TOWN OF BRECKENRIDGE
*OPEN SPACE ADVISORY COMMISSION*
Monday, January 21, 2013
150 Ski Hill Road

5:30 Call to Order, Roll Call

5:35 Discussion/approval of Minutes – December 17, 2012 ***5***

5:40 Discussion/approval of Agenda

5:45 Public Comment (Non-Agenda Items)

5:50 Staff Summary
- 2013 Golden Horseshoe Trails NEPA Process
- Trail Map revision
- Engage Breckenridge Feedback

5:55 Open Space
- 2012 Cucumber Gulch Wetland Monitoring Report ***8***
- Forest Management Prescription for MBJ and Wedge Parcels ***56***
- 2012 Field Season Update ***64***
- 2013 Workplan ***68***
- Town Council Update

7:30 Adjourn

For further information, please contact the Open Space and Trails Program at 970-547-3155 (Scott) or 970-453-3371 (Chris).

**Memorandum**

To: Breckenridge Open Space Advisory Commission
From: Open Space Staff
Re: January 21, 2013 Meeting

## Staff Summary

### 2013 Golden Horseshoe Trails NEPA Process

Staff has been working with U.S. Forest Service and Summit County Government representatives to plan near-future trail projects in the Golden Horseshoe (e.g. Weber Gulch and Aspen Alley realignments, ZL Trail, Galena extension, and more). Eight different trail projects have been identified that require site-specific NEPA analysis because they are new trails or significant realignments of existing routes. Environmental, cultural and other evaluations are underway, and staff anticipates a late spring, 2013 decision. Most of these projects are targeted for 2014 and after. Staff will keep BOSAC informed of these potential future projects.

### Trail Map revision

Staff has begun work on a revised, second edition trail map for website distribution and purchase at local shops. Edits have been solicited from County and USFS staffs, and many others. Please send any suggested revisions you have to Scott Reid so that the next map can be as complete and updated as possible.

### Engage Breckenridge

Recently, the Town has unveiled a new public engagement tool, called Engage Breckenridge (www.engagebreckenridge.com). This site provides a social media forum in which Town-related ideas and suggestions can be discussed. Since the site's inception, staff has received four open space-related comments to be considered, including some River Trail improvements, Sallie Barber drainage concerns, and a proposed volunteer mountain bike patrol. Staff will consider all suggestions from the site, and include in the monthly agenda any issues that require BOSAC consideration.

## Open Space and Trails

### 2012 Cucumber Gulch Wetland Monitoring Report

Attached, please find the 2012 Wetland Monitoring Report for Cucumber Gulch Preserve, provided by EcoMetrics and Johnson Environmental Consulting. This report was commissioned by Town Council and BOSAC to scientifically evaluate the quality and health of the water and wetland resources in the Preserve.

This report:

1) Satisfies the U.S. Army Corps of Engineers (Corps) permitting requirements for the 2012 Upper Cucumber Gulch wetland restoration project;
2) Develops a set of measureable variables and standards from which wetland health can be evaluated over time; and

3) Establishes baseline data for future research.

All of this information will be used to better understand, track, and manage the sensitive Cucumber Gulch wetland complex. The 2012 report is of particular importance because in September the Town and Breckenridge Ski Resort (BSR) jointly undertook a wetland restoration project in upper Cucumber Gulch, with oversight by the Corps and the U.S. Environmental Protection Agency. Data for this report were collected before, during, and immediately after the wetland restoration work occurred, and therefore provide a valuable benchmark for restoration goals.

In summary, the report reaches the following conclusions:

1) The condition of the upper Cucumber Gulch wetlands had diminished significantly prior to the 2012 work to the point that much of the area previously considered wetlands no longer qualified. The wetlands were worse off, and smaller, than originally thought.
2) Relic hydric soils and wetland vegetation remain in these areas, and suggest a strong potential for rapid restoration of wetland conditions if hydrologic function can be restored.
3) Voluntary wetland restoration efforts by the Town and BSR are constructed to plan and appear to be on track to restore functional hydrology. Initial readings suggest improving hydrologic function in the soil.
4) Performance criteria for the wetland restoration goals are now established and can be tracked in the future to determine project success.

The wetland restoration project completed in 2012 therefore appears to be a good first step towards improving the wetlands in upper Cucumber Gulch. Using framework provided in the attached report, BOSAC and staff will be able to track the results of the effort and document any project successes or failures.

Staff requests BOSAC review the provided report and respond to the questions below. Following BOSAC review and edits, staff will provide Town Council a similar project and research update.

1. ***Does BOSAC have any clarifying questions regarding the information provided in the attached report?***
2. ***Does BOSAC have any other topics deemed important enough to research to determine project success?***

**Forest Management Prescription for MBJ and Wedge Parcels**

Attached, please find a Forest Management report for the MBJ and Wedge parcels written by Eric Petterson of Rocky Mountain Ecological Services. Staff commissioned Mr. Petterson to address the newly acquired MBJ and Wedge parcels, which, as new purchases, were not included in his previous December 2007 *Forest Health and Mountain Pine Beetle Analysis in the Cucumber Gulch Wildlife Preserve* report.

The original report recommended not undertaking active tree removal efforts within Cucumber Gulch Preserve for two primary reasons:

1) The lodgepole pine component of the Preserve is approximately 30%, meaning almost 70% of the forest is Engelmann spruce or subalpine fir. The majority of the forest within the Preserve is likely to survive the current mountain pine beetle infestation.
2) Access for ground-based logging equipment in this sensitive wetland area is poor, and developing such access would compromise other area wetland protection goals.

The acquisitions of the MBJ and Wedge parcels offer a new management challenge because they contain a developed access road, an existing, partially cleared area, and an overstory dominated by dead or mature lodgepole pines. Following his review of the site, Mr. Petterson recommended the Town undertake an overstory removal project with the following objectives:

1) To clean up and reclaim the previous owners' unfinished tree removal effort.
2) To improve the forest health of a 5.5 acre lodgepole pine stand that has largely succumbed to mountain pine beetle infestation.
3) To avoid future hazard tree concerns with the existing "Hang 10" nordic ski trail.

As described, the proposed patch cut would improve the forest age-class and structure in a small portion of the Preserve. It would provide more diverse habitat through the removal of the dead forest overstory, while also reducing the potential for falling trees on a popular nordic trail. Lastly, following the initial disturbance from logging operations, long-term revegetation and restoration efforts will enhance the open space values for which these properties were acquired.

Staff requests BOSAC review the attached report and answer the following questions:

***1) Does BOSAC have any clarifying questions regarding the attached report and prescription?***
***2) Does BOSAC support staff to undertaking this project in the fall of 2013?***

**2012 Field Season Update**
Attached, please find the 2012 Field Season report. Tony Overlock will offer a presentation to BOSAC, detailing the trail crew's recent accomplishments.

**2013 Workplan**
Please review the attached draft 2013 workplan and be prepared to provide any feedback for a BOSAC discussion.

**Town Council Update**
Councilmember Ben Brewer will update BOSAC on recent Council discussions and decisions.

***Roll Call***
Jeff Cospolich called the December 17, 2012 BOSAC meeting to order at 5:35 pm. Other BOSAC members present included Chris Tennal, Devon O'Neil, Ben Brewer, Erin Hunter, and Jeffery Bergeron. Staff members present were Peter Grosshuesch and Chris Kulick. Katie Kent and Brian Lorch from Summit County Government were also in attendance.

***Approval of Minutes***
Ms. Hunter – Wished to clarify her comments from the November 19, 2012 minutes saying that if we pay for Dr. Carello's studies we should follow the recommendations from the results.

The minutes were approved with that change.

***Approval of Agenda***
The agenda was approved as presented.

***Public Comments***
There were no public comments.

**Staff Summary**

**Trail Projects Update**
The seasonal trail crew finished work in late November, after a long and productive season. The Slalom Trail realignment project was completed, as well as the "dirty T" connection with the Upper Flume. Winter snowpack will help compact the new trails and prepare them for 2013 summer use. We appreciate the productivity of the 2012 trail crew. A season-end trail crew report is scheduled for the January BOSAC agenda.

**Friends of Dillon Ranger District McCullough Gulch Trail Project Donation**
As part of the Town's grant program, Town Council approved a $10,000 grant to fund the Friends of Dillon Ranger District's 2013 McCullough Gulch Trail project, which will repair the upper portion of the McCullough Gulch Trail. The goal of the project is to clearly and sustainably define the popular trail to prevent the proliferation of steep social trails in the area. Council directed staff to draw the $10,000 grant from the 2013 open space budget. The pro forma will be revised to include this donation.

**Open Space and Trails**

**State of the Open Space Report**
Staff presented the final version of the State of the Open Space Report which reflected recent BOSAC edits. This draft is currently scheduled to be brought to Town Council on January 22, 2013.

Mr. Bergeron – I think we should count indoor recreation amenities as park space.

Mr. Brewer – Are there metrics on volunteer hours in the report. (Staff, no but we could integrate that data into the report in the future).

BOSAC recommended forwarding the report for Town Council's review.

**Hoosier Pass Recpath Update**
Summit County Government and Town of Breckenridge staff presented information pertaining to initial planning work for the Hoosier Pass Rec Path. Recently, Summit County Government received a State Trails planning grant to develop a feasibility study for the Hoosier Pass Recpath. The County hired Belt Collins, a planning consultant from Boulder, to analyze the potential for a recpath alignment between Breckenridge and Alma. County staff and the consultants have hosted several stakeholder meetings and public open houses to evaluate the recpath concept, the results of which can be reviewed on the County website.

The Town Trails Plan, approved by both BOSAC and Town Council in 2009, identifies the Hoosier Pass Recpath as a priority to be evaluated and pursued. The Town has also contributed $3,000 (50/50 cash and in-kind) to the County's grant and feasibility study.

Mr. Bergeron – How much longer is the option through neighborhoods than the separated that is parallel to the road. (Staff- The neighborhood option is considerably longer, plus it is on existing roads which presents some user conflicts).

Mr. Bergeron – Could there be an individual homeowner that becomes a roadblock for the alignment of the separated path (Staff- we believe we can avoid these type of conflicts with a thorough planning and design process).

Mr. Truckey – Will the preferred alignment stay on one side of the highway (Staff – yes, the west side of the highway).

Ms. Kent – The Breckenridge-to-Alma segment is part of a much larger planned Western Colorado bicycle system through Aspen and Glenwood Springs.

Mr. Bergeron – If the alignment is completed in segments the priority should be from Breckenridge to the base of Hoosier Pass, just before the climb, since that is where the greatest number of conflicts presently occur.

Mr. Tennal – How will we integrate this proposed path through the Town and with the existing recpath to the north? (Staff- that concept is included in the Trails Plan, but we currently have three designated bicycle routes through town that can handle cycling traffic).

Ms. Hunter – Any timeline on when this can be built. (Ms. Kent- we do not yet have a timetable, we are only currently working on the planning, feasibility and estimated costs).

Mr. Carlson (Via Email) – The fewer road crossings in the design, the better.

Mr. Cospolich – This bike path segment was pretty high up in terms of priority in the Trails Plan. (Staff - this is listed in the priorities but it is acknowledged as being ambitious and fairly costly).

**Town Council Update**

Councilmember Ben Brewer updated BOSAC on recent Town Council agenda topics and direction, including the appointment of new BMAC members, McCain parcel issues, and the Welk development.

**Next Meeting**
The next regularly scheduled meeting is on Monday January 21, 2013, which is also the Martin Luther King holiday, in the Administrative Conference Room at the Breckenridge Town Hall (150 Ski Hill Road). Staff inquired if there will be a quorum for the next meeting. BOSAC members confirmed there will be a quorum for that date.

Mr. Brewer made a motion to adjourn the meeting, which was seconded by Mr. Tennal.

The meeting was adjourned at 6:52 p.m.

_____
Jeff Cospolich, Chair

# 2012 Wetlands Monitoring in Upper Cucumber Gulch Preserve Breckenridge, CO:

A report of baseline conditions and initial indications of success for wetlands restoration

Mark Beardsley, M.S., EcoMetrics LLC, and
Brad Johnson, Ph.D., P.W.S., Johnson Environmental Consulting, LLC

Submitted to the Town of Breckenridge Open Space and Trails Department, December 26, 2012

## PURPOSE OF REPORT

This report was prepared to fulfill requirements related to Army Corps of Engineers (Corps) NW-27 Wetlands Restoration Permit # SPK-2012-00780 special conditions #3 and #4 which specify the need for annual monitoring and reporting. The report generally follows the format described in the Corps Regulatory Guidance letter No. 08-03 dated October 10, 2008.

## i. PROJECT OVERVIEW

**(1) Corps Permit Number**: SPK-00780

**(2) Permittee**:
Town of Breckenridge
Open Space and Trails Division
c/o Scott Reid
P.O. Box 168
Breckenridge, CO 8042
(970) 547-3155
scottr@townofbreckenridge.com

**Consultants**:
EcoMetrics, LLC
c/o Mark Beardsley, M.S.
P.O. Box 1469
Fairplay, CO 80440
(719) 839-1497
mark.ecometrics@gmail.com

Johnson Environmental Consulting, LLC
c/o Brad Johnson, Ph.D., P.W.S.
1518 W. Oak St.
Fort Collins, CO 80521
(970) 490-1388
bjohnson-jec@comcast.net

**Party Responsible for Monitoring:** EcoMetrics, LLC

## (3) Project Summary:

In 2011, EcoMetrics, LLC and Johnson Environmental Consulting, LLC (JEC) completed a comprehensive assessment of wetland condition within the Cucumber Gulch Preserve (CGP) for the Town of Breckenridge (Beardsley and Johnson 2011). In that study, we identified significant reductions in the extent of wetland habitat and impaired functioning in Upper Cucumber Gulch (Upper CG) resulting from the loss of ponds and channel incision which caused widespread lowering of the water table. Channel incision was attributed to external impacts to the wetland's water source, sediment balance, and loss of beavers. A voluntary, cooperative project was initiated by the Town of Breckenridge and Vail Resorts to restore lost wetland habitat and to improve functional condition on site. A description and work plan for the project was provided to the Corps by Claffey Ecological Consulting, Inc. on behalf of the Town of Breckenridge on July 30, 2012. (Claffey 2012a and 2012b). EcoMetrics and JEC were retained by the Town of Breckenridge to provide oversight and input into the ecological design of the restoration and to monitor as-built performance.

The fundamental goal of on-site mitigation is the restoration of lost or degraded beaver ponds and groundwater wetlands to a state as close to natural conditions as possible. In addition to restoring habitat conditions within the site, the project also aims to ameliorate the effects of up-gradient watershed stressors by: (1) re-spreading the discharge from the watershed (which is presently collected by a drainage system on the ski area and transferred to CGP through a 60" culvert) in a more natural pattern; (2) collecting allochthonous sediment in a catchment pond within Upper CG so that it may be removed before it enters the greater CGP wetland complex; and (3) restoring habitat that supports healthy beaver populations. The project is viewed as a rapid response to issues identified in Upper CG, which seeks to restore hydrology to the dewatered pond complex while wetland soils and vegetation are still present and the habitats amenable to restoration.

## (4) Site Location

The project is located on Boreas Creek and associated wetlands in Section 36, Township 6 South, Range 78 West (Lat: 39° 28' 56.84" Long: 106° 03' 49.47") in Upper Cucumber Gulch near Breckenridge, CO. The site is immediately north of Ski Hill Road, across from the Peak 8 Base of the Breckenridge Ski Area.

## (5) Project Timeline/Work Dates

**Table 1.** *Milestones in the mitigation project.*

| Date | Work Action |
|---|---|
| 2011 | Comprehensive Wetlands Assessment of CGP (EcoMetrics and JEC) |
| May-Oct. 2012 | Baseline monitoring (EcoMetrics and JEC) |
| Sept. 2012 | Completion of restoration (Claffey Ecological Consulting) |
| Sept. 2012 | Implementation monitoring (EcoMetrics) |

## (6) Baseline Wetland Conditions

Baseline wetland conditions for Upper CG were assessed in 2011 using FACWet (Beardsley and Johnson 2011). FACWet variable scores determined at that time are summarized in Table 2, below.

**Table 2.** *FACWet variable scores for Upper CG as reported in (Beardsley and Johnson 2011).*

| FACWet Variable # | Variable Description | Pre-project score |
|---|---|---|
| 1/2 | Connectivity | C |
| 3 | Buffer Capacity | D |
| 4 | Water Source | D |
| 5 | Water Distribution | D- |
| 6 | Water Outflow | D |
| 7 | Geomorphology | D |
| 8 | Chemical Environment | D |
| 9 | Vegetation Structure and Complexity | C |

Also in 2011, we delineated the boundary of wetlands in Upper CG, with a conservative approach that assumed all questionable areas to be within the wetland boundary (Beardsley and Johnson 2011). In 2012, we initiated a quantitative wetlands monitoring program within Upper CG to measure specific hydrology, soils, and vegetation parameters to better ascertain the jurisdictional status of wetlands on the site. Results from these studies show that the 2011 wetland boundary was indeed very conservative, and in fact the actual extent of wetlands is much smaller than reported in 2011. Of 14 sample points within Upper CG, only one was found to meet jurisdictional requirements for wetland status. These results are summarized by the map in Appendix B. The critical conclusion of these results is that by 2012, most of the historic wetland area within Upper CG had become dewatered and was no longer technically wetland.

## (7) Compliance with Performance Standards

Due to the voluntary nature of the project, formal performance standards were not required of this project by either the Corps or the Town of Breckenridge. Performance standards described in section ii.(1) represent desired or predicted project outcomes rather than mandated criteria for project success. This document reports on baseline, pre-project conditions. Continued monitoring is planned for years to come to evaluate the success of the project. Restoration treatments were completed in October 2012 and quantitative post-project monitoring will be initiated in spring 2013. We also monitored the implementation of the restoration plan and conclude that the project was executed in a way that meets all the requirements outlined in the design plan. The work was also conducted in a manner that created very minimal negative impacts to downstream water quality.

### (8) Corrective actions and Adaptive Management

None currently

### (9) Specific Recommendations for Additional Corrective or Remedial Actions

The Town is pursuing restoration of the Boreas Creek channel in Upper CG, where it is enlarged and incised, as a means to protect the existing and restored wetland complex.

### (10) Adaptive Management and Maintenance

The Town plans to establish a weed monitoring and control program for the site in 2013.

## ii. REQUIREMENTS

### (1) Performance standards

Formal performance standards have not been described as part of this project, yet general narrative goals have been described and it is important to tract project performance regardless of regulatory obligation. The Functional Assessment of Colorado Wetlands 2.0 method (FACWet; Johnson et al. 2010) provides a systematic means of articulating and organizing project goals in light of keystone habitat attributes and their expected responses to restoration treatments. The FACWet framework is intended to summarize and clarify the linkages between project goals, design, and monitoring.

Based on the stated goals of the project described in the work plan (Claffey 2012a and 2012b) and the findings of our 2011 site evaluation (Beardsley and Johnson 2011), we developed success criteria to help benchmark site improvements and forecast the need for adaptive management. The FACWet framework describes five narrative targets or condition classes, including: *reference standard*, *highly functioning, functioning, functionally impaired* and *non-functional*. These targets correspond to academic letter grades A to F, respectively. Each FACWet variable was assigned a pre-project grade based on Beardsley and Johnson (2011) and a projected post-restoration grade based on our interpretation of project goals in the context of surrounding land uses (Table 3). We then describe the ecological conditions that would be indicative of the grade. These are the project performance criteria. Finally, in Table 2 we list the specific monitoring parameters that are being used to track each variable's response in light of the performance criteria.

**Table 3.** *Proposed Success Criteria based on FACWet 2.0 variables.*

| FACWet Variable # | Variable Description | Pre-project score | Target score | Success Criterion | Monitoring |
|---|---|---|---|---|---|
| **1/2** | **Connectivity** | C | C | N/A | N/A |
| **3** | **Buffer Capacity** | D | D | N/A | N/A |
| **4** | **Water Source** | D | B | Incoming water from Boreas Cr. is spread laterally in a full spreader pond that feeds multiple distributary channels across the width of the complex. | Observation, photopoints, streamflow monitoring |
| **5** | **Water Distribution** | D- | B | 1. Historic extent and depth of pond habitat restored to abandoned ponds.<br>2. Water table elevations throughout historic wetland area meet criteria for wetland hydrograph. | 1. Observation, photopoints.<br>2. Water table depth monitoring at 14 test sites within Upper CG. |
| **6** | **Water Outflow** | D | B | 1. Water out flow distributed through multiple channels.<br>2. Reduced erosive capacity of outflowing water. | Observation, photopoints |
| **7** | **Geo-morphology** | D | B | 1. Breached beaver dams repaired and functional.<br>2. Beavers present and actively maintaining dams.<br>3. Soil profiles indicate hydric soil throughout historic wetland area.<br>4. Boreas Creek channel is no longer actively degrading, enlarging, or becoming further incised | 1. Observation, photopoints.<br>2. Observation, wildlife cameras.<br>3. Soil profiles<br>4. Channel surveys. |
| **8** | **Chemical Environment** | D | B | Restoration of the characteristic soil redox environment via reestablishment of the natural saturation regime. | Redox monitoring at 12 test sites within Upper CG, evaluate ongoing WQ monitoring |
| **9** | **Vegetation Structure and Complexity** | C | B | 1. Wetland vegetation is present throughout historic wetland area.<br>2. Vegetation composition and structure is similar to unimpacted reference condition. | Observation, photopoints, Vegetation plots at 14 test sites within upper CG, Weed surveys, ongoing veg. monitoring |

The aim of the project is to restore the wetlands in Upper CG to the highest functional condition possible. Ideally, that would mean restoring FACWet variable scores for the wetland to *reference standard* condition (A). However, there are practical factors limiting the amount of ecological lift possible. For instance, many of the ecological stressors acting on this wetland occur outside its footprint, including watershed impacts and drainage infrastructure upstream from the site that influence the amount and timing of water and sediment input. Restoration work within the project site may reduce these impacts, but it cannot eliminate them completely. Obviously, none of the landscape context variables can be improved in a restoration effort that is limited to treatments within the footprint of the wetland area, but most of the other variables are in the scope of influence since their impairment is a direct result of the hydrologic, sediment, and beaver processes that this project is aimed at improving.

We judge that a realistically achievable target for this project would be to restore hydrologic and habitat functions to the level of *highly functioning* (B) as laid out in Table 3. In Table 3, pre-project scores are listed for each of the FACWet variables along with target scores that would indicate success and short narrative description detailing specific success criteria. These criteria are essentially the physical conditions that must be restored to achieve the desired increase in variable score.

**(2) Appraisal of Performance**

In section i. (7), we reported that the project appears to be in compliance with performance criteria so far, based successful implementation of treatments as designed. In this section, we provide a preliminary appraisal of restoration performance through interpretation of the limited post-build data and observations that are available. These data document the response of FACWet variables relative to the performance criteria listed in section ii. (1). Our summary findings are outlined in Table 4, with additional interpretation of the quantitative data obtained to date provided below.

- **V5 Water Distribution:** Several of the groundwater wells were removed just prior to the restoration treatments to protect them from construction activities. Of the seven functioning wells that were in place (A, F, G, J, L, M, and N), six showed marked increase in the elevation of groundwater table after construction (A, F, G, J, L, and M; see Appendix D). The existing well that did not show a groundwater rebound was N, which is on the opposite side of Boreas Creek from any of the water distribution treatments.

- **V8 Chemical environment:** Redox probes were also left in place for about three weeks following construction at eight of the test sites, (A, F, G, J, K, L, M, and N). On five of these sites (A, G, J, K, and M) we observed a marked improvement in soil redox conditions (see Appendix G).

These data provide additional evidence, beyond simple observation, that the restoration "as-built" was performing as planned in its initial phases.

**Table 4**. *Current Status Relative to Success Criterion.*

| FACWet Variable # | Variable Description | Target score | Success Criterion | Current Status Relative to Success Criterion |
|---|---|---|---|---|
| **1/2** | **Connectivity** | C | N/A | N/A |
| **3** | **Buffer Capacity** | D | N/A | N/A |
| **4** | **Water Source** | B | Incoming water from Boreas Cr. is spread laterally in a full spreader pond that feeds multiple distributary channels across the width of the complex. | Spreader pond is constructed as designed. It feeds multiple distributary channels across the width of the complex, but is not full due to lowered "spillways" along dam. |
| **5** | **Water Distribution** | B | 1. Historic extent and depth of pond habitat restored to abandoned ponds.<br>2. Water table elevations throughout historic wetland area meet criteria for wetland hydrograph. | 1. Extent and depth of abandoned ponds appear to be constructed as described as designed, and similar to observed recent conditions.<br>2. No data |
| **6** | **Water Outflow** | B | 1. Water out flow distributed through multiple channels.<br>2. Reduced erosive capacity of outflowing water. | Outflow no longer confined to incised channel. Increased distribution among branched channels and groundwater. |
| **7** | **Geo-morphology** | B | 1. Breached beaver dams repaired and functional.<br>2. Beavers present and actively maintaining dams by fall, 2013.<br>3. Soil profiles indicate hydric soil throughout historic wetland area.<br>4. Boreas Creek channel is no longer actively degrading, enlarging, or becoming further incised | 1. Beaver dams are repaired and functioning according to design.<br>2. No new beaver activity observed within the project area in 2012.<br>3. Hydric soil indicators present on profiles at 11 of 14 plots.<br>4. Apparently minimal erosion on Boreas Creek in 2012. |
| **8** | **Chemical Environment** | B | Restoration of the characteristic soil redox environment via reestablishment of the natural saturation regime. | No data, but suspected improvement based on re-saturation. |
| **9** | **Vegetation Structure and Complexity** | B | 1. Wetland vegetation is present throughout historic wetland area.<br>2. Vegetation composition and structure is similar to unimpacted reference condition. | 1. Most plots still had remnant wetland vegetation prior to project<br>2. Some of the weediest areas are now inundated by ponds. |

# iii. SUMMARY DATA

### (1) Site map

Site maps are provided in appendix A. The maps identify the location of all relevant photopoints and study test sites. Appendix B includes a map showing the baseline condition of wetlands in Upper CG, prior to the project.

### (2) Relevant photopoints (FACWet Variables 4-7 and 9)

Photopoints 1, 2, 3, 26, 27, and 28 are relevant for the appraisal of performance of the Upper CG restoration project. These photos are provided in appendix C, showing views taken in May, August, and October, 2012. These show the site prior to the growing season and during the peak of the growing season before construction, and following construction after the growing season.

### (3) Hydrology (FACWet Variables 4-6)

**Observations:** All of the ponds within Upper CG were dry for the majority of the 2012 growing season. The exception was that a few of the ponds toward the lower end of the site contained shallow water that spilled over from Boreas Creek for several days during a rainy cycle in late July. For all intents and purposes though, the ponds and distributary channels in Upper CG were completely nonfunctional through the season.

**Hydrographs:** We set 14 datalogging wells at each of the monitoring test plots in Upper CG (A-N) to monitor the height (depth) of the water table. The loggers measure the height of the water table every four hours. Hydrographs from these wells are provided in appendix D. For each well location we measured the amount of time during the 120-day period from May 21 to Sept 17 that the water table was shallower than 12 in. This sum is reported as total hydric days (THD), for that location. We also calculated the duration of the maximum length of time for which the hydrograph shows the water table at less than 12 in. deep. This figure is reported as consecutive hydric days (CHD). THD and CHD results for 2012 are shown in Table 5. The jurisdictional requirement for wetlands in this region is 14 CHD during the growing season. By this criterion, none of the plots had wetland hydrology this season, except probably well H. The datalogger of this well failed, so the record was lost, but wetland hydrology is inferred to have been present at this site based on redox data. At some of the sites, wells were present for several days after construction, and many of these sites showed an increase in the height of the water table following construction.

**Table 5**. *Hydrology summary.*

| Site ID | THD | CHD | Wetland hydrology (by hydrograph) | Note |
|---|---|---|---|---|
| CGP-A | 0 | 0 | Negative | water table spikes with rain events, frequently reached a depth < 20 in. |
| CGP-B | 0 | 0 | Negative | water table consistently deeper than 40 in. through entire season |
| CGP-C | 0 | 0 | Negative | several short spikes within 20 in., otherwise 38 in. or deeper |
| CGP-D | 0 | 0 | Negative | water table consistently deeper than 34 in. through entire season |
| CGP-E | 0 | 0 | Negative | water table consistently deeper than 35 in. through entire season |
| CGP-F | 0 | 0 | Negative | one short spike within 30 in., otherwise 38 in. or deeper |
| CGP-G | 2.5 | 2 | Negative | one spike within 12 in. at the end of July |
| CGP-H | *N/A Well datalogger failed* ***(assumed wetland hydrology present due to redox data)*** | | | |
| CGP-I | 0 | 0 | Negative | water table consistently deeper than 37 in. through entire season |
| CGP-J | 0 | 0 | Negative | water table consistently deeper than 29 in. through entire season |
| CGP-K | *N/A Well datalogger failed (assumed wetland hydrology absent due to redox data)* | | | |
| CGP-L | 0 | 0 | Negative | 2 multi-day spikes (May and July) but peak at 18 in. |
| CGP-M | 5.5 | 2 | Negative | multiple short spikes from rain-related overflow from Boreas Cr. |
| CGP-N | 0 | 0 | Negative | one short spike during late July event, but peak at 32 in. |

**Boreas Creek discharge:** Water discharge of Boreas Creek at the inlet to CGP was measured within the 60 in. culvert using a datalogger with depth and velocity sensors that measured flow every 10 minutes from May through September, 2012. Results are plotted in appendix E. Flows tended to drop through the season from around 4 cfs in May and early June to about 1.5 cfs in September. There were few spikes in flow related to precipitation events. A likely exception was an intense thunderstorm on about July 30. Unfortunately, our sensor was destroyed by large bedload sediment in the large gravel/small cobble size range (60-100 mm) during this event. As a result, we have no discharge data for that short period of time this summer during which there were significant rain events. The thunderstorm events over the rest of the season were typically very small.

### (4) Geomorphology (FACWet Variable 7)

**Observations:** Through the 2012 growing season prior to construction, all water entering CGP from Boreas Creek passed through the breach in the Spreader Pond and down the incised channel through Upper CG. Many of the subsidiary ponds were also breached and filled with recent sediment. According to the design, the spreader pond dam was re-constructed, and much of the accumulated sediment was dredged out of it. Likewise, ponds downstream were similarly repaired and dredged. Most of the flow from Boreas Creek is now diverted through the pond system and into distributary channels north of the incised channel.

### (5) Soils (FACWet Variable 8)

**Soil profiles:** At each of the test sites in Upper CG, we analyzed a soil profile. Results of the soil profile analysis are provided in appendix F and summarized in Table 6. At sites D-N (11 sites) positive indicators of hydric soil were present, meaning that the soil condition is presently or has recently been formed within wetland. At the three other sites (A-C), the profiles did not meet conditions for any of the hydric soil indicators. On each of these sites, however, there is evidence that the location was wetland in the recent past. On sites B and C which are both in relic ponds, we found what appears to be hydric soil buried under layers of recently deposited sediment. At site A which is upstream of the ponds and close to Ski Hill Road, the pattern is more indicative of a relic wetland soil that has been dry and subject to oxidation for many years.

**Observations on soil environment:** The breadth of the site shows unnatural periods of drying and unsaturated soil which is a strong indicator that the normal reducing chemical environment would not be present across most of the area.

**Table 6**. *Determination of hydric soil status.*

| Site ID | Hydric soils presence (by indicators) | Note |
|---|---|---|
| CGP-A | Negative* | *Past hydric soil condition apparently impacted by drying |
| CGP-B | Negative* | *Hydric soils apparently recently buried under sediment |
| CGP-C | Negative* | *Hydric soils apparently recently buried under sediment |
| CGP-D | Positive | Positive indication of hydric soil |
| CGP-E | Positive | Positive indication of hydric soil |
| CGP-F | Positive | Positive indication of hydric soil |
| CGP-G | Positive | Positive indication of hydric soil |
| CGP-H | Positive | Positive indication of hydric soil |
| CGP-I | Positive | Positive indication of hydric soil |
| CGP-J | Positive | Positive indication of hydric soil |
| CGP-K | Positive | Positive indication of hydric soil |
| CGP-L | Positive | Positive indication of hydric soil |
| CGP-M | Positive | Positive indication of hydric soil |
| CGP-N | Positive | Positive indication of hydric soil |

**Redox probes:** Each of the test sites was equipped with platinum-tipped redox electrodes set to a depth of 12 in. Throughout the growing season, we made periodic site visits to measure the redox potential of the soil at these plots using an electric circuit connecting the redox probe to a reference Ag/AgCl electrode. This test provided a quantitative indicator of the presence of wetland soil chemistry based on the measured value of redox potential, expressed in mV of current in the circuit. Strongly positive values,

particularly greater than +300 mV indicate highly aerobic, drained soils. Values typical of the redox potential in saturated wetland soils are strongly negative, particularly less than -100 mV (See Fig. 1).

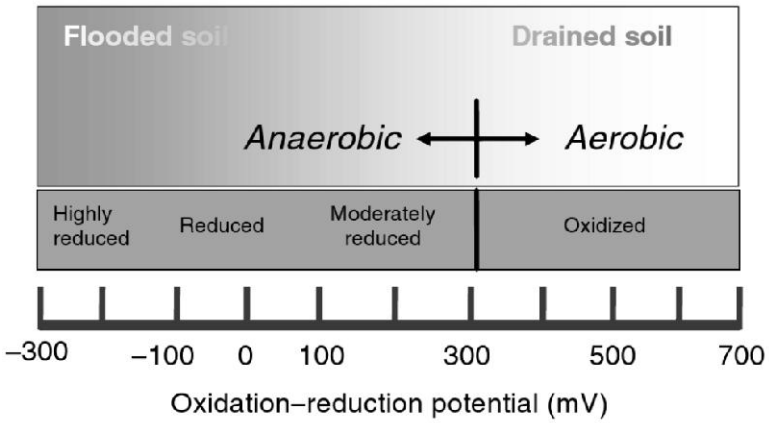



**Fig. 1.** *Narrative interpretation of the meaning of redox potential values.*

**Table 7.** *Soil redox summary*

| Site ID | redox pattern indicative of wetland soil chemistry |
|---|---|
| CGP-A | Negative |
| CGP-B | Negative |
| CGP-C | Negative |
| CGP-D | Negative |
| CGP-E | Negative |
| CGP-F | Negative |
| CGP-G | Negative |
| CGP-H | **Positive** |
| CGP-I | Negative |
| CGP-J | Negative |
| CGP-K | Negative |
| CGP-L | Negative |
| CGP-M | Negative |
| CGP-N | Negative |

Results for soil redox monitoring on Upper CG through the 2012 season are provided in appendix G and summarized in Table 7. Only one of the test sites, site H, showed a pattern of soil redox potential that is typical of wetlands. Soil chemistry at all of the other sites clearly indicate dry, non-wetland conditions. It is worth noting that some of the sites did show a marked drop in redox potential (indicating saturation of the soil) following construction in late September.

### (6) Vegetation (FACWet Variable 9)

**Observations:** Plant species composition was visually estimated in 14 five-meter diameter plots placed adjacent to the groundwater well. Vegetation monitoring occurred on July 28, 2012. Overall the vegetation appeared in a state of transition from the species composition characteristic of pond habitat to a more mesic one. This is evidenced by the prevalence of facultative or facultative upland species, such as redtop (*Agrostis scabra*), brome (*Bromopsis ciliata*), small wing sedge (*Carex microptera*), quack grass (*Elymus repens*) or blue grass (*Poa pratensis*) in various plots across upper CG which would not be expected in flooded or very hydric habitats (see appendix H for plot data). Vegetation also showed signs of water stress, and this was particularly evident in the more hydric species. During the extremely dry 2012 season, wetland vegetation throughout the mountains commonly exhibited drought stress, however.

No rare species were observed in this survey. Weed infestation is not yet a major issue, but troublesome patches of weedy species were observed throughout upper CG. The Town of Breckenridge is instituting a weed control plan in 2013. Our prediction is that most weeds will be eradicated if hydrologic restoration is successful, because the weeds that are present tend to be more upland species. The exception to this may be reed canary grass which grows well in hydric conditions and which has become well established in several areas. This species was present in six of the 14 vegetation plots, but only at a maximum level of 15%. We have observed dense patches of it, however, outside of the monitoring plots. We recommend that this species be a particular target of weed control efforts.

**Hydrophytic Vegetation status:** The hydrophytic status of vegetation was determined using the "Prevalence Index" as described by the Corps' *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*. This is the most precise and objective way to determine whether or not vegetation meets wetland criteria. A Prevalence Index of 3.0 or less indicates that wetland vegetation is present. Table 8 presents the Prevalence Index score for each vegetation plot. All but three plots still retain hydrophytic vegetation. Three additional plots are at or approaching borderline conditions.

**Table 8.** *Vegetation summary showing Prevalence Indices for each of the test sites. A score of 3.0 or less indicates the presence of wetland vegetation at the site.*

| Plot ID | Prevalence Index |
|---|---|
| A | 2.17 |
| B | 2.65 |
| C | 3.03 |
| D | 3.00 |
| E | 1.81 |
| F | 1.46 |
| G | 3.22 |
| H | 1.67 |
| I | 3.17 |
| J | 2.89 |
| K | 2.61 |
| L | 2.85 |
| M | 2.15 |
| N | 2.40 |

## iv. MAPS

Appendix A contains two maps showing the location of photopoints and monitoring test sites in Upper CG, respectively. Construction designs and site plan maps are provided in Claffey 2012a. Appendix B contains a map showing the extent of wetlands as delineated in 2007 and conservatively again in 2011. This map also shows the results of quantitative tests made in 2012 to determine the wetlands boundary more definitively. The 2012 results define the baseline condition of wetlands for this restoration project.

## v. CONCLUSIONS

The condition of Upper CG wetlands had diminished to the point that, in 2012, almost none of the historic wetland area even met the technical definition of wetland habitat based on hydrology, soils, and vegetation. The extent of surviving wetland habitat is apparently much less than we estimated in 2011 (Beardsley and Johnson 2011). The cause of this habitat loss is diminished water distribution resulting in a lack of hydrology on 13 of the 14 test sites. Over most of the area, relic hydric soils and characteristic wetland vegetation are still present, indicating the potential for rapid restoration of wetland condition if

hydrology can be restored. Voluntary wetland restoration efforts by the Town of Breckenridge and Vail Resorts in September 2012 appear to have been constructed as designed and appear to be on track to restoring functional condition. In this document we reported quantitative baseline conditions in upper CG and we provided a set of performance criteria by which project performance can be appraised in years to come. For most of the performance criteria, quantitative or observational monitoring parameters were also identified. Ongoing monitoring of these parameters in light of performance criteria will provide an objective means by which to track habitat improvements and ultimately appraise project success.

# vi. LITERATURE CITED


- Beardsley and Johnson. 2011. *A Comprehensive Assessment of Wetland Condition in Cucumber Gulch Preserve, Breckenridge, Colorado.* Submitted to Town of Breckenridge. October 31, 2011.
- Claffey Ecological Consulting, Inc. and Five Rivers, Inc. 2012a. *UPPER CUCUMBER GULCH, Breckenridge, Colorado, RESTORATION PLAN.* Submitted to Town of Breckenridge, Open Space and Vail Summit Resorts. July, 2012.
- Claffey Ecological Consulting, Inc.. 2012b. *REQUEST FOR VERIFICATION OF NATIONWIDE GENERAL PERMIT AUTHORIZATION. CUCUMBER GULCH RESTORATION PROJECT. PHASE 1, STAGE 2 & PHASE 2.* Submitted to Army Corps of Engineers Sacramento District, on behalf of the Town of Breckenridge Open Space and Trains Department, Scott Reid. July 25, 2012.
- Johnson, J.B., M. Beardsley, and J. Doran. 2010. *Functional Assessment of Colorado Wetlands Version 2.0*. Colorado Department of Transportation Research Report.

# APPENDIX A: SITE MAPS

**Fig. A1.** *Location of monitoring photopoints across the greater Cucumber Gulch Preserve. Photopoints relative to monitoring project effectiveness on Upper CG include #1, 2, 3, 26, 27, and 28.*

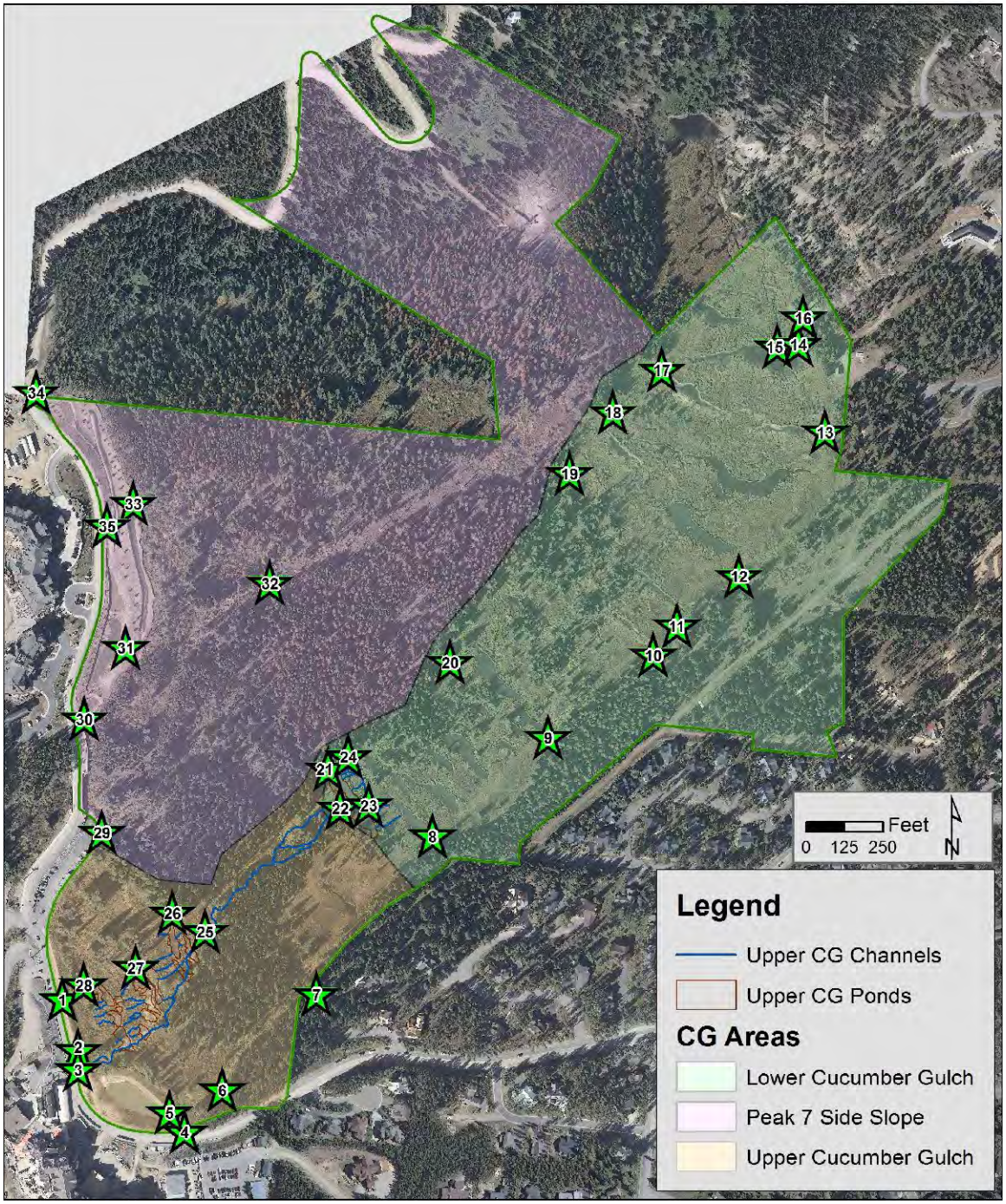
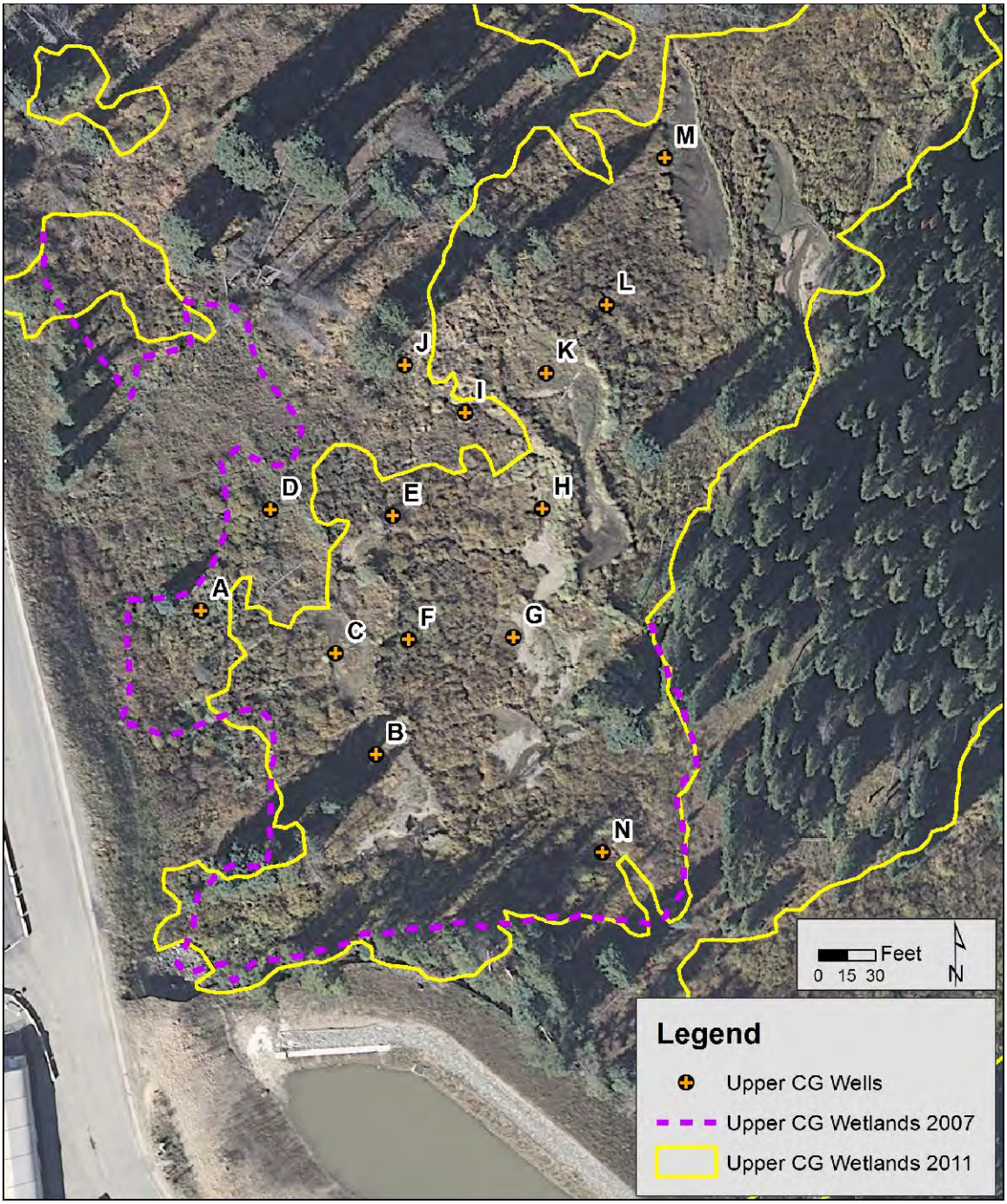
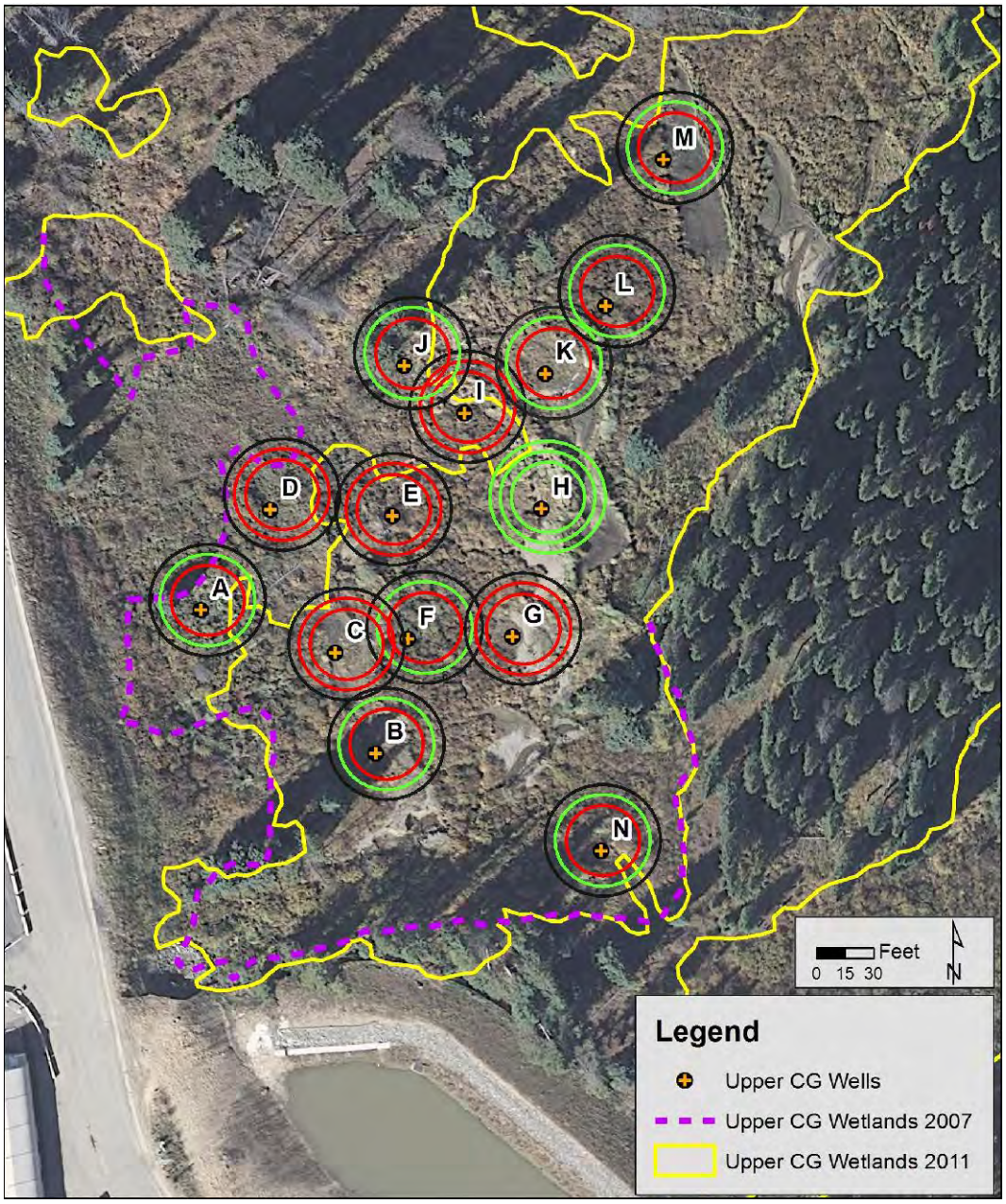


**Fig. A2.** *Location of monitoring test sites within Upper CG. Each site is equipped with a groundwater monitoring well and datalogger, redox probes, vegetation sample plot, and soil profile point. 2007 and 2011 wetland delineation boundaries are shown as well, so that the location of test sites relative to purported wetlands can be easily ascertained.*



# APPENDIX B: BASELINE WETLANDS CONDITION MAP

**Fig. B1.** *Results of 2012 baseline monitoring of wetlands condition in Upper CG are depicted on this map. The concentric circles at each test site indicate wetlands status based on hydrology (inner circle), vegetation (middle circle), and soils (outer circle). Green indicates the presence of a wetland indicator, red indicates the absence of a wetland indicator, and grey indicates the presence of relict hydric soils that presently lack hydrology. Of all these test locations, in 2012 only site H possessed all three wetland criteria. Comparison of the quantitative results to recent wetland delineations shows that the wetland area has contracted more than was previously appreciated.*



# APPENDIX C: RELEVANT PHOTOPOINTS

**Fig. C1**. *Photopoint 1*

**Fig. C2**. *Photopoint 2a*

**Fig. C3**. *Photopoint 2ba*

**Fig. C4**. *Photopoint 3a*

**Fig. C5**. *Photopoint 3b*

**Fig. C6**. *Photopoint 26*

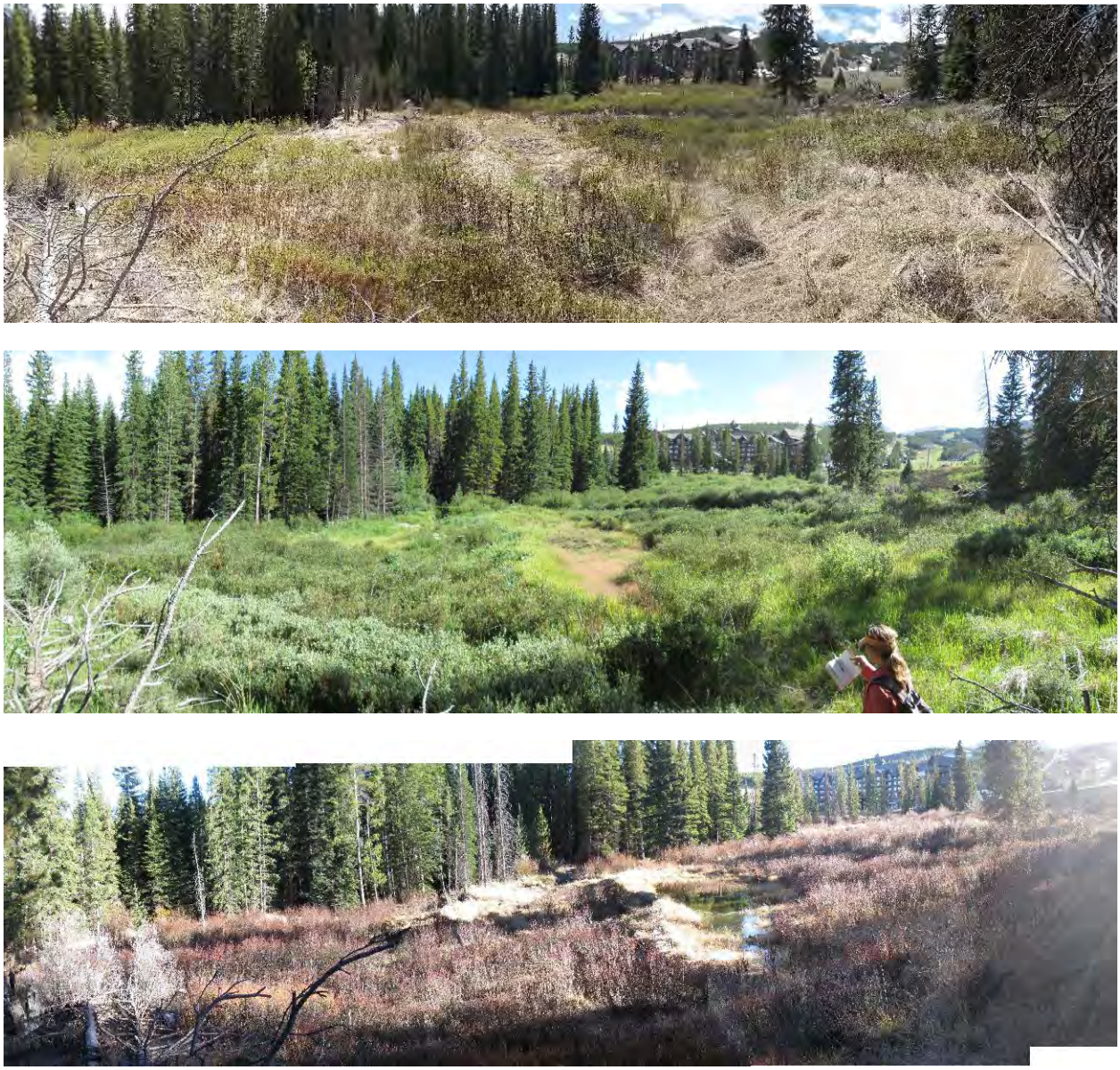


**Fig. C7**. *Photopoint 27a*

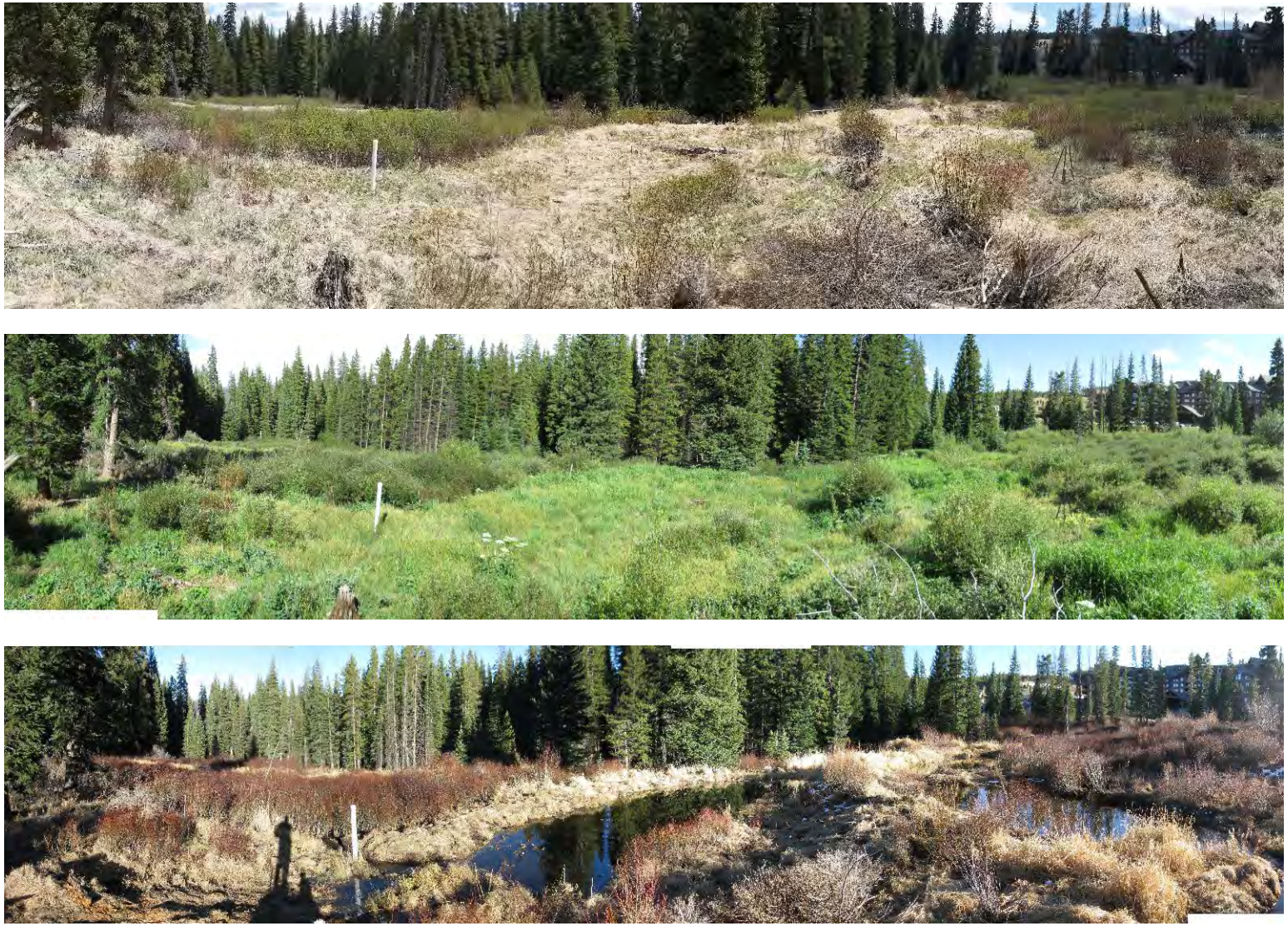
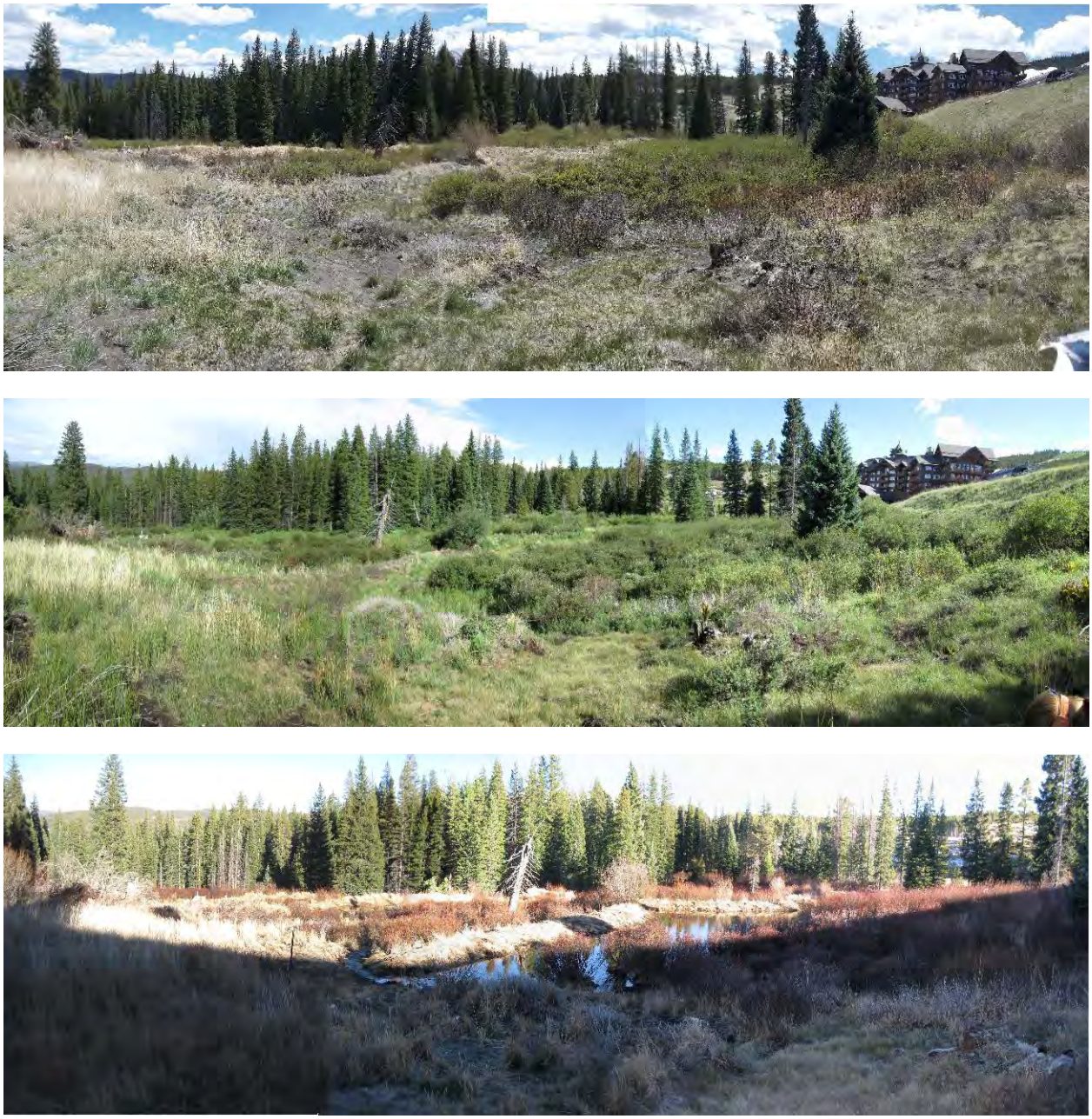


**Fig. C8**. *Photopoint 27b*

**Fig. C9**. *Photopoint 28*



# APPENDIX D: HYDROGRAPHS

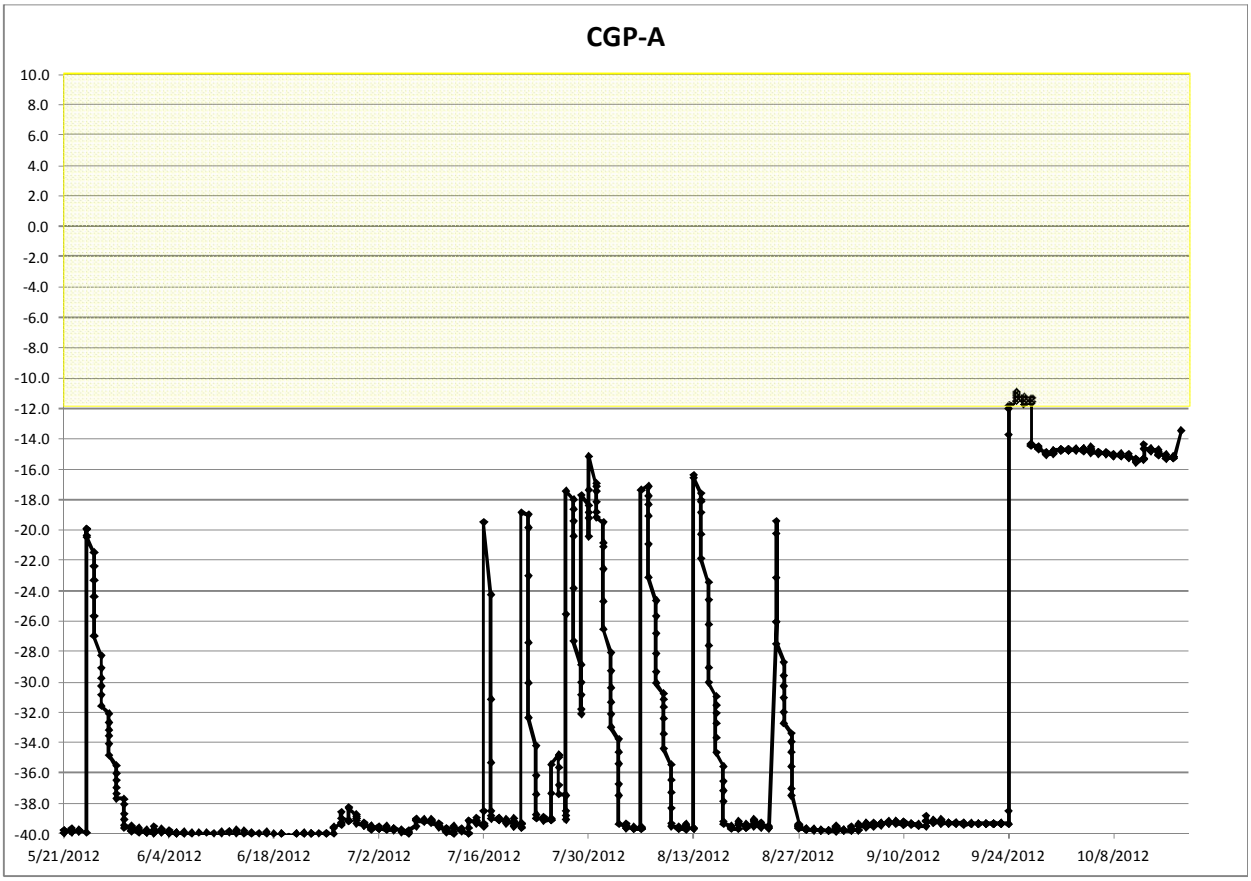



**Fig. D1**. *Well Plot A*

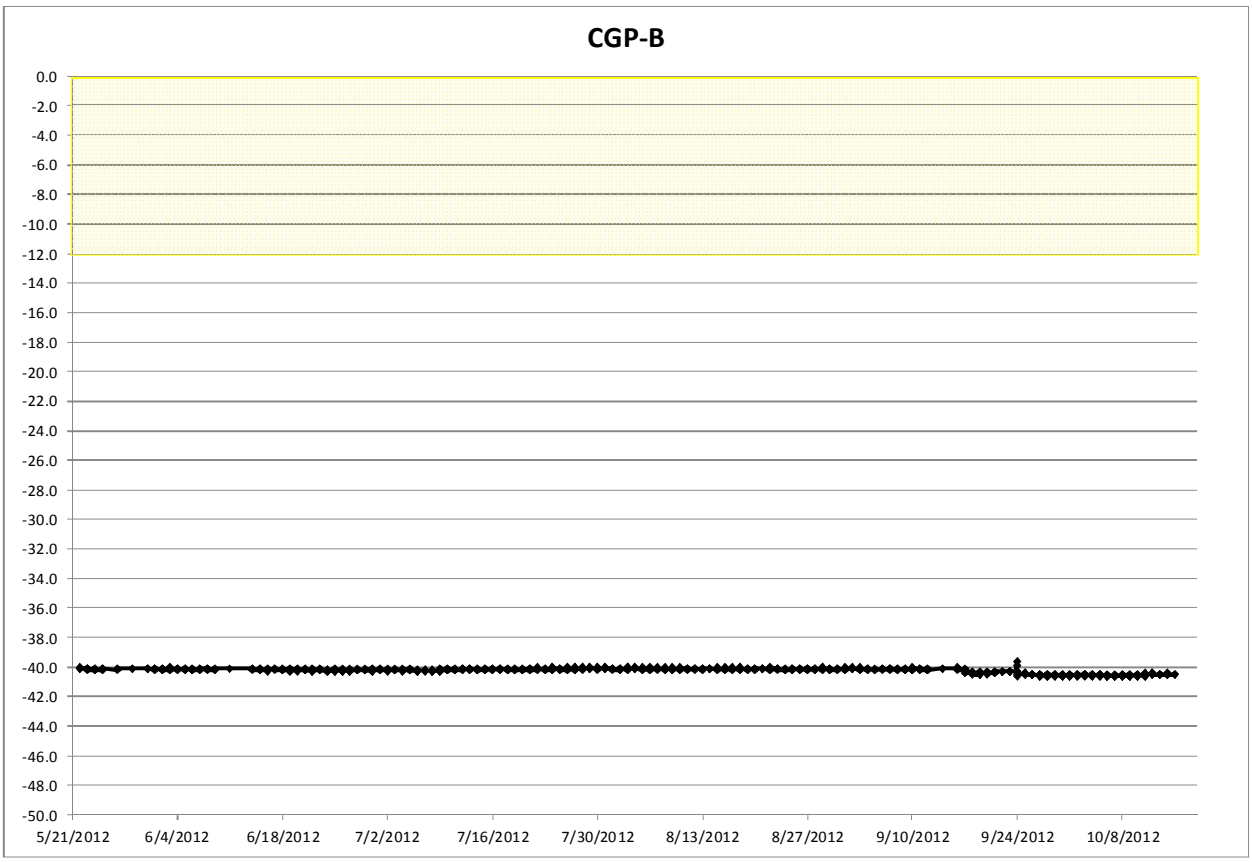



**Fig. D2**. *Well Plot B*

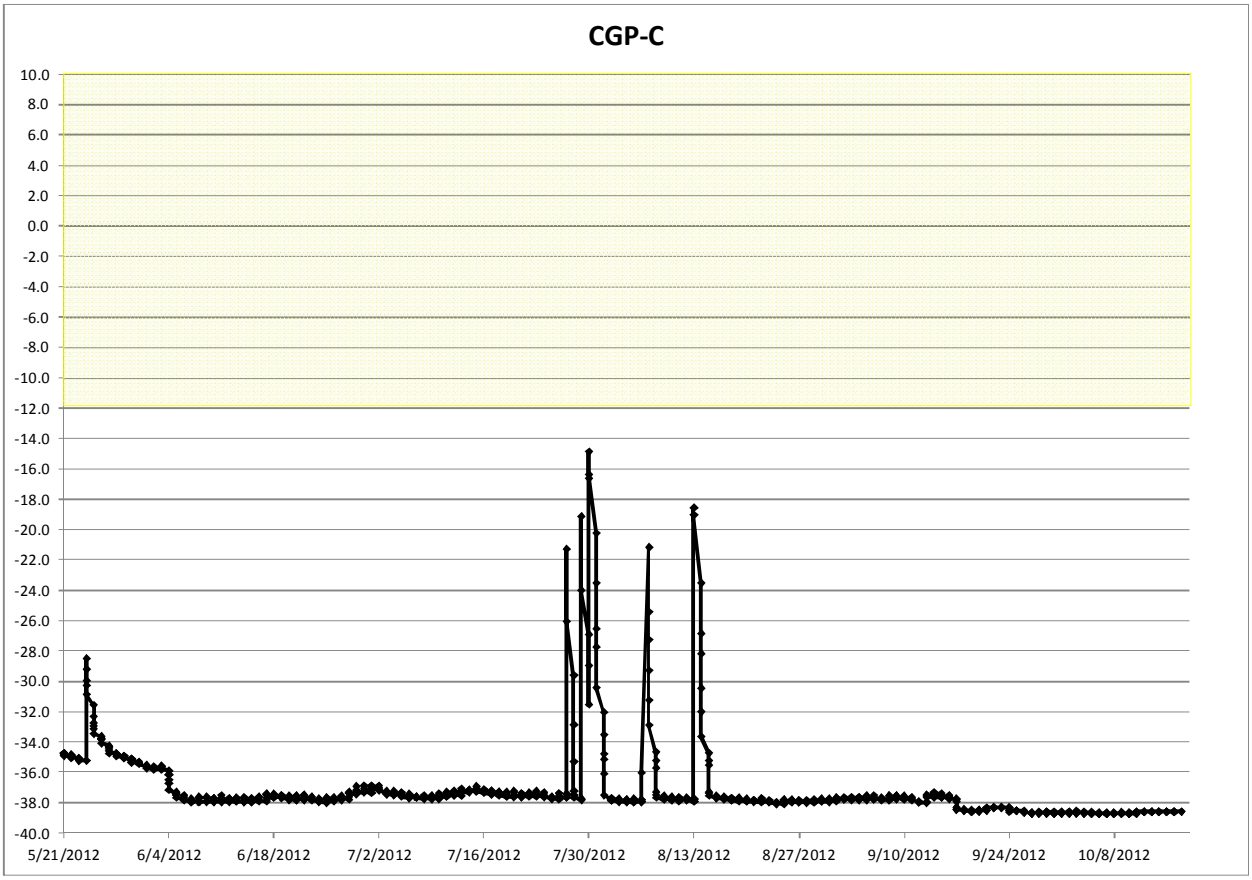



**Fig. D3**. *Well Plot C*

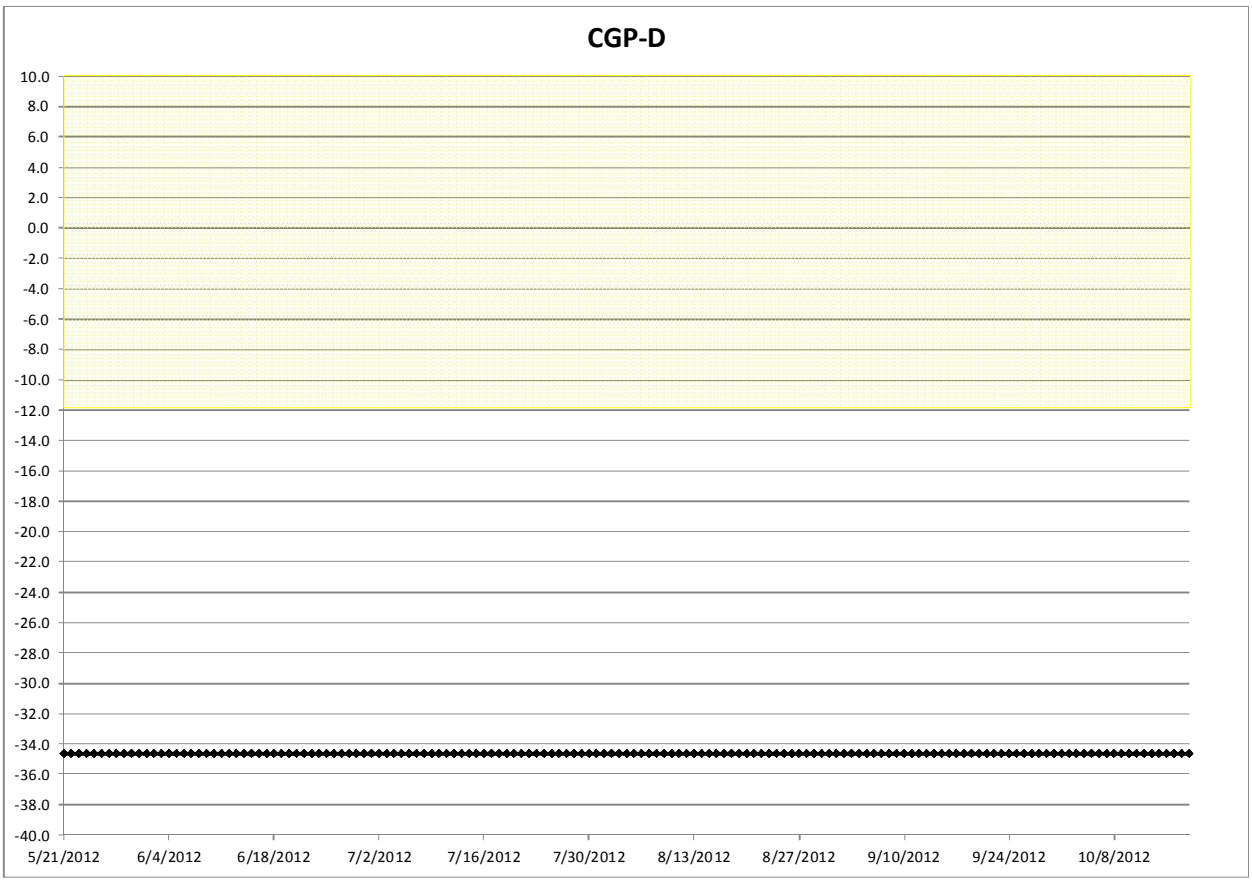



**Fig. D4**. *Well Plot D*

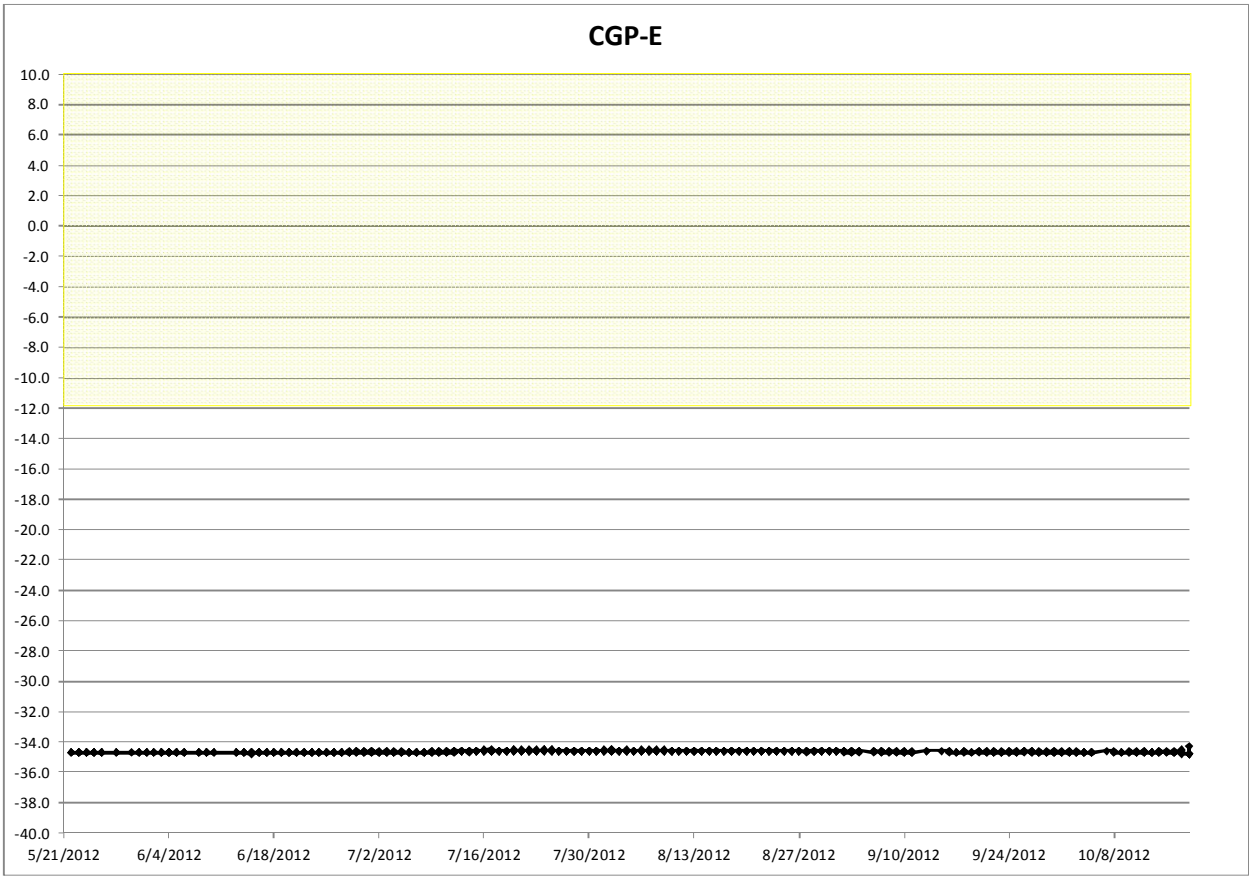



**Fig. D5**. *Well Plot E*

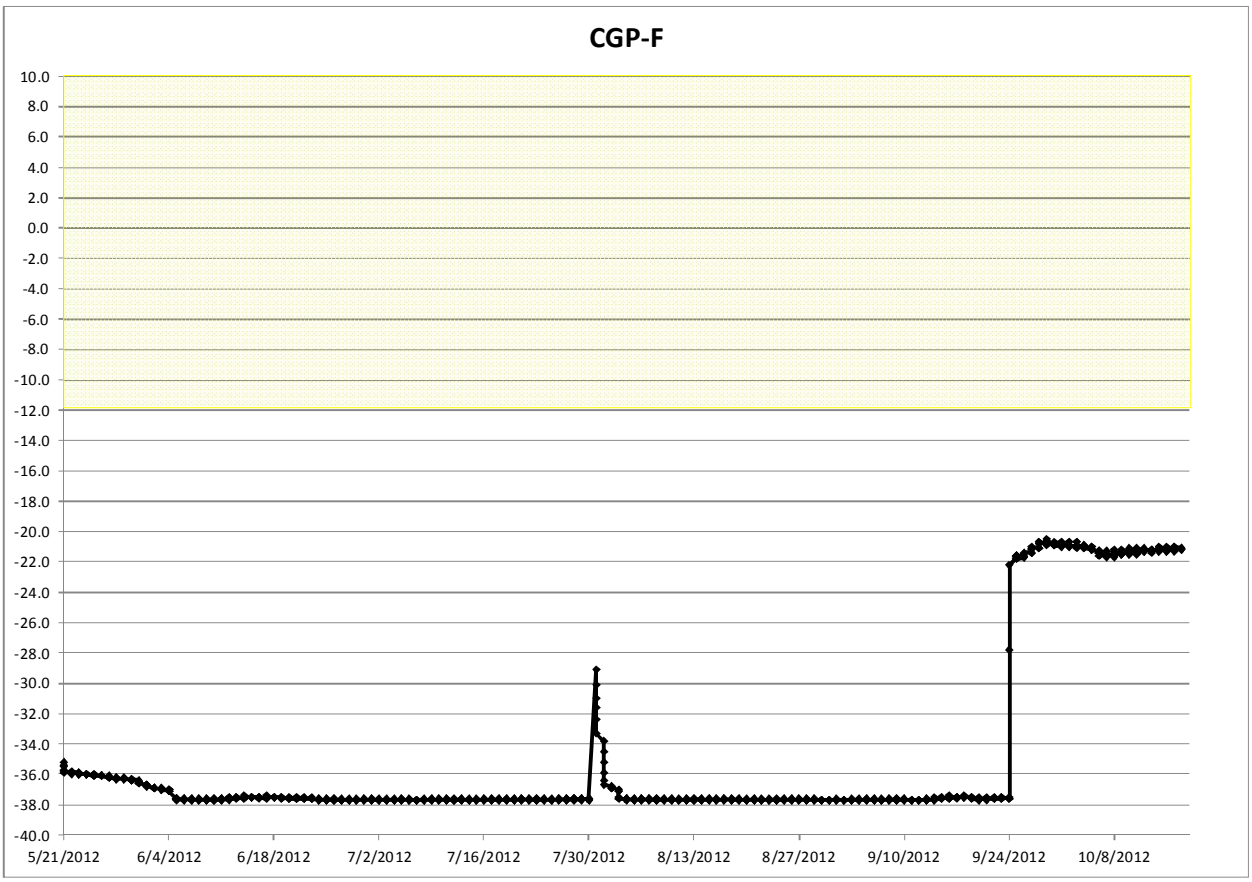



**Fig. D6**. *Well Plot F*

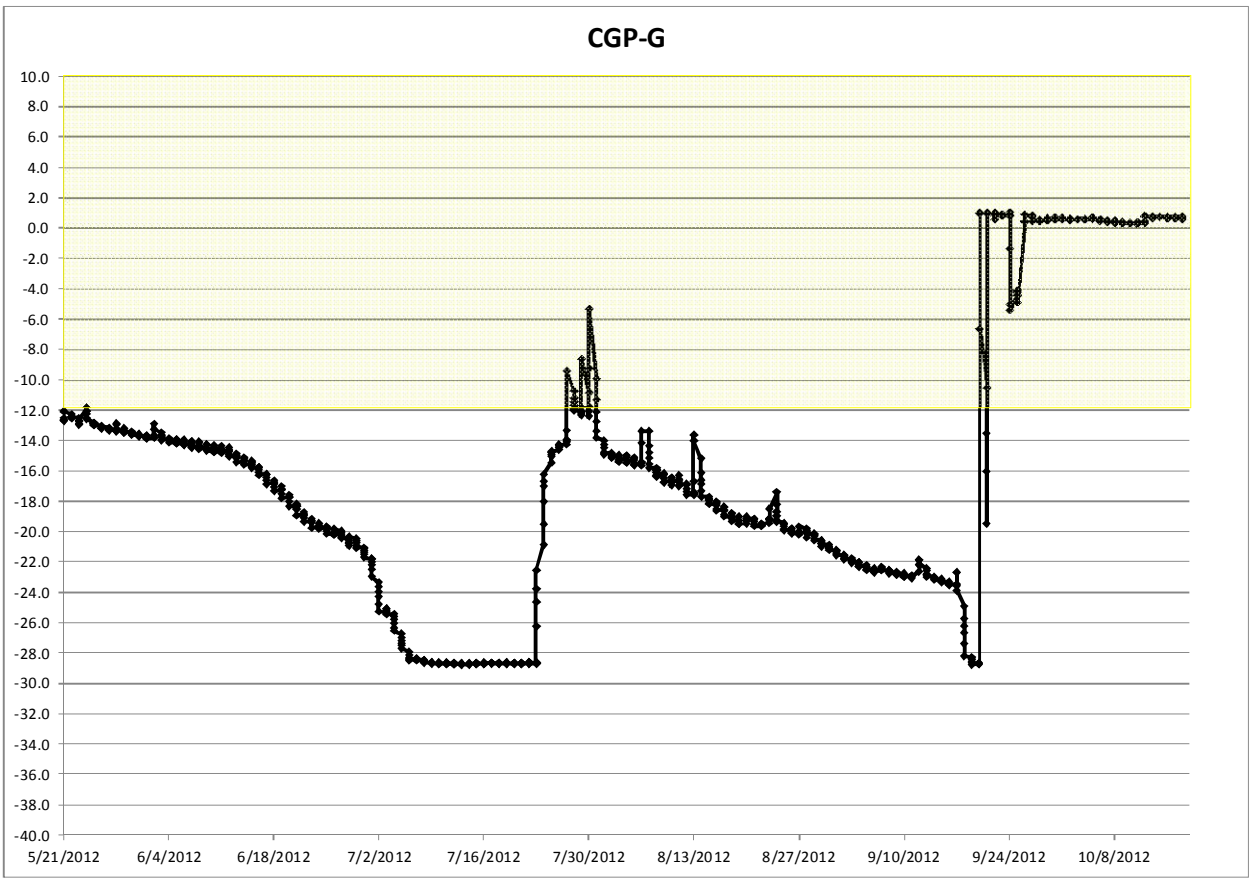



**Fig. D7**. *Well Plot G*

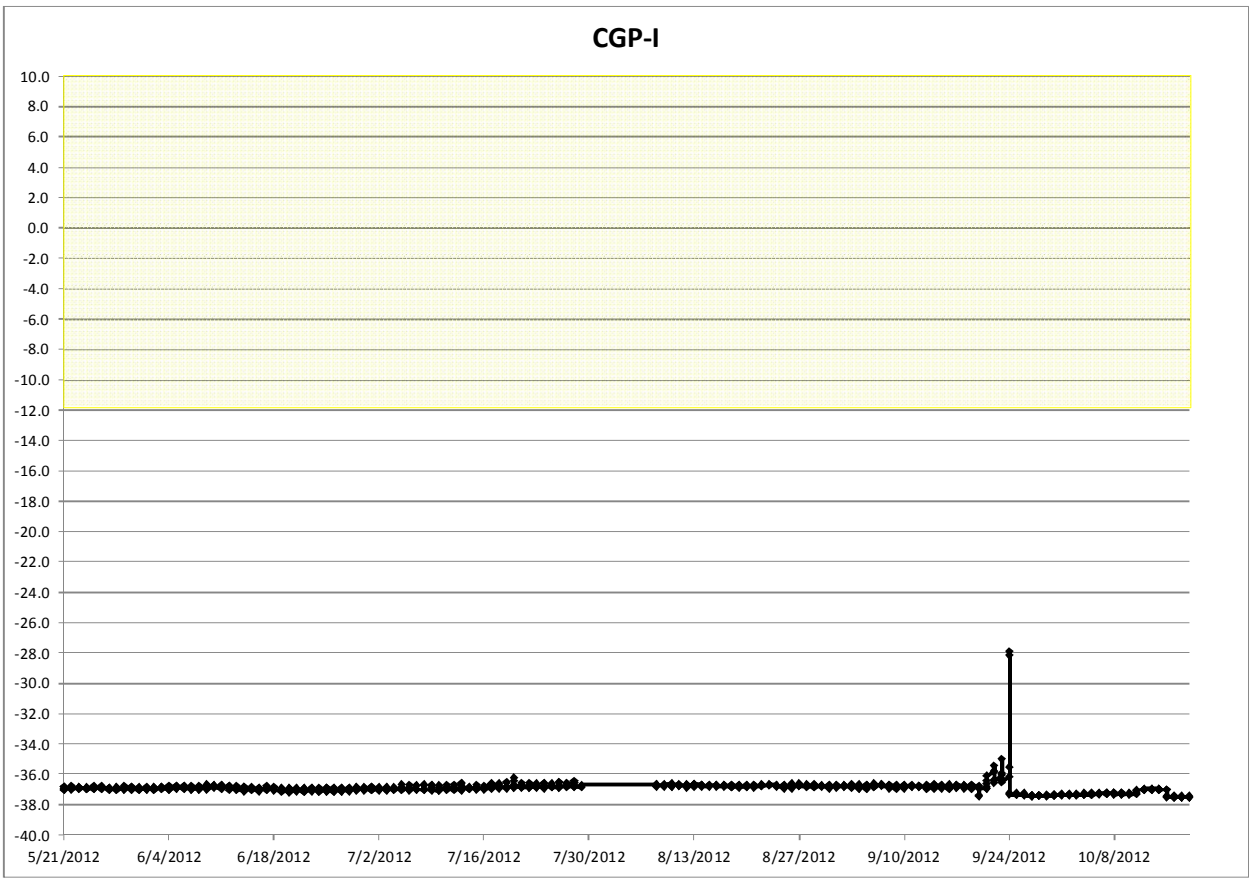



**Fig. D8**. *Well Plot I*

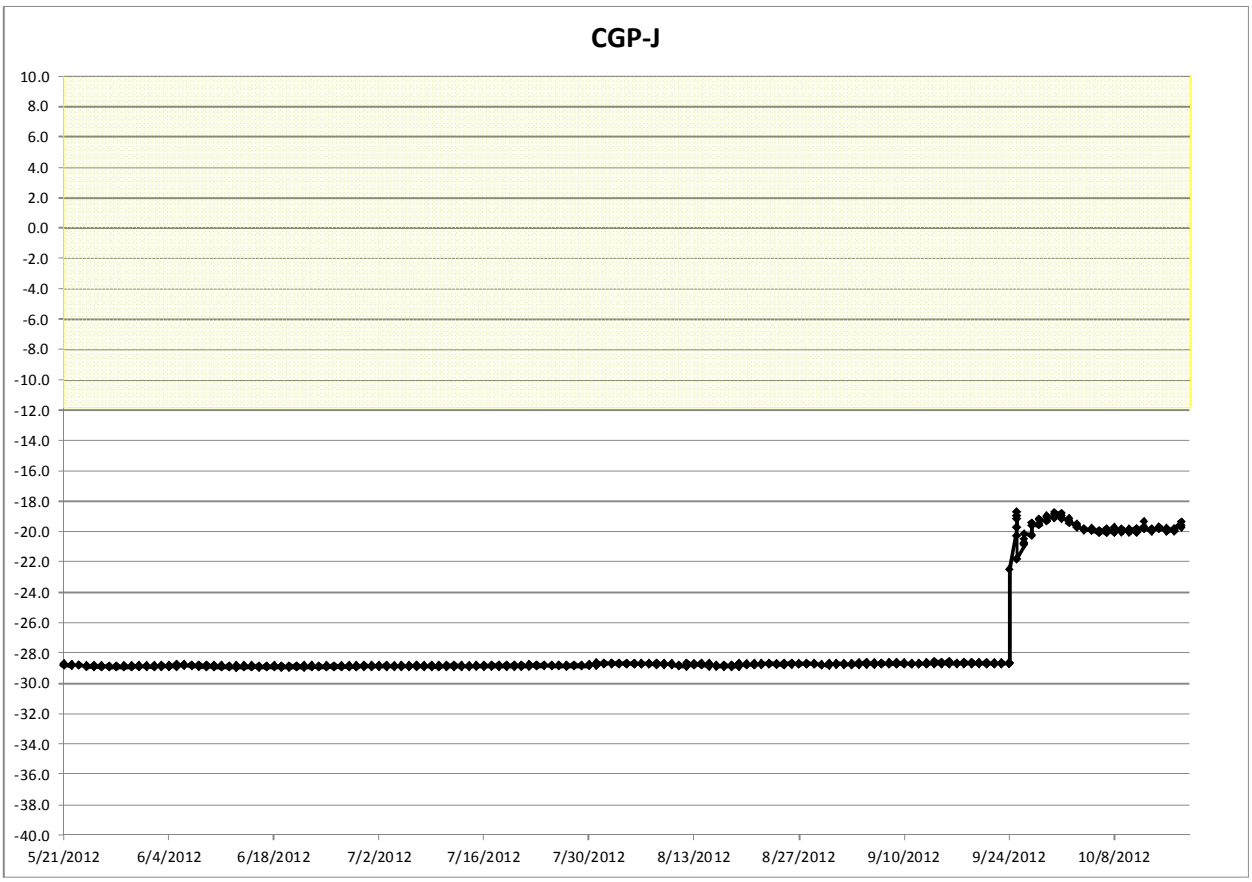



**Fig. D9**. *Well Plot J*

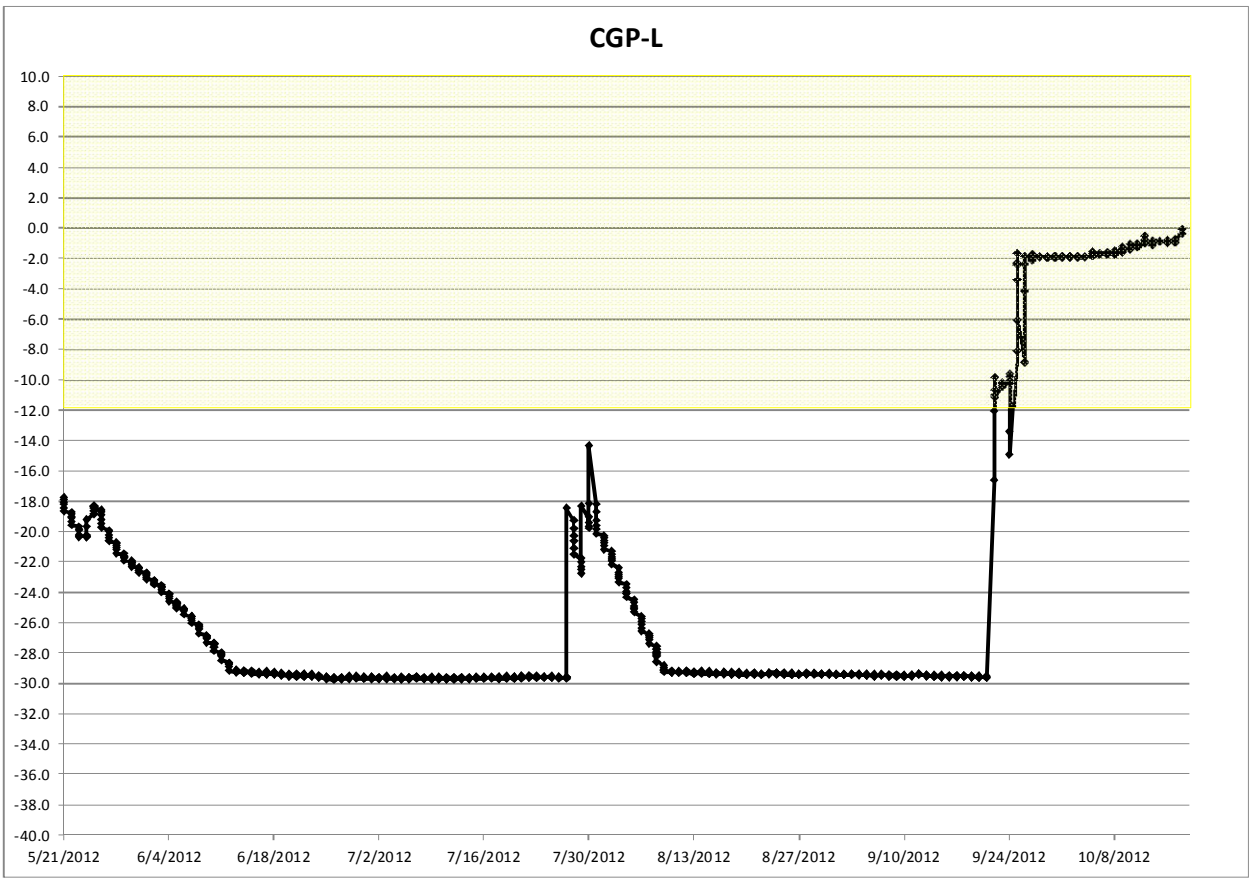



**Fig. D10**. *Well Plot L*

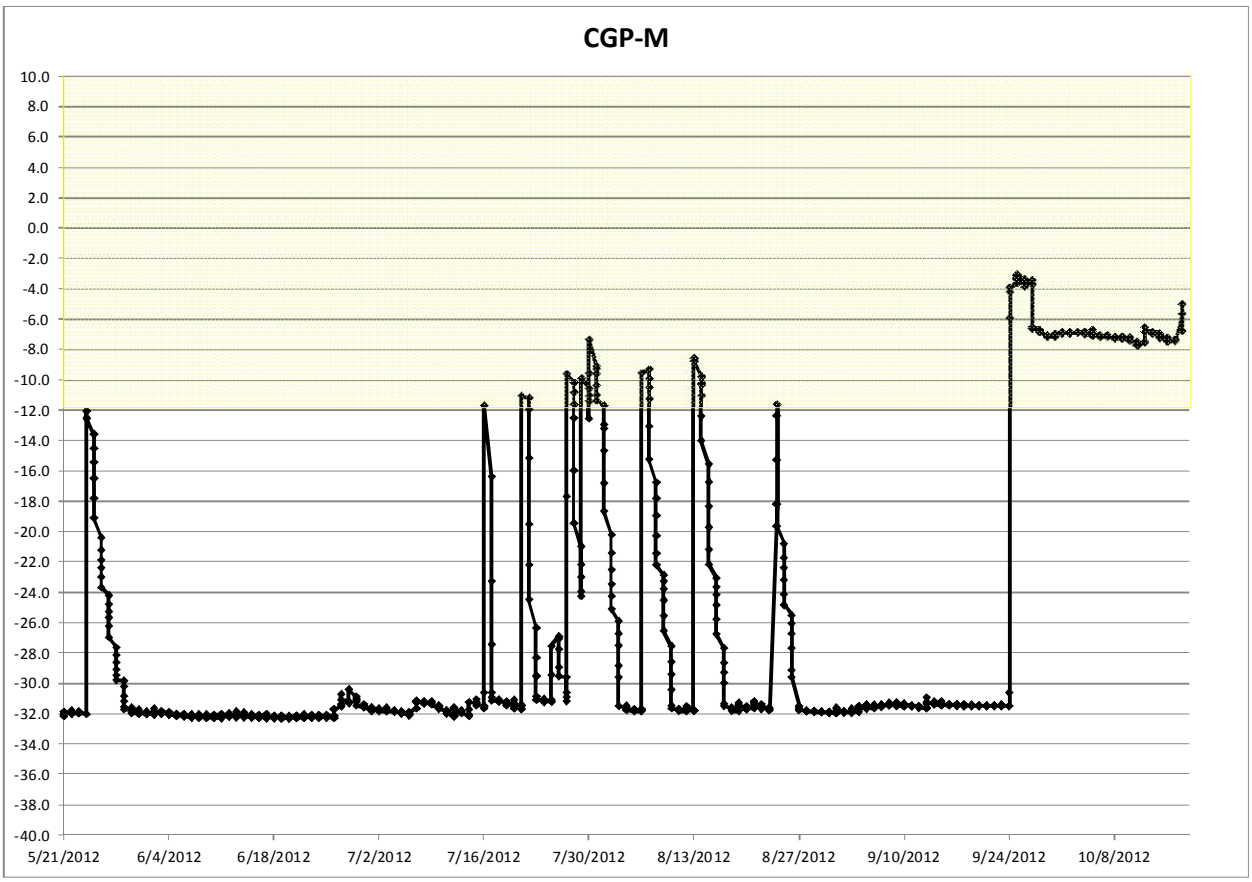



**Fig. D11**. *Well Plot M*

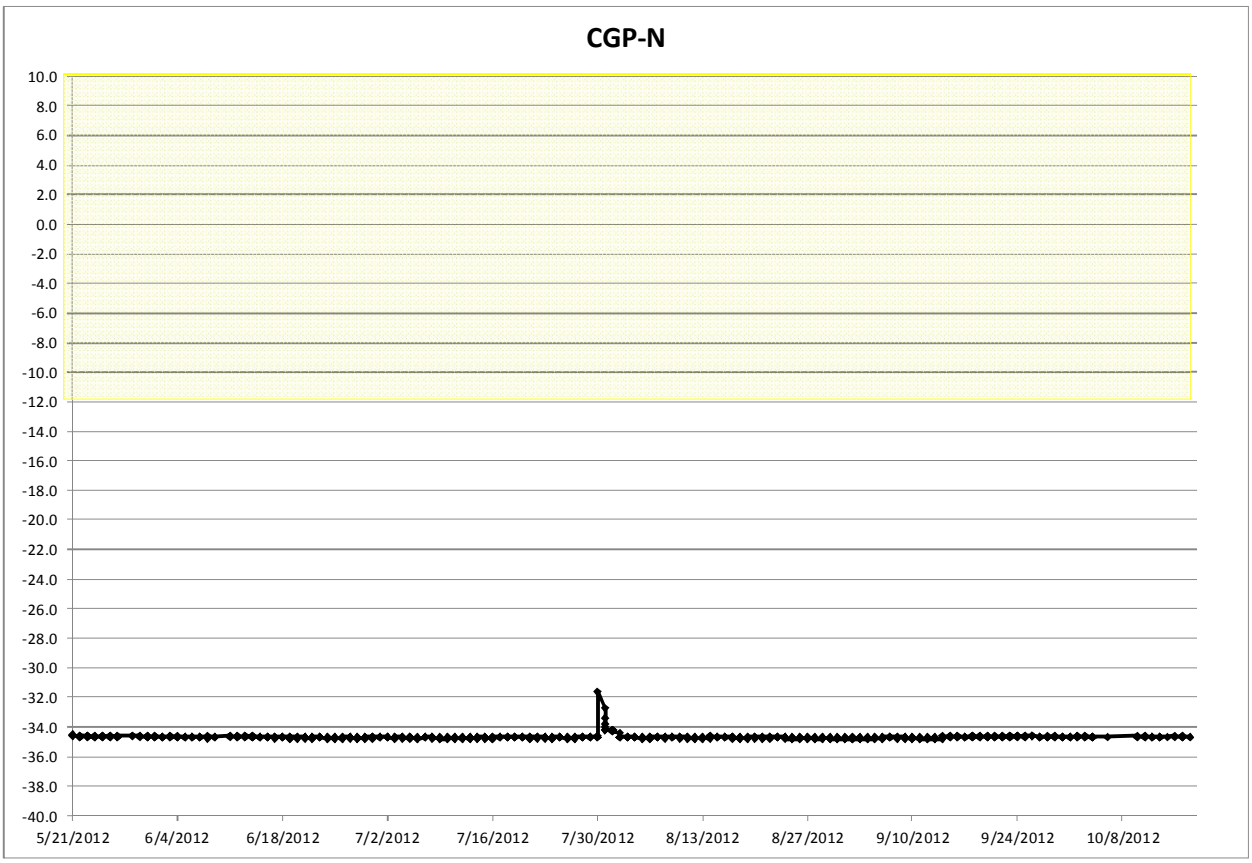
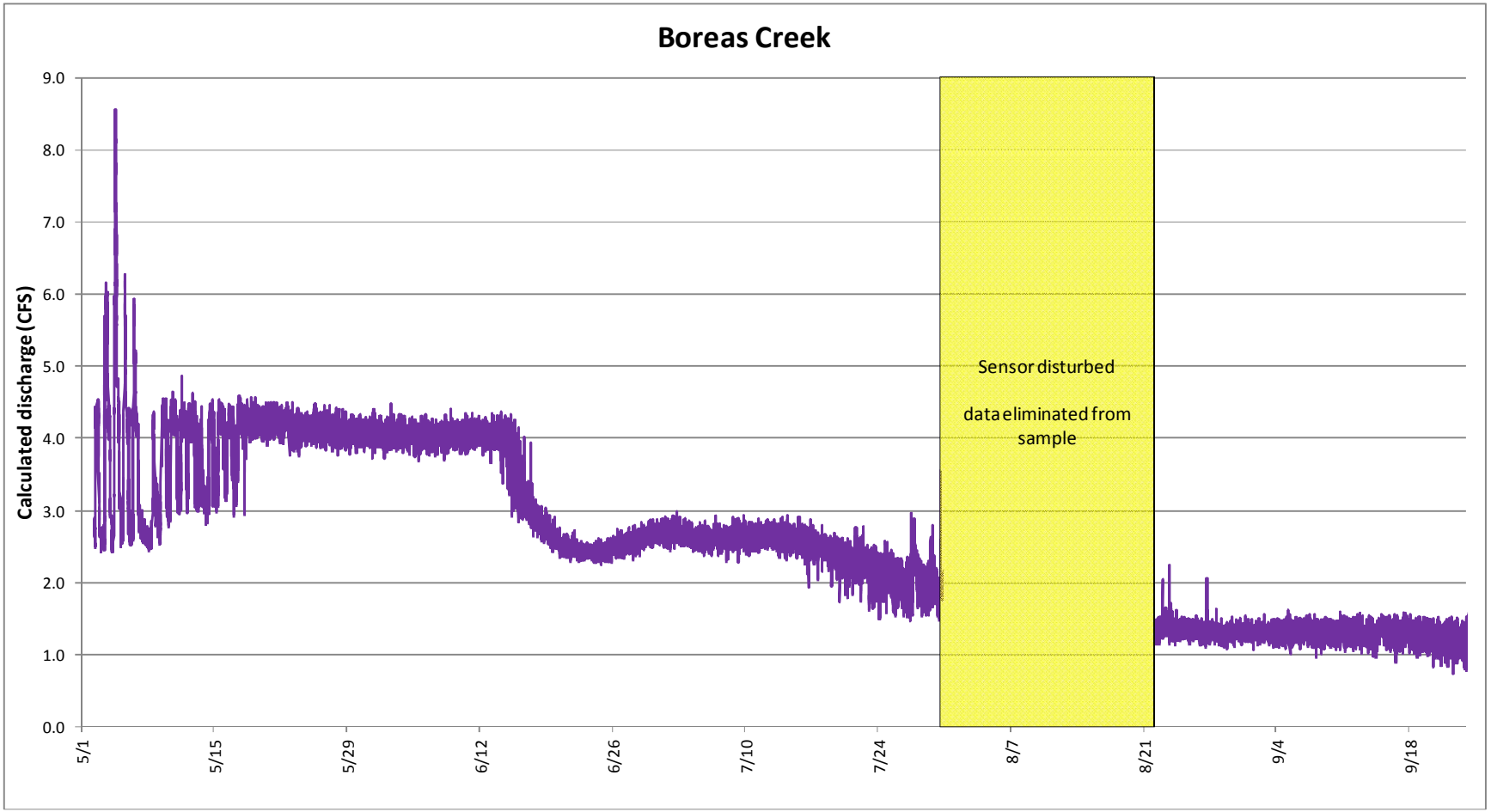



**Fig. D12**. *Well Plot N*

# APPENDIX E: BOREAS CREEK DISCHARGE (STREAMFLOW)

**Fig. E1.** *Calculated streamflow discharge (CFS) in the Boreas Creek Culvert, where it enters CGP.*



# APPENDIX F: SOIL PROFILES

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-A | Analyst | Mark Beardsley |

| Site description | Slope below Ski Hill Road fill, up-gradient from ponds. |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| O Hydric - wetland (existing or relic) | | |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| X Not hydric | | |

Notes: The profile is indicative of a hydric soil that became buried or is impacted by drying. The deep organic layers would qualify the profile as hydric if they were closer to the surface. The upper 25 cm may be mineralized peat or recent fill.

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-8 | loam | org. content < 5% | 10YR 4/3 | | | |
| 10 | | | | | | | |
| 15 | 8-25 | clay loam | wood and fibers presnt | 10YR 4/3 | 1 | 5YR 5/8 | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | 25-35 | organic | fibric peat | 10YR 2/1 | 3-5 | 5YR 5/8 | These two layers qualify as a histic epipedon (A2) or black histic (A3) but it is unusual that they are buried under mineral soil. |
| 35 | | | | | | | |
| 40 | 35-48 | organic | fibric peat | 10YR 2/1 or darker | 5 | 5YR 5/8 | |
| 45 | | | | | | | |
| 50 | 48-52 | silt loam | | 10YR 3/4 | | | |
| 55 | 52-58+ | loam | | 10YR 2/1 | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-B | Analyst | Mark Beardsley |

| Site description | The plot is in the center of the spreader pond, which is now filled with sediment and dry. |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| O Hydric - wetland (existing or relic) | | |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| X Not hydric | | |

Notes: The profile is consistent with a recently buried hydric soil, but it is resently not a hydric soil type.

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-4 | silty loam | | 2.5Y 4/3 | | | |
| 10 | 4-10 | sand | | 2.5Y 5/4 | | | |
| 15 | 10-18 | sandy loam | | 2.5Y 3/3 | 10 | 7.5YR 5/8 | |
| 20 | | | | | | | |
| 25 | 18-34 | silty clay loam | | 10YR 3/3 | 20 | 7.5YR 5/6 and 7.5YR 5/8 | color influenced by redox |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | 34-51 | sand | | 2.5Y 4/4 | 10 | 7.5YR 5/6 | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | 51-62+ | organic | | 10YR 2/1 | | | this layer appears to be a buried histosol |
| 60 | | | | | | | |

**Fig. F1**. *Soil Profiles at plots A and B*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-C | Analyst | Mark Beardsley |

| Site description | Center of dry pond |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| O Hydric - wetland (existing or relic) | | |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| X Not hydric | | |

Notes: The profile does not meet critera for hydric soil by any of the indicators, but there is apparently a buried histosol.

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-5 | silty loam | | 2.5Y 3/3 | 10 | 5YR 5/6 | |
| 10 | 5-14 | organic | fibric peat | 10YR 2/2 | 10 | 5YR 5/8 | |
| 15 | | | | | | | |
| 20 | 14-23 | silty clay loam | | 10YR 3/3 | 20 | 2.5YR 5/6 | |
| 25 | | | | | | | |
| 30 | 23-34 | sand and small gravel | | 10YR 4/4 | 10 | 5YR 5/8 | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | 34-52+ | organic | fibric peat | 10YR 2/1 | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-D | Analyst | Mark Beardsley |

| Site description | Center of dry pond |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A1 | possible histosol underneath clay |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | A2 | Histic epipedon |
| O Not hydric | | |

Notes: There is a deep peat layer that likely makes upo more than 40 cm if the upper 80 cm which would qualify as a histosol.

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-9 | silty clay loam | | 7.5YR 2.5/2 | | | |
| 10 | | | | | | | |
| 15 | 9-27 | clay | | 2.5Y 4/3 | 20 | 7.5YR 5/6 | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | 27-60+ | organic | fibric and woody peat | 7.5YR 2.5/2 | | | histosol or histic epipedon |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F2**. *Soil Profiles at plots C and D*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-E | Analyst | Mark Beardsley |

| Site description | old spill way channel |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A3 | black histic |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | A11 | depleted below dark surface |
| O Not hydric | | |

Notes: hydric, depleted matrix

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-9 | sand | | 10YR 4/4 | | | |
| 10 | | | | | | | |
| 15 | 9-29 | organic | fibric peat | 10YR 2/1 | 10 | 5YR 5/8 | dark surface |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | 29-42 | sandy clay | | 2.5Y 5/2 | 20 | 5YR 5/8 | depleted matrix |
| 40 | | | | | | | |
| 45 | 42-48+ | sandy clay loam | | 10YR 4/1 | 20 | 5YR 5/8 | depleted matrix |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-F | Analyst | Mark Beardsley |

| Site description | sloped willow community area, groundwater area |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A1 | histosol |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: histosol

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-10 | loam | 20% organic | 10YR 2/1 | | | |
| 10 | | | | | | | |
| 15 | 11-45+ | organic | fibric peat | 10YR 2/1 | | | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F3**. *Soil Profiles at plots E and F*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-G | Analyst | Mark Beardsley |

| Site description | On upper edge of a dried pond bottom, adjacent to very recent gravel deposit. |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | F8 | redox depression |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: The profile is consistent with a recently buried hydric soil (redox below dark surface at >18 cm). The profile meets criteria for F8 (redox depression) given its depressional location and presence of seasonal hydrology.

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-12 | silty clay loam | 10-15% organic fibers | 7.5YR 2.5/2 | | | |
| 10 | | | | | | | |
| 15 | 12-18 | sand | 20% gravel | 7.5YR 3/2 | | | |
| 20 | 18-34 | organic | fibric peat | 10YR 2/1 | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | 34-40+ | clay | 5% gravel | 2.5Y 5/2 | 10 | 5YR 5/8 | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-H | Analyst | Mark Beardsley |

| Site description | Bottom of an old pond that is now breached, area recently innundated by overflow from Boreas Creek |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | F6 | redox dark surface |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | F8 | redox depression |
| O Not hydric | | |

Notes: Hydrology present, redox dark surface present, also redox depression

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-20 | silty loam | | 2.5Y 3/2 | 5-10 | 2.5YR 3/4 | redox dark surface |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | 20-34 | sand | | 10YR 4/4 and 10YR 4/6 | | | |
| 30 | | | | | | | |
| 35 | 34-43+ | gravel | mucky | 10YR 2/1 | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F4**. *Soil Profiles at plots G and H*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-I | Analyst | Mark Beardsley |

| Site description | Within a pond (bed) that is now dry |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A11 | depleted below dark surface |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: hydric, depleted below dark surface

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-5 | silty loam | 5-10% organic | 7.5YR 2.5/2 | | | dark surface |
| 10 | 5-17 | silty clay loam | 20% organic (wood) | 7.5YR 3/2 | 10 | 5YR 5/6 | dark surface |
| 15 | | | | | | | |
| 20 | 17-45 | silty clay loam | 10% organic (wood) | 10YR 4/2 | 15 | 2.5YR 4/6 | depleted |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | 45-50+ | gravel and cobble | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-J | Analyst | Mark Beardsley |

| Site description | slope on the side of the gulch, not associated with a pond, presumed groundwater influence. |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A3 | Black histic |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: hydric, black histic

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-34 | organic | fibric peat 15% wood | 10YR 2/1 | | | Black histic |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | 34-55+ | loam | | 10YR 2/1 | 2-5% redox channels | 5YR 5/6 | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F5**. *Soil Profiles at plots I and J*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-K | Analyst | Mark Beardsley |

| Site description | bed of dry pond |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A2 | histic epipedon |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | F8 | redox depression |
| O Not hydric | | |

Notes: histic epipedon

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-6 | silty loam | | 10YR 3/2 | 5 | 5YR 5/8 | |
| 10 | 6-13 | silty clay loam | 15% organic | 10YR 3/2 | 2-5 | 5YR 5/8 | |
| 15 | | | | | | | |
| 20 | 13-26 | organic | fibric peat | 10YR 3/1 | 5-10 | 5YR 5/8 | |
| 25 | | | | | | | |
| 30 | 26-31 | clay | 20% organic | 10YR 4/2 | 20 | 5YR 4/6 | |
| 35 | | | | | | | |
| 40 | 31-50+ | organic | fibric and woody peat | 10YR 2/1 | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-L | Analyst | Mark Beardsley |

| Site description | back side of a very old beaver dam |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | F6 | redox dark surface |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: hydric, redox dark surface

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | | | | | | | |
| 10 | | | | | | | |
| 15 | 0-29 | loam | | 10YR 2/1 or darker | 2 | 5YR 4/6 | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | 29-40+ | organic | fibric peat | 10YR 2/2 | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F6**. *Soil Profiles at plots K and L*

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-M | Analyst | Mark Beardsley |

| Site description | upper edge of the recently-dried seahorse pond |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | A2 | histic epipedon |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | | |
| O Not hydric | | |

Notes: histic epipedon

**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | organic | fibric peat | | 10YR 2/1 | 2 | | histic epipedon |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | sandy loam | fragmental | | 2.5Y 4/2 | 10 | | depleted |
| 45 | clay | 20% organic | 10YR 2/1 | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

| Site | Cucumber Gulch Preserve | Sample date | 7/31/2012 |
|---|---|---|---|
| Point ID | CGP-N | Analyst | Mark Beardsley |

| Site description | in willow community just up-gradient from a very old dam |
|---|---|

| Hydric and wetland status (based on indicators) | Relevant indicators | |
|---|---|---|
| X Hydric - wetland (existing or relic) | F3 | depleted matrix (shallow) |
| O Hydric - artificial (artificial hydrology) | | |
| O Borderline/questionable (see notes) | F8 | redox depression |
| O Not hydric | | |

Notes: Extremely high redox concentrations.

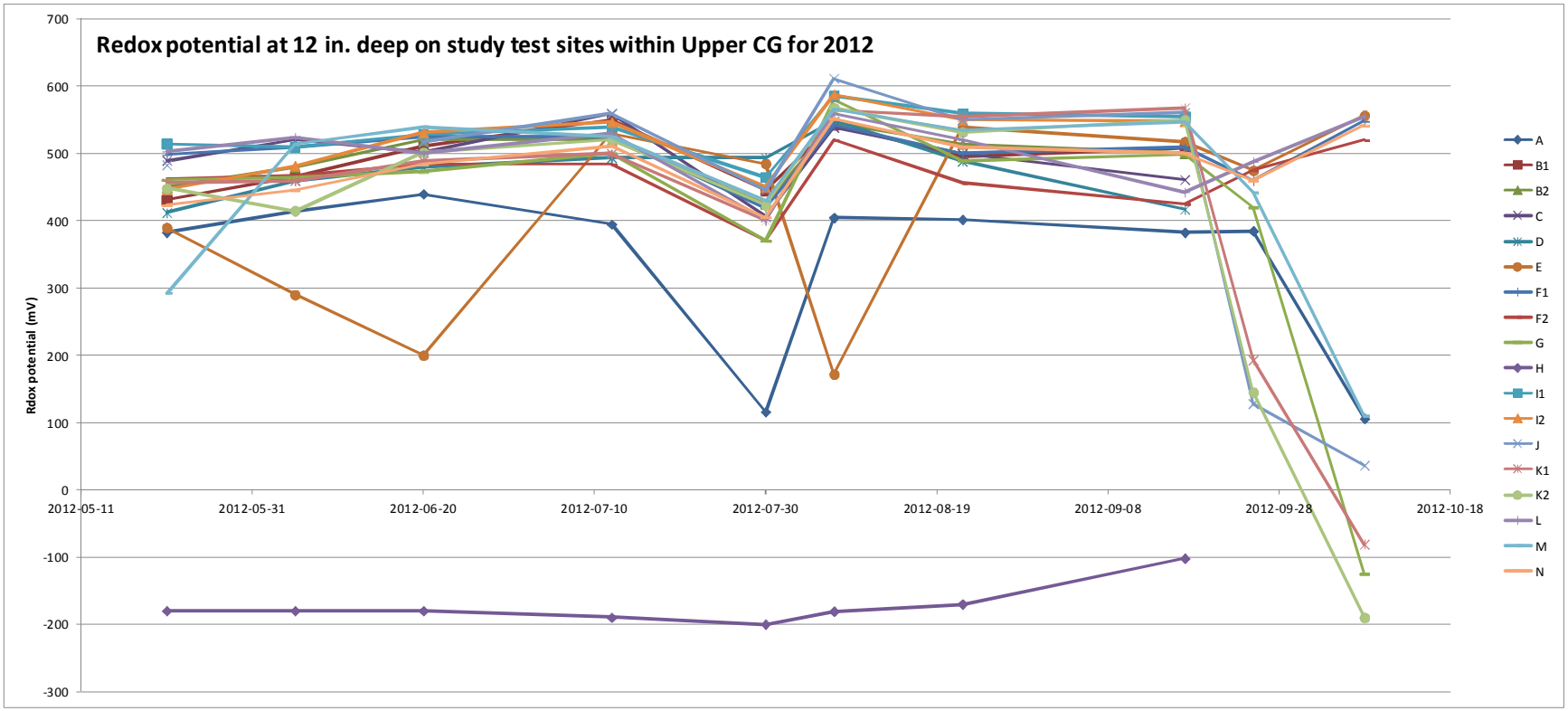
**Soil profile**

| ruler (cm) | horizon (cm) | texture | modifier | matrix color | redox features % | redox features color | notes |
|---|---|---|---|---|---|---|---|
| 5 | 0-10 | silt loam | 20% organic | 2.5Y 4/2 | 25 | 7.5YR 5/8 | depleted matrix |
| 10 | | | | | | | |
| 15 | 10-22 | silt loam | 10% organic | 2.5Y 4/2 | 40 | 7.5YR 5/8 | depleted matrix |
| 20 | | | | | | | |
| 25 | 22-30 | silt loam | 10% organic | 2.5Y 4/2 | 40 | 7.5YR 5/8 | depleted matrix |
| 30 | | | | | | | |
| 35 | 30-40+ | silt loam | charcoal ? | 10YR 2/1 | 10 | 2.5YR 3/6 | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

**Fig. F7**. *Soil Profiles at plots M and N*

# APPENDIX G: REDOX POTENTIAL

**Fig. G1.** *Measured soil redox potential at 12" depth on test sites in Upper CG. Only site H had a pattern of redox potential typical of wetland hydric soils.*



# APPENDIX H: PLANT SPECIES COMPOSITION

| Species | Indicator Status | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bare | NA | 0.1 | 5 | 20 | 25 | 15 | 10 | 4 | 0.1 | 20 | 4 | 0.1 | 40 | 4 | 2 |
| Litter | NA | 25 | 30 | 15 | 20 | 15 | 1 | 2 | 3 | 4 | 35 | 10 | 12 | 3 | 20 |
| *Achillea millefolium* | FACU | | | 1 | | 0.1 | | 3 | 2 | 0.1 | 0.1 | 1 | 1 | | 2 |
| *Aconitum columbianum* | FACW | | | | | 2 | 3 | | | | | | | 2 | |
| *Agrostis scabra* | FAC | | | | | 2 | | 20 | 5 | | | | 25 | | |
| *Alopecurus aequalis* | OBL | | 3 | | | 7 | 2 | | | 2 | 2 | 2 | 4 | | 0.1 |
| *Alopecurus pratensis* | FAC | | | 2 | | | | 1 | | | | 1 | | | |
| *Arabis glabra* | UPL | | | | | | | | | | | | | | 0.1 |
| *Aster foliaceus* | FACU | | | | | | 1 | | | | | | | | 5 |
| *Bromopsis ciliata* | FAC | | | | 55 | | | 3 | | | 2 | 6 | | 15 | 20 |
| *Carex aquatilis* | OBL | | 1 | 1 | 1 | 15 | 3 | 6 | 45 | 15 | 3 | 12 | 1 | | 2 |
| *Carex microptera* | FACU | | 20 | 9 | 8 | 2 | | 25 | 4 | 0.1 | 10 | 25 | | 3 | 2 |
| *Carex nebrascensis* | OBL | | | | | | | | | | | | | | |
| *Carex simulata* | OBL | | 5 | 0.1 | | | | | | 2 | | 1 | | | |
| *Carex utriculata* | OBL | | 7 | | | 3 | 0.1 | 1 | 20 | 1 | | 1 | 2 | | 1 |
| *Castilleja sulphurea* | FACW | | | 1 | | | | 0.1 | 1 | | | | | | |
| *Chamerion angustifolium* | FACU | | | | | 1 | 1 | | | | 0.1 | | | 0.1 | 1 |
| *Cirsium arvense* | FAC | 2 | | | 2 | | | | | | 1 | | | | |
| *Conioselinum scopulorum* | FACW | | | | | | 0.1 | | | | | | | | |
| *Deschampsia cespitosa* | FACW | | 5 | 10 | | 2 | | 2 | | 2 | | | | | |
| *Descurania incana* | FACU | | | | | | 0.1 | | | 0.1 | 2 | | | | |
| *Elymus repens* | FAC | | | | 11 | | | | | 8 | 15 | 5 | | | |
| *Epilobium lactiflorum* | FACW | | | | | 0.1 | 0.1 | 0.1 | 0.1 | | | | 1 | | |
| *Equisetum arvense* | FAC | | 1 | 1 | | 1 | | 2 | 1 | | | | | | |
| *Fragaria vesca* | FACU | | | | 0.1 | 0.1 | | | | 1 | 0.1 | | 1 | | 3 |
| *Galium septentrionale* | FACU | | | | | | | | | | | 2 | | | |
| *Geranium richardsonii* | FAC | | | | | | | | | | | | | | 0.1 |
| *Geum macrophyllum* | FAC | | | 2 | | 2 | 0.1 | 3 | 2 | 1 | 1 | 7 | 7 | 1 | 1 |
| *Geum triflorum* | FACU | | | | | | | 0.1 | | 1 | 2 | | | | |
| *Glyceria borealis* | OBL | | | | | | | | | | | 1 | | | |

| Species | Indicator Status | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Heracleum sphondylium* | FAC | | | | | 4 | 15 | 0.1 | 3 | | | | | 35 | 5 |
| *Juncus balticus* | FACW | | 3 | 1 | 0.1 | | | | | | | | | | |
| *Linaria vulgaris* | UPL | | | | | 0.1 | | | | 25 | 5 | | | | |
| *Lonicera involucrata* | FAC | | | | | | 1 | | | | | | | | |
| *Mertensia ciliata* | FACW | 7 | | | | 4 | 4 | | | 3 | 3 | | 0.1 | 1 | 4 |
| *Pedicularis groenlandica* | OBL | | | | | | | 0.1 | | | | | | | |
| *Phalaris arundinacea* | FACW | | | 1 | | | 2 | 2 | 15 | | 6 | 10 | | | |
| *Phleum pratense* | FAC | | 3 | 3 | | 0.1 | | | | 2 | 4 | | | | |
| *Poa compressa* | FACU | 2 | 5 | 5 | | 3 | | | | | 2 | 2 | | | |
| *Poa pratensis* | FAC | 2 | 2 | 10 | 30 | 3 | | | | 3 | | 5 | | 3 | 5 |
| *Polemonium caeruleum* | FACW | | | | | | 0.1 | | 4 | | | | | | |
| *Salix geyeriana* | FACW | | | | | | | | 4 | 1 | | | | | |
| *Salix monticola* | OBL | | | 1 | | 3 | 1 | 2 | | | 3 | 1 | | | 15 |
| *Salix planifolia* | OBL | 8 | 5 | 2 | 3 | 25 | 70 | 5 | 1 | 1 | 5 | 10 | 0.1 | 45 | 18 |
| *Sedum rhodanthum* | FACW | | | | | | | 1 | | | | | | | |
| *Symphytum officinale* | UPL | | | | | | | | | | 0.1 | | | | |
| *Taraxacum officinale* | FACU | 2 | 0.1 | 1 | 0.1 | 2 | 0.1 | 1 | 3 | 5 | 1 | 0.1 | 5 | 0.1 | 5 |
| *Trifolium fragiferum* | FACU | | | 5 | | 2 | | 25 | 0.1 | | | | 1 | | 3 |
| *Trifolium pratense* | FACU | | | 1 | | | | 2 | | | | | | | |
| *Trifolium repens* | FAC | | 3 | 3 | | | | | | | | | | | |
| *Tripleurospermum perforatum* | FACU | | 2 | 1 | | 2 | | 1 | 0.1 | 2 | 0.1 | | | | |
| *Trisetum spicatum* | UPL | | | | | | | | | 1 | | | | | |
| *Veronica nutans* | FACW | | | | | | | | | | | | | | 0.1 |

# Forest Management Prescription

For the Town of Breckenridge's MBJ & Wedge Parcels

*Summit County, Colorado* *December 2012*

***Prepared for:***

**Town of Breckenridge**
Open Space & Trails Department
150 Ski Hill Road
Breckenridge, CO 80424

Rocky Mountain
Ecological Services, Inc.
PO Box 833 Glenwood Springs CO 81602 | 970-309-4454
epetterson@rmes-inc.com | www.rmes-inc.com

# ROCKY MOUNTAIN ECOLOGICAL SERVICES, INC.

NEPA••WILDLIFE••VEGETATION••WILDFIRE MITIGATION••WETLANDS••PLANNING


December 26, 2012

Scott Reid
Town of Breckenridge
150 Ski Hill Road
Breckenridge, CO 80424

**RE: MBJ & Wedge Parcels Forest Management Plan**

Dear Mr. Reid

This memo describes some of the planning efforts and objectives for forest management of the MBJ & Wedge Parcels in the Cucumber Gulch Preserve area. I have provided some background information here, to illustrate some of the forest management and forest ecology parameters we would be working with.

**Background**

Mountain pine beetle (*Dendroctonus ponderosae*) ("MPB") infestation and mortality of lodgepole pine (*Pinus contorta*) trees was a widespread and major impact to the forested ecosystems in Summit County. The MBJ & Wedge Parcels adjacent to the Cucumber Gulch Preserve were assessed in October of 2012 in order to ascertain the best forest treatment scenarios. Some general considerations which were reviewed during the decision-making process when determining how to manage these parcels included the following:

1. Desired Forest Conditions (goals or guiding management strategies)
    a. Keep the forest "as is", or
    b. Emphasis on natural processes
    c. Realize that the stand is relatively unhealthy, with many MPB-killed trees, so implement management for "future forest"
    d. Reduce wildfire concerns through strategic fuel breaks, etc.
    e. Improve habitats for a variety of species
2. Limitations to Managing MPB Mortality
    a. Access
    b. Wetlands
    c. Terrain
        i. Are roads nearby (to haul in equipment and haul out logs)
            a. Terrain
            b. Resource Concerns
                1. Important wildlife habitat
                2. Wetlands
                3. Erosive soils
                4. Visual impacts


PO BOX 833 • GLENWOOD SPRINGS • COLORADO • 81602
PHONE/FAX: (970) 945-9558 • CELL: (970) 309-4454
EMAIL: EPETTERSON@RMES-INC.COM • WWW.RMES-INC.COM

## CURRENT CONDITIONS

The adjacent Cucumber Gulch Wildlife Preserve is unique in that so much information and research on the site has been conducted. Information on understory diversity, wildlife use patterns, wetlands and hydrology, and guiding management principals are incorporated by reference in the Cucumber Gulch Resource Protection & Recreation Plan (1998) Cucumber Gulch Recreation Master Plan (2003), and in the Cucumber Gulch Annual Conservation Monitoring Report (2005).

Existing access road from Ski Hill Road

Cucumber Gulch is a north to northeast facing drainage and associated wetlands complex that lies just northwest of the Town of Breckenridge's central business district. The area lies just below Breckenridge Ski Area's Peak 7 and Peak 8 base areas and is bordered to the south, west and much of the north by adjacent existing or planned residential development along Ski Hill Road. To the northeast, Cucumber Gulch joins with Cucumber Creek.

Cucumber Gulch is valued for its summer and winter recreation opportunities and as an ecologically significant habitat area for sensitive wildlife and vegetation. Four major vegetation habitat types are located within Cucumber Gulch. These include lodgepole pine forest, mixed conifer forest, mixed conifer forest/shrubland, and shrublands. Detailed descriptions of the forest types appear below in this document.

### Lodgepole Pine Forests

As much of the area around Breckenridge was historically logged during the mining era, subsequent lodgepole pine regeneration has produced fairly homogenous lodgepole pine stands across the valley. Average diameter breast height (dbh) of trees is 5 to 10 inches. Understory regeneration of seedling conifers in these lodgepole pine stands in general is marginal and patchy. Understory conifer species (where they do occur) generally consists of lodgepole pine, Engelmann spruce, or subalpine fir. Grasses and forb composition in the understory is dependant upon the individual stand location (slope and aspect). For instance, stands on hillsides where drainage is more rapid and sites are drier, understory cover and composition is more limited. Stands located on benches and on shallow slopes where topography is fairly

Typical stand conditions

level and moisture retention is higher and has higher forb cover.

Aside from mountain pine beetle, overall forest health in these lodgepole pine stands is moderate at this time, but species and age class diversity is very low. Mountain pine beetle produced moderate mortality across most of these stands. Overall stand mortality in the mature lodgepole pine stands appeared to be around 40%, with smaller isolated stands of small diameter lodgepole, and mixed coniferous understory species persisting. At this time, significant numbers of trees are beginning to lose branches, and trees will begin to be blown down by high wind events. Within another 5 to 10 years, most of the trees will have fallen down. In areas with stand thinning from MPB mitigation activities (i.e. dead lodgepole pine trees are being actively removed), blowdown may occur. Lodgepole pine is such a shallow-rooted species that opening up the canopy more than 30% in any one area will likely produce some level of blowdown of residual trees. The level of blowdown will be determined by slope, aspect, level of thinning or stand perforation, and soil conditions.

Management options in these stands are dependant upon access, slope, and stocking of MPB prone lodgepole pine.

**Mixed Conifer Stands**

"Mixed conifer" stands refer to the tree composition within the stand, in that these stands have a mixture of Engelmann spruce, subalpine fir, and lodgepole pine. Within a mixed conifer stand, there can be variations on species dominance and size classes. For example, some areas of a stand will have almost total dominance by spruce and fir trees, with only a marginal lodgepole pine component, while other areas may have lodgepole pine as the overstory dominant species with spruce and fir seedlings/saplings forming a strong under-story component.

These stands provide the highest wildlife benefit, due to the physical structure of the trees and the increase in understory plant diversity. Mixed conifer stands usually have higher understory plant species diversity and structure, which also makes these stands more suitable for use by wildlife species such as red-backed vole, pine marten, and other various microtine rodents and various bird species.

MPB activity within these stands is limited to the lodgepole pine component of the stand. Therefore, within mixed conifer stands with a high lodgepole pine component, there will be more of a visible and structural impact from MPB mortality, and in stands with little to no lodgepole component, the impacts of MPB were negligible.

Mixed conifer stands offer more management options, as these stands often have multiple stories, and can be thinned and treated to remove MPB trees. As many of these stands have spruce and fir seedlings and saplings, summertime logging to remove MPB infested or dead lodgepole pine would result in crushing or damaging understory trees. Winter logging offers more protection for understory spruce and fir, and even lodgepole pine seedlings. This is from deep snows protecting the small trees, as most logging equipment will "float" on snow, and trees being removed with heavy equipment will generally stay on top of snow.

The project area generally does not support much mixed conifer stand types, but this stand type can be encouraged be leaving spruce-fir trees found within the unit.

**Town Guidance**

The Cucumber Gulch Preserve Management Plan (2012) provides a framework for preserving the natural qualities of the drainage while providing for appropriate recreational experiences. This plan documents important aspects of all the resources within Cucumber Gulch including wetlands, uplands,

wildlife, and water quality. It also provides detailed recommendations for land and resource protection.

The Cucumber Gulch Preserve Management Plan provides direction for the protection of the important and unique natural and recreation resources of Cucumber Gulch, requiring development standards and establishing best management practices. It also provides guidance for forest management in adjacent parcels (including MBJ and Wedge parcels) for improving forest health and for the benefit of wildlife.

The management direction for the Cucumber Gulch area are:

- Protect sensitive natural areas of the Preserve that may need additional conservation.
- Provide for limited, managed public access to the Gulch.
- Monitor the resource values of the Preserve to determine if the management objectives are being achieved.

In summary, the goals and objectives of the Cucumber Gulch Wildlife Preserve prioritize the protection of the hydrology and wetland function of the area. This is in order to protect the unique fen wetlands and habitats. Further, guidance documents emphasize managing recreational activities in such a way as to minimize disturbances to wildlife and wildlife habitats. The guidance documents also emphasize the protection of the natural processes of the area, and protection of native vegetation and wildlife processes (feeding, reproduction, shelter and dispersal). These goals and objectives were considered in the development of the following recommendations, even though the treatment area is not entirely within the Cucumber Gulch Preserve.

## Prescription

Town of Breckenridge staff requested an evaluation of the feasibility and appropriateness of stand health improvements in the MBJ and Wedge Parcels. This section details the recommended approach for the Town to consider.

An area around a recent patch cut was traversed, and deemed suitable for MPB salvage operations and forest health improvement. The terrain was relatively level, which would help minimize ground disturbance. The area was also free of wetlands or saturated areas that could be adversely impacted by ground-based logging operations. There is already an existing two-track roadway to the area, which would allow for easy vehicle and equipment access with no additional road-building needed. There is already a log-landing area in the parcel, which would allow for trees to be skidded and processed in the parcel without impacting other areas or stands of trees. The stands in the proposed treatment area are dominated by lodgepole pine, with a few scattered spruce and fir trees, and there was evidence of remnant aspen.

Based on these factors, removal of MPB-killed lodgepole pine, and salvage of recently blown-down trees would be appropriate treatment. Additionally, removal of taller lodgepole pine and ground scarification would help improve stand diversity. Taller lodgepole pines are recommended for removal as they would likely blow-down if the stand is opened more than 30%, and they were left standing. Any spruce or subalpine fir trees should be retained.

Treatments should occur during the late summer or fall months, after the ground has dried, and nesting bird activities have ceased. Also, ground scarification through the use of equipment will help with lodgepole pine seedling establishment and aspen suckering.

Access- Access would be on Ski Hill Road, and the existing access route. It is anticipated that approximately 4 to 8 semi-truck loads of logs may be hauled off the site.

Treatment- Approximately 5.4 acres of forests may see some level of salvage and thinning for stand health improvement, and increased stand diversity for wildlife habitat improvement. All MPB-killed trees should be removed, and approximately 30% of the taller lodgepole pine should be removed. If more than 30% of lodgepole pine removal occurs, then the Town should re-assess as to whether more intensive tree removal should occur in order to reduce the issue of blow-down and subsequent needs to blow-down mitigation.

Recently blown-down trees at eastern edge of unit should be assessed for removal, or some trees may also be left for small mammal and subnivean habitats

The site already has a recently used log-landing area, which should be used again, scarified and reclaimed using a native grass seed mix.

Smaller trees would be chipped on-site, or possibly piled for later burning. Larger trees, which are too crooked or have too many "defections" to be sold for lumber would be cut using a harvester, and piled in centrally located burn-piles. These piles would then be burned during the early winter by the contractor with coordination/cooperation of Red White & Blue Fire Protection District staff. Trees which are sound enough to be salvaged will be de-limbed on-site, and limbs and tree tops will also be piled in the "slash piles" to be burned in the winter. Sound logs would be skidded to the existing landing area, and would be loaded onto log-trucks to be hauled off.

At this time, stumps are planned to be left "as is", however all stumps should not be left taller than 6 inches. Some slash will be left on-site, and scattered and broken down to less than 6 inches in depth. Any significant slash piles should be re-piled and burned, but some piles for small-mammal habitat may be beneficial.

Skid trails will be ripped (with bulldozer-rippers), and track-packed perpendicularly to the fall of the slope. Any earthmoving done for temporary access to the treatment area will be reclaimed to pre-disturbance topography. A native grass seed mix and certified wee-free straw mulch will be applied in areas where significant disturbance has occurred. Further re-seeding will occur in the fall or in the spring as needed.

Burn pile areas will have topsoils scraped and stockpiled for reclamation prior to piling for burning, but the re-spreading of stockpiled topsoils may need to occur next summer, depending on snowfall

during the winter. This is to avoid long-lasting "burn scars" from heat-damage to soils during burning of slash piles.

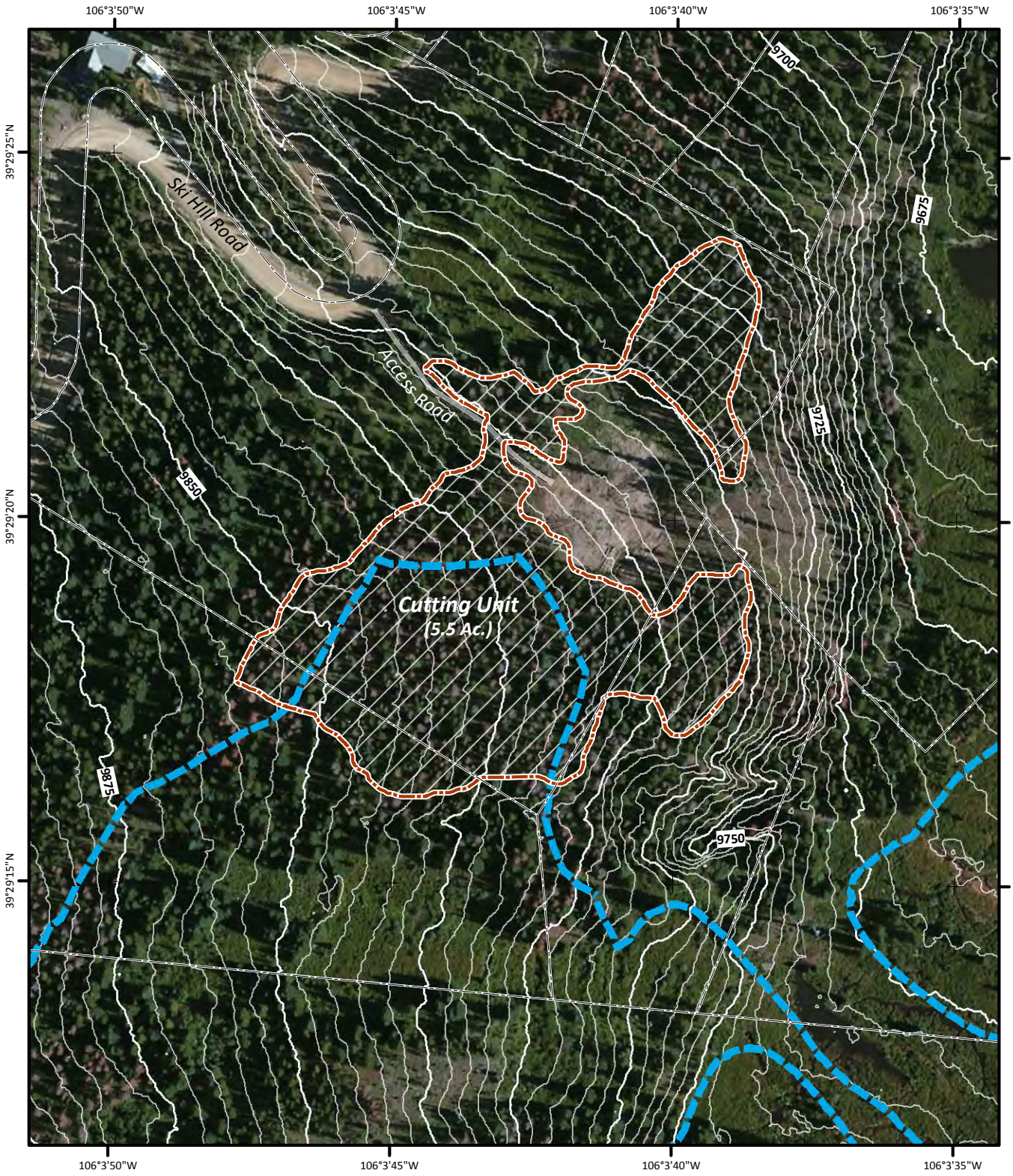
Timing- treatment is scheduled to begin in late August, through the fall and early winter months, and should take about 2 to 3 weeks. Burning of slash piles would occur when there is at least 3 inches of snow on the ground, and could occur in mid- to late October (depending on snowfall).

Post-Treatment Needs- Post-treatment, Town of Breckenridge staff would do a site-inspection prior to releasing the contractor. Any additional requirements will be outlined at such time to meet the requests of the Town of Breckenridge staff. Additional "beautification" may include stump grinding, additional slash treatment etc., but would likely be outside of the scope of this contract with the logging company.

Thank you for the opportunity to work with the Town of Breckenridge on this project, please feel free to email if you have any questions.

Sincerely,

Eric Petterson
Rocky Mountain Ecological Services, Inc.




Cutting Unit

Parcel Boundary

Temporary Access Road

Nordic Ski Trail

# Town of Breckenridge

## MBJ & Wedge Parcels Forest Management Project

0 100 200 400 Feet

1 inch = 200 feet

Date: January 2013

**Disclaimer:**

*This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. The maps are distributed "AS-*

**MEMORANDUM**

**TO:** BOSAC and Town Council
**FROM:** Tony Overlock, Lead Trails Technician
Scott Reid, Open Space and Trails Planner
**DATE:** January 11, 2013
**SUBJECT:** 2012 Trail Crew Field Season Report

The Town of Breckenridge Trail Crew is a four person seasonal crew whose main responsibilities include:

1) Designing and maintaining natural surface trails;
2) Protecting historical sites and sensitive habitats; and
3) Overseeing the Friends of Breckenridge Trails volunteer program.

In its eighth year, the trail crew accomplished a wide variety of projects while partnering with multiple volunteers and organizations. With every project, the crew's goal is to produce a product that is sustainably designed, is constructed with the highest quality workmanship, and provides an enjoyable experience for trail users.

**2012 Highlights**

- **Total Volunteers and Hours:** 311 volunteers donated a total of 1680 hours, with a value of almost **$36,600** to the Town.
- **Constructed** over **4.6 miles** of new trail.
- **Extensive trail maintenance** to over 41 miles of natural surface trails.

**Project Details**

- **Barney Ford:** In conjunction with Higher Ground Earthworks, constructed and improved over 1,500 feet of trail.
- **V3:** In conjunction with Higher Ground Earthworks, constructed 4,000 feet of new trail, 60 foot boardwalk and a 40 foot log bridge.
- **Galena Ditch:** Constructed 12,000 feet of new trail, 4 boardwalks totaling a160 feet, in cooperation with Volunteers for Outdoor Colorado (VOC), Summit County Government, and Rocky Mountain Youth Corps.
- **Cucumber Gulch Preserve**
    - Volunteers targeted the removal of false chamomile, coast tarweed, and Canada thistle.
    - Installed 150 feet of buck-and-rail fencing

    - Reconstructed 120 foot turnpike
    - Continued traffic use studies
- **Reforestation Efforts:** In cooperation with Bristlecone Foundation's Legacy Forest Program and Make a Difference Day, volunteers planted 300 trees and spread 300 pounds of native grass seed on recently cleared Town open space parcels.
- **Betty's Trail:** Constructed 4,000 feet of new trail and 50 feet of boardwalk in collaboration with Friends of Breckenridge Trail volunteers and Rocky Mountain Youth Corps.
- **Moonstone Trail:** In conjunction with Higher Ground Earthworks, constructed and improved over 2,000 feet of trail.
- **Slalom:** In cooperation with Friends of Breckenridge Trails and Higher Ground Earthworks, constructed 4,000 feet of new trail.
- **Pump Track:** Reconstructed and expanded track size by 125 feet.

The 2012 season was by the far the crew's most productive season to date. The four experienced crew members efficiently accomplished tasks and led volunteers. This improved the overall user experience by creating a wide variety of trails, enhanced signage and protecting and preserving the Town's open space. In addition, volunteer numbers increased to 10 people per event which produced a donated value of over $36,000 to the Town trails and open space program.

Staff is looking forward to the 2013 field season with emphasis on diversifying trail use close to town, overseeing Side Door, Moonstone/Barney Ford and Toxic Forest projects, increasing volunteer numbers, and continuing work on the Town's extensive trail network.

## 2012 Cucumber Gulch Preserve Trail Traffic Counts

**Summary**
Since 2009, The Town of Breckenridge Open Space Division staff has conducted trail traffic counts between July 9th and September 30th at the five designated entrances to the Cucumber Gulch Preserve. The data collected is used to track visitor use patterns and help inform management of the Preserve.

**Methods**
All data was gathered with The Trail Master Data Collector™, an infrared beam-based trail counter. Trail users who break the infrared beam by passing between the transmitter and receiver are recorded as an 'event'. An event does not differentiate between users, their travel direction, or whether they traveled out-and-back on a given trail. The data are therefore limited in their scope, but indicate general trail use trends.

The data collectors were installed at designated Cucumber Gulch Preserve entrances.
1) Toad Alley: the fenced entrance across from the Peaks Trailhead parking area
2) Overlook: the large rock overlook near the gondola mid-station
3) White Wolf: the terminus of Highwood Circle in the White Wolf subdivision
4) Sauna: east of the Nordic Center
5) Training Area: west of the Nordic Center, between the lodge and training area

Data outliers due to equipment malfunction or data tampering were omitted from the analysis.

**Results**
Total 2012 traffic counts for a given location are displayed in Table 1, along with largest daily count, and average per-day counts.

**Table 1. Total Traffic Counts for 2012:** July 9th –September 30th

| Site Name | Number of Counts | Largest daily count | Average Events per Day |
|---|---|---|---|
| Toad Alley | 8710 | 240 on 8/4 | 104 |
| Overlook | 6007 | 179 on 7/19 | 72 |
| White Wolf | 2150 | 87 on 8/18 | 51 |
| Sauna | 1999 | 138 on 8/29 | 47 |
| Training Area | 1883 | 92 on 8/15 | 44 |

**Table 2: Comparison of Average Daily Count:** July 9th –September 30th

| Year | Toad Alley | Overlook | White Wolf | Sauna | Training Area: |
|---|---|---|---|---|---|
| **2012** | 104 | 72 | 51 | 47 | 44 |
| **2011** | 81 | 63 | 63 | 44 | 38 |
| **2010** | 79 | 48 | 30 | 32 | 30 |
| **2009** | 68 | 50 | 23 | 57 | 31 |

**Conclusions:**

- Toad Alley/Peaks TH and the Overlooks are the most heavily accessed entrances.
- Nordic Center entrances are the least used.
- The number of events has increased each of the past four years at the Toad Alley and Overlook sites.
- Toad Alley entrance saw the largest rise in daily counts.
- Most events occur between 10:00 am and 3:00 pm.
- Events increase during weekends and decrease during weekdays.

| Project | Proposed Completion Date | Priority | Notes |
|---|---|---|---|
| Assist USFS and Summit County Government with Travel Management Plan implementation | Summer 2013 | High | GH Oversight meeting scheduled for 1/23 |
| Perform overall trail system evaluation and repair | Summer 2013 | High | Task list drafted in autumn 2012. |
| Implement forest health management strategies as prioritized in the forest health plan | Summer 2013 | High | Focus will be on newly acquired open space parcels. |
| Work with County on forest health/fire mitigation projects on joint properties | Summer 2013 | High | Golden Horseshoe area is the target. |
| Implement Cucumber Gulch Preserve monitoring program. | Winter 2013 | High | Draft research plan being developed. |
| Construct Golden Horseshoe non motorized routes as outlined State Trails grant. | Summer 2013 | High | Sidedoor, Toxic Forest and Great Flume are primary goals. |
| Complete several new trail construction efforts | Spring 2013 | High | See list below. |
| Revise and reprint trail map | Spring 2013 | High | Revision process has begun. |
| Evaluate and improve signs and sign posts throughout Town system | Summer 2013 | High | Improve existing trail posts. Address new trail signage needs. |
| Pursue options for relocating the Peaks trailhead | Unknown | High | Property acquisiiton failed; will work with USFS on next steps. |
| Evaluate proposed new Golden Horseshoe routes and initiate NEPA for new alignments. | Spring 2013 | Medium | Dependant on USFS NEPA analysis priorities. |
| Initiate NEPA for existing routes outside of Town boundaries. | 2012 | Medium | e.g. Aspen Alley, Wheeler Trail. |
| Organize, catalogue and electonically document property files | Winter 2013 | Medium | Ongoing process. |
| Develop wildlife management plan in conjunction with TOB Sustainability Plan | Autumn 2013 | Medium | Work together with County, CDOW and TOB PD. |
| Assist Summit County with the proposed Swan River Restoration plan. | Autumn 2013 | Medium | |
| Organize and refine trail counts and system-wide monitoring program | Summer 2013 | Medium | Staff has begun this research design. |
| Complete cabin clean up and management, particulalrly in the Golden Horseshoe | Summer 2013 | Medium | Sites cleaned up; need signage installation and management |
| Manage OS&T-related social media and website | Spring 2013 | Low | Distribute information on acquisitions, trail projects, trail conditions, etc. |
| Develop management plans for open space parcels deemed appropriate | Unknown | Low | |

**Proposed Trails projects include:** Shekel Trail, Lower Flume minor realignment, Klack Placer Trail, Claimjumper Trail, Toxic Forest realignment, Upper Flume boardwalks, Great Flume drainage, Side Door realignment, Western Sky Trail, B-Line completion, Barney Ford/Moonstone extension