



Bear Creek Watershed - Rapid Trail Condition Assessment

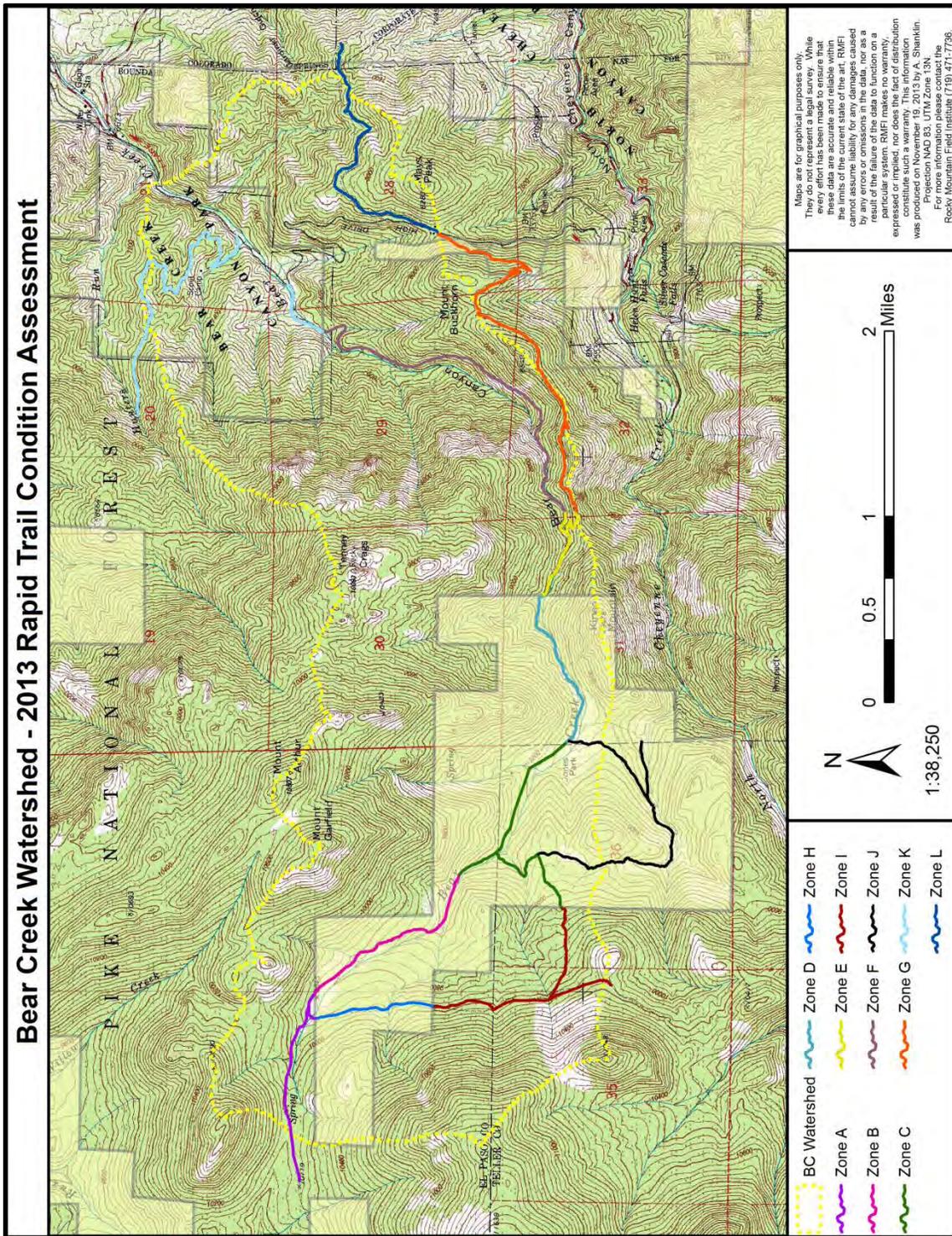
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Figure 1. Bear Creek Watershed with trails broken out by assessment zones.



Background

The Bear Creek Watershed lies just west of the City of Colorado Springs along the eastern flank of the Pikes Peak Massif (38°48'15", 104°55'30"). Encompassing National Forest lands administered by the Pike National Forest, private lands owned by Colorado Springs Utilities (CSU), and lands administered by the City of Colorado Springs, the watershed is extremely important for its recreational opportunities, its value as a water resource, and as vital habitat for the threatened greenback cutthroat trout (*Oncorhynchus clarki stomias*).

The excessive rains received in Colorado Springs during September 2013 caused resource damage throughout the Southern Colorado region. The US Geological Society suggests a 'one percent annual exceedance probability flood,' or a 100-year flood event occurred over the region. Due to the unstable nature of soils found in the Pikes Peak Region, damage to natural resources in many areas is assumed to be severe. Assessments are required to determine the exact extent of damage from these events.

This document constitutes a rapid assessment of the condition of system trails within the Bear Creek Watershed as requested by the US Forest Service and Colorado Springs Utilities.

Rapid Trail Condition Assessment

Trails are separated into Zones (A-L) for discussion in this assessment (Figure 1). Each Zone is divided into sections approximately 300 feet in length (i.e. A-1, A-2, A-3, etc.). A total of 263 sections were evaluated and analyzed for this assessment. Trail condition attributes were measured by RMFI personnel in each Section (Table 1). An average number (for the ~300 feet) for each attribute was determined for each section and was recorded in a GPS unit. The data was downloaded and analyzed to determine the classification rating for each Section. Areas that were deemed important to record but were not fully captured within the assessment framework are labeled 'Hot Spots' on the maps and are discussed within each Zone.

Table 1. RTCA Inventory Indicators determined on-site for each ~300-foot section of trail.

Inventory Indicators	Trail Descriptors
Section	Uniquely numbered within each zone; each ~300 feet in length
Tread width	In inches
Trail Profile	CR - Crowned
	OS+ - Flat/Properly Outsloped
	OS- - Flat/Improperly Outsloped
	1-12 inches below grade
	12-24 inches below grade
	>24 inches below grade
Trail Tread Incision	0-3 inches
	3-6 inches
	6-12 inches
	12-24 inches
	>24 inches
Structure failure	How many structures in section have failed
Wet Soil	Moisture is present on trail (yes/no)
Root Exposure	Excessive root exposure present (yes/no)
Hotspots	Problem areas not covered by this assessment will be indicated separately

Methodology

Seven Inventory Indicators were collected for the purpose of this assessment; trail width, trail profile, trail tread incision, structure failure, trail moisture, root exposure, and hot spots. See definitions for each attribute in Appendix A. Within each Inventory Indicator, categorical Trail Descriptors were pre-determined to keep field data collection consistent. For example, the Trail Descriptors for Trail Profile included 'CR', 'OS+', 'OS-', '1-12 inches below grade', '12-24 inches below grade', and '>24 inches below grade' (see Table 1 for detailed explanation of each Trail Descriptor). Each Trail Descriptor was assigned a score based on its severity. For example, a trail whose tread profile was CR or OS+ received a '0', a profile of OS- received a '1', a profile of 1-12 inches below grade received a '2' and so on. Trail Descriptor scores were analyzed to determine the Total Category Number (Figure 2), which was used to determine the final Classification Rating.

Figure 2. Equation used to determine Total Category Number.

$$\begin{aligned}
 & \textit{Total Category Number} \\
 & = (\textit{Trail profile} \times 0.25) (\textit{Trail tread incision} \times 2) (\textit{Failures} \times 1) (\textit{Moisture} \\
 & \times 0.25) (\textit{Roots} \times 0.25) (\textit{Minimal incision} \times 0.25)
 \end{aligned}$$

To best assess and classify the trails in regards to user hazards, attributes were given weights. Trail incision was given a weight of 2. Trail moisture, root exposure, and trail profile were each weighted 0.25 and structure failures were left un-weighted. Trail incision was weighted the most because it is one of the best indicators of hazardous trail conditions. Trail incision is an excellent indicator of improper water movement on trails, extreme erosion conditions, and other hazardous conditions within a trail system. Please remember that weights are applied to the scores for each Trail Descriptor within each Inventory Indicator, as explained above. For example, a Tread Incision of 3-6" will have a score of 1 that will be weighted by 2. A Tread Incision of 6-12" will have a score of 2 and will be weighted by 2. Though trail profile is an important characteristic in determining trail sustainability and water movement within trail systems, a trail with a diminished profile is not necessarily hazardous. Therefore, this attribute, along with trail moisture, root exposure, and minimal incision were only given a quarter the importance in the final equation to determine Total Category Number. For example, a Trail Profile of 1-12" below grade will have a score of 2 and will be weighted by 0.25. Lastly, a minimal incision multiplier was added to sections to differentiate no (or minimal) incision from 1-3 inch incision.

Final numbers were broken into Classification Ratings, given a specified color, and a map was created to show ratings within each Section (Figure 3) (Appendix B shows an overview map of classifications broken down by zone). Classification Ratings can be found in Appendix C while final equations will be delivered in a separate spreadsheet along with finalized GIS data. Given the range of attributes used to derive the Total Category Number and the rapid nature of the field data collection, classifications are subject to some minor computational variation. Final classification ratings were determined based upon the spread of data (standard deviation and skewness) and adjusted when necessary to correlate with on-the-ground trail conditions

Table 2. Trail Degradation Level Matrix.

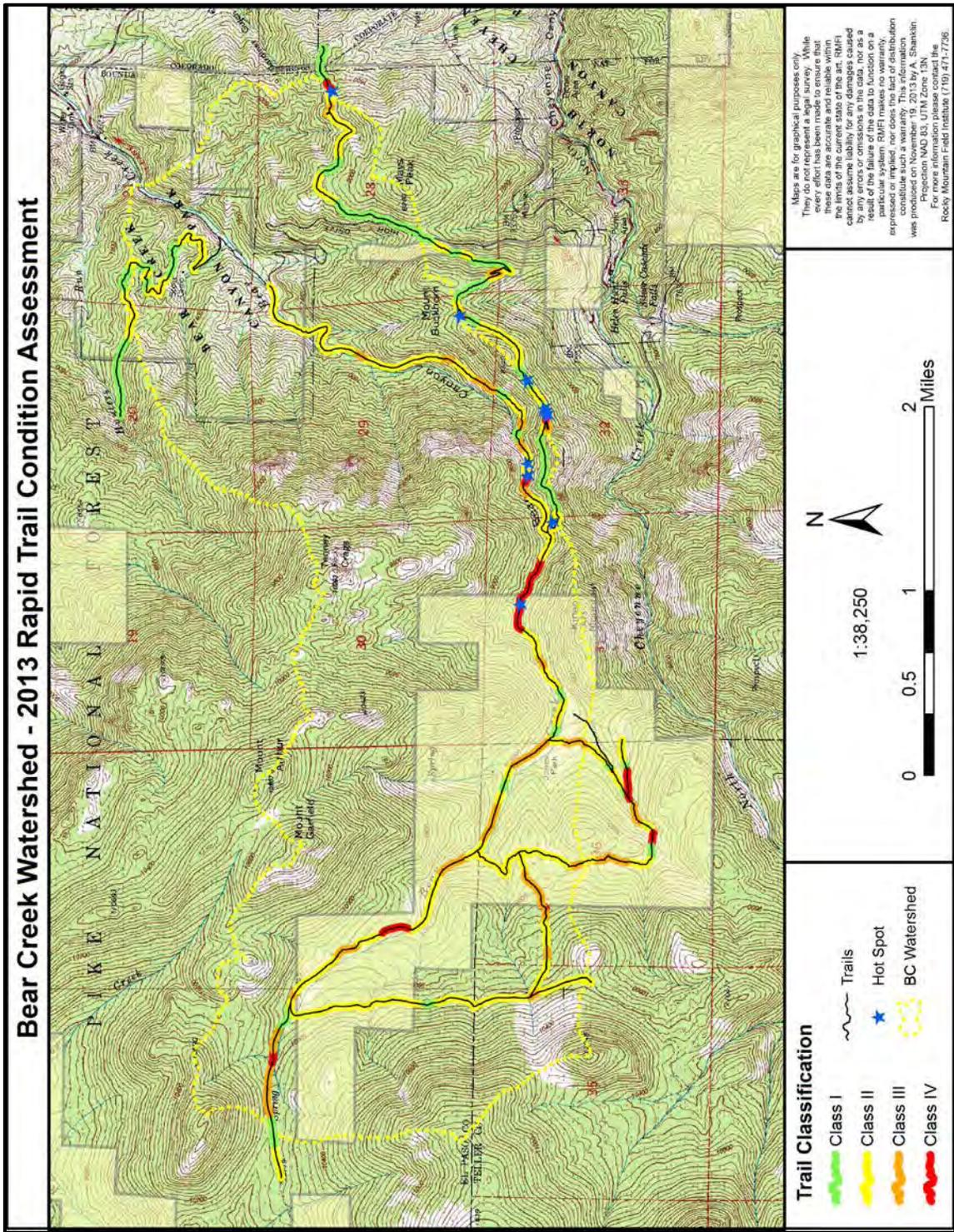
Classification Rating	Total Category Number	Description
Class I	-0.25 – 0.25	Only the least damaged trail sections will fall into this category; trails with minimal incision and gulling with no safety concerns
Class II	0.50 – 2.25	Trails with a moderate amount of damage will fall into this category; more incision than Class I, but remains a non-hazardous trail
Class III	2.5 – 3.25	Trails with severe damage will fall into this category; incision and gulling may cause hazards
Class IV	3.50 – 9.25	Only the most severely damaged sections of trail will fall into this category; trails with excessive incision and gulling that pose a clear hazard to the public

Assessment protocol for the Rapid Trail Condition Assessment compiled in this document was taken from multiple documents. The US Forest Service's (2011) national quality standards and trail design parameters were used as a baseline for typical trail management. The concept and framework for the Rapid Trail Condition Assessment was borrowed from Houston (2012) with inventory indicators and trail

descriptors taken from research by Leung and Marion (1999), Marion and Olive (2006), and Marion and others (2006). Indicators and descriptors were modified slightly from these documents to best fit the local environment and better explain the specific issues within this region.

A Trimble GeoXH receiver was used to collect GPS data. All GPS data was collected with Projected Coordinate System UTM, NAD83 Zone 13N. Data collected in the field was analyzed in the office. All GIS data and associated photos will be provided to land owners separately. RMFI also completed a brief assessment of cut-slope, fill-slope and % vegetation cover for Trails #668, 701, 720, and 720A. Info for this assessment can be found in a separate GIS layer that will be provided to the land management agencies. Please contact the Rocky Mountain Field Institute with any additional questions.

Figure 3. Bear Creek Watershed; trails highlighted to distinguish Classes I-IV.



Zone A (USFS)

This zone lies within the Pike National Forest and currently dead ends at the Colorado Springs Utilities South Slope watershed. The length of trail included in the assessment of this zone is approximately 6,099 feet. Sixteen sections were assessed in Zone A. The average trail tread width is approximately 40 inches. One section is Class IV, 7 are Class III, 4 are Class II, and 4 are Class I. One structure failure was discovered in Zone A; an in-trail drain has filled and is no longer functional.



Example of Class I within Zone A



Example of Class III within Zone
A

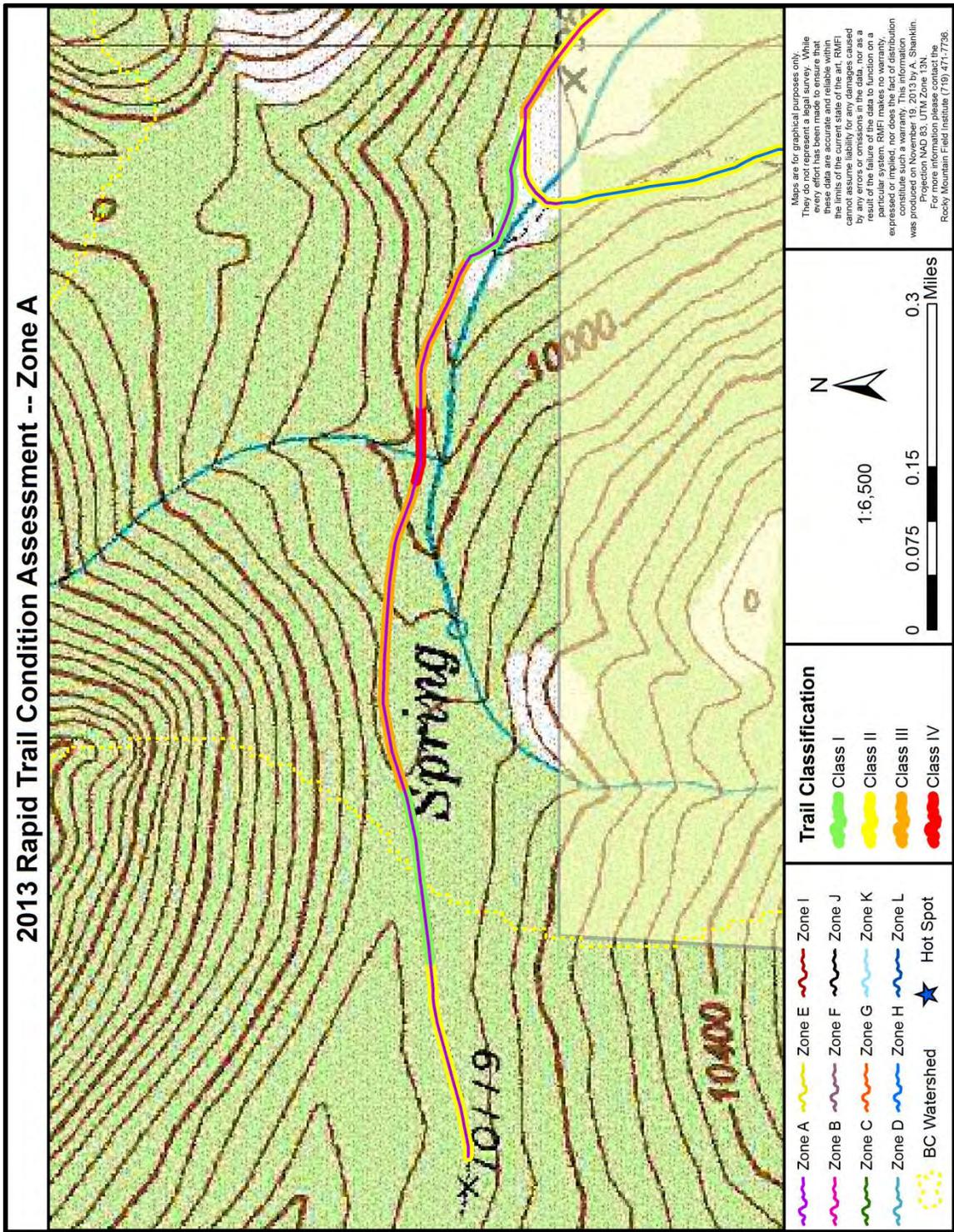


Example of Class III within Zone
A



Structure failure within Zone A

Figure 4. Bear Creek Watershed; Zone A with Classification Ratings displayed.



Zone B (CSU)

Zone B lies exclusively on Colorado Springs Utilities land. Approximately 5,907 feet of trail was assessed within this zone. Sixteen sections were assessed in Zone B. Two sections are Class IV, 3 are Class III, 11 are Class II, no Class I sections exist in this Zone. The average trail tread width is approximately 50 inches. One structure failure was discovered in Zone B, a bridge to keep users out of the stream has become inundated with sediment and continues to contribute sediment into the stream.



Example of Class III within Zone
B

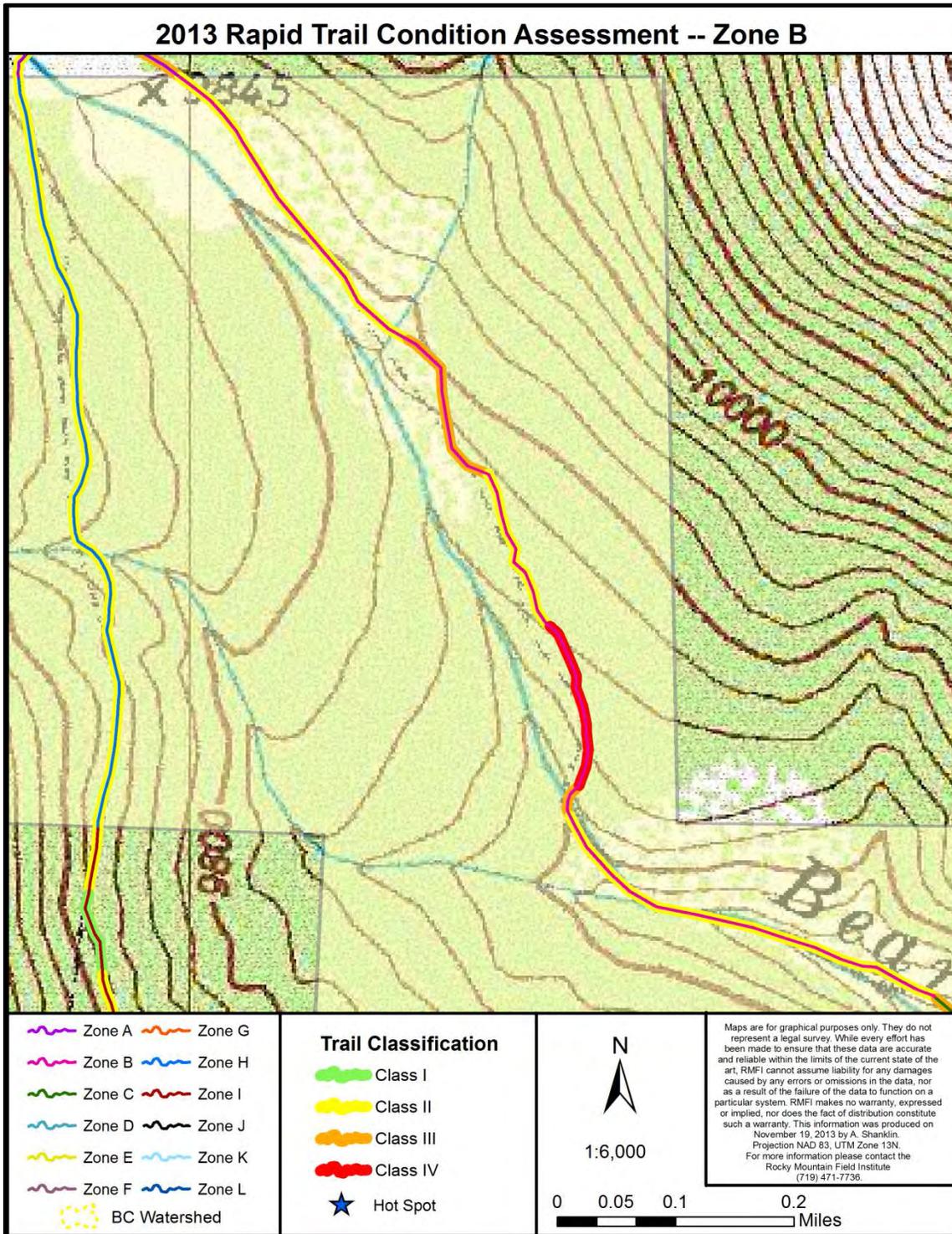


Example of Class IV within Zone
B



Structure failure within Zone B

Figure 5. Bear Creek Watershed; Zone B with Classification Ratings displayed.



Zone C (CSU)

The assessment for Zone C covered approximately 8,753 feet of trail on CSU property. Trail #720A connects with #667 in this zone. Twenty-four sections were assessed in Zone C. No Class IV sections are present in this section, 12 are Class III, 11 are Class II, and 1 is Class I. The average trail tread width is approximately 47 inches. One structure failure was discovered in Zone C; an outslope retaining wall is no longer functioning properly and is causing sediment to be deposited into the stream.



Example of Class III within Zone C



Example of Class II within Zone C

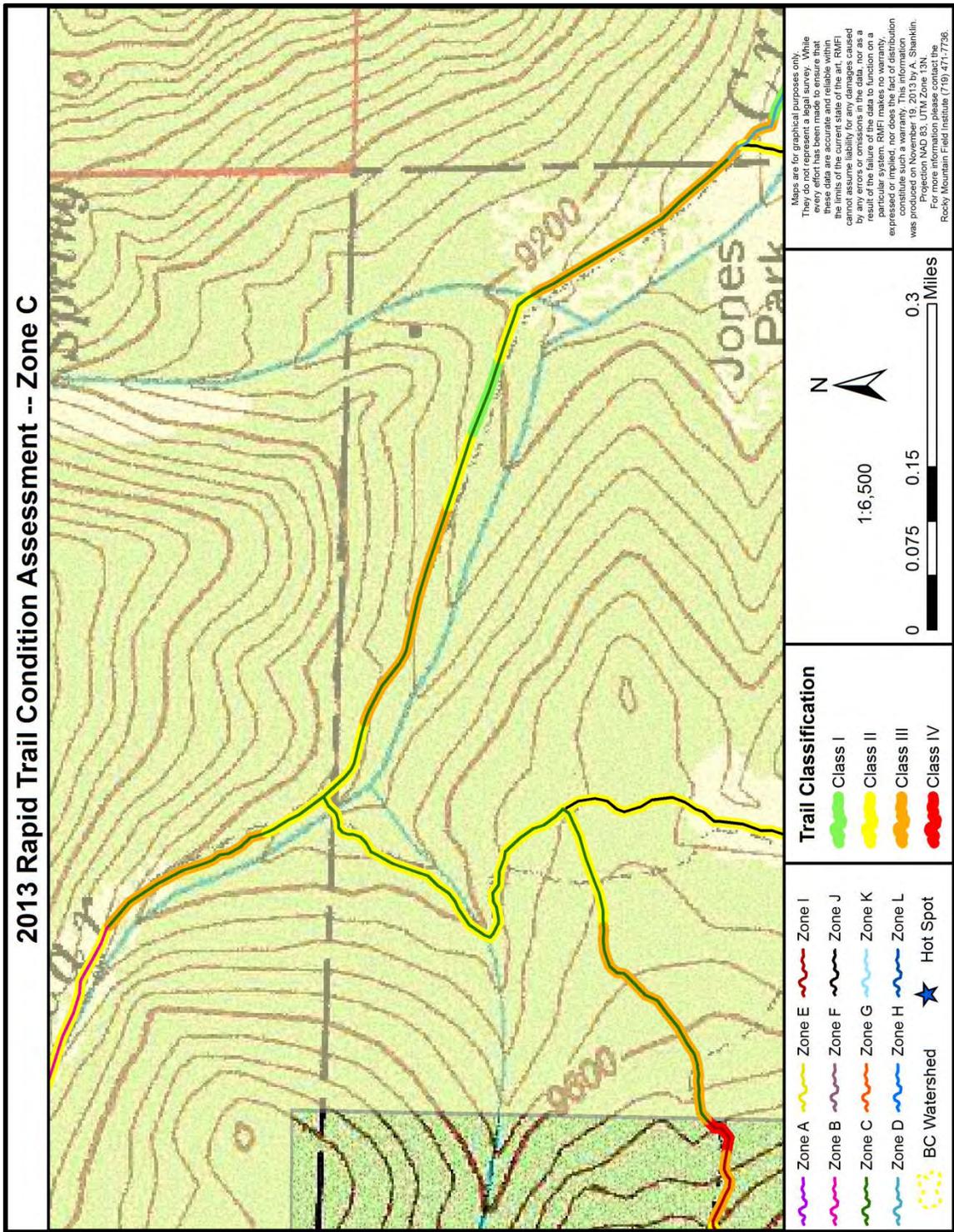


Structure failure within Zone C



Example of root exposure within Zone C

Figure 6. Bear Creek Watershed; Zone C with Classification Ratings displayed.



Zone D (CSU)

This Zone encompasses the last section of Trail #667 on CSU land. The trail along Zone D that was assessed for this document stretches approximately 5,057 feet adjacent to Bear Creek. Fourteen sections were assessed in Zone D. Three sections are Class IV, 2 are Class III, 7 are Class II, and 2 are Class I. The average trail tread width is approximately 37 inches. Four structure failures were discovered in Zone D. Within Section D-14 an extremely incised portion of trail that is approximately 10 feet wide was discovered, this was not captured within the assessment framework and was individually identified as a 'hot spot' for the purposes of this assessment.



Example of Class II within Zone D



Example of Class III within Zone D

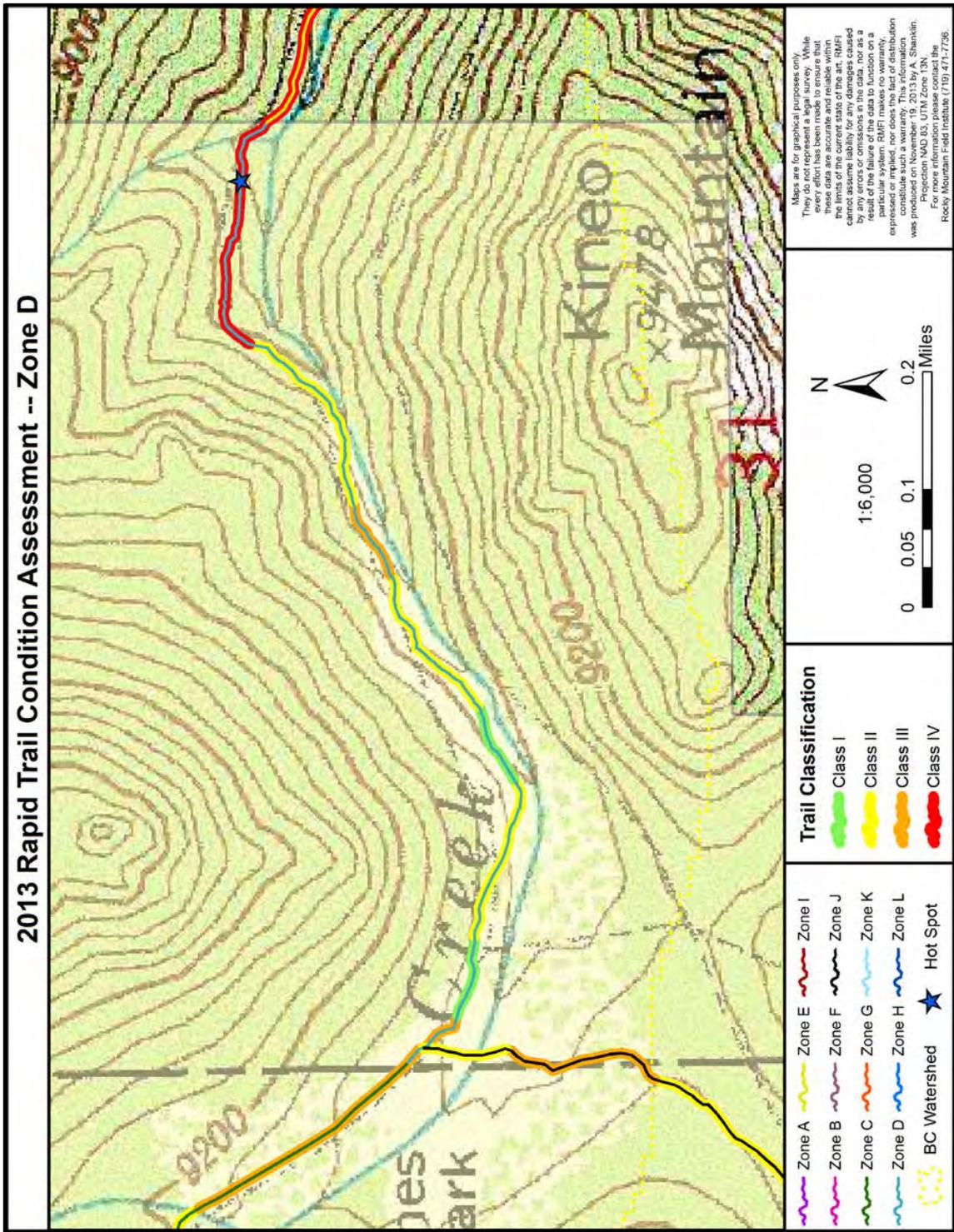


Example of Class IV within Zone D



Hot Spot within Zone D

Figure 7. Bear Creek Watershed; Zone D with Classification Ratings displayed.



Zone E (USFS)

Zone E contains portions of trail from both Trail #666 and #667. Approximately 3,909 feet of total trail within this zone was assessed. Ten sections were assessed in Zone E. The average trail tread width is approximately 37 inches. Three Sections are Class IV, 1 is Class III, 6 are Class II, and there were no Class I sections in this zone. Six structure failures were discovered in Zone E. Within Section E-09 a portion of trail was discovered that was incised approximately 5 feet deep. This was not captured within the assessment framework and was individually identified as a ‘hot spot’ for the purposes of this assessment.



Example of Class IV within Zone E

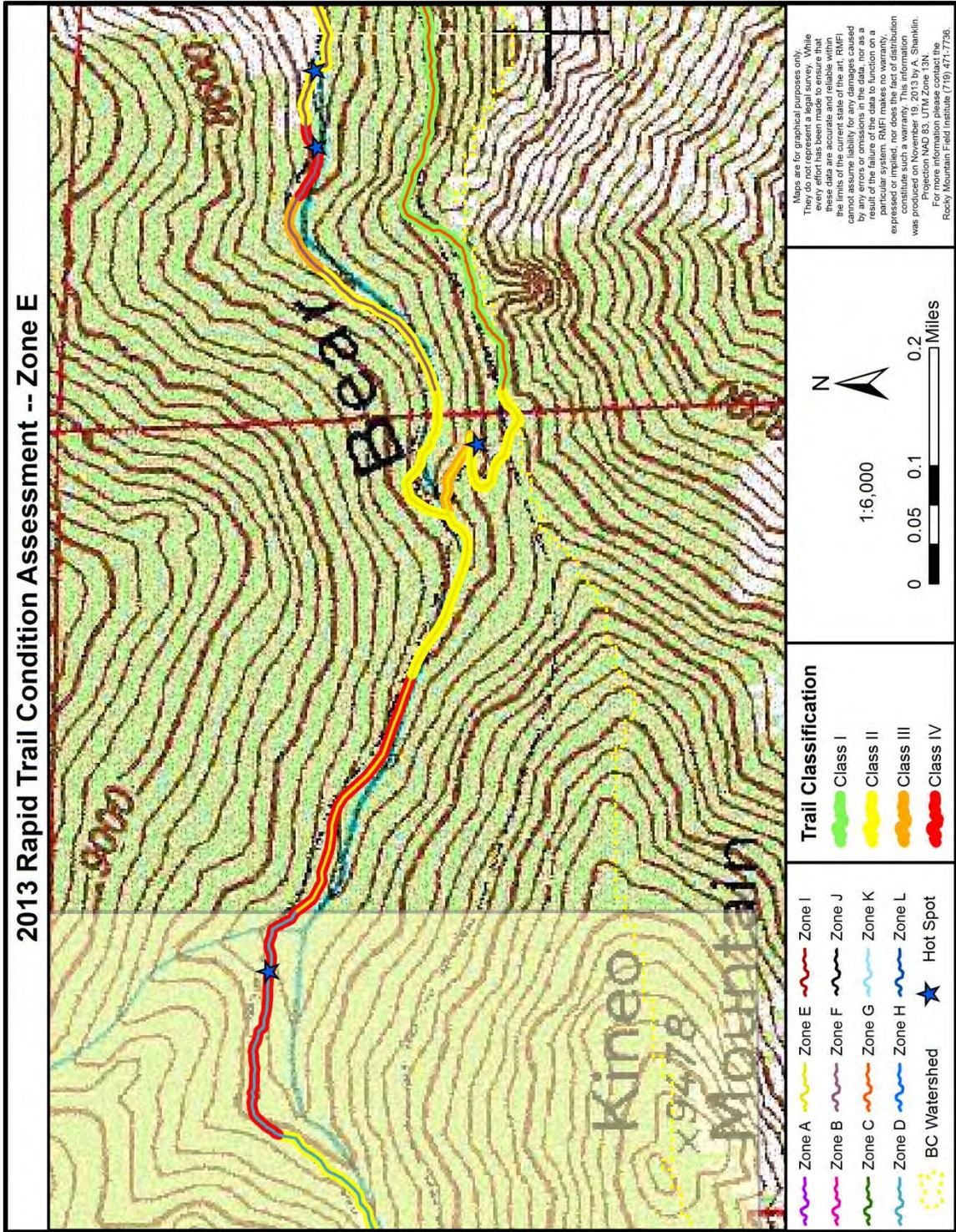


Example of Class IV within Zone
E



Example of Class IV within Zone
E

Figure 8. Bear Creek Watershed; Zone E with Classification Ratings displayed.



Zone F (USFS)

The trail in Zone F is on Forest Service land and includes Trail #666. The eastern section of this trail runs into City of Colorado Springs property. This is one of 2 Zones within this assessment that are designated fully non-motorized. There were 11,424 feet of trail assessed within Zone F. Thirty sections were assessed in Zone F. The average trail tread width is approximately 27 inches. One Section is Class IV, 7 are Class III, 20 are Class II, and 2 are Class I. Two structure failures were discovered in Zone F. Within Section F-04 water from the trail is causing incision and gulying into the stream. Also, within Section F-05 a section of constructed steps is no longer functioning and causing sediment to enter the stream. These structures were not captured within the assessment framework and were individually identified as a 'hot spot' for the purposes of this assessment.



Example of Class I within Zone F

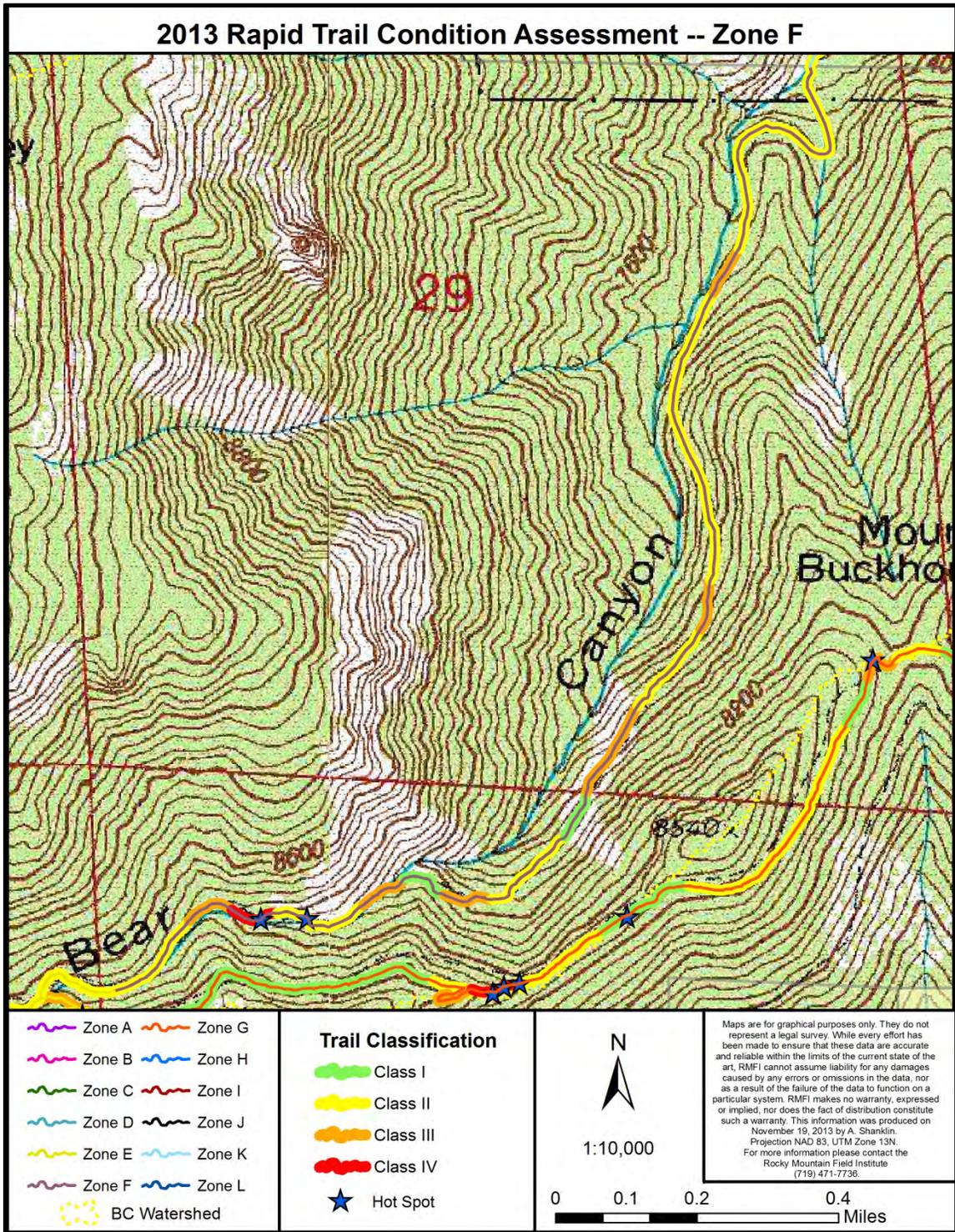


Example of Class III within Zone F



Example of Class IV within Zone F

Figure 9. Bear Creek Watershed; Zone F with Classification Ratings displayed.



Zone G (USFS)

The section of trail in Zone G includes Trail #667, starting at High Drive and ending just before the trail meets Trail #666. The 13,876 foot section of trail in Zone G that was assessed follows a contour line closely. Thirty-seven sections were assessed in Zone G. The average trail tread width is approximately 27 inches. One Section is Class IV, 4 are Class III, 13 are Class II, and 19 are Class I. One structure failure was discovered in Zone G. Within Section G-10 there are 3 areas that have been incised to bedrock and have extreme incision and downcutting occurring. Section G-13 contains dips that are causing water to pool and the trail to widen. A portion of trail within Section G-24 is extremely incised. This information was not captured within the assessment framework and was individually identified as a 'hot spots' for the purposes of this assessment.



Example of Class I within Zone G

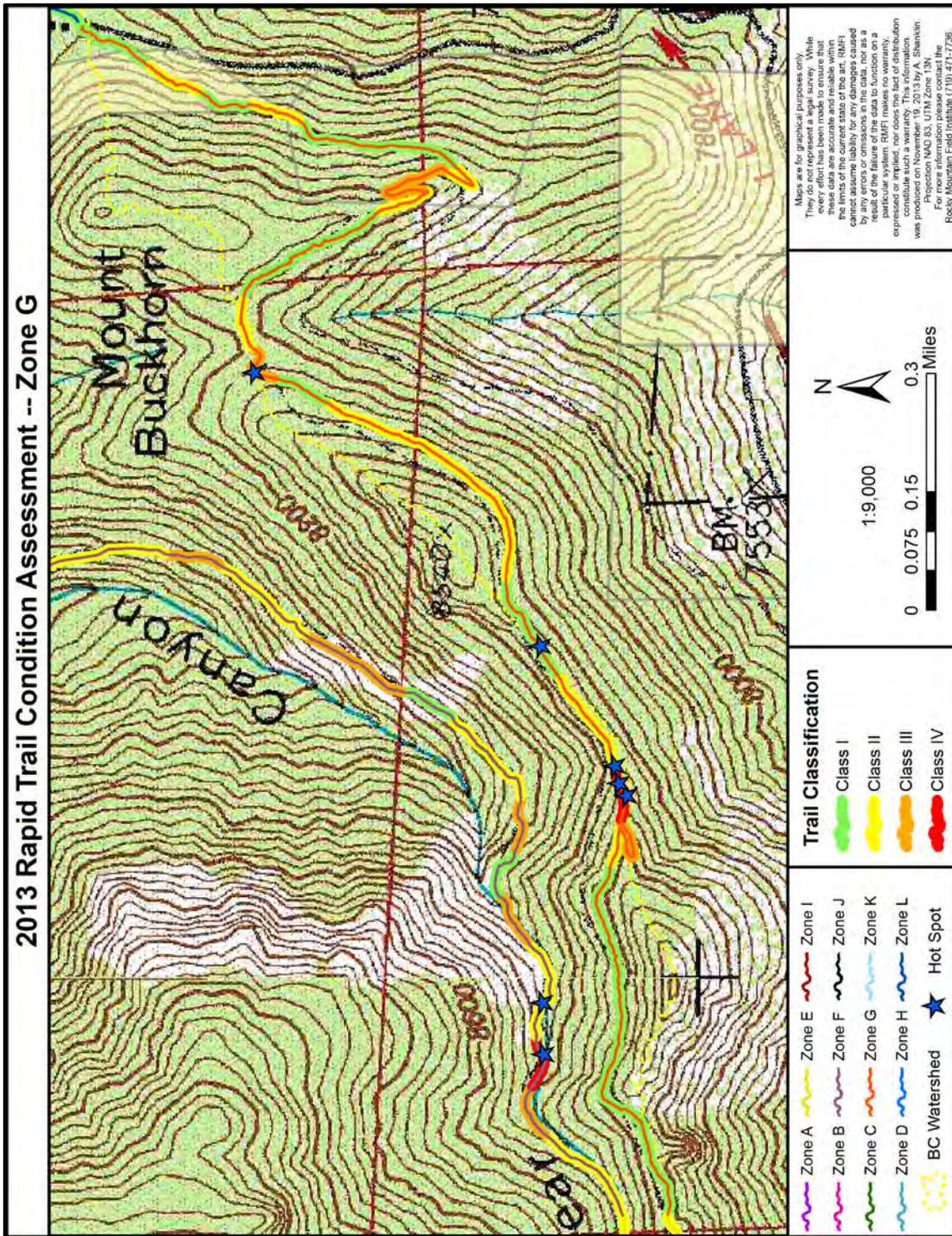


Example of Hot Spot within
Zone G



Example of Hot Spot within Zone G

Figure 10. Bear Creek Watershed; Zone G with Classification Ratings displayed.



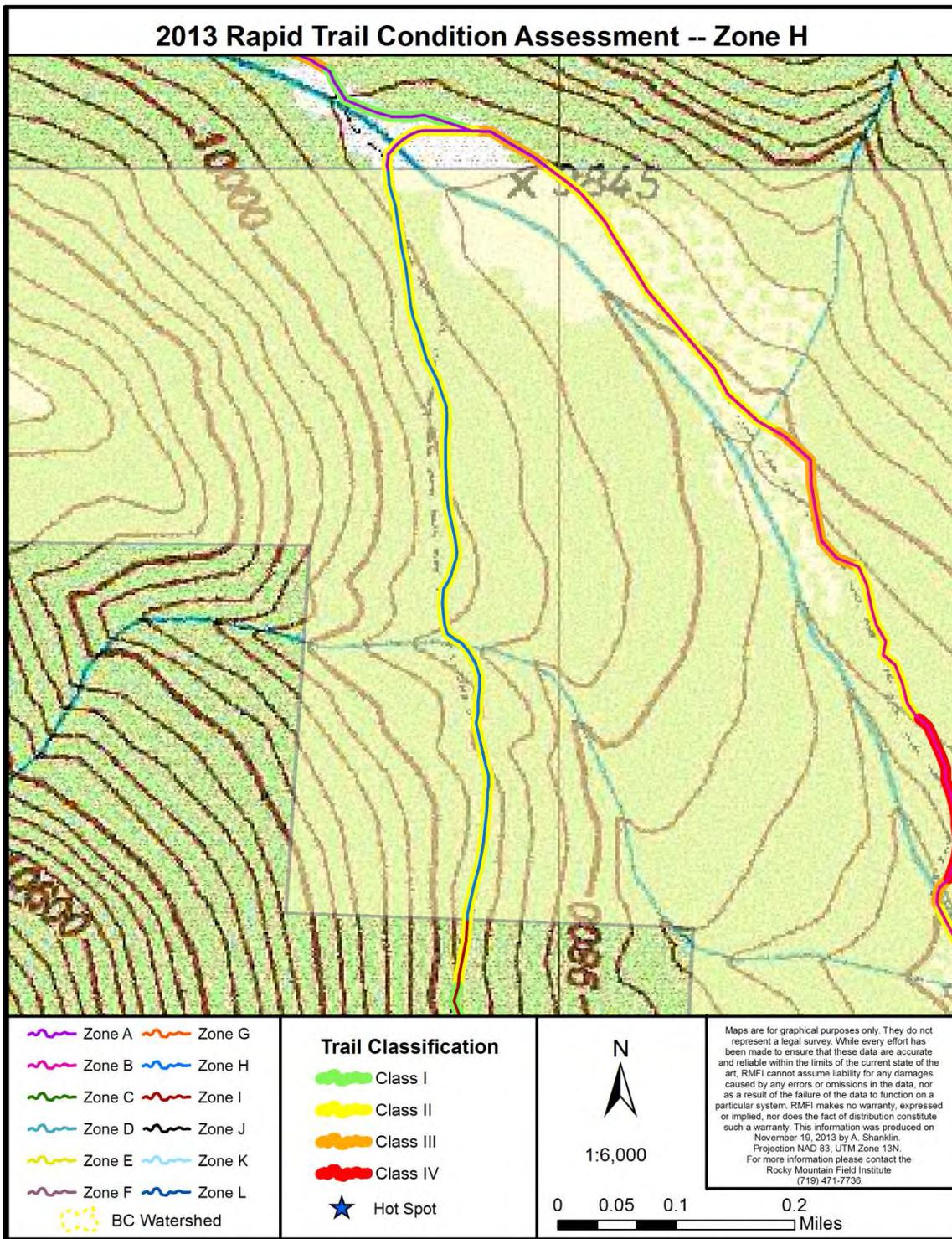
Zone H (CSU)

This trail is located on CSU land and is designated for multi-use, including motorized vehicles. Zone H encompasses Trail #701, which runs south from Trail #666 near the western extent of the Bear Creek Watershed to the edge of one of the southern borders of CSU property. Within this zone, 3,478 feet of trail were assessed. Ten sections were assessed in Zone H. The average trail tread width is approximately 39 inches. All sections were classified as Class II. No structure failures were discovered in Zone H.



Example of Class II within Zone
H

Figure 11. Bear Creek Watershed; Zone H with Classification Ratings displayed.

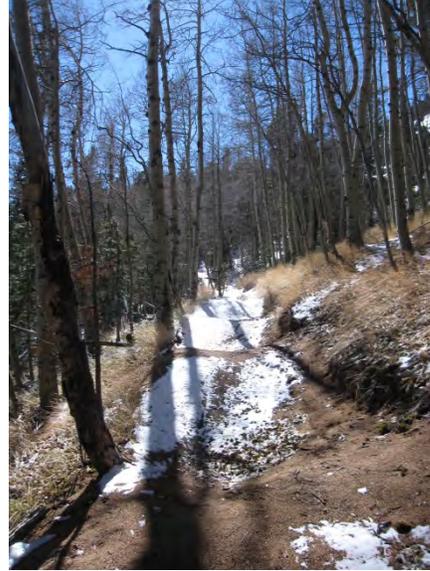


Zone I (USFS)

Zone I falls entirely on Forest Service land, encompassing both Trail #701 and a portion of Trail #720 where it connects with Zone C. Approximately 8,278 feet of trail in Zone I were assessed. Twenty-two sections were assessed in Zone I. The average trail tread width is approximately 37 inches. One Section is Class IV, 3 are Class III, 17 are Class II, and 1 is Class I. No structure failures were discovered in Zone I.

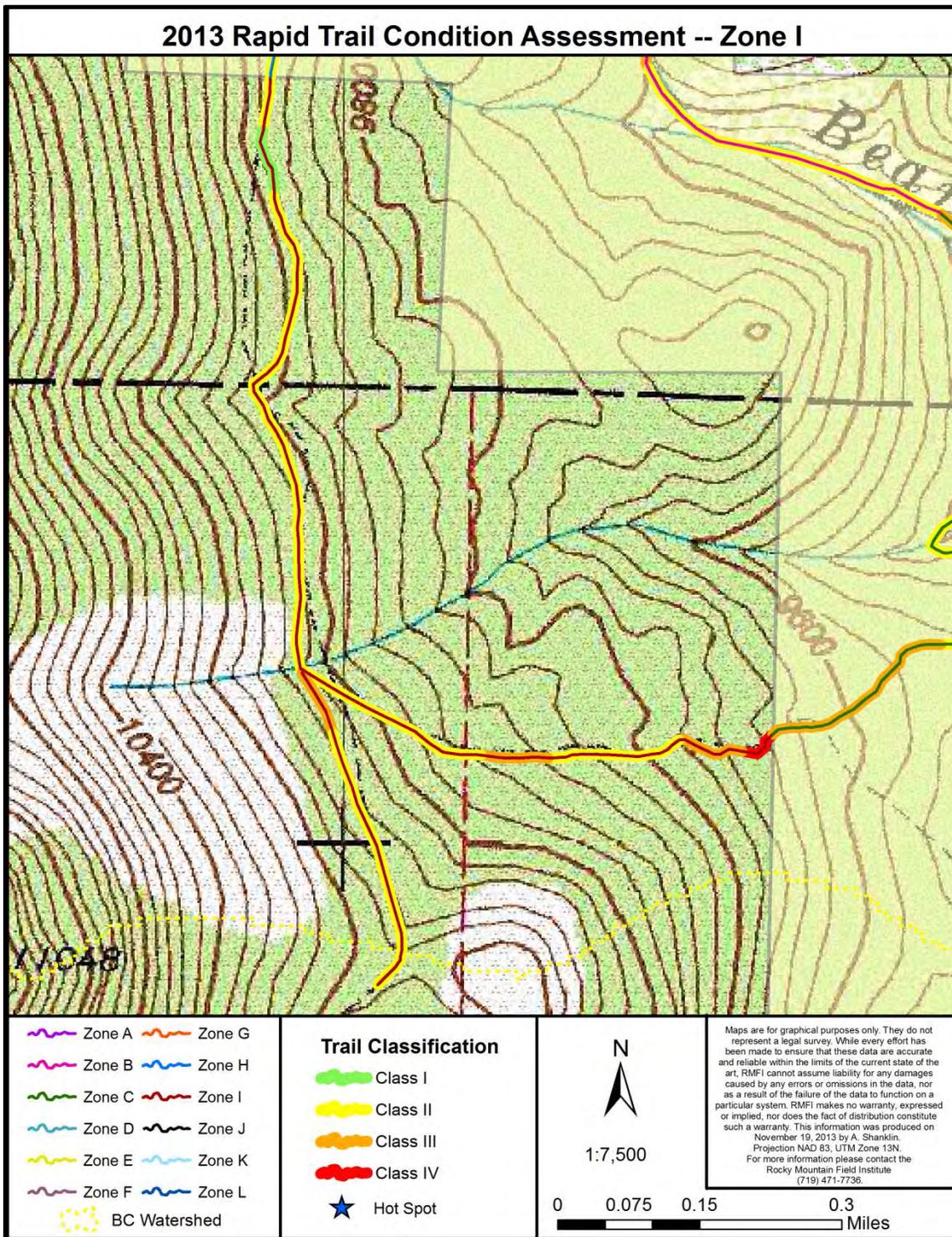


Example of Class I within Zone I



Example of Class II within Zone I

Figure 12. Bear Creek Watershed; Zone I with Classification Ratings displayed.



Zone J (CSU)

The section of trail in Zone J includes portions of Trail #720A, #720, and #668. This zone contains the lower loop around Jones Park. Approximately 11,286 feet of trail was assessed for this document from this Zone. Portions of this zone are not within the Bear Creek Watershed (the lower portion of Trail #720 and #668) but were analyzed in this assessment. Twenty-nine sections were assessed in Zone J. The average trail tread width is approximately 35 inches. Two sections are Class IV, 8 are Class III, 14 are Class II, and 5 are Class I. Four structure failures were discovered in Zone J. Within Section J-11 a new section of trail has been constructed where users have gone around an incised area of trail. Additionally, there is an area within J-27 with a number of step structures that are no longer functional. This information was not captured within the assessment framework and was individually identified as a ‘hot spots’ for the purposes of this assessment.



Example of Class I within Zone J



Example of Class II within Zone J

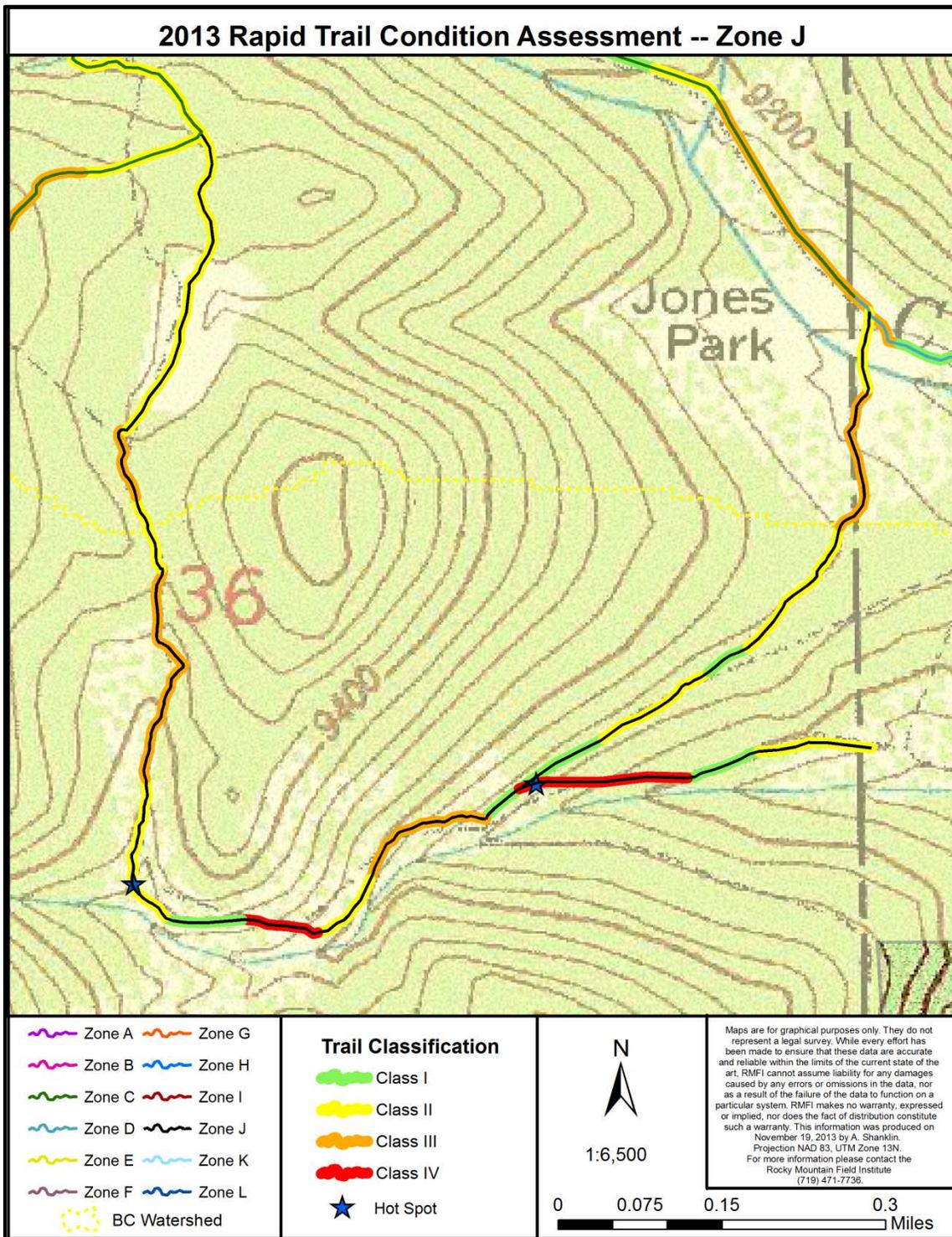


Example of Class III within Zone J



Example of Hot Spot within Zone J

Figure 13. Bear Creek Watershed; Zone J with Classification Ratings displayed.



Zone K (City of Colorado Springs)

There are two system trails in Zone K (City of Colorado Springs land), one along a portion of Trail #666 and one along a portion of the Palmer Loop Trail. The eastern section of the first trail connects to High Drive and the western section meets Trail #666 where it enters US Forest Service land. This is the only other fully non-motorized designated section in this assessment (with Zone F). There are a total of 12,301 feet of trail in Zone K that were analyzed for this assessment. Thirty-two sections were assessed in Zone K. The average trail tread width is approximately 28 inches. There are no Class IV or Class III sections in this zone, 19 sections are Class II, and 13 are Class I. Three structure failures were discovered in Zone K.

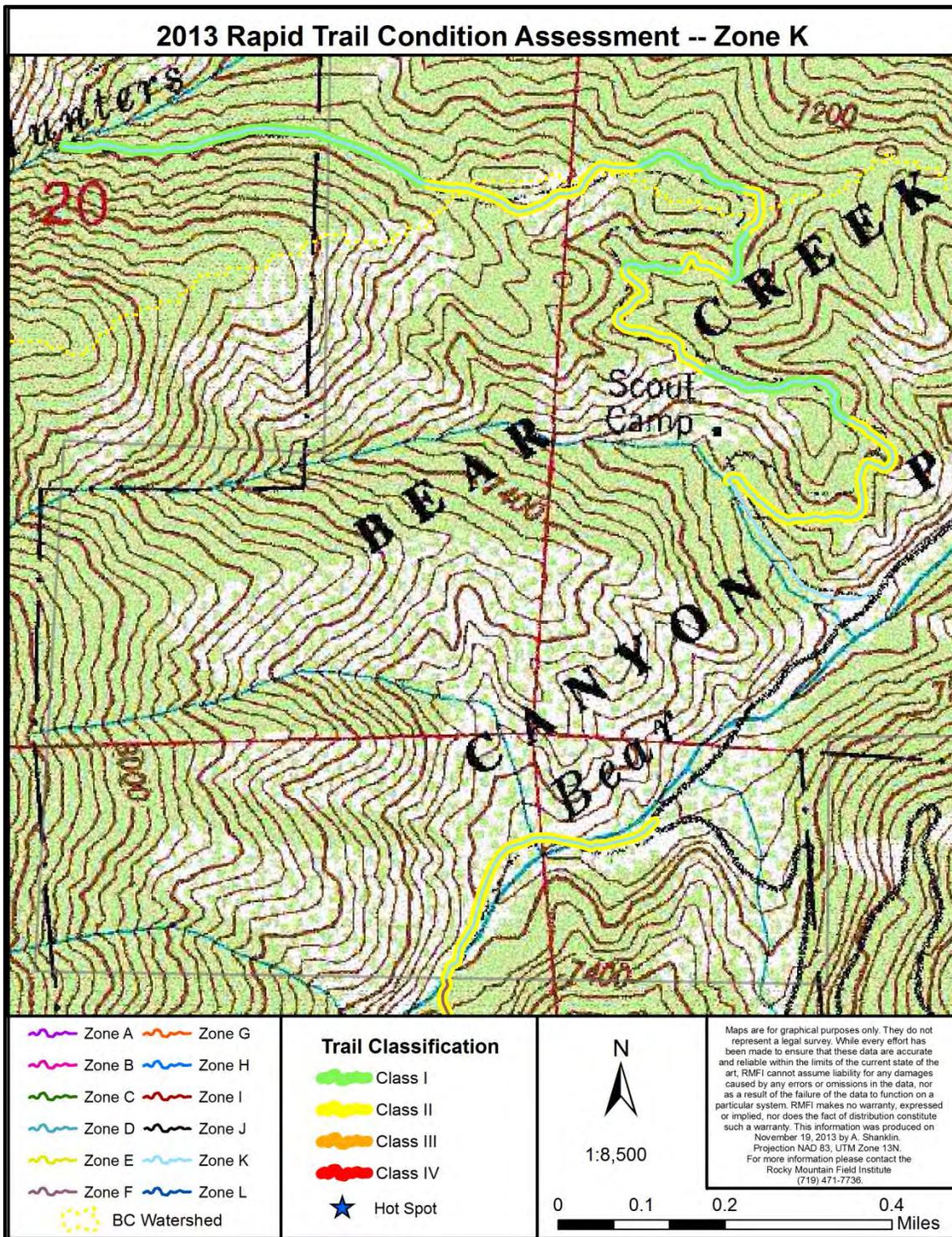


Example of Class I within Zone K



Example of Class II within Zone K

Figure 14. Bear Creek Watershed; Zone K with Classification Ratings displayed.



Zone L (USFS)

There is one system trail (#665) east of High Drive within Zone L. Trail #665 travels northeast from High Drive (near Trail #667), with approximately 8,762 feet of trail within the Bear Creek Watershed for this assessment. Twenty-three sections were assessed in Zone L. The average trail tread width is approximately 24 inches. One Section is Class IV, 1 is Class III, 9 are Class II, and 12 are Class I. No structure failures were discovered in Zone L. Within Section L-20 there is an area that is extremely downcut from the original trail profile. This was not captured within the assessment framework and was individually identified as a 'hot spot' for the purposes of this assessment.

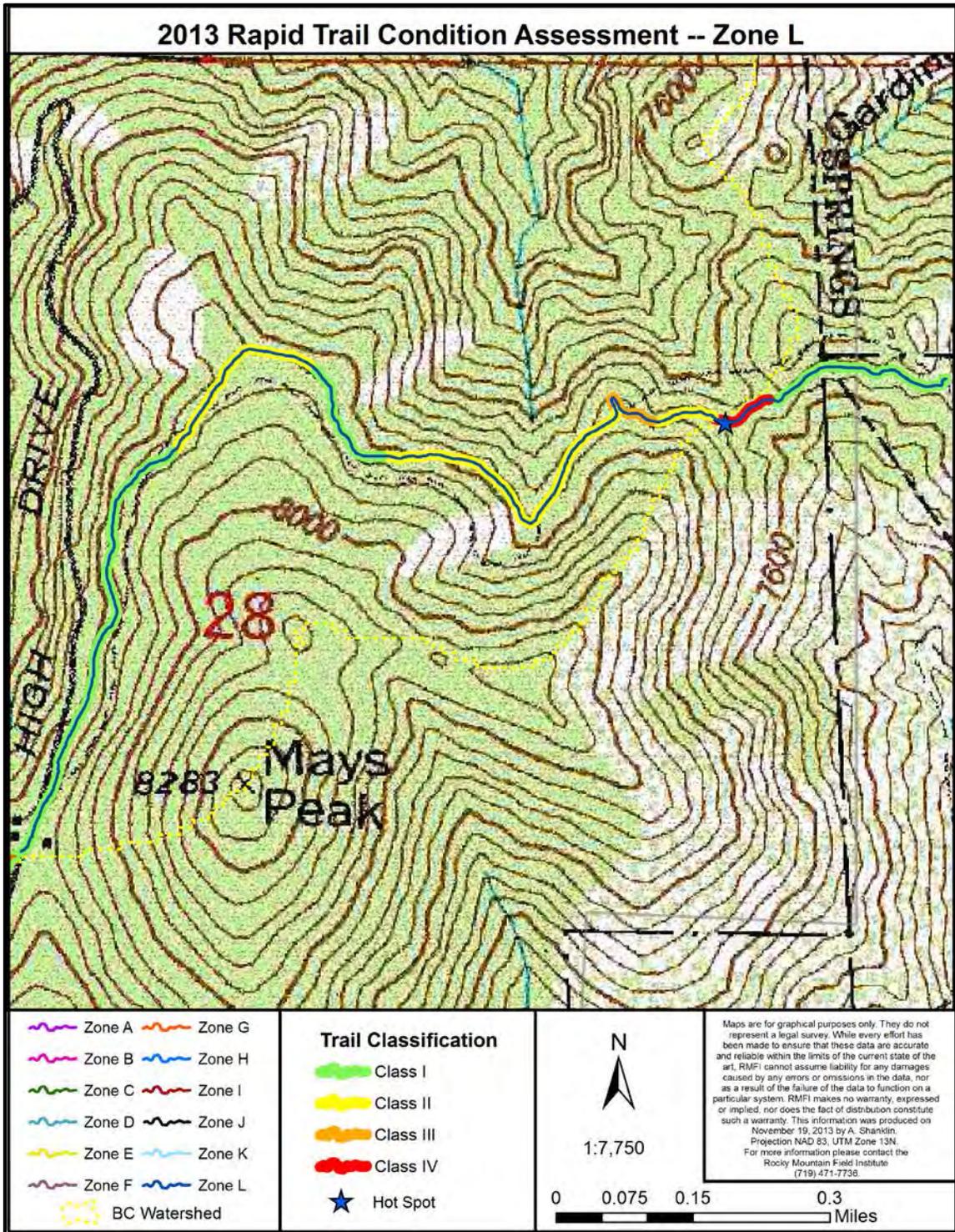


Example of Class I within Zone L



Example of Hot Spot within
Zone L

Figure 15. Bear Creek Watershed; Zone L with Classification Ratings displayed.



Appendix A

Definitions

Tread width – The average width of the selected 300-foot section of trail.

Trail Profile – The trail profile quantifies the amount of soil erosion that has occurred from the original surface of the landscape to the level of the current trail tread.



The trail profile is below the original level of surrounding landscape

Trail Tread Incision – The trail tread incision quantifies the amount of trail incision that has occurred within the current trail tread. Trail incision is an indicator of excessive soil erosion, soil and nutrient loss, alteration of water runoff, and can cause increased water sedimentation. This can create hazardous conditions and increase ecological impacts along trails.



The trail tread has been incised below the trail profile

Structure Failure – The number of visible structures within each Section that have failed and/or are non-functional and require maintenance.

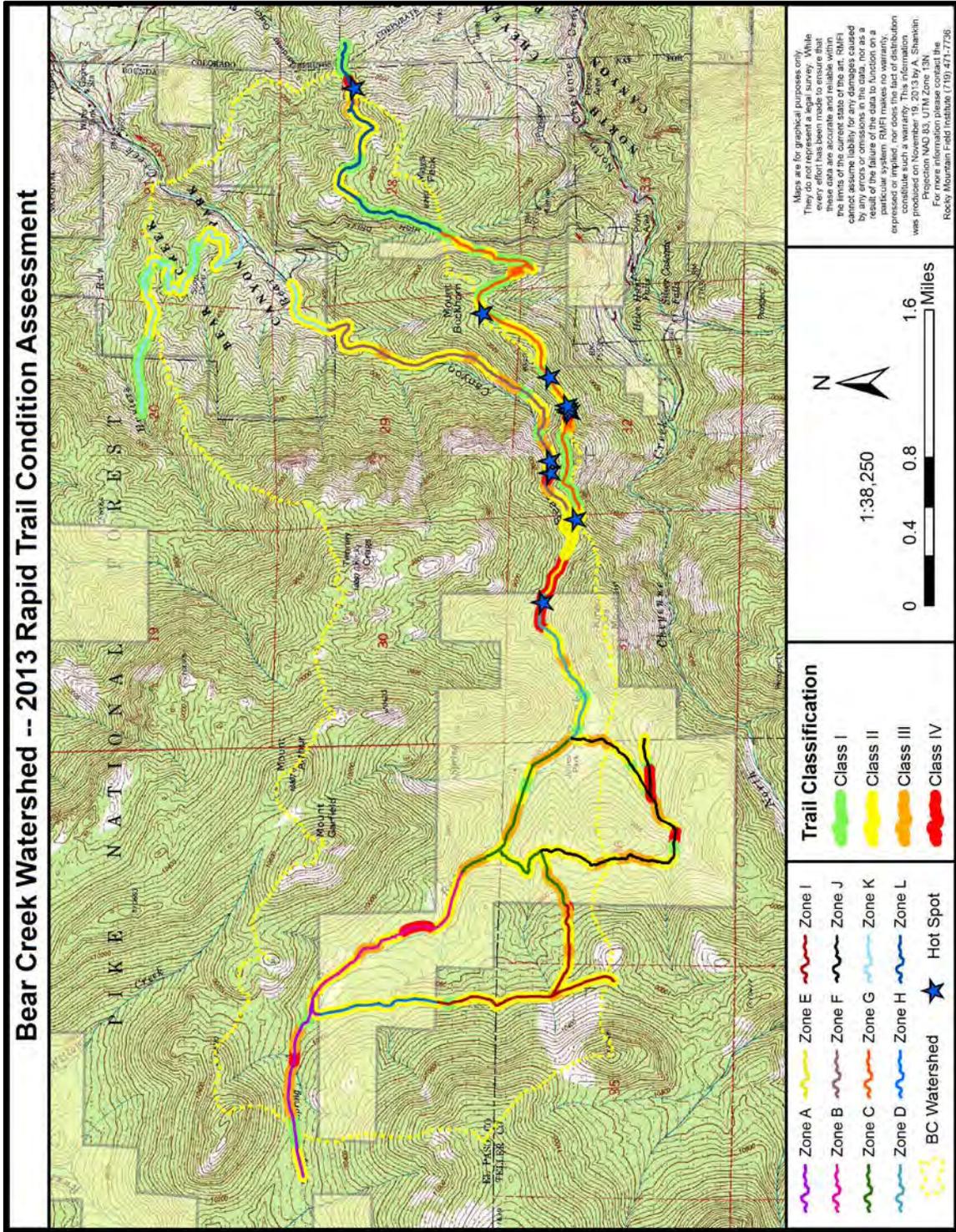
Trail Moisture – Standing water on the trail (yes/no) was noted. Moisture on the trail is used as an indicator of areas where users may go off-trail to avoid wet areas; this could lead to trail widening and loss of stabilizing vegetation.

Root Exposure – Areas where roots were exposed through the trail tread were noted (yes/no) to indicate where tread is eroding and where vegetation has reduced health and may become unstable. Exposed roots can also be a hazardous condition when found within the trail tread.

Minimal incision – This was noted when the OS+ (properly outsloped) category was not an accurate explanation but there was little to no incision within the trail (nearer the 0” than the 3” in the Trail Tread Incision attribute).

Hotspots – Hotspots refer to any area along the trail where our classification system does not work; trail blowouts, large slumping or sloughing of surrounding hillslopes not on-trail, etc. We anticipate the general Rapid Trail Condition Assessment (RTCA) will capture the majority of the issues found on the trail and 'Hotspots' will be used when this classification will not suffice.

Appendix B. Bear Creek Watershed with trails broken out by assessment zones and highlighted to distinguish Classes I-IV.



Appendix C. Attributes by trail section with Total Category Number and Classification Ratings.

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
667	A	596.99	36	1-12"	0-3"	0	NO	NO	10/29/13	A-01	0.75	II
667	A	378.62	36	1-12"	0-3"	0	NO	NO	10/29/13	A-02	0.5	II
667	A	428.49	36	1-12"	0-3"	0	NO	NO	10/29/13	A-03	0.25	I
667	A	431.34	48	1-12"	0-3"	0	NO	NO	10/29/13	A-04	0.25	I
667	A	378.67	60	1-12"	3-6"	0	NO	NO	10/29/13	A-05	2.5	III
667	A	378.59	36	12-24"	3-6"	0	NO	NO	10/29/13	A-06	2.75	III
667	A	378.60	36	12-24"	3-6"	0	NO	NO	10/29/13	A-07	2.75	III
667	A	378.72	48	12-24"	3-6"	0	NO	NO	10/29/13	A-08	2.75	III
667	A	378.61	36	1-12"	6-12"	1	NO	NO	10/29/13	A-09	5.5	IV
667	A	378.68	36	>24"	3-6"	0	NO	NO	10/29/13	A-10	3	III
667	A	378.87	48	>24"	3-6"	0	NO	NO	10/29/13	A-11	3	III
667	A	379.14	24	OS+	0-3"	0	NO	NO	10/29/13	A-12	-0.25	I
667	A	362.56	24	OS+	0-3"	0	NO	NO	10/29/13	A-13	0	I
667	A	378.94	48	1-12"	3-6"	0	NO	NO	10/29/13	A-14	2.5	III
701	A	182.26	60	1-12"	0-3"	0	NO	NO	10/30/13	A-15	0.5	II
701	A	309.42	48	12-24"	0-3"	0	NO	NO	10/30/13	A-16	0.75	II
667	B	437.69	48	1-12"	0-3"	0	NO	NO	10/29/13	B-01	0.5	II
667	B	379.62	48	1-12"	0-3"	0	NO	NO	10/29/13	B-02	0.5	II
667	B	379.49	48	1-12"	0-3"	0	NO	NO	10/29/13	B-03	0.5	II
667	B	379.30	48	1-12"	0-3"	0	NO	NO	10/29/13	B-04	0.5	II
667	B	379.64	60	>24"	3-6"	0	NO	NO	10/29/13	B-05	3	III
667	B	379.54	48	1-12"	3-6"	0	NO	NO	10/29/13	B-06	2.5	III
667	B	379.90	36	1-12"	0-3"	0	NO	NO	10/29/13	B-07	0.5	II
667	B	379.72	36	1-12"	0-3"	0	NO	NO	10/29/13	B-08	0.5	II
667	B	379.81	60	>24"	6-12"	0	NO	NO	10/29/13	B-09	5	IV
667	B	380.02	48	>24"	6-12"	0	NO	NO	10/29/13	B-10	5	IV

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
667	B	158.51	60	12-24"	3-6"	0	NO	YES	10/29/13	B-11	3	III
667	B	379.51	48	1-12"	0-3"	1	NO	NO	10/29/13	B-12	1.5	II
667	B	378.80	48	1-12"	0-3"	0	NO	NO	10/29/13	B-13	0.5	II
667	B	378.63	60	12-24"	0-3"	0	NO	NO	10/29/13	B-14	0.75	II
667	B	378.71	60	1-12"	0-3"	0	NO	NO	10/29/13	B-15	0.5	II
667	B	378.80	48	1-12"	0-3"	0	NO	NO	10/29/13	B-16	0.5	II
667	C	147.17	48	>24"	3-6"	0	NO	NO	10/29/13	C-01	3	III
667	C	379.71	48	>24"	3-6"	0	NO	YES	10/29/13	C-02	3.25	III
667	C	379.74	48	12-24"	3-6"	0	NO	YES	10/29/13	C-03	3	III
667	C	379.59	48	1-12"	0-3"	0	NO	NO	10/29/13	C-04	0.5	II
667	C	378.87	48	1-12"	0-3"	1	NO	NO	10/29/13	C-05	1.5	II
667	C	378.92	48	12-24"	3-6"	0	NO	YES	10/29/13	C-06	3	III
667	C	378.61	48	>24"	3-6"	0	NO	YES	10/29/13	C-07	3.25	III
667	C	378.66	48	>24"	3-6"	0	NO	NO	10/29/13	C-08	3	III
667	C	378.67	48	12-24"	0-3"	0	NO	NO	10/29/13	C-09	0.75	II
667	C	378.69	48	CR	0-3"	0	NO	NO	10/29/13	C-10	0	I
667	C	378.91	60	1-12"	0-3"	0	NO	NO	10/29/13	C-11	0.5	II
667	C	379.66	48	12-24"	3-6"	0	NO	YES	10/29/13	C-12	3	III
667	C	379.59	48	12-24"	3-6"	0	NO	YES	10/29/13	C-13	3	III
667	C	379.35	48	12-24"	3-6"	0	NO	YES	10/29/13	C-14	3	III
720.A	C	405.42	24	12-24"	0-3"	0	NO	NO	10/29/13	C-15	0.75	II
720.A	C	379.70	24	1-12"	0-3"	0	NO	NO	10/29/13	C-16	0.5	II
720.A	C	379.23	48	12-24"	0-3"	0	NO	NO	10/29/13	C-17	0.75	II
720.A	C	378.68	48	12-24"	0-3"	0	NO	NO	10/29/13	C-18	0.75	II
720.A	C	379.42	36	12-24"	0-3"	0	NO	YES	10/29/13	C-19	1	II
720	C	238.97	48	1-12"	0-3"	0	NO	YES	10/30/13	C-20	0.75	II
720	C	378.62	48	12-24"	0-3"	0	NO	NO	10/30/13	C-21	0.75	II
720	C	378.99	48	12-24"	3-6"	0	NO	NO	10/30/13	C-22	2.75	III
720	C	379.16	60	12-24"	3-6"	0	NO	NO	10/30/13	C-23	2.75	III
720	C	378.66	60	12-24"	3-6"	0	NO	YES	10/30/13	C-24	3	III

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
667	D	336.67	36	12-24"	3-6"	0	NO	NO	10/23/13	D-01	2.75	III
667	D	378.66	48	OS+	0-3"	0	NO	NO	10/23/13	D-02	0	I
667	D	378.73	36	1-12"	0-3"	0	NO	NO	10/23/13	D-03	0.5	II
667	D	378.68	30	>24"	0-3"	0	NO	NO	10/23/13	D-04	1	II
667	D	378.83	30	OS+	0-3"	0	NO	NO	10/23/13	D-05	0	I
667	D	379.31	30	1-12"	0-3"	1	NO	NO	10/23/13	D-06	1.5	II
667	D	378.82	36	OS-	3-6"	0	NO	NO	10/23/13	D-07	2.25	II
667	D	378.86	36	12-24"	3-6"	0	NO	NO	10/23/13	D-08	2.75	III
667	D	378.63	48	1-12"	0-3"	0	NO	NO	10/23/13	D-09	0.5	II
667	D	379.26	36	1-12"	0-3"	0	NO	NO	10/23/13	D-10	0.5	II
667	D	174.24	36	12-24"	0-3"	0	NO	NO	10/23/13	D-11	0.75	II
667	D	378.91	36	12-24"	3-6"	2	YES	NO	10/23/13	D-12	4	IV
667	D	378.63	36	>24"	3-6"	0	YES	YES	10/23/13	D-13	3.5	IV
667	D	378.90	48	1-12"	3-6"	1	YES	NO	10/23/13	D-14	3.75	IV
667	E	468.96	48	>24"	>24"	0	NO	YES	10/23/13	E-01	9.25	IV
667	E	379.08	48	1-12"	3-6"	2	NO	NO	10/23/13	E-02	3.5	IV
667	E	378.67	48	1-12"	3-6"	1	NO	NO	10/23/13	E-03	3.5	IV
667	E	378.84	36	12-24"	0-3"	1	NO	NO	10/23/13	E-04	1.75	II
667	E	378.77	36	1-12"	0-3"	0	NO	NO	10/23/13	E-05	0.5	II
667	E	379.31	24	1-12"	0-3"	0	NO	NO	10/23/13	E-06	0.5	II
667	E	378.71	24	1-12"	0-3"	0	NO	NO	10/23/13	E-07	0.5	II
667	E	409.29	36	1-12"	3-6"	0	NO	NO	10/23/13	E-08	2.5	III
667	E	378.80	36	1-12"	0-3"	2	NO	NO	10/23/13	E-09	1.5	II
667	E	378.89	36	1-12"	0-3"	0	NO	NO	10/23/13	E-10	0.5	II
666	F	419.84	24	1-12"	0-3"	0	NO	NO	10/24/13	F-01	0.5	II
666	F	379.52	24	1-12"	0-3"	0	NO	NO	10/24/13	F-02	0.5	II
666	F	378.92	24	12-24"	3-6"	0	NO	YES	10/24/13	F-03	3	III
666	F	378.82	24	>24"	>24"	0	NO	YES	10/24/13	F-04	9.25	IV
666	F	378.81	24	OS-	0-3"	1	NO	NO	10/24/13	F-05	1.25	II
666	F	378.90	24	1-12"	0-3"	1	NO	NO	10/24/13	F-06	1.5	II

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
666	F	379.02	24	1-12"	3-6"	0	NO	NO	10/24/13	F-07	2.5	III
666	F	378.93	24	OS+	0-3"	0	NO	NO	10/24/13	F-08	0	I
666	F	378.68	24	1-12"	3-6"	0	NO	NO	10/24/13	F-09	2.5	III
666	F	379.10	24	1-12"	0-3"	0	NO	NO	10/24/13	F-10	0.5	II
666	F	379.26	24	1-12"	0-3"	0	NO	NO	10/24/13	F-11	0.5	II
666	F	379.71	24	OS+	0-3"	0	NO	NO	10/24/13	F-12	0	I
666	F	379.58	24	1-12"	3-6"	0	NO	NO	10/24/13	F-13	2.5	III
666	F	379.70	24	1-12"	3-6"	0	NO	NO	10/24/13	F-14	2.5	III
666	F	379.33	24	1-12"	0-3"	0	NO	NO	10/24/13	F-15	0.5	II
666	F	379.53	24	1-12"	0-3"	0	NO	NO	10/24/13	F-16	0.5	II
666	F	379.96	24	1-12"	3-6"	0	NO	NO	10/24/13	F-17	2.5	III
666	F	380.03	24	1-12"	0-3"	0	NO	NO	10/24/13	F-18	0.5	II
666	F	379.96	24	1-12"	0-3"	0	NO	NO	10/24/13	F-19	0.5	II
666	F	379.82	24	1-12"	0-3"	0	NO	YES	10/24/13	F-20	0.75	II
666	F	379.99	24	1-12"	0-3"	0	NO	NO	10/24/13	F-21	0.5	II
666	F	379.90	24	1-12"	0-3"	0	NO	NO	10/24/13	F-22	0.5	II
666	F	379.83	36	1-12"	0-3"	0	NO	NO	10/24/13	F-23	0.5	II
666	F	379.70	36	1-12"	3-6"	0	NO	YES	10/24/13	F-24	2.75	III
666	F	380.03	36	1-12"	0-3"	0	NO	NO	10/24/13	F-25	0.5	II
666	F	380.03	36	1-12"	0-3"	0	NO	NO	10/24/13	F-26	0.5	II
666	F	379.10	36	1-12"	0-3"	0	NO	NO	10/24/13	F-27	0.5	II
666	F	379.03	36	1-12"	0-3"	0	NO	NO	10/24/13	F-28	0.5	II
666	F	379.73	36	1-12"	0-3"	0	NO	NO	10/24/13	F-29	0.5	II
666	F	379.87	36	>24"	0-3"	0	NO	NO	10/24/13	F-30	1	II
667	G	416.00	24	OS+	0-3"	0	NO	NO	10/23/13	G-01	0	I
667	G	378.82	24	OS+	0-3"	0	NO	NO	10/23/13	G-02	0	I
667	G	379.18	24	OS+	0-3"	0	NO	NO	10/23/13	G-03	-0.25	I
667	G	378.65	24	OS+	0-3"	0	NO	NO	10/23/13	G-04	-0.25	I
667	G	378.59	24	OS+	0-3"	0	NO	NO	10/23/13	G-05	-0.25	I
667	G	378.76	24	OS+	0-3"	0	NO	NO	10/23/13	G-06	-0.25	I

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
667	G	378.74	24	OS+	0-3"	0	NO	NO	10/23/13	G-07	-0.25	I
667	G	378.66	24	OS+	0-3"	1	NO	NO	10/23/13	G-08	0.75	II
667	G	378.82	36	1-12"	3-6"	0	NO	NO	10/23/13	G-09	2.5	III
667	G	378.67	36	>24"	6-12"	0	NO	NO	10/23/13	G-10	5	IV
667	G	378.91	36	1-12"	0-3"	0	YES	NO	10/23/13	G-11	0.75	II
667	G	379.03	36	1-12"	0-3"	0	NO	NO	10/23/13	G-12	0.5	II
667	G	378.95	36	OS+	0-3"	0	YES	NO	10/23/13	G-13	0	I
667	G	378.84	36	OS+	0-3"	0	NO	NO	10/23/13	G-14	-0.25	I
667	G	378.57	36	1-12"	0-3"	0	NO	NO	10/23/13	G-15	0.5	II
667	G	379.17	36	1-12"	0-3"	0	NO	NO	10/23/13	G-16	0.5	II
667	G	379.52	24	1-12"	0-3"	0	NO	YES	10/23/13	G-17	0.75	II
667	G	379.77	24	1-12"	0-3"	0	NO	NO	10/23/13	G-18	0.5	II
667	G	379.76	24	1-12"	0-3"	0	NO	NO	10/23/13	G-19	0.5	II
667	G	379.75	24	OS-	0-3"	0	NO	NO	10/23/13	G-20	0.25	I
667	G	379.46	36	12-24"	3-6"	0	NO	NO	10/23/13	G-21	2.75	III
667	G	378.67	36	1-12"	0-3"	0	NO	NO	10/23/13	G-22	0.5	II
667	G	379.55	24	OS+	0-3"	0	NO	NO	10/23/13	G-23	0	I
667	G	379.58	24	OS+	0-3"	0	NO	NO	10/23/13	G-24	0	I
667	G	379.60	24	OS+	0-3"	0	NO	NO	10/23/13	G-25	0	I
667	G	379.82	48	OS+	3-6"	0	NO	NO	10/23/13	G-26	2	II
667	G	379.84	36	1-12"	3-6"	0	NO	NO	10/23/13	G-27	2.5	III
667	G	379.76	24	1-12"	3-6"	0	NO	NO	10/23/13	G-28	2.5	III
667	G	379.44	24	1-12"	0-3"	0	NO	NO	10/23/13	G-29	0.5	II
667	G	379.82	24	OS+	0-3"	0	NO	NO	10/23/13	G-30	-0.25	I
667	G	380.00	24	OS+	0-3"	0	NO	YES	10/23/13	G-31	0	I
667	G	379.62	24	OS+	0-3"	0	NO	NO	10/23/13	G-32	-0.25	I
667	G	379.84	24	1-12"	0-3"	0	NO	NO	10/23/13	G-33	0.5	II
667	G	379.72	24	OS+	0-3"	0	NO	NO	10/23/13	G-34	0	I
667	G	379.65	24	1-12"	0-3"	0	NO	NO	10/23/13	G-35	0.5	II
667	G	185.15	24	OS-	0-3"	0	NO	NO	10/23/13	G-36	0.25	I

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
667	G	379.68	48	OS+	0-3"	0	NO	NO	10/23/13	G-37	0	I
701	H	162.20	48	1-12"	0-3"	0	NO	NO	10/30/13	H-01	0.5	II
701	H	380.08	48	1-12"	0-3"	0	NO	NO	10/30/13	H-02	0.5	II
701	H	379.98	48	1-12"	0-3"	0	YES	YES	10/30/13	H-03	1	II
701	H	380.01	48	12-24"	0-3"	0	NO	NO	10/30/13	H-04	0.75	II
701	H	380.08	48	1-12"	0-3"	0	NO	NO	10/30/13	H-05	0.5	II
701	H	276.81	36	1-12"	0-3"	0	NO	NO	10/30/13	H-06	0.5	II
701	H	379.71	36	12-24"	0-3"	0	NO	NO	10/30/13	H-07	0.75	II
701	H	380.04	36	1-12"	0-3"	0	NO	NO	10/30/13	H-08	0.5	II
701	H	380.06	24	1-12"	0-3"	0	NO	NO	10/30/13	H-09	0.5	II
701	H	380.02	24	1-12"	0-3"	0	NO	NO	10/30/13	H-10	0.5	II
701	I	303.46	24	1-12"	0-3"	0	NO	NO	10/30/13	I-01	0.5	II
701	I	379.94	36	1-12"	0-3"	0	NO	NO	10/30/13	I-02	0.25	I
701	I	441.32	36	1-12"	0-3"	0	NO	YES	10/30/13	I-03	0.5	II
701	I	445.09	24	1-12"	0-3"	0	NO	NO	10/30/13	I-04	0.5	II
701	I	379.51	36	12-24"	0-3"	0	NO	YES	10/30/13	I-05	1	II
701	I	379.78	24	1-12"	0-3"	0	NO	YES	10/30/13	I-06	0.75	II
701	I	379.99	24	1-12"	0-3"	0	NO	YES	10/30/13	I-07	0.5	II
701	I	380.05	48	1-12"	0-3"	0	NO	NO	10/30/13	I-08	0.5	II
701	I	399.53	48	12-24"	0-3"	0	NO	NO	10/30/13	I-09	0.75	II
701	I	383.62	36	1-12"	3-6"	0	NO	YES	10/30/13	I-10	2.75	III
701	I	379.88	24	1-12"	0-3"	0	NO	YES	10/30/13	I-11	0.75	II
701	I	379.81	36	1-12"	0-3"	0	NO	YES	10/30/13	I-12	0.75	II
701	I	379.92	24	1-12"	0-3"	0	NO	YES	10/30/13	I-13	0.75	II
701	I	379.66	36	1-12"	0-3"	0	NO	NO	10/30/13	I-14	0.5	II
720	I	378.90	36	1-12"	0-3"	0	NO	NO	10/30/13	I-15	0.5	II
720	I	378.83	36	12-24"	0-3"	0	NO	YES	10/30/13	I-16	1	II
720	I	378.74	48	12-24"	0-3"	0	NO	YES	10/30/13	I-17	1	II
720	I	378.50	48	12-24"	3-6"	0	NO	NO	10/30/13	I-18	2.75	III
720	I	378.52	36	1-12"	0-3"	0	NO	NO	10/30/13	I-19	0.5	II

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
720	I	378.69	48	>24"	0-3"	0	NO	NO	10/30/13	I-20	1	II
720	I	378.71	60	>24"	3-6"	0	NO	NO	10/30/13	I-21	3	III
720	I	236.13	60	>24"	6-12"	0	NO	NO	10/30/13	I-22	5	IV
720.A	J	467.20	48	1-12"	0-3"	0	NO	NO	10/29/13	J-01	0.5	II
720.A	J	379.79	36	1-12"	0-3"	0	NO	YES	10/29/13	J-02	0.75	II
720.A	J	379.93	18	1-12"	0-3"	0	NO	NO	10/29/13	J-03	0.5	II
720.A	J	379.52	36	12-24"	0-3"	0	NO	NO	10/29/13	J-04	0.75	II
720	J	379.72	48	1-12"	3-6"	0	NO	NO	10/29/13	J-05	2.5	III
720	J	379.80	48	12-24"	0-3"	0	NO	NO	10/29/13	J-06	0.75	II
720	J	379.89	48	>24"	3-6"	0	NO	YES	10/29/13	J-07	3.25	III
720	J	379.47	48	>24"	3-6"	0	NO	NO	10/29/13	J-08	3	III
720	J	379.85	36	12-24"	3-6"	0	NO	YES	10/29/13	J-09	3	III
720	J	379.88	24	12-24"	0-3"	0	NO	NO	10/29/13	J-10	0.75	II
720	J	379.52	24	1-12"	0-3"	0	NO	NO	10/29/13	J-11	0.5	II
720	J	378.51	24	1-12"	0-3"	0	NO	NO	10/29/13	J-12	0.25	I
720	J	378.56	60	>24"	6-12"	0	NO	NO	10/29/13	J-13	5	IV
720	J	379.25	24	1-12"	0-3"	0	NO	NO	10/29/13	J-14	0.5	II
720	J	379.32	36	12-24"	3-6"	0	NO	NO	10/29/13	J-15	2.75	III
720	J	336.25	36	>24"	3-6"	0	NO	NO	10/29/13	J-16	3	III
668	J	314.26	36	1-12"	0-3"	0	NO	NO	10/29/13	J-17	0.25	I
668	J	378.85	36	OS+	0-3"	0	NO	NO	10/29/13	J-18	-0.25	I
668	J	378.87	24	1-12"	0-3"	0	NO	NO	10/29/13	J-19	0.5	II
668	J	232.55	24	1-12"	0-3"	0	NO	NO	10/29/13	J-20	0.5	II
668	J	223.90	36	1-12"	0-3"	0	NO	NO	10/29/13	J-21	0.25	I
668	J	379.31	36	1-12"	0-3"	0	NO	NO	10/29/13	J-22	0.5	II
668	J	379.54	36	1-12"	0-3"	0	NO	NO	10/29/13	J-23	0.5	II
668	J	379.68	48	>24"	3-6"	0	NO	YES	10/29/13	J-24	3.25	III
668	J	379.75	36	1-12"	3-6"	0	NO	NO	10/29/13	J-25	2.5	III
668	J	379.97	36	1-12"	0-3"	0	NO	NO	10/29/13	J-26	0.5	II
668	J	820.43	36	1-12"	3-6"	4	NO	NO	10/30/13	J-27	3.5	IV

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
668	J	370.86	24	OS+	0-3"	0	NO	NO	10/30/13	J-28	0	I
668	J	551.89	24	1-12"	0-3"	0	NO	NO	10/30/13	J-29	0.5	II
666	K	410.42	36	1-12"	0-3"	0	NO	NO	10/24/13	K-01	0.5	II
666	K	379.96	36	1-12"	0-3"	2	NO	NO	10/24/13	K-02	1.5	II
666	K	379.02	48	1-12"	0-3"	1	NO	NO	10/24/13	K-03	1.5	II
666	K	378.67	48	1-12"	0-3"	0	NO	NO	10/24/13	K-04	0.5	II
666	K	378.89	48	1-12"	0-3"	0	NO	NO	10/24/13	K-05	0.5	II
Palmer Loop	K	379.27	24	1-12"	0-3"	0	NO	NO	10/24/13	K-10	0.5	II
Palmer Loop	K	378.81	24	1-12"	0-3"	0	NO	NO	10/24/13	K-11	0.5	II
Palmer Loop	K	379.31	24	1-12"	0-3"	0	NO	NO	10/24/13	K-12	0.5	II
Palmer Loop	K	379.49	24	1-12"	0-3"	0	NO	NO	10/24/13	K-13	0.5	II
Palmer Loop	K	379.33	24	1-12"	0-3"	0	NO	NO	10/24/13	K-14	0.5	II
Palmer Loop	K	379.42	24	OS+	0-3"	0	NO	NO	10/24/13	K-15	0	I
Palmer Loop	K	378.75	24	OS+	0-3"	0	NO	NO	10/24/13	K-16	0	I
Palmer Loop	K	378.83	36	OS+	0-3"	0	NO	NO	10/24/13	K-17	0	I
Palmer Loop	K	379.20	36	1-12"	0-3"	0	NO	YES	10/24/13	K-18	0.75	II
Palmer Loop	K	379.02	36	1-12"	0-3"	0	NO	NO	10/24/13	K-19	0.5	II
Palmer Loop	K	379.38	24	1-12"	0-3"	0	NO	NO	10/24/13	K-20	0.5	II
Palmer Loop	K	378.89	24	OS+	0-3"	0	NO	NO	10/24/13	K-21	0	I
Palmer Loop	K	379.17	24	1-12"	0-3"	0	NO	NO	10/24/13	K-22	0.5	II

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
Loop												
Palmer Loop	K	379.74	24	OS+	0-3"	0	NO	NO	10/24/13	K-23	0	I
Palmer Loop	K	379.63	24	1-12"	0-3"	0	NO	NO	10/24/13	K-24	0.5	II
Palmer Loop	K	378.97	24	OS+	0-3"	0	NO	NO	10/24/13	K-25	0	I
Palmer Loop	K	378.96	24	OS+	0-3"	0	NO	YES	10/24/13	K-26	0.25	I
Palmer Loop	K	378.89	24	1-12"	0-3"	0	NO	YES	10/24/13	K-27	0.75	II
Palmer Loop	K	379.14	24	1-12"	0-3"	0	NO	YES	10/24/13	K-28	0.75	II
Palmer Loop	K	378.89	24	1-12"	0-3"	0	NO	YES	10/24/13	K-29	0.75	II
Palmer Loop	K	378.71	36	1-12"	0-3"	0	NO	NO	10/24/13	K-30	0.5	II
Palmer Loop	K	378.99	24	OS+	0-3"	0	NO	NO	10/24/13	K-31	0	I
Palmer Loop	K	378.84	24	OS+	0-3"	0	NO	NO	10/24/13	K-32	0	I
Palmer Loop	K	378.66	24	OS+	0-3"	0	NO	NO	10/24/13	K-33	0	I
Palmer Loop	K	378.72	24	OS+	0-3"	0	NO	NO	10/24/13	K-34	0	I
Palmer Loop	K	378.71	24	OS+	0-3"	0	NO	NO	10/24/13	K-35	0	I
Palmer Loop	K	518.42	24	OS+	0-3"	0	NO	NO	10/24/13	K-36	0	I
665	L	379.71	24	OS+	0-3"	0	NO	NO	10/23/13	L-01	0	I
665	L	379.87	24	OS+	0-3"	0	NO	NO	10/23/13	L-02	0	I
665	L	379.86	24	OS+	0-3"	0	NO	NO	10/23/13	L-03	0	I
665	L	379.82	24	OS-	0-3"	0	NO	NO	10/23/13	L-04	0.25	I

Trail #	Zone	Length	Width	Profile	Incision	Failures	Moisture	Roots	Date	Section	Total Category Number	Classification Rating
665	L	379.98	24	OS+	0-3"	0	NO	YES	10/23/13	L-05	0.25	I
665	L	379.93	24	OS+	0-3"	0	NO	NO	10/23/13	L-06	0	I
665	L	379.19	24	OS+	0-3"	0	NO	NO	10/23/13	L-07	0	I
665	L	379.57	24	1-12"	0-3"	0	NO	NO	10/23/13	L-08	0.5	II
665	L	379.50	24	1-12"	0-3"	0	NO	NO	10/23/13	L-09	0.5	II
665	L	378.70	24	1-12"	0-3"	0	NO	NO	10/23/13	L-10	0.5	II
665	L	379.71	24	OS-	0-3"	0	NO	NO	10/23/13	L-11	0.25	I
665	L	379.24	24	OS-	0-3"	0	NO	NO	10/23/13	L-12	0.25	I
665	L	378.64	24	1-12"	0-3"	0	NO	NO	10/23/13	L-13	0.5	II
665	L	378.94	24	1-12"	0-3"	0	NO	NO	10/23/13	L-14	0.5	II
665	L	379.52	24	1-12"	0-3"	0	NO	NO	10/23/13	L-15	0.5	II
665	L	379.74	24	1-12"	0-3"	0	NO	NO	10/23/13	L-16	0.5	II
665	L	379.26	24	1-12"	0-3"	0	NO	NO	10/23/13	L-17	0.5	II
665	L	379.25	24	1-12"	3-6"	0	NO	NO	10/23/13	L-18	2.5	III
665	L	378.74	24	1-12"	0-3"	0	NO	YES	10/23/13	L-19	0.75	II
665	L	378.96	36	>24"	6-12"	0	NO	NO	10/23/13	L-20	5	IV
665	L	379.10	24	OS+	0-3"	0	NO	NO	10/23/13	L-21	0	I
665	L	378.68	24	OS+	0-3"	0	NO	NO	10/23/13	L-22	0	I
665	L	416.55	24	OS+	0-3"	0	NO	NO	10/23/13	L-23	0	I

References

- Houston, R. 2012. Evaluation of trail impact assessments for use at Oregon Parks and Recreation Department. Portland State University. http://www.pdx.edu/cps/sites/www.pdx.edu.cps/files/Houston_Capstone_final%20_2.0.pdf
- Leung, Y.F., J.L. Marion. 1999. Assessing trail conditions in protected areas: Application of a problem assessment method in Great Smoky Mountains National Park, USA. *Environmental Conservation* 26, 270-279.
- Marion, J.L., Y.F. Leung, S. Nepal. 2006. Monitoring trail conditions: new methodological considerations. *George Wright Forum* 23, 36-49.
- Marion, J.L., N. Olive. 2006. Assessing and understanding trail degradation: Results from Big South Fork National River and Recreational Area. USGS Unnumbered Series, US Geological Series. http://www.pwrc.usgs.gov/prodabs/pubpdfs/6612_marion.pdf
- US Forest Service. 2011. Trail Fundamentals and Trail Management Objectives: Training Reference Package. http://www.fs.fed.us/recreation/programs/trail-management/trail-fundamentals/Fundamentals_Trng_Pkg_05_01_2011.pdf

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