	5 – 20%	5 – 10%	3 – 7%	2 – 3% (or crowned)
	Maximum	Up to natural side-slope.	Up to natural side-slope	15%	10%	3%
Design Clearing	**Width**	Sufficient to define trail corridor.	24" – 36", with some encroachment into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge	12" – 24" outside of tread edge.
	Height	6'	6' – 7'	8'	8'	> 8'
Design Turns	**Radius**	No minimum.	2' – 3'	3' – 6'	4' – 8'	6' – 12'

* Trail Classes 3, 4 and 5 may potentially provide accessible passage. If assessing or designing trails for accessibility, refer to current Agency trail accessibility guidance.

** Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential.

*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (1/31/2005)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use PACK AND SADDLE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Wilderness**	Not Applicable: Not designed for equestrians as primary user, although equestrians may be present.	12" – 18" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes.	12" – 24" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes. Up to 60" along precipices.	24" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes. Up to 60" along precipices.	Not Applicable: Not designed for equestrians as primary user. Equestrians generally not present.
	Non-Wilderness		12" – 24" (With above exceptions)	18" – 48" (With above exceptions)	36" – 96"	
Design Surface	**Type**		Native, w/ limited grading.	Native with some on-site borrow or imported materials.	Native with some imported materials or stabilization.	
	Obstacles		Roots, rocks, logs to 12"	Generally clear. Occasional protrusions to 6".	Smooth, few obstacles. Occasional protrusions 2-3".	
Design Grade*	**Target Range** (>90% of Trail)		< 20%	< 12%	< 10%	
	Short Pitch Max (Up to 200' lengths)		30%	20%	15%	
	Max Pitch Density* **		< 5% of trail	< 5% of trail	< 3% of trail	
Design Cross-Slope	**Target Range**		5 – 10%	5%	5%	
	Maximum		Natural side-slope	10%	10%	
Design Clearing	**Width**		36" – 48"	60" – 78"	72" – 96"	
	Height		8' – 10''	10'	10' - 12'	
Design Turns	**Radius**		4' – 5'	5' – 6'	6' – 10'	

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use BICYCLE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**One Lane**	6" – 12"	12" – 24"	18" – 30"	24" – 48"	36" – 60"
	Two Lane	Not applicable.	Not applicable.	48 " – 60" Accommodate two-lane travel with passing lanes.	60" – 84"	72" – 120"
Design Surface	**Type**	Native. Rough, unstable or soft tread.	Native, with limited grading. Unstable or soft sections likely.	Native with some on-site borrow or imported materials. Some soft areas.	Likely imported or stabilized tread. Few, if any, loose or soft surfaces.	Firm, hardened surface.
	Obstacles	Rocks, logs and roots up to 6–12" common. Forced portages likely.	Embedded rock, protrusions to 6". Some portages may be needed.	Generally smooth with few protrusions exceeding 3".	Smooth, few obstacles. 1 – 2" protrusions.	No obstacles to wheeled transport.
Design Grade*	**Target Range** (>90% of Trail)	15% – 18%	< 12%	< 10%	< 8%	< 5%
	Short Pitch Max (Up to 200' lengths)	30% 50% on downhill-only travel.	25% 35% on downhill-only travel.	15%	10%	8%
	Max Pitch Density* **	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	**Target Range**	5% – 10%	5% – 10%	5%	3% – 5%	3% – 5%
	Maximum					
Design Clearing	**Width**	24" – 36" Some vegetation may encroach into clearing area.	36" – 48" Some light vegetation may encroach into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge.	18" – 24" outside of tread edge.
	Height	6' – 7''	7' – 8''	8'	8' - 9'	8' - 9'
Design Turns	**Radius**	3' - 4'	4' – 6'	6' – 8'	8' – 10'	8' - 12'

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use **ALL TERRAIN VEHICLE**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width [If sideslopes are >50%, increase widths by 6”-18”]	**One Lane**	NA – Not designed for ATV as primary user.	30” – 48” At switchbacks, > 48”	42”-60” At switchbacks, >60”	54”-72” At switchbacks, >60”	NA – Not designed for ATV as primary user.
	Two Lane		Typically not designed for two-lane travel. Passing areas (uncommon) - 60”	60” and/or accommodate with passing areas 60”-78”.	72”-96”	
Design Surface	**Type**		Native, w/ limited or no grading. Commonly soft and unstable.	Native w/ some onsite barrow or imported materials. Some loose or soft sections.	Relatively firm and stable. Gravel, pavers or other imported materials possible.	
	Obstacles		Embedded rock, steps, waterbars, holes and protrusions to 6”.	Generally smooth, with few protrusions exceeding 4”. Drain dips and low waterbars.	Smooth, few obstacles. 1-3” protrusion. Drain dips or waterbars with low-angle approach.	
Design Grade*	**Target Range** (>90% of Trail)		<25%	<15%	<10%	
	Short Pitch Max (Up to 200’ lengths)		35%	25%	15%	
	Max Pitch Density**		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	**Target Range**		5% – 10%	3% – 5%	3% – 5%	
	Maximum		15%	10%	8%	
Design Clearing	**Width** [On steep side hills, increase clearing on uphill side by 6 – 12”]		36”- 48” Some vegetation may encroach into clearing area.	8”-12” outside of tread edge.	>12” outside of tread edge	
	Height		5’ – 6’	6’ – 7’	8’	
Design Turns	**Radius** [Use Climbing Turns vs. Switchbacks for ATVs whenever possible]		6’ – 8’	8’ – 10’	>10’	

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches must be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use MOTORCYCLE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width [Note: If side-slope >50%, increase widths by 6" – 18"]	**One Lane**	Not Applicable: Not designed for equestrians as primary user, though equestrians may be present.	8" – 24" At switchbacks, 36 – 48"	18" – 36" At switchbacks, > 48".	30" – 48" At switchbacks, > 48".	Not Applicable: Not designed for equestrians as primary user, though equestrians may be present.
	Two Lane		Typically not designed for two-lane travel. Passing areas (uncommon) up to 60".	48 " – 60" Occasional passing lanes to 72".	60" – 72"	
Design Surface	**Type**		Native, with limited or no grading. Commonly unstable and soft.	Native with some on-site borrow, pavers, or imported materials. Some loose or soft areas.	Gravel, pavers or other imported materials possible. Relatively firm, stable surface.	
	Obstacles		Soft sand and embedded rock, steps and protrusions up to 12".	Generally smooth with few protrusions exceeding 6".	Smooth, few obstacles. Few 2" – 4" protrusions.	
Design Grade*	**Target Range** (>90% of Trail)		< 25%	< 15%	< 10%	
	Short Pitch Max (Up to 200' lengths)		40% Rarely to 50% on downhill-only travel.	25%	15%	
	Max Pitch Density**		< 10% of trail	< 10% of trail	< 5% of trail	
Design Cross-Slope	**Target Range**		5% – 10%	5%	3% – 5%	
	Maximum		15%	10%	10%	
Design Clearing	**Width** [Note: On steep side-hills, increase clearing on uphill side by 6-12"]		36" – 48" Some vegetation may encroach into clearing area.	12" – 18" outside of tread edge.	> 18" outside of tread edge.	
	Height		7' – 8''	8'	8' - 9'	
Design Turns	**Radius**		4' – 5'	5' – 6'	6' – 8'	

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use CROSS-COUNTRY SKI		**Trail Class 1**	**Trail Class 2**	**Trail Class 3***	**Trail Class 4***	**Trail Class 5***
Design Groomed Width*	**One Lane**	N/A – Not designed or managed for skiers as primary user.	3'-4'. If groomed, width of grooming equipment.	6'-8' (or minimum width of grooming equipment).	8'-10', but typically managed to accommodate two-way passage.	N/A – Not designed or managed for skiers as primary user.
	Two Lane		Typically not designed for two-lane travel. Employ 6'-8' passing areas in steeper sections.	>8' (or min width of grooming equipment) and/or accommodate with passing areas 8'-12' wide.	12'-14'.	
Design Grooming & Surface	**Type**		Coarse compaction. Occasional or no grooming (may be ski-packed). Snowmobile packing sufficient. Tracklayer optional.	Groomed or compacted using implements and/or tracklayer when packed surface is snow-covered, drifted, melted or skied out.	Well-groomed with tiller and/or other implements. Groomed frequently, and when groomed surface becomes degraded or buried.	
	Obstacles [Caused by use, lack of grooming, melt, or surface/subsurface protrusions]		Dips, bumps, or ruts to 12" common and may be tightly spaced. Surface obstacles may occasionally require off-trail bypass.	Generally smooth. Dips, bumps, or ruts to 8" uncommon and widely spaced. Surface obstructions not present.	Consistently smooth. Small, rolling bumps, dips and rises. Surface obstructions not present.	
Design Grade**	**Target Range** (>90% of Trail)		<15%	<10%	<8%	
	Short Pitch Max (Up to 200' lengths)		25%	20%	12%	
	Max Pitch Density***		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	**Target Range**		<10%	<5%	<5%	
	Maximum [For up to 50']		20%	15%	10%	
Design Clearing	**Width**		4'-6' (or minimum width of grooming equipment, if larger). Light vegetation may encroach into clearing area	>1' outside of groomed edge. Light vegetation may encroach slightly into clearing area.	>2' outside of tread edge. Widen clearing at turns or if increased sight distance needed.	

Designed Use CROSS-COUNTRY SKI		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
	Height [Above normal max. snow level]		6'-8' or height of grooming machinery, if used.	>8' or height of grooming machinery.	10'	
Design Turns	**Radius** [Use Climbing Turns versus Switchbacks for Ski trails whenever possible]		8'-10' if not snowcat-groomed. OR: Minimum based on turning limits of grooming machine.	15'-20' (Provide sufficient radius for grooming equipment).	>25'	

* Trail Classes 3, 4 and 5 may potentially provide accessible passage. If assessing or designing trails for accessibility, refer to current Agency trail accessibility guidance.

** Grade variances should be based upon factors such as common snow type, use levels, tightness of turns, and other factors contributing to surface stability and erosion potential.

*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use SNOWMOBILE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**One Lane**	N/A – Not designed for Snowmobile as primary user.	Typically not groomed, but commonly signed. If groomed, 4'-6' (or minimum width of grooming equipment.)	6'-8' (or minimum width of grooming equipment). On tight-radius turns, increase groomed width to >10'.	8'-10'. On tight-radius turns, increase groomed width to >12'.	N/A – Not designed for Snowmobile as primary user.
	Two Lane		Typically not groomed, but commonly signed. If groomed, >8' groomed width.	>11' and/or accommodate with passing areas 12'-14' wide.	12'-16'. On tight-radius turns, increase groomed width to >14'.	
Design Surface	**Type**		Occasional or no grooming or user-packed. Coarse compaction with cat or snowmobile. Use of implements optional.	Groomed or compacted after significant snow accumulations or when moguled/rutted. Use of implements likely.	Well-groomed with tiller and/or other implements. Groomed frequently, soon after significant snow accumulations and before surface is degraded.	
	Obstacles [Caused by use, lack of grooming, or surface and subsurface protrusions]		Dips/bumps/ruts to 24" common and may be tightly spaced. Obstacles may occasionally require off-trail bypass.	Generally smooth. Dips, bumps, ruts to 12" infrequent and widely spaced. Surface obstacles not present.	Consistently smooth. Small, rolling bumps, dips and rises. Surface obstacles not present.	
Design Grade*	**Target Range** [>90% of Trail]		<20%	<15%	<10%	
	Short Pitch Max [Up to 200' lengths]		35%	25%	20%	
	Max Pitch Density**		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	**Target Range**		<15%	<10%	<5%	
	Maximum		25%	15%	10%	
Design Clearing	**Width**		4'-6' (or minimum width of grooming equipment if used). Some vegetation may encroach into clearing area	>1' outside of groomed trail edge. Light vegetation may encroach into clearing area.	>2' outside of groomed trail edge. Widen clearing at turns or if increased sight distance needed.	

Designed Use **SNOWMOBILE**		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
	Height [Above normal maximum snow level]		>6' (Provide sufficient clearance for grooming equipment if used).	>7' (Provide sufficient clearance for grooming equipment).	10' (Provide sufficient clearance for grooming equipment).	
Design Turns	**Radius** [Use Climbing Turns vs. Switchbacks for Snowmobiles whenever possible]		8'-10' if not groomed. (Provide sufficient radius for grooming equipment if used – typically 15-20')	15'-20' (Provide sufficient radius for grooming equipment).	>25'	

* Grade variances should be based upon factors such as common snow type, use levels, tightness of turns and others

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

Appendix G

Mapping Trails the DCR Way

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This document describes the method used by DCR GIS staff to map forest and park trails using GPS (Global Positioning System).

DCR has developed a methodology for obtaining accurate, useful trail data. It requires a high-quality GPS unit that can take point and line features with complex attributes. We have used Trimble GPS units (GeoExplorer II, GeoExplorer3 and 3c, ProXR, and more recently the GeoXM and GeoXT with ArcPad and GPScorrect software). This document does not cover a specific GPS unit; the information should be applicable to any GPS unit of adequate specifications.

The principle concept we use for mapping trails is that of a topological network. In simpler terms, the trails are individual lines that meet at trail intersection points. Lines begin and end where they meet other trails; a single line does not continue through an intersection. This approach has two major benefits: it allows the lines that meet at an intersection to be snapped to an accurate point, and it provides a measure of quality control because the intersection points are coded with an attribute showing how many trails meet there. If the GPS user doesn't map one of the trails that should come into an intersection, it is easy to tell that a trail is missing because the numbers won't match.

Features and Attributes
The GPS unit should be set up to collect point and line features, each of which has several attribute fields. With the Trimble units we have used, some use a file called a "Data Dictionary" which contains information on the types of features that can be collected and what attributes are needed for each, and some collect data into a shapefile, which can be customized to have a form where the user can enter in similar attribute information. In both cases, some of the attributes can be chosen from a picklist (which limits the possible attribute values and ensures consistent spelling). For both feature types the current date and time are collected as attributes, and some other GPS information may be collected depending on the hardware and software.

For lines, the attributes collected are:

Type: Trail, Forest Road/Trail, Administrative Road, Public Road, or Other
Condition: Good, Fair, or Poor
Surface: Natural, Paved, Gravel, etc.
Width: 0-3', 3-5', 5-10', etc.
Illegal?: Y/N
Comments: a text field that the user can type anything into
For points, the attributes collected are:

Type: Trail Intersection, Road Intersection, Trailhead, Dead End, Parking Area, Gate, Road Bridge, Road Culvert, , Road Damage, Trail Damage, Campsite, Picnic Area, Scenic/View, Trail Crosses Stream, Trail Crosses Utility Lines, Trail Crosses Boundary, Trail StructureVernal Pool, or Other
Num: 0, 1, 2, 3, 4, 5, or 6+
Comments: a text field that the user can type anything into
Photo Taken: True/False – whether the user took a photo at this point (default is false)
Photo ID: If they took a photo, the number of the photo
Field Note: If they wrote a note (on paper) about this point, the number of the note

It is important to familiarize yourself with the possible attribute values (especially the many values for point Type) so that you will be on the lookout for these features in the field. For instance, you need to be aware that if you cross a stream or bridge, you should take a point there.

Field Work

Typically, GPS field work will start at a parking lot. This is a good opportunity to take your first point of the day – Type should be Parking Area. This will also help you get back to your vehicle at the end of the day! If you start at a point that is not a parking lot, it may be a Trailhead. After taking this first point, start your first line. Walk along this line until you get to the first intersection (an intersection is anywhere that the trail splits or encounters another trail or road). When you get to the intersection, stop your line and enter its attributes. These attributes apply to the entire line. If a section of trail changes dramatically at some point other than an intersection (for instance, if it goes from being gravel to dirt, or from being 15 feet wide to 4 feet wide, etc.) then you'll need to end the line at that point, enter the attributes, and then start a new line. This way the attributes will be accurate for the line they are associated with.

Now you are at an intersection. Take a point at the intersection, giving it a Type of Trail Intersection and then enter the number of trails that meet at this intersection into the Num field. IMPORTANT: this number includes all the possible ways you can go from the intersection, including the trail you came in on. A trail that splits has a value of 3; a place where two trails cross has a value of 4 (see images below). Entering this number correctly is essential.

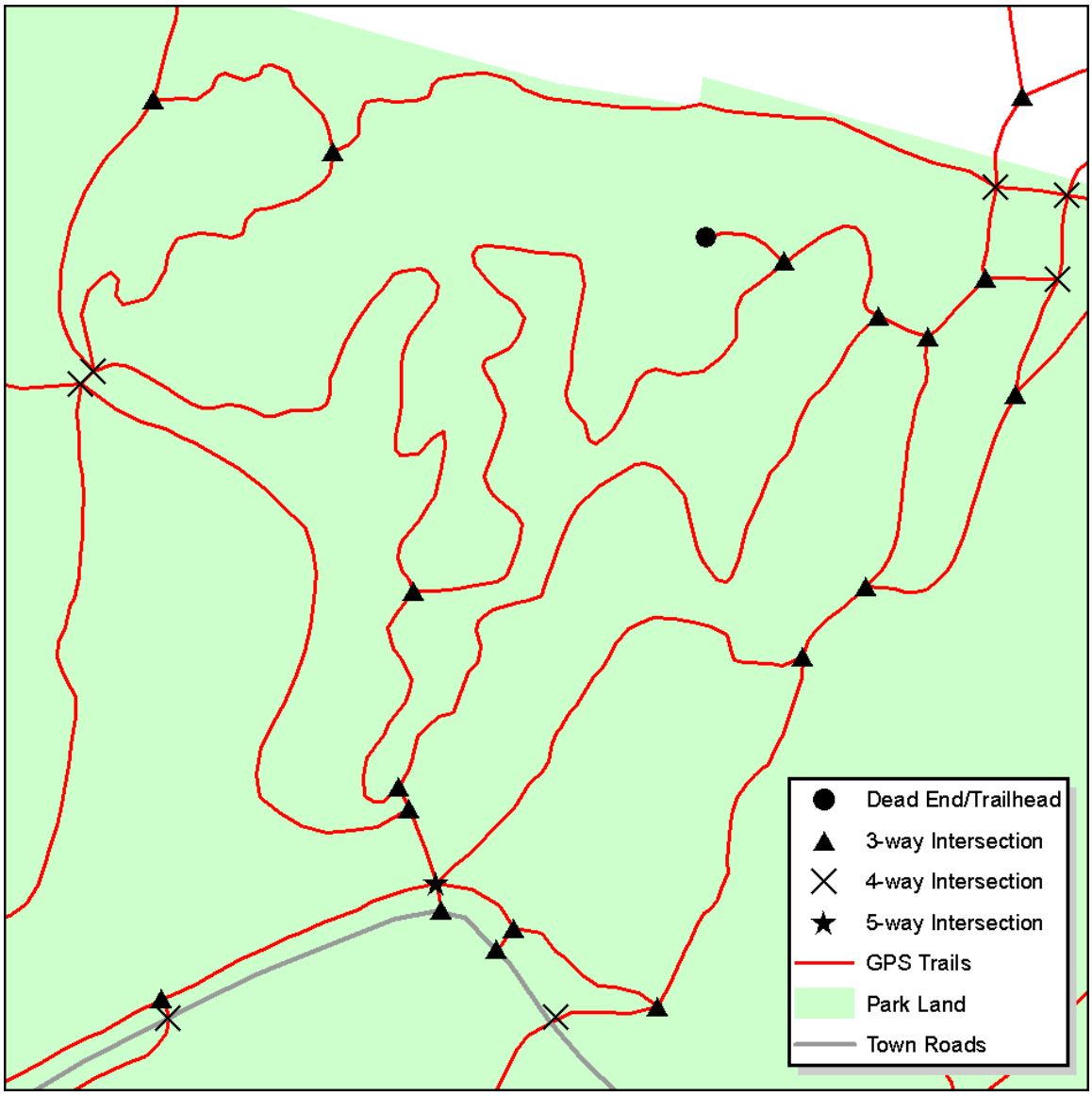
 A three-way intersection (red dot is intersection point)

 A four-way intersection

 A five-way intersection

 A two-way "intersection" is just a point along a trail (not actually an intersection!)

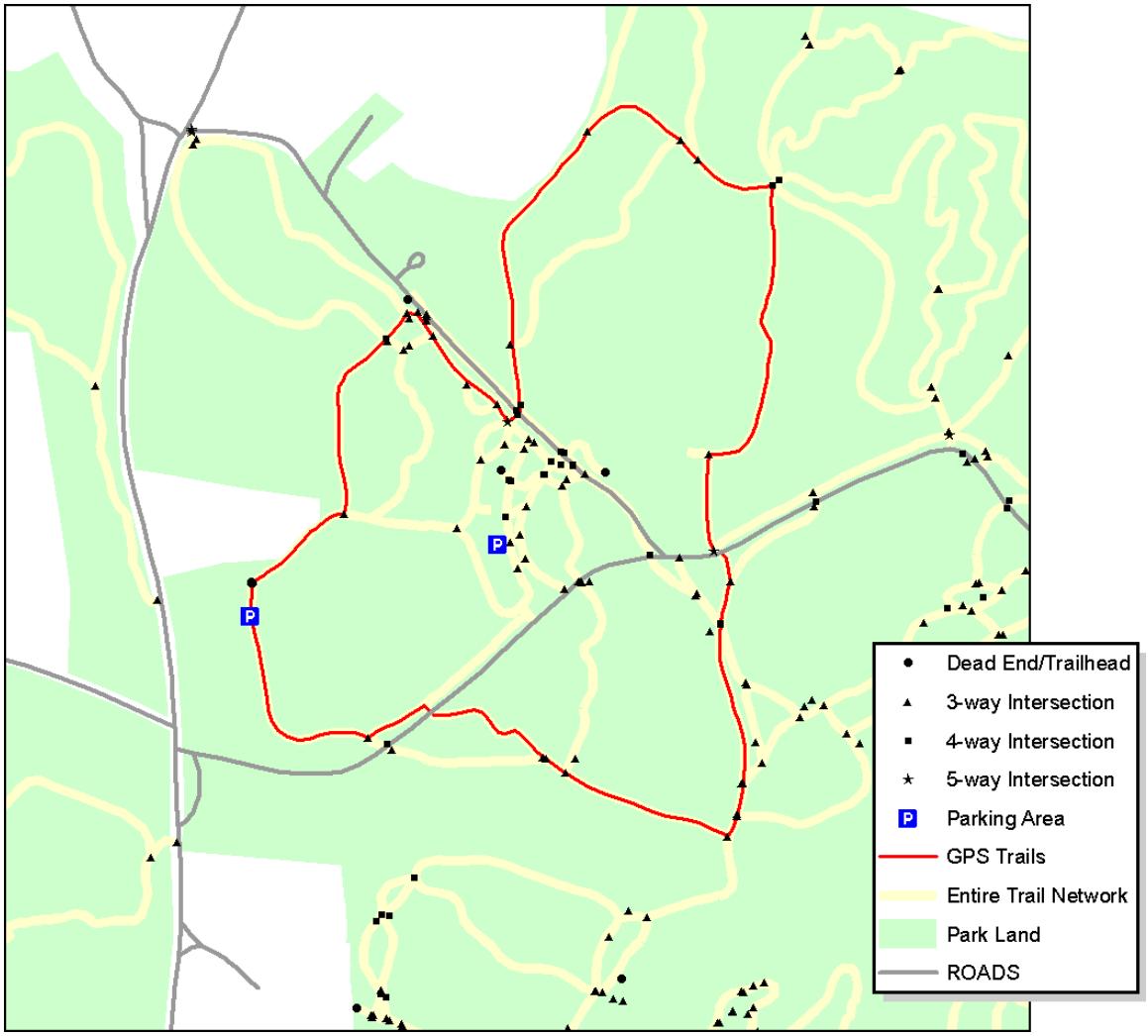
 A one-way "intersection" is a dead end or trailhead or parking lot (there is only one way you can go)



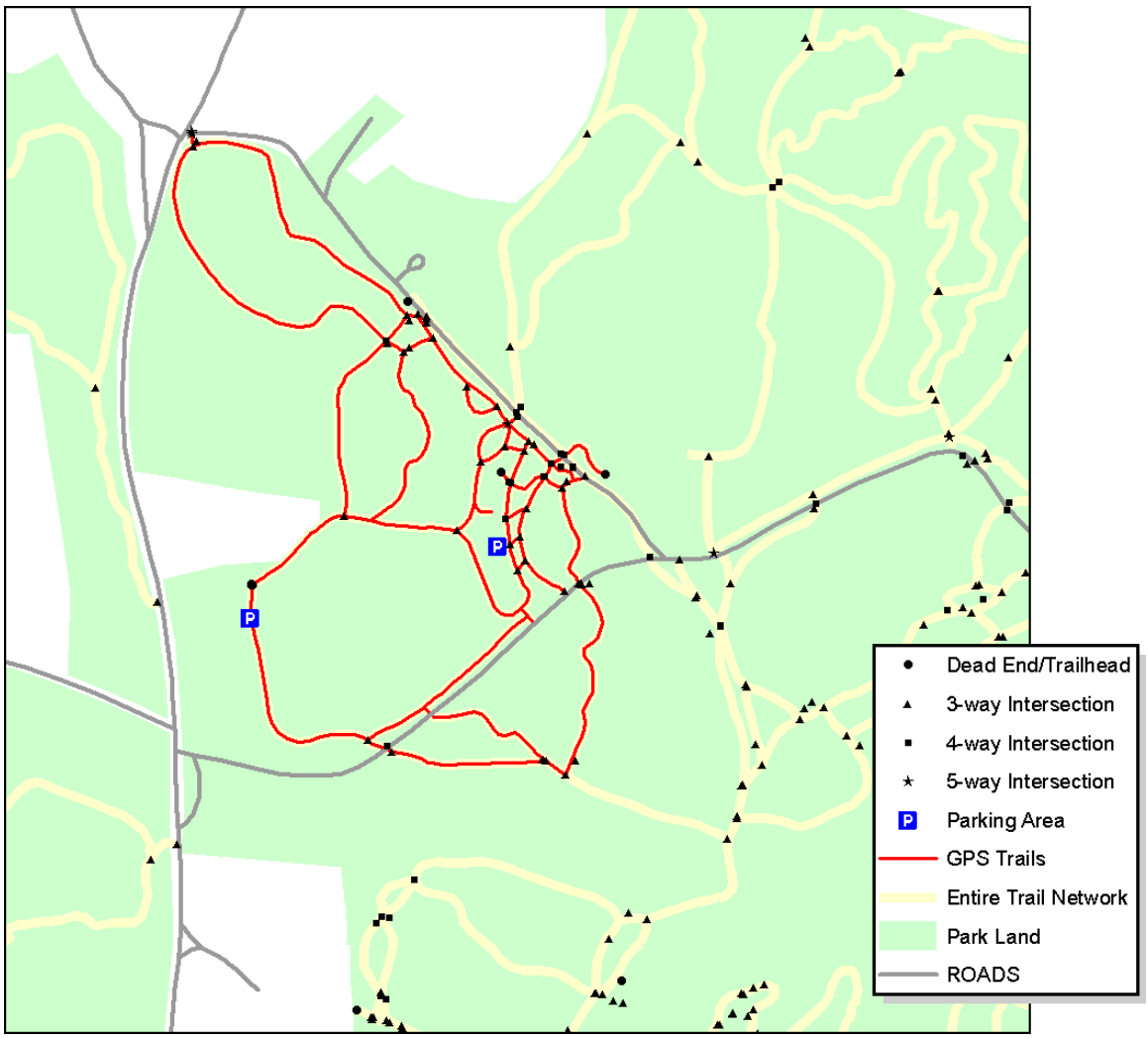
Here's an example of part of a trail map showing trail intersection points symbolized by the number of trails that meet at that intersection.

Now you need to choose which way to go next. The way you walk when GPSing trails is very different from the way you walk when you're out for a pleasant walk in the woods. If you walk a long loop on a trail through the forest, you will miss all the side trails and you'll have to go back for them later. It is best to try to walk every side trail in a section

of the park or forest before moving on to another section. This way you won't have to go back to get that one piece of trail you missed. Inevitably you will end up backtracking quite a bit to get to every trail section. Avoid the instinct to just keep walking on the main trail.



This is a bad example of how to walk when GPSing trails. The user walked a large loop, but will have to go back and GPS all the side trails he missed. This was basically a complete waste of time, since he'll end up walking almost all these trails again to get to the missed trails.



This is a good example of how to walk. The user chose a small area of the park to concentrate on and GPSed every side trail in that area. Now that part of the park is done and the next day she can start on a new area.

Continue walking trail sections and collecting intersection points (and other points like bridges, gates, stream crossings, etc.). Eventually you will build up a connected network of intersection points and trail sections that will fill the whole park. For all but the smallest parks, this will take more than one day. If you have time between fieldwork days, make a map of your progress, symbolizing the intersection points by how many trails are supposed to meet there. This will help you see which areas you need to return to (if you see a four-way intersection with only three trails sticking out of it, you'll need to return to get that missing trail). If the park is segmented by paved town roads (like in the image above), try not moving to a new section across a road until you are sure you have gotten every trail in the section you are in. Remember, you are collecting data, and if you only collect 90% of the trails in the park, your dataset is worse than useless: it is misleading.

Sometimes park users create their own trails that are not considered official by the park management. It is a good idea to GPS these trails anyway, even if they are clearly unofficial. This way the park managers can have a clear record of where the trails are so they can decide what to do about them (either block them off, ignore them, or make them into an official trail). They can be removed from the trail data later, but if you don't GPS them, no one will ever know about them. If you think a trail is unofficial, mark it as such in the "Illegal" field.

GPS techniques

For points, the GPS unit should be set up to average several position readings to get a more accurate point. We have generally used 30 position readings, one per second. It is important not to move away from the point while taking these positions.

For lines we generally set the GPS unit to take a reading (vertex) every 4 seconds if on foot; if the user is riding a bike, car, or other vehicle, set it to take a reading more often. When walking a line it is important to be aware of the GPS status—if your GPS unit stops receiving positions you need to slow down or stop until it resumes collecting vertices. If you keep walking your line will have long straight segments that will not accurately reflect the trail shape. This is especially important if the trail has sharp turns; make sure you slow down and collect a position (vertex) at any sharp corner in the trail. Some GPS units beep with every vertex collected; some will make a sound if they stop getting readings, and some may indicate GPS status visually.

Assessing Trail Condition

Trail segments are assessed for their "Condition" as either 'Good,' 'Fair' or 'Poor'

Condition assessments need to be based on the intended / designed use and intended trail class.

Good:

- Trail segment that generally meets the design parameters as described in Appendix F of the DCR Trail Guidelines Manual for the managed uses and trail class and thus functions well for its intended or managed uses.
- Trail segment that requires no (or only limited) immediate maintenance, with structures in generally good repair.
- Trail segment with a stable tread, showing no major signs of soil loss, muddy areas or obstructions; and that allows water to drain.
- A trail segment with one or intermittent damage points, but still generally meeting the above conditions would still be good.

Fair:

- Trail segment that meets many but not all of the design parameters as described in Appendix F of the DCR Trail Guidelines Manual for the managed uses and trail class and thus functions moderately well for its intended or managed uses.
- Trails segment that requires some maintenance to function fully such as tread work, drainage work, vegetation clearing and / or minor repair to structures.
- Trail segment that shows some signs of tread degradation, that does not fully drain water and / or that includes some moderate damage areas or consistent minor damages (such as erosion areas, channelized tread, muddy areas or obstructions) that might affect the trail experience.

Poor:

- Trail segment that does not meet the design parameters as described in Appendix F of the DCR Trail Guidelines Manual for the managed uses and trail class and thus functions poorly for its intended or managed uses.
- Trail segment that requires immediate maintenance to function fully including addressing obstructions, muddy areas, erosion, and / or channelization.
- Trail segment showing on-going degradation, that does not fully drain water, and / or that includes numerous and severe damages (such as erosion areas, channelized tread, muddy areas or obstructions) that affect the trail experience.

Examples of Good:
Assuming the remainders of the trail segment are similar,
Both generally meet design parameters for their uses.
Neither show signs of degradation or damage points
Both appear to drain water
Neither require current maintenance.

Examples of Fair:
(Top) Shows some trail widening and moderate erosion or degradation. Along with some protruding rocks to 4" or so. Fair, assuming there are various other locations similar to this along the trail segment. If this is an anomaly within an otherwise good segment, then it might be categorized as Good.

(Bottom) This segment is slightly channelized, water does not appear to drain, the tread width appears possibly wider than design parameters, and the clearing width appears narrower. Requires current clearing maintenance and maybe drainage structure maintenance or installation. Fair, assuming this is typical for the trail segment.

Poor: All show current degradation, lack of drainage, erosion. None would meet design parameters or guidelines. All affect the trail experience. All require current and significant maintenance to repair.

Appendix H

DCR – NHESP Biodiversity Conservation Initiative
Conditions for Yellow Guidance Codes

1. The trail segment does not cross a stream, river, pondshore, lakeshore, or muddy bank. The trail work covers less than 100 meters of trail length.
2. The trail is not on a river bank.
3. No work is carried out within 25' of a stream.
4. No work is carried out within 50' of a stream.
5. All trail work must be done entirely with hand tools; if machinery is used, turtle sweeps must be done over the entire work area (including areas where vehicles are driven to the work area) prior to each day's work.
6. All trail work shall be carried out from October 1-April 15; during the rest of the year, if machinery is used, turtle sweeps must be done over the entire work area (including areas where vehicles are driven to the work area) prior to each day's work.
7. No work is carried out between April 15-August 10.
8. No work is carried out between May 1-July 20.
9. No work is carried out between April 1-July 15.
10. No work is carried out between April 1-August 31.
11. No work is carried out between May 20-August 1.
12. No work is carried out between March 15-May 15.
13. No work is carried out between March 15-August 1.
14. No work is carried out between January 1-August 15.
15. No work is carried out between May 20-July 20.
16. No work is carried out between April 15-July 20.
17. No work is carried out between April 15-August 31.
18. Before any work, surveys must be conducted as described in the definition below. If no vernal pools or breeding amphibians are found, then the work may proceed. If any vernal pools or breeding amphibians are found, then NHESP must review Site Specific Plans under MESA before work proceeds. A report of the survey results must be submitted to NHESP **before** work proceeds, regardless of whether vernal pools or breeding amphibians are found or not. Note that these surveys must be conducted at the appropriate time of year, as described in the survey definition.
19. Between April 15 and October 15, no mowers or brush-hogs can be used. If mowers or brush-hogs must be used, then either the vegetation must be less than 1 foot high, or the vegetation must be swept with a long stock immediately prior to mowing or brush-hogging. Between October 15 and April 15, mowers or brushhogs may be used with no additional conditions.
20. Rocks more than 20 feet from trail must not be moved.
21. Drainage must not be directed towards rock ledges, rock piles, or talus slopes.
22. Drainage must not be directed towards rock ledges, rock piles, or talus slopes; rocks more than 20 feet from trail must not be moved.

23. From May 1 to October 15, only woody plants may be cut or removed and only hand-held manual or mechanized tools may be used. From October 15 to May 1, mowing or weed-whacking is allowed. No vehicles or heavy machinery may be used unless the ground is frozen.
24. No soil is removed or disturbed (no digging or re-grading) outside of existing trail bed. (To be revised.)
25. No woody vegetation made be cut or removed, except small branches growing into the corridor of foot trails, or dead or dying stems and trunks leaning or fallen into the trail corridor, which may be removed with hand tools or chain saws. For this purpose, the foot trail corridor is defined as a rectangle 1 foot wider than the footprint of the existing trail and 8 feet high centered over the foot trail. No branches over 2 inches in diameter may be removed. No vehicle-mounted equipment may be used for trimming woody vegetation in the trail corridor.
26. No spruce trees may be cut or removed.
27. No herbaceous vegetation may be removed from rock walls, ledges, or outcrops.
28. Puncheons must be less than 20 feet long and represent less than 5% of the entire trail segment.
29. From June 1 to September 30, only woody plants may be cut or removed and only hand-held manual or mechanized tools may be used. From October 1 to May 31, mowing or weed-whacking is allowed. No vehicles or heavy machinery may be used unless the ground is frozen.
30. No aquatic plants may be removed by manual, mechanical, or chemical means; structures over water must be less than 4 feet wide.
31. From July 1 to March 15, only woody plants may be cut or removed and only hand-held manual or mechanized tools may be used. From March 16 to June 30, mowing or weed-whacking is allowed. No vehicles or heavy machinery may be used at any time.

Definitions

*Turtle sweep: the entire trail in question has been thoroughly searched for turtles on and within 5 feet of trail; if a turtle is found it should be moved approximately 20 feet (not>50 feet) away from work limits.

**Surveys: Amphibian/Vernal Pool Surveys must include the following parameters:

- Surveys must be completed by personnel who are pre-approved ahead of time by NHESP to conduct vernal pool and/or rare salamander surveys. Rather than provide such approval on a project-specific basis, NHESP is willing to annually approve a list of qualified DCR staff and/or contractors, and update the list as needed.
- Surveys will include egg mass counts during the obligate amphibian breeding season (March - May); the specific timing of the surveys should be determined by documented amphibian movement phenology in a given region of Massachusetts in a given year (e.g., check Vernal Pool ListServ, a Yahoo Group List Serve monitored by the Vernal Pool Association). Sites should be surveyed for all vernal pool obligate species, including fairy shrimp, and also facultative amphibian species, if present at this time of the year.
- A minimum of two (2) surveys should be conducted with at least 1 week (i.e., 7 days) between surveys (since salamanders may take up to 6 weeks to lay all of their eggs) and should be conducted within all suitable breeding wetlands identified by the vernal pool expert within 100 feet of trails. Individual counts for each visit and a total count (or highest number observed) should be included with survey results.
- Results (regardless of outcome) must be reported to NHESP as a Site Specific Report with detailed trail maintenance information and surveys results, which should include: completed Vernal Pool Certification Forms (if applicable), maps (topographic and aerial maps), GPS coordinates of each site/pool surveyed, and photos of sites (i.e., vernal pool) and any obligate or facultative species found using the pool. Additionally, if a rare salamander is found in the vernal pool, a Rare Animal Observation Form must be included with the report.
- If a new or larger culvert is needed within a trail, there must be an evaluation conducted to determine if there are any hydrological effects on any pools in the vicinity of the trail (i.e., within 100 feet of the trail and culvert location). If vernal pool habitat hydrologically connected to the culvert replacement area is not identified, maintenance work may proceed; otherwise NHESP needs to review Site Specific Plans for maintenance work.

Appendix I

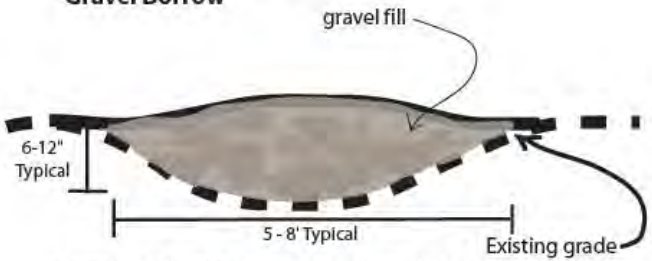
Additional Trail Maintenance Specifications

Mudholes/Protruding Rocks, Roots/Exposed Ledge

Causes:	Mudholes and ditches are depressed areas of notable deviation in grade from the surrounding area within the trail. Mudholes tend to be rounded depressional features whereas ditches are linear. After rain events, these depressional areas are often found to contain water and present and obstruction to some trail users. Mudholes in very tight soils (silts/clays) tend to pond water for longer periods of time and in some instances, where soil permeability is very low, ponding can impact the functionality of regulated wetlands.
Standard Repair:	The standard repair for mudholes and ditches is placement of a gravel/cobble mixture with compaction. Mudholes adjacent to wetlands should be flanked by erosion and sedimentation control structures such as hay bales or silt fencing during construction.
Regulatory Considerations:	Placement of fill within a wetland would require an Order of Conditions from the local Conservation Commission (Cons Com) and, possibly a permit from the U.S. Army Corps of Engineers and MA DEP. Fill placed within the "buffer zone" of the wetland may also require a permit from the Cons Com. The buffer zone will differ from town to town.
Other Repair Options:	Trails with frequent mudholes and ditches should be evaluated to determine if the standard repair would result in a sustainable trail. Large numbers of severe mudholes may be an indicator of a non-sustainable trail.

Photo of Problem Type: Mudholes

Standard Repair Diagram:
Gravel Borrow



Gravel specification: 2/3 processed gravel, 1/3 bank run gravel

Stream & Wetland Crossings - Narrow Trails

Causes: Trails often cross intermittent streams, perennial streams or wetlands and impacts to water quality can occur if the trail users cannot cross the resource without directly contacting the water and stream substrate.

Standard Repair: Along narrow streams used for non-motorized purposes, streams can be crossed in several ways depending on the size and type of the stream and the trail's geometric relationship to the water feature. For intermittent streams, placement of flat stone along the stream bed may be appropriate. Another option is the placement of a pipe or culvert to convey flow under the trail. For perennial streams, an anchored bridge is preferred, but culverts may also be used. For wetlands (marshes, swamps) the use of a bog bridge (aka puncheon) or a boardwalk can be used although boardwalks are preferred as they are elevated above the ground.

Regulatory Considerations: Placement of fill within a wetland would require an Order of Conditions from the local Conservation Commission (Cons Com) and, possibly a Section 404 Permit from the U.S. Army Corps of Engineers and a 401 Water Quality Certification from the DEP. Fill placed within the "buffer area" of the wetland may also require a permit from the Cons Com. The buffer area will differ from town to town. The crossing of perennial streams must conform to the MA DEP Stream Crossing Standards.

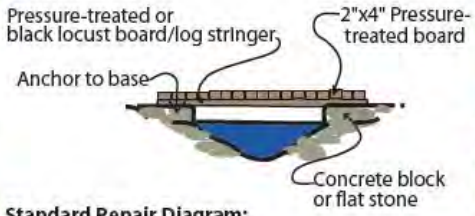
Other Repair Options: Bridge material options include steel or fiberglass pre-fab.

Information Sources: USFS, http://www.ettechtonics.com/pedestrian_and_trail_bridges/

Photo of Problem Type: Intermittent Stream Crossing

Standard Repair Diagram: Bog Bridge

Standard Repair Diagram: Elevated Bridge



Standard Repair Diagram: Bog Bridge

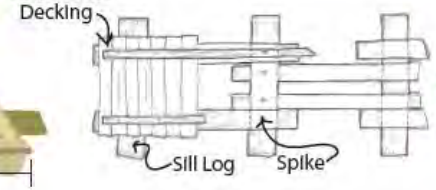


Photo of Problem Type: Perennial Stream Crossing

Standard Repair Diagram: Elevated Bridge

Appendix J

Erosion and Sedimentation Control Techniques

SEDIMENT BARRIERS

Definition

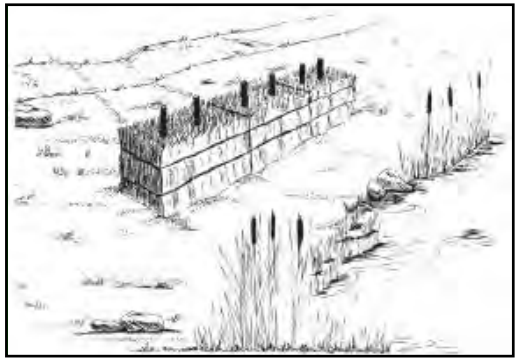
An erosion control device installed across and at the toe of a slope, usually consisting of hay, straw bales, or geo textile materials, to prevent sediment from entering wetlands or open water.

Conditions where appropriate

• When the erosion which would likely occur is in the form of sheet or rill erosion.
• Where temporary sediment retention is necessary until permanent vegetation is firmly established.

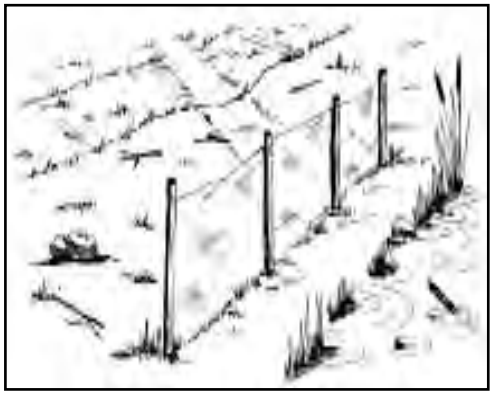
Bales

Guidelines for bale installation



• Bales shall be placed in a single row on the contour with the ends tightly adjoining, not to exceed 600 feet in length.
Turn up the ends and begin a new row, if needed.
• The bales should be embedded into the ground at least 4" deep.
• After placing bales, they should be anchored in place with two stakes per bale driven through the bale and into the ground.
• Bales should be used where the area below the barrier has exposed soils and would be impacted by water flowing through a barrier.
• Inspections should be frequent. Repair or replacement should be done promptly, as needed.

Silt Fencing: A silt fence is a temporary sediment barrier consisting of filter fabric attached to supporting posts and entrenched in the soil. Silt fence is a sediment control practice, and is intended to be installed where sediment-laden water can pond, thus allowing the sediment to fall out of suspension and separate from the runoff. It is not intended to be an erosion control practice. Improperly applied or installed silt fence will increase erosion. A silt fence detains sediment by ponding water behind it and allowing sediment to settle out.



Silt fence can be used where:

- The slope is gentle, allowing temporary ponding and deposition of sediment;
- Sheet runoff would occur
- The size of the drainage area is no more than 1/4 acre per 100 linear feet of silt fence;
- The maximum flow path length above the barrier is 100 feet (30.5 m);

Guidelines for silt fencing

• If wooden stakes are utilized for silt fence construction, they must have a diameter of 2" when oak is used and 4" when pine is used.
• The filter fabric should be purchased in a continuous roll and cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter cloth should be spliced together only at a support post, with a minimum of a six-inch overlap, and sealed.
• When wire support is used, a standard-strength filter cloth maybe used. When wire support is not being used, extra-strength cloth should be used.
• The fabric should be stapled or wired to the fence and a minimum of 4" of the fabric should be extended into the trench.
• The trench should be backfilled and the soil compacted over the filter fabric.

Additional considerations•

Inspect bales and barriers after heavy rains.

• Sediment deposits should be removed when the level of deposits reaches one-half of the height of the bale or the silt fencing.
• Barriers should be removed when the area has revegetated and the barriers are no longer needed. The sediment should be removed or graded out before removal.
• Straw and hay bale barriers require more maintenance than geo textiles due to the permeability of the bales being less than that of silt fencing.
• Silt fences should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.
• For specific information regarding the different types of geo textile materials and their construction and maintenance guidelines, contact the Department of Environmental Services, county conservation district, or a local industrial supplier.