

# Trail Condition Monitoring

Boulder Open Space and Mountain Parks  
**East Trail Study Area**



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## East Trail Study Area Trail Condition Monitoring Report

### **Background & Intent**

Boulder's Open Space and Mountain Parks (OSMP) department manages over 140 miles of designated trails. OSMP lands receive an estimated 5.3 million visits each year (OSMP 2005). Trends indicate that visitation will continue to increase into the future (OSMP 2004). Increasing levels of use could impact the trail system, affect the quality of the visitor experience, and alter the condition of natural resources.

One of the goals of the OSMP Visitor Master Plan's (VMP) is to ensure that the designated trail system provides a high quality visitor experience while protecting and preserving environmental resources. To achieve this goal, it is essential to provide and maintain a sustainable trail system. The VMP calls for annual designated trail condition monitoring.

The purpose of this monitoring project is to assess the compliance of our trail system with sustainability standards (Attachment A). Trail condition monitoring identifies unsustainable trail segments, documents the location and condition of constructed features and provides management recommendations or prescriptions for trail maintenance and sustainability.

This monitoring report provides managers with information to allocate staffing and resources strategically, and to prioritize trail maintenance projects. Trail monitoring will also describe the condition of trails and trail features, enabling managers to document and communicate the extent and location of regular trail maintenance needs. This information can be used in conversations with the Open Space Board of Trustees, City Council and interested members of the community.

### **Methods<sup>1</sup>**

Trails were divided into segments based upon their combined *trail class* and *designed use*. Trail class refers to a trail's level of development and designed use refers to the allowed use on the trail that controls how it is designed, built and maintained. Each segment was visited in the field. OSMP staff measured trail parameters and compared the measurements to trail standards for a given

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<sup>1</sup> A detailed protocol for trail condition monitoring is available upon request from the OSMP department.

trail class and designed use. Those sections of the trail out of compliance with standards require maintenance or, in some cases, more significant response such as reconstruction.

In addition to measuring parameters related to the trail standards, OSMP also collected information about other maintenance issues such drainage problems, erosion and trail braiding. These were detected by direct observation of evidence such as muddy areas, gullies and loose rocks. The department has no standards for erosion, drainage problems or trail braiding because they are unacceptable wherever they occur and therefore require maintenance.

For ease of communication, the term “area of concern” refers to portions of trail that are either out of compliance **or** exhibit maintenance issues. The following list contains the indicators that were monitored to identify areas of concern.

<b>Trail Parameters Related to Design Standards</b>	<b>Maintenance Issues</b>
Trail grade	Drainage
Tread width	Erosion
Outslope	Braiding
Clearing width, height	
Surface material	
Turn radius	

Staff also inventoried and evaluated constructed features as part of this project. Constructed features are human-made structures designed to help maintain a trail’s sustainability, by diverting water, retaining sediment, or raising the level of the tread. Examples include retaining walls, turnpikes, bridges, waterbars, steps, or culverts. Constructed features condition classes are described in Table 1.

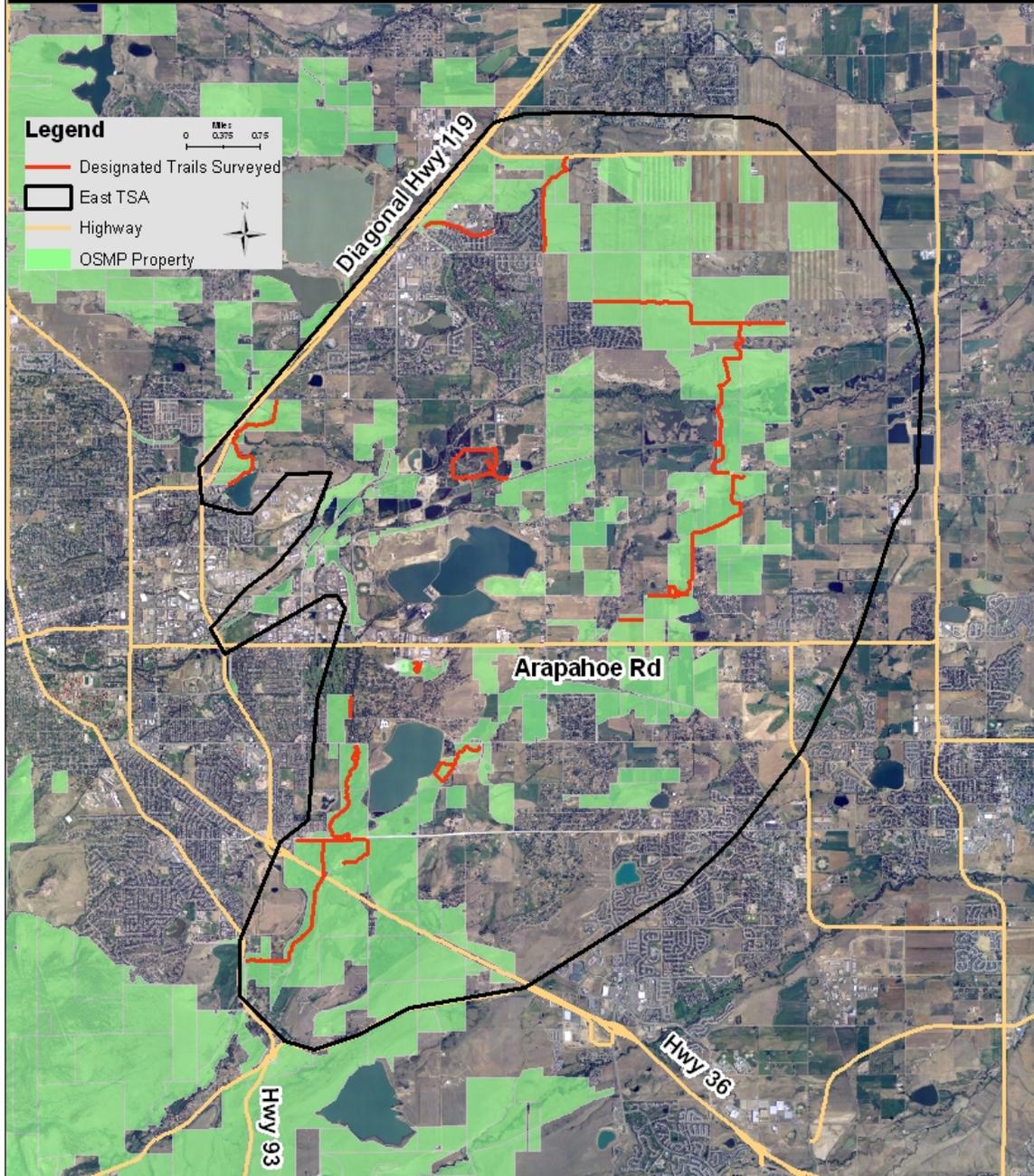
**Table 1:** Condition Classes and Descriptions for Constructed Features

Condition Class	Description
Routine Maintenance	Feature is <b>FUNCTIONING WITHIN STANDARD</b> as designed and is within normal maintenance cycle (generally at a cost of less than 20% of replacement)
Repair/Rehab	Feature is in <b>DISREPAIR</b> , may or may not be useable, but needs to be repaired to bring feature to standard (generally at a cost between 21% & 50% of replacement)
Replace in-kind	Feature is <b>DYSFUNCTIONAL</b> and beyond it’s designed lifecycle or has deteriorated to a point where unable to perform as designed or constructed (generally at a cost of over 51% of new construction and includes demolition and removal of existing)
Decommission	Feature is <b>NOT NEEDED</b> for the operation of the trail or is inappropriate for the setting and should be removed from system with no replacement planned.
Expansion	Feature is basically functioning as designed but is <b>UNDERSIZED</b> . Would typically be lengthened or widened, but in some cases size may be reduced.
Alter Function	Modify feature to <b>CHANGE FUNCTION</b> to either increase capacity, change function, or durability.
Install New	<b>NEW</b> Feature is needed.

Trail condition monitoring was conducted in the **East Trail Study Area (TSA)** (see Figure 1) during September and October of 2007. Extensive database development time for this project was a one-time cost shared across all TSAs. Estimates of time to complete monitoring are given below.

<b>Preparation:</b>	45 days - Trails Management Framework and Protocol development (one time) 4 days - Data dictionary and TMO (standards) development (one time) <hr/> <b>Subtotal: 49 days</b>
<b>Fieldwork:</b>	9 days - Survey East TSA (16 trails - 18.6 miles) <hr/> <b>Subtotal: 9 days</b>
<b>Post-processing:</b>	2 days - GPS export to GIS, editing 5 days - GIS map production 1 day - database reporting <hr/> <b>Subtotal: 8 days</b>
<b>GRAND TOTAL</b>	<b>66 days = 13 weeks inclusive</b> <b>17 days for East TSA specific work</b>

# Trail Condition Monitoring - Designated Trails Surveyed East Trail Study Area



**Figure 1:** Designated trails surveyed for trail condition monitoring in East TSA.

# Results

## Trail Condition

Roughly 19 miles of trail were surveyed in the East TSA. Approximately nine percent of the trail system identified as either out of compliance with standards or exhibiting other maintenance issues. These areas of concern total about 9,104 feet or 2,775 meters (1.72 miles). The trail with the highest percentage of non-compliant/maintenance issues is the East Boulder -Teller Lake Accessible Spur Trail. Maps showing the location and extent of areas of concern in the East TSA are included as Attachment B. Details about the areas of concern are included in Attachment C.

Tables 2 and 3 show the percentages of areas of concern for **trails** and **trail segments** within the East TSA.

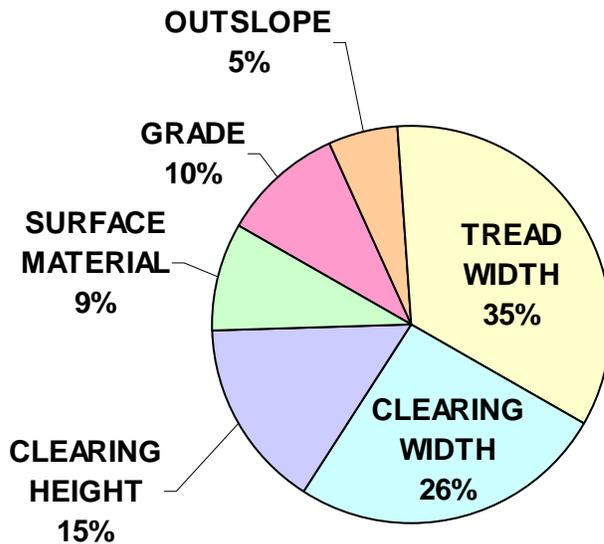
**Table 2:** Areas of concern for each **trail** in the East TSA. *The shaded areas in tables 2 and 3 identify trails with less than five percent of their length in undesirable condition.*

Trail Name	% of Total Trail Length with Areas of Concern
Teller Lake Accessible Spur	100%
E. Boulder - Gunbarrel	16%
E. Boulder - White Rocks	16%
Cottontail	15%
Cottonwood	14%
Dry Creek	14%
E. Boulder - Teller Lake #5	9%
Centennial - equestrian	8%
E. Boulder - Teller Lake	3%
South Boulder Creek	2%
Sawhill Ponds	2%
Sombrero Marsh	1%
Cherryvale	1%
E. Boulder - Teller Spur	0%
South Boulder Creek - equestrian	0%
Dry Creek	0%

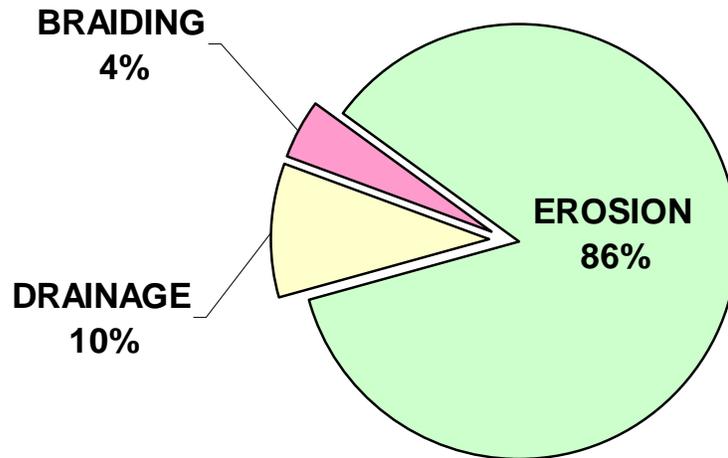
**Table 3:** Areas of concern for each **trail segment** in the East TSA.

Trail Name	Trail Seg ID	% of Trail Segment Length with Areas of Concern
Teller Lk Accessible Spur	504.01	100%
Cottonwood	507.02	65%
E. Boulder - White Rocks	501.03	28%
Cottontail	506.01	25%
E. Boulder - Teller Lake	503.02	22%
E. Boulder - Gunbarrel	502.01	21%
E. Boulder - White Rocks	501.01	19%
E. Boulder - Gunbarrel	502.02	17%
Dry Creek	514.02	14%
Cottonwood	507.01	14%
E. Boulder - Teller Lake #5	515.01	9%
E. Boulder - Gunbarrel	502.03	9%
Centennial - equestrian	510.01	8%
Sawhill Ponds	508.03	4%
South Boulder Creek	511.03	3%
South Boulder Creek	511.01	2%
Sawhill Ponds	508.02	2%
South Boulder Creek	511.02	2%
Cherryvale	513.03	2%
Sombrero Marsh	509.01	2%
E. Boulder - Teller Lake	503.01	1%

Figure 2 shows the factors most responsible for non-compliance with standards. Figure 3 shows the relative proportion of different types of maintenance issues.



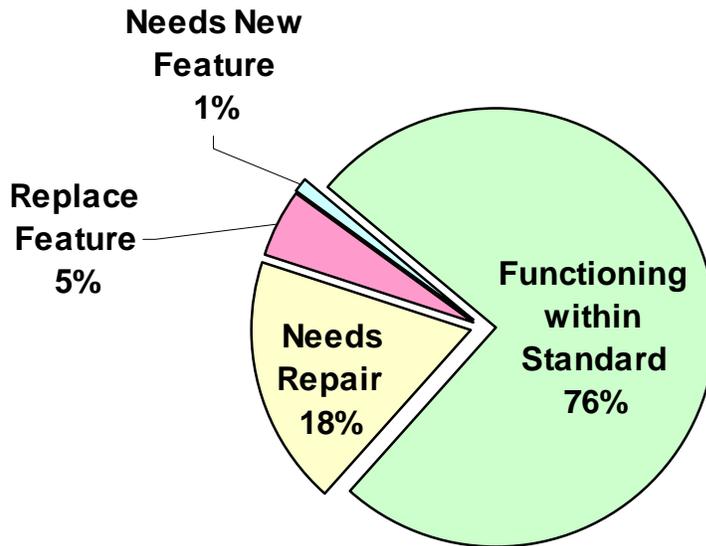
**Figure 2:** Contribution of various trail sustainability factors to **non-compliance** in the East TSA. (total distance of trail out of compliance = 4,190ft or 1,277m)



**Figure 3:** Contribution of various **maintenance issue** categories in the East TSA. (total distance of trail with maintenance issues = 4,914ft or 1,498m)

### Constructed Features

Figure 4 shows the condition class distribution of the 98 constructed features associated with trails in the East TSA. Three fourths of the features are functioning within standard. Maps showing the location and condition of constructed features in the East TSA are included as Attachment D. Details about the constructed features are included in Attachment C.



**Figure 4:** Condition class of constructed features in the East TSA.

## Discussion

### *East Trail Study Area*

#### **Trail condition**

All designated trails in the East TSA were surveyed (18.6 miles). Nine percent of this trail system is either out of compliance with standards or exhibiting other maintenance issues. Taken together these two categories are referred to as areas of concern.

The East Boulder Trails are exhibiting the highest percentages in areas of concern. Certain sections of the East Boulder Trails require extensive maintenance and/or possible reroutes to achieve sustainability.

The trail with the highest percentage in areas of concern is the East Boulder – Teller Lake Accessible Spur Trail. The trail has a sustainable design but is overgrown with vegetation throughout its entire length (530 ft) and hardly resembles a trail. This trail will need maintenance in order to be in compliance with its designed use—wheelchair accessible.

The East Boulder – White Rocks and Gunbarrel trails both exhibit areas of concern for 16% of their length. Certain segments of these trails exhibit even higher percentages. Reroutes are constrained due to existing Open Space and Mountain Parks (OSMP) land ownership. Consequently considerable construction will be needed to address the serious erosion problems occurring on the affected segments. Bar ditches with a raised tread and erosion control structures may be adequate solutions to these trails' problems. Alternatively, OSMP could consider obtaining additional easement/ownership in selected areas that would allow for a more sustainable design.

The Cottontail and Cottonwood Trails also exhibit high percentages in areas of concern. The Cottonwood Trail will require significant routine maintenance (e.g. pruning vegetation and constructing small drains and applying fill material in low-lying areas).

The Dry Creek Trail will also need extensive maintenance to address its problems. Tread width is about 10-12 feet wide in some areas, and the raised tread structure is eroding. Geo-textile material has been exposed and ripped away leading to the formation of small depressions in the tread.

The majority of trail segments in the East TSA has sustainable designs and should require only routine maintenance. The following locations are recommended trail reroutes or major re-construction.

1. Segment 501.03 of the East Boulder – White Rocks Trail paralleling Valmont Road. The trail follows the fall line and has a low side-slope, making it difficult to divert run-off. The sandy substrate also contributes to

stability problems for the trail. These factors combined with infrequent routine maintenance have resulted in severe erosion and trail braiding.

2. Segment 506.01 of the Cottontail Trail will need reroutes (re-alignment) in certain sections to achieve a sustainable design. The location of this trail segment contributes to most of its issues. One section for example is located in a flash flood area.

Some portions of the Cottontail Trail (segment 506.01) are out of compliance with grade standards. Re-aligning the trail will be necessary to achieve compliance with the existing handicapped accessible designed use for this trail segment.

3. Segment 502.01 of the East Boulder – Gunbarrel Trail will need major re-construction in places to achieve a sustainable design. Severe erosion problems occur due to the trail's location, sandy soils, lack of erosion control structures and infrequent maintenance.

### **Types of Non compliance/Maintenance Issues**

Tread width accounts for about one third of the non-compliant portions of trails in the TSA. Erosion contributed to the majority (86%) of maintenance issues identified. The erosion issues in the TSA appear to be largely related to the extensive sandy soils underlying many of the East Boulder Trails. Sandy soils do not provide stability for a trail and they erode easily.

### **Constructed Features**

Three fourths of the 98 constructed features associated with trails in the East TSA are functioning within standard. The most common features in need of repair are culverts. These require extensive cleaning to regain proper function. A few wooden fences need minor repairs as well, such as securing posts and/or fallen logs. Two bridges are in need of repair: one on East Boulder-Teller Lake Trail segment 503.01 and one on South Boulder Creek Trail segment 511.04. Five erosion control structures need to be replaced on the East Boulder – White Rocks Trail due to deterioration. One drain dip is recommended for the Cherryvale Trail segment 513.02.

## **Attachments**

- A. Trail Design Standards
- B. Maps of Areas of Concern in the East TSA
- C. Details About Areas of Concern and Constructed Features in the East TSA
- D. Maps of Constructed Features in the East TSA

### Literature Cited:

City of Boulder Open Space and Mountain Parks (OSMP). 2005 Visitor Master Plan.  
Accessed. 6/19/2007.

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