TOWN OF BRECKENRIDGE
OPEN SPACE ADVISORY COMMISSION
Monday, February 17, 2014
2nd floor, Stephen C. West Ice Arena
189 Boreas Pass Road
Please note temporary meeting location

5:30 Call to Order, Roll Call

5:35 Discussion/approval of Minutes – January 20, 2014 ***8***

5:40 Discussion/approval of Agenda

5:45 Public Comment (Non-Agenda Items)

5:50 Staff Summary ***2***
- North Main Street Park Preliminary Plan ***11***
- 2014 VOC Project Date
- Wellington Trail Project
- Trails Open House

5:55 Open Space ***2***
- USFS Referral: Breckenridge Ski Resort Master Development Plan Addendum ***12***
- Breckenridge Nordic Center Facility Use Request ***20***
- Forest Health Report ***21***
- 2013 Cucumber Gulch Preserve Research ***26, 102, 115***

7:30 Executive Session

8:00 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: February 17, 2014 Meeting

Staff Summary

North Main Street Park Preliminary Plan

At its February 25th meeting, Town Council is scheduled to review preliminary designs for the North Main Street Park (see attached draft site plan). The park will be located south of the Local Market and is intended to serve as a gathering space, a visual draw from Main Street to the Carter Museum, and relief from development on Main Street. If BOSAC members are interested in further reviewing the draft plans, please plan to attend the February 25th work session.

2014 VOC Project Date

Good news! The Upper Turk's Trail project has been selected as a "30th Anniversary Commemorative Project" by Volunteers for Outdoor Colorado (VOC) in 2014. The project will complete a long-envisioned connection between the existing Turk's Trail and Sallie Barber Road alignments, and will be used to highlight VOC's 30th anniversary of statewide volunteer efforts. Please plan on attending at least one day of the volunteer weekend: July 26-27, 2014. More information is available on the VOC website.

Wellington Trail Project

Staff has requested a license agreement from Xcel/Public Service Company of Colorado (PSCo) to cross a portion of the substation property on Wellington Road and construct a new singletrack trail from the junction of Wellington Road/Campion Trail to the beginning of the Wellington Trail, near the stables on the Stilson Lot. If approved by PSCo, the license agreement would allow staff to pursue construction of a trail to bypass a portion of Wellington Road, provide an interpretive opportunity for the Reliance Dredge site, and connect Town neighborhoods to the larger French Gulch trail network. Staff will update BOSAC regarding progress on this potential project.

Trails Open House

This year, staff will host a trails open house in conjunction with the May or June BOSAC meeting. The goal of the open house will be to share with the general public the trail projects that the Town and County have planned for the next few years, and to field any public questions or comments regarding trail priorities and goals. Staff will provide additional information to BOSAC as the meeting approaches. The timing of the open house just before the summer trail season will also provide an opportunity to educate the public on avoiding using trails before they have dried out.

Open Space

USFS Referral: Breckenridge Ski Resort Master Development Plan Addendum

Attached is a referral from the U.S. Forest Service (USFS) pertaining to the Breckenridge Ski Resort (BSR) Master Development Plan Addendum. The USFS is

seeking Town comments on the BSR proposal to increase on-mountain summer and winter amenities.

Based in part on the 2011 passage of the *Ski Area Recreational Opportunity Enhancement Act (SAROEA)*, BSR has proposed multiple new facilities on National Forest lands within the current ski area boundary. The intent of the SAROEA was to encourage additional year-round ski area facilities and provide more diverse recreational offerings on the National Forest. Accordingly, BSR has designed and proposed a wide-ranging addendum to their existing Master Development Plan to include: multiple zip lines and canopy tours, new and revised hiking/mountain biking trails, ropes courses, climbing walls, expanded Vista House and Peak 7 Hut, realigned upper Four O'clock Road, new observation deck, summer operation of the Independence, 6-Chair and Imperial Express, expanded off-highway vehicle tours, and associated revegetation efforts.

In general, BSR's proposal is consistent with the intent of the SAROEA. It is logical to focus summer visitation on the ski area, where the lifts and other infrastructure exist to accommodate high visitation levels. Directing more on-mountain summer use could also help reduce recreational pressure on Town-owned open space parcels such as Cucumber Gulch Preserve. However, the USFS seeks scoping comments from the Town, Summit County and other entities to evaluate BSR's expansive proposal. The primary intent of the scoping process is to identify all issues that should be addressed in the environmental review that will be conducted on the proposal. The Town will have another opportunity to comment on the proposal when an Environmental Impact Statement (EIS) is drafted for the proposal. Scoping comments will be discussed by Town Council at its March 11th work session and are due to the USFS by March 12th. Also, a public open house regarding the proposal is scheduled for March 5th between 4:30-6:30 at the Mountain Thunder Lodge (50 Mountain Thunder Drive).

To help frame the BOSAC discussion, staff offers the following points for consideration, drawn largely from previous Town Council/BOSAC comments regarding proposed ski area facility expansions:

- Surface drainage from Peak 8 into the existing Boreas Creek inlets and Upper Cucumber Gulch continues to be a high priority and keen concern for the Town. BSR is responsible for enhancing drainage and ski slope revegetation efforts in an effort to reduce sediment loads in Cucumber Gulch via the 60" culvert. The additional infrastructure included in this proposal underscores the need to install and effectively maintain sediment traps to reduce sediment transport. The revegetation element of the proposal is intriguing, but short on details.

- Recently, a draft base area master plan for the portions of the ski area **not** on National Forest was submitted for Town staff consideration. The Town seeks a defined base area plan to better define all of BSR's seasonal activities, including the summer fun park improvements and the winter activities such as lift maze configurations, entertainment stage location, and skier circulation. The addition

of more on-mountain infrastructure proposed by BSR underscores the need for an integrated base area plan that provides clear direction for the future management of crowd control, special event management, and infrastructure needs.

- Extending the Peaks Trail through the ski area to bypass Cucumber Gulch and the pedestrian-only Peak 8 base area would provide a better trail connection to Town from this popular trail. As part of the Town Council approval to operate the Breckconnect gondola during summer months, BSR agreed to pursue the NEPA analysis and construction of this route. The Peaks Trail extension warrants evaluation via this NEPA process, even though portions of the proposed trail would occur outside of the ski area permit boundary.

- Visual impacts of the various proposed zip lines and observation towers should be thoroughly evaluated to determine whether the associated infrastructure will affect the Breckenridge's backdrop. Protecting scenic vistas and discouraging ridgeline development is an important Town planning and open space goal.

- Part of the intent of the SAROEA is to focus recreational facilities on already-impacted areas with existing infrastructure. More locally, BSR committed to limiting on-mountain facilities north of the Peak 7 terrain as part of the recent Peak 6 expansion. The proposed Ore Bucket canopy tour could violate both of these goals, given the new roads, cables, and towers necessary to complete the proposed canopy tour. Additional impacts to forest cover and wildlife habitat could be limited if the proposed recreational facilities were focused on the interior portion of the ski area rather than the periphery.

- The proposed goal to realign upper Four O'clock Road to make it more sustainable is laudable, but highly constrained topographically. In general, the Town supports on-mountain drainage improvements on all current and future trails, roads, and ski runs that 1) promote water infiltration and vegetative regeneration, and 2) limit soil transport and 'flashy' surface flows.

- The proposal to increase on-mountain off-highway vehicle tours could negatively impact the area wildlife habitat and the 'forest experience' sought by many summer visitors.

- As a gold-level Bicycle Friendly Community, the Town of Breckenridge generally supports improvements to the existing mountain biking and hiking trail network on the Breckenridge Ski Area. Expansion of the trail system, with a goal of providing lift-served access to intermediate flow trails would significantly improve the Breckenridge's overall bike-related offerings.

Staff requests BOSAC review the attached proposal, map, and discussion points above, and then answer the questions below. Staff will include BOSAC's suggestions and comments in the March 11th Town Council discussion.

1. ***Does BOSAC have any clarifying questions regarding the BSR proposal and map?***
2. ***Does BOSAC have any additions or edits to the discussion points above?***

Breckenridge Nordic Center Facility Use Request

At its February 11th meeting, Town Council considered the attached request from Gene and Therese Dayton of the Breckenridge Nordic Center. The proposal seeks approval to host weddings and other events in the new Nordic Center building. In their review of the proposal, Town Council requested BOSAC review and comment on the potential for impacts to Cucumber Gulch Preserve by guests of the proposed Nordic Center events.

Specifically, Council was concerned about use of the trails during the seasonal closure, noise impacts to area neighbors and wildlife, and parking overflow on to local Town streets. Council suggested approving a temporary, one-year permit of Nordic Center events with conditions put in place to protect Cucumber Gulch Preserve. The Council also suggested placing fencing between the lodge and Gulch, along with educational signage, to dissuade event attendees from walking into the Gulch. Council requested BOSAC direction, including conditions to be placed on the Nordic Center operations to protect Cucumber Gulch Preserve.

In summary, the Cucumber Gulch Preserve Management Plan provides the following policy direction regarding special events and uses in Cucumber Gulch Preserve:

- An 8-person group size limit exists within the Preserve boundaries.
- Despite the previous popularity of special events utilizing the Preserve, Town Council directed staff to discontinue special events in the Preserve outside of the Nordic ski season. The prohibition of special events is based the intensity and concentrated special event activity levels compared with typical recreational use and the limited habitat impacts during winter months.
- Summer trails use in Cucumber is limited until after July 1st annually, and more typically, until the first Monday following July 4th. This date was established to keep visitors out the Preserve during the incubation period and the beginning of the chick-rearing stage for many of the migratory birds that utilize Cucumber Gulch Preserve as habitat. The first Monday following July 4th date was set to specifically avoid the high volume of trail use that characterizes the Independence Day weekend and recent research that shows displacement of some wildlife species by high volumes of trail use.

With the 2012 passage of the Cucumber Gulch Preserve Management Plan, Town Council reaffirmed the policies above and also retained the discretion to overrule them.

Regarding the attached request from the Daytons, staff includes the following additional discussion points:

- If special events are approved in the Nordic facility, a clear policy regarding special event access to Cucumber Gulch is needed.

- Outdoor party tent rentals for food preparation, serving, or guest seating could significantly increase guest service capacity and, correspondingly, noise impacts to area wildlife.
- Outdoor lighting, music, or amplifiers could also affect wildlife habitat in the adjacent Preserve.
- The potential exists for guests and partygoers to leave the Nordic facility and wander into the Preserve, either on-trail or off-trail. Restricting this public access will be at least as challenging as implementing seasonal trail closures in the Preserve.

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

1. ***Does BOSAC have any clarifying questions regarding the Nordic Center proposal?***
2. ***If Council approves the special event permit, does BOSAC have any consensus recommendations for conditions of approval?***

Forest Health Report

Attached is a memo outlining the Town open space and joint Town/Summit County forest health efforts in the Upper Blue basin since 2008? The goal of the memo is to provide an overall report on the efforts undertaken to address forest-related issues on open space lands and adjacent properties.

Please review the attached memo and answer the following questions:

1. ***Does BOSAC have any clarifying questions regarding the attached forest health memo?***
2. ***Does BOSAC have any recommendations to improve or edit the memo prior to presentation to Town Council?***

2013 Cucumber Gulch Preserve Research

Attached, please find three documents related to the 2013 research in Cucumber Gulch Preserve. The documents include the following:

1. EcoMetrics' water quality report on the Upper Cucumber Gulch Preserve wetland restoration efforts. This report provides a broad overview of the projects and their successes, and fulfills the reporting requirements for the Army Corps of Engineers' permit. In summary, the restoration efforts have so far been highly successful in attaining the water quality and habitat value improvements sought.
2. Claffey Environmental Consulting, Inc's status report on the 2014 Boreas Creek channel restoration effort. This report summarizes the channel restoration project goals and successes, and fulfills the Army Corps of Engineers' permit reporting requirements. In general, the channel restoration project achieved the stated goals and will be monitored during spring runoff to evaluate its long-term stability and success.
3. Dr. Christy Carello's annual Cucumber monitoring report, which summarizes the results of the various wildlife-related research elements commissioned by BOSAC and Town Council. Generally, on-the-ground management and

research efforts in Cucumber Gulch Preserve continue to achieve stated objectives, and can be improved to better protect sensitive wildlife habitat and species. Specific recommendations for improvement include:

a. Bolster seasonal closures to improve visitor compliance and prevent access to the Preserve during sensitive wildlife periods.
b. Expand the docent program to increase a management presence, particularly during the spring seasonal closure.
c. Further restrict access to the Peak 7 underpass to prevent human encroachment in this sensitive wildlife corridor.
d. Continue and expand noxious weed eradication efforts in the Preserve.
e. Encourage the planting of native vegetation in surrounding development.
f. Minimize disruptive human activities during sensitive wildlife periods.

Staff requests BOSAC review the attached reports and answer the following questions regarding 2013 Cucumber Gulch Preserve research. At its March meeting, BOSAC will evaluate and recommend the 2014 Cucumber Gulch research priorities.

1. ***Does BOSAC have any questions or clarifications regarding the content of the reports?***
2. ***Does BOSAC have any direction for staff pertaining to the various research projects in the Preserve?***

Roll Call
Jeff Cospolich called the January 20, 2014 BOSAC meeting to order at 5:35 pm. Other BOSAC members present included Jeff Carlson, Jeffery Bergeron and Craig Campbell. Staff members present were Peter Grosshuesch, Scott Reid, Mark Truckey, and Chris Kulick. Jeff Zimmerman from the Breckenridge Ski Resort was also present.

Approval of Minutes
The minutes were approved as presented.

Public Comments
There were no public comments.

Staff Summary
The Ranch at Breckenridge Referral
At BOSAC and Town Council's direction, staff recently submitted comments to Summit County regarding the Ranch at Breckenridge development proposal. Since that time, Summit County planning staff has compiled referrals from multiple agencies and provided those comments to the applicant. Town staff also met with applicant and County representatives to clearly articulate the Town's expressed concerns. Staff will continue to communicate with the County staff and the applicant, and convey any pertinent decisions to BOSAC.

Mr. Cospolich - Can you explain how the referral process works? (Mr. Reid - It is a process through which different agencies or entities can comment on a proposal to a given agency. Typically, we respond to referrals from the Summit County Planning Department, the U.S. Forest Service and a few others on which we are referred. The referral process allows entities to solicit receive comments for consideration prior to the decision forum (e.g. Planning Commission). The comments can then be integrated with a response in the agency's staff report.)

USFS - Swan River Restoration and Colorado Chair Upgrade Referrals
Staff recently received referrals from the U.S. Forest Service regarding the Swan River Restoration project and the proposed upgrade of the Colorado Super Chair from a quad to a six-person chair. Jeff Zimmerman from the Breckenridge Ski Resort was in attendance to answer questions regarding the proposal.

The Town is a supporter and planning partner in the Swan River Restoration project, a portion of which was completed in 2013. The Colorado Super Chair upgrade is anticipated to retain the existing lift footprint, but some excavation and tree clearing will be required. As BOSAC has previously discussed, the Boreas Creek inlets beneath the Colorado Super Chair direct water to the 60-inch culvert that exits at the top of Upper Cucumber Gulch. Erosion control measures and monitoring will prevent additional sediment deposition in Cucumber Gulch. Also, staff continues to seek a base area plan from the ski area that better defines seasonal activities, including the summer fun park improvements, and the winter activities such as lift maze configurations, entertainment stage, circulation, etc. This lift upgrade referral is an opportune time for the ski area to complete a final base area plan.

Mr. Cospolich - How many trees will you have to cut? (Mr. Zimmerman - We will only cut trees if the Colorado Tramway Board requires it. We may have to replace the majority of the towers and footers to install the new lift.)

Mr. Cospolich - Any ideas for crowd control on the mountain since the installation of a six person chair will increase uphill capacity? (Mr. Zimmerman – Uphill capacity will increase from 2,800 to 3,400 an hour and we will continue manage skier traffic with the same methods we employ currently. We're confident that the increased downhill skier capacity can be effectively and safely managed.)

Mr. Campbell - Any plans for sediment mitigation with this project? (Mr. Zimmerman - Sediment mitigation will mainly comprise of reseeding and erosion control since the footprint of the footers is only 6x6. We will use a spider hoe and helicopters for removal and installation of the lift towers. We would like to reuse as much of the terminal concrete as possible. There will be no real changes in mountain drainage as part of this project.)

Mr. Campbell - What will happen with the old Colorado Chair? (Mr. Zimmerman - It may be scrapped or resold. The chairs are just a couple years old and will be repurposed at the Beaver Run Chair.)

Mr. Bergeron - How much helicopter traffic will be required for this project compared to Peak 6? (Mr. Zimmerman - Significantly less than Peak 6; all concrete will be poured over two days and towers installed over one day, at most ten days. Helicopter time is expensive it is in our best interest to minimize helicopter time with any project.)

Mr. Cospolich - Any plans for the replacement of 6 or C Chair? (Mr. Zimmerman – Most likely not anytime soon, but we do have approval from the Forest Service to replace those.)

Mr. Grosshuesch - Did you inspect the on-mountain detention ponds this summer to see how they were performing. (Mr. Zimmerman - We did not but plan to inspect them next year.)

Staff requested BOSAC provide any comments regarding these two referrals in advance of the February 5th comment deadline.

Cucumber Gulch Research
The 2013 Cucumber Gulch Preserve monitoring report will be presented to BOSAC at its February meeting. Next month's discussion will focus on the results of the 2013 monitoring program and the design of the 2014 monitoring program. Staff has solicited and received a proposal from Claffey Environmental to document and eradicate reed canary grass in Cucumber Gulch Preserve. Staff plans to evaluate the proposal and provide it to BOSAC at the February meeting.

Mountain Lion Press Release
Staff recently received a confirmed report of a mountain lion in the area of Cucumber Gulch. A recent press release communicated this information to the public. Staff is working to educate the Breckenridge Nordic Center staff about appropriate precautions in mountain lion territory, to post informational signs at area trail access points, and to offer a mountain lion safety presentation by the local Colorado Parks and Wildlife manager.

BOSAC Meeting Location
Due to the ongoing Town Hall remodel, BOSAC meetings for the next several months will be held upstairs at the Stephen C. West Ice Arena. Please plan to attend BOSAC meetings from February 2014 through July 2014 at the Stephen C. West Ice Arena.

Open Space
2014 State of the Open Space
Staff presented a revised, 2014 version of the State of the Open Space report. Staff updated several statistics in the report to reflect progress made over the past year.

Mr. Cospolich - What is the parcel just to the west of the North Gondola lot, I believe it is mislabeled as "school property". (Mr. Kulick - You are correct that is a wetland parcel and should be labeled "other". We will make that correction prior to releasing the report to the public.)

BOSAC was supportive of the State of the Open Space report and recommended distributing the report to a wider audience through contacting the local paper and the use of social media.

Indiana Gulch and Pennsylvania Gulch Trailheads
Staff was recently notified about access challenges at the Indiana Gulch Trailhead in Spruce Valley Ranch, within Town of Blue River jurisdiction. According to citizen complaints, cars parked at the Indiana Gulch Trailhead have received notices threatening towing if the vehicles are not removed from the site. At a recent Blue River Town Trustee meeting, several citizens commented on the trailhead issue. The trailhead is on private Spruce Valley Ranch homeowner's association property, and is not managed by the Town of Blue River. The Blue River Town Trustees agreed to evaluate the issue further and meet with Summit County and Spruce Valley Ranch representatives to seek potential solutions to this recreational access issue.

Also, as part of the Blue River Town Trustees' public hearing, access issues surrounding Pennsylvania Gulch were discussed. As BOSAC is aware, the Town and County jointly acquired the Royal Placer in 2010. The parcel is within Town of Blue River jurisdiction and use of the Pennsylvania Gulch Road is subject to the USFS Travel Management Plan, which prohibits winter motorized use. However, despite a USFS request to install a gate on the Royal Placer, any winter motorized closure on the public open space would have to be coordinated with the Town of Blue River.

Summit County staff is scheduled to meet with Town of Blue River elected officials to discuss both of these access-related issues.

Mr. Truckey - The HOA in general is not against recreational usage but a few individual homeowners have taken it upon themselves to discourage trail use.

Mr. Bergeron - Town of Blue River representatives do not want to enforce this closure and have been really sympathetic to the trail users.

Mr. Grosshuesch - In general, the Spruce Valley Ranch HOA representatives stated that they are not against the trailhead per se. They stated that they are concerned about dog waste, trash, fire equipment access and private property rights.

Mr. Campbell - When was the Travel Management Plan adopted? (Mr. Reid - 2010, with 15+ years of public process.)

Next Meeting
The next regularly scheduled meeting is on Monday, February 17, 2014, at the Stephen C. West Ice Arena (189 Boreas Pass Road).

Mr. Bergeron made a motion to adjourn the meeting, which was seconded by Mr. Carlson.

The meeting was adjourned at 7:24 p.m.

_____
Jeff Cospolich, Chair

WALK AT PROP. LINE

36.2'

SET 1' WITNESS CORNER

CHISELED X IN CONC. AT PROPERTY CORNER

3" STEEL PIPE INV. 56.0

STAIRS

ASPHALT PARKING

CURB AND GUTTER

CONCRETE

66.5

66.8

67.2

67.7

68.1

69.1

3' CONCRETE PAN

EDGE OF ASPHALT

PLANT

BOULDER AMPHITHEATER SEATING

OPTIONAL ARBOR OR SHADE SAIL

BIKE PARKING

CONCRETE WALK

PTARMIGAN

NATIVE GRASSES

PINK FENCE POST

BRIDGE

EWF

PIP

BENCH SEAT

SOD

ROCK PILE

PIP

PL

BEAR CUB

BENCH OR TABLE

BENCH OR TABLE

NATIVE GRASSES

STONE PAVERS

+ 9559.07

9559.55

SET 1' WITNESS CORNER

192

IRR

E

G

T

PHONE

3' CONCRETE PAN

File Code: 1950/2720
Date: February 4, 2014

Dear Interested Public:

Breckenridge Ski Resort (BSR) has submitted a proposal to the White River National Forest (WRNF) to pursue approval of proposed projects included in its 2013 Master Development Plan (MDP) Addendum. The WRNF has accepted this proposal and is preparing an Environmental Impact Statement (EIS) to analyze and disclose the potential environmental effects of implementing the projects.

All of the proposed projects are within BSR's existing Forest Service-administered Special Use Permit (SUP) boundary. The Proposed Action includes additions to the existing year-round recreational opportunities at BSR, including two zip lines, three canopy tours, two challenge courses, new and realigned hiking and mountain bike trails, off-highway vehicle tours, and additional lifts for scenic rides and activities access. The Proposed Action also includes improvements to the Vista Haus and Independence SuperChair summit sites, realignment of Four O'Clock Road, expansion of the Peak 7 Hut and deck, expansion of the Vista Haus deck, construction of a climbing wall at Vista Haus and a lookout tower on Peak 8, and summer restoration projects.

The project Purpose and Need and the Proposed Action are discussed in the following sections. At this time, I am soliciting comments from the public on this project. Details on how to comment are found at the conclusion of this scoping notice.

PURPOSE OF AND NEED FOR ACTION

Summer recreational opportunities have been offered at BSR since the 1970s. These opportunities are, and continue to be, important to BSR and its guests, in providing outdoor recreation activities in the National Forest in a comfortable setting. The current summer guest experience at BSR is primarily defined by more developed activities on private lands and dispersed activities on National Forest System (NFS) lands. Specific to the activities on NFS lands within the BSR SUP area, guests primarily participate in lift-served and non-lift-served hiking and mountain biking via the Colorado SuperChair and trails dispersed across Peaks 7, 8 and 9.

Through ongoing, year-round tourism growth, BSR is becoming a summer destination for guests primarily from the United States, and from Colorado in particular. In both winter and summer, BSR caters to a broad spectrum of guests of all ages, abilities, and experience with the outdoors. Since 2010 the Peak 8 Fun Park (located on private lands), which includes an alpine slide, a coaster, mini-golf, and other activities, has experienced approximately 18 percent annual growth in its summer activity usage. The proposed projects would complement these current activities by offering an even broader range of passive and active recreation opportunities in the Forest to engage visitors.

The philosophy for BSR's summer program on NFS lands is based on the premise that the National Forests are, and have always been, the greatest opportunity for guests to use and enjoy public lands. The summer program goal is to introduce guests to the White River National Forest and encourage outdoor recreation and enjoyment of nature. BSR desires to provide a fun recreational experience while reducing the barriers that can be associated with recreating in a mountain environment.

Over the past several decades, summer recreation activities have evolved to include a significant variety of activities and user experiences. Likewise, recreational use in the National Forests has evolved beyond the traditional activities and solitude-seeking experiences such as hunting, fishing, camping or hiking.

There is a desire to not only provide new experiences for current Forest users but to provide opportunities that will engage new users to visit and experience NFS lands. Currently at BSR, there is a lack of recreational opportunities that provide:

(1) Adventure or thrill-based experiences that require little specialized knowledge, skills, equipment or familiarity with the mountain environment—elements which can be a barrier for visitors (e.g., families, the elderly/aging, or those with disabilities) desiring to engage in outdoor activities;

(2) Activity-based interaction with a forested, mountain environment in a controlled setting, offering an opportunity for users to interact with and learn about nature;

(3) Human-powered, active recreational experiences that cater to all ability levels; and

(4) Interpretive programs that offer an educational experience for users seeking to learn more about the environment.

There is a need for recreational and learning opportunities on public lands that include passive, active and interactive forms of recreation to provide this comprehensive range of user experiences.

In addition, there is a need for adequate access and support service infrastructure (e.g., roads, support buildings, restaurants) to meet current and anticipated summer use at BSR.

The *Ski Area Recreational Opportunity Enhancement Act of 2011* (SAROEA) provides authority for mountain resorts operating on NFS lands to offer an expanded range of outdoor recreation activities in order to further recreational opportunities for the public, allow year-round utilization of existing resort facilities and stimulate job creation and economic growth within local communities. The proposed projects align with the intent of SAROEA.

PROPOSED ACTION

The Proposed Action includes the following elements. The attached figure identifies the locations of all proposed projects within the context of BSR's SUP area.

1) Vista Haus and Independence Chair Summit Site Plan

As visitors venture from base area activities on Peak 8 to the Vista Haus and surrounding areas and/or enter through Peak 7 and continue to the summit of the Independence SuperChair and surrounding areas the summit locations would be heavily utilized. The site plan would improve the natural aesthetic look and feel of these locations by bolstering vegetative growth, developing and defining access pathways, realigning access roads, integrating signage, and adding landscaping improvements to provide guests access to activities in an organized and safe manner.

2) Zip Lines

Sawmill Zip Line

The proposed Sawmill Zip Line would be located near Sawmill Creek and would cross between Peak 8 and 9. The Sawmill Zip Line would be approximately 5,955 feet (1.13 miles) in length from its start just south of the top terminal of the Peak 8 SuperConnect to its end point near the top terminal of the Snowflake lift. The zip line would consist of two segments: 1) top station from Peak 8 to the north side of

Peak 9 near the Volunteer ski trail, and 2) station 2 to a bottom station location near the top terminal of Rip's Ride and the Snowflake lift, along the Four O'Clock ski trail. Due to the topography of this area, minimal overstory vegetation removal would be necessary. The zip line would require platform construction at each tower station, electrical infrastructure installation, new road installation to the Peak 9 site for access, and a small operations and shelter facility construction. The Sawmill Zip Line would be accessed from the Colorado SuperChair out of the Peak 8 base area.

Peak 7 Zip Line

The proposed Peak 7 Zip Line would be located on Peak 7 south of the existing Independence SuperChair. The Peak 7 Zip Line would be approximately 6,890 feet (1.3 miles) in length from a starting point near the top terminal of the Independence SuperChair to its end near the Peak 7 base area. The zip line would feature three sections: 1) top station from near the Independence SuperChair top terminal to a location near the connection trail between Pioneer and Claimjumper ski trails; 2) station 2 to a location on skiers right side of Claimjumper; 3) station 3 to the bottom station near the base of Peak 7 utilizing the Fort Mary B return ski trail to the base of Peak 7. Overstory vegetation would be cleared (approximately 25-foot width) along the zip line where necessary, based on topography. Construction, operations and power access would be provided to each station, utilizing existing clearings on ski trails.

The Peak 7 Zip Line would be accessed from the Independence SuperChair. A short proposed hiking trail on NFS lands would provide access to an existing road, which would return guests to the Peak 7 base area.

3) Zip Line Canopy Tours

Sawmill Canopy Tour

The Sawmill Canopy Tour is proposed as an established route starting just south of the top terminals of the Peak 8 SuperConnect and Colorado SuperChair lifts, on Peak 8. The canopy tour would utilize a series of approximately nine zip lines and ten canopy tour stations to bring guests on a guided aerial tour from near the Vista Haus and ending along Four O'Clock ski trail. All zip lines in this canopy tour would total a length of approximately 6,338 feet (1.2 miles). The elevation of each individual zip line would be determined by features such as topography, vegetation and proximity to access roads, trails, or lifts.

Ore Bucket Canopy Tour

The Ore Bucket Canopy Tour is proposed as an established route through Ore Bucket, north and west of the top terminal of the Independence SuperChair. The guided tour would utilize a series of approximately nine zip lines and ten stations and would be accessed from the existing Independence SuperChair. Guests would experience an aerial tour that begins just west (uphill) of the Independence SuperChair in the gladed trees of Peak 7 and ends along the Angels Rest ski trail and the 7/8 Access Road on Peak 7. All zip lines in this canopy tour would total a length of approximately 5,476 feet (1.1 miles). The elevation of each individual zip line would be determined by features such as topography, vegetation and proximity to access roads, trails, or lifts.

Claimjumper Canopy Tour

The Claimjumper Canopy Tour would be located on Peak 7 near the upper 1/3 portion of the Independence SuperChair and Claimjumper ski trail. It would be similar in length to the Ore Bucket Canopy Tour. Similar infrastructure and access would be required for this canopy tour.

4) Ropes Challenge Courses

Two ropes challenge courses are proposed adjacent to the Vista Haus on Peak 8 to offer visitors an energetic and skills-based activity. One course would be designed to serve children under 10 years of age and a second course would be designed for older guests. Each course is a monitored yet self-guided

activity that involves a series of wooden columns, platforms and rope walkways/bridges. Challenge courses contain multiple alternate routes with varying degrees of difficulty and are designed to accommodate varying skill levels and ages. The overall site foot print would vary by design but are typically less than 0.5 acre, or 100 feet by 200 feet, in size and approximately 40 feet in height for the larger system and up to 10 feet in height for the children's course. The children's course would be approximately 100 feet by 100 feet. A small shelter would be constructed adjacent to the challenge course for safety and storage. All towers would require concrete foundations, and the ground beneath the challenge courses would be revegetated.

5) New and Realigned Mountain Bike Trails and Skills Course

The existing network of lift-served hiking and mountain bike trails on Peak 8 and 9 are proposed for select improvements along with an expansion of new trails onto Peak 7. Existing mountain biking trails slated for upgrade to meet current mountain bike design guidelines include Pioneer, Dwight's, Game Trail, Swinger Switchbacks and Frosty's Challenge. New trails are proposed on Peak 7 along with spur routes to tie into existing trails on Peak 8. Trails would be designed to accommodate lower ability levels, including families and children. The Colorado and Independence SuperChairs would be utilized for bike and guest transport. Signage and way-finding along with rest stops and scenic overlook opportunities, including small shelters and/or kiosks would be utilized to enhance the guest connection with the surrounding forest.

All trails would strive to not exceed a 6 to 8 percent grade. Approximately 15 miles of new and rerouted mountain bike trails are proposed. New trails would be located primarily on Peak 7 and realigned/rerouted trails would provide necessary improvements on the existing trails elsewhere at BSR. Proposed mountain bike trails would be constructed using a combination of hand tools and machinery, and would require grading and tree removal for the length of the trails. All trails would average approximately 6 feet wide. Wetlands and/or sensitive ecological areas within the vicinity of the trails would be avoided and/or bridged.

A component of the mountain biking program would include the creation of beginner skills courses. These courses would be located on Peak 7 and 8 near: 1) Vista Haus; 2) bottom of Colorado SuperChair on non-NFS lands near the existing Fun Park; 3) top of Independence SuperChair; and 4) bottom of Independence SuperChair on non-NFS lands. These skills courses would include a short circuit to allow riders to become familiar with the equipment and terrain they would encounter during the day.

6) New Hiking Trails

Approximately 2 miles of new hiking trails are proposed. These trails would be both dispersed and guided hiking and include select way-finding and interpretive signage. New trails consist of a loop trail at the top of Peak 7 and Peak 8 as well as maintenance and decommissioning of select sections of existing trails on Peak 8. In addition, a trail is proposed to allow a hike from the top of 6 Chair to the lake at the bottom of Lake Chutes. Other new proposed trails largely serve as access trails to proposed activities such as the observation tower, zip lines and canopy tours. Hiking trails would be approximately 3 feet wide.

7) Off-highway Vehicle Tours

BSR proposes the addition of one new route for off-highway vehicle tours that would include access to 6 Chair and the Imperial Express. The current system includes the Peak 7/8 mountain access road and a spur route to the top of the Independence SuperChair. The proposed route would access 6 Chair and the Imperial Express and allow additional sightseeing chairlift opportunities and add new options to this already successful resort amenity. The program would continue to utilize specifically designed vehicles and trained guides for exploration and interpretive opportunities for guests of all ages. Tours also integrate with guided hikes as well as access to guest rest facilities.

8) Four O'Clock Road Realignment

The existing upper section of Four O'Clock Road is extremely steep and presents challenges for the use of the road for recreation or service/access by staff. The realignment of the road would remove the excessive grade by adding switchbacks and adding roughly half a mile of new roadway. Additional engineering would be required prior to implementation.

9) Building and Deck Expansion and Climbing Wall

The existing Vista Haus would be expanded in size to better accommodate guests year round. The lodge and deck expansion is proposed to add approximately 1,500 square feet on the south side of the lodge and would accompany the construction of a climbing wall at the Vista Haus site. The climbing wall would be open during the summer months as weather permits and would be supervised by staff that can provide basic training and assistance to guests. Ropes, harnesses, and helmets would be required. The Vista Haus would serve as a guest service and operations center for all up-mountain activities on Peak 8.

The Peak 7 Hut would also be expanded by approximately 500 square feet. Both the interior space and outside deck would be expanded to better provide space for guests and operations for all up-mountain activities and guest services on Peak 7. Located at the top terminal of the Independence SuperChair, the Peak 7 Hut would continue to provide restroom facilities and a gathering space.

10) Observation Tower

One observation lookout tower is proposed on Peak 8 to provide guests with views of the surrounding mountainous landscape and adjacent outdoor activities. The tower would be approximately 30 feet in height and located adjacent to an existing hiking trail in the lower elevation of the Horseshoe Bowl. Guests visiting the proposed observation tower would enjoy views of the WRNF, the TenMile Range, the Continental Divide, and the Blue River Valley of Summit County.

11) Existing Lifts Operations, Scenic Lift Rides and Activities Access

While a large segment of summer up-mountain users would continue to access activities via the Colorado SuperChair, this proposal includes operation of the Independence SuperChair on Peak 7, and the Imperial Express and 6 Chair on Peak 8. The base area lifts would provide scenic rides from the base of Peak 7 and 8, as well as provide access to zip lines, canopy tours, hiking and mountain bike trails and other activities on Peak 7 and 8. Imperial Express and 6 Chair would provide a new experience for BSR guests in more remote locations. These scenic lift rides would allow guests to gain access to views that many would not otherwise achieve while visiting the White River National Forest. At the top terminal of the 6 Chair, guests would follow the road to the bottom terminal of the Imperial Express to enjoy another scenic lift ride. Instead of riding the Imperial Express, guests would also have the option to hike from the top of 6 Chair to the lake at the bottom of Lake Chutes for a destination hike. Those that elect to ride the Imperial Express, once at the top terminal, guests would enjoy the views from close to 13,000 feet in elevation, but no dispersed hiking would occur from this location. Guests would download from the mountain via the Imperial Express and the 6 Chair.

The four lifts proposed for summer lift use are critical to the overall program as they are the primary means of access for on-mountain activities.

12) Summer Uses Restoration Projects

BSR and the WRNF would jointly develop a suite of restoration projects in response to existing and proposed disturbed areas within and potentially beyond the SUP boundary. These projects would be developed subsequent to scoping and would be analyzed in the Draft EIS.

COMMENT PERIOD

The purpose of this comment process is to provide an opportunity for the public to have early and meaningful participation on these proposals and to learn more about the projects. Comments from this scoping period will be used to help formulate the foundation of the upcoming environmental analysis by identifying resource issues and, potentially, developing additional action alternatives.

Scoping materials, including a project map, can be found on the White River National Forest website at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=43291. Please submit comments by March 12, 2014, so that our planning efforts can proceed in a timely manner.

Written comments can be submitted by one of the following means:

Mail: Scott Fitzwilliams, Forest Supervisor, c/o Roger Poirier, Project Leader, 120 Midland Ave, Suite 140, Glenwood Springs, CO 81601

In person: Shelly Grail-Braudis, Snow Ranger, 680 Blue River Parkway, Silverthorne, CO 80498 (Monday through Friday, 8:00 a.m. to 4:30 p.m., excluding holidays)

FAX: (970) 945-9029

Electronic: https://cara.ecosystem-management.org/Public//CommentInput?Project=43291. The name and mailing address of the person submitting electronic comments must be included.

A public open house regarding this proposal will be held at Mountain Thunder Lodge (50 Mountain Thunder Drive, Breckenridge, CO 80424) on **March 5, 2014 between 4:30 and 6:30 p.m.** Representatives from the WRNF and BSR will be present to answer questions and provide additional information on this project.

To be most effective when submitting comments, please include: (1) name, address, email address, and organization represented, if any; (2) the title of the project for which the comment is being submitted; and (3) specific facts, concerns or issues, and supporting reasons for the Responsible Official to consider.

For more information about the project, please contact: Roger Poirier, Project Leader, White River National Forest, 120 Midland Ave, Suite 140, Glenwood Springs, CO. Mr. Poirier can be reached by email at rogerpoirier@fs.fed.us.

Those who submit comments will have eligibility to file an objection under 36 CFR §218.8. There will be an additional opportunity to comment when the Notice of Availability of the Draft EIS is published in the Federal Register. For objection eligibility, each individual or representative from each entity submitting written comments must either sign the comment or verify identity upon request. Individuals and organizations wishing to be eligible to object must meet the information requirements in 36 CFR §218.25(a)(3). Names and contact information submitted with comments will become part of the public record and may be released under the Freedom of Information Act.

Individuals who do not submit comments but wish to remain on the project mailing list should contact Roger Poirier (contact information noted above).

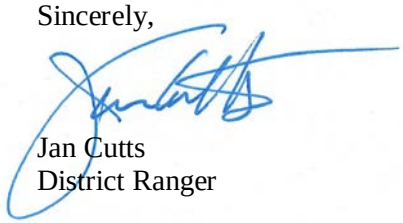
SCOPE OF THE PROJECT AND DECISION TO BE MADE

The Proposed Action will be analyzed within an EIS, which will contain full disclosure of potential impacts on the human, physical and biological environment. A result of public scoping may be the generation of alternative(s) to the Proposed Action that address specific resource issues yet still meet the Purpose and Need for Action.

The EIS will culminate with a Record of Decision being issued. Based on the analysis presented in the EIS, I will decide whether to authorize an action alternative, a modified action alternative (if needed), or the no-action alternative. If an action alternative is selected, the Record of Decision will include: details on the location(s), physical parameters(s), and scheduling of any approved projects; as well as any mitigation measures and monitoring requirements that may be necessary to meet Forest Plan and other legal direction.

Thank you for your participation in this project and your interest in the management of your public lands.

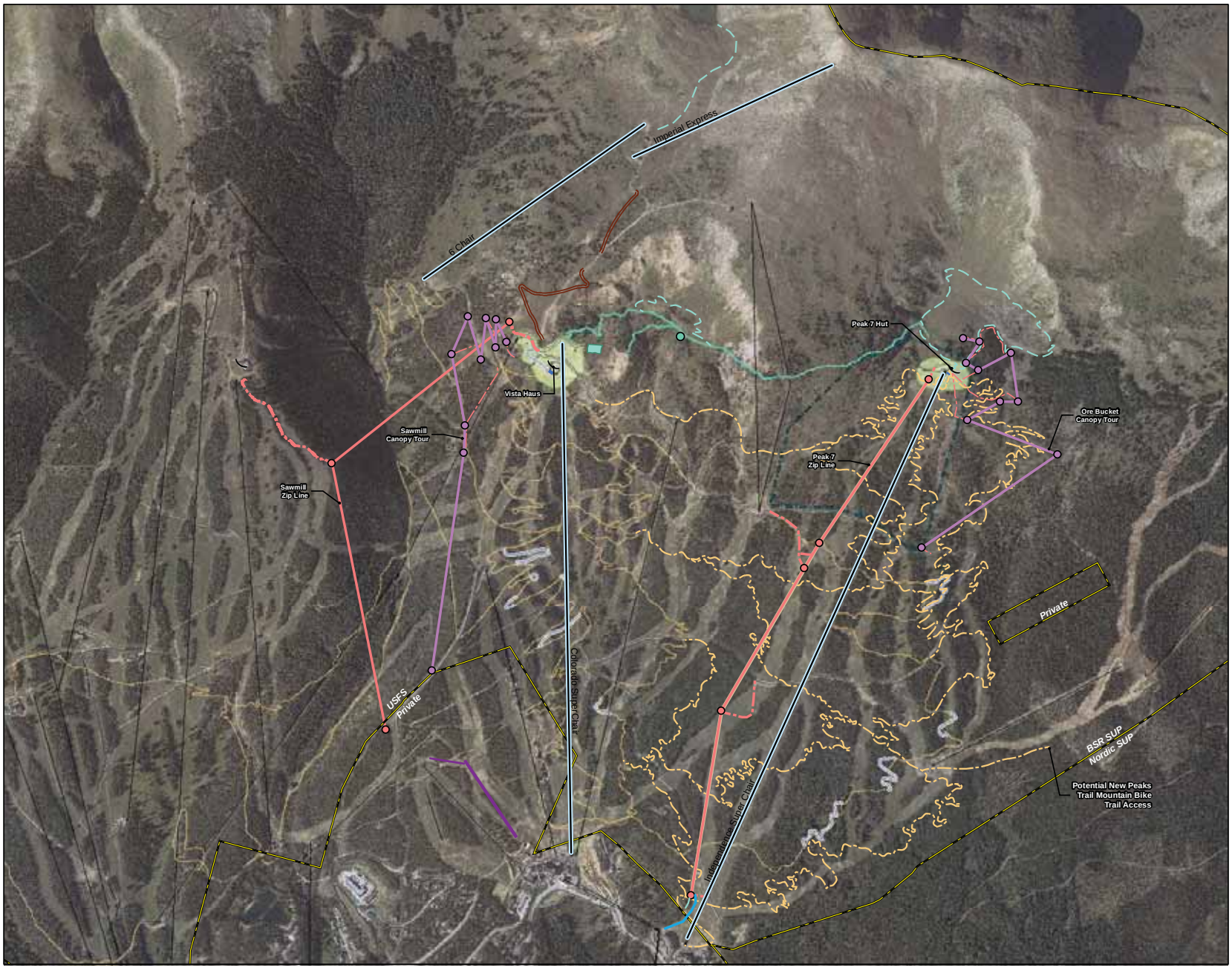
Sincerely,



Jan Cutts
District Ranger

Enclosure

cc: Scott Fitzwilliams, Roger Poirier, Shelly Grail-Braudis



USDA Forest Service
White River National Forest
Dillon Ranger District

BRECKENRIDGE SKI RESORT

Multi-Season Recreation Projects
Scoping Figure

Proposed Projects:

- Zip Line Towers
- Zip Line Cables
- Canopy Tour Stations
- Canopy Tour Cables
- Poten. Claimjumper Canopy Tour Area*
- Deck/Building Expansions
- Decks
- Observation Tower
- Vista Haus Challenge Courses
- Vista Haus and Indep. Chair Site Work
- Hiking Trails
- Mountain Biking Trails
- Mountain Biking Trail Re-routes
- 4 O'Clock Road Realignment
- Utility Line
- Constr/operations access path
- Constr/operations/utility road

Existing:

- Lifts
- Lifts to be used for summer
- Tenmile Flyer Zip Line
- Mountain Biking Trails
- Hiking Trails
- Roads
- SUP Boundary

**Exact location TBD.*

0 500 1,000 Feet

Created by:
SE GROUP

February 2014

From the Breckenridge Nordic Center to the Town of Breckenridge - Proposal for Permission to Host Events & Private Groups
Mayor John G. Warner and the Breckenridge Town Council,

We would like to meet with you at your next scheduled Work Session, on February 11th, to further discuss our plans to host Host Events & Private Groups at the New Nordic Log Lodge facilities on town lands. After a Labor of Love construction process, we received our Certificate of Occupancy and were able to move in to the new "Oh, Be Joyful" Nordic Log Lodge on December 23rd, 2013. We are most grateful to you and the Town of Breckenridge staff for the awesome cooperative effort to get this project completed.

Following recent discussions with nearby home owners, land manager Tim Casey and your town administrators…it seems that the main concerns about us hosting events and private groups, in the off Nordic season, are for the continued protection of Cucumber Gulch, surrounding resources and adjacent neighborhoods. Limiting noise pollution and any group/event activities that might disturb the peace.

Out of respect for our neighbors, we will carefully screen applicants to determine which groups to host, how often to host and what event # of persons are appropriate at the venue. We will reserve the right to serve groups/activities that best fit with our goals, uphold our town contract and will protect the facility from abuse and overuse and events that are in keeping with all codes, town ordinances, including the Noise Ordinance and respecting our building maximum occupancy loads, while upholding all public safety regulations.

This document is a first for us, and since we can find no other model to work from…we hope it can remain flexible, as experience will reveal much to us and provide necessary revisions and changes as we learn and grow. We plan to grow slowly offering the facility for rent for no more than 2 events per week, no more than one large event per weekend, limiting the space to two - three weddings per month for the first year, and accommodating all other groups, private functions, rehearsal dinners, ceremonies, celebrations as they fit with our already busy schedules and Nordic Operations year round.

We applied for a Tavern Liquor License with the Town of Breckenridge and attended our first Liquor Authority Board hearing on January 21st, 2014. We were granted approval at that time, but are still in the application process with the State of Colorado. We have plans to offer these Bar/Tavern services with limited hours of operation, and for special group functions. We already serve food and will carefully consider how toad and manage these additional services to our guests. All outside Catering Services operating out of the Black Forest Tavern will likely be using their own Licenses to serve food and beverages.

Anticipated Hours of Operation for the Tavern/Events/Private Groups: 7:00 am - 11:00 pm, last Call 10:30 pm.
Frequency of Events: the building capacity will dictate most our event and group size numbers. Our ability to seat guests for meals will be determined by our Food Service License and Black Forest Tavern Liquor License, as well as, upholding all of our fire/public safety requirements. The fewer events per week (2-3) and the limit on the # of people per event (less than 150 for sit down meals and no more than 225 for stand up socials), than the less impact we feel we will have on our adjacent neighborhood concerning noise, vehicular, and pedestrian traffic. We have a good relationship with most all of our neighbors and will be in close communication with them concerning neighborhood impacts. We would not host more than 1 wedding per week or weekend. Most of the event requests we have so far are for groups of less than 100 persons for less than 3 hours per event and are during afternoon and early evening hours that end before 9-10 pm.

In House Staffing for Events: providing an onsite attendant(s) to manage groups/events, oversee use of the facilities, including but not limited to parking attendants to make sure people are parking correctly in designated spaces, not to exceed parking lot limits, closing facilities inside and out in a timely fashion, cleaning and trash removal/recycling, and overseeing property security. All groups will be required to sign a written contract for venue leasing, that include fees for use of the facilities and a damage deposit and cleaning fee; to include but are not limited to dedicated security staff to oversee and control trespassers out onto closed trails and into the Cucumber Gulch Preserve, management staff to reduce damage and impacts to premises, cleaning and trash removal of premises, and a parking attendant(s).
Parking Management and Use: exclusive use of the paved and striped BNC parking lot, unless other permits have been approved in advance for overflow parking, such as for our Annual March Breckebeiner 60K fund-raiser for the BOEC. Staffing for a parking attendant(s) to maximize parking efficiency and assist in preventing pedestrian and vehicular access into prohibited areas.
Music and Entertainment: encourage amplified sound for inside use only, unless other approvals have been arranged in advance. We will follow the rules of the Town's "Noise Ordinance" to help to alleviate loud/noise disturbances and not permit outside deck or patio use past 10 pm nightly (no exceptions).

Use of Trails: only existing approved trail use during all seasons, including the PMA. Entering the PMA during periods of closures is strictly prohibited, as defined by buck and rail fencing and town signage. Our In-House Staffing will be posted to prevent such prohibited uses, trespassers will be escorted out and proper authorities will be notified upon such mis-use of trails/PMA.

Cleaning and Trash Removal: users will be charged a Damage Deposit; to include interior and exterior cleaning and the prompt removal of any debris/garbage. Premises will be cleaned promptly during and after daily and event use.

We have not had any issues with the groups we have rented our property to in the past. We do not have unresolved issues with our adjacent neighbors. We are well aware that Private Groups who have a focus on drinking can cause problems and late hours of operation that we are not interested in being a part of. Our Event Contracts will cover rules and financial consequences for any issues to the property and/or unruly behavior on the part of our guests.

Our hope is to continue to be successful, maintain our good reputation, provide a great amenity, and be an asset to our community. The new log lodge is attractive and is gaining in popularity already. Please visit us anytime between the hours of 9 am - 4 pm daily for a project tour.
Respectfully Submitted, Gene & Therese Dayton and Family
www.BreckenridgeNordic.com
970-453-6855

MEMORANDUM

TO: Town Council
FROM: Open Space and Trails Staff
DATE: February 14, 2014 (for the March 11, 2014 meeting)
SUBJECT: Forest Health Report for Town Open Space Parcels

Summary
Over the past several years, the Town of Breckenridge Open Space and Trails program has undertaken multiple tree removal projects to address forest health issues on Town and jointly-owned Town/Summit County open space parcels. The primary goals of these initiatives include: 1) removing dead and infested trees that succumbed to mountain pine beetle, 2) establishing fire breaks and defensible space areas to protect nearby homes and infrastructure, and 3) completing regeneration cuts to encourage forest regrowth and create a more dynamic forest in the Upper Blue basin. This memo summarizes recent open space forest health efforts, and outlines how the Town and joint Town/County initiatives have been designed to function in consort with private, federal, and other tree removal efforts to create a wildland/urban interface buffer for large portions of Town.

Background
The Town's open space property portfolio has grown significantly since 1996, prompting increased management presence on Town-owned and joint Town/Summit County properties. Increased stewardship responsibilities, the recent mountain pine beetle infestation, and increased community awareness of wildfire hazards have prioritized forest health efforts on public open space parcels since 2009.

In 2008, the Town open space and trails division commissioned Rocky Mountain Ecological Services, Inc. (RMES) to analyze the mountain pine beetle hazard on open space properties. The RMES report evaluated all existing open space parcels for susceptibility to mountain pine beetle infestation and prioritized forest health actions to be taken system-wide. Based on the findings in the report, staff has implemented annual tree removal projects on Town open space and on joint Town/County properties since 2009.

The primary goals of these forest health initiatives are:

1. To remove dead and infested trees that succumbed to mountain pine beetle, thereby reducing fuel loads, fire hazards, and potential wind-throw hazards.
2. To establish fire breaks and defensible spaces to protect area homes and infrastructure.
3. To complete cuts to encourage forest regeneration and create a more dynamic forest (i.e. more diverse age class, species composition, forest structure).

Attached, *Map 1: Upper Blue Forest Health Treatments* highlights the open space forest health treatments that have occurred since 2008, as well as those of the USFS, Summit County, and private landowners. Over 297 acres of public open space have been treated in and around Breckenridge through Town and joint Town/County forest health measures. This year, the Town and County have jointly assigned a contract for an additional 75 acres to be treated in the Gold Run drainage. These open space efforts will work in conjunction with the U.S. Forest Service contracts already assigned for tree removal to be performed in the Golden Horseshoe in 2014 and 2015 (see attached *Map 2: Summit County Fuels Reduction and Watershed Protection Project*).

Taken together, the forest health treatments across multiple jurisdictions will result in a defined fuel break, particularly east of Town at the Town/Golden Horseshoe interface. This fuel break matches the Community Wildfire Protection Plan (CWPP), established by the Summit County Wildfire Council.

Partnerships

Community partnerships are essential to the completion of the forest health tasks across the Upper Blue basin. Current partners for the forest health effort include the following:

- **Summit County Government**- As a joint owner for many parcels, the Summit County open space and trails department assisted with planning, contracting, and implementing forest health efforts. Summit County also shared costs on forest health projects on joint property.
- **U.S. Forest Service**- The USFS has assigned multiple contracts and forest health treatments on area National Forest lands. Town and County staff members have coordinated efforts with the National Forest projects, so that the treatment areas effectively adjoin one another and create a community firebreak.
- **Colorado State Forest Service**- The CSFS has assisted the Town efforts through project design and implementation, and through grant support. The expertise of the CSFS staff has enabled Town and County staff to effectively develop, contract, and manage several forest health projects.
- **Summit County Wildfire Council**- The Wildfire Council has supported the Town's forest health efforts through grant support and guidance on implementing the local CWPP.
- **Private property owners**- Many private landowners have supported the Town's efforts through dedication of temporary access easements, general support for the forest health/fuel break projects, and completion of corresponding fuels reduction efforts on their HOA and private parcels. These efforts have resulted in multiple Fire Wise designations in and around Breckenridge.

Expenses

Overall costs for the Town's open space forest heath projects were funded through the Town's dedicated open space fund. Since 2009, the Town open space fund has spent a total of $600,621 on tree removal efforts on Town-only and joint Town/Summit County open space parcels. These expenses were matched by the Summit County Open Space and Trails Department contribution on joint properties for $125,865 and were leveraged via $348,259 in grant funding from the State of Colorado and the Summit County Wildfire Council. In 2014, the Town, Summit County Open Space, Summit County Wildfire Council, and the State of Colorado DNR have committed $35,000 apiece to complete the 75-acre tree removal project exhibited in Map 2.

Ongoing and Future Forest Heath Efforts

To ensure that the open space forest health projects taken by the Town yield a more healthy long-term forest, staff plans to:

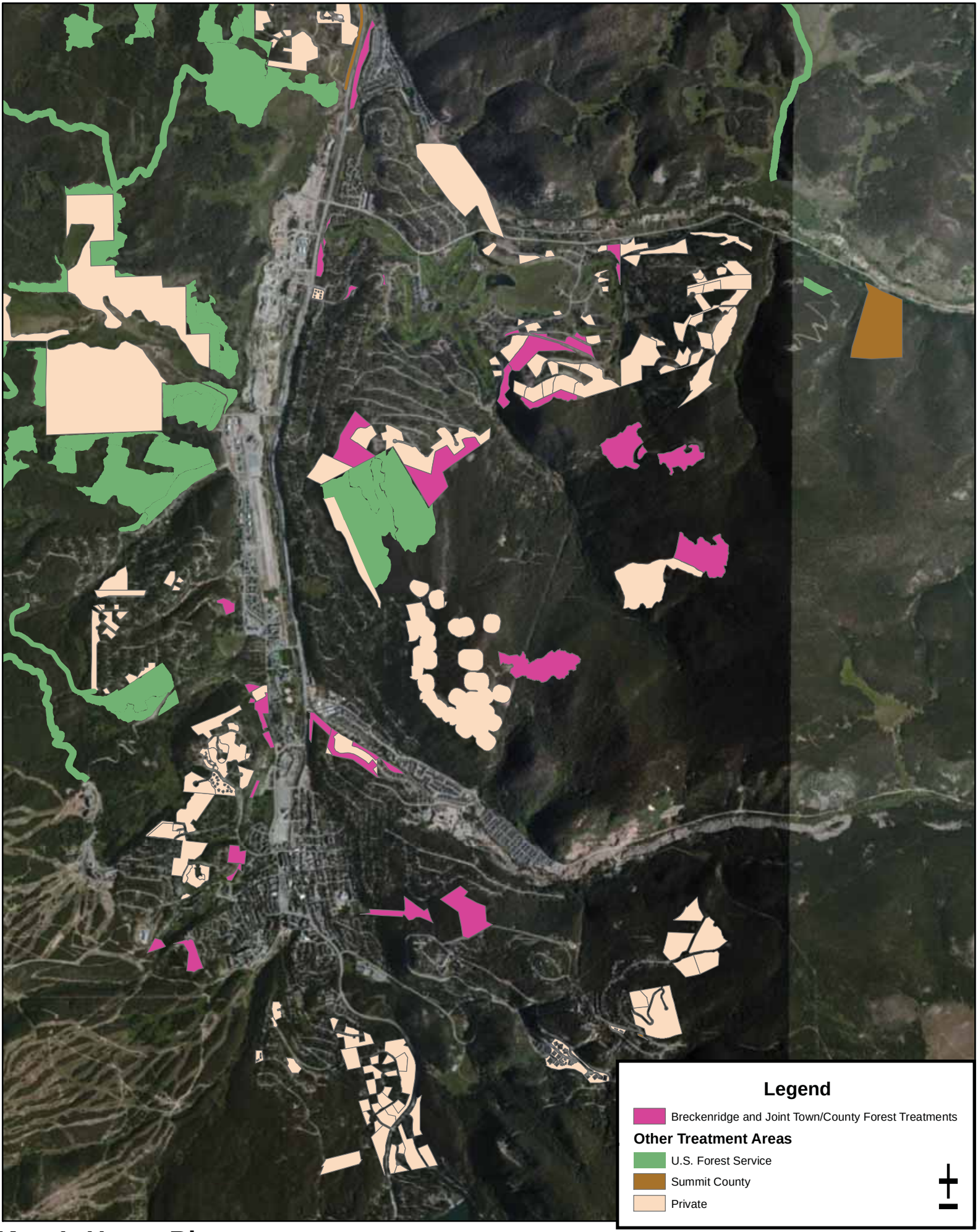
- Complete the 5.4-acre MBJ/Wedge treatment in 2014,
- Undertake a new 75-acre cut in the Golden Horseshoe,
- Monitor all treated open space parcels to evaluate forest regeneration,
- Selectively thin regeneration trees in approximately ten years to create a more evenly-spaced spaced forest,
- Maintain open areas that provide valuable defensible space, and
- Communicate the Town's long-term commitment to healthy forests in the Upper Blue basin.

Since the USFS has assigned multiple forest health contracts to be completed in the next three years, Town staff believes that now is an appropriate time to refrain from additional significant forest health projects until the USFS completes their projects and the landscape-level tree forest health can be reevaluated. In the meantime, the Town's open space program will focus its resources on hazard tree removal along trails, and other smaller tree removal efforts on newly acquired open space parcels or other sites needing minor additional tree removal (e.g. Iowa Hill).

Conclusion

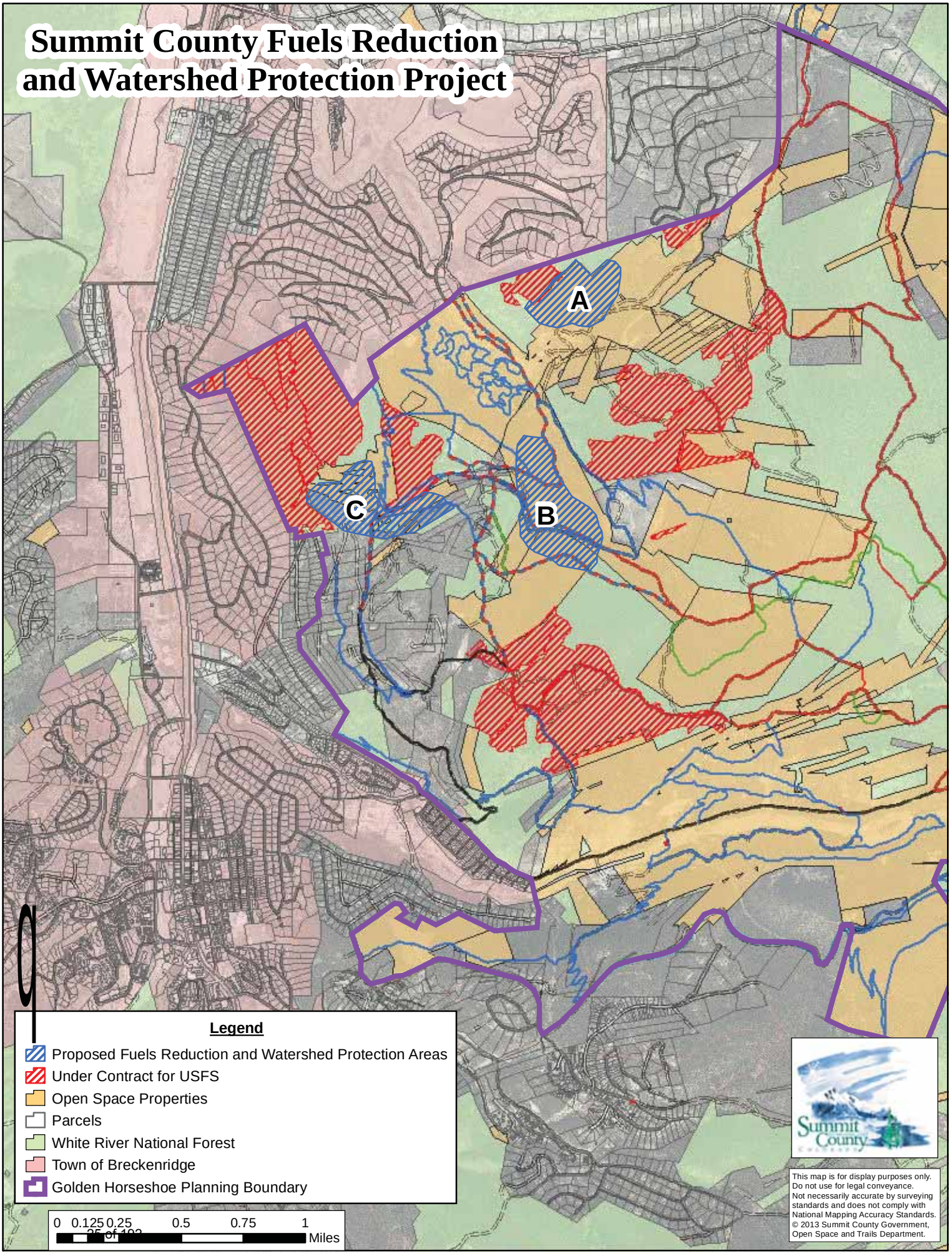
This memo provides an update on efforts made thus far to address forest health issues on Town and joint Town/Summit County open space parcels, and their relation to the overall efforts basin-wide. Town open space staff will be available to respond to Town Council questions at the March 11th work session. Staff requests Town Council review the attachments and answer the following questions:

1. ***Does Town Council have any questions related to the information in this memo?***
2. ***Does Council have any suggestions or changes to the proposed course of action moving forward?***



Map 1: Upper Blue Forest Health Treatments

Summit County Fuels Reduction and Watershed Protection Project



2013 Wetlands Monitoring in Upper Cucumber Gulch Preserve Breckenridge, CO:

Restoration performance monitoring

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, January 14, 2014

PURPOSE OF REPORT

This report was prepared to fulfill requirements related to Army Corps of Engineers (Corps) NW-27 Wetlands Restoration Permits # SPK-2012-00780 and # SPK-2012-00781 special conditions #3 and #4 which specify the need for annual monitoring and reporting. The two permits are part of the same restoration project, so monitoring results have been consolidated into a single annual report. This report generally follows the format described in the Corps Regulatory Guidance letter No. 08-03 dated October 10, 2008. An initial report was submitted in this format last year describing baseline (pre-project) condition, initial response, and a preliminary assessment of project effectiveness (Beardsley and Johnson 2012). This present report is a follow-up to that initial one. Results from the first full season of post-treatment monitoring are described to inform an updated appraisal of project success.

i. PROJECT OVERVIEW

(1) **Corps Permit Number**: SPK-00780 (phases 1 and 3) and SPK-00781 (phase 2)

(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 that affect the wetland's water source, sediment balance, and ultimately the loss of beavers from the site. 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. The project has so far involved three phases of work covered by two separate Corps permits. A description and work plan for phases 1 and 2 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) and for phase 3 in a letter to the Corps dated August 13, 2013 (Claffey 2013). EcoMetrics and JEC were retained by the Town of Breckenridge to monitor implementation and performance of the project.

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 as possible by alleviating identified human stressors (Beardsley and Johnson 2011). In addition to restoring habitat conditions within the site, the project also aims to ameliorate the effects of off-site stressors by: (1) re-spreading water that is discharged from the contributing watershed to CGP in a more natural pattern at the head of the site (water is presently collected by a drainage system on the ski area upstream of the site and transferred to Upper GG through a 60" culvert); (2) collecting incoming 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 encourages immigration and colonization of the site by beavers so that they will continue to maintain ponds, dams, and the water distribution network that supports the wetland. 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 while the habitats are still amenable to restoration.

In addition to the original work in Upper Cucumber Gulch, proper, in 2012 (Phase 1), the Town was also granted permission under a separate NWP-27 for aquatic habitat restoration (SPK-2012-00781) downstream from Upper CG (but still within Cucumber Gulch Preserve) known as the "reset pond". This additional corrective action is known as Phase 2 of the Cucumber Gulch Restoration Project, and the objective was to restore depth and structural integrity of the pond at this location by dredging out sediment that had accumulated and repairing the dam that breached after beavers left the area. The long term goal is to restore the pond to a condition that is habitable by beavers so that they will once again come to occupy the area and to maintain the dam which supports the pond, the local groundwater table, and a system of distributary channels that feeds the rest of the wetland downstream. These efforts are aimed at restoring the natural pattern of water outflow from Upper CG to the rest of the wetland complex.

Next, the Town was granted permission by the Corps for Phase 3 of the Cucumber Gulch Restoration Project in 2013. This additional corrective action involved "restoration of approximately 550 linear feet of Boreas Creek using bio-engineering techniques, including log jams, Bio Logs, log wedges, facines (*sic*.), hinge lots (*sic*.), and willow dams" (Corps Permit SPK 2012-00780). The work was

designed to treat portions of the Boreas Creek channel within Upper CG where it was enlarged and incised, so that it may respond by aggrading and becoming more connected with the adjacent floodplain. The primary goal is to protect the recently restored wetland habitats that are adjacent to the channel from the risk of being dewatered when flows become captured by the channel again in the future. The incised channel acts as a barrier to the positive effects of groundwater restoration treatments which were all made on the northwest side of the creek in phase 1. That is, the positive effects of the treatments cannot spread to the southeast side of the creek as long as the channel is incised and enlarged, because it functions as a drain which diverts would-be ground water downstream as surface flow. If the phase 3 work is successful, then we eventually expect to see a heightened groundwater table and improved wetland condition of the southeast side of the creek similar to the improvements seen on the northwest side.

(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

The initial assessment was completed in 2011 with baseline monitoring through the 2012 season. Restoration treatments for Phases 1 and 2 were completed in October 2012 and additional corrective actions (Phase 3) were completed on the incised portion of the Boreas Creek channel in September 2013 (See section 9), with concurrent implementation monitoring. Quantitative post-project monitoring was initiated in spring of 2013 and continued until after the end of the growing season (Table 1).

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 (Phases 1 and 2) (Claffey Ecological Consulting)
Sept. 2012	Implementation monitoring (EcoMetrics)
Dec. 2012	Performance monitoring report (EcoMetrics and JEC)
May-Oct. 2013	Performance monitoring (EcoMetrics and JEC)
Sept. 2013	Completion of channel work (Phase 3) (Claffey Ecological Consulting)
Jan. 2014	Performance monitoring report (this report) (EcoMetrics and JEC)

(6) Baseline Wetland Conditions

Baseline wetland conditions for Upper CG were assessed in 2011 using FACWet 2.0 (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 wetland boundary 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. Baseline results from these studies show that the 2011 wetland boundary was indeed very conservative, and in fact the actual extent of wetlands had become much smaller than the area we reported in 2011. Of 14 sample points within Upper CG, only one was found to meet jurisdictional requirements for wetland status, meaning that most of the area we delineated as wetlands at that time did not actually qualify as wetland habitat according to the three technical criteria. By 2012, most of the historic wetland area within Upper CG was dewatered and no longer functioning as wetland habitat. In other words, the extent of wetlands in Upper CG had shrunken to a mere fraction of its former area (see the maps in appendix B). The aim of this project is to restore the wetland habitat that has been lost.

(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. So far, monitoring results indicate that the project is on track to meeting the short-term and long-term performance goals stated in section ii (1). There is strong evidence that the target criteria for each of the FACWet variables are being attained, and that wetland function is being restored to areas that were recently impaired or non-functional.

Further discussion of this appraisal is made in section ii (2) of this report, and a summary of the monitoring results that support this stance (the evidence) is provided in section iii. Quantitative monitoring data upon which these conclusions are made is provided at the end of the report, in appendices. In addition to performance monitoring, we also monitored the implementation of all three phases of the restoration plan and our estimation is that the project was executed in a way that meets all the requirements outlined in the design plan and permit. Ongoing water quality monitoring throughout Cucumber Gulch also indicates that the work was conducted in a manner that created no detectable negative impacts to downstream water quality.

(8) Corrective actions and Adaptive Management

See sections 9 and 10.

(9) Specific Recommendations for Additional Corrective or Remedial Actions

No additional on-site remedial actions appear necessary at this time. Off-site, non-regulatory remedial actions are being taken within the contributing watershed. Our 2011 report specifically identified high levels of allochthonous sediment as a primary stressor to CGP wetlands. This sediment originates on the Peak 8 portion of the Breckenridge Ski Area and other developments upstream of CGP, and is carried to the site via Boreas Creek. We specifically recommended application of sediment BMPs on the ski area to decrease sediment stress to the wetland habitats in Cucumber Gulch. Monitoring these efforts in the contributing watershed is beyond the scope of this report, but the Town has reported that some efforts in this realm were being made in 2012, including a new small retention pond at one of the Boreas Creek culvert inlet structures (see Photo C1).

(10) Adaptive Management and Maintenance

During runoff in 2013, a channel cut began eroding through the newly repaired reset pond dam. Town staff acted quickly to plug the breach with a temporary structure made of brush seated against wooden poles that were driven into the ground (see Photo C2). By mid-August, a pair of juvenile beavers had moved into the reset pond and began working the dam, including the section repaired by the Town, and the dam is now a continuous structure across this section that held through the 2013 season.

To increase the odds that beaver would inhabit Upper CG in the 2013 season the Town, in cooperation with Colorado Parks and Wildlife staff, relocated a beaver to the spreader pond area. The beaver was trapped from a nearby area where it was a nuisance early morning on August 2nd and released to the spreader pond at 9:30 AM that day (see Photo C3). A volunteer beaver also came to occupy this general area at about the same time, and both beavers apparently remained here through the 2013 season.

The Town plans to continue a weed monitoring and control program for the site in 2014, and is directing special attention towards treating reed canary grass, which appears to be expanding its foothold within the project area. The extent of other weeds in Upper CG decreased significantly following rehydration of the site. The worst weed problems were on the bed of dewatered ponds which are now full of water. Weed control efforts around the periphery of the site are ongoing.

ii. REQUIREMENTS

(1) Performance standards

Because the project is voluntary, formal performance standards were not required. General narrative goals were stated, however, and it is important to track project performance regardless of regulatory obligation. The Functional Assessment of Colorado Wetlands (FACWet) 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. Though a newer version of FACWet is now available, this project continues to use version 2.0 (FACWet; Johnson et al. 2010) to maintain consistency through the monitoring period.

Based on the stated goals of the project described in the work plan (Claffey 2012a, 2012b, and 2013) 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 condition classes, including: *reference standard*, *highly functioning, functioning, functionally impaired* and *non-functional*. These classes correspond to academic letter grades A to F, respectively. Each FACWet variable was assigned a pre-project grade during our initial 2011 assessment (Beardsley and Johnson 2011), and at the outset of the project we projected potential post-restoration grades based on our interpretation of project goals in the context of surrounding land uses (Table 3) (Beardsley and Johnson 2012). We then described the ecological conditions that would be indicative of the grade presuming that the treatments function as designed. These are the project performance criteria.

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 that is possible. For instance, many of the ecological stressors acting on this wetland occur outside of its footprint, including watershed impacts and drainage infrastructure upstream from the site that influence the amount and timing of water and sediment input, in addition to stressors originating in the buffer and the disruption of habitat connectivity. Restoration work within the project site may reduce these impacts, but it cannot eliminate them completely. For example, 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. Most of the other variables, on the other hand, are within 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 judged 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 meant to define the physical conditions that must be restored to achieve the desired increase in variable score. In the final column of Table 3 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 (from Beardsley and Johnson 2012).*

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	1. Incoming water from Boreas Cr. is spread laterally in a full "spreader pond" that feeds multiple distributary channels across the width of the complex.	1. Observation, photos, streamflow monitoring
5	**Water Distribution**	D-	B	1. Historic extent and depth of pond habitat restored to abandoned ponds. 2. Water table elevations throughout historic wetland area meet criteria for wetland hydrology.	1. Observation, photos. 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 and groundwater.	1. Observation, photos
7	**Geo-morphology**	D	B	1. Breached dams repaired and functional. 2. Beavers present and actively maintaining dams. 3. Soil profiles indicate hydric soil throughout historic wetland area. 4. Boreas Creek channel is no longer enlarging or becoming further incised	1. Observation, photos. 2. Observation, photos, wildlife cameras. 3. Soil profiles 4. Channel surveys.
8	**Chemical Environment**	D	B	1. Restoration of the characteristic soil redox environment via reestablishment of the natural saturation regime. 2. Maintain existing water quality	1. Observation, photos, redox monitoring at test sites 2. Evaluate ongoing WQ monitoring
9	**Vegetation Structure and Complexity**	C	B	1. Wetland vegetation is present throughout historic wetland area. 2. Vegetation composition and structure is similar to unimpacted reference condition.	1. Observation, photos, sampling 2. Vegetation plots at test sites, weed surveys, ongoing vegetation monitoring

(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 and on positive responses for all relevant FACWet variables. Summary findings are outlined in Table 4 which describes the observed response of FACWet variables relative to the performance criteria listed in section ii (1). The table also identifies portions of section iii in this report where the reader can find the supporting data and evidence that underlie each variable score appraisal.

Table 4. *Current status relative to pre-project condition and success criteria.*

FACWet Variable #	Variable Description	Pre-project score	Target score	Present score	Current Status Relative to Success Criterion (Summary)	Supporting Data/Evidence (reference to section iii)
1/2	**Connectivity**	C	C	C	N/A	N/A
3	**Buffer Capacity**	D	D	D	N/A	N/A
4	**Water Source**	D	B	B	1. Lateral branch channel below Boreas Creek culvert diverts water back to upper northern portion of Upper CG. Spreader pond feeds multiple distributary channels across the width of the complex. Beavers are actively maintaining the dam and stage of water in the spreader pond.	1. Observations (4a), Boreas Creek discharge monitoring (4b)
5	**Water Distribution**	D-	B	B	1. Extent and depth of ponds in is similar to historic conditions. Beavers are present and actively maintaining dams and distributary channels. 2. Hydrographs for all test well locations northwest of Boreas Creek show wetland hydrology or nearly wetland hydrology.	1. Observations (5a), Spreader pond survey (5b) 2. Water table monitoring (5c)
6	**Water Outflow**	D	B	B	1. Outflow no longer confined to incised channel and is distributed amongst branched channels and groundwater. Corrective actions addressed breached dam. Reset pond is re-occupied by beavers that are maintaining the dam and distribution of water downstream.	1. Observations (6a)
7	**Geo-morphology**	D	B	B	1. Beaver dams are functioning according to design. 2. Beaver maintenance of dams and channels is apparent throughout the phase 1 and 2 project areas in 2013. 3. Minimal erosion on Boreas Creek in 2012 or 2013. Phase 3 work completed in channel as designed. 4. Some sediment BMPs applied within contributing watershed (ski area). Approximately 18 cubic yds of sediment trapped in spreader pond retention cell.	1. Observations (7a) 2. Observations (7a) 3. Observations (7a), Channel surveys (7b) 4. Observations (7a), Spreader pond surveys (7c)
8	**Chemical Environment**	D	B	B	1. Redox monitoring at 12" depth shows positive response at 10 out of 14 sites indicating successful restoration of soil redox characteristics 2. No significant changes to water chemistry parameters	1. Observations (8a), redox monitoring (8b) 2. Observations (8a), Water chemistry monitoring (8c)
9	**Vegetation Structure and Complexity**	C	B	B	1. Most plots still had remnant wetland vegetation prior to project. Transplants have been effective. 2. Some of the weediest areas are now inundated by ponds. The extent of some exotic plants (mainly reed-canary grass) appears to be spreading.	1. Observations (9a) 2. Observations (9a)

iii. SUMMARY DATA

(1) Site map

Site maps are provided in appendix A. The maps identify the location of relevant photopoints and study test sites.

(2) Baseline and current condition maps

Appendix B includes two maps, one showing the baseline wetland condition of Upper CG as it existed prior to the project, and the second showing current wetland status based on 2013 monitoring.

(3) Photos and photopoints

The monitoring protocol includes photos taken from approximately 40 locations in CGP two to three times per season so that the appearance of these locations can be compared precisely over time. In addition, we also employed two time-lapse cameras and two motion sensor cameras at different locations on the site. We also took photographs to document each of the geomorphic surveys and at any time and place where it seemed that recording an image might be useful or interesting. These images are organized and stored in a central database which will be made available to the Corps through the Town, if desired. A small subset of these photos is used in this report, and these may be found in appendix C. Photos are referenced in the text where appropriate.

(4) Water Source (FACWet Variable 4)

(4a) Observations: Prior to treatment, water entering Upper CG from Boreas Creek through the 60" culvert (Photos C4, C5, C6) was confined to an incised channel (Photo C7) through the length of the project area. Mitigation efforts included a lateral channel which diverts a portion of the flow from the Boreas Creek culvert northward along the head of the Upper CG wetland area (Photo C8) and restoration of the spreader pond which now acts to block flows in the incised Boreas Creek channel, to re-establish hydraulic head across the width of the wetland area, and to feed a set of distributary channels that spread water laterally downstream (Photos C9a, C10a, C11a). We reported that these treatments were generally functioning after implementation in 2012, but that functioning would be improved if spillways on the constructed dams were blocked to allow water in the ponds to reach the height of dam crests. All of these treatments continued to function through 2013, and indeed the constructed dam spillways became plugged by beavers once the animals re-inhabited these areas this summer (Photo C12). The spreader pond is now full to the crest of the dam which provides maximal hydraulic head laterally across the wetland area and a source of flow to the system of distributary channels downstream of the dam (Photos C9b, C10b, C11b).

(4c) Boreas Creek discharge: Water discharge of Boreas Creek at the inlet to CGP was measured within the culvert using a datalogger with depth and velocity sensors that recorded every 10 minutes from May through September in 2012 and 2013. Discharge was then calculated from measured values of water height and velocity, and the results are plotted in appendix D. The overriding influence of snowmelt runoff is apparent on the 2013 hydrograph but was largely absent in 2012 due to low snowpack and early melt-off that season. In 2012, flows tended to drop through the season from around 4 cfs in May and early June to about 1.5 cfs in September. Flows were generally about twice as high in 2013.

This season, mean discharge during runoff in June was about 8 cfs, with an average base flow in September around 3 cfs. The spikes observed in July and August of both seasons correspond to thunderstorm events, and while intense in magnitude, the duration of these peaks was typically less than one hour. It is noteworthy that spikes are also observable on hydrographs for the Blue River gauges on these dates which is verification these were actual hydrologic events and not just errant readings by the sensors. Measurements of the magnitude of peak discharge by these methods should be considered rough estimates because of the influences of sediment and turbulence in the culvert at these unusually high discharge rates. At the very least, though, these data demonstrate that unusually high discharge spikes of short duration are common with especially severe thunderstorm rainfall events.

(5) Water Distribution (FACWet Variable 5)

(5a) Observations: In 2012, we reported that all of the ponds within Upper CG were dry for the majority of the season (Photos C9a, C10a, C11a, C13a, C14a). 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 nonfunctional throughout the season. Treatments made in fall of 2012 successfully restored the major ponds on Upper CG (Photos C9a, C10a, C11a, C13a, C14a). At the same time flows were restored to the major arteries of the channel distribution system (Photo C15). These conditions persisted through 2013. In August, beavers re-inhabited the area, and their activities raised the stage in several existing ponds, created additional ponds, and activated a wider set of distributary channels (Photos C9b, C10b, C12).

(5b) Water table monitoring: We established well sites at each of the 14 monitoring test plots in Upper CG (See the site map in Appendix A) and used automatic data-logging wells to monitor the depth of the water table every six hours. Hydrographs from these well sites are provided in appendix E, along with an explanation of how these relate to the evaluation of project success. For each well location we measured the amount of time during the 150-day period from May 30 to Oct 7 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). The jurisdictional requirement for wetlands in this region is 14 CHD during the growing season. By this criterion, none of the plots except site H had wetland hydrology prior to treatment in 2012. At some of the sites, wells were present for several days after construction in 2012, and many of these sites showed an increase in the height of the water table following construction at the end of that season.

THD and CHD results for 2013 are shown in Table 5. All but two of the sites showed positive wetland hydrology in 2013. Six of the well sites (B, C, D, G, H, and I) are located in areas that are now ponds. These sites were submerged under surface water for the entire 2013 season which qualifies them as aquatic habitat. At five additional sites (A, E, K, L, and M) wetland hydrology was observed on locations that are outside the footprint of reclaimed ponds. These sites qualify as terrestrial wetlands. The two well sites that did not show wetland hydrology are J and N. At well J, the water table rose considerably after treatment (from deeper than 28 in. before, to within 15-20 in. of the surface after treatment) but the hydrograph still fell short of the depth criteria needed to qualify as wetland hydrology.

At well N, which is on the opposite side of Boreas Creek from the treatments, no measureable response in the hydrograph was detected. This site continued to show water table depths that were consistently deeper than 30 in. through 2013, which suggests that the incised creek was a barrier to groundwater elevation.

Table 5. *Hydrograph summary for water table monitoring. Sites shaded in red did not show wetland hydrology. Sites shaded in green or blue did show wetland hydrology, with blue indicating aquatic habitat at sites that were submerged within ponds for the entire season.*

Site ID	THD	CHD	Wetland hydrology (by hydrograph)	Note
CGP-A	99	98	Positive	water table within 12 in. for 98 days spanning June, July, and Aug.
CGP-B	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-C	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-D	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-E	45	45	Positive	water table within 12 in. following beaver activity
CGP-F	*N/A - Well datalogger failed (assumed that wetland hydrology is absent due to redox data)*			
CGP-G	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-H	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-I	150	150	Positive	surface water over well site through the entire season - aquatic
CGP-J	0	0	Negative	water table consistent at 15-20 in. through entire season
CGP-K	150	150	Positive	water table consistent at 3-6 in. through entire season
CGP-L	150	150	Positive	water table consistent near surface through entire season
CGP-M	150	150	Positive	surface water present for all but 10 days through the season
CGP-N	0	0	Negative	water table deeper than 34 in. through most of season

(5c) Spreader pond surveys: One of the objectives under the water distribution variable is to restore the depth and extent of pond habitat. This objective is easily monitored by simple observation, but we also made quantitative surveys of the east cell of the spreader pond to track conditions more precisely and with a finer resolution (see Appendix F). Prior to the project, the spreader pond had become full of sediment to the height of the dam and had a deeply incised channel eroded through it. It was no longer a pond and no longer even wetland. During treatment, the dam was re-built and the pond was dredged to a depth of about 5.0 ft. Over the course of the season, the height of water surface in the pond came up about 0.7 ft after beavers began maintaining the dam, and this effectively increased the extent and depth of the pond further. These positive gains were counteracted by the accumulation of sediment in the pond, which decreased pond depth in the east cell by about 1.0 ft over the course of the season. At this rate, the

depth and extent of the pond will continue to decrease over time until it becomes full of sediment after several years.

As an example of pond restoration, the spreader pond surveys indicate an short-lived and transient improvement at best. However, this cell of the spreader pond was intended to serve as a sediment catchment to prevent ponds further downstream from becoming similarly filled, and it was designed so that it could be periodically dredged. There is every indication that the retention function of this pond is working and that downstream ponds are not filling with sediment at this rate. This apparent trend could be tested quantitatively by monitoring additional ponds in Upper CG with detailed surveys in the future.

(6) Water Outflow (FACWet Variable 6)

(6a) Observations: If Upper CG is considered the assessment area for this project, then the outflow area is the reset pond. Phase 2 of this project was aimed at improving the transfer of waters from Upper CG to the rest of the wetland complex through this pond. Prior to the project in 2011 and 2012, beavers had abandoned the reset pond which had become filled with sediment (Photos C16, C17, C18). The dam was breached, and a new incised channel was forming through its bed which meant that the bulk of water exiting the area was confined to that new forming channel, which was actively eroding and becoming more incised. After dredging sediments from the pond (Photo C18) and repairing the dam, immediate improvement to the water outflow pattern was apparent with a raised stage (head) of water behind the dam and activation of a system of small distributary channels downstream of the dam.

This immediate improvement was threatened early in 2013, however, when a new channel began eroding around the plug that was built to repair the breached dam. Remedial efforts by the Town to patch this cut were successful (Photo C2), and since that time beavers have moved into the pond and taken over maintenance of the dam (Photo C20). Beaver activity further raised the stage of water in the pond which also pushed more water into the system of distributary channels that feed the wetland area south and east of the reset pond (Photo C19).

(7) Geomorphology (FACWet Variable 7)

(7a) Observations: Prior to construction through the 2012 growing season, all water entering CGP from Boreas Creek passed through the breach in the spreader pond and down the incised channel through Upper CG (Photo C7). Many of the subsidiary ponds were also breached and filled with recent sediment. As part of the project, the spreader pond dam was re-constructed and much of the accumulated sediment was dredged out of the pond to increase its depth to 4-5 ft. (See section 7c for an explanation of detailed pond surveys). Likewise, the Upper CG ponds downstream of the spreader were similarly repaired and dredged (Photos C13, C14, C15). The aerial extent and depth of the ponds appears to be similar to historic conditions. Importantly, beavers have returned to Upper CG and appear to have taken winter residence there. In 2013, the new resident beavers were active in dam construction and maintenance as well as new channel and tunnel excavations within Upper CG.

Phase 3 work took place in September with numerous treatments made along a 550-ft length of the Boreas Creek channel. Along this reach, several breached and eroded dams were repaired to check spread water and materials added to the channel to increase roughness and encourage deposition of sediments over scour (Photos C21, C22, C23). It is too early to make a judgment about how well these treatments will function in mitigating or reversing incision of the channel and further spreading water, but at this time we can at least say that implementation monitoring does confirm that the treatments were installed according to design criteria. So, if the restoration concept is sound we can expect a positive response.

(7b) Channel surveys: We continued monitoring Boreas Creek geomorphology through 2013 with a detailed longitudinal profile of the Upper CG reach in January which was repeated again after phase 3 treatments in October. We also resurveyed cross sections (XS) on the reach in September and October of 2013. The profile and relevant XS plots are displayed in appendix G. During the 2013 season, prior to treatment, we observed some changes to channel geomorphology such as bank erosion and some shifting of bed material, but there did not appear to be any major alterations in dimension, and neither incision nor enlargement were significantly exacerbated this year. This is no surprise given the fact that nearly the entire flow of water through the channel at this location was diverted through the restored wetland by the treatments made in 2012, which severely limited the potential of further erosion by the creek itself. The erosion and bed shifts that were observed probably occurred via dry soil processes rather than alluvial processes.

The results of channel surveys document the geomorphic changes that were made to the channel with the phase 3 treatments. By comparing bed elevations on profile surveys before and after treatment in Fig. G1, one can identify segments of the channel that were filled and locations where dams were repaired to restore on-channel ponds. There was little change in either of the relevant XS after treatment since these locations happened to fall between treatment locations. Monitoring these XS in the future will allow us to determine whether the spot treatments that were made will function in raising the bed of the channel over a greater portion of its length.

(7c) Spreader pond surveys and sediment capture: A primary geomorphic stressor to the wetlands of CGP is sediment discharge from the contributing watershed through the Boreas Creek culvert. Ideally, this inordinately high sediment discharge would be controlled at the source before it reaches CGP, but initiating the changes necessary to do this is viewed as a long-term proposition. Taking a more immediate approach, this project aims to capture sediment as it comes onto land owned by the Town within CGP and remove it before it reaches the main wetlands complex. The spreader pond was constructed in such a way that the east cell (retention cell) would function as a sediment retention basin that captures a large fraction of the bedload sediment discharge from the Boreas Creek culvert. An access road and hardened ramp on the bank of the spreader pond is intended to facilitate periodic excavation of accumulated sediments as necessary to maintain its depth and retention function.

In 2013, we began monitoring the amount of sediment accumulating in the spreader pond by surveying the topography of the bed of the pond and comparing pond volumes through time. In addition to the set of points we used to create a topographic surface, we also completed detailed surveys along monumented transects (Photo F1) to precisely track changes in bed elevation along these transects. Data

from these surveys are presented graphically in Appendix F. The pond filled by a volume of about 18 cubic yards between May 13 and September 16, and the sediment responsible for this ranged in size from fine silt to small gravel. The predominant size seemed to be sand. The accumulating sediment decreased pond volume as the bed raised from 0.0 ft to about 1.4 ft in places. Though the bed elevation came up with the accumulation of retained sediments, the actual volume of water in the pond increased over the period of monitoring in 2013 since the height of water also rose after beavers began maintaining the dam. In sum, the treatments effectively prevented 18 cubic yards of incoming sediment from reaching the wetlands in the core of CGP.

Previous efforts to monitor the volume of sediments that enter CGP through the Boreas Creek culvert using sediment rating curves were ineffective. We concluded in 2012, after one season trying to measure sediment discharge with sediment sampling equipment, that this approach was impractical because the bulk of sediments are transported during very short, high intensity storm peaks that are difficult to quantify and even more difficult to sample. The volume of sediment retained in the spreader pond over time is the best estimate we have of bedload discharge at the Boreas Creek culvert. Using these data to quantify incoming sediment is possible if we can reasonably assume that all incoming sediment is actually retained in the pond. As long as the dam is not breached, this assumption is probably reasonable at least for the bedload fraction of sediment discharge. For suspended sediment, on the other hand, we suspect that only a portion of the incoming load is actually retained in the pond. The volume and retention time of the spreader pond is likely too small to force these particles out of suspension. For these reasons, our calculated volume of 18 cubic yards in the spreader pond should be viewed as a proportion of the actual total volume of incoming sediment.

(8) Chemical environment (FACWet Variable 8)

(8a) Observations: Soil chemistry: Prior to the project in 2012, the breadth of the site showed unnatural periods of drying and unsaturated soil which are strong indicators that the normal reducing chemical environment was not present across most of the study area. The primary aim of the project regarding soil chemistry is to reestablish an appropriate saturation regime and redox environment. After implementation in 2012, and more so in 2013 after beavers returned and began maintaining dams, natural patterns of soil saturation appear to have been restored across much of the study area (see variable 5, water distribution). Thus, the prerequisites for maintaining the redox environment of the native wetland soils appear to have been largely restored.

Water chemistry**:** In fall of 2012, we investigated reports of increased algae and elodea blooms in CGP, because there appeared to be more of both these plants in ponds this season compared to previous ones (Photo C24). The evidence for this is anecdotal, but if the pattern is real, there are several possible explanations. Of greatest concern to the Town is that proliferation of these aquatic plants could be an indicator of elevated nutrient levels in the water. That is, excessive aquatic vegetation growth can be an indicator of decreased water quality or a pollution source, so this was our first concern. However, detailed water chemistry monitoring across CGP and the contributing watersheds revealed no significant increase in nutrient concentrations compared to past years (See section 8d) which is evidence against the decreasing water quality hypothesis. An alternative hypothesis is that the low flows and drought conditions present in 2012 caused the water in ponds to be more "stagnant" and thus subject to additional

warming in summer. Warmer water temperatures would spur faster growth of aquatic plants and algae. To investigate this hypothesis further, we looked to other similar wetland areas in the area such as Cucumber Creek and Barton Creek. We found higher than normal levels of algae and elodea in ponds within these wetlands as well, which is further evidence that the increased aquatic vegetation levels seen on CGP that season were the result of a more widespread response to drought and weather rather than an indication of water pollution. Normal levels of aquatic vegetation were generally seen in 2013 within CGP which further supports this explanation.

(8b) 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 the past two years 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. Results for soil redox monitoring on Upper CG through the 2013 season are provided in appendix H and summarized in Table 7. Prior to treatment in 2012, only one of the test sites, site H, showed an anaerobic pattern of soil redox that is typical of wetlands. Soil chemistry at all of the other sites clearly indicates dry, aerobic conditions prior to treatment. After treatment in 2012, sites A, G, J, K, and M showed an immediate conversion to anaerobic conditions. In 2013, anaerobic conditions were indicated through most of the season on all sites except for E, F, J, and N.

Table 7. *Soil redox summary*

Site ID	redox pattern indicative of anaerobic soil chemistry
CGP-A	Yes
CGP-B	Yes
CGP-C	Yes
CGP-D	Yes
CGP-E	No
CGP-F	No
CGP-G	Yes
CGP-H	Yes
CGP-I	Yes
CGP-J	No
CGP-K	Yes
CGP-L	Yes
CGP-M	Yes
CGP-N	No

(8c) Water quality data: The Breckenridge Ski Area has been contracting with TetraTech to complete detailed water chemistry monitoring throughout CGP and the contributing watersheds within the ski area and base areas since the early 2000s, and annual reports are made available to the Town. The repots provide raw data without analysis, findings, or recommendations. We collect the data from these reports into a separate database for the Town so we can monitor water quality parameters and scan for "red flags" or indications of change that suggest a threat to water quality. There were no significant red flags in the new water chemistry data from 2012 or 2013. Water quality data and the TetraTech annual reports will be made available to the Corps through the Town if requested.

(9) Vegetation (FACWet Variable 9)

(9a) Observations: Quantitative vegetation monitoring was not repeated in 2013, but we did make some general observations. Prior to treatment, there was an emerging weed problem apparent in Upper CG as weeds have been colonizing recently dried pond beds and newly deposited sediment. Ponds and wet soil conditions have been restored to most of these locations which has eliminated a large portion of the weed population in the study area (Photos C9 and C14, for example). An exception to this pattern is the recent spread of reed canary grass which is not considered a noxious weed but is a resilient exotic

nonetheless. This species appears to be thriving in the re-saturated soils and even as emergents in some of the restored ponds. More generally, most of the project area already had remnant wetland vegetation present prior to treatment which appears to be thriving in the re-saturated condition. Vegetation that was planted as part of the phase 1 and 2 treatments appears to be surviving well and becoming established at all sites (Photos C2 and C6, for example)

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 and 2013. 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. A separate map in Appendix B shows the current status of wetland determination at test sites according to data from 2013, indicating widespread restoration of hydrology and wetland status following treatment.

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 Corps three-parameter test for wetland habitat. The extent of surviving wetland habitat prior to restoration was much smaller than we estimated in 2011 (Beardsley and Johnson 2011). The cause of this habitat loss was diminished water distribution that resulted in a lack of hydrology on 13 of the 14 test sites. Over most of the area, relic hydric soils and characteristic wetland vegetation were still present prior to treatment, indicating the potential for rapid restoration of wetland condition if hydrology could be restored, which is what this project set out to do.

These efforts appear to be largely successful so far, since we documented improved hydrology at all but one of the 14 test sites and true wetland hydrology at all but three of the sites. Voluntary wetland restoration efforts by the Town of Breckenridge and Vail Resorts in September 2012 (Phases 1 and 2) and 2013 (Phase 3) appear to have been constructed as designed and appear to be on track towards restoring functional condition. In addition to improved or restored hydrology, a positive response in wetland condition is documented by improved scores on all relevant FACWet variables. Each of the improved variable scores is supported by direct evidence from detailed monitoring data that is explained in this report. In short, the project appears to be on track towards meeting success criteria in the restoration of quality wetland habitat within Upper CG. The main questions now are whether these positive changes will be sustainable and whether the improved condition will spread over a greater area. Continuing to monitor these parameters in light of performance criteria will provide an objective means by which to track habitat improvements and ultimately appraise project success in the long term.

vi. REPORTS 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.
- Beardsley and Johnson. 2012. *2012 Wetlands Monitoring in Upper Cucumber Gulch Preserve Breckenridge, CO: A report of baseline conditions and initial indications of success for wetlands restoration.* Submitted to Town of Breckenridge. December 26, 2012.
- Claffey Ecological Consulting, Inc. 2013. *Cucumber Gulch Boreas Creek Restoration.* Submitted to Lesley McWhirter, US Army Corps of Engineers . August 12, 2013
- 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 (numbered stars) across the greater Cucumber Gulch Preserve. Photopoints relative to monitoring project effectiveness on Upper CG include #1, 2, 3, 26, 27, and 28.*

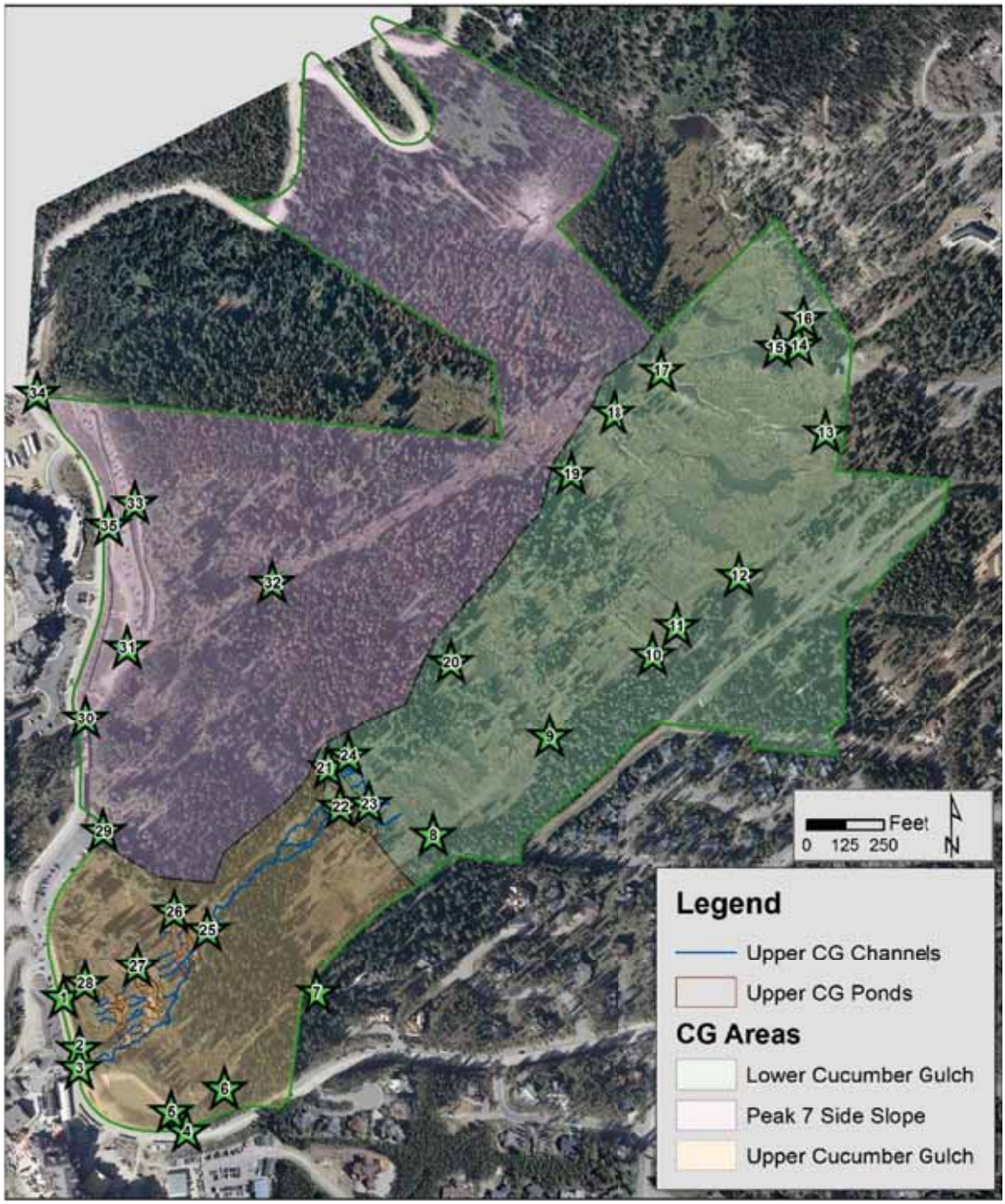
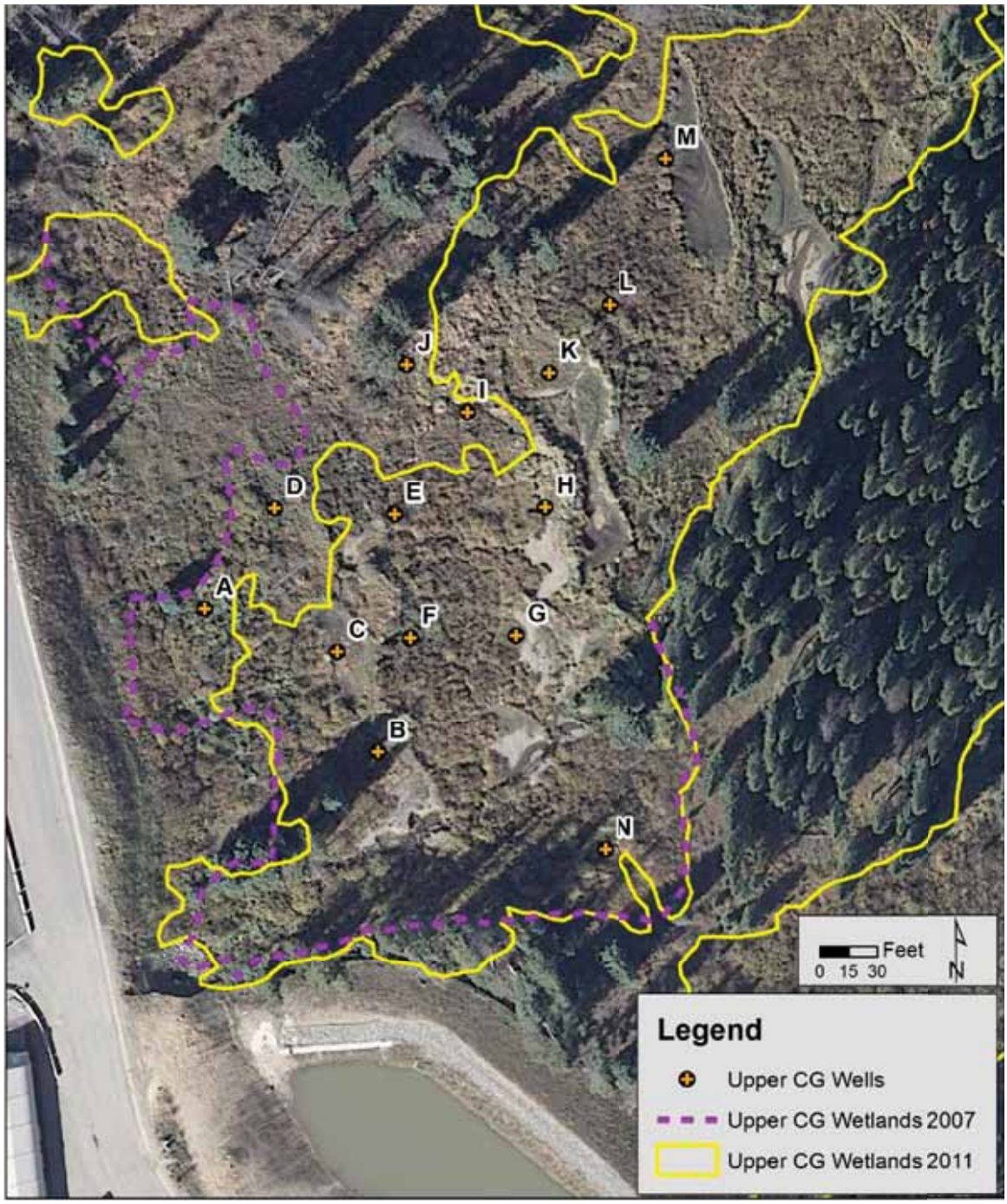


Fig. A2. *Location of monitoring test sites within Upper CG. Each site is equipped with a groundwater monitoring well and datalogger, redox probes, vegetation sample plot, and soil profile point. 2007 and 2011 wetland delineation boundaries are shown as well, so that the location of test sites relative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



APPENDIX B: WETLANDS CONDITION MAPS

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 had actually contracted much more than was previously appreciated.*

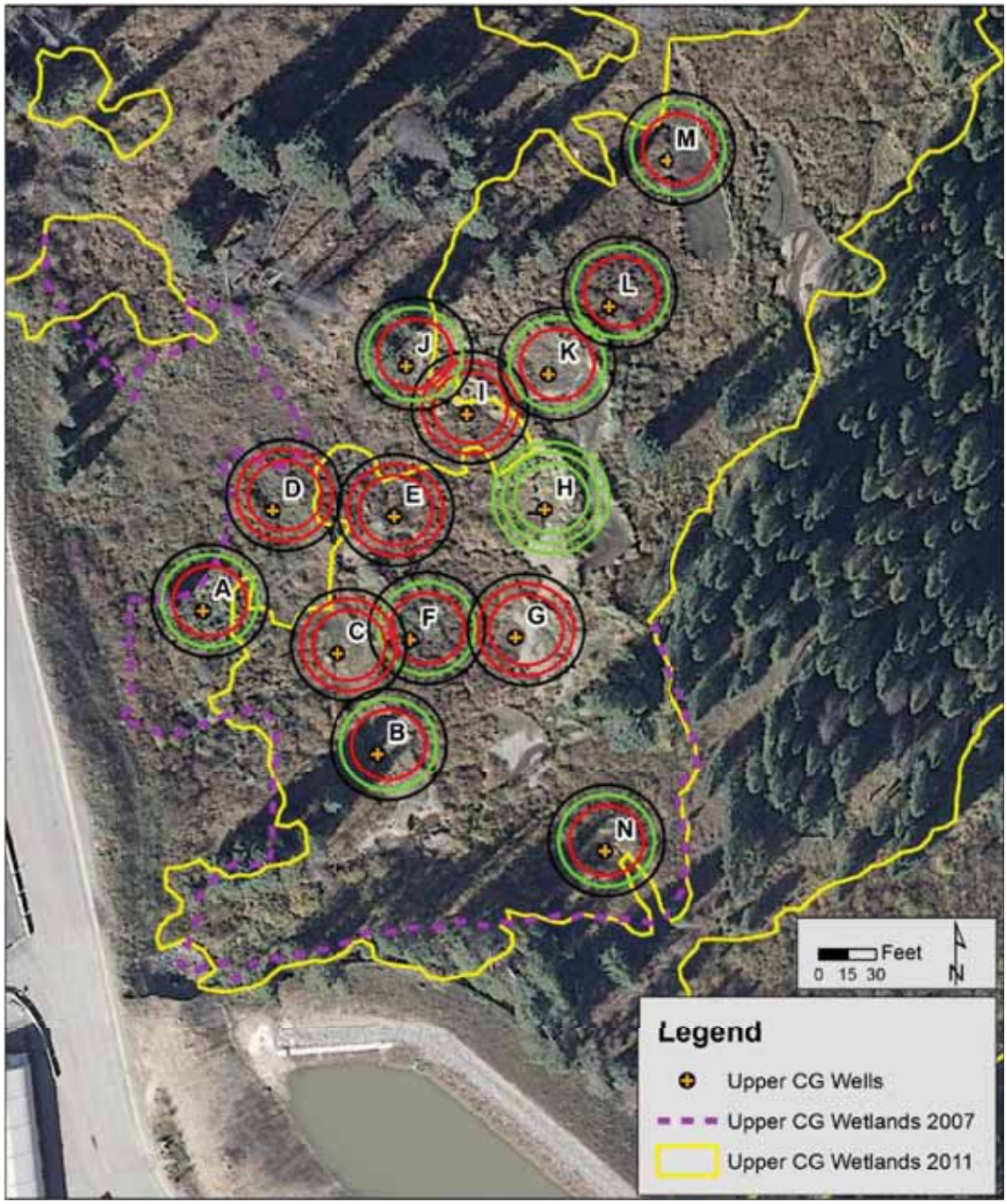
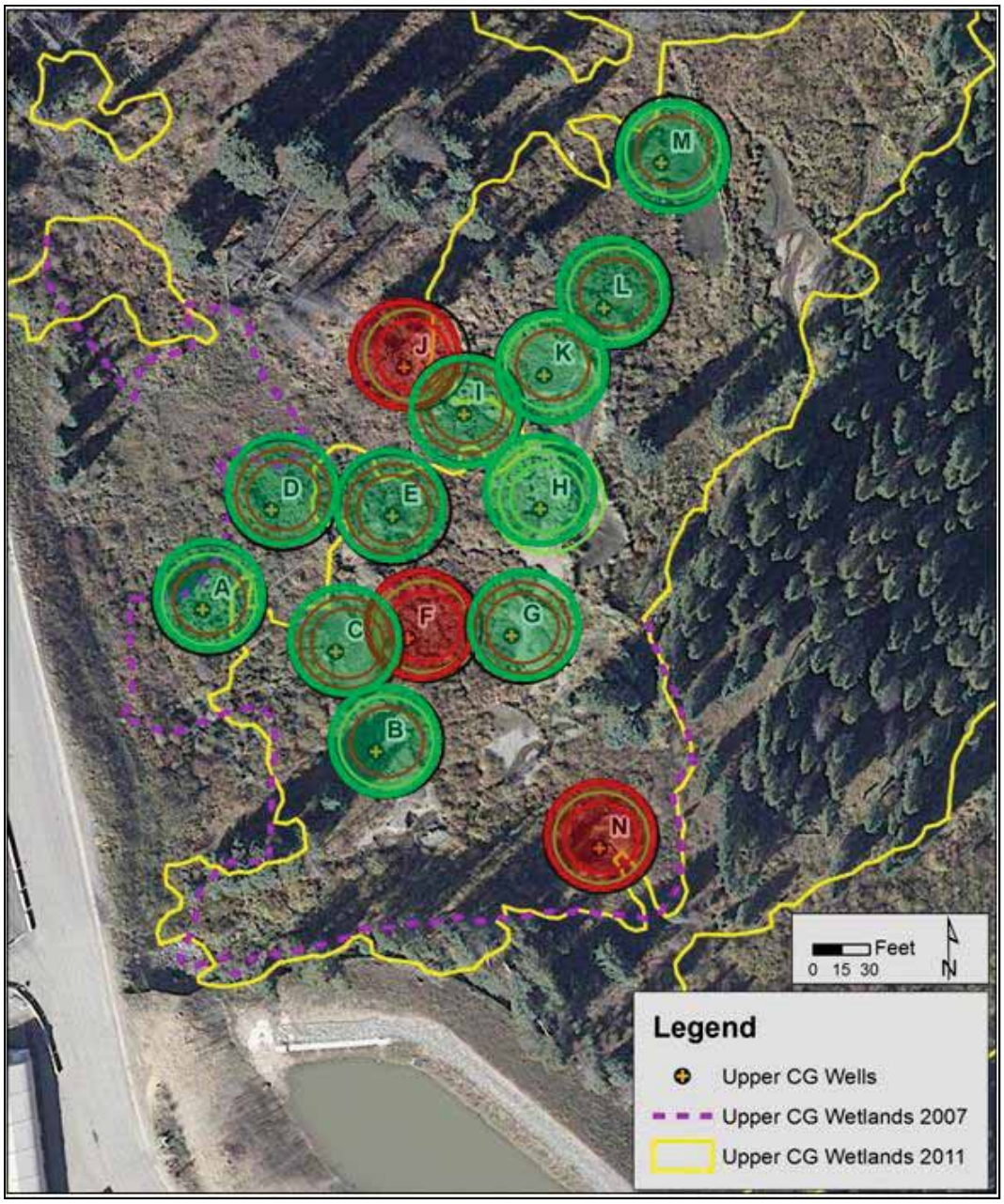


Fig. B2. *Post-restoration data indicates restoration of wetland habitat on 11 of the 14 test sites based on 2013 data. On this map, sites circled in green are those for which data indicate wetland restoration based on re-establishment of wetland hydrology. Sites circled in red did not display wetland hydrology in 2013.*



APPENDIX C: PHOTOS

Photo C1. *This photo shows one of the intakes to the Boreas Creek culvert on the ski area within the contributing watershed. The sediment retention pond upstream of the grated intake was constructed in 2013 in an effort to reduce the volume of sediment transferred from the ski area to Cucumber Gulch through Boreas Creek. The volume of the retention pond is approximately 3 CY. The pond did not appear to capture a measureable amount of sediment in 2013.*

Photo C2. *In June of 2013,a channel began to cut around the repaired plug in the reset pond dam. Town staff arrested the breach with a structure composed of brush packed against vertical poles driven into the ground (upper photo). This temporary structure was meant to mimic a beaver dam and was intended to prevent water from concentrating in the eroding channel until such time that beavers reoccupied the pond, which occurred later that season (lower photo).*

Photo C3. *On August 2, 2013, this beaver was trapped from a nearby area and relocated to the spreader pond in Upper CG by Town and CPW staff. Photos from Scott Reid.*

Photo C4a. *Photopoint 2b, 2012. The photos show the Boreas Creek culvert and detention pond that are the main source of water to Upper CG. Essentially all of the flow from the contributing watershed is confined to the 60" culvert in the foreground through which it is delivered to Upper CG. The detention pond in the background holds runoff from parking lots and impervious surfaces from upstream development. Water from this pond may reach parts of the wetland via seepage through the ground.*

Photo C4b. *Photopoint 2b, 2013. The restoration project included reconstruction of the culvert outlet structure and revegetation. The construction in the lower photo is for drainage from a new parking lot and hotel building. It is unrelated to the project.*

Photo C5a. *Photopoint 3a, 2012. The photos show the development of treatments at the head of the Upper CG project area including reconstruction of the culvert outlet structure, a lateral distributary channel, and revegetation.*

Photo C5b. *Photopoint 3a, 2013.*

Photo C6a. *Photopoint 3b, 2012. A closer view of the Boreas Creek culvert outlet.*

Photo C6b. *Photopoint 3b, 2013. The Boreas Creek culvert outlet. The flows seen in the photo from May are typical of snowmelt runoff. The low in the September photo shows runoff from a small thunderstorm. Note the severe turbidity.*

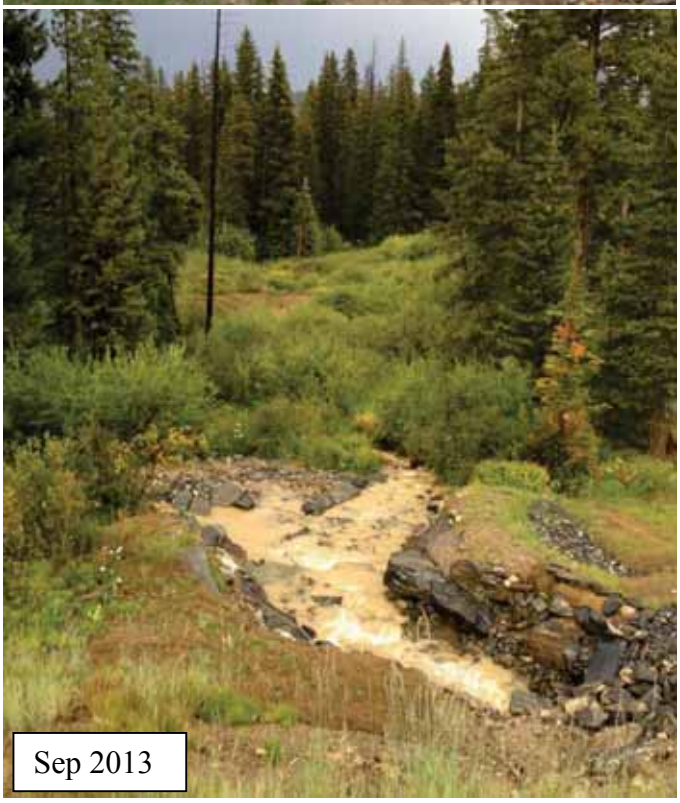


Photo C7. *Photos of the incised Boreas Creek channel that had recently formed by erosion through the entire length of Upper CG, as seen in 2011.*

Photo C8. *One of the treatments aimed at improving water source and distribution was construction of a lateral distribution channel that draws water from just downstream of the Boreas Creek culvert to spread it northward along the toe of the road fill at the head of Upper CG. The upper photo and the lower right photo shows the alignment of the new channel (shown in green) and the main channel of Boreas Creek (shown in blue) just after construction in October, 2012. The lower right photo shows a segment of the new channel in August, 2013.*

Photo C9a. *Photopoint 1, 2012. The restored pond in the foreground is the spreader pond. Prior to restoration (upper two photos) water entering Upper CG was confined to the south edge of the wetland within the incised Boreas Creek channel, leaving the bulk of the wetland area in the foreground high and dry. When full, (lower photo) this pond distributes water laterally across the wetland area, feeding distributary channels and maintaining high water table.*

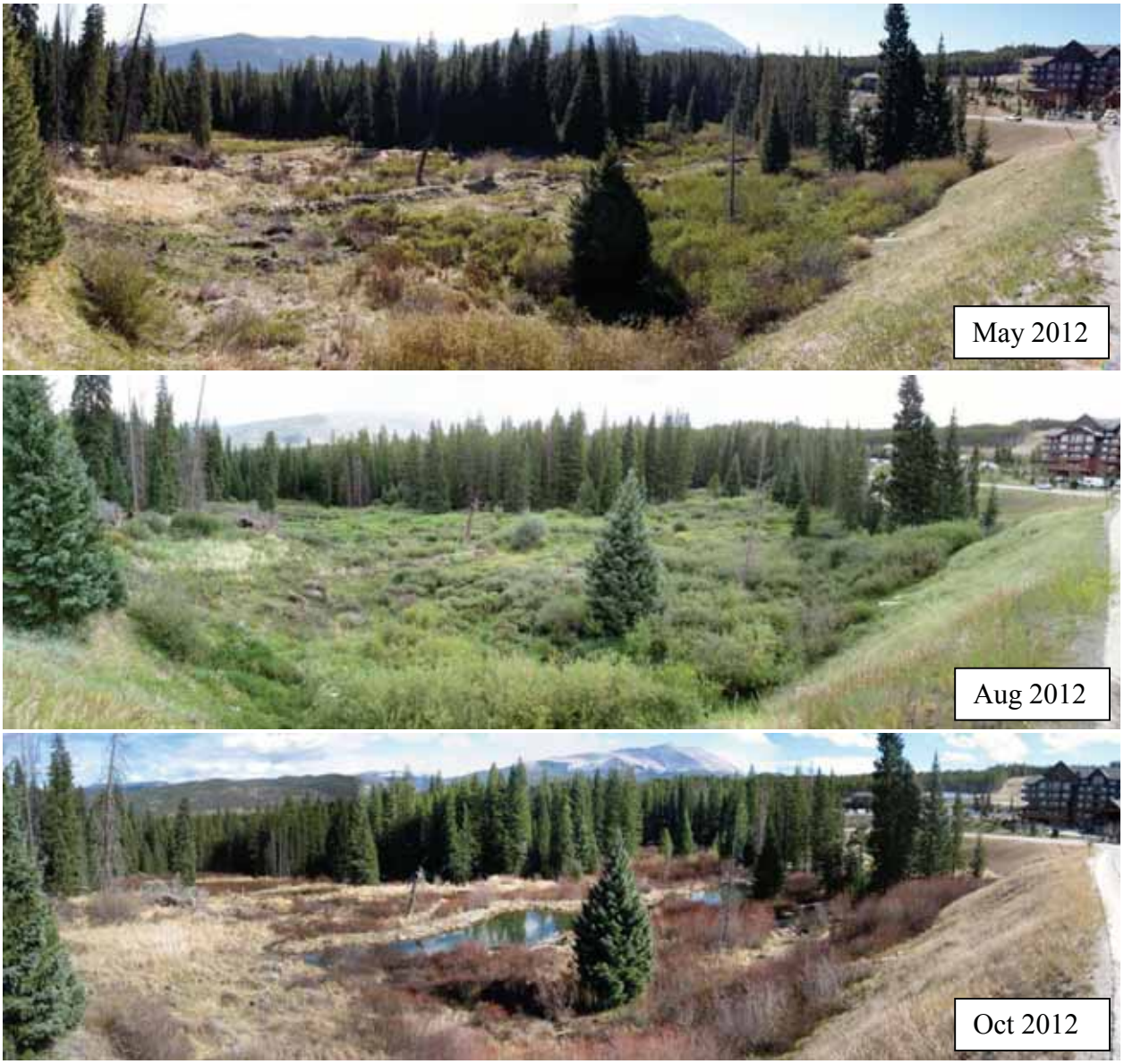


Photo C9b. *Photopoint 1, 2013. The photos show how the spreader pond consists of two cells, with the northeast cell on the right and the southwest cell on the left. The northeast cell was built to function as a sediment retention pond, and in the lower photo which was taken just after a thunderstorm, one can see how turbid that cell is compared to the southwest cell. The photo from September was also taken after beavers had moved in and completed the dam. Beavers effectively blocked the spillway channel that used to exit the pond on the west (left) end to raise the stage of water in the spreader pond by about 1 foot.*

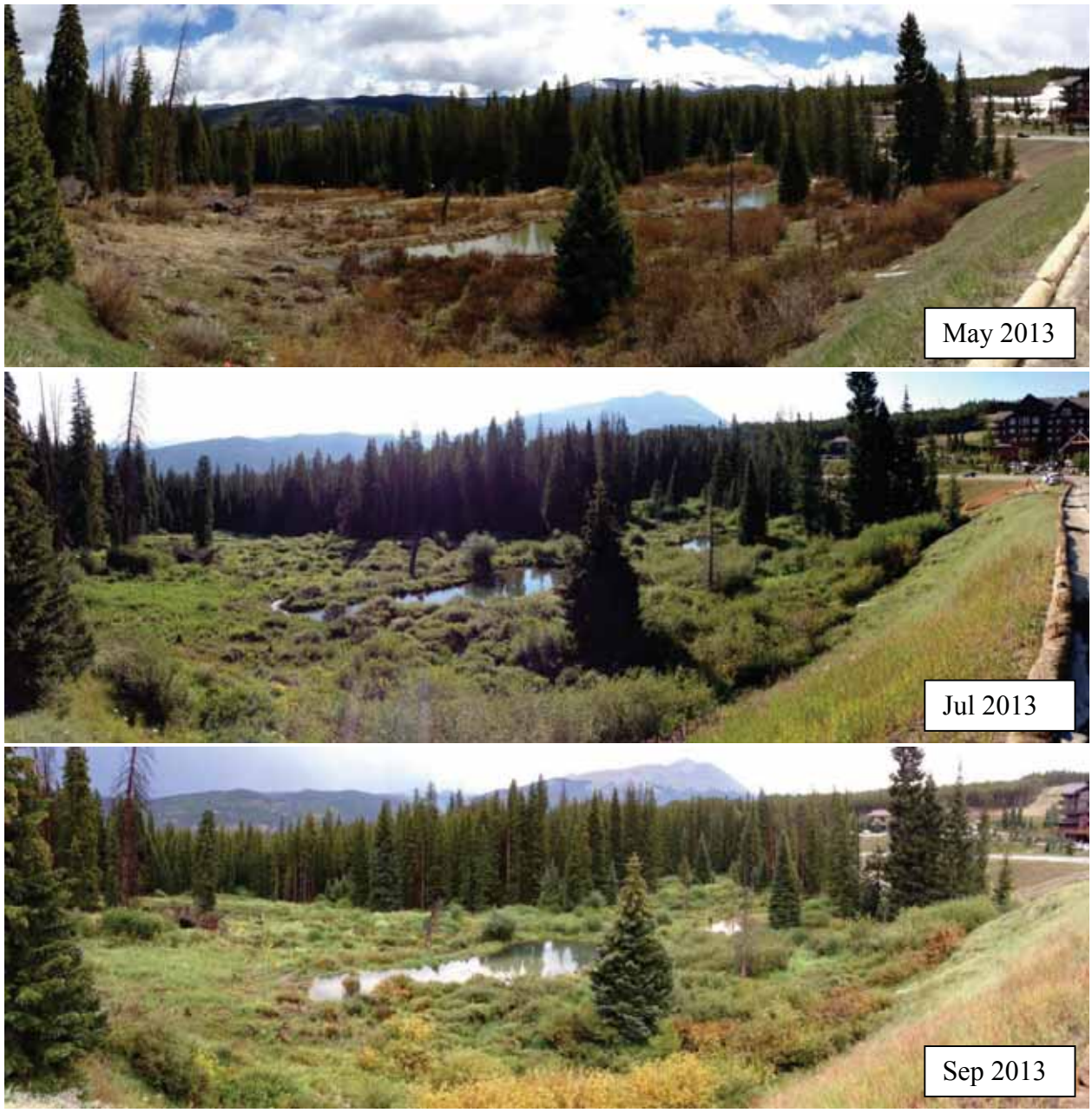


Photo C10a. *Photopoint 2a, 2012.*

Photo C10b. *Photopoint 2a, 2013. The photos show the spreader pond restoration through 2013. In the lower photo from September, one can see how turbid the water in the northeast cell becomes after a thunderstorm which is indication of its intended function as a sediment retention pond. The stage of water in the ponds are higher in the lower photo as well, owing to beavers completing and elevating the pond dams.*

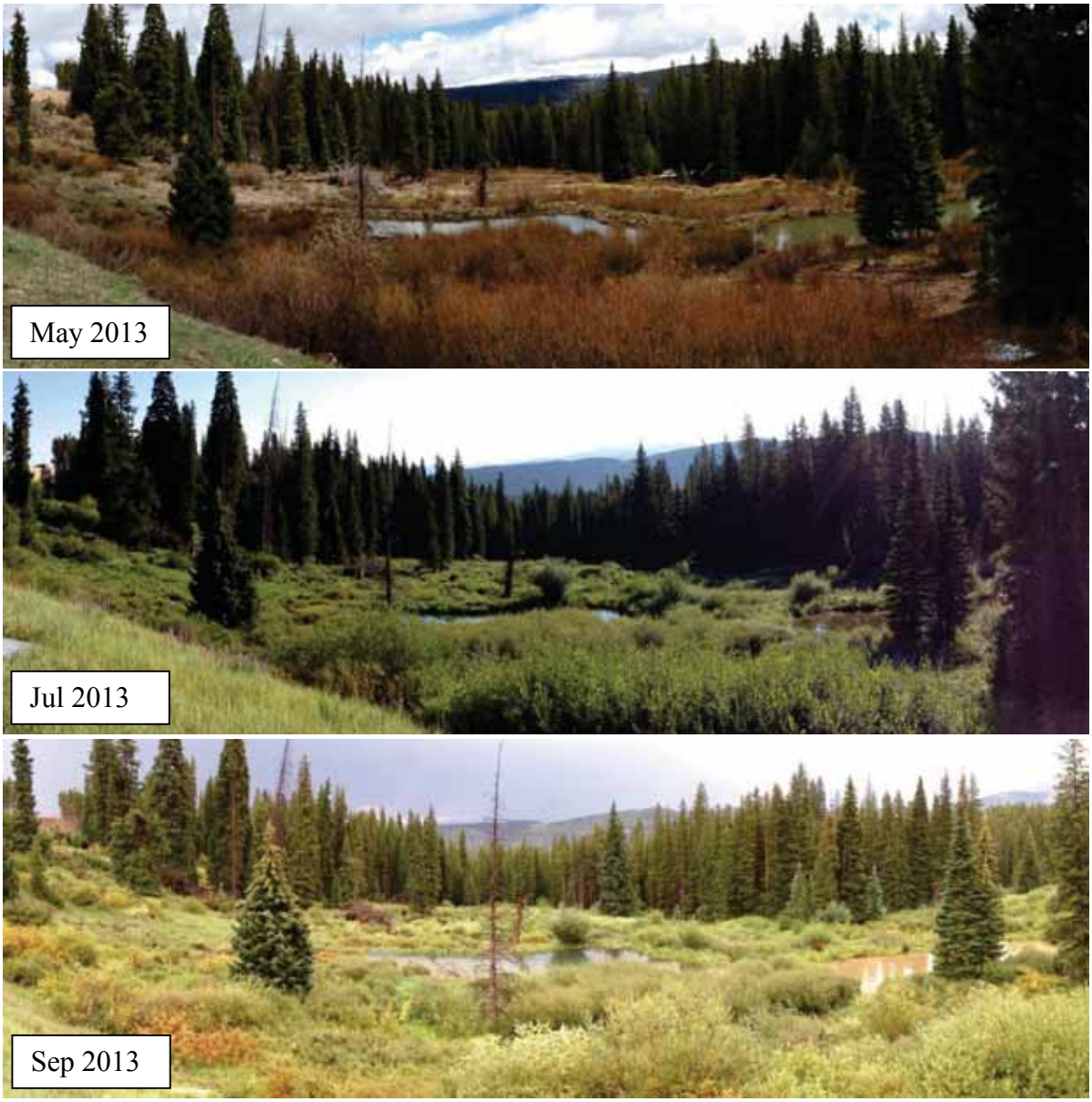


Photo C11a. *Photopoint 28, 2012. Spreader pond area seen from the west.*

Photo C11b. *Photopoint 28, 2013. Spreader pond seen from the west side.*

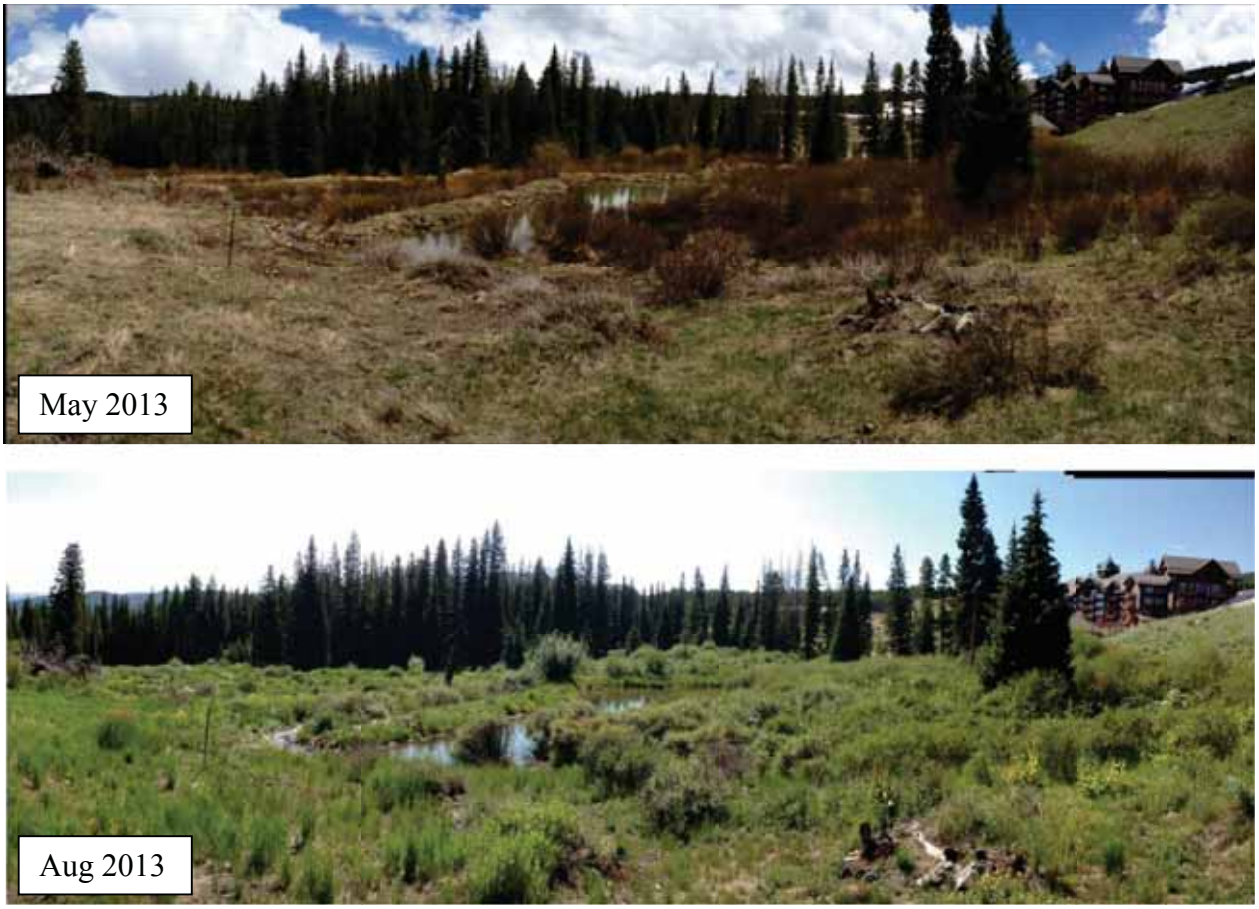


Photo C12. *These photos show the west end of the spreader pond as constructed in October 2012 (upper photo) and on August 29, 2013, soon after beavers reoccupied the area (lower photo). In 2013, beavers plugged the constructed spillway channel which allowed the pond to function fully for spreading water. In the lower photo, the pond is full to the crest of the dam (foreground and left edge) which is being maintained by the beavers (the rings on the pond are from a beaver packing mud on the dam face). The full pond spreads water among a number of distributary channels downstream.*

Photo C13a. *Photopoint 26, 2012 shows the lower portion of the Upper GC project area where ponds were restored during phase 1.*

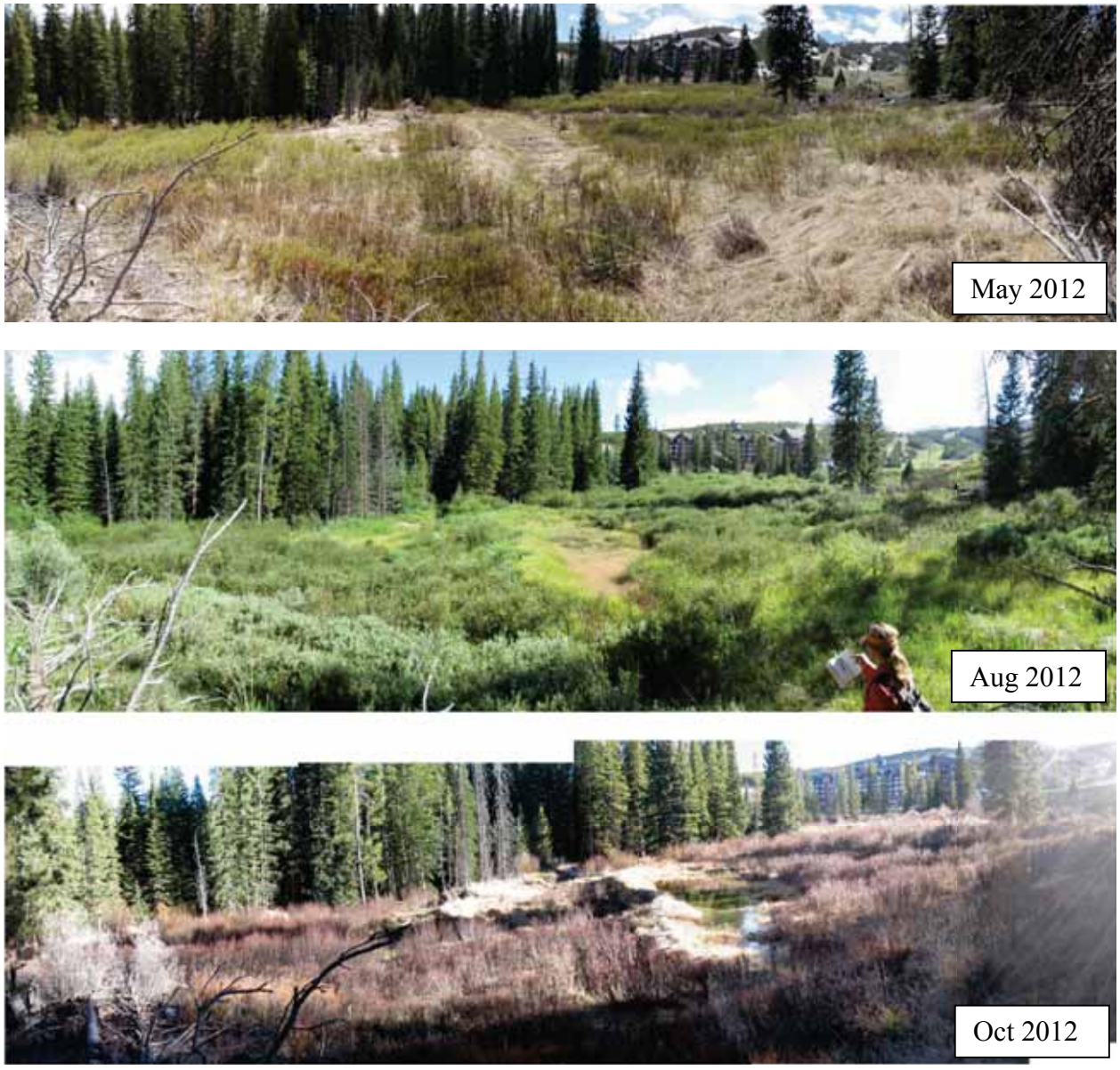


Photo C13b. *Photopoint 26, 2013. The stage of the ponds raised during 2013 after beavers reoccupied the area.*

Photo C14a. *Photopoint 27a, 2012. The photos show pre-project condition followed by restoration of the ponds in the center of Upper CG.*

Photo 14b. *Photopoint 27a, 2013. In August, beavers reoccupied the area and began maintaining the dams, including plugging the spillway channel which raised the stage of the pond in the center of the photo by about 1 foot, which spread surface water laterally.*

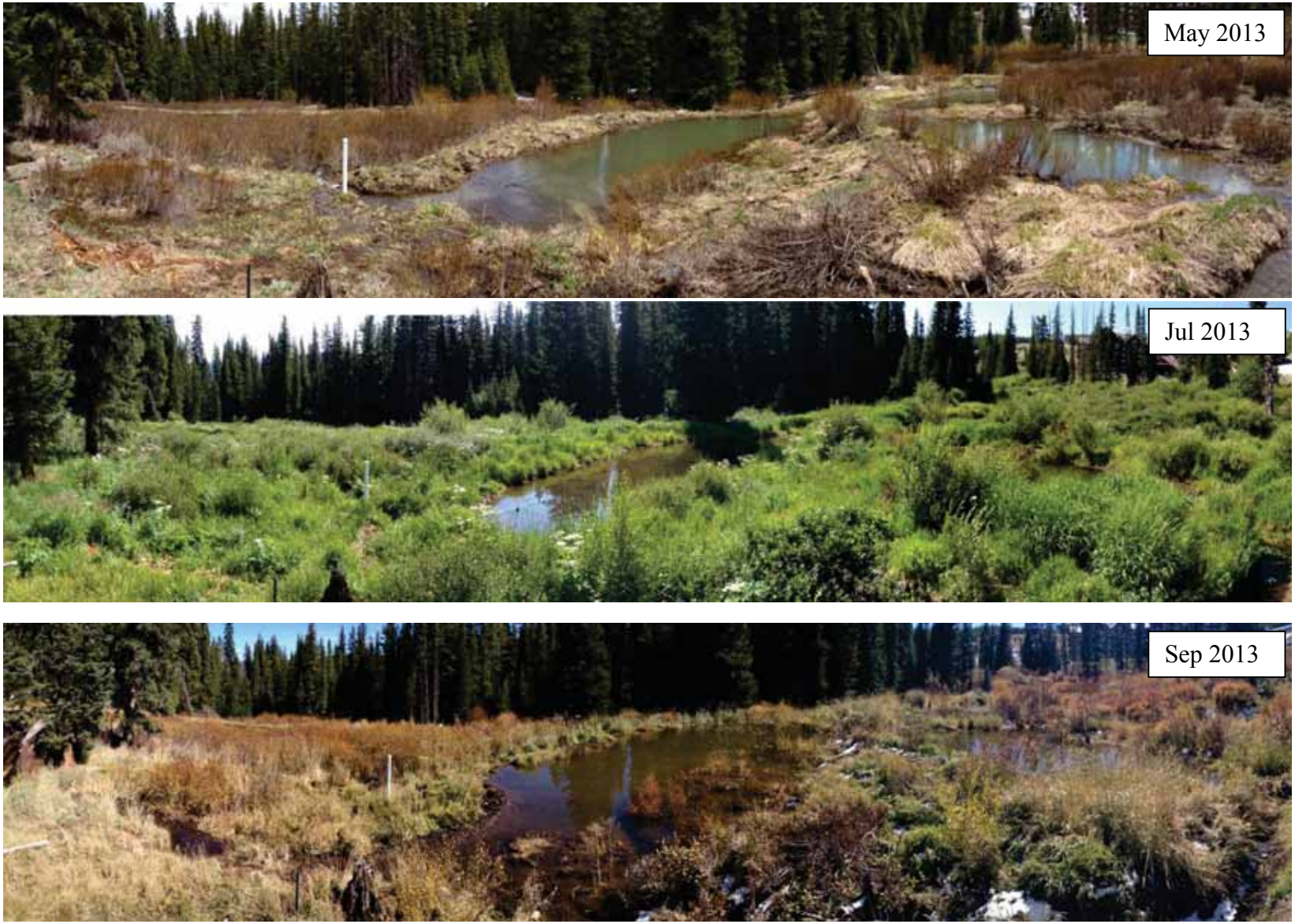


Photo C15. *Photopoint 27b, showing a comparison of 2012 to 2013 conditions in May. The photos document the restoration of pond habitat and water distribution channel in the central portion of Upper CG.*

Photo C16. *Photopoint 21. The reset pond is where water flows from Upper to Lower CG. Prior to restoration in 2012 (upper photo) a breach in the dam captured all water outflow which lowered the water table and dried up the numerous distributary channels that normally feed wetland areas downstream and to the south. After restoration and re-occupation by beavers, the reset pond was again able to provide an elevated water table and active distributary channels.*

Photo C17. *Another view of the reset pond before and after restoration treatments which were made to repair the dam and dredge sediments from the pond. In the lower photo, the mud sill along the dam was created by beavers that re-occupied an abandoned lodge in this pond which, prior to dredging, had lost connection with the pond due to accumulating sediments.*

Photo C18. *Photopoint 22, before and after restoration of the reset pond. Dredging sediments restored depth to the pond and re-connected the abandoned beaver lodge (just left of the large dead tree) with aquatic habitat, making it habitable again by beavers.*

Photo C19. *Photopoint 23, before and after restoration of the reset pond. The full pond elevates the local water table, and it spills along the width of the dam crest supplying water to a system of distributary channels downstream of the dam. The channels are in the vegetation towards the right foreground of these photos, and they feed ponds in the right background.*

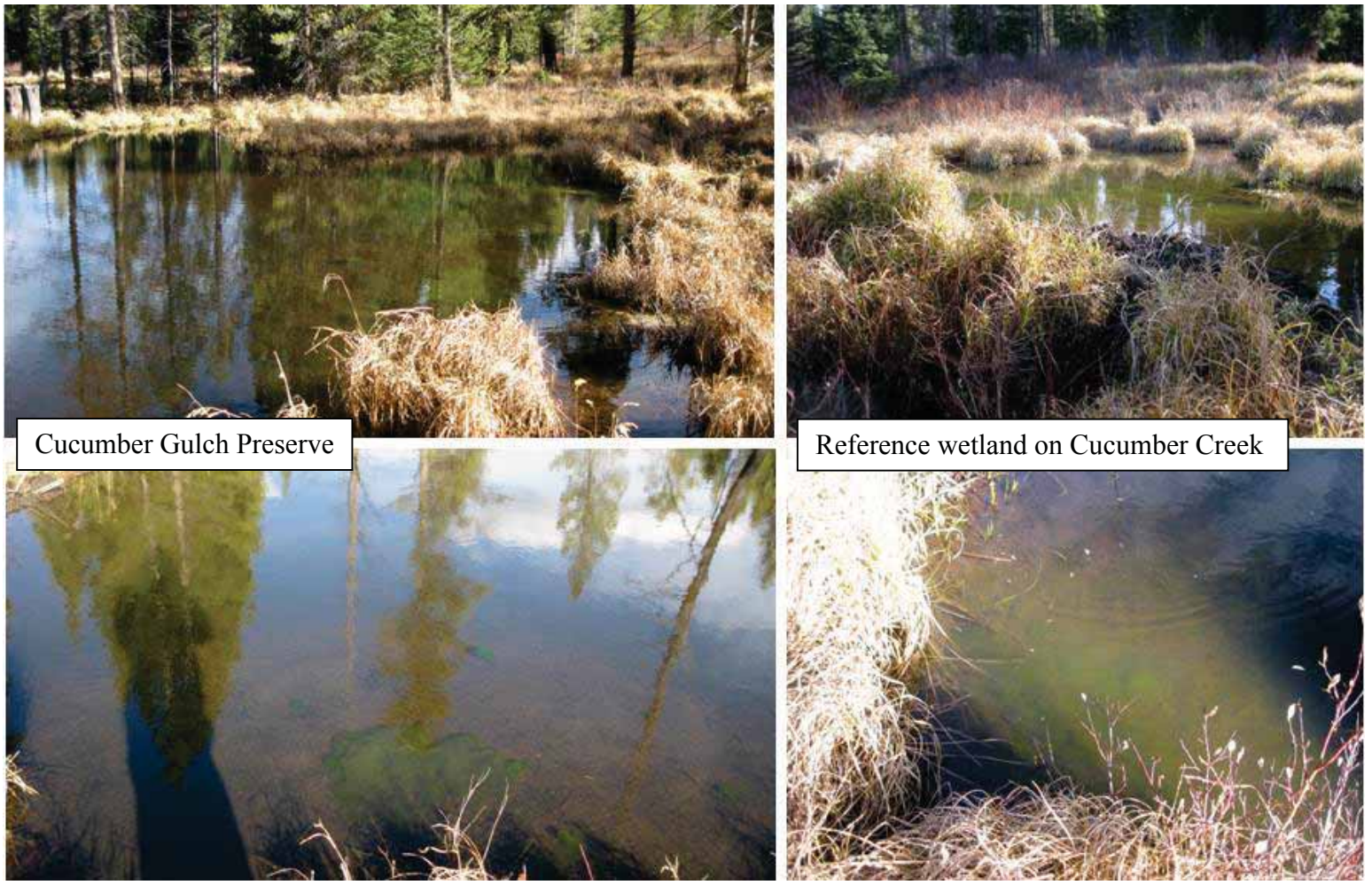
Photo C20. *A close up view showing beaver activity on the dam of the reset pond.*

Photo C21. *This segment of the Boreas Creek channel was partially filled with cobble and woody debris to reduce channel volume and bank height during phase 3 work in September 2013.*

Photo C22. *An old breached dam was repaired on the downstream end of the Boreas Creek channel that is visible in these photos to create a pond. Large woody debris was also placed in the channel.*

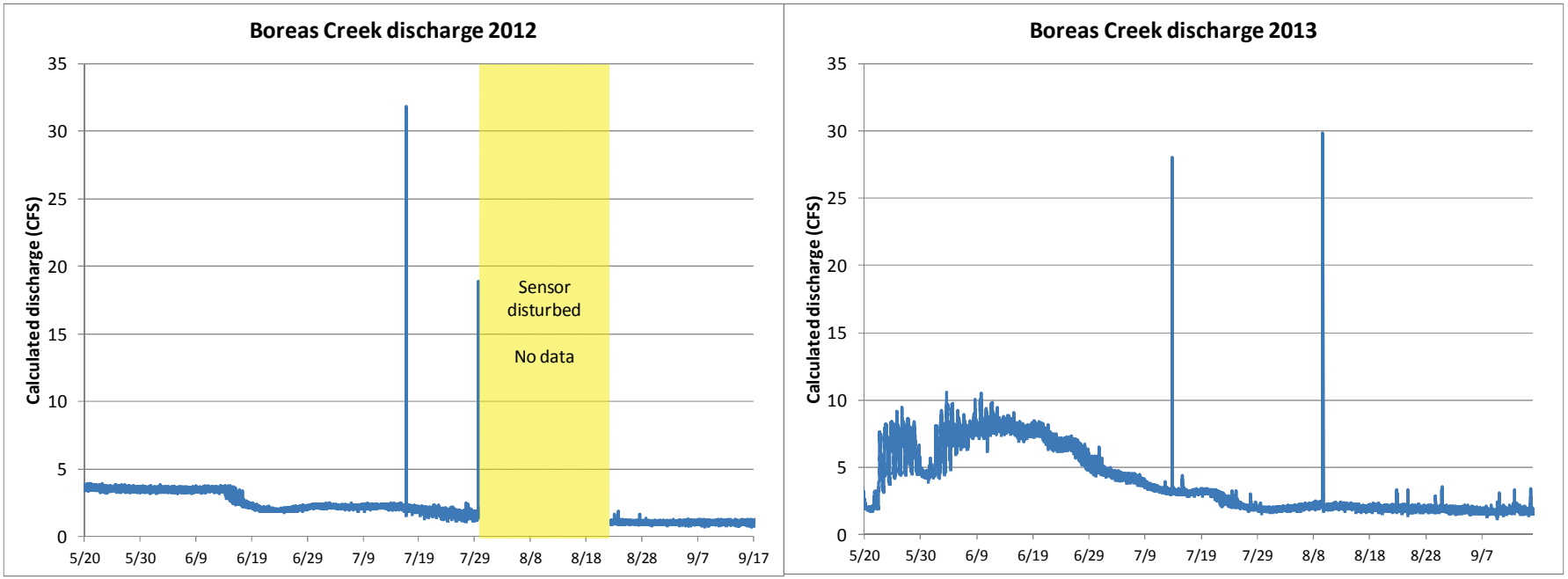
Photo C23. *Another old breached dam near the lower end of the project area was repaired to form this pond on the Boreas Creek channel.*

Photo C24. *These photos document algae blooms that were investigated in late summer 2012. The photos on the left are from CGP. Those on the right are from reference wetland on the neighboring Cucumber Creek drainage.*



APPENDIX D: BOREAS CREEK DISCHARGE (STREAMFLOW)

Fig. D1. *Stream discharge (CFS) in the Boreas Creek Culvert, where it enters CG. Discharge was calculated from measured values of water height and velocity collected and logged every ten minutes from May through September. The overriding influence of snowmelt runoff is apparent on the 2013 hydrograph but was largely absent in 2012 due to low snowpack and early melt-off that season. The spikes observed in July and August correspond to thunderstorm events that also caused spikes on hydrographs for the Blue River gauges (verifying that these were actual hydrologic events). The duration of these peaks was typically less than one hour. Measurements of the magnitude of peak discharge by these methods should not be considered highly accurate due to impacts of sediment and turbulence at these unusually high discharge rates. At the very least, though, it is clear that unusually high discharge, short duration peaks do occur with especially severe thunderstorm rainfall events.*



APPENDIX E: HYDROGRAPHS

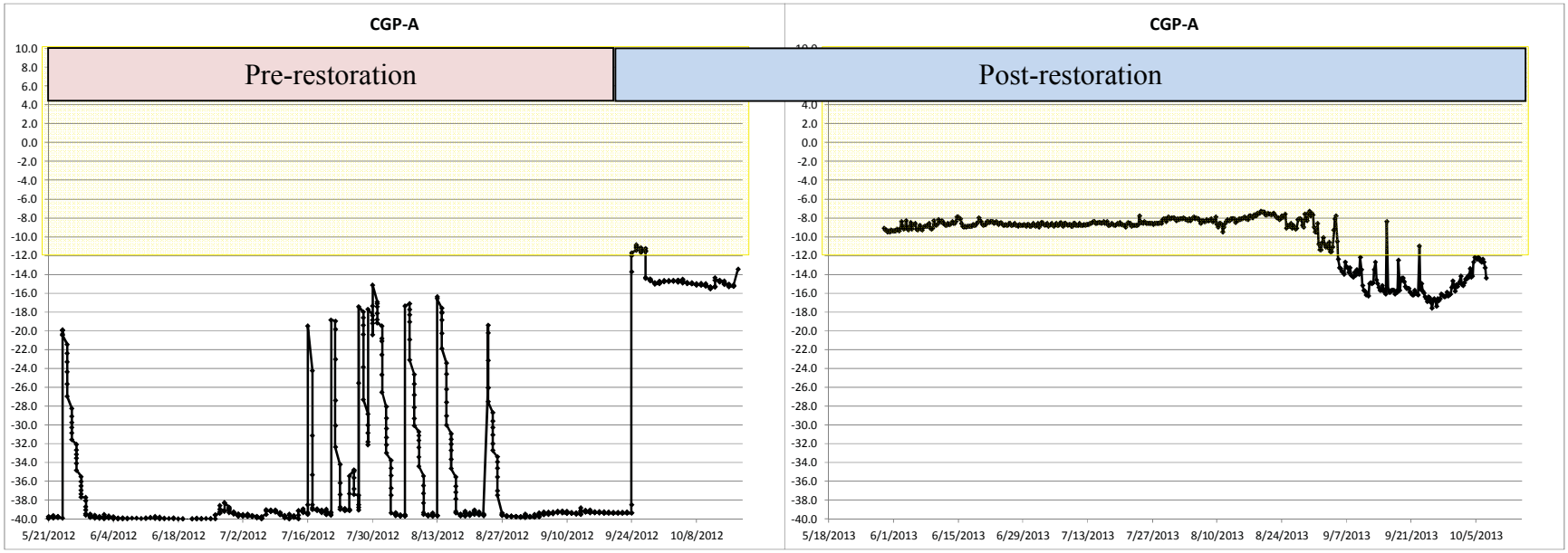


Fig. E1. *Well Plot A*

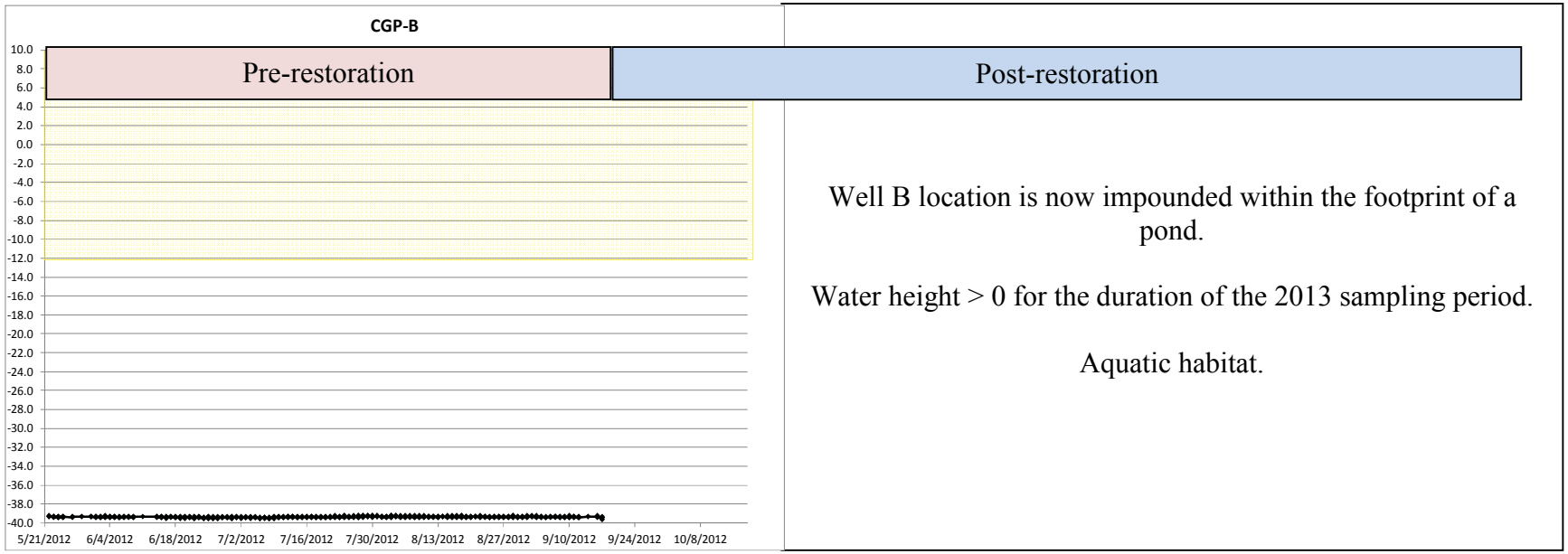


Fig. E2. *Well Plot B*

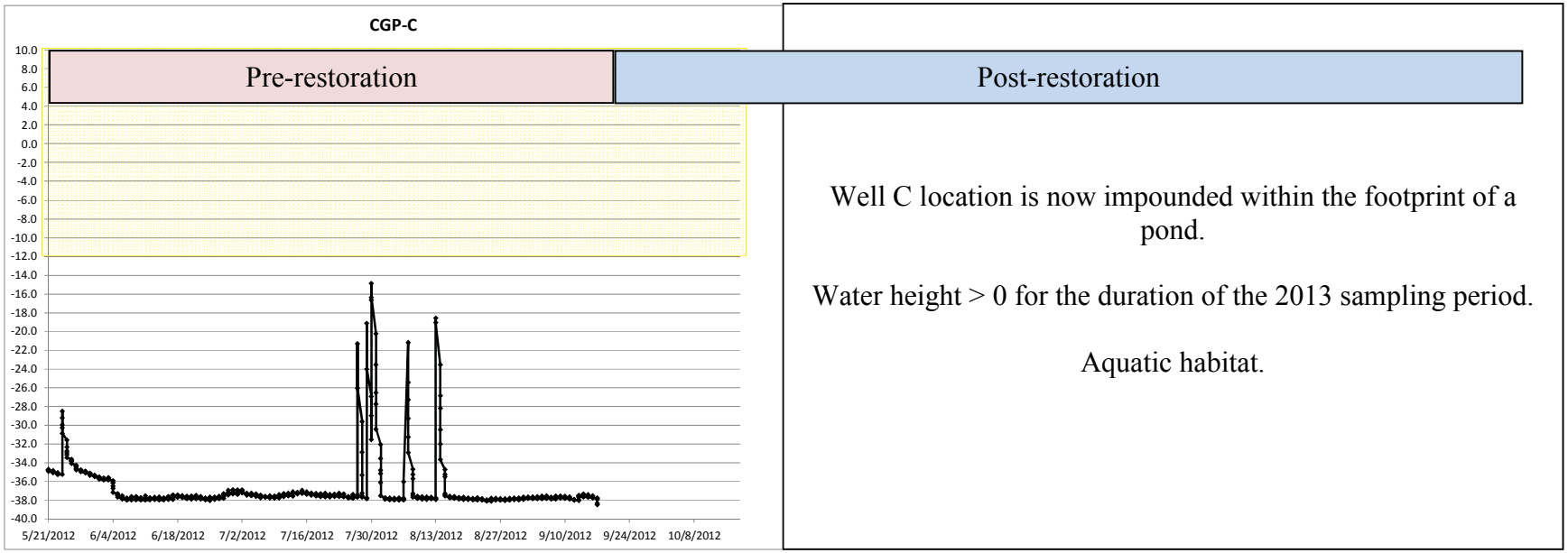


Fig. E3. *Well Plot C*

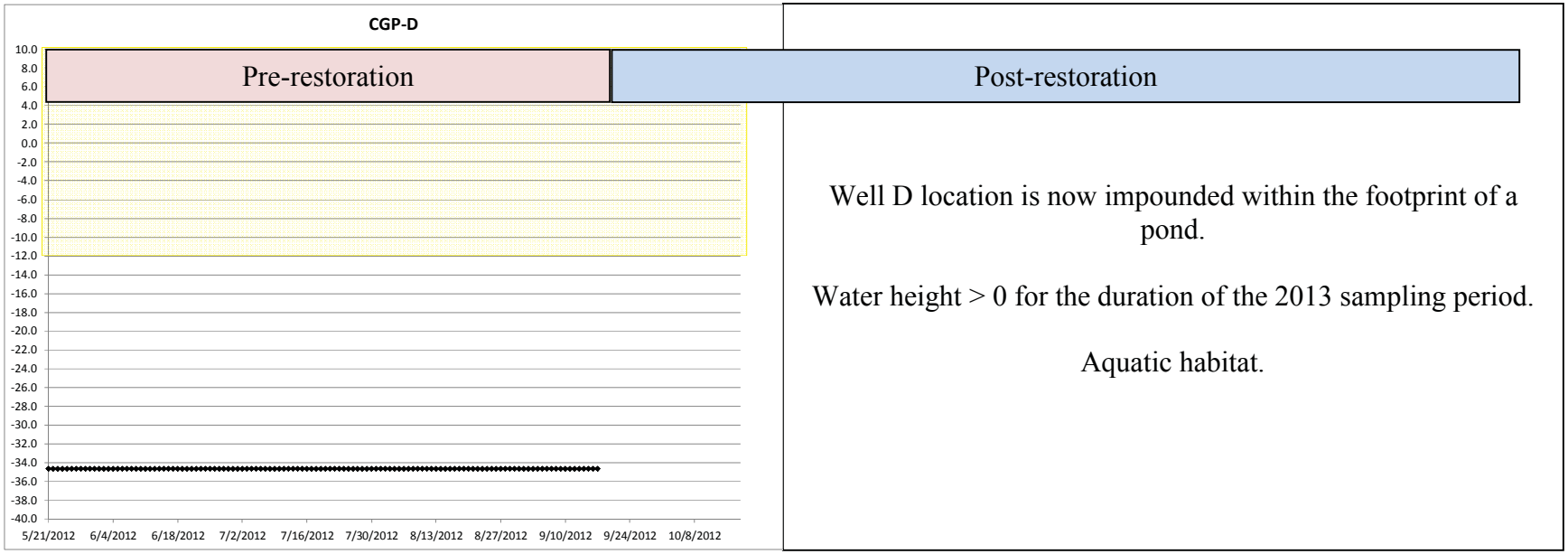


Fig. E4. *Well Plot D*

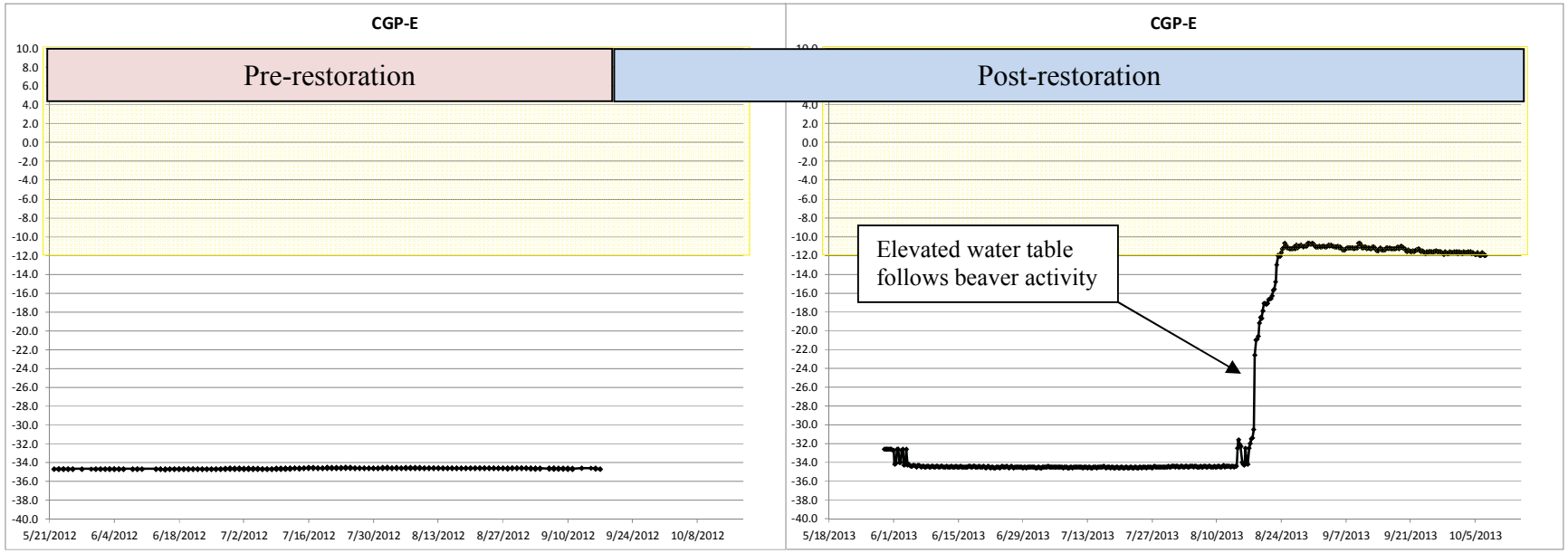


Fig. E5. *Well Plot E*

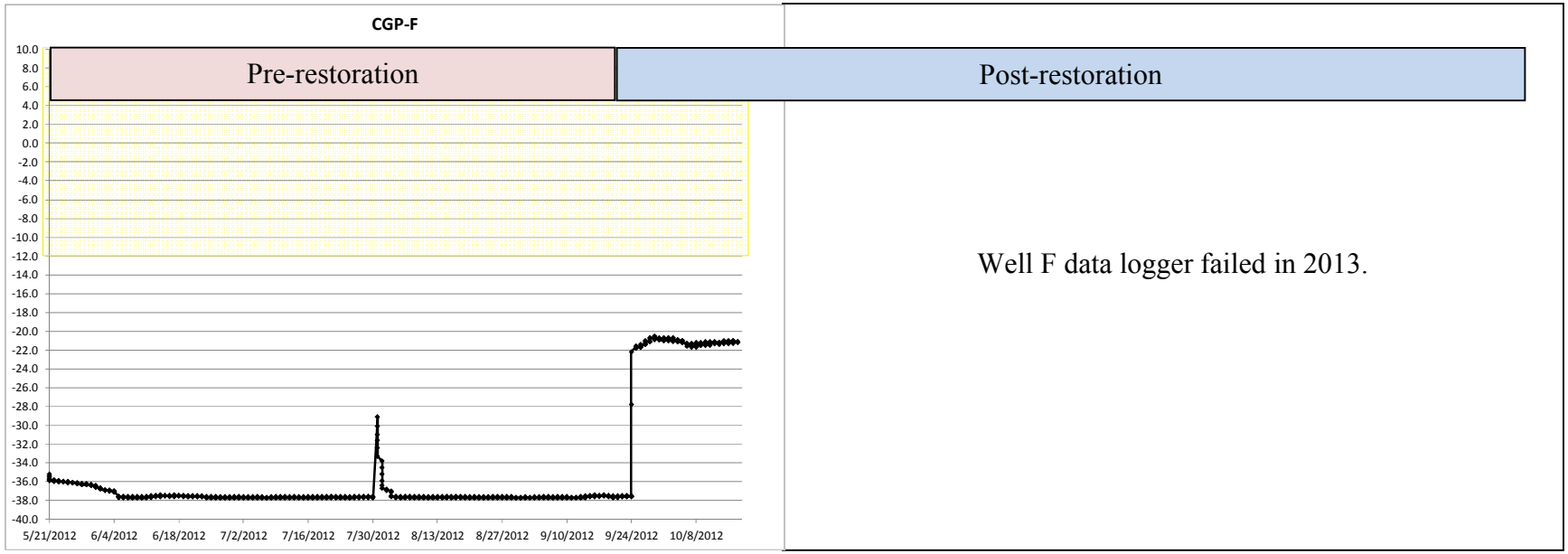


Fig. E6. *Well Plot F*

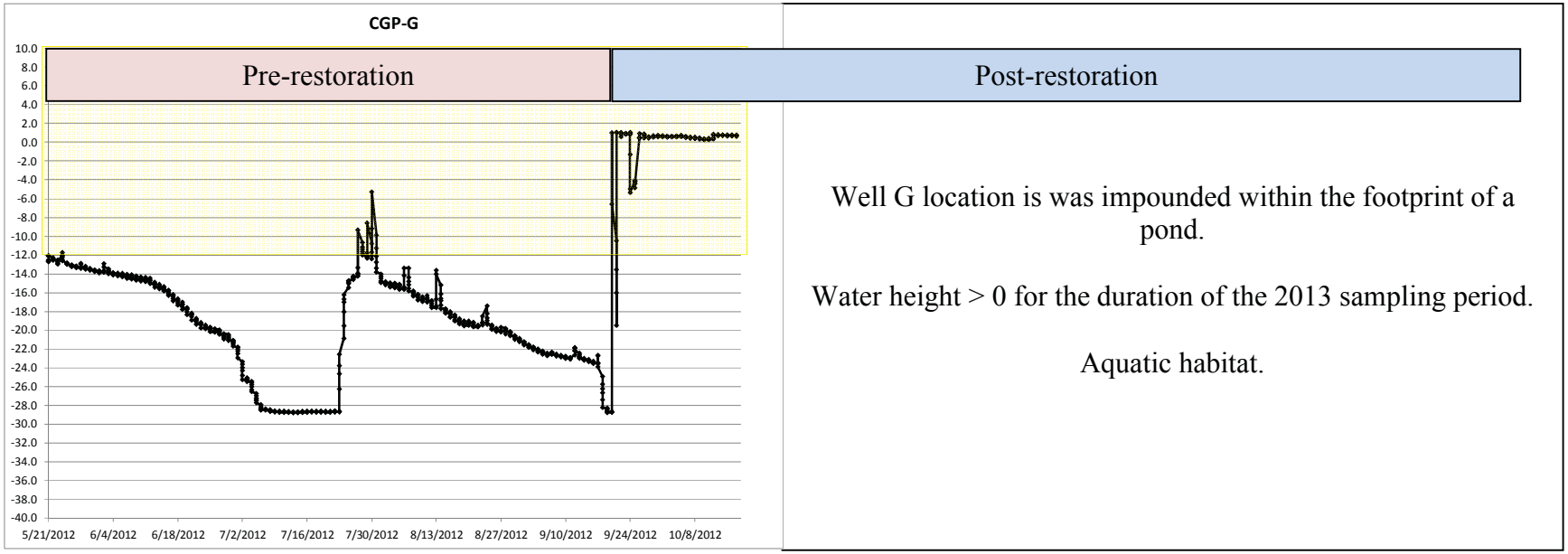


Fig. E7. *Well Plot G*

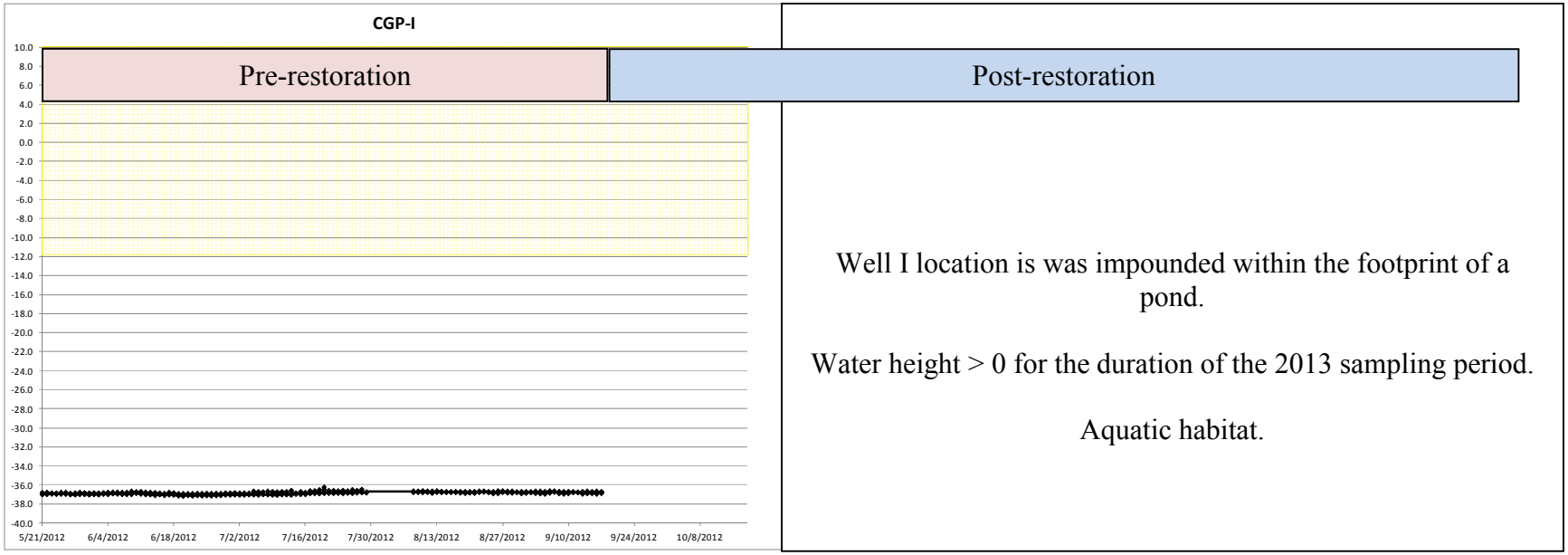


Fig. E8. *Well Plot I*

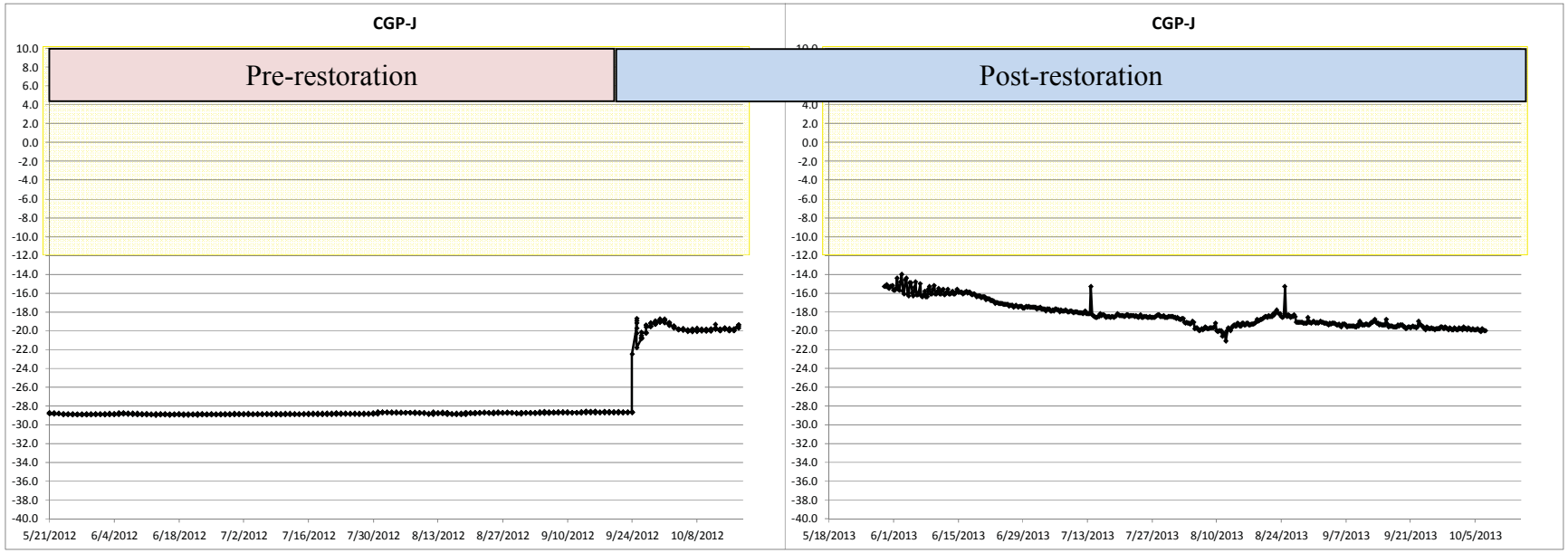


Fig. E9. *Well Plot J*

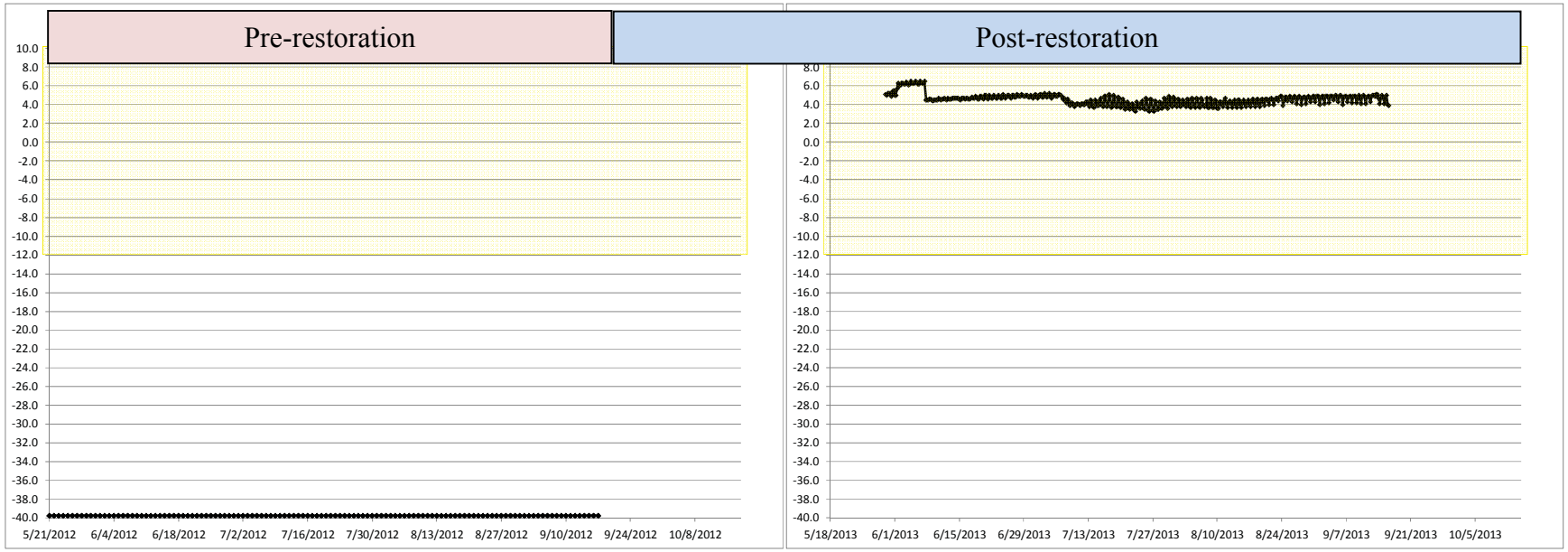


Fig. E10. *Well Plot K*

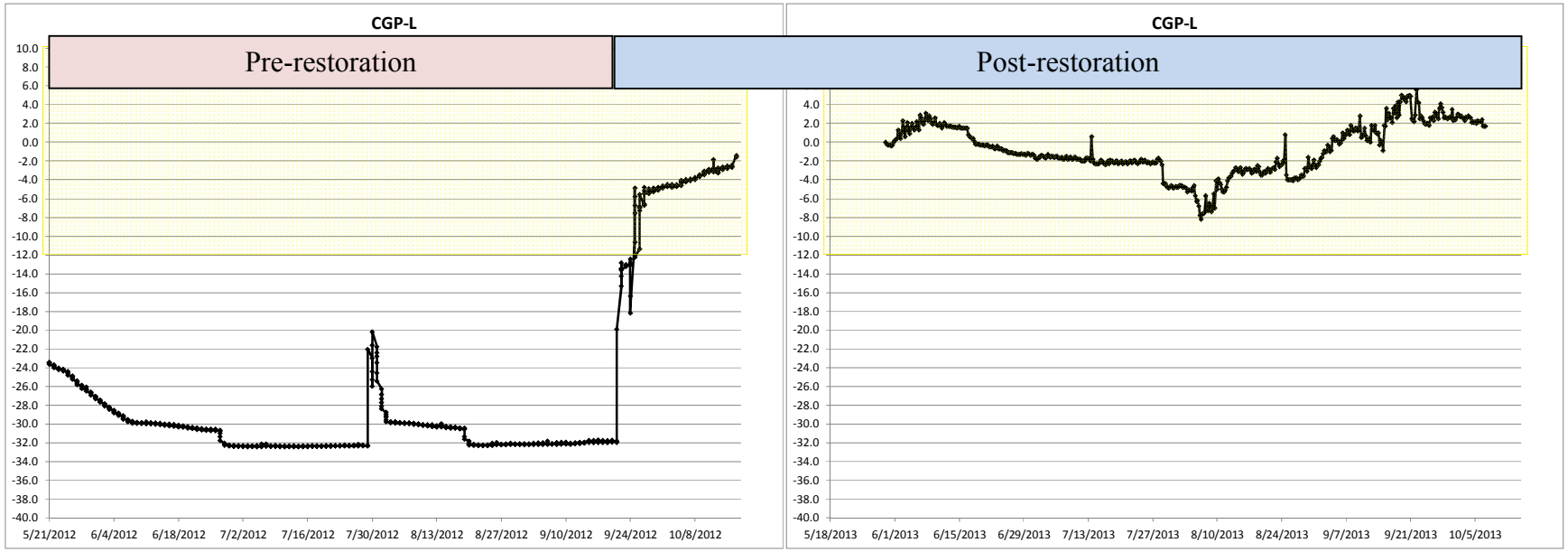


Fig. E11. *Well Plot L*

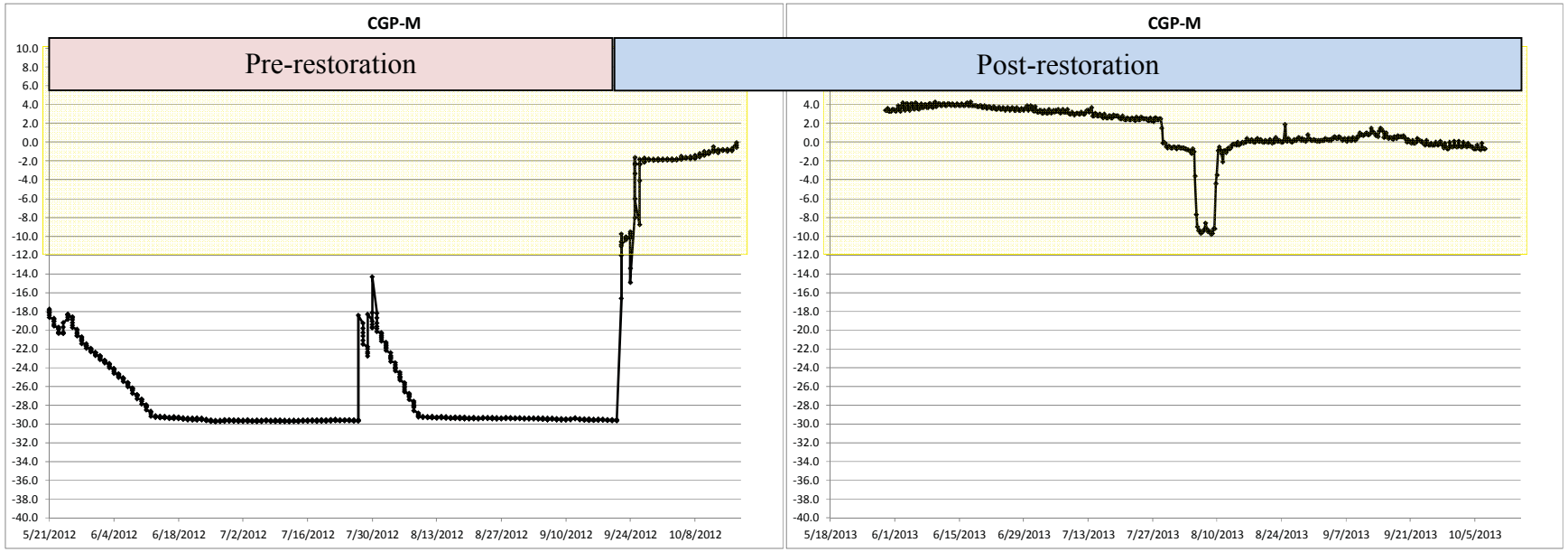


Fig. E12. *Well Plot M*

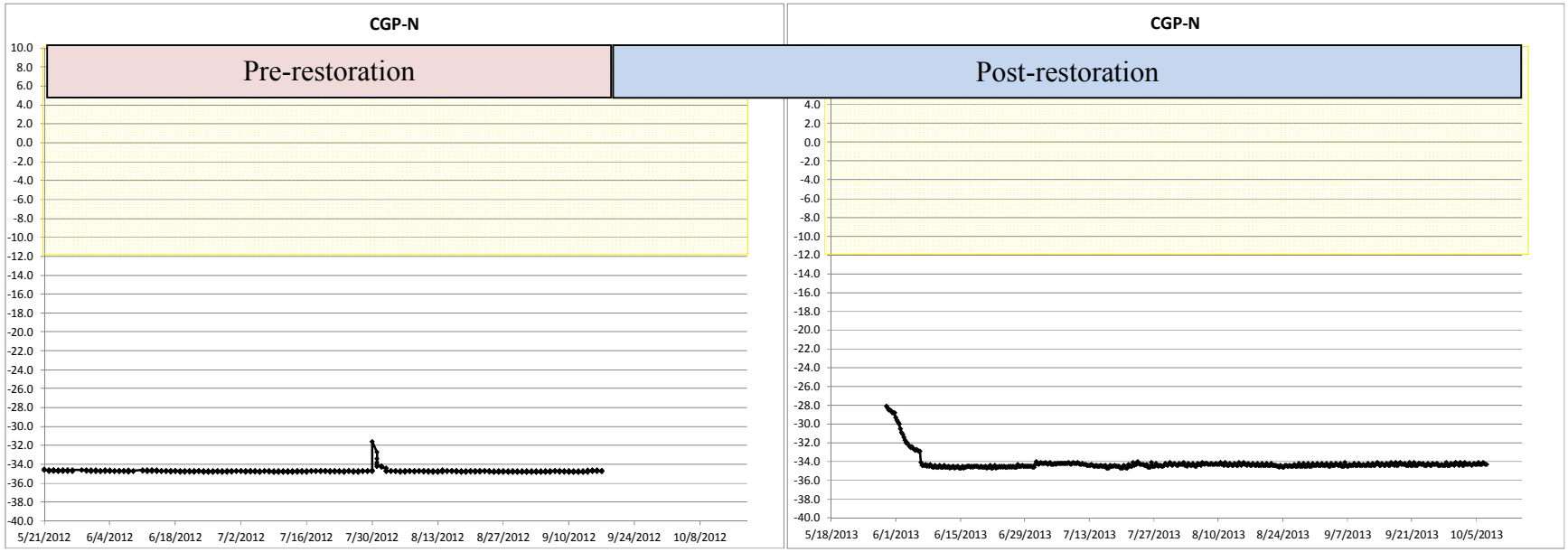


Fig. E13. *Well Plot N*

APPENDIX F: SPREADER POND CATCHMENT CELL SURVEYS

Photo F1. *This photo shows the catchment cell of the spreader pond during our September 2013 survey. The northwest cell of the pond is visible in the background. Survey points were taken using a handheld survey grade GPS and laser level. The data were used to generate a contour map for the bed surface of the pond (Fig. F1a-b). The tapes show the location of four monumented cross sections. Cross section survey results are shown in Fig. F3a-d.*

Fig. F1a-b. *Contour maps of the spreader pond catchment cell created from surveys made on May13, 2013 (left) and September 16, 2013 (right). Elevations are relative to a benchmark which was arbitrarily assigned the value of 100.00 ft. The location of monumented cross sections are also shown.*

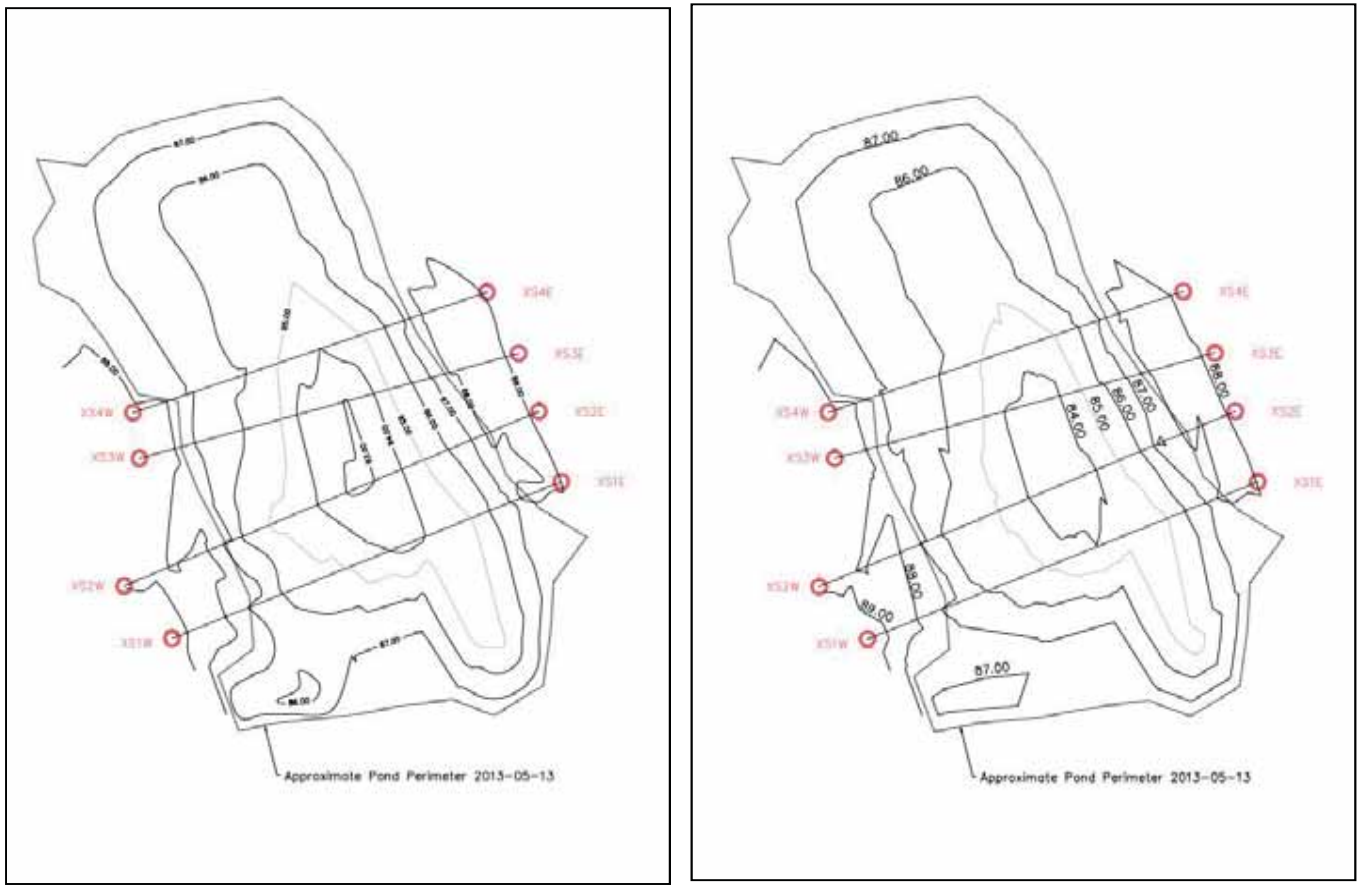


Fig. F2. *The difference in elevation of the bed of the spreader pond from May to September provides a way to measure the depth and volume of sediment that was deposited in the pond over that time period. In this map, the contours show depth of accumulated sediment between May 13 and Sept. 16, 2013. The total volume of sediment accumulated in the pond over this time is calculated as 18 cubic yards.*

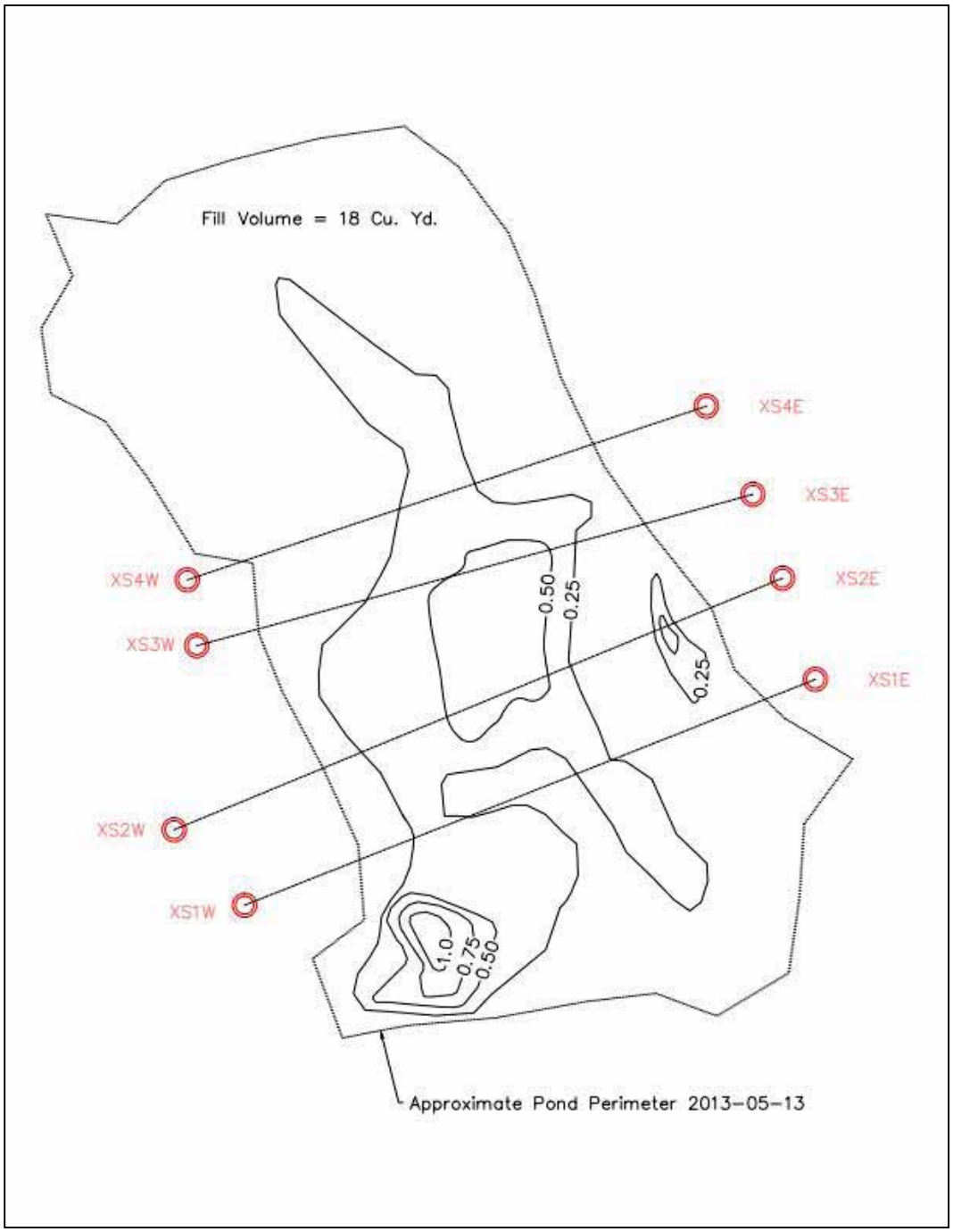
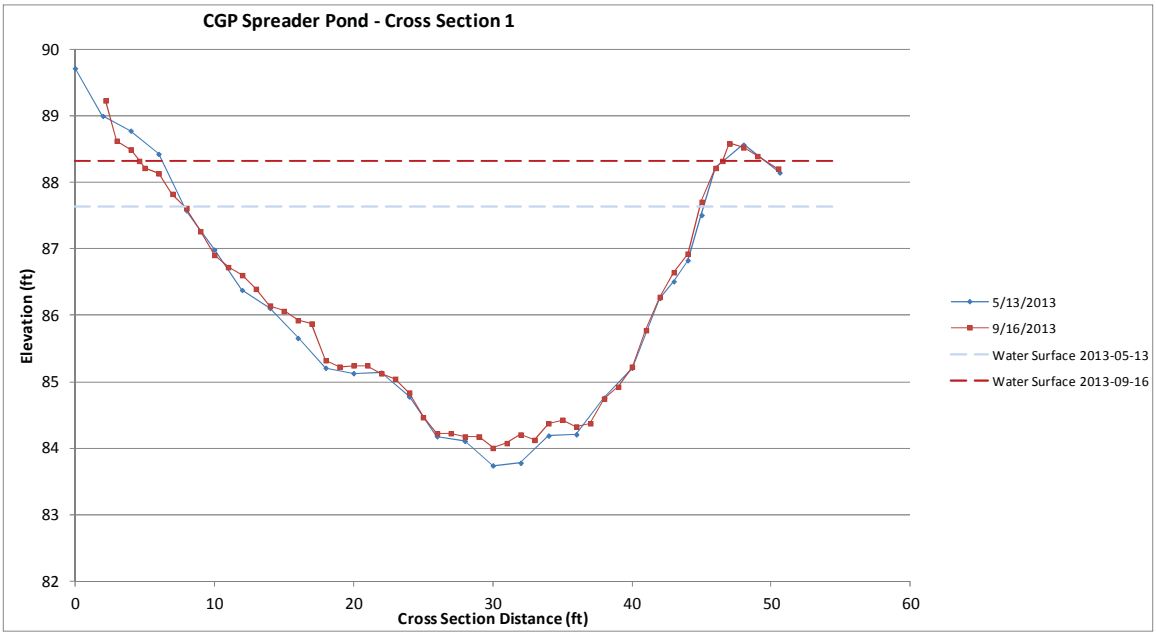


Fig. F3a-b. *Detailed survey data were taken on four monumented cross sections that cross the spreader pond. These plots of XS-1 and XS-2 are provided as a more precise method of documenting the elevation of the bed and water surface of the spreader pond. The rise in water surface elevation from May to September was caused by a beaver dam. The rise in bed elevation was due to accumulation of sediment in the pond over that 4-month time period.*



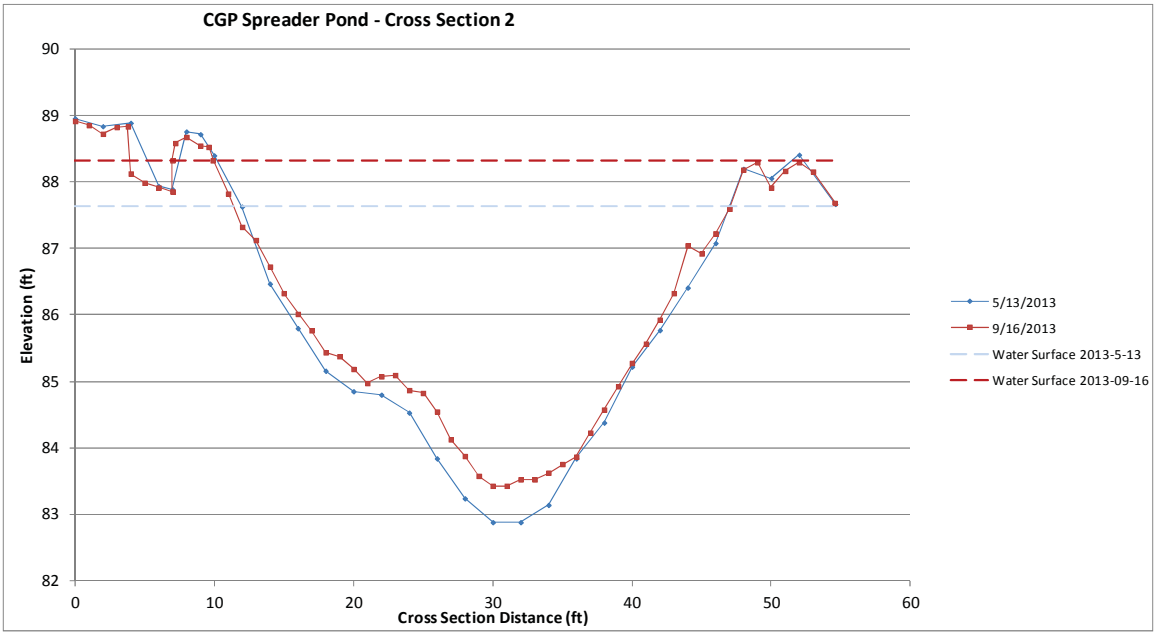
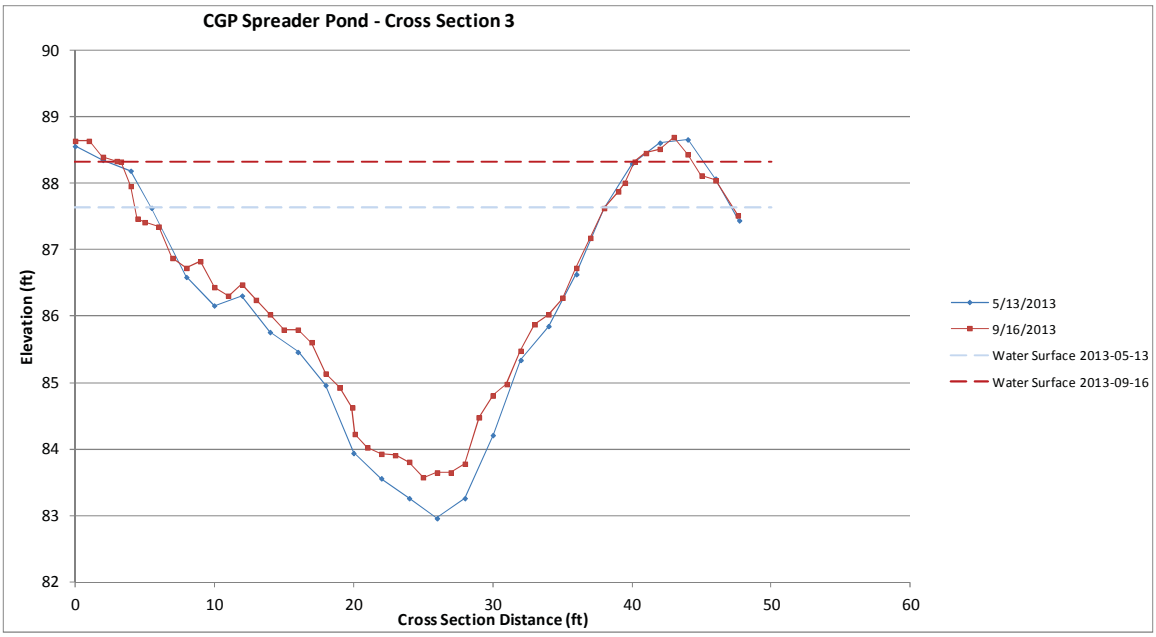
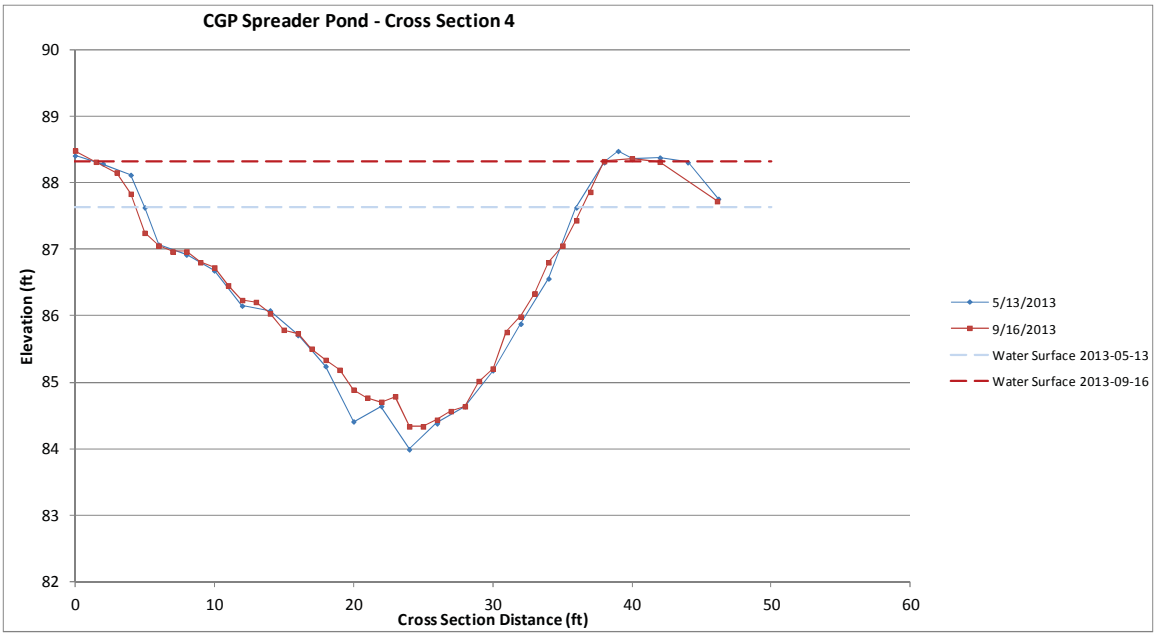


Fig. F4c-d. *Plotted cross section survey data for XS-3 and XS-4.*





APPENDIX G: BOREAS CREEK CHANNEL SURVEY PLOTS

Fig. G1. *Longitudinal surveys of the Boreas Creek reach in Upper CG that was treated in 2013 as Phase 3. A comparison of new bed elevation to old (pre-treatment) shows where mechanical treatments were made to fill channel segments and to repair breached beaver dams to create ponds.*

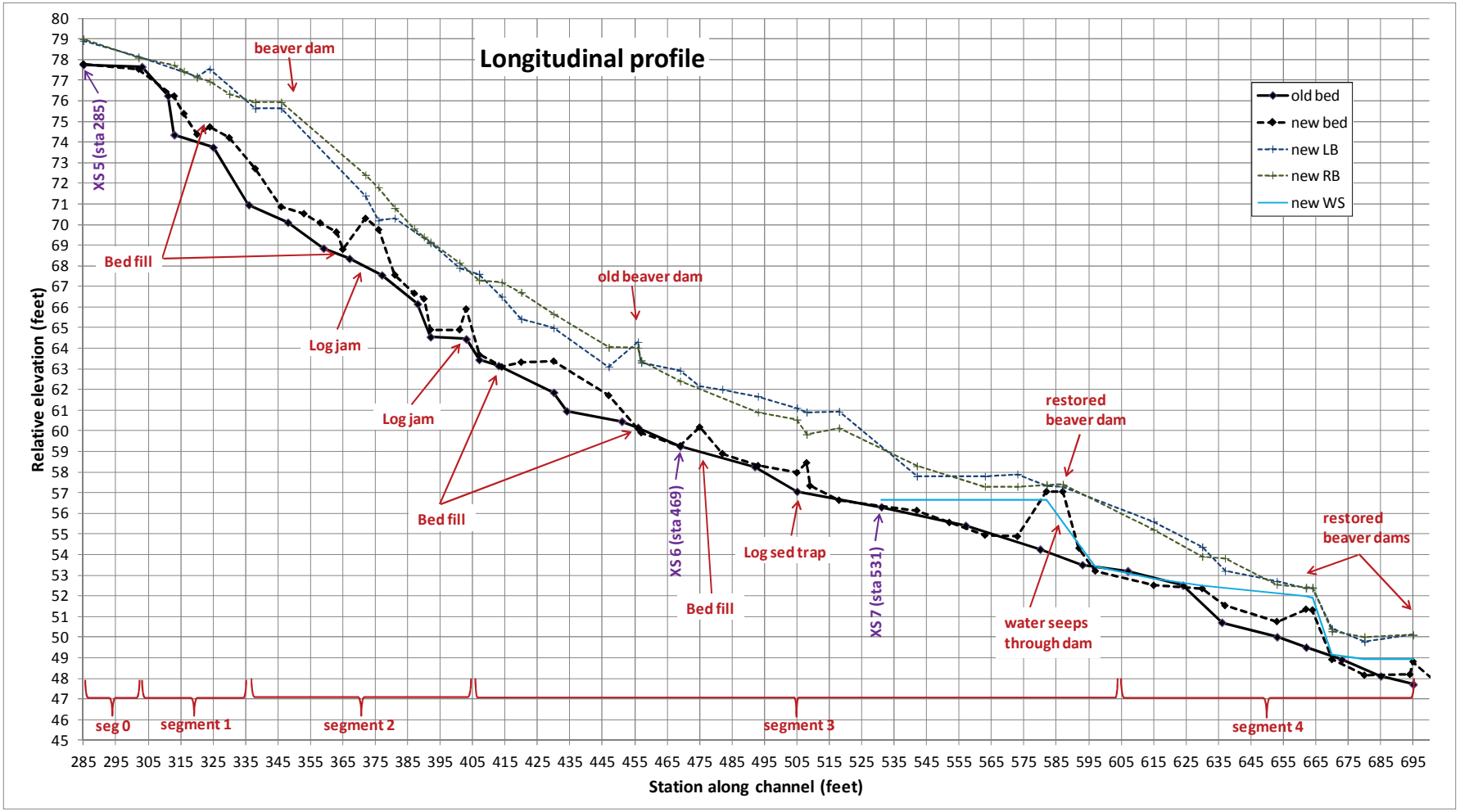


Fig. G2. *XS 6 survey plots for 2012and 2013 before and after treatment. The channel cross section changed significantly during the 2013 season. The overhanging left bank was lost to cantilever failure, and redistribution of bend material resulted in a shift of the thalweg towards the right bank and a 0.7 ft decrease in maximum depth. This XS is between major channel treatments and was not significantly affected by construction. Monitoring this XS will show if downstream treatments do effectively cause channel aggradation and mitigation of incision at this location in the future.*

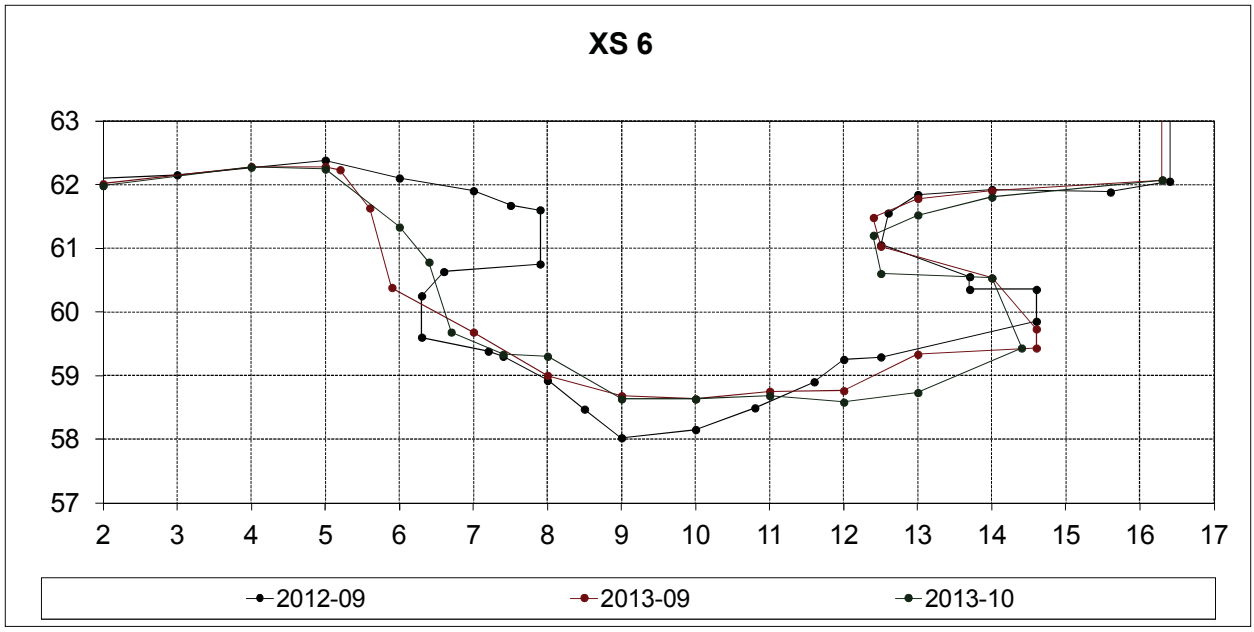
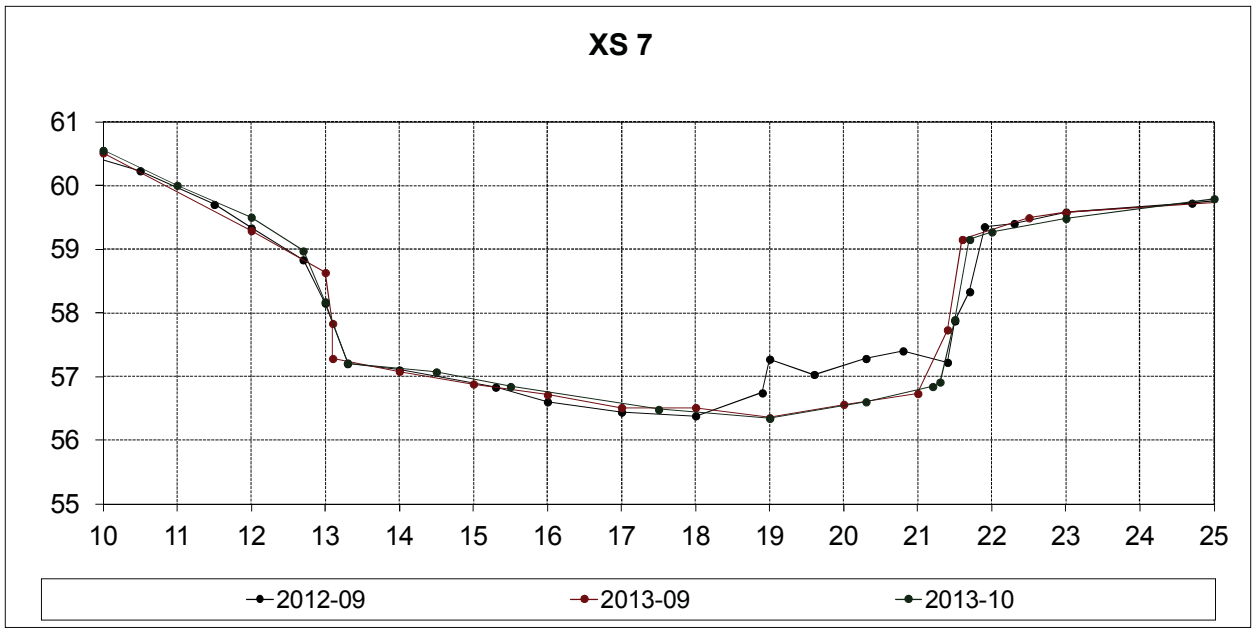


Fig. G3. *XS 7 survey plots for 2012and 2013 before and after treatment. Like XS 6,XS 7 is between portions of the channel that were mechanically treated, so predictably there is little post-treatment change observed. Monitoring this XS will show if downstream treatments do effectively cause channel aggradation and mitigation of incision at this location in the future.*



APPENDIX H: SOIL REDOX POTENTIAL

Fig. H1. *Soil redox potential measured at several sites in Upper CG during 2012 and 2013. Despite a few short spikes on sites A and E, none of the sites showed significant redox indication of anaerobic soil chemistry in 2012 until after the treatments were made in September. After treatment, anaerobic conditions appeared on sites A, G, J, K, and M. In 2013, anaerobic conditions were indicated through most of the season on all measured sites except for E, F, J, and N.*

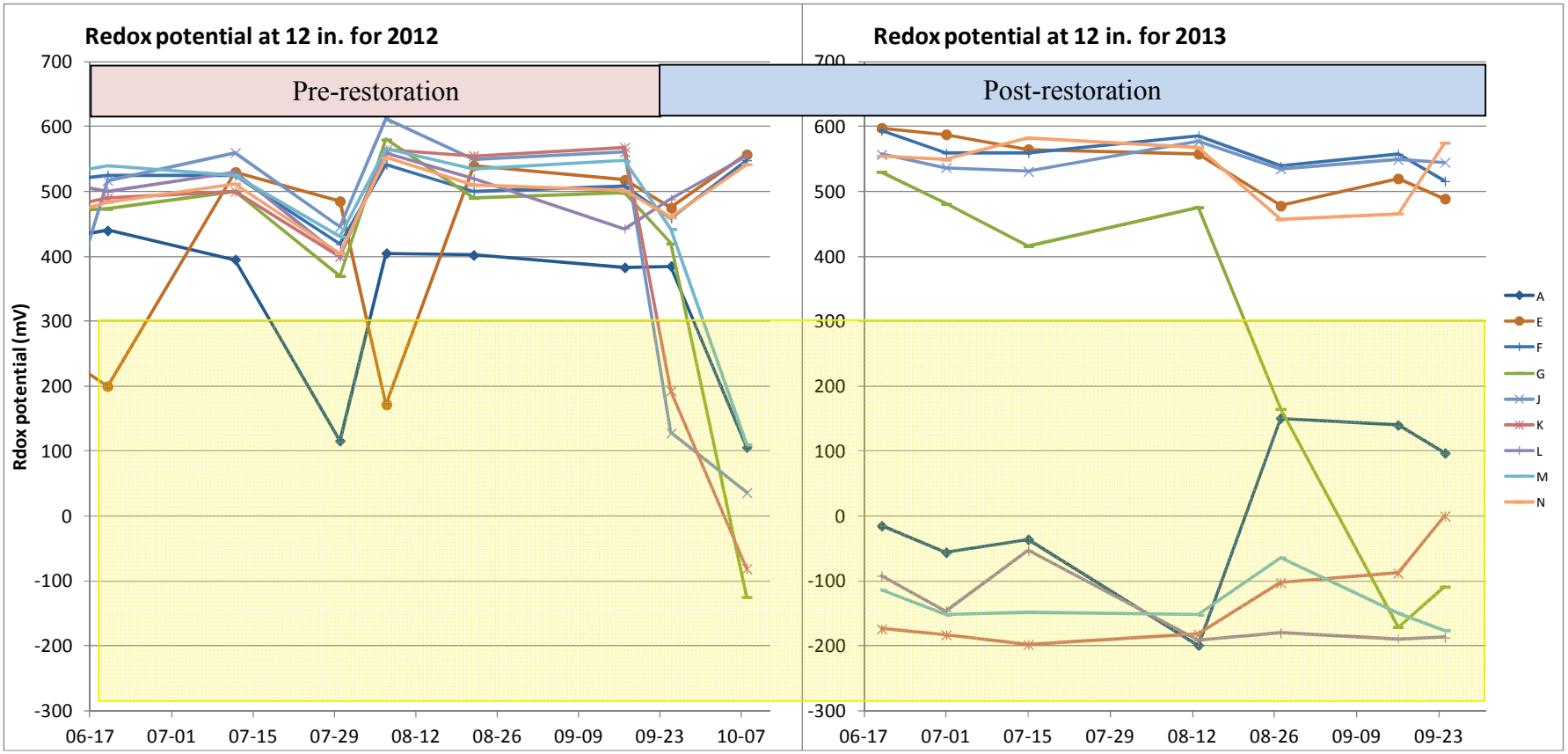
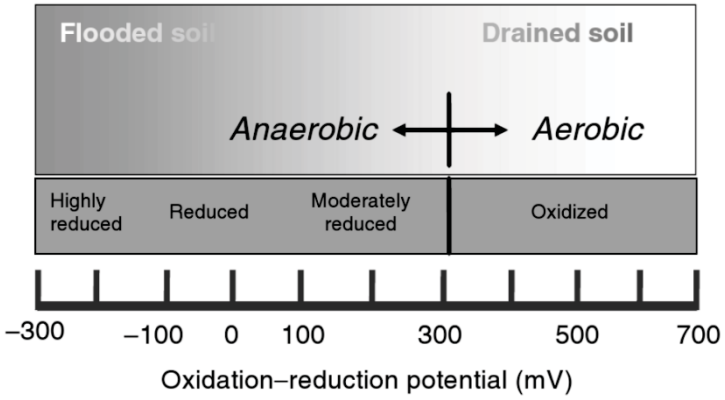


Fig. H2. *Interpretation guidelines for the meaning of redox potential values. Strongly positive values, particularly greater than +300 mV indicate highly aerobic, drained soils. Values typical of the redox potential in fully saturated wetland soils are strongly negative, and usually less than -100 mV.*



CHANNEL RESTORATION IN UPPER CUCUMBER GULCH

Status Report on an Attempt to Stabilize a Degraded Reach of the Main Channel in Upper Cucumber Gulch, Breckenridge, Colorado

Department of the Army Nationwide Permit 27 – SPK-2012-00780

February 2014

1371 17 RD, FRUITA, COLORADO (970) 640-3783
MCLAFFEY@ACSOL.NET

I. Introduction/Background

This report summarizes the restoration work we completed on behalf of the Town of Breckenridge (Town) in 2013 on the degraded channel reach in Upper Cucumber Gulch. This project is within the Cucumber Gulch Preserve (CGP), a protected habitat managed by the Town. This report should also satisfy the Corps of Engineers special condition 5 included in their September 5, 2013 nationwide permit 27 verification letter for the project. Since the Corps required only a photographic documentation of the construction, we have kept the narrative short only summarizing the work completed and the concept for additional work using the remaining budget approved for this project.

Claffey Ecological Consulting, Inc and Five Rivers, Inc completed Phase 1 and 2 of the Cucumber Gulch restoration project in September of 2012. That project appears to have exceeded our own expectations of success; or, at least the timing of success as beavers have reoccupied these habitats with a little help from the Town transplanting one of the current occupants. Previously drained and barren ponds are now full of water, and that, as expected, restored the water supply to the Upper Gulch's wetland water supply. Mark Beardsley and Brad Johnson have prepared a detailed monitoring report on those phases of the project, and that report also includes some of the as-built drawings for the channel restoration project described herein.

This channel restoration project has been labeled Phase 3 of the Cucumber Gulch Restoration Project. The Upper Gulch is primarily a riverine wetland with slope wetlands on the perimeter with water distribution in the wetland supplied by a series of beaver dams perpendicular to the valley gradient. Gradient is fairly steep in excess of 8 percent in locations. The Cucumber Gulch valley generally trends north-northeast, however, the upper part of the Upper Gulch gradient actually points east directly at this channel reach which flows north. The channel separates the wetlands of the Upper Gulch from an upland forest. Over the past decade the channel has degraded with incision and bank erosion. In 2011, Beardsley and Johnson were able to document fairly substantial erosion and incision in that year between runoff and a series of major convection storm generated flows.

On this project Claffey Ecological teamed with Robert O'Brien of AquaTerra Services. Mr. O'Brien is a fluvial geomorphologist with 30 years of experience restoring aquatic habitats and an abundance of knowledge on restoration techniques. Sierra Excavating, LLC was the earth moving contractor.

II. Implementation

We started work after October 2, and were done with the project in about ten days. We used a small track hoe with a long reach. We also used a mini dump truck on tracks which allowed us to deliver material to the creek without removing an excessive amount of trees along the right descending bank of the channel. In addition there was a good deal of hand labor involved.

The goal of the project remained to affect restoration of the channel to stabilize it in place, and reduce the amount of erosion and channel incision that would occur on the next big event. We

did not want to remove trees which provided bank stability via their massive root system, yet we had to move both large woody debris (logs) and pit run into the channel system. The mini dump truck proved invaluable in moving between trees. The approach was to add large woody debris to the channel, fortify that with pit run in places, and to rebuild at least two of the incised and abandoned beaver dams. We wanted to take minimalist approach to work due to the sensitive nature of the environments downstream, and the habitats present dictated minor work items. The thought was to complete restoration work but possibly not in every work area identified on the permit application, observe the channel after runoff and after the new beaver population makes adjustments to what we created, and then possibly return in 2014 to complete additional work. The Town retained budget from our cost estimate for work in 2014.

The pit run was obtained from the LG Everest Pit in the upper Swan River, and delivered by Stan Miller, Inc (SMI). The original plan was to use local pit run that we (Claffey) removed from the area of a restoration of a reach of Sawmill Gulch on the ski hill that was affected by the same storm system in 2011. That material was stored at the C-Lift and Vail Associates agreed to provide it to the town for free, but unfortunately when SMI went to retrieve the material, someone had pushed road base into the pile making the material unsuitable for our needs. Claffey and O'Brien went to the Mascot Pit to specifically select the material we wanted as far a size and amount of fines. The fines (sand sized material) mixed with the 4 to 8 inch rock helped seal the structures in which we placed the pit run.

We constructed 13 structures including the repair of two beaver dams. Most of the structures were log structures many of which included the addition of the pit run to provide more stability. In some cases the structures were simple log placement in the channel to reduce velocities. We also planted 400 nursery willows of quart sized material. We seeded stream banks with a wetland seed mix, and seeded the adjacent riparian/upland areas with an upland mix. We used coir fabric to cover disturbed areas after seeding, and planted willows in these areas. We also constructed a few coir dams in the channel to reduce velocity.

Work was completed in accordance with the permit issued. We controlled sediment releases by completing the downstream beaver dam reconstruction first. We will visit the project area after high water, and work with the town on whether or not some additional work would be completed in 2014. The photographs attached depict the work in progress and some of the completed structures.

Michael Claffey
Claffey Ecological Consulting, Inc.

Photo 1. Lower abandoned beaver dam, non functional prior to work, October 2013. Note reed canary grass on left bank, which has spread into wetland complex formerly occupied by beaver pond.

Photo 2. Starting on dam reconstruction at incision using logs, pitrun and whole live willows.

Photo 3. Adding more whole live willows to dam reconstruction.

Photo 4. Downstream side of same dam rebuild. Note logs mixed with pitrun for added stability.

Photo 5. Dam reconstructed, pond forming. Wetland to left of photo is now rewetted.

Photo 6. Reconstructing second dam downstream. Adding whole live willows onto of base constructed with large logs and pit run.

Photo 7. Incised and overwide eroded channel reach upstream of Nordic ski bridge.

Photo 8. Starting to build upstream V-Log structure.

Photo 9. Adding pit run to build lateral bar upstream of V-Log. Note mini 2 yard dump truck which allowed us to move material with minimal resource damage.

Photo 10. Structure complete. Topsoil added and left exposed on lateral bar to allow sediment (fines) to wash downstream to help seal next structure downstream.

Photo 11. Logs jammed into downstream end of very narrow deep incision. We did not want to fill this section as we would reduce channel capacity to fast, the logs will create sediment deposition stopping the incision.

Photo 12. Same area but looking downstream on outlet of incised and narrow channel section. Large log structures on left side where a side channel enters from now active beaver ponds placed to prevent headcut from pond outflow.

Photo 13. Erosion control and stability measures in overflow channels near downstream dam repairs. Includes seed, straw fabric, heavy coir fabric and wattles.

Photo 14. Fabric and new pond, with some of the willow plantings.

Photo 15. Downstream cross log structure with pit run added just below Nordic bridge.

Photo 16. Upstream portion of project, logs and pitrun placed to fill channel, raise grade and slow velocity. Woody debris supported by pitrun will prevent further channel erosion.

Photo 17. Large woody debris dams just upstream of severe channel incision and narrow section (see Photos 11 and12). Water will flow through structure but at much reduced velocity, and flows will access the well vegetated floodplain on left descending bank.

Photo 18. Log with root wad placement in lower dam rebuild. Chain used to maintain integrity of log. With the right operators, track hoe can sit right in wetland and channel with minimal disturbance.

Photo 19. Brook trout occupied habitats created before the equipment was hauled away. This adult moved into pool habitat the day after the equipment left the channel. We checked prior to work and no trout were observed.

Photo 20. Some of the neighbors came up to check out the work while equipment was in stream. Probably the rut made this bull a little more aggressive, and less wary of the equipment in his habitat.

Cucumber Gulch
Annual Conservation Monitoring Report 2013

Breckenridge, Colorado
February 2014

Prepared for the Town of Breckenridge, Colorado

By
Dr. Christy Carello and Elizabeth Kelso

Emerald Planet, Fort Collins, CO
The Metropolitan State College of Denver, Denver CO

Table of Contents

EXECUTIVE SUMMARY

Cucumber Gulch, a fen wetland, contains a diversity of habitats including shrublands, lodgepole pine forests, mixed conifer forests and pronounced ecotones of mixed conifer and shrubland habitat. Conservation monitoring of vegetation, avian populations, beaver and ungulate populations and water quality have occurred since 2001. Recent anthropogenic threats to the integrity of Cucumber Gulch include private home construction and lodge development along the perimeter. Both development and gondola construction resulted in a large area of tree removal in 2006. More tree removal occurred in 2008 along the perimeter of an enlarged retention pond below the Peak 8 base area. Lodge construction at the ski area base of Peak 8 and Peak 7 began in 2009 and continued throughout 2013. Changes in hydrology have resulted in drying of the wetland system near the top of the Gulch and sedimentation of ponds downstream. Hydrological restoration in 2012 and 2013 included diverting water at the main culvert entering Cucumber Gulch below Ski Hill Road at Peak 8 and the dredging of the reset pond near the beaver interpretive sign. This project is showing signs of success in terms of beaver activity and water flow.

Avian abundance, species richness and diversity was significantly lower in shrubland habitat in June of 2013. At this time the cause of this decline is unclear, continued monitoring will reveal whether this was a natural population fluctuation or an alarming trend. The most exciting observations in Cucumber Gulch in 2013 seem to be connected to the recent hydrological improvements. An abandoned lodge located at the reset pond had considerable beaver activity and is clearly an active lodge again. Also, at this same location there was a significant reduction in the number of crows and a significant increase in the number of aquatic birds captured on camera, both likely the result of the restoration project. In addition there was less human activity at the lodge at the reset pond in 2013 compared to 2012 where there were many instances of humans treading on the lodge. This is likely due to the restoration project that raised the water table and reduced access to the lodge. There was also a change in the diversity of the small mammals using the gulch in 2013 with an increase in the number of pine martens seen and a decrease in the number of raccoons and coyotes. Moose numbers were roughly the same as in 2012 and there were several camera captures of a cow with young calves. One cow was captured on camera several times with twins. Deer captures continue to increase throughout the Gulch. Humans continue to be the 4th most frequently seen pictures, with the number of captures increasing significantly from an average of 75/year in 2010-2012 to 122/year in 2013. Most of the photos of humans were at the Peak 7 bridge underpass and in the gondola cut. Extensive graffiti occurred on the underside of the Bridge at Peak 7 (see photos in chapter 8 of this report). The Peak 7 underpass is an important movement corridor for animals and the increased human traffic is of concern. Boreal Toads and other amphibians were once again not observed in 2013. The last toad to be identified in Cucumber Gulch was in 2005.

Traffic on the portion of the recreation trail that crosses the gondola cut in Cucumber Gulch was monitored in both June and July of 2013. There was a two-fold increase in the number of people on the trail when it was closed over the July 4th weekend. There were slightly more people using the open trail in July of 2013 compared to the equivalent time period in 2012. The number of individuals using the

trails did not vary statistically between weekend days and weekdays. Day hiking, mountain biking and trail running comprised 56%, 35% and 9% respectively of the trail use activities. The average deer and moose camera captures on the trail did not change significantly in 2013. It should also be noted that a mountain lion was captured on the trail camera in August 2013.

In an attempt to reduce trail use when trails were closed and educate visitors on proper trail use when trails were open, a pilot docent program was instituted. A docent was stationed at the top entrance to Cucumber Gulch across from the Peaks Trailhead on Ski Hill Road. The docent was in attendance when the trails were both closed and open for a total of 30 hours. An educational information board was on display at the trailhead that featured a wide variety of the species captured on camera in the wetlands. Over 200 people interacted with the docent. During the time the trail was closed, only four of the 68 people voiced their disagreement to the closure. The majority of the visitors seemed happy to comply with the closure. They also seemed interested in looking at the information board photos and learning more about the wetland complex. Out of the 68 people that were turned away from the trail, only one local young man (with his dog off leash) entered the Gulch despite being informed that the trails were closed. Several visitors did not know the ecology and value of a wetland and were shocked to see the species diversity present in Cucumber Gulch Preserve.
Many people who were coming out of the Gulch when trails were closed claimed they did not see any closed trail signage where they entered. When asked where they entered, most said it was by the houses along Gold Digger trail or from the gondola interchange at Shock Hill. Overall there was increased traffic on the closed trail during the 4th of July weekend between 2012 and 2013. However, the difference between years was not significant during the time the docent was in place. This suggests that the docent was effective in reducing traffic on closed trails in 2013. Trail closure signage needs to be increased on the trails in Cucumber Gulch. One closure that was not installed in 2013 and was present in 2012 was at the Glenwild and Toad Alley intersection location and this seems to be a critical second line of defense against trail users.

Exotic, invasive and weedy species have not significantly encroached in the wetland habitat of Cucumber Gulch, except for directly under the gondola where a large patch of Canada thistle has taken root. The perimeter of the wetlands and areas such as the hillside below the Peak 7 and 8 base areas, the Nordic Center and nearby trails, Josie's Cabin and the bridge at Peak 7 do have significant numbers of exotic, invasive and weedy species. The newly deforested path under the gondola had an abundant Canada thistle population, however weed removal efforts in this area seem to have had an effect. Efforts must continue to control weedy species in the gondola cut, under the gondola in the main wetland complex and on the hillside at Peak 8 in order to prevent further encroachment on the wetlands.

RECOMMENDATIONS

1. Increase the number of seasonal closure signs in Cucumber Gulch from mid May until the day following the 4th of July weekend. This is a very sensitive time in Cucumber Gulch. Plants are emerging, breeding birds are establishing nests and moose are calving.
2. Expand the docent program to include more hours and more days, especially while the trails are closed. This was a very successful project and was well received by the public.
3. Restrict access into Cucumber Gulch at the Peak 7 underpass. Increased Signs and buck and rail fencing were implemented in 2013, yet there still was an increase in human encroachment. Perhaps patrol at the underpass and signage at the Grand Lodge and Crystal Peak would help in this matter.
4. Invasive and non-native plants (weeds) should be identified and removed before going to seed, especially plants that are wetland adapted such as scentless chamomile, yellow toadflax, coast tarweed and Canada thistle.
5. Private home owners, landscape professionals working for the lodges at Peak 7 and 8, and ski area contractors/employees should be encouraged to plant only native plants in landscaping in order to prevent the introduction of foreign seeds to Cucumber Gulch.
6. Activities that may disrupt avian and mammalian breeding behavior should be minimized between May and August.

GENERAL OVERVIEW OF MONITORING IN CUCUMBER GULCH

Cucumber Gulch contains a diversity of habitats including shrublands, lodgepole pine forests, mixed conifer forests and a pronounced ecotone of mixed conifer and shrublands. A major portion of Cucumber Gulch is comprised of Fen Wetlands. Wetlands in Colorado are considered habitats at risk due to the near extermination of the beaver in 1840, housing developments, agriculture conversion, water use/dams, and pollution (Miller et al. 2003). Fen Wetlands have a unique ecology of rare plants. Fens are slow to recover from environmental degradation. For example it takes about 1,000 years to produce 8-10 inches of peat. Thus, peat is not a resource that is renewable (epa.gov, 2004). The wetlands in Cucumber Gulch have been designated an Aquatic Resource of National Importance (ARNI) by the Environmental Protection Agency (EPA). Cucumber Gulch is a historical breeding site for the state endangered boreal toad. The last sighting of a boreal toad was in May of 2005. In addition, several avian species of special concern continue to use Cucumber Gulch as a breeding site. Therefore it is necessary to continue efforts of monitoring habitat quality, species diversity and abundance, and human activity in and around the area.

Science Applications International Corporation (SAIC) developed baseline monitoring procedures in 2001 and conducted 3 years of plant and animal surveys as well as water quality analyses in order to satisfy the Town's Cucumber Gulch Overlay Protection District (OPD) Ordinance of February 2000, which legally created the Cucumber Gulch Preventive Management Area (PMA). This report represents a continuation and expansion of annual conservation monitoring that has occurred from 2001-present. Here we document monitoring results for the 2012 calendar year. The data presented includes original data and the data collected by SAIC in order to establish general trends and overall baseline results. The OPD is approximately 225 acres (91 hectares) and the PMA is approximately 153 acres (62 hectares) or 68% of the total. Roughly half of the PMA is wetland habitat.

Several anthropogenic activities have occurred in and around the Cucumber Gulch Preserve since 2005. Development of the BreckConnect Gondola began in April of 2005 and was operational by January of 2007. Development of the Peak 7 residential units began in April of 2006 and continued throughout 2012. Peak One Place at the Peak 8 base area and other construction activities on the permitted ski area occurred in 2010. These activities resulted in large areas of tree removal, noise disturbance, litter and changes in the overall hydrology of the system. Hydrological restoration in September of 2012 in Cucumber Gulch Preserve included diverting water at the main culvert entering Cucumber Gulch below Ski Hill Road and Peak 8 and dredging coarse sediment from the reset pond near the beaver interpretive sign. The 2012 report is an analysis of trends in natural populations in Cucumber Gulch.

1.0 SONGBIRDS AND AQUATIC BIRDS

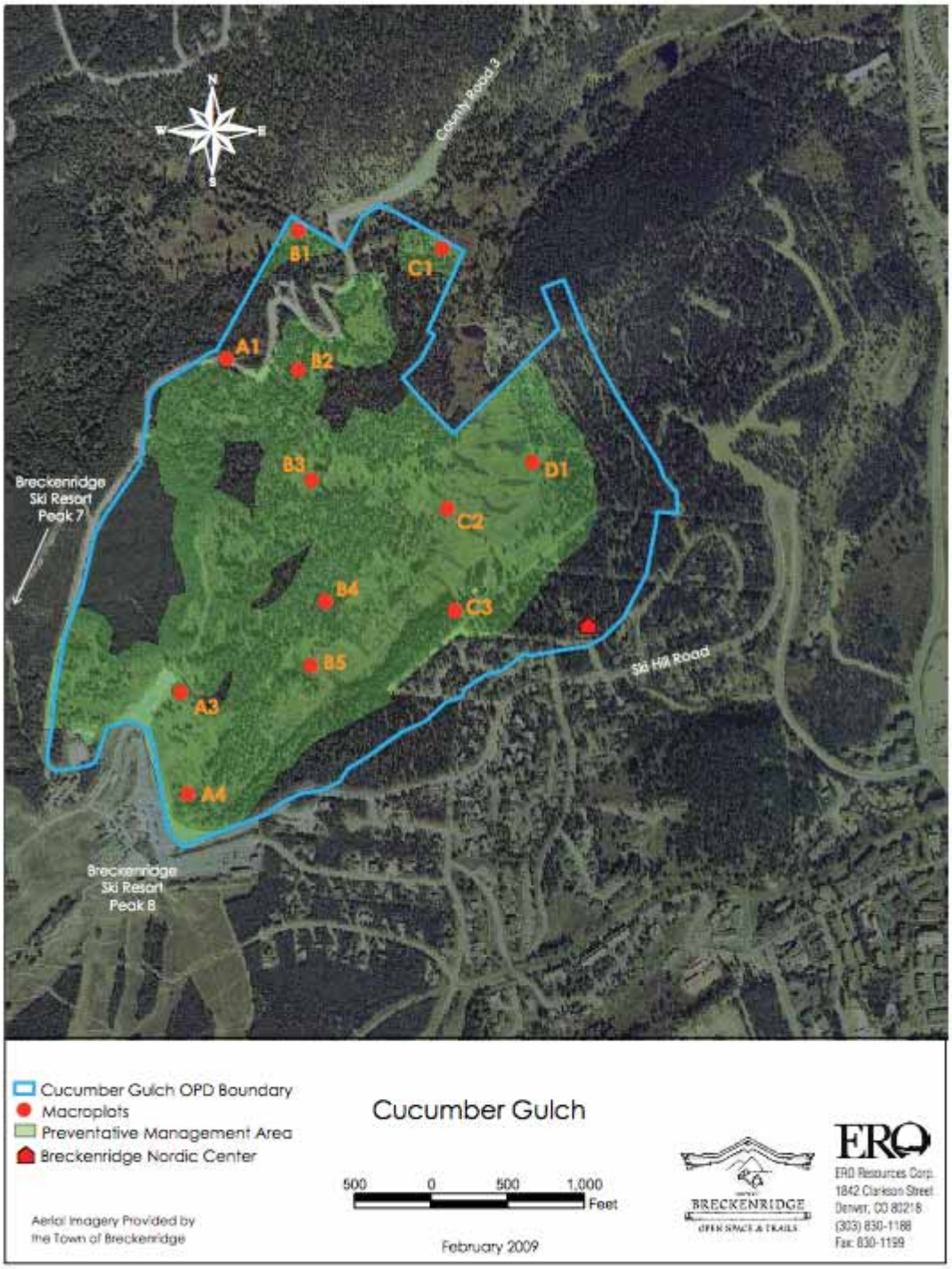
1.1 Background – terrestrial birds

Avian populations are importance to monitoring the quality of the habitats within Cucumber Gulch. Bird populations are particularly sensitive to habitat disturbances and act as indicators of overall habitat quality. Birds select habitats based on the type of terrain (presence of lakes, ponds, streams and wetlands), vegetative features (grasslands, types and extent of forests, shrubby areas) and structural configuration of vegetation (density of leaves at various elevations above the ground or patchiness) (Smith and Smith 2001). Thus, it is necessary to maintain and protect those aspects of the landscape that are important to birds. Many of the avian species found in Cucumber Gulch require regular monitoring because they are exceptionally sensitive to habitat alteration.

1.2 Methods – terrestrial birds

Songbird population surveys were conducted in December, February, April, May, June, July, August and October from 2003-2011. In 2012 and 2013 avian monitoring was conducted May – August by Dr. Christy Carello, Audrey Hoffa, and Matt Stoddard. Each survey was conducted at 13 macroplots (See Map on following page) that are a minimum of 200 meters apart from each other (A1, A3, A4, B1, B2, B3, B5, C1, C2, C3, D1, SW4, and GW1). A2 was eliminated in the later half of 2006 due to the Peak 7 development. A2 was the only macroplot in lodgepole pine habitat and was eliminated as a result of the Peak 7 development in April of 2006. A1, B2, C3 are found in mixed conifer habitat. A3, A4 and GW1 are in mixed conifer/shrubland habitat. The final 7 macroplots are located in the shrubland habitat (the macroplot habitat designations are slightly different from the vegetation surveys because the sampling areas are much larger). A point-count was used in which population numbers and species were recorded by visual or auditory identification for a total of 5 minutes within 50 meters from the center of the circular plot. At least 3 minutes were allowed to elapse prior to each sampling episode in order to minimize disturbance. Observations of individual birds were made during each survey in order to avoid counting the same bird more than once. The Simpson's Index was used to calculate both species diversity and evenness.

Single factor Analysis of Variance statistics and/or two sample T-test statistics were used to determine statistically significant differences between means on data from 2004-2012 (data prior to 2004 was collected by different personnel at SAIC and show different trends). Data from 2001-2003 is presented on graphs in previous reports, but is not included on graphs in this report. A standard probability value of 0.05 was used to determine significance, meaning that there is less than a 5% chance that the statistical differences are a result of error.



Map 1. Cucumber Gulch Map illustrating vegetation macroplots

1.3 Results – terrestrial birds

Overall there was a statistically significant difference observed in the number of birds in the different habitats, where mixed conifer habitat had significantly fewer individual birds compared to the other two habitat types (Table 1.1; F=5.23, p=0.01). However, there were significantly more species and greater species diversity found in the ecotone (mixed conifer/shrub habitat). There was no difference in evenness between the three habitat types (Table 1.1; F=2.68, p=0.07). Significantly fewer birds were observed in shrubland habitat in 2013 compared to a combination of the previous years (Fig1.1; t=2.52, p=0.014). This same pattern of decrease was also observed for species richness in shrubland habitat (Fig 1.2; t=2.02; p=0.05). Diversity is significantly greater in the ecotone habitat (Table 1.1; F=5.77, p=0.00) and is significantly variable between years in shrubland habitat (Fig. 1.3; F=2.51, p=0.02). In addition, there was a significant decrease in species diversity in the shrubland habitat in 2013 compared to years 2004-2012 (Fig 1.3; t=2.52, p=0.01). Although evenness has not varied between habitat types, it has been significantly variable between years in mixed conifer habitat and shrubland habitat (Fig 1.4; F=2.62, p=0.04; F=3.00, p=0.01).

Peak numbers of individual birds and species have consistently been observed in June and July from 2004-2013 (Figures 1.5 and 1.6). However, in 2013 the number of birds in Cucumber Gulch was fairly constant from June through August. Migratory songbirds are mainly in the area from May to August with some arriving as early as February. From October through December the least number of birds have been identified. Overall, in 2013, we found that the average number of birds and species richness was on the lower side of normal.

Brown-headed Cowbirds are in Breckenridge from April to July. Brown-headed Cowbirds are nest parasites that lay their eggs in other birds' nests. The host birds incubate the cowbird's eggs and raise the cowbird's young, often at the expense of their own young. There was an overall significant increase in the number of cowbird sightings from 2005-2009 ($r2 = 0.74$, $p = 0.01$; Figure 1.7). There was a decrease in the number of Brown-headed Cowbirds sighted during avian surveys from 2010 - 2013 compared to 2009. Brown-headed Cowbirds may have reached a saturation point and may be stabilizing around the 2008-2013 numbers.

There was a 45% decrease in the number of Violet-green Swallows (*Tachycineta thalassina*) seen in Cucumber Gulch between 2004 and 2007 (Figure 1.8). Violet-green Swallow numbers noticeably decreased from 83 and 76 individuals seen in 2004 and 2005, respectively to 48 and 42 individuals in 2006 and 2007. This drop in the number of birds may be a result of the tree removal operation and construction sounds of the gondola and the Peak 7 development that began in April of 2006. Violet-green Swallows are particularly sensitive to anthropogenic activity and depend on mature trees with pre-existing cavities for nesting. The Violet-green Swallow population appears to have rebounded in 2008 and has remained stable for 2009-2013.

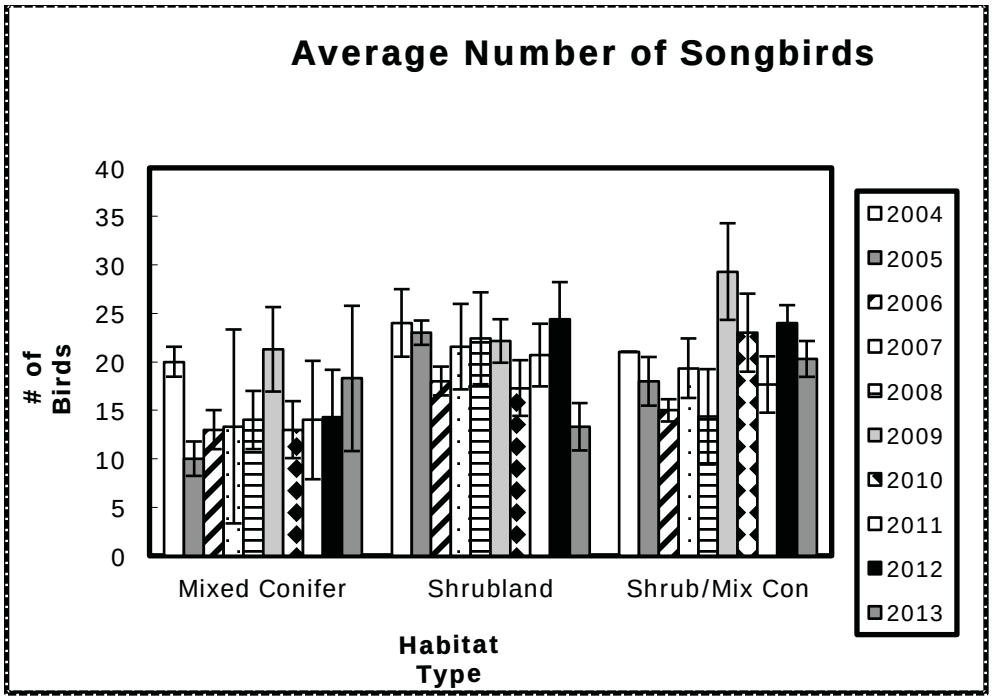


Figure 1.1 A comparison of the average number of birds seen or heard during two avian point counts in June 2004-2013 in Cucumber Gulch, Breckenridge, Colorado.

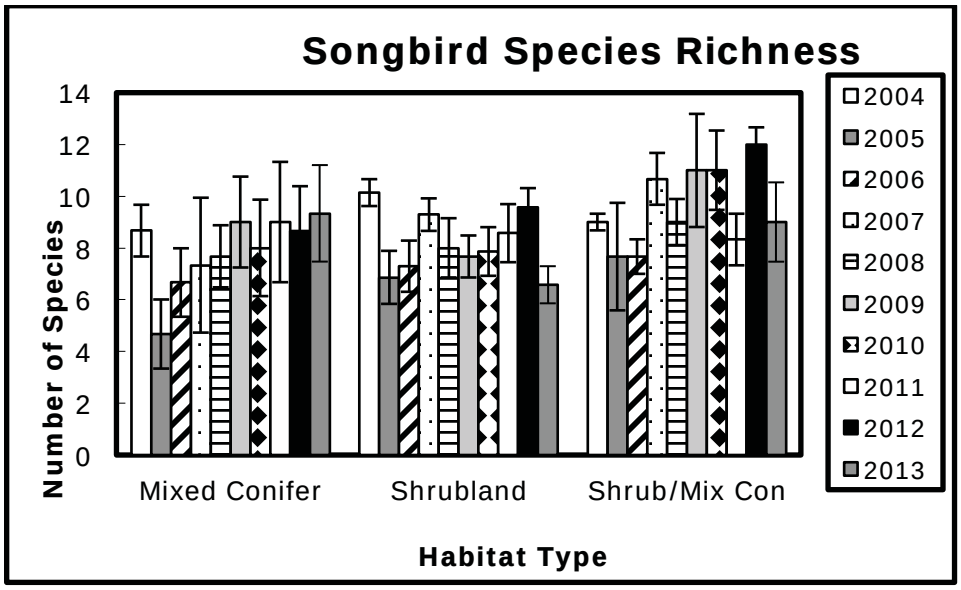


Figure 1.2 A comparison of the average avian species richness from two avian point counts in June 2004-2013 in Cucumber Gulch, Breckenridge, Colorado.

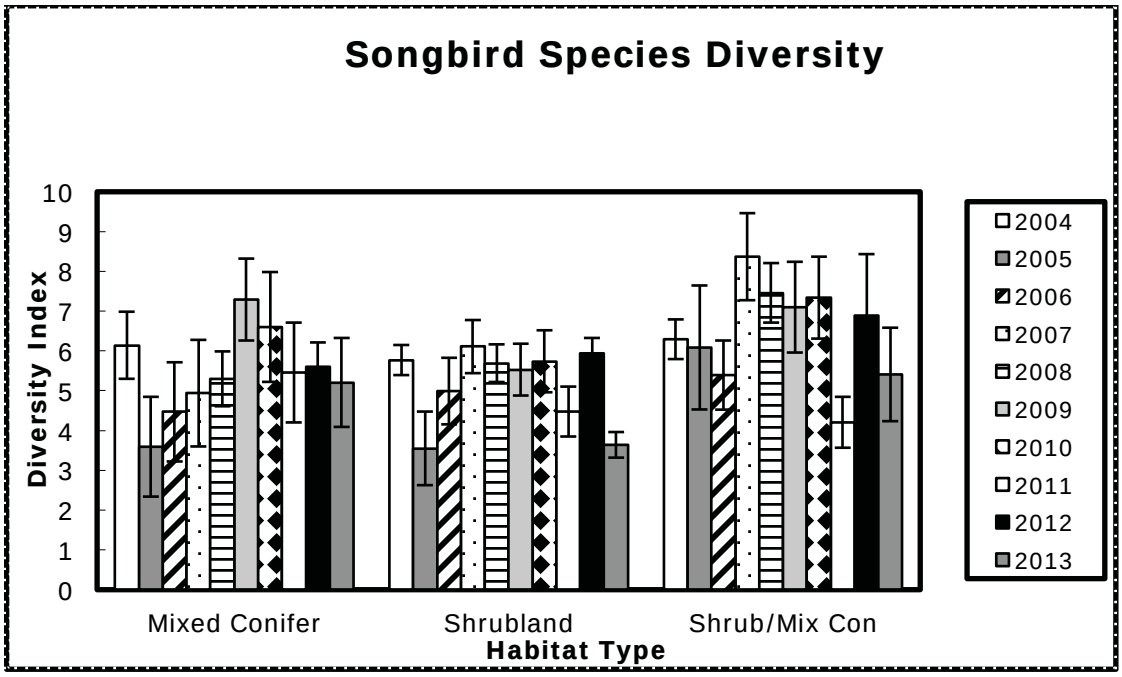


Figure 1.3 A comparison of the average avian species diversity from two avian point counts in June 2004-2013 in Cucumber Gulch, Breckenridge, Colorado.

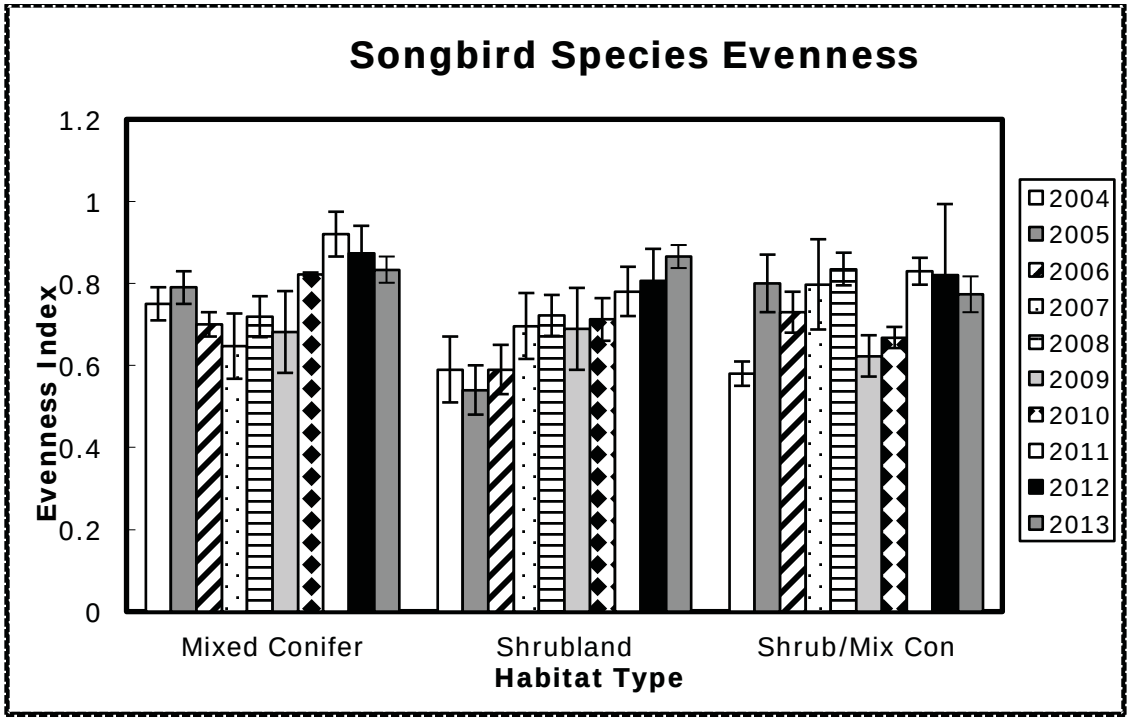


Figure 1.4 A comparison of the average avian species evenness from two avian point counts in June 2004-2013 in Cucumber Gulch, Breckenridge, Colorado.

Table 1.1. Overall comparison (2004-2013) of means (standard error) between habitat types. + and – symbols represent statistically different results. + means statistically greater than the other two and – means significantly less than the other two.

	Abundance	Richness	Diversity	Evenness
Mixed Conifer	**15.2 (4.74) -**	8.1 (1.76)	5.5 (1.05)	0.8 (0.07)
Shrubland	20.7 (4.90)	8.3 (2.38)	5.1 (0.99)	0.7 (0.10)
Mixed Conifer/Shrub	20.2 (3.61)	**9.6 (2.42) +**	**6.5 (1.07) +**	0.8 (0.08)

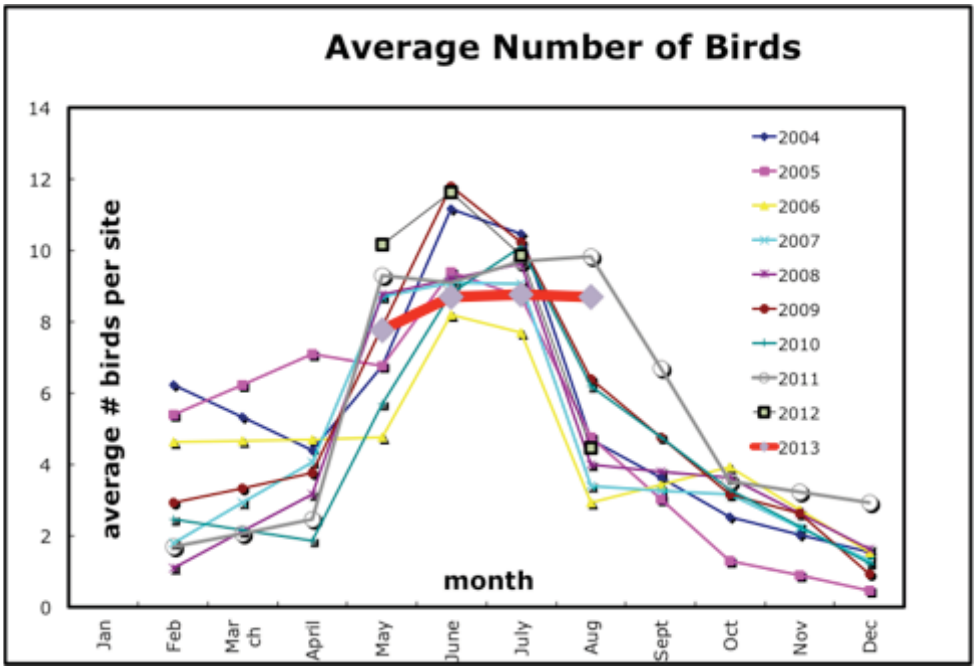


Figure 1.5 The mean number of birds at each point count location observed in all habitats in Cucumber Gulch, Breckenridge, CO 2004 - 2013.

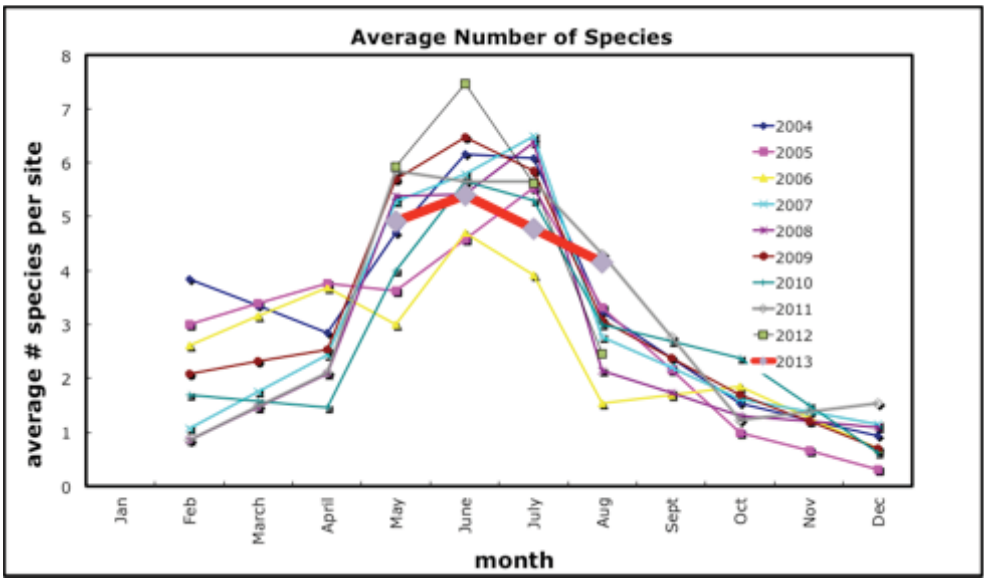


Figure 1.6 The mean number of species at each point count location observed in all habitats in Cucumber Gulch, Breckenridge, CO 2004 – 2013.

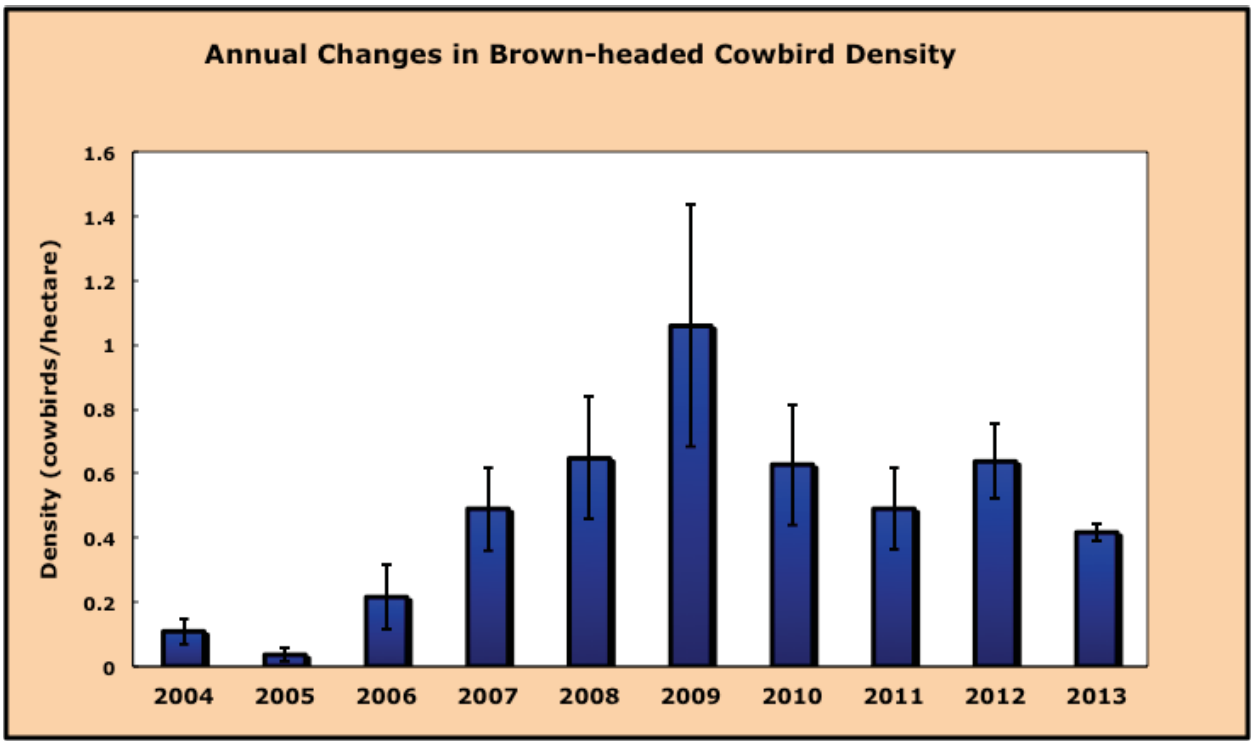


Figure 1.7 The average density of Brown-headed Cowbirds seen in Cucumber Gulch, Breckenridge Colorado during April, May, June and July point counts from 2004-2011 and May-July of 2012-2013.

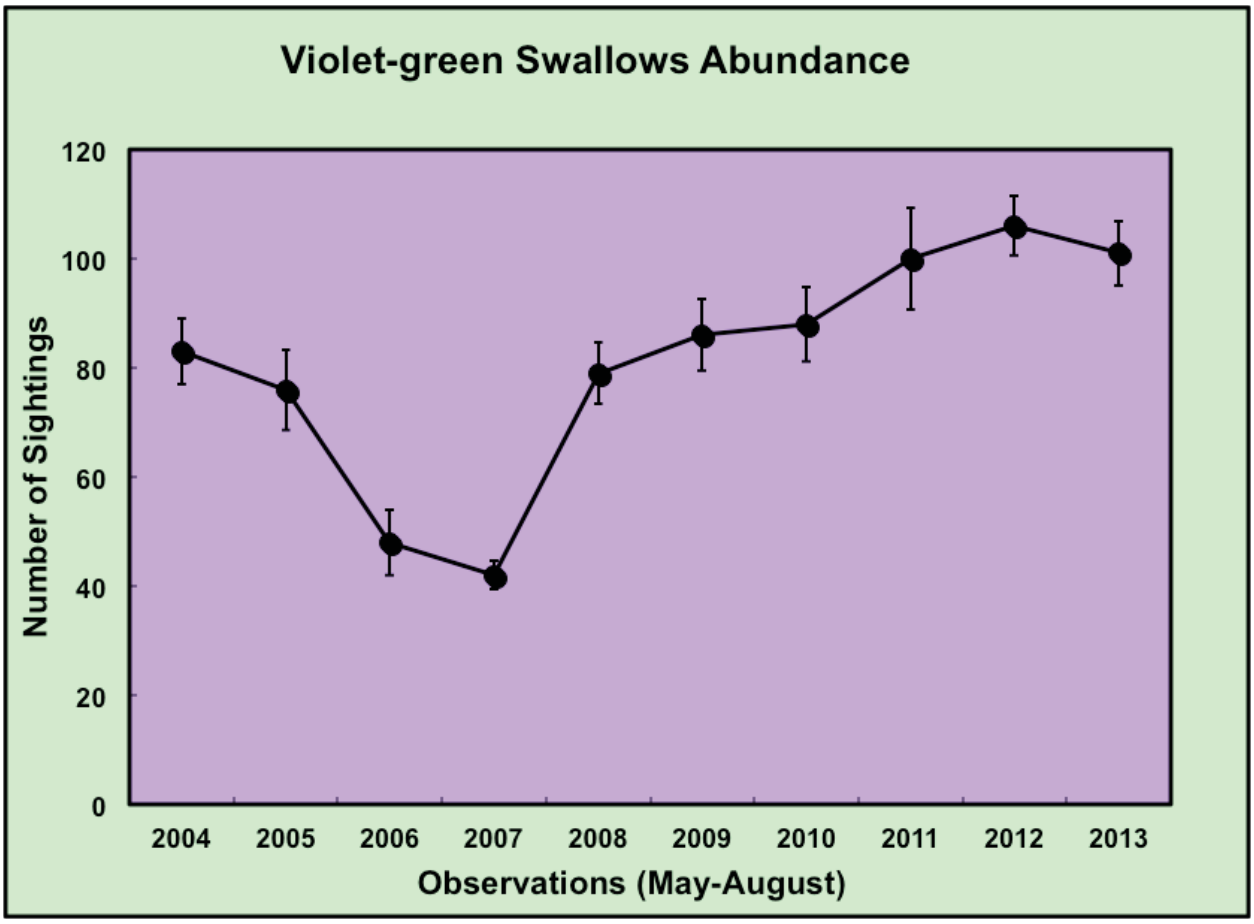


Figure 1.8 The number of Violet-green Swallow sightings in Cucumber Gulch, Breckenridge, CO in 2004 - 2013.

1.4 Aquatic birds

Aquatic birds include both shorebirds and waterfowl. Surveys were conducted throughout the breeding season, mainly during regularly scheduled bird surveys and gondola bird surveys. All aquatic birds that were seen or heard were recorded. Aquatic birds observed in 2013 include Mallards with chicks (*Anas platyrhynchos*), Common Snipes (*Gallinago gallinago*), Spotted Sandpipers (*Actitis Macularia*), Canada Geese (*Branta Canadensis*), and Green-winged Teals (*Anas crecca*).

1.5 Conclusions – terrestrial and aquatic birds

The diversity of habitat found in Cucumber Gulch provides numerous niches for avian species that are both generalists and specialists. The wetland habitat made up mostly of shrubland vegetation is a rare habitat in Colorado and attracts species that are not found in other habitat types. Thus far 65 species have been identified in Cucumber Gulch up from 55 in the 2004 report. The most frequently observed predatory bird was the Cooper's hawk (*Accipiter cooperii*). The Olive-sided Flycatcher (*Contopus cooperi*) was observed several times in 2011, but not in 2012 or 2013. The U.S. Fish and

Wildlife Service currently lists the Olive-sided Flycatcher as a Species of Conservation Concern, and it has been included as a priority species for conservation on Watch Lists for both Partners in Flight and the National Audubon Society. The American Three-toed Woodpecker (*Picoides tridactylus*) was newly identified in 2009 and has been observed every year since. This species is considered a rare bird in Colorado and a sensitive species by the USDA Forest Service (USFS) for Region 2, which includes Forest Service land near Breckenridge. The National Forest System considers a species sensitive if its population viability has shown or is predicted to show a downward trend in abundance or habitat requirements (Wiggins 2004).

Warbling Vireos (*Vireo gilvus*) had previously been observed in all habitat types in Cucumber Gulch. It is important to document the Warbling Vireo population because they suffer a relatively high rate of Brown-headed Cowbird (*Molothrus ater*) parasitism. Brown-headed Cowbirds have been observed in Cucumber Gulch and parasitism on a Hermit Thrush (*Catharus guttatus*) nest was documented in 2004. Warbling Vireos can have up to 80% of their nests parasitized by Brown-headed Cowbirds (Ward and Smith 1999). Parasitism on Warbling Vireos greatly reduces the number of successful fledglings (Ortega and Ortega 2003) and thus will ultimately have a negative impact on their population. It is common for Warbling Vireos to not produce offspring when parasitized. Brown-headed Cowbirds take advantage of forest edges. Vireos forced to nest in trees that are not deep within a forest are more susceptible to parasitism. Every effort to minimize forest fragmentation and thus edges in Cucumber Gulch should be taken to protect the Warbling Vireo and other migratory songbirds from cowbird parasitism. Unfortunately Warbling Vireos have not been observed in Cucumber Gulch since 2009.

Colorado Partners in Flight lists the Cordilleran Flycatcher (*Empidonax occidentalis*), American Dipper (*Cinclus mexicanus)*, Olive-sided Flycatcher (*Contopus cooperi*) and Wilson's Warbler (*Wilsonia pusilla)* as priority species in the area (2000). American Dippers (*Cinclus mexicanus)* are also of special concern because they are indicators of water quality (Andrews and Righter 1992). An American Dipper was seen in 2012, but not in 2013. In addition, the USGS has listed the Wilson's Warbler (*Wilsonia pusilla)*, Fox Sparrow (*Passerella iliaca)* and Lincoln's Sparrow (*Melospiza lincolnii*) as a management indicator species (Johnson and Anderson 2003, Johnson and Anderson 2004, Stephens and Anderson 2004). Unfortunately, only two Fox Sparrows have been seen since 2004, one of which was in 2013. Wilson's Warblers and Lincoln's Sparrows are a common bird in Cucumber Gulch.

The Audubon Society has identified a 58% decline of the Rufous Hummingbird (*Selasphorus rufus*) in the last 40 years. The species has been given a YELLOW designation, meaning it is a moderately high priority or moderate priority at the national level. Logging on both the breeding and wintering grounds and development are threats to the Rufous Hummingbird (Audubon, 2007). Unfortunately a Rufous Hummingbird was not observed in 2012 or 2013.

Another important bird to watch is the Osprey (*Pandion haliaetus)*. The Osprey was

once on the Endangered Species list and is considered a forest sensitive species in Colorado. They have been known to migrate as far south as Argentina. Ospreys historically were frequently spotted in the Gulch perched in trees adjacent to beaver ponds and flying over the ponds. Fish are the primary food source for Osprey. Ospreys were not observed in Cucumber Gulch between 2005-2012, and one Osprey was seen in 2013.

The migratory status of each species is listed in the Appendix. This species list is a list in progress that will likely be expanded as additional species are observed during future monitoring. Resident species can be found in Cucumber Gulch during all months of the year. Altitudinal migrants migrate to lower elevations during the winter. Short-distance migrants migrate south of Colorado. Neo-tropical migrants migrate south of the Tropic of Cancer for the winter. These birds are typically the last to arrive to breed in Cucumber Gulch and are among the first species to leave in the fall.

2.0 BEAVER POPULATIONS

2.1 Background - *Beaver*

Large rodents in Cucumber Gulch include the American beaver (*Castor canadensis)* and the common muskrat (*Ondatra zibethicus)*. Both species are known to have localized home ranges and as a result may spend their entire life in the Gulch. Thus, these species are important to monitor as indicators of habitat stability.

Beavers in North America were almost extirpated by the early 1900s due to trapping and draining of lands for agriculture. Estimates of the current population are as low as 2.5% of those present prior to European settlement (Miller et al. 2003). Thus, every effort should be made to protect the beaver population in Cucumber Gulch.

Beavers are a keystone species in Cucumber Gulch. Their activity has substantially altered the landscape and created this particular wetland ecosystem. Beavers created the wetland habitat in Cucumber Gulch by retaining water in ponds through dam development. The health of Cucumber Gulch is dependent on their continual activity. Beavers provide and enhance habitats for waterfowl, amphibians, fish and ungulates. In addition, newly metamorphosed toadlets may use beaver lodges and dams as winter hibernacula (Miller et al. 2003). The boreal toad, a state endangered species, has a historical record in Cucumber Gulch and likely used beaver habitat for completing its lifecycle. In addition to providing habitat through maintaining water levels, we have evidence from a motion sensor camera that the beaver lodges are important structures for wildlife in Cucumber Gulch. Beaver lodges provide habitat for migratory, resident, and aquatic bird species as well as provide additional foraging sites for other mammals.

2.2 Methods - *Beaver*

2.2.1 Lodge Study

Cucumber Gulch has been surveyed for evidence of beaver activity by Christy Carello and Audrey Hoffa every October from 2003 - 2008. Eric Thomas also assisted in the 2006 and 2007. Tanya Chesney assisted with the 2008 and 2009 survey. Emily Latta assisted Audrey Hoffa and Christy Carello in 2010 and Matt Stoddard assisted Christy Carello from 2011 and 2013. Prior surveys were conducted by SAIC. Beaver activity is located in two main drainages in shrub-wetland habitat in Cucumber Gulch. One of the drainages runs in a SE direction from B3 to C2 and the other runs in a NE direction from A4 towards D1 (see Map in section 1). These areas were inspected for lodges, bank dens, dams and beaver paths. A lodge was considered active based on the following criteria: little vegetative growth on the mound, a cache of newly clipped sedge in and near the pond, and a well maintained dam. A bank den was considered active when there was evidence of woody debris piled on the side of a pond and in the vicinity of a maintained dam. Global Positioning coordinates were recorded at active lodges, lodges with low activity and inactive lodges.

2.2.2 Observation Study

We used established methods for determining the relative abundance of beavers and muskrats in Cucumber Gulch (Engeman and Whisson, 2003). Surveys were conducted monthly from June – August 2013 at four sites that included the Beaver Interpretive Sign, the Bird Interpretive Sign, Gondola Post 16, and Ski Hill Road below the Peak 8 Lodge (Table 2.1). These four sites provided maximum coverage of ponds and lodges and were chosen based on data collected from previous Beaver/Muskrat Surveys. Trained technicians were assigned to each of the sites sometimes observing in pairs and sometimes observed alone. Observations were made for 45 minutes at each site in the two hours after sunrise and before sunset. Visual observations of beavers, muskrats, waterfowl, and other mammals were recorded using binoculars and spotting scopes.

Table 2.1. Observational study locations

Site #	GPS	Description
1	39°29.242'N 106°03.634'W	Located near Gondola Post 16. It provides a wide view of several ponds and one active lodge (Photo 14) in the eastern portion of the gulch from the Beaver Interpretive Sign to Josie's Cabin.
2	39°29.062'N 106°03.664'W	Located at the Bird Interpretive Sign. This site has a view of four ponds where beaver activity has been observed frequently in the past. Recent dam work shows this site is still active.
3	39°29.049'N 106°03.812'W	Historic lodge located at the Beaver Interpretive Sign (Photo 10). Restoration at this site completed last year has changed the area by significantly flooding the pond containing the lodge.
4	39°28.917'N 106°03.997'W	Located on Ski Hill Road near the Peak 8 Super Lodge at the highest point of the gulch. Restoration work in this area was completed in 2013 re-flooding several ponds and providing new habitat for beavers and muskrats. One beaver was released in this area in August.

2.3 Results - *Beaver*

Beavers were observed in cucumber Gulch on numerous occasions in 2013. Figure 2.1 depicts the trend among the active beaver lodges in October since the beginning of monitoring in 2000. A walk-through was conducted on October 17, 2013 to note recent signs of beaver activity in the gulch. Photos 2.1 through 2.14 highlight the signs of beaver activity in 2013. Several dams showed signs of recent work (Photos 2.3, 2.4, 2.6, 2.7, and 2.9). Numerous lodges were also recoded (Photos 2.1, 2.2, 2.8, 2.10, 2.11, 2.12, 2.13, and 2.14), most of which appear inactive (Table 2.2). The fall walk-through, combined with the summer surveys, depicts the profile of beaver activity in Cucumber Gulch.

The most active lodge is located near the Moose Interpretive Sign (Photo 2.14; Table 2.2). The summer surveys monitored this lodge at Site 1. The largest number of beavers and muskrats were observed in the ponds visible from Site 1 compared with all other sites (Tables 2.1). Beavers were observed moving in and out of this lodge during the surveys and the dams in the ponds surrounding it show signs of constant care. It appears that beaver activity was most concentrated in this area during 2013.

New lodges appeared in 2013 (Photos 2.1 and 2.2) but they do not appear to be active. Photo 2.12 shows lodge 2013-6 (Table 2.2) in a pond with recent dam work but no observations were made showing muskrats or beavers using this lodge. The only other lodge in the gulch that beavers and muskrats were observed using is lodge 2013-4 (Table 2.2) observed from Site 3 (Photo 2.10). This lodge has a motion sensor camera trained on it and activity in this area is constantly monitored.

An area of note is the upper portion of the gulch near the Peak 8 ski area base where recent hydrologic restoration has been completed. Ponds that have been empty in this area for several years are now flooded providing a large area of new habitat (Photos 2.4, 2.6, and 2.7). While no beavers or muskrats were seen in this area during the surveys, signs of recent activity were observed near Site 4 during the walk-through, most notable was fresh willow chew (Photo 2.5).

Observation of beavers and muskrats appears concentrated at Sites 1 and 2. The walk-through showed that they are utilizing a large portion of the gulch despite the lack of observations at certain sites. The most probable lodging areas are lodge 2013-8 near Site 1 (Photo 2.14) and lodges 2013-4 and 2013-6 near Site 3 (Photos 2.10 and 2.12). Restoration completed in 2012 and 2013 provided new and restored habitat that is now being actively maintained by beavers and these areas may show increased activity in the future.

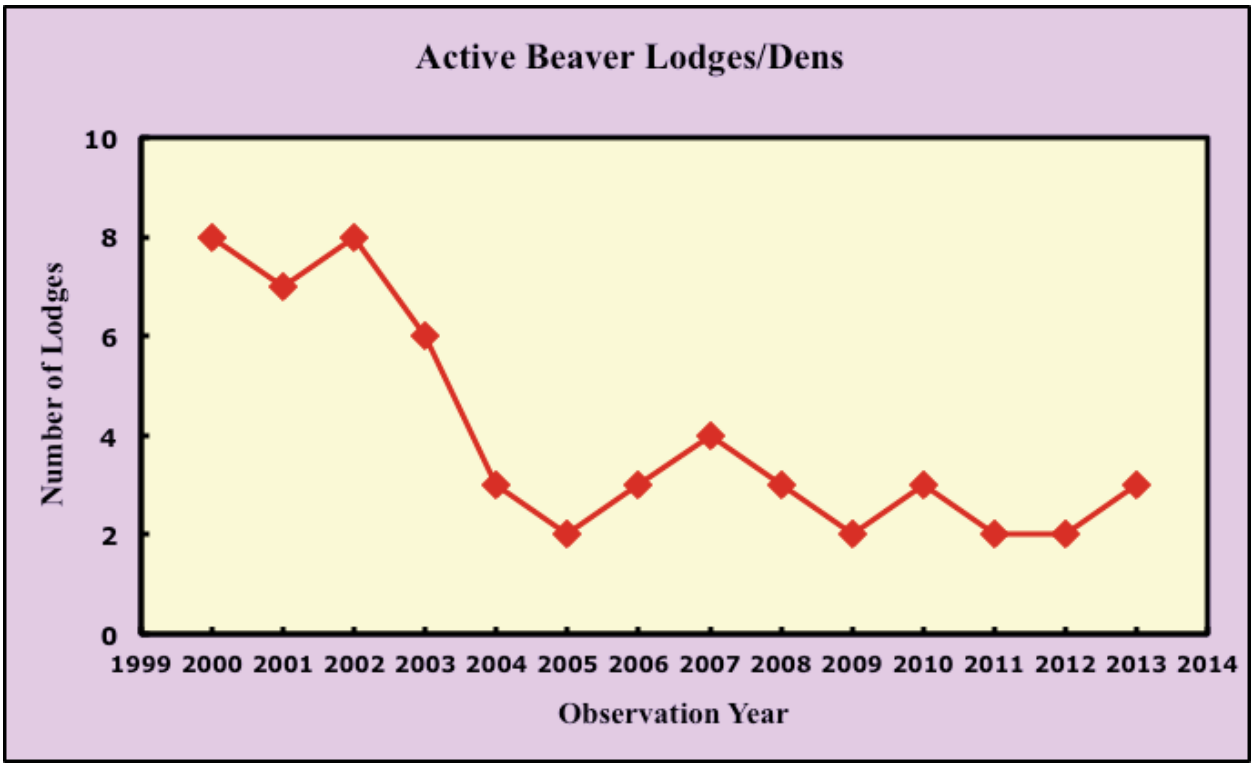


Figure 2.1 Active Beaver lodges and bank dens in Cucumber Gulch, 2000-2013.

Table 2.2: Summary of beaver lodges documented in Cucumber Gulch in October 2013.

Lodge ID	GPS	Active (A) or Inactive (I)	Photo Number
2013-1	39°29.306'N 106°03.524'W	I	1
2013-2	39°29.287'N 106°03.566'W	I	2
2013-3	39°29.980'N 106°03.829'W	I	8
2013-4	39°29.026'N 106°03.808'W	A	10
2013-5	39°29.055'N 106°03.731'W	I	11
2013-6	39°29.029'N 106°03.745'W	A	12
2013-7	39°29.143'N 106°03.602'W	I	13
2013-8	39°29.174'N 106°03.570'W	A	14

Table 2.3: Number of beaver and muskrat sightings during surveys by month in 2012 and 2013 (Note: numbers indicate number of sightings and not number of individuals).

	Beavers 2012	Beavers 2013	Muskrats 2012	Muskrats 2013
June	9	3	5	5
July	7	4	6	3
August	5	3	1	2
Total	**21**	**10**	**12**	**10**

Photo 2.1: Lodge 2013-1; near Gondola Post 15 in between D1 and SW4; first seen in May, there is obvious signs of work from this year; no recent beaver activity observed near lodge; appears inactive.

Photo 2.2: Lodge 2013-2; possible new lodge in between Gondola Posts 16 and 15 (near SW4 and C2); appears to be a few weeks old, no recent beaver signs observed near lodge and lodge not close to any ponds; appears inactive.

Photo 2.3: Recent work on dam next to Gondola Post 16; all ponds in between Post 16 and the Moose Interpretive Sign show recent signs of dam work as well as fresh chew and Beaver Runs are obvious throughout wetland in this area.

Photo 2.4: Recent dam work at top of Gulch downhill from Peak 8 Lodge and Ski Hill Road; dam work appears to be about a month old; fresh beaver sign was observed in wetland around A4 (Figure 5) and there is additional flooding in the same area (Figure 6).

Photo 2.5: Fresh beaver chew (probably less than a week old) recovered near A4

Photo 2.6: Recent dam work and additional flooding at top of gulch below Ski Hill Road

Photo 2.7: Close-up of dam work at top of Gulch

Photo 2. 8: Lodge 2013-3; first appeared in Summer of 2012 about 100 meters SSW of Camera 5; lodge is situated on ground next to a small pond; no recent signs of activity were observed on or around this lodge; appears inactive.

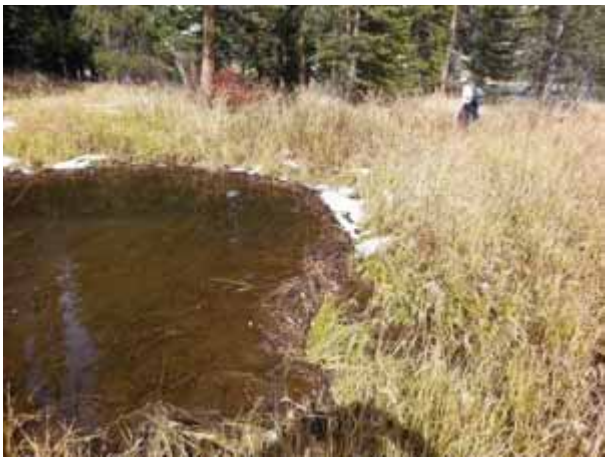


Photo 2.9: New dam and pond started about 50 meters SSW of Camera 5; dam appears to be about one or two months old; no other obvious beaver signs were observed near this pond.

Photo 2.20: Lodge 2013-4; next to Camera 5; lodge shows signs of recent activity; work has been completed recently on the dam in the pond and there is a stash of willow fronds next to the lodge; a muskrat was observed entering and exiting this lodge when this photo was taken.

Photo 2.11: Lodge 2013-5; old lodge about 150 meters west of Camera 5; appears inactive; no apparent beaver sign on or near this lodge.

Photo 2.11: Lodge 2013-6; about 75 meters ESE of Camera 5; some beaver sign observed near this lodge (chew and dam work); lodge may be active but there are no definite signs or observations to confirm this.

Photo 2.13: Lodge 2013-7; old lodge about 20 meters north of Moose Interpretive Sign; inactive but recently flooded.

Photo 2.14: Lodge 2013-8; located about 100 meters NNE of Moose Interpretive Sign; lodge appears to be active; lots of work on dams and other recent beaver sign near this lodge; beavers were observed throughout the entire summer entering and exiting this lodge.

2.4 Conclusions - *Beaver*

Beavers serve an integral role in Cucumber Gulch by maintaining standing water in ponds and as part of the food chain. Small kits have many potential predators in Cucumber Gulch including hawks, owls, bobcats, lynx, fox and coyote. Bears, coyotes, mountain lions and wolves are also viable predators on adults. Thus far, bobcats and lynx have not been identified in Cucumber Gulch, but the habitat is suitable and it is likely that they use this habitat on occasion. In addition, wolves have not yet repopulated Colorado, however population estimates suggest that the Wyoming population will eventually move south into Colorado. Mountain lion prints have been frequently seen in Cucumber Gulch and one was captured on camera in 2013.

Evidence shows that the beaver population in Cucumber Gulch experienced a rapid decline between 2002-2005 and has stabilized at a new point around 2-3 lodges. The exact reasons for the beaver decline are unknown. Possibilities for the decline include the following: lack of beaver lodge and dam construction material, disease, increased predation particularly from dogs, increased encroachment of both humans and dogs in the critical habitat area, changes in water flow from the base of the Peak 8 ski area or simply a natural fluctuation in the population. In 2011, sediment flowed into some beaver ponds and changed the nature of these ponds. The beaver lodge at the reset pond, where there was motion sensor camera monitoring, was historically surrounded by water. With the increased sediment in the pond, the lodge had a land bridge. This bridge has resulted in both humans and dogs routinely walking on and in close proximity to the lodge. The hydrological restoration project that occurred at the top of the gulch and the dredging of the reset pond in 2012 has likely provided a more stable environment for beaver occupancy. In addition, the beaver that was relocated to the Gulch in August of 2013 has likely contributed to the overall stability of the ponds.

3.0 BOREAL TOADS

3.1 Introduction –boreal toads

The global threat to amphibian populations worldwide mandates the identification of current breeding populations of amphibians. The significant fen wetland system located in Cucumber Gulch provides suitable habitat for both the western chorus frog (*Pseudacris triseriata*) and the Colorado State endangered boreal toad (*Bufo boreas boreas*). The boreal toad is especially at risk of local extinction due to habitat loss and because of its susceptibility to chytrid fugus (*Batrachochytrium dendrobatits* (Bd)). Chytrid fungus is the primary pathogen responsible for the statewide die-off of boreal toads. Testing on two individual frogs found in Cucumber Gulch in 2005 was negative for the fungus.

3.2 Methods –boreal toads

Cucumber Gulch was surveyed for amphibian populations in June, July, and August of 2012. Proper protocol was followed based on established techniques (Loeffler 2001). Field technicians underwent a three-hour training session prior to conducting surveys in the field. All surveys involved a minimum of three technicians and were supervised by either Dr. Carello, Audrey Hoffa or Matthew Stoddard. Finally, proper protocol was followed for sterilization procedures of equipment and footwear to minimize the risk of spreading the *chytrid* fungus.

3.3 Results –boreal toads

No boreal toads, larvae or eggs were found during the 2013 toad survey in Cucumber Gulch, despite the suitability of habitat. The wetland is characterized by dense wetland vegetation with numerous water channels, some of which are clear and still to slow moving. There is also significant vegetation on banks for egg attachment and cover for larvae.

3.4 Conclusions – boreal toads

Cucumber Gulch is a wetland system that has historically had boreal toads. The last confirmed sighting of boreal toads was in 2005. The two toads found in 2005 both tested negative for *Chytrid* fungus. The result of this survey does not mean that they are not in the area, but that if they are in Cucumber Gulch they are not found in large numbers.

4.0 MOTION SENSOR CAMERA WILDLIFE MONITORING

Monitoring with motion sensor cameras (Silent Image Model RM30 available from Reconyx.com) continued throughout 2013. The five cameras have been in place since 2008 (Map 2). Cameras were operative most days throughout the year with very few down days in 2013 (Table 4.1). All cameras were placed at known areas of animal and human use. The cameras are infrared and silent, thus observations have been made without the effect of human disturbance. Each camera uses a 2GB memory card capable of holding up to 4,000 photos per card. Memory cards are methodically changed every 2-3 weeks. This method of data collection should continue as it allows us to view wildlife in its natural state and gives wildlife managers valuable decision making information.

The 2013 field season has yielded thousands of photographs of animals. Cucumber Gulch is being used by a variety of species throughout the year. The following are the camera captures for 2013 in order from greatest to least: beaver, mule deer, moose, human, fox, aquatic birds, and 10 other species of mammals and birds (Fig 4.1). Fox, bear, squirrel and snowshoe hare camera captures did not change significantly in 2013. Coyote captures declined significantly from an average 46 captures/year for 2010-2012 to 22 camera captures during 2013. Pine marten captures increased significantly from an average 1/year for 2010-2012 to 12 camera captures during 2013 (Photo 4.1). Raccoon camera captures continue to decrease from an average 16 captures/year in 2010-2011 to an average 2/year for 2012-2013. Moose camera captures continue to hold steady with an average of 159/year for 2012-2013. Deer camera captures continue to increase from an average 140/year in 2010-2012 to 228 camera captures in 2013. Deer spent most of their time by cameras four, three and one respectively (Photo 4.2). As seen in previous years, moose were captured mostly on cameras one and two (Photo 4.3). Beaver captures increased significantly in 2013 at camera five (the reset pond restoration site), likely as a result of the restoration project that may have attracted beaver back to the abandoned lodge, which is now considered active (Photos4.4- 4.12). One beaver was relocated to the Gulch this summer and while we cannot know for sure we suspect the large beaver observed working on the lodge may in fact be the relocated beaver. Unfortunately, the tree that camera five was placed on fell on November 18th and we were unable to place the camera in a suitable place for the month of December so we likely missed many more photos of the busy beaver. Several muskrat were also captured on camera at the newly reoccupied beaver lodge at camera five (Photo4.13). The number of crows decreased significantly at camera five this year from 142 captures in 2012 to two captures in 2013. This reduction in crows may be connected to the restoration project and subsequent beaver activity at the lodge. The number of aquatic bird (ducks and geese) captures on camera five doubled in 2013 (Photo 4.14), also likely a result of the restoration project at the reset pond. We finally caught a mountain lion strolling down the trail on the recreation trail camera in August 2013 (Photo 4.15). A porcupine was also photographed this year on camera three (Photo 4.16). Off trail humans and canine presence are still of concern throughout the Gulch, particularly at camera three, which is an important wildlife corridor (Photos 4.17 &4.18). There was a significant increase in the number of people captured off trail in 2013: from an average

75/year for 2010-2012 to 122 human captures in 2013. There was no change in the number of dogs captured on the off trail cameras in 2013. However, there was an increase in dogs captured on the recreation trail camera (Chapter 5) and dogs continue to be of concern for wildlife in the Gulch (Photo 4.19).

Peak numbers of animals were photographed from March through October 2013 (Fig 4.2& 4.3). In figure 4.2 & 4.3 the spikes seen on camera four in June and August were from deer, the spike seen on camera three in June is also from deer and the spike seen on camera five in October was from extremely busy beaver.

Map 2. Permanent location of motion sensor cameras. These cameras have been in place since 2008.

Camera number	GPS Coordinate	Camera installation date	# of days camera inoperative	2013 Dates camera inoperative
Camera 1	N 39°29.205 W 106°03.732	December 17, 2007	0	N/A
Camera 2	N 39°29.222 W 106°03.812	December 17, 2007	0	N/A
Camera 3	N 39°29.028 W 106°03.983	January 12, 2008	0	N/A
Camera 4	N 39°29.179 W 106°03.769 N	January 12, 2008	0	N/A
Camera 5	N 39°29.019 W 106°03.803	May 18, 2008	27	18 November – 15 December
Camera 6	N 39°29.040 W 106°03.434	January 1, 2012	6	19-23 July & 31 July

Table 4.1 Inoperative camera dates, GPS coordinates of motion sensor cameras and date of installation.

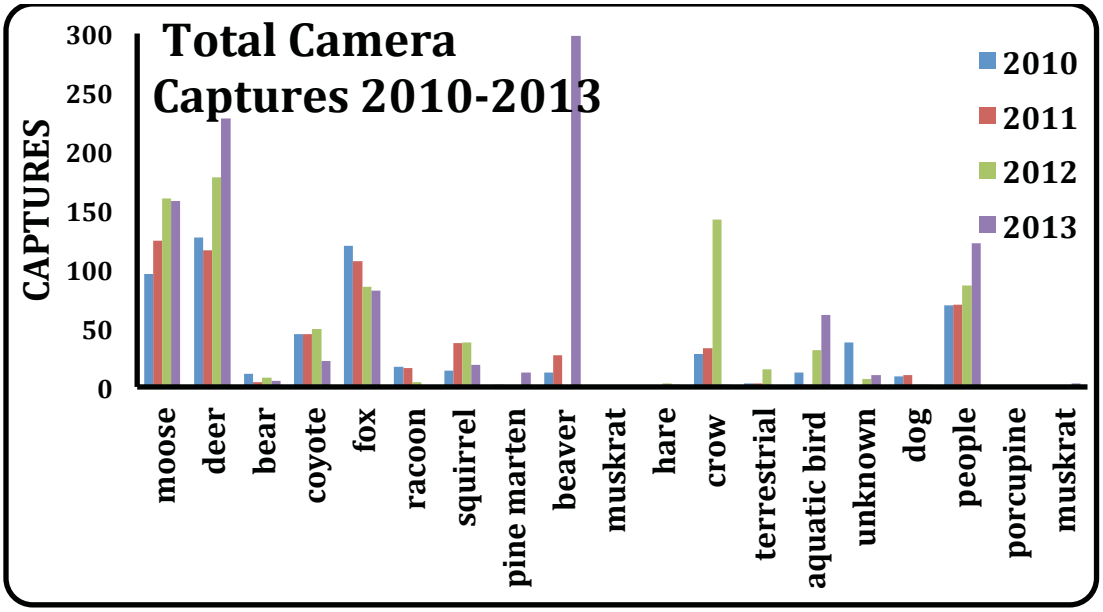


Figure 4.1 The total number of camera captures for individual species in 2010 (blue), 2011 (red), 2012 (green) and 2013 (purple). A camera capture is defined as a single photo or the first photo in a series of photos.

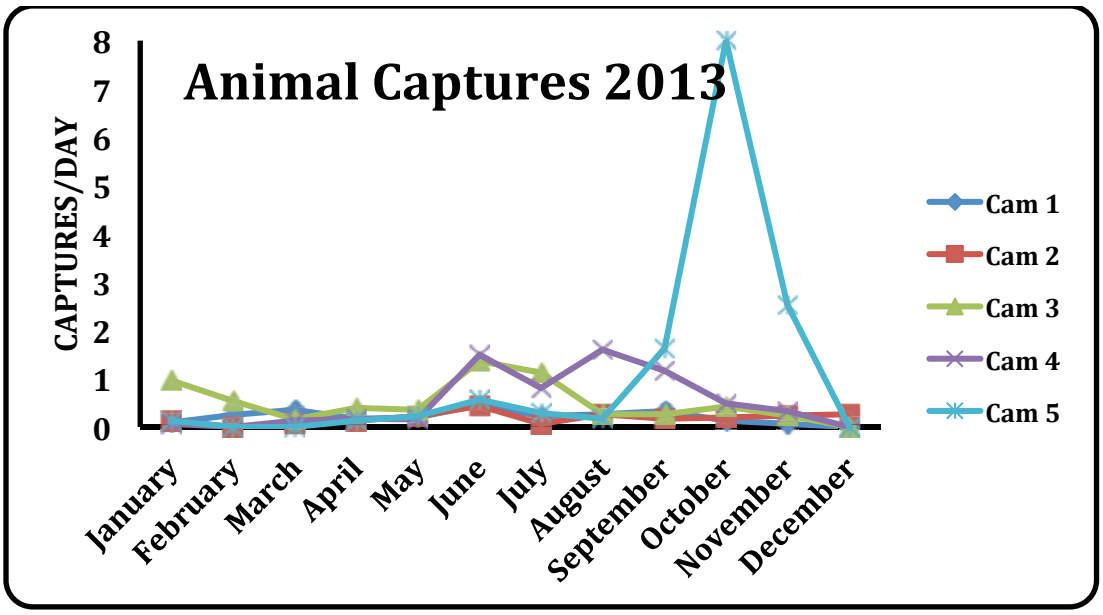


Figure 4.2 The number of camera captures per day for each month the camera was out (total monthly captures divided by operational days per month). The legend at the right is camera number. A camera capture is defined as a single photo or the first photo in a series of photos. Of note; camera 4 June and August spikes were deer and camera 5 October spike was beaver. This graph does not include humans and dogs.

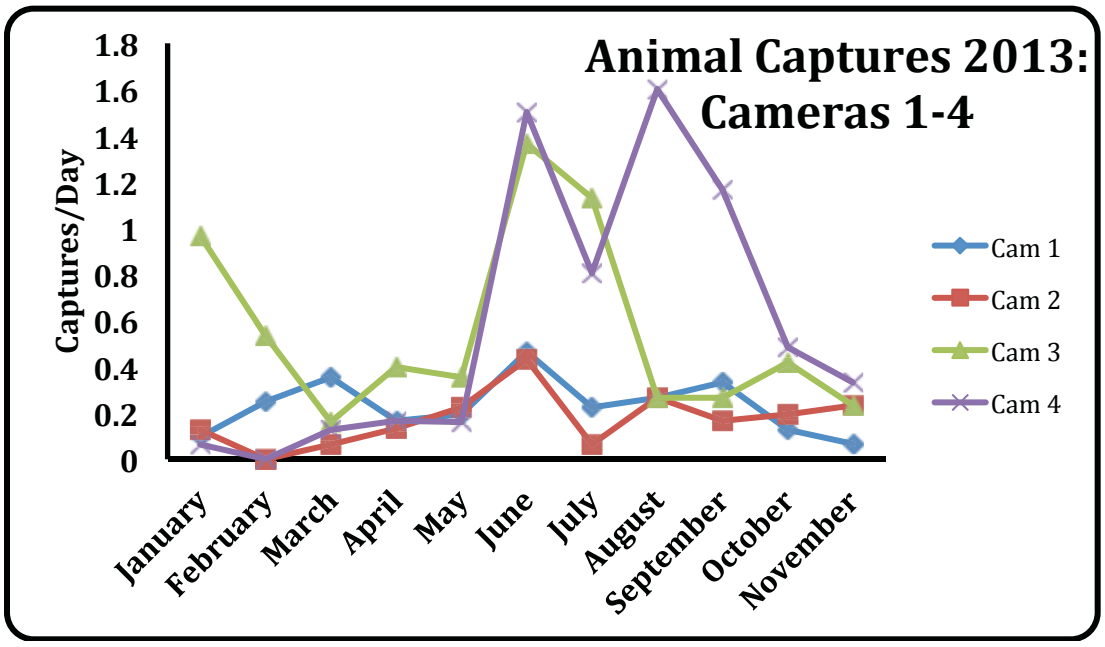


Figure 4.3 This is the same figure as 4.1 except without camera five data so the trends on the other cameras can be more easily seen.

4.1 Summary Photos

Photo 4.1 This pine marten (*Martes americana*) was photographed at camera one on April 19th at 7:23am.

Photo 4.2 A mule deer and her fawn photographed at camera four on July 31st at 8:26pm.

Photo 4.3 Moose cow and twin calves captured on camera two on August 12th at 2:17pm. Many photographs of these twins were captured in 2013.

Photo 4.4 A moose calf at the then inactive lodge at camera five on August 11th.

Photo 4.5 By September 19th the beaver have been working steadily for two weeks and the changes to the lodge are evident.

Photo 4.6The lodge at camera five on September 27th at 10:15pm. Most of the work was carried out at night.

Photo 4.7 Two beaver working together at the camera five lodge on October 4th 9:25pm. We captured these two working together on many occasions. The big beaver on the lodge is likely the animal relocated summer 2013.

Photo 4.8 October 7th at 1:57am the beaver have piled many branches on top of the lodge and are now working on placing mud on top.

Photo 4.9 The lodge at camera five on October 17th 1pm.

Photo 4.10 Two beaver at the camera five lodge October 25th at 3:15am.

Photo 4.11 A fox checking out the new improvements at the camera five lodge on November 2nd 5:29pm.

Photo 4.12 Beaver continue to work on the lodge at camera five even during a snow storm on November 16th at 9:13pm.

Photo 4.13 This muskrat (bottom right) was photographed on October 3rd at 2:05 pm on camera five.

Photo 4.14 A significant increase was seen in the number of ducks and geese captured at camera five. These mallards were photographed on October 3rd at 2:03 pm.

Photo 4.15 This mountain lion was photographed on the recreation trail camera on August 5th at 1:48 am.

Photo 4.16 While there is ample evidence of porcupine throughout the Gulch this is the first clear photo taken of one at camera three on April 22nd at 2:35am.

Photo 4.17 These two youths spent a half hour snowboarding under the bridge at camera three on December 13th at 5pm. This underpass is an important wildlife corridor and we have seen increased human activity at this location in 2013 including incidence of graffiti.

Photo 4.18 The twin moose calves and their mother were photographed at camera three on July 19th at 8:21am.

Photo 4.19 This human and her off leash dog were photographed at camera two (a popular moose locale) June 1, 2013 at 12:31pm when the trails were officially closed to recreation.

5.0 RECREATION TRAIL CAMERA

5.1 Introduction

In 2011 a trail camera study was carried out in Cucumber Gulch to investigate the impact of summertime human recreation activities on wildlife habitat usage. The results indicated that animals such as deer, fox and coyote were likely habituated to predictable human disturbance, as they did not vacate the Gulch once the trails were open in July. The study demonstrated that moose have a low tolerance for human presence. In June, when the trails were closed and human disturbance was low, moose were captured often on camera. However, when the trails officially opened in July moose camera captures significantly declined with moose abandoning the trails all together (Carello, 2011).

Moose cows are likely more sensitive to human disturbance in June and July when newborn calves are still young and vulnerable. In an effort to minimize the amount of

stress and energetic demands placed on new cow/calf pairs it was decided that the recreation trails be closed through July 8th in 2012 and July 7th in 2013.

In the interest of investigating the effect of this closure and to continue monitoring trail use in the Gulch it was decided that the most fruitful trail camera from the 2011 study would be placed out again in 2012 and 2013.

5.2 Methods

In May 2013 one motion sensor camera (Hyperfire Image Model PC 900 available from Reconyx.com) was installed on the recreation trail at the gondola corridor. This was the same location of Camera 9 in the 2011 study. The camera uses a 2GB memory card capable of holding up to 4,000 photos per card. Memory cards were methodically changed every 2-3 weeks. A camera capture is defined as a single photo or the first photo in a series of photos. The camera was removed from the trail at the end of August 2013.

5.3 Results

Over 4,000 individual photos were taken during June and July 2013. Despite the fact that the trails were officially closed in June there were a total of 274 individual humans captured on camera during June, an insignificant decrease from the 348 individuals captured in June 2012 (Table 5.1, Figure 5.1).

The trails were officially closed July 1-7, 2013. When compared to the same time period in 2012, there was a highly significant increase in the average number of humans captured on the trail camera (Table 5.1, Figure 5.2), thus indicating the trail closure was not as effective at reducing human traffic in 2013 as it was in 2012.

When the trails opened on July 8th 2013 the number of individual humans increased exponentially from when trails were closed in June (Table 5.1). When compared to July 2012, there was no statistical difference in the average number of humans using the trails in July 2013 (Figure 5.3). However, when comparing July open trail averages for 2011 to 2013 there was a significant increase in the average number of humans per day (Figure 5.3)

There was no statistical difference between the number of humans per day when comparing weekdays to weekends in 2013 (Figure 5.4). Day hiking, mountain biking and trail running comprised 56%, 35% and 9% respectively of the trail use activities (Figure 5.5).

The animals photographed included moose, deer, fox, coyote, bear (Photo 5.1), and raccoon (Table 5.1). When comparing June and July 2012 to June and July 2013, there was no significant difference in the average number ofdeer per day (Figure 5.6). When comparing June 2012 to 2013, there was no significant difference in the average number of moose per day (Figure 5.7). However, when comparing June 2011 to June

2013, there was a significant decrease in the average number of moose per day (Figure 5.7). When the trails were open in July there was only one moose captured on camera the morning of the first official day opened, July 8th.

5.4 Conclusion

The decision to keep the recreation trails closed over the July 4th holiday weekend prevented the holiday weekend spike in human activity that was observed in 2011. However, the average number of humans using the trail during the holiday closure in 2013 more than doubled from 2012. There was no significant change in the average number of people on the trails when closed in June when comparing 2012 to 2013. However in June 2013, there was a significantly greater average number of humans per day when comparing it to June 2011.

The trails opened on July 8th and this year there was no significant change in the average number of July visitors from 2012. There was a significant increase in average July visitors when comparing 2011 to 2013.

Unlike other members of the deer family, moose are solitary animals. Moose cow and calf pairs do not have the benefit of a herd to alert them to danger. In addition, moose have poor eyesight and therefore are not depending on vision to detect danger but instead rely heavily on their keen hearing and sense of smell to alert them. The combination of moose behavior and physiology results in moose being quick to flee an area when danger is detected. The energy devoted to flight plus decreased time for foraging and increased stress come at the cost of energy resources that could be devoted to the individuals' survival, growth, and reproduction (Geist 1978). Unfortunately, once moose abandon a habitat they are not likely to return soon. Therefore it only takes one big disturbance and moose will vacate the area. The huge June increase in human presence plus double the average visitors during the holiday closure were enough of a disturbance to drive the moose away from this location for the summer.

The overall increase in summertime human trail recreation in 2013 did not deter the coyote and fox from using the trail and surrounding areas, the same result seen in the previous years. However, the number of small mammals decreased significantly from 2012 to 2013. There was no difference in the average number of deer when comparing 2012 to 2013. Neither the deer nor the moose abandoned the gulch entirely and were observed quite often throughout the summer on the off trail cameras (Photo 5.2) and a mountain lion was captured strolling down the trail on the recreation trail camera on August 5th 2013 (Photo 4.15). The concern is that human recreation is causing increased stress and energetic demands to newborn moose calf and mother pairs. The energy lost to vigilance behaviors and taking flight result in decreased foraging time and over time come at the cost of energy needed for growth and development (Geist 1978).

In conclusion, it is recommended that the recreation trails continue to remain closed through the July 4th weekend in an effort to minimize ungulate disturbance and

abandonment of the habitat. In addition it is strongly recommended that the docent program be fully implemented and expanded to include all of June and July (Docent Report: Breckenridge 2013). Studies show that recreationists are more likely to support restriction restrictions if they have an understanding of how wildlife will benefit (Purdy et al.1987). The docent's task is to emphasize how human activities affect wildlife, helping visitors to associate their actions with either benefiting or harming animal populations. Klein (1993) found that visitors who spoke to wildlife refuge personnel were less likely to disturb wildlife than visitors who did not. For example, there continues to be a significant number of people who bring dogs to the Gulch even though it is against the rules. Likely these visitors do not have a clear understanding of why the no dog policy is in place and how it can negatively affect wildlife (Photos 5.3 - 5.5). Through education, docents will inform recreationists of how their activities impact wildlife and how they can adjust their behavior to minimize the effects. The docents will provide education and instruction to visitors and help outdoor enthusiasts to minimize their impact on wildlife and gain a greater understanding of the natural world.

Table 1.The total number of individual humans and animals photographed on a recreation trail during June and July 2011, 2012 & 2013.

	June 2011 TRAILS CLOSED	June 2012 TRAILS CLOSED	June 2013 TRAILS CLOSED	July 1-8 2011 TRAILS OPEN	July 1-8 2012 TRAILS CLOSED	July 1-7 2013 TRAILS CLOSED	July 9-31 2011 TRAILS OPEN	July 9 - 31 2012 TRAILS OPEN	July 8 - 31 2013 TRAILS OPEN
Human	96	348	274	709	91	189	1303	2512	2175
Moose	14	5	4	0	0	0	0	3	1
Deer	37	24	30	7	3	5	51	28	24
Fox	9	21	3	1	2	0	9	3	0
Coyote	1	8	2	3	0	0	1	2	1
Bear	1	0	0	0	0	0	1	0	1
Small mammal	2	13	5	5	1	2	7	15	0

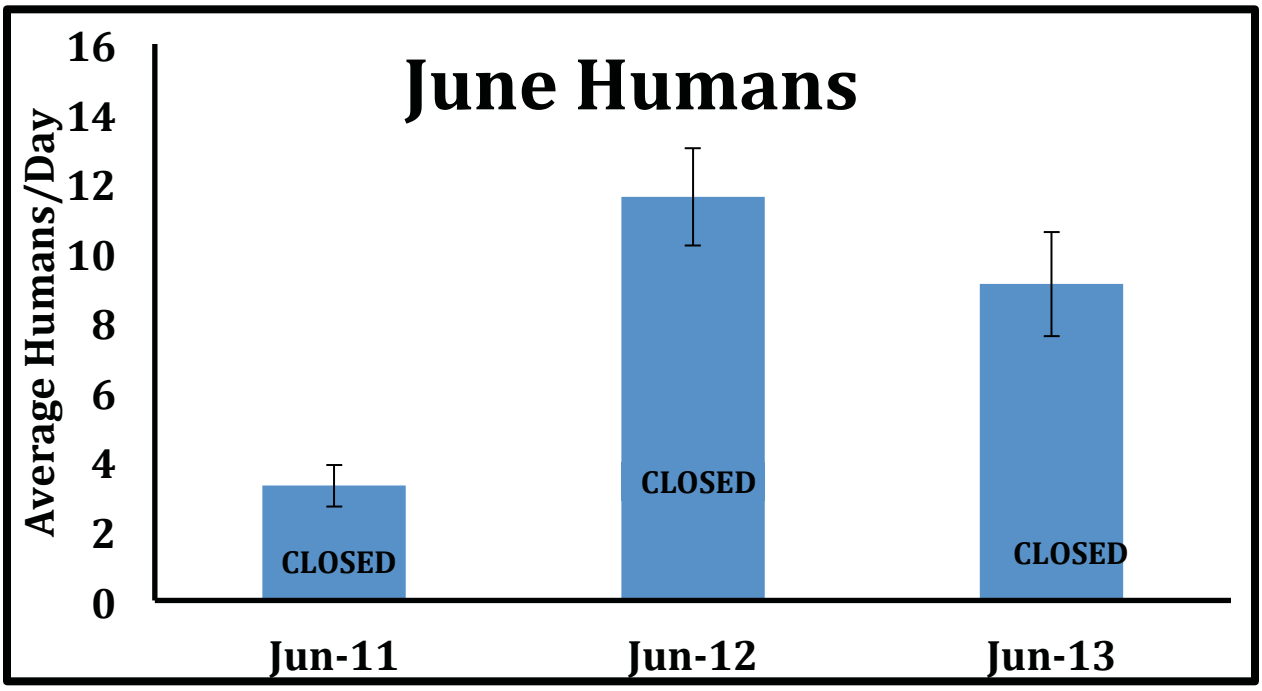


Figure 5.1. There was no significant change in the average number of humans captured on camera per day during the month of June from 2012($\bar{X}$ =11.6±1.4) to 2013($\bar{X}$ =9.1±1.5; p =0.2).

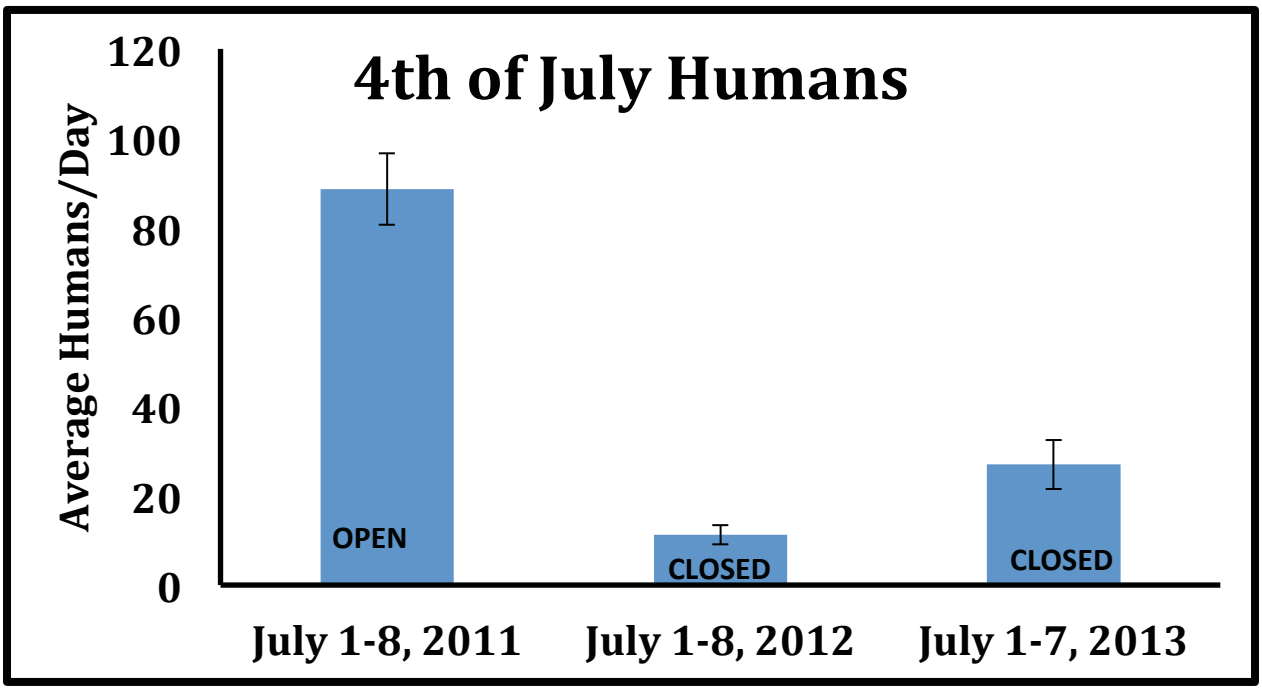


Figure 5.2. When comparing July 1-8, 2012 to the July 1-7, 2013 the average number of humans per day during this time period increased significantly from 2012($\overline{X}$=11.3±2.1) to 2013 ($\overline{X}$=27±5.5; p = 0.01).

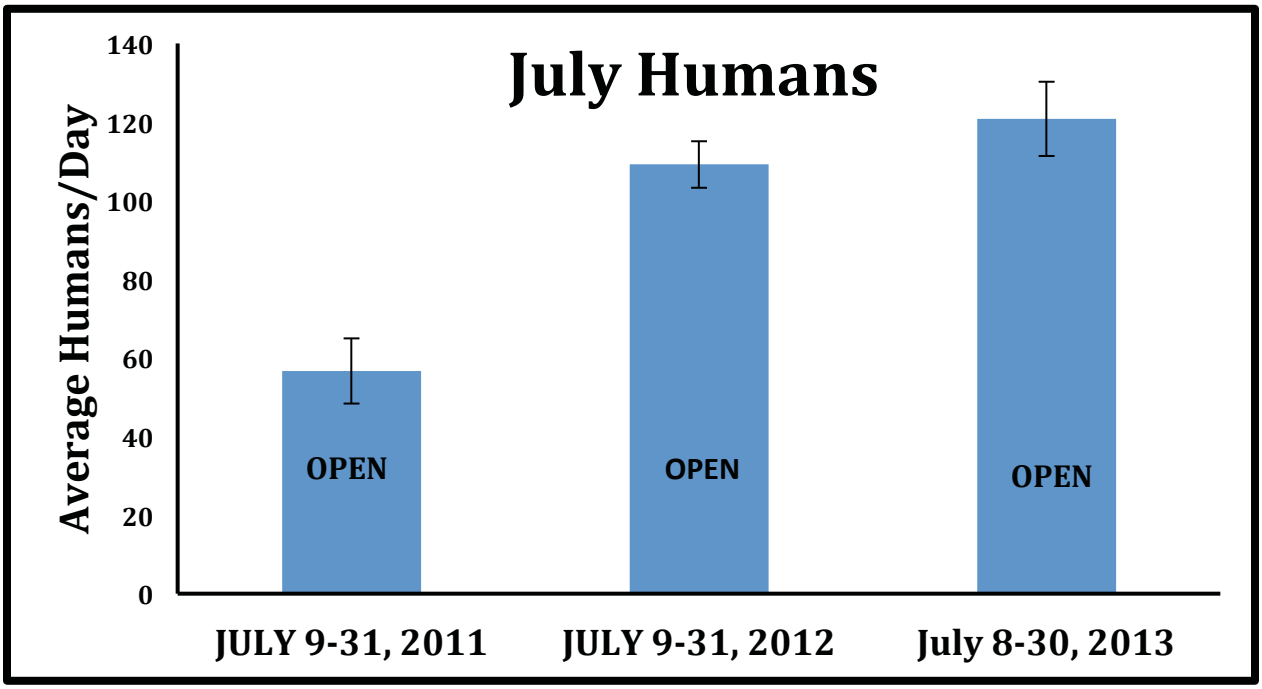


Figure 5.3. The average number of individual humans captured per day on camera in the month of July was not significantly different from 2012($\overline{X}$=109±5.9) to 2013 ($\overline{X}$=121±9.7; p= 0.26).

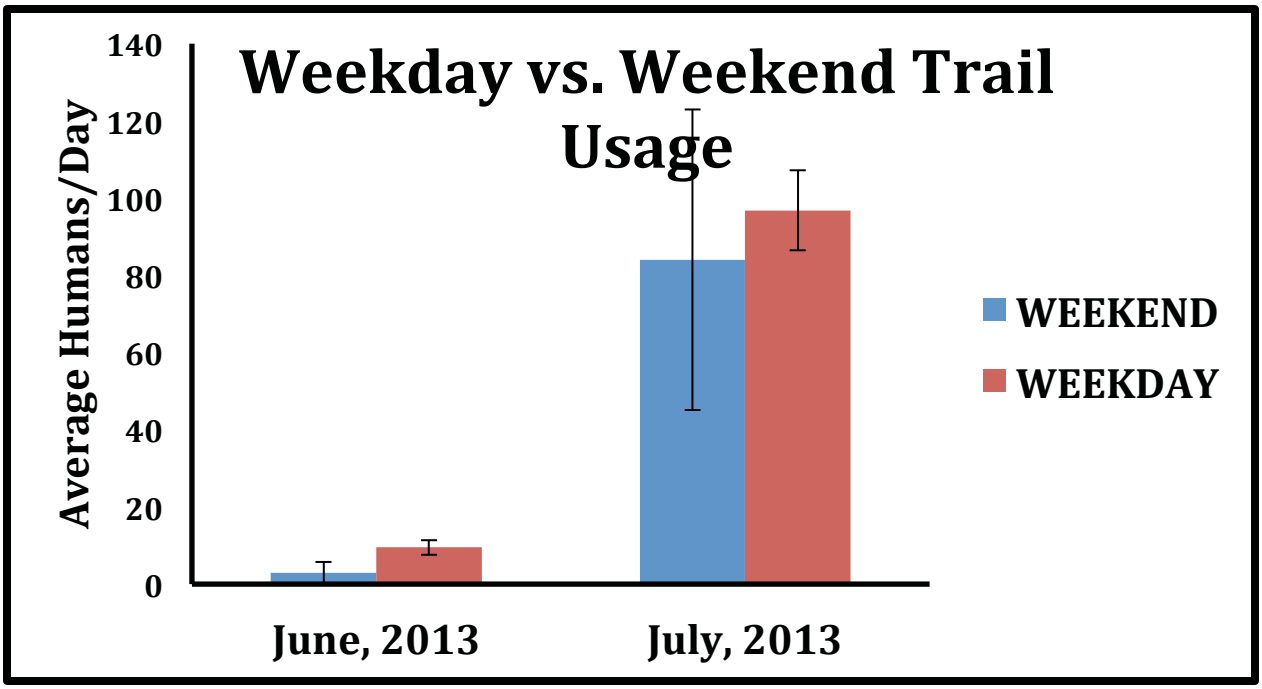


Figure 5. 4 There was no statistical difference in the average number of humans per weekend day compared to the average number of humans per weekday ($p > 0.05$).

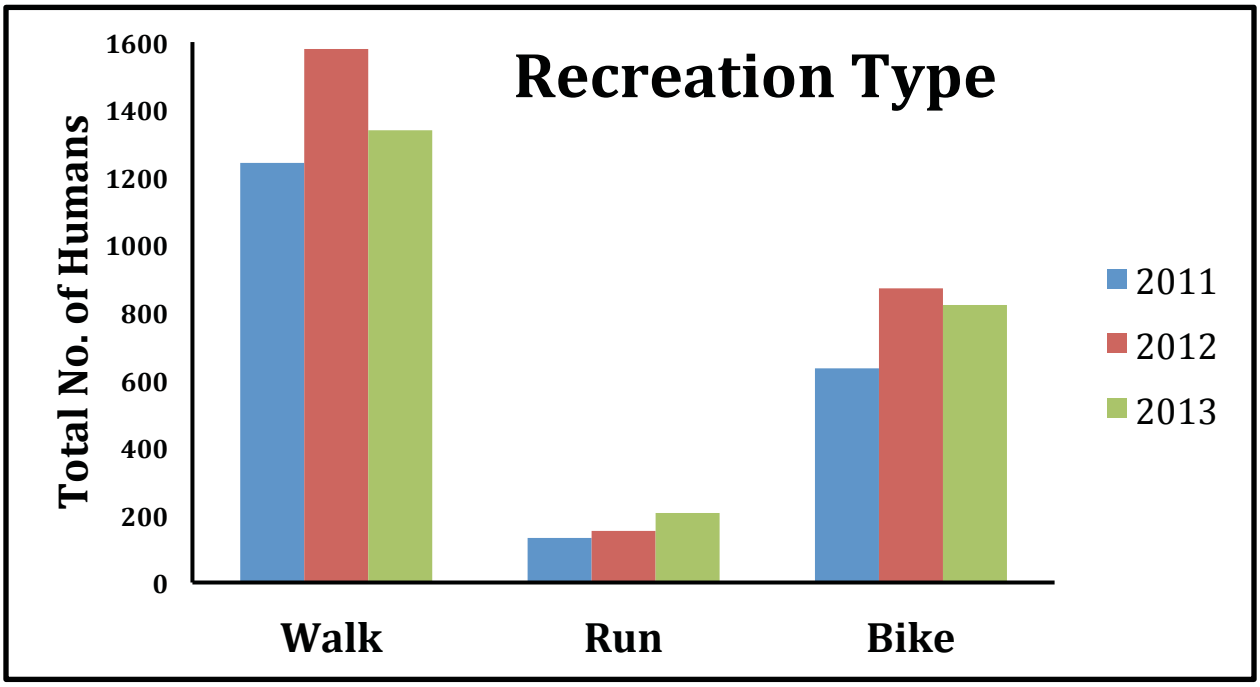


Figure 5.5 The type of recreation observed on a recreation trail for 2011, 2012 & 2013.

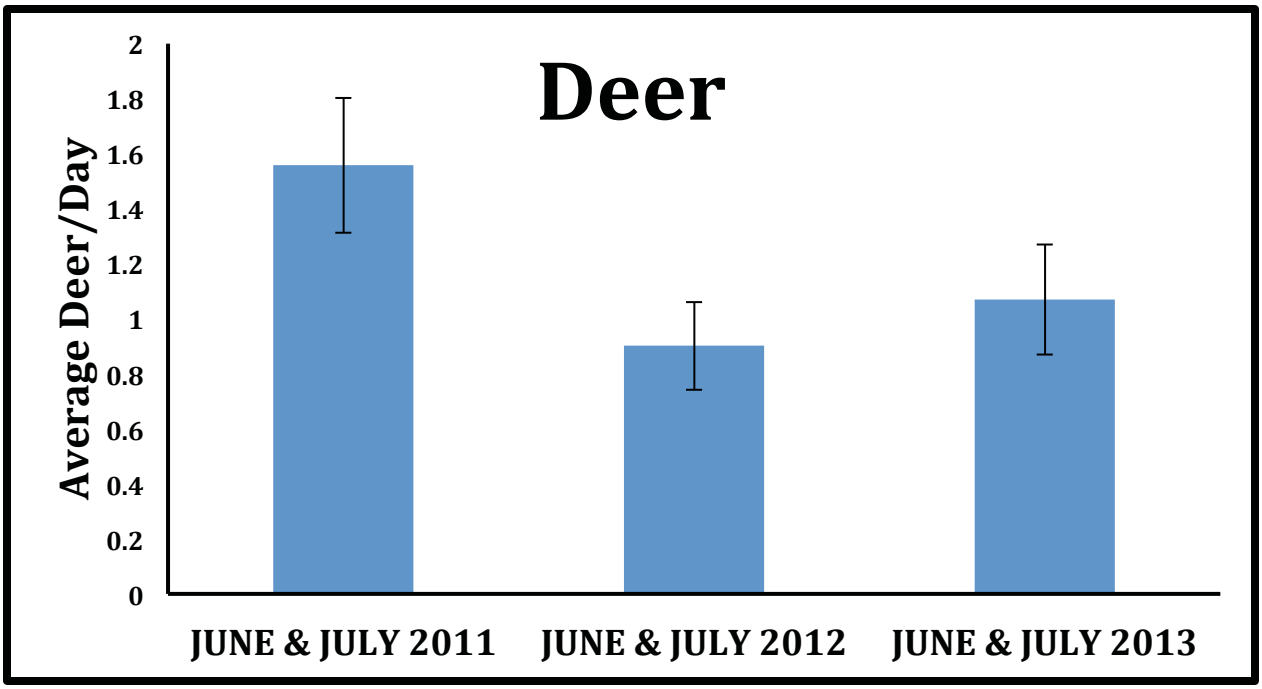


Figure 5.6 The average number of deer per day was not significantly different from June and July 2012 ($\overline{X}$=0.9±0.15) to June and July 2013 ($\overline{X} = 1.07 \pm 0.2$±; p =0.5).

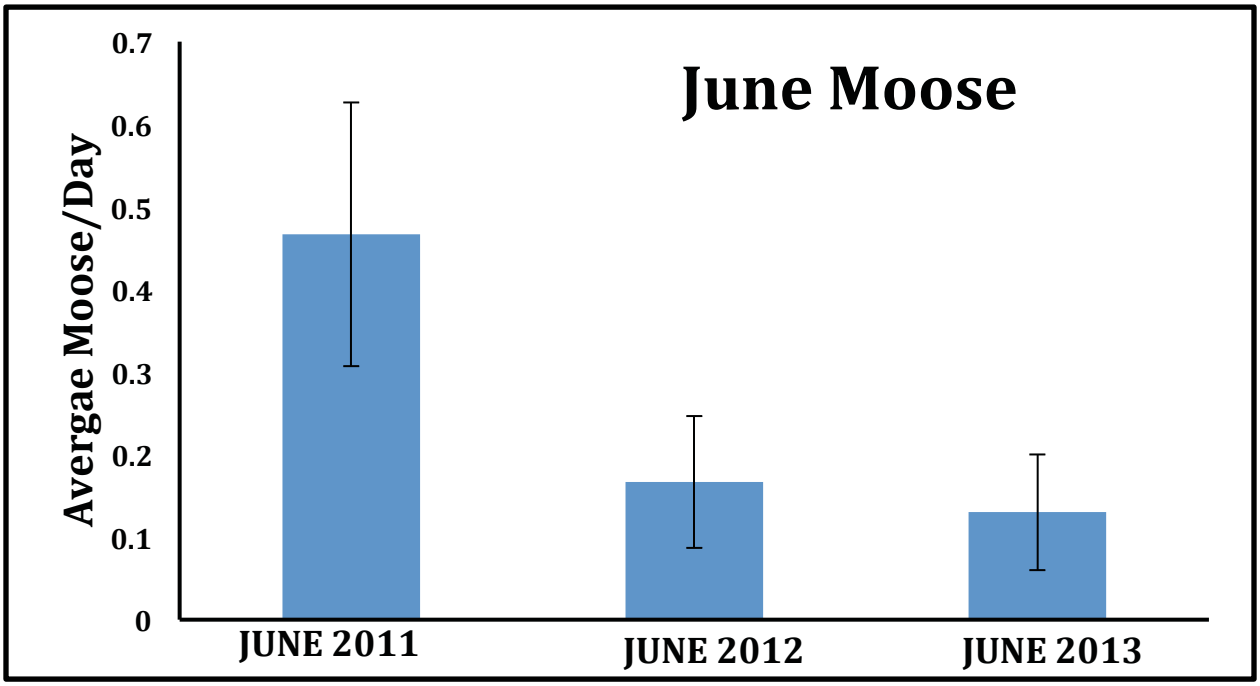


Figure 5.7 The average number of moose per day was not significantly different when comparing June 2012 ($\overline{X}$ =0.17±0.08) to June 2013 ($\overline{X}$= 0.13±0.07, p = 0.7).

Photo 5.1 This brown bear was photographed on the trail on July 27th at 6:37am.

Photo 5.2 This bull moose was photographed on June 8th at 7;37pm.

Photo 5.3 This human and his off leash dogs were photographed on June 15th at 1:26pm. The trails are officially closed at this time.

Photo 5.4This husky was photographed with no human in sight on July 10th at 5:19pm.

Photo 5.5 These people are using the trails on the 26th of June when the trails are officially closed.

6.0 WEEDS

6.1 *Background* -Weeds

Weeds are non-native plants that were intentionally or accidentally introduced to an area. Weeds are often categorized as invasive and/or noxious. Invasive weeds are non-native plants whereas noxious weeds are not only invasive but are also highly destructive to agriculture, human health and/or the environment. Title 35, Article 5.5 of the Colorado Noxious Weed Act refers to noxious weeds as plants that have a direct or indirect detrimental effect to the environmentally sound management of natural ecosystems. Noxious weeds impact the natural integrity of the environment by robbing native plants of precious water, nutrients and sunlight. Because of their highly competitive nature and lack of natural predators they rob animals of their food sources, nesting areas, access to water, and habitat used for protection from predators. They also reduce ecological diversity. Noxious weeds seem to thrive in areas of disturbance from construction, travel and recreation. Colorado has 1,300 native plants of which 130 or 10% have been displaced by non-native weeds (Colorado Weed Management

Association). Specific areas, focusing on the perimeter of Cucumber Gulch were evaluated for the presence of invasive and noxious weed species on July 24 and August 31, 2013. The following reports were sent to the Town of Breckenridge Open Space and Planning within two days of conducting the surveys.

6.2 *Weed Survey July 24, 2013*

A weed inventory was conducted at specific locations in Cucumber Gulch on July 24, 2013. The weeds of most concern were scentless chamomile and yellow toadflax (butter and eggs) found on the hillside interface with the wetlands at Peak 8.

Main Wetland Complex just down from Gondola supporting pole #16

Last August a large patch of Canadian Thistle was observed at this site. This patch is not evident at this time.

Gondola Clearing between supporting poles #17 and #18

Some thistle directly under gondola and penetrating into intact forest on the south side. Also dandelion is prevalent. Otherwise regrowth of understory vegetation looks good.

Gold Digger Nordic Trail

Sporadic **Scentless chamomile and thistle** growing along edges of footpath. The chamomile can easily be pulled.

Practice Nordic Trail

Scentless chamomile, Canadian thistle, pineapple weed, yellow sweet clover. Tarweed is about to flower and should be removed as soon as possible.

Peak 8 hill side (below Ski Hill road and directly below the Peak 8 base area)

Scentless chamomile and yellow toadflax invading wetland, especially in area adjacent to the Stables parking lot. Also, present were yellow sweet clover, dandelion, Canadian thistle, and *Rumix spp.* (likely Curly Dock).

Peak 7 retention ponds (Just below Peak 7 base area)

Abundant yellow sweet clover, dandelion, **scentless chamomile** and a couple of patches of yellow toadflax.

6.3 Weed Survey August 31, 2013

All areas in and around Cucumber Gulch looked pretty good, with one exception. The area below Ski Hill Road at Peak 8 had very few Scentless Chamomile plants and toadflax. It seems that this area had weed removal since I last surveyed the area in July. There were some small Canada thistle plants under the gondola cut, but I did not see any that had gone to flower. **The area of most concern is in the wetland portion of the Gulch, just under the gondola.** This is the same location where Canada thistle was removed the previous two years. Currently there are a few Canada thistle plants in

flower and smaller plants that have not gone to flower as of yet. There are also a few large curly dock plants in seed (this is a tall plant with a big red stalk that emerges from the top). The Canada thistle and curly dock should be removed. The only other are that could use a little attention is the nordic practice trail where there is chamomile and thistle.

6.4 Conclusions and Recommendations -Weeds

Every effort should be made to eradicate weeds and prevent future invasions of weeds in Cucumber Gulch. Thus far, weeds have not completely inundated the wetlands of Cucumber Gulch. However, a large patch of Canada thistle was identified in the main portion of the Gulch, just below the gondola in 2011 and was seen again in 2012 and 2013. In general, the wetlands have a very small barrier for protection from future weed invasions. The deforestation for the Peak 7 development and the gondola that occurred in April of 2006 has provided an opportunity for thistle and dandelions to flourish. Additional deforestation associated with expansion of the detention pond below the Peak 8 base area as well as the new road near Josie's cabin in 2009 to service the sewage pump station, further reduced the protective barrier against weeds. Town weed experts should prioritize removing weeds of all types from the Preventive Management Area (PMA) and adjacent areas. Residents on Ski Hill Road that border Cucumber Gulch should be encouraged and educated on maintaining their landscape in an environmentally friendly manner where native plants are grown, and weeds and non-natives are removed as soon as they appear. The weeds that posed the greatest threat to the wetlands in 2013 and should be prioritized for mechanical removal are scentless chamomile, yellow toadflax and Canada thistle. Herbicides, unless well studied should not be used.

7.0 DOCENT: PILOT PROGRAM

7. 1 Introduction & Methods to Docent Program

Cucumber Gulch Preserve is widely used throughout the summer months for recreation such as hiking, trail running and biking. While most visitors tend to stay on the trail and leave their dogs at home, there continues to be many who do not. The trails in Cucumber Gulch were closed in 2012 and 2013 from June 1 until the Monday following the 4th of July holiday weekend. This time of year is a sensitive period due to wildlife reproduction and is an ideal time to keep disturbance to a minimum.

In an effort to reduce trail use when trails were closed and educate visitors on proper trail use when trails were open, a pilot docent program was instituted. A docent was stationed at the top entrance to Cucumber Gulch by the Peaks Trailhead on Ski Hill Road (photo 1). The docent was in attendance when the trails were closed on July 5, 6, & 7 from approximately 10:00-15:00. The docent was in attendance again July 12, 13, & 14 from approximately 10:00-15:00 when the trails were open. An educational

information board was on display at the trailhead that featured a wide variety of the species captured on camera in the wetlands.

7.2 Results of Docent Program

Trails Closed

July 5th – Thirty-seven people approached the docent at the Peaks Trailhead. Of those people, 11 were exiting the Gulch, 20 were on their way into the Gulch from the Ski Hill Road and six came over from the Peaks Trailhead across the road.

July 6th – Twenty-three people approached the docent at the Peaks Trailhead. Of those people, nine were exiting the Gulch, 13 were on their way in from Ski Hill Road and one came over from Peaks Trailhead across the road.

July 7th – Twenty-seven people at the Peaks Trailhead. Of those people, one was exiting the Gulch, 24 were on their way in from Ski Hill Road and two came over from Peaks Trailhead across the road.

Sixty-eight of the interactions were with non-residents and 18 were with Breckenridge-area locals. Only one person entered the Gulch despite the docent's presence at the trailhead.

When comparing the number of individuals who passed by a motion sensor camera setup on the trails in Cucumber Gulch in 2013 to 2012 over the 4th of July weekend, there was a significant increase in visitor volume overall in 2013 (Fig 1). When comparing only the hours when the docent was present, there was no significant difference between the years (Fig 2).

Trails Open

On July 12, 13 & 14th two docents interacted with ~150 people at the Peaks Trailhead on Ski Hill Road.

7.3 Discussion of Docent Program

Over 200 people interacted with the docent in 30 hours. Overall, it was an extremely positive experience for the public. During the time the trail was closed, only four of the 68 people voiced their disagreement to the closure. The majority of the visitors seemed happy to comply with the closure. They also seemed interested in looking at the information board photos and learning more about the wetland complex. Out of the 68 people that were turned away from the trail, only one local young man (with his dog off leash) entered the Gulch despite being informed that the trails were closed. Several visitors did not know the ecology and value of a wetland and were shocked to see the species diversity present in Cucumber Gulch Preserve. On the first day out, there was a local lady who stopped her car to let the docent know how excited she was to see the Gulch being monitored. She went on to tell the docent how important this 'wetland gem'

is and thanked the docent profusely for being out there. Another local couple wanted to know how they could volunteer as docents in Cucumber Gulch to help enforce the trail closures and the no dog ordinance.

Many people who were coming out of the Gulch when trails were closed claimed they did not see any closed trail signage where they entered. When asked where they entered, most said it was by the houses along Gold Digger trail or from the gondola interchange at Shockhill. One group told the docent that a person out on his porch along Gold Digger told them (incorrectly) that the trail was closed to bikes but open to foot traffic.

While there were a few who knew the trails were closed and chose to ignore it, the overall impression was that most people present in the Gulch when trails were closed genuinely did not know of the closure. Many of the people seemed to not understand why they could not use the trails in June. I recommend improving the 'trail closed' signage to include dates of closure and a sentence or two about bird nesting and moose calving. I believe having these details available will help people better understand and respect the closure. Also, with so many people coming from Ski Hill Road to enter Cucumber Gulch, it seems frequent reminders to the front desk at the lodges at Peak 7 and 8 might help to redirect guests to open trails.

Overall, awareness about the ecological value of Cucumber Gulch was provided for the public. Tourists and locals alike were delighted to see the camera capture photos on display and eager to stop and chat about the wetland. While there was an increase in traffic from 2012, that increase was curbed greatly by the docents' presence at the trailhead. In 2014, I recommended having a docent present at the Peaks Trailhead entrance on weekends during the entire trail closure period.

Photo 1. The upper trailhead at Cucumber Gulch with educational information board on left.

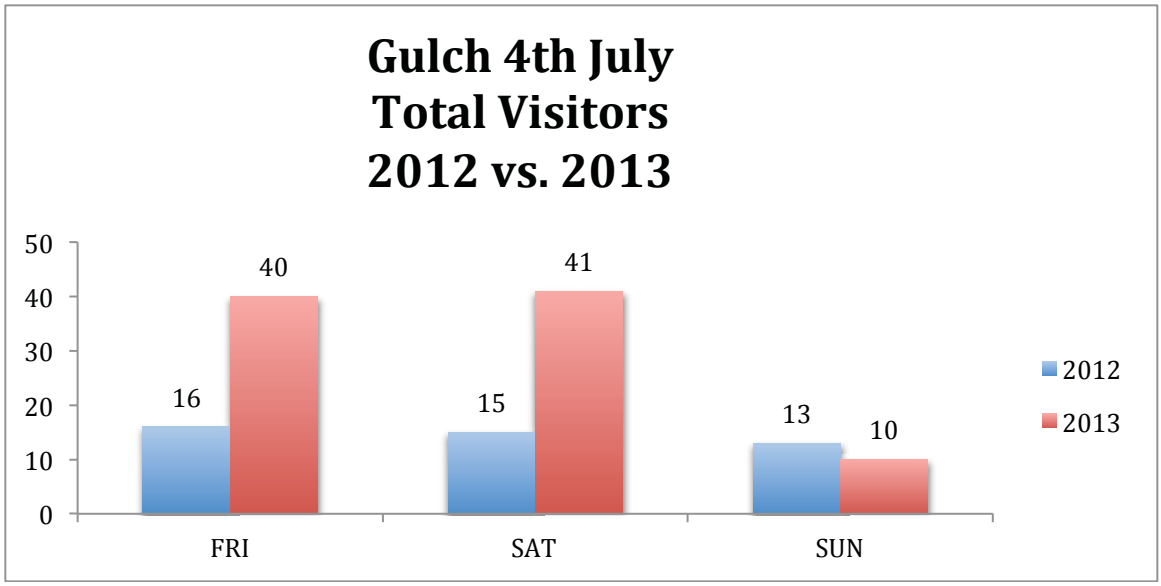


Figure 1. July 4th weekend total trail use in 2012 compared to 2013.

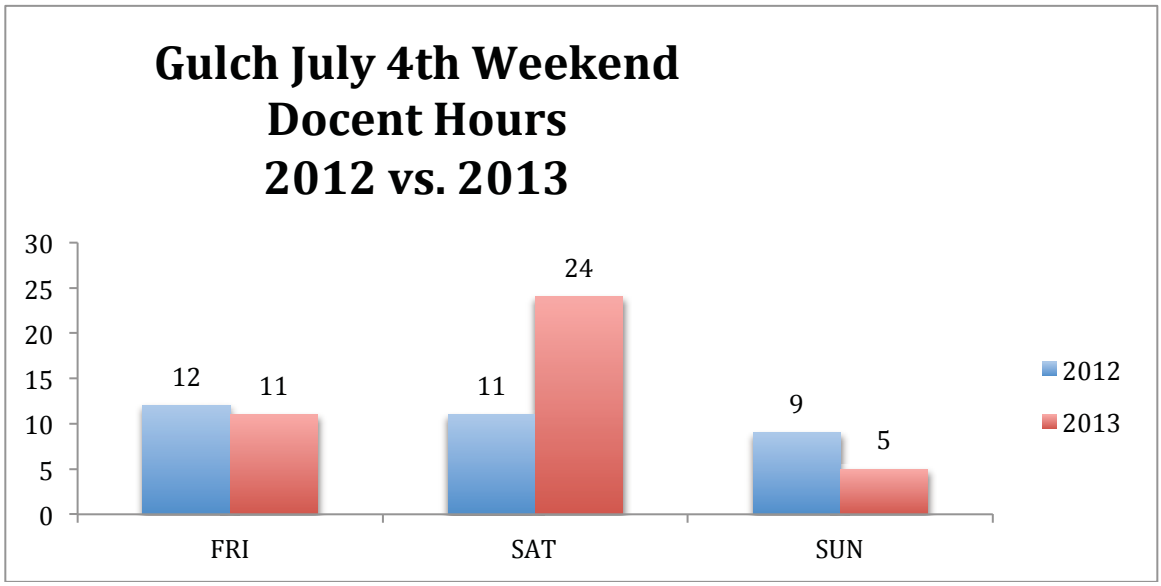


Figure 2. July 4th weekend trail use while docent present at upper trailhead.

8.0 PHOTOGRAPHIC DOCUMENTATION

8.1 *Summary* - Photos

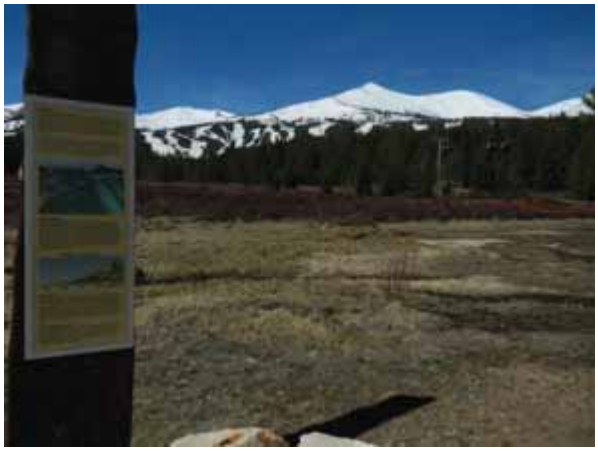
Digital photographs were taken at specific locations in Cucumber Gulch in May, August and December of 2013. The photos should be used as a reference of change and can be compared to photos in the Visitors Experience and Resource Protection Plan (VERP) in Cucumber Gulch, Breckenridge, CO, 2009 and the Cucumber Gulch Monitoring Report for 2009 - 2012. The following locations were photographed from multiple view points on all photo dates: Shock Hill Overlook, Geology Interpretive Sign, Ungulate Interpretive Sign, Avian Interpretive Sign, Beaver Interpretive Sign, Ski Hill Road at Peak 8 and the bridge at Peak 7. Photographs are organized by date and GPS coordinates are given for each location. It is recommended that photographic documentation continue in order to visually monitor the health of Cucumber Gulch.

Location Description: Overlook at Shock Hill
GPS: N39°29.332, W106°03.463
Date: May 23, 2013






Location Description: Geology Interpretive Sign
GPS: N39°29.305, W106°03.480
Date: May 23, 2013






Location Description: Ungulate Interpretive Sign
GPS: N39°29.091, W106°03.637
Date: May 23, 2013






Location Description: Avian Interpretive Sign
GPS: N39°29.050, W106°03.664
Date: May 23, 2013






Location Description: Beaver Interpretive Sign
GPS: N39°29.055, W106°03.815
Date: May 23, 2013






Location Description: Peak 7 Bridge
GPS: N39°29.028, W106°03.983
Date: May 22, 2013

Location Description: Ski Hill Road at Peak 8
GPS: N39°28.895, W106°03.996
Date: May 29, 2012

Location Description: Overlook at Shock Hill
GPS: N39°29.332, W106°03.463
Date: August 31, 2013






Location Description: Geology Interpretive Sign
GPS: N39°29.305, W106°03.480
Date: August 31, 2013






Location Description: Ungulate Interpretive Sign
GPS: N39°29.091, W106°03.637
Date: August 31, 2013






Location Description: Avian Interpretive Sign
GPS: N39°29.050, W106°03.664
Date: August 31, 2013

Location Description: Beaver Interpretive Sign
GPS: N39°29.055, W106°03.815
Date: August 31, 2013



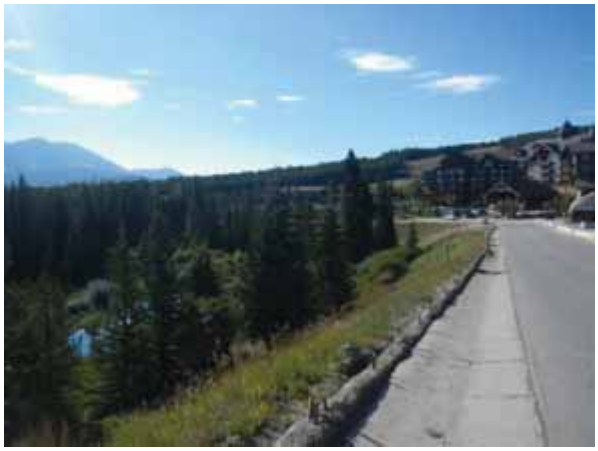



Location Description: Peak 7 Bridge
GPS: N39°29.028, W106°03.983
Date: August 26, 2012

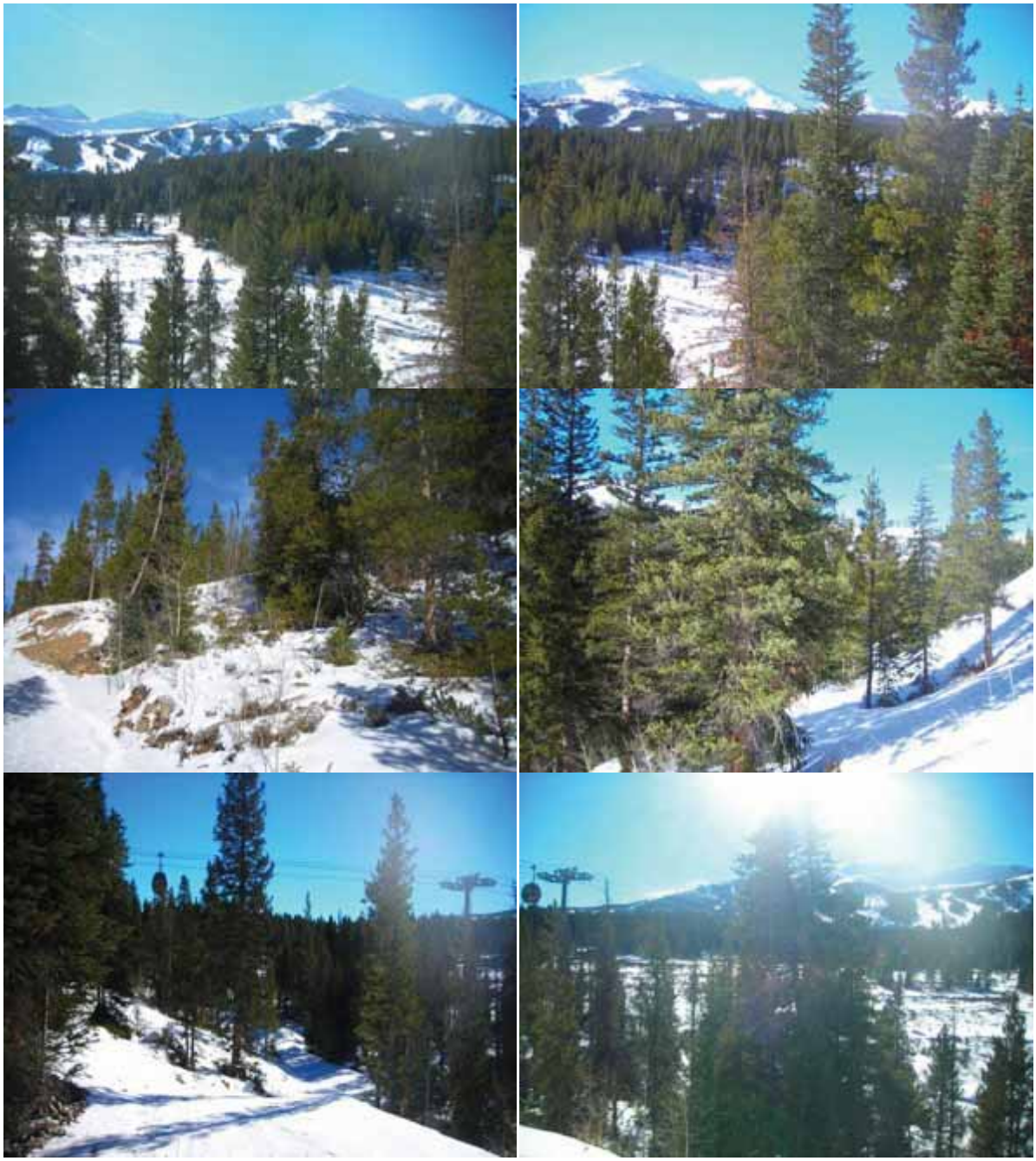




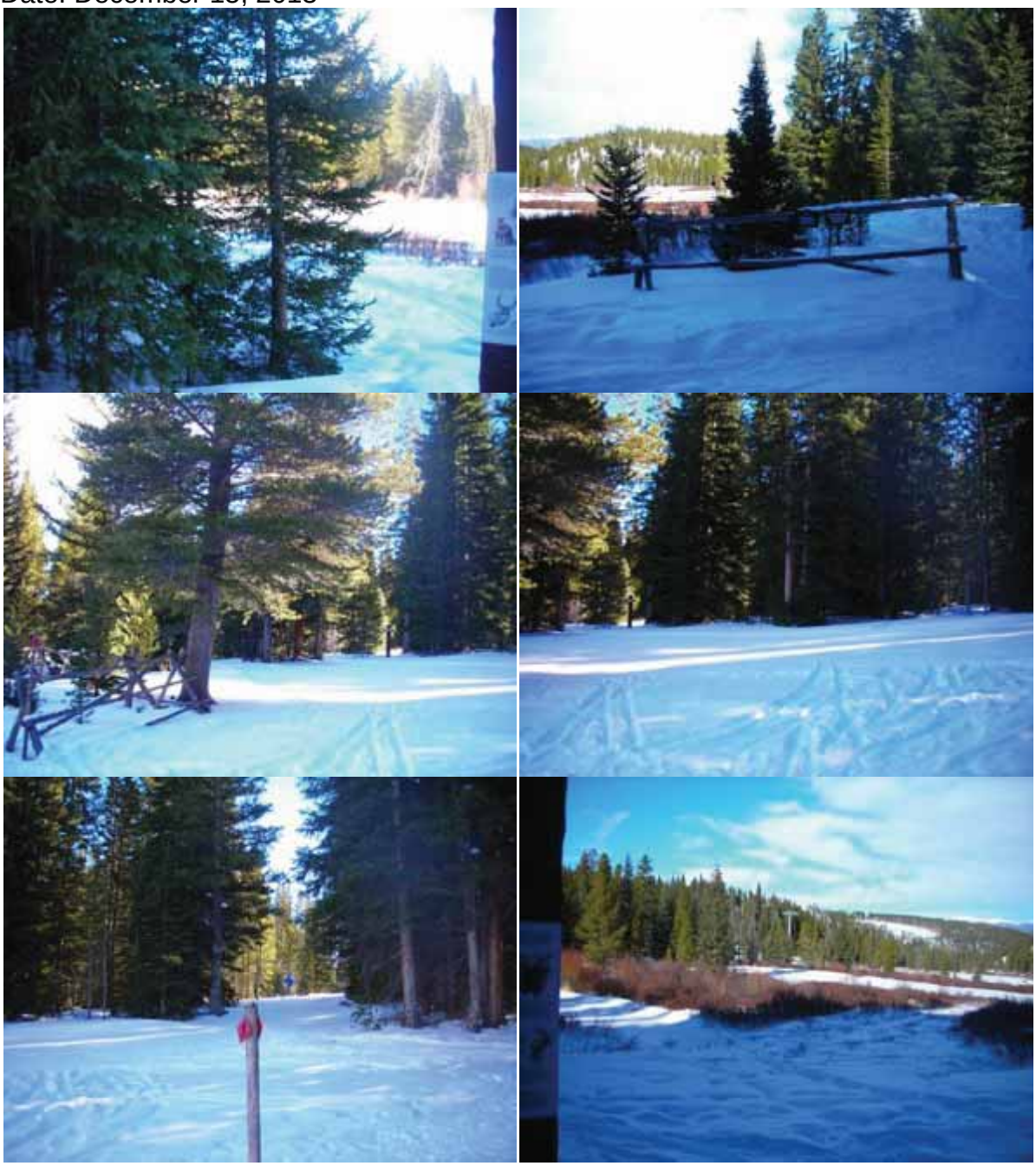

Location Description: Ski Hill Road at Peak 8
GPS: N39°28.895, W106°03.996
Date: August 31, 2013



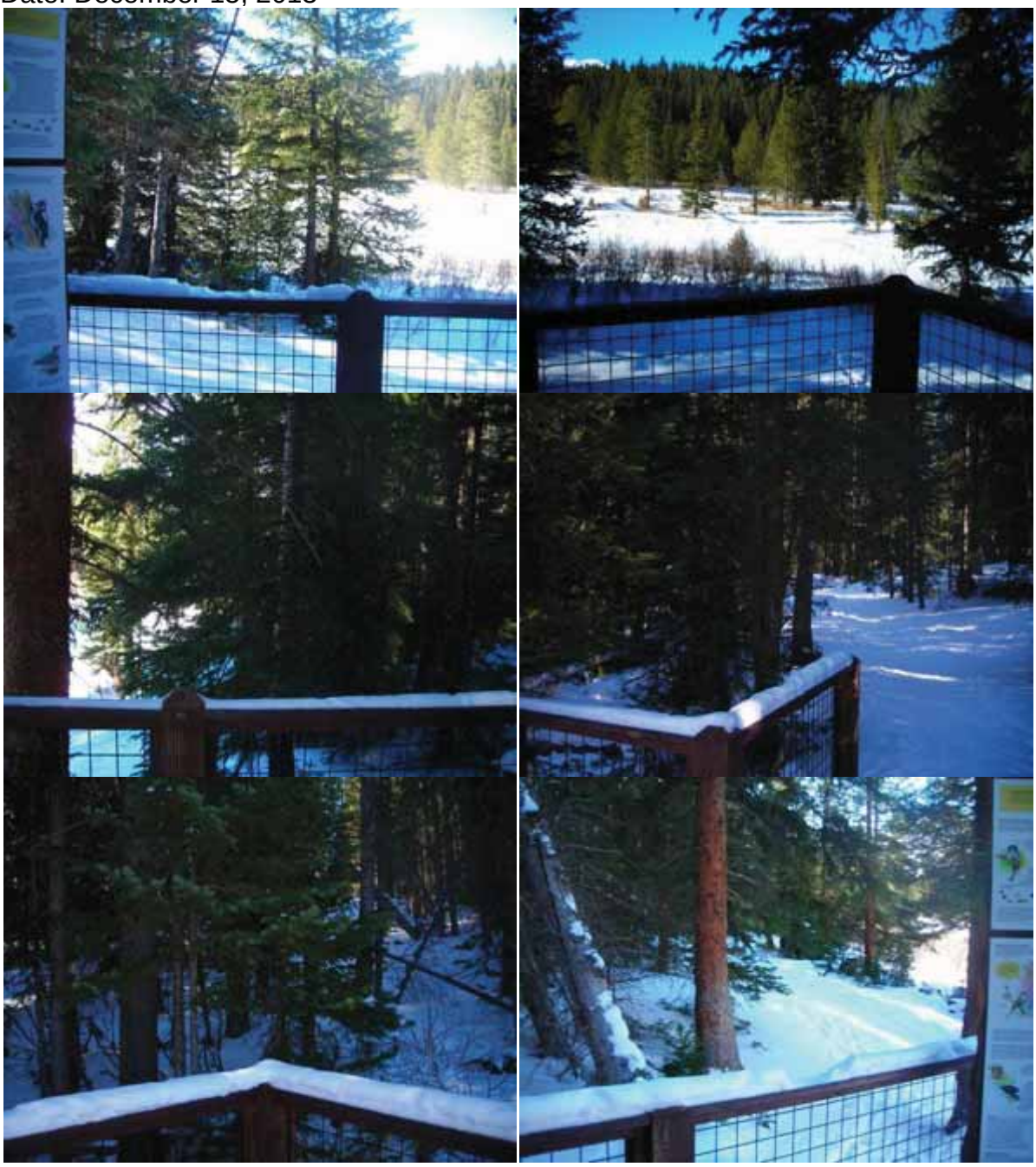
Location Description: Overlook at Shock Hill
GPS: N39°29.332, W106°03.463
Date: December 15, 2013



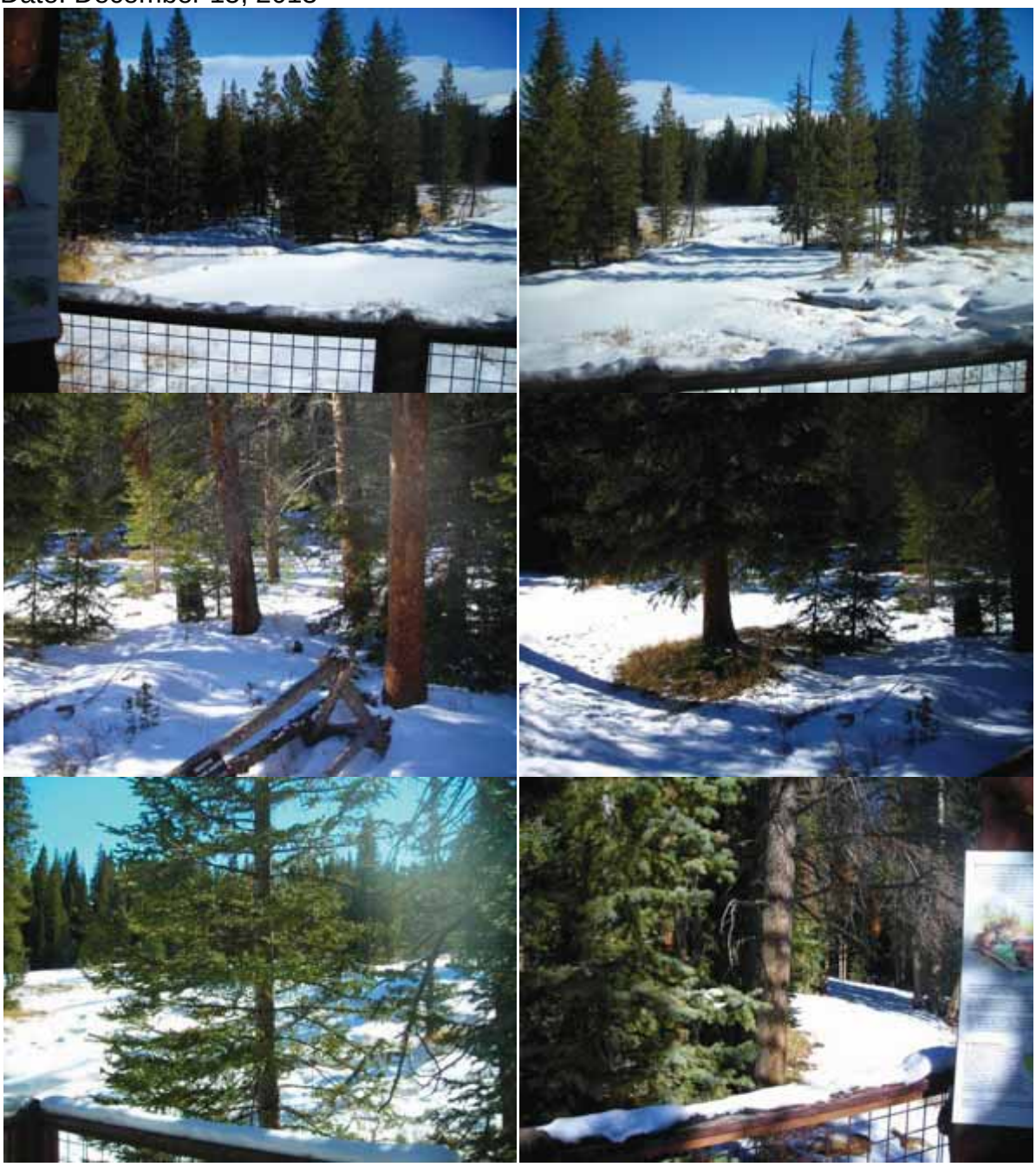
Location Description: Ungulate Interpretive Sign
GPS: N39°29.091, W106°03.637
Date: December 15, 2013



Location Description: Avian Interpretive Sign
GPS: N39°29.050, W106°03.664
Date: December 15, 2013



Location Description: Beaver Interpretive Sign
GPS: N39°29.055, W106°03.815
Date: December 15, 2013



Location Description: Ski Hill Road at Peak 8
GPS: N39°28.895, W106°03.996
Date: December 15, 2013






9.0 REFERENCES

Andrews, R. & Righter, R. (1992). Colorado Birds: A reference to their distribution and habitat. Denver Museum of Natural History.

Carello, C.A. (2012) Cucumber Gulch Annual Conservation Monitoring Report 2011. Prepared for the Town of Breckenridge.

Colorado Partners in Flight. (2000). Land Bird Conservation Plan.

Colorado Weed Management Association @ www.cwma.org.

Engeman, R.M. and Whisson, D.A. (2003). A visual method for indexing muskrat populations. International. *Biodeterioration & Biodegredation*. Vol 52. pp. 101-106.

Freddy, D. J., Bronaugh, W. M. and Fowler, M. C. (1986). Responses of mule deer to disturbance by persons afoot and snowmobiles. *Wildlife Society Bulletin*, 63-68.

Geist, V., 1978. Behavior. In: Geist, V. (Ed.), Big Game of North America, Ecology and Management. Stackpole Books, Harrisburg, Pennsylvania, pp. 283–296

Johnson, A. S. and S. H. Anderson. (2004). Fox Sparrow (*Passerella iliaca schistacea*) Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

Johnson, A. S. and S. H. Anderson. (2003). Wilson's Warbler (*Wisonia pussilla pileolata*) A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. Wildlife Society Bulletin 21: 31 -39.

Loeffler C., (2001) Conservation Plan and Agreement for the Management and Recovery for the southern Rocky Mountain Population of the Boreal Toad. Survey and monitoring of habitat protocol.

Ortega, C. P. and J. C. Ortega. (2003) Brown-headed Cowbird (*Molothrus Ater*) parasitism on Warbling Vireos (*Vireo Gilvus*) in southwest Colorado. *The Auk*. Vol. 120, No. 3, pp.759-764.

Purdy, K. G. 1987. Landowners' willingness to tolerate deer damage in New York: an overview of research and management response. Pages 371- 375 in D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, Colo.

Science Applications International Corporation, (2000). Cucumber Gulch Technical Report. Littleton, Colorado.

Science Applications International Corporation, (2001-2003) Cucumber Gulch Conservation Monitoring Report. Littleton, Colorado.

Smith, R.L. and T.M. Smith. (2001). Ecology and Field Biology. Benjamin Cummings. USA. 236-237, 388-391 pp.

Stephens, R. M. and S. H. Anderson. (2003) Lincoln's Sparrow (*Melospiza lincolnii*):A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

Ward, D., and J.N.M. Smith. (1999). Brown-headed Cowbird parasitism results in a sink population in Warbling Vireos. *The Auk*. Vol. 117, No. 2, pp. 337-344.

Wiggins, D. (2004, July 1). American Three-toed Woodpecker (*Picoides dorsalis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. www.fs.fed.us/r2/projects/scp/assessments/americanthreetoedwoodpecker.pdf

APPENDIX –BIRDS IDENTIFIED IN CUCUMBER GULCH

Common Name	Scientific Name	Migratory Status in Colorado	01	02	03	04	05	06	07	08	09	10	11	12	13
American Crow	*Corvus brachyrhynchos*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
American Dipper	*Cinclus mexicanus*	Altitudinal Migrant				X		X	X		X		X	X	
American Robin	*Turdus migratorius*	Altitudinal Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
American Three-toed Woodpecker	*Picoides tridactylus*	Resident									X	X	X	X	X
Bald Eagle*	*Haliaeetus leucocephalus*	Accidental					X								
Band-tailed Pigeon	*Patagioenas fasciata*	Short-distance Migrant											X	X	
Barn Swallow	*Hirundo rustica*	Neotropical Migrant								X					
Black-capped Chickadee*	*Poecile atricapillus*	Altitudinal Migrant					X	X							
Belted Kingfisher	*Ceryle alcyon*	Altitudinal Migrant	X		X	X	X	X	X	X	X	X		X	
Blue-winged Teal	*Anas discors*	Short-distance Migrant			X	X									
Brewer's Blackbird	*Euphagus cyanocephalus*	Altitudinal Migrant	X		X	X	X	X	X	X		X			
Broad-tailed Hummingbird	*Selasphorus platycercus*	Neotropical Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown Creeper	*Certhia americana*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown-headed Cowbird	*Molothrus ater*	Short-dist Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Canada Goose*	*Branta canadensis*	Altitudinal Migrant				X	X	X	X	X	X	X	X	X	X
Cassin's Finch	*Carpodacus cassinii*	Resident	X		X		X	X	X	X	X	X	X	X	X
Chipping Sparrow	*Spizella passerina*	Short-dist migrant						X	X	X		X	X	X	X
Cliff Swallow	*Hirundo pyrrhonota*	Migrant				X	X	X		X	X		X	X	
Common Raven	*Corvus corax*	Resident		X	X	X	X	X	X	X	X	X	X	X	X
Common Snipe	*Gallinago gallinago*	Short-dist Migrant		X	X	X	X	X	X	X	X	X	X	X	X
Cooper's Hawk	*Accipiter cooperii*	Short-dist Migrant						X	X	X	X	X	X	X	X
Cordilleran Flycatcher	*Empidonax occidentalis*	Neotropical Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Dark-eyed Junco	*Junco hyemalis*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Downy Woodpecker*	*Picoides pubescens*	Resident					X	X	X		X	X	X	X	X
Dusky Flycatcher	*Empidonax oberholseri*	Neotropical Migrant	X	X	X	X	X								
Dusky Grouse	*Dendragapus obscures*	Resident											X		
Fox Sparrow	*Passerella iliaca*	Short-dist Migrant	X	X	X	X				X			X		X
Golden-crowned Kinglet	*Regulus satrapa*	Resident											X	X	X
Gray Jay	*Perisoreus canadensis*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Great Blue Heron	*Ardea herodias*	Altitudinal Migrant				X	X	X		X	X	X	X		X
Great Horned Owl	*Bubo virginianus*	Resident												X	
Green-winged Teal	*Anas crecca*	Short-dist Migrant	X		X	X	X	X	X		X	X	X	X	X
Hairy Woodpecker	*Picoides villosus*	Resident		X	X	X	X	X	X	X	X	X	X	X	X
Hermit Thrush	*Catharus gattatus*	Short-dist Migrant	X	X		X	X	X	X	X	X	X	X	X	X
House Wren	*Troglodytes aedon*	Accidental				X									
Killdeer	*Charadrius vociferus*	Altitudinal Migrant													
Lincoln's Sparrow	*Melospiza lincolnii*	Short-dist Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Long-eared Owl	*Asio otus*	Short-dist Migrant							X						
Mallard	*Anas platyrhynchos*	Altitudinal Migrant	X	X	X	X	X	X	X	X	X	X	X	X	
Mountain Bluebird*	*Sialia currucoides*	Altitudinal Migrant				X	X	X	X		X			X	
Mountain Chickadee	*Poecile gambeli*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X

Common Name	Scientific Name	Migratory Status in Colorado	01	02	03	04	05	06	07	08	09	10	11	12	
Mourning Dove	*Zenaida macroura*	Altitudinal Migrant		X		X	X	X	X	X	X	X	X	X	X
Northern Flicker	*Colaptes auratus*	Resident	X			X	X	X	X	X	X	X	X	X	X
Northern Shrike	*Lanius excubitor*	Winter Resident											X		
Olive-sided Flycatcher	*Contopus cooperi*	Neotropical Migrant							X				X		
Osprey	*Pandion haliaetus*	Neotropical Migrant	X	X	X	X	X								X
Pine Grossbeak	*Pinicola enucleator*	Resident			X	X	X	X	X	X	X	X	X	X	X
Pine Siskin	*Carduelis pinus*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Pygmy Nuthatch	*Sitta pygmaea*	Resident							X						
Red-breasted Nuthatch	*Sitta canadensis*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Red Crossbill	*Loxia curvirostra*	Irregular				X		X	X	X				X	X
Red-naped Sapsucker	*Syphrapicus nauchalis*	Short-dist Migrant	X			X	X		X	X		X			
Red-tailed Hawk	*Buteo jamaicensis*	Resident		X		X	X	X	X	X	X	X	X	X	X
Red-winged Blackbird	*Agelaius phoeniceus*	Altitudinal Migrant	X	X	X	X	X	X	X	X	X		X	X	X
Ruby-crowned Kinglet	*Regulus calendula*	Altitudinal Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Rufous Hummingbird	*Selasphorus rufus*	Migrant					X						X		
Solitary Sandpiper	*Tringa solitaria*	Accidental					X		X						
Spotted Sandpiper	*Actitis macularia*	Neotropical Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Stellar's Jay	*Cyanocitta stelleri*	Resident	X	X	X	X	X	X	X	X	X	X	X	X	X
Townsend's Solitaire	*Myadestes townsendi*	Resident					X								
Tree Swallow*	*Tachycineta bicolor*	Short-dist Migrant					X			X					
Violet-green Swallow	*Tachycineta thalassina*	Short-dist Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Warbling Vireo	*Vireo gilvus*	Neotropical Migrant	X	X	X	X	X		X	X	X				
Western Wood Pewee	*Contopus sordidulus*	Neotropical Migrant				X	X		X						
White-breasted Nuthatch	*Sitta carolinensis*	Resident				X	X	X	X	X	X	X	X	X	X
White-crowned Sparrow	*Zonotrichia leucophrys*	Altitudinal Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Wilson's Warbler	*Wilsonia pusilla*	Neotropical Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-rumped Warbler (Audobon's)	*Dendroica coronata*	Neotropical Migrant	X	X	X	X	X	X	X	X	X	X	X	X	X

*Rare at higher elevations

New: Song Sparrow and Northern Harrier seen in 2013