

March 12, 2013

Mr. Kiel Downing
U.S. Army Corps of Engineers
9307 S. Wadsworth Boulevard
Littleton, Colorado 80128

RE: Corps File No. NWO-2010-02530-DEN
McMurdo Gulch Reclamation Project 2012 Annual Monitoring Report

Dear Mr. Downing:

Attached is the 2012 Monitoring Report for the McMurdo Gulch Reclamation Project as required by Corps Permit No. NWO-2010-02530-DEN that was issued for the project.

Please review the attached monitoring report and contact me at (303) 830-1188 if you have any questions or if you need additional information. Thank you.

Sincerely,



Jenelle Kreutzer
Ecologist

cc: David Van Dellen – Town of Castle Rock

Attachment

Denver
1842 Clarkson St.
Denver, CO 80218
303.830.1188

Boise
3314 Grace St.
Boise, ID 83703
208.373.7983

Durango
1015 ½ Main Avenue
Durango, CO 81301
970.422.2136

Western Slope
P.O. Box 932
161 South 2nd St.
Hotchkiss, CO 81419
970.872.3020

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**2012 ANNUAL MITIGATION MONITORING REPORT
MCMURDO GULCH RECLAMATION PROJECT
DOUGLAS COUNTY, COLORADO
CORPS FILE No. NWO-2010-02530-DEN**

Prepared for—

Town of Castle Rock
Utilities Department
175 Kellogg Court
Castle Rock, Colorado 80109

Prepared by—

ERO Resources Corporation
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188

ERO Project #4723

March 12, 2013



ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199
www.eroresources.com
ero@eroresources.com

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**2012 ANNUAL MITIGATION MONITORING REPORT
MCMURDO GULCH RECLAMATION PROJECT
DOUGLAS COUNTY, COLORADO
CORPS FILE No. NWO-2010-02530-DEN**

MARCH 12, 2013

Project Overview

Corps File No #: NWO-2010-02530-DEN

Permittee Contact Information:

David Van Dellen – Town of Castle Rock, Utilities Department
175 Kellogg Court, Castle Rock, Colorado 80109

Consultant Contact Information:

Jenelle Kreutzer – ERO Resources Corporation: (303) 830-1188
1842 Clarkson Street, Denver, Colorado 80218

Site Visit Date: Jenelle Kreutzer and Courtney Marne with ERO Resources Corporation (ERO) visited the site on September 18, 2012 (2012 site visit).

Project Summary: On November 2, 2010, ERO, on behalf of the Town of Castle Rock (Town) and in partnership with the Cherry Creek Basin Water Quality Authority (Authority), submitted a request for Nationwide Permit authorization to the U.S. Army Corps of Engineers (Corps) to conduct restoration and enhancement activities along several reaches of McMurdo Gulch. On November 29, 2010, the Corps issued authorization to the Authority to work under NWO-2010-02530-DEN for the project. The project impacted 2.21 acres of waters of the U.S., including 1.03 acres of wetlands. The project consisted of restoring and stabilizing nine areas (Reaches A through I) along about 3 miles of McMurdo Gulch. Stabilization measures consisted of a combination of ungrouted boulder drop structures, void-filled rock channel lining, and buried riprap bank projection.

Project Location: The project area is Sections 20, 30, 31, and 32; Township 7 South; Range 66 West of the 6th P.M. in Douglas County, Colorado (Figure 1). To access the site from the Corps' office, take C-470 east and merge onto I-25 South. Go south on I-25 and take exit 184 for US-85 North/Meadows Parkway toward CO-86 East/Founders Parkway. Turn left on Meadows Parkway and continue onto Founders Parkway. Turn left onto Autumn Sage Street, then go left onto Castle Oaks Drive. The project area is located in nine reaches of McMurdo Gulch along Castle Oaks Drive.

Completion Dates: Construction activities were completed in spring 2012 and revegetation activities were completed in fall 2012. This is the first annual monitoring report.

Summary of Results: Proposed improvements to Reach D were not constructed as part of the project. As a result of a large storm event in July 2012, channel and bank erosion occurred within Reaches C, E, and I, and many of the channel banks with sandbar willow stakes and coir blanket were either buried with sediment or washed away. Some wetlands adjacent to and outside the project limits were also washed out during the July 2012 storm event. Despite impacts from the storm event, wetlands are reestablishing within Reaches A and B and portions of C, E, and F. Reaches G, H, and I did not have wetlands prior to construction and no wetlands were observed in these areas during the 2012 site visit. The survival rate of planted and volunteer trees and willows is 79 percent. Five species on the State of Colorado Noxious Weed Inventory List B were observed in the project area and made up between 5 and 20 percent of the total vegetative cover. The total cover of List B species in the reestablishing wetlands was less than 10 percent.

Recommendations: ERO recommends planting additional sandbar willows and native trees to replace the ones impacted during the July 2012 storm event and to meet permit requirements, and repairing the channel banks within Reaches C, E, and I. ERO also recommends conducting weed control within the disturbed uplands to prevent the spread of noxious weeds. No other remedial measures are recommended at this time. The site will be monitored during the 2013 growing season.

Requirements

To mitigate for project impacts, wetlands and riparian areas will be restored in place within the project area. Mitigation included planting wetland, riparian, and upland seed mixes in the disturbed areas. Wetland plugs were to be harvested and transplanted within the restored wetlands in Reaches A through C, and sandbar willow (*Salix exigua*) stakes and fascines were to be harvested from local areas and planted in Reaches A through E. Shrubs and trees removed during construction were to be replaced with a similar native species and based on the ratios listed in Table 1.

Table 1. Tree and shrubs mitigation ratios.

Common Name	Mitigation Ratio
Trees and each multistemmed trunk 6 inches or less in diameter	1:1 w/trees 1 inch in diameter
Trees and each multistemmed trunk greater than 6 inches in diameter	2:1 w/trees 3 inches in diameter or 3:1 w/trees 2 inches in diameter
Shrubs	1:1

Under permit conditions, the restored wetlands and riparian habitat will be considered successful and self-sustaining when the following conditions have been met without intervention in the form of irrigation, removal of undesirable vegetation, or replanting of desirable vegetation during the last three (3) years of a five (5)-consecutive-year period or as determined by the Corps:

1. At least 80 percent of the mitigation site is vegetated, at least 50 percent of the total number of dominant species present will consist of species rated as facultative or wetter, and at least 50 percent of the dominant species present shall have been planted species.
2. Trees and shrubs, to include volunteer specimens, will have a survival rate of at least 85 percent. Species composition shall be representative of species planted.
3. Those species listed on the Colorado Weed Inventory List A shall be 100 percent eradicated. Those species listed on List B shall be no more than 10 percent or less of the total cover in the mitigation areas.

Methods

Jenelle Kreutzer and Courtney Marne with ERO conducted the annual mitigation monitoring on September 18, 2012 (2012 site visit). During the 2012 site visit, ERO took photos at established photo points within the project area. Representative photos of the site, including preconstruction photos, are attached and photo points are indicated on Figures 2a through 2h. ERO qualitatively assessed vegetation cover and composition in the mitigation areas. Hydrology, noxious weed cover, erosion problems, and other pertinent factors were noted, if present, and the general success of the site was evaluated.

Results

Based on project plans and field observations, it appears the project was constructed as planned, and that 4723 the proposed mitigation plan was properly implemented, with the exception of Reach D not being constructed. During a large storm event in July 2012, channel and bank erosion occurred within Reaches C, E, and I, and many of the channel banks with sandbar willow stakes and coir blanket were either buried with sediment or washed away. Some wetlands adjacent to and outside the project limits were also washed out during the July 2012 storm event. Most notable were wetland areas scoured away upstream of the boulder cascade drop structure in Reach A4 and the wetlands in the channel bottom within Reach E. During the 2012 site visit, about 1 foot of standing water was observed in the existing wetlands and the proposed mitigation area upstream of the drop structure in Reach A4, which has inundated about 0.03 acre of existing wetlands. About 0.01 acre of wetlands was scoured away at Reach E.

Despite some of the existing and developing wetlands being washed away during the July 2012 storm, the stream restoration activities have created conditions favorable for the establishment of wetland vegetation along McMurdo Gulch within the project area. During the 2012 site visit, saturated and inundated soil conditions were present in the mitigation areas (Reaches A and B and portions of C, E, and F), indicating these areas have sufficient hydrology to support wetland vegetation. Evidence of flows was observed within portions of Reach C and downstream of Reach F, but the entire channel bottom was dry during the 2012 site visit. Reaches G, H, and I did not have wetlands prior to

construction and no wetlands were observed in these areas during the 2012 site visit. The following sections include a brief summary of the site conditions within each of the project reaches.

Reach A

Reach A includes seven boulder cascade drop structures located at three sites along McMurdo Gulch in the project area (Figure 2a; Photos 1a through 4b). Wetlands were beginning to establish within the constructed drop structures and the temporarily disturbed areas surrounding the structures, with the exception of the area upstream of Reach A4, which had about 1 foot of standing water in the channel. Most of the planted willow stakes upstream of Reach A4 were also dead due to inundation. During the 2012 site visit, sandbar willow clumps and black locust (*Robinia pseudoacacia*) shrubs were observed resprouting in areas temporarily impacted during construction. Overall, the average vegetation cover in the wetlands ranged from 60 to 80 percent, with hydrophytes comprising 100 percent of the species. All of the dominant species represent what was either transplanted in the wetlands or what was present at the site prior to construction, including Baltic rush (*Juncus arcticus*), redtop (*Agrostis gigantea*), softstem bulrush (*Schoenoplectus tabernaemontani*), fringed willowherb (*Epilobium ciliatum*), cattail (*Typha latifolia*), common spikerush (*Eleocharis palustris*), and Nebraska sedge (*Carex nebrascensis*). No noxious weed species on the State of Colorado Noxious Weed Inventory List A or B were observed in the establishing wetlands.

Upland vegetation was beginning to establish along the disturbed banks, with the total cover about 50 percent, and common mullein (*Verbascum thapsus*) and Canada wildrye (*Elymus canadensis*) were the dominant species observed. Some Canada thistle (*Cirsium arvense*) and leafy spurge (*Euphorbia esula*), both species on the Colorado Noxious Weed Inventory List B, were observed in the disturbed uplands and made up between 5 and 10 percent of the total cover.

Reach B

Three boulder cascade drop structures and a section with void-filled rock channel lining were installed within Reach B (Figure 2b; Photos 5a through 6b). Wetlands were beginning to establish in temporarily impacted portions of the channel and within the rock structures. The total vegetation cover in the wetlands was between 85 and 95 percent, with hydrophytes comprising 100 percent of the species. All of the dominant species represent what was either transplanted in the wetlands or what was present at the site prior to construction, including Baltic rush, reedtop, Torrey's rush (*Juncus torreyi*), water speedwell (*Veronica catenata*), softstem bulrush, cattail, common spikerush, and Nebraska sedge. No noxious weed species on the State of Colorado Noxious Weed Inventory List A or B were observed in the establishing wetlands or adjacent uplands. The disturbed upland banks were about 70 percent vegetated with common mullein and sweet clover (*Melilotus* sp.) as the dominant species observed.

Reach C

Reach C consists of two sites along McMurdo Gulch (Upper Reach C and Reach C-lining) where a combination of boulder cascade drop structures and void-filled rock channel lining was installed (Figure 2c; Photos 7a through 12b). Within Upper Reach C, the low-flow channel was mostly open water, but a 1- to 3-foot-wide fringe of wetlands was observed along the edge of the channel and within the drop structures during the 2012 site visit. Sandbar willows were beginning to resprout in areas temporarily impacted during construction. The total cover in the reestablishing wetlands was about 55 percent, with hydrophytes comprising 100 percent of the species and most of the dominant species representing what was planted or was present at the site prior to construction. No noxious weed species on the State of Colorado Noxious Weed Inventory List A or B were observed in the establishing wetlands.

The upland banks were about 60 percent vegetated with a combination of native grass and weedy species, such as blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), western wheatgrass (*Pascopyrum smithii*), sweet clover, and common mullein. The noxious weeds Canada thistle, musk thistle (*Carduus nutans*), and Scotch

thistle (*Onopordum acanthium*), all List B species, were observed in both the disturbed and undisturbed uplands. Within the disturbed uplands, the noxious weeds comprise 15 percent of the vegetative cover and in the adjacent undisturbed uplands comprise about 60 percent of the vegetative cover.

Evidence of high flows, including displaced void-filled rock and scour holes, were observed in Reach C-lining during the 2012 site visit. Prior to construction, no wetlands occurred in this reach; however, small pockets of wetland vegetation were observed during the 2012 site visit. The dominant species observed in the establishing wetlands was Baltic rush, redtop, and sandbar willow. During the 2012 site visit, sandbar willow clumps and black locust shrubs were resprouting in areas temporarily impacted during construction.

Reach D

Reach D was not constructed.

Reach E

One riprap run down, two boulder cascade drop structures, and a section with void-filled rock channel lining were installed within Reach E (Figure 2d; Photos 13a through 15b). During the 2012 site visit, extensive bank and channel erosion was observed within Reach E and most of the planted sandbar willow stakes and coir blanket was either buried with sediment or washed away. Despite the damage caused by the storm event, wetlands were observed within the boulder cascade drop structures, in the channel bottom between the two structures, and in a 1- to 2-foot-wide fringe along the western bank of the void-filled rock channel lining section. The wetlands are approximately 55 percent vegetated and dominated by species similar to what was present prior to construction (Baltic rush, water speedwell, Torrey's rush, and redtop). Because of bank erosion, the uplands were only about 30 percent vegetated and were comprised mostly of sweet clover, common mullein, Canada thistle, and musk thistle.

Reach F

One boulder cascade drop structure and a riprap rundown were installed within Reach F (Figure 2e; Photos 16a through 17b). During the 2012 site visit, no flowing water was observed in the channel but portions of the channel bottom were saturated. All temporarily impacted wetlands have been restored within Reach F. The dominant wetland vegetation included Baltic rush, Canada wildrye, Torrey's rush, redtop, spotted lady's thumb (*Polygonum maculata*), and barnyard grass (*Echinochloa crus-galli*). The total cover in the wetlands was about 85 percent, with hydrophytes making up 100 percent of the species. During the 2012 site visit, more than 50 percent of the dominant species represent either what was planted or was present prior to construction.

The upland banks were about 75 percent vegetated with Canada wildrye, switchgrass (*Panicum virgatum*), witchgrass (*Panicum capillare*), common mullein, sweet clover, and sideoats grama. Diffuse knapweed (*Centaurea diffusa*) and musk thistle, both species on the noxious weed List B, were found within the drop structure and the disturbed uplands and made up about 10 percent of the total vegetation cover. Patches of lead plant (*Amorpha canescens*), western snowberry (*Symphoricarpos occidentalis*), and Woods' rose (*Rosa woodsii*) were reestablishing in temporarily impacted upland areas. In addition, 10 plains cottonwoods (*Populus deltoides* subsp. *monilifera*) and 15 peachleaf willow (*Salix amygdaloides*) volunteers were observed in the channel bottom and within the drop structure.

Reach G

Improvements at Reach G included installing a riprap rundown upstream of the Castle Oaks Road bridge crossing (Figure 2f; Photos 18a and 18b). During the 2012 site visit, some minor channel erosion was observed in the project area due to the July 2012 storm event. No wetlands occurred in this reach prior to construction. The upland vegetation was dominated by similar species as the adjacent undisturbed areas including annual ragweed (*Ambrosia artemisiifolia*), sand dropseed (*Sporobolus cryptandrus*), sideoats grama, blue grama, Canada wildrye, switchgrass, and common sunflower (*Helianthus annuus*). The total cover was between 50 and 70 percent. Diffuse knapweed and musk

thistle, both List B species, made up approximately 15 percent of the total vegetation cover.

Reach H

One boulder cascade drop structure was installed within Reach H (Figure 2g; Photos 19a and 19b). During the 2012 site visit, some minor channel erosion was observed downstream of the drop structure due to the July 2012 storm event. No wetlands occurred in this reach prior to construction. The uplands surrounding the drop structure were 60 percent vegetated with species similar to the adjacent undisturbed uplands. The dominant species included annual ragweed, sand dropseed, sideoats grama, blue grama, Canada wildrye, and switchgrass. Diffuse knapweed (List B) made up about 20 percent of the upland vegetative cover in Reach H. During the 2012 site visit, all of the black locust shrubs temporarily impacted during construction were resprouting in the project area.

Reach I

One boulder cascade drop structure was installed within Reach I (Figure 2h; Photos 20a and 20b). During the 2012 site visit, evidence of high flows from the large storm event in July 2012 were observed, including minor bank erosion downstream of the drop structure and displaced boulders within the drop structure. No wetlands occurred in this reach prior to construction and the vegetation reestablishing in the project area was similar to the preconstruction conditions. The upland vegetation cover was about 70 percent and was dominated by wild tarragon (*Oligosporus dracunculus*), common mullein, annual ragweed, and smooth brome. Diffuse knapweed, a List B species, was also observed in the disturbed uplands and made up about 10 percent of the total vegetation cover.

Overall, the vegetation cover in the establishing wetlands throughout the project area ranged from 50 to 85 percent. The dominant species observed within the wetlands were Baltic rush, Torrey's rush, softstem bulrush, cattail, water speedwell, fringed willowherb, common spikerush, Nebraska sedge, barnyard grass, witchgrass, sandbar willow, and

redtop. On average for the entire project area, 83 percent of the dominant wetland species was rated as facultative or wetter and more than 50 percent of the dominant species represent either what was planted or was present prior to construction. Table 2 lists the prevalent species observed within the reestablishing wetland areas.

Table 2. List of prevalent species in the wetland mitigation areas.

Common Name	Scientific Name	Wetland Ranking*
Annual ragweed	<i>Ambrosia artemisiifolia</i>	Facultative Wetland
Baltic rush	<i>Juncus arcticus</i> sp. <i>ater</i>	Facultative Wetland
Barnyard grass	<i>Echinochloa crus-galli</i>	Facultative
Broadleaf cattail	<i>Typha latifolia</i>	Obligate Wetland
Canada thistle	<i>Breca arvensis</i>	Facultative Upland
Canada wildrye	<i>Elymus canadensis</i>	Facultative Upland
Common spikerush	<i>Eleocharis palustris</i>	Obligate Wetland
Fringed willowherb	<i>Epilobium ciliatum</i>	Facultative Wetland
Jointleaf rush	<i>Juncus articulatus</i>	Obligate Wetland
Pennsylvania smartweed	<i>Persicaria pensylvanica</i>	Facultative Wetland
Sandbar willow	<i>Salix exigua</i>	Facultative Wetland
Softstem bulrush	<i>Schoenoplectus tabernaemontani</i>	Obligate Wetland
Spotted lady's thumb	<i>Persicaria maculata</i>	Facultative Wetland
Switchgrass	<i>Panicum virgatum</i>	Facultative
Torrey's rush	<i>Juncus torreyi</i>	Facultative Wetland
Water speedwell	<i>Veronica catenata</i>	Obligate Wetland
Western wheatgrass	<i>Pascopyrum smithii</i>	Facultative Upland
Witchgrass	<i>Panicum capillare</i>	Facultative

*Obligate Wetland – Occurs with an estimated 99% probability in wetlands.
Facultative Wetland – Estimated 67%–99% probability of occurrence in wetlands.
Facultative – Equally likely to occur in wetlands and nonwetlands (34%–66% probability).
Facultative Upland – 67%-99% probability in nonwetlands, 1%–33% in wetlands.
Upland – Occurs with an estimated > 99% probability in upland (nonwetlands).
Sources: Weber and Wittmann (2012); secondary source Kartesz (2006).

As part of the mitigation plan, a total of 2,675 willow stakes, 112 peachleaf willow trees 1 inch in diameter, and 96 plains cottonwood trees 2 inches in diameter were to be planted in the project area. During the 2012 site visit, ERO noted several sandbar willow clumps and black locust, western snowberry, lead plant, and Woods' rose shrubs resprouting in areas temporarily impacted during construction within Reaches A, C, F, and H. In addition, 58 peachleaf willows and 27 plains cottonwood volunteers were observed in project area. Based on the quantities required by the permit, including volunteer specimens, the survival rate of the trees and shrubs is 79 percent. Table 3 lists

the quantity of each species required by the permit and the number observed during the 2012 site visit.

Table 3. Tree and shrub plantings, including volunteers.

Common Name	Scientific Name	Number Required by Permit	Number Living in 2012
Peachleaf willow, 1-inch diameter	<i>Salix amygdaloides</i>	112	106
Plains cottonwood, 2-inch diameter	<i>Populus deltoides</i>	96	116
Sandbar willow, stakes	<i>Salix exigua</i>	2,675	2,062
Total		2,883	2,284

Discussion of Successes, Failures, and Problems

As a result of the July 2012 storm event, channel and bank erosion occurred within Reaches C, E, and I, and many of the channel banks with sandbar willow stakes and coir blanket were either buried with sediment or washed away. In addition, wetlands adjacent to and outside the project limits were washed out during the July 2012 storm event. Most notably were wetland areas scoured away upstream of the boulder cascade drop structure in Reach A4 (0.03 acre) and the wetlands in the channel bottom within Reach E (0.01 acre).

Despite some of the existing and developing wetlands being washed away during the July 2012 storm, the stream restoration activities have created conditions favorable for the establishment of wetland vegetation along McMurdo Gulch within the project area. Overall, the vegetation cover in the establishing wetlands ranged from 50 to 85 percent, with 83 percent of the dominant wetland species rated as facultative or wetter and more than 50 percent of the dominant species representing either what was planted or was present prior to construction.

Prior to construction, the disturbed uplands throughout the project area were a mixture of native grasses and annual weed species. Post-construction uplands have vegetation cover similar to preconstruction conditions. The total vegetation cover in the uplands ranged from 30 to 75 percent. Five species listed on the Colorado Weed Inventory List B—Canada thistle, musk thistle, Scotch thistle, diffuse knapweed, and leafy spurge—were observed in the project area and mostly occurred in the disturbed

uplands areas. The total cover of List B species in the reestablishing wetlands was less than 10 percent and between 5 and 20 percent in the disturbed uplands. Overall, the cover percentage of noxious weeds in the disturbed uplands is similar to or less than the cover percentage in adjacent undisturbed uplands. Trees and shrubs, including volunteers, had a survival rate of 79 percent. The success criteria for the project and status of the project meeting these criteria are as follows:

- **At least 80 percent of the wetland mitigation site is vegetated, at least 50 percent of the total number of dominant species present will consist of species rated as facultative or wetter, and at least 50 percent of the dominant species present shall have been planted species.**
 - The reestablishing wetland areas are between 50 and 85 percent vegetated. This criterion is not being met.
 - An average of 83 percent of the dominant species in the reestablishing wetland areas throughout the project area are rated as facultative or wetter. This criterion is being met.
 - More than 50 percent of the dominant species represent the species planted or what was present prior to construction. This criterion is being met.
- **Trees and shrubs, to include volunteer specimens, will have a survival rate of at least 85 percent. Species composition shall be representative of species planted.**
 - Trees and shrubs, including volunteer species, have a survival rate of 79 percent and the species composition is representative of species planted. Currently, this criterion is not being met.
- **Those species listed on the Colorado Weed Inventory List A shall be 100 percent eradicated. Those species shown on List B shall be no more than 10 percent or less of the total cover in the mitigation areas.**
 - No noxious weeds on List A are present in the project area. This criterion is being met.
 - The average cover of the List B species leafy spurge, Canada thistle, Scotch thistle, diffuse knapweed, and musk thistle in the temporarily disturbed upland areas is between 5 and 20 percent. Currently, this criterion is not being met.

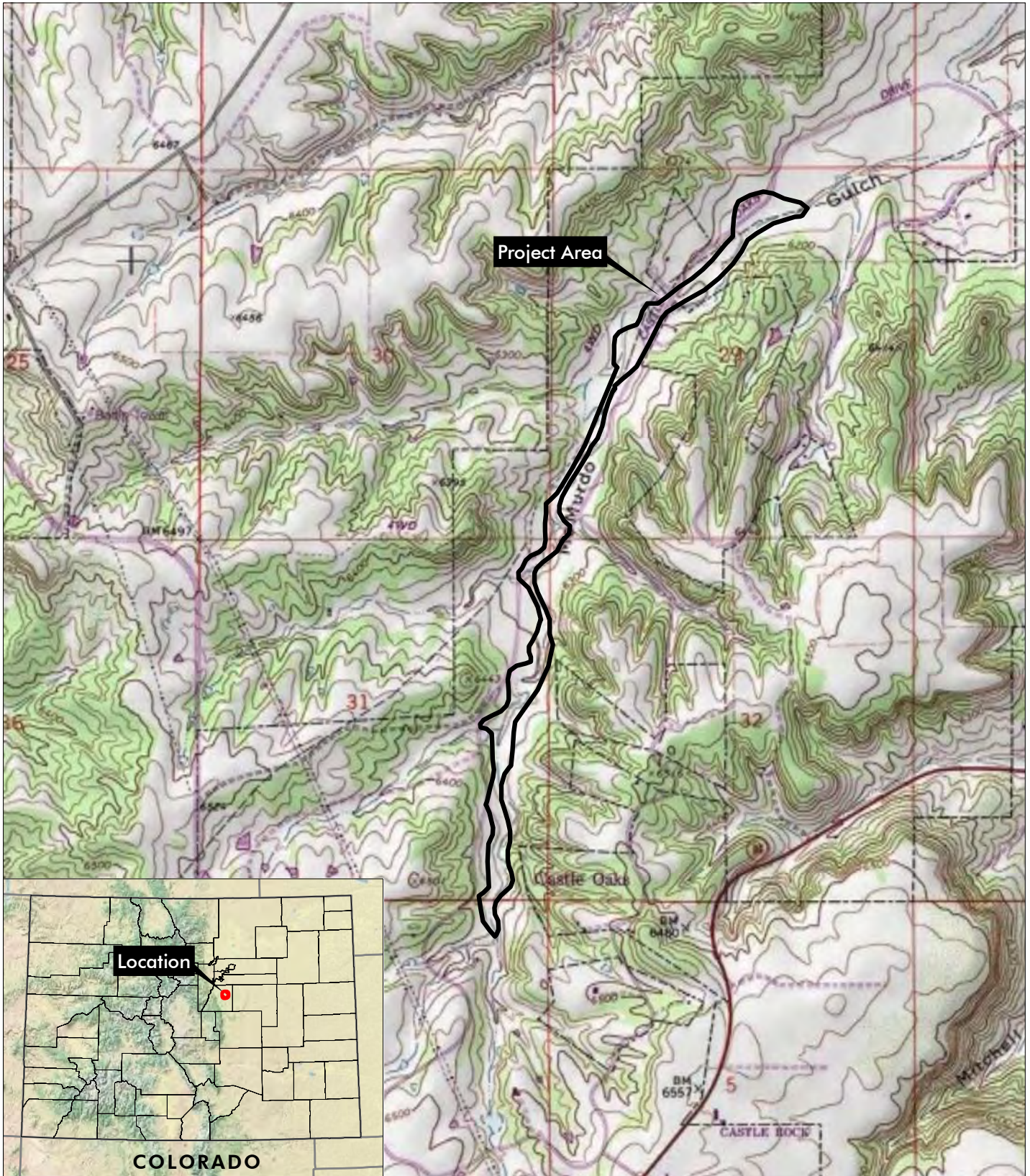
Conclusions and Recommendations

Despite damage from the July 2012 storm, project improvements have created an environment suitable for supporting wetland vegetation establishment throughout most of the project area. During the 2012 site visit, wetland vegetation was reestablishing within

Reaches A through C, portions of Reach E, and all of Reach F, and woody vegetation was resprouting in temporarily impacted areas throughout the project area. Although wetlands have begun to reestablish within the project area, ERO recommends repairing the channel bottom and banks within portions of Reaches C, E, and I. No remedial actions are recommended in the wetlands impacted by the July 2012 storm event as it is anticipated these wetlands will reestablish on their own over time. The survival rate of planted trees and willows, including volunteer specimens is 79 percent. ERO recommends planting additional willow stakes to replace the ones buried or washed out during the July 2012 storm event, and planting more trees to meet the permit requirements. In addition, ERO recommends conducting weed-control treatments in the uplands throughout most of the project area to prevent the spread of noxious weeds into the wetland mitigation areas. No other remedial actions are recommended at this time. The site will be monitored in 2013.

References

- Kartesz, J. 2006. Biota of North America Program from NRCS Plants National Database. Available at: <http://plants.nrcs.usda.gov/cgi_bin/topics>.
- Weber, W. and R. Wittmann. 2012. Colorado Flora, Eastern Slope – 4th Edition. University Press of Colorado.



McMurdo Gulch Stabilization

Sections 29, 30, 31 and 32, T7S, R66W;
 Section 6, T8S, R66W; 6th PM

UTM NAD 83: Zone 13N; 516347mE, 4361847mN

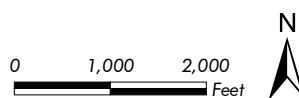
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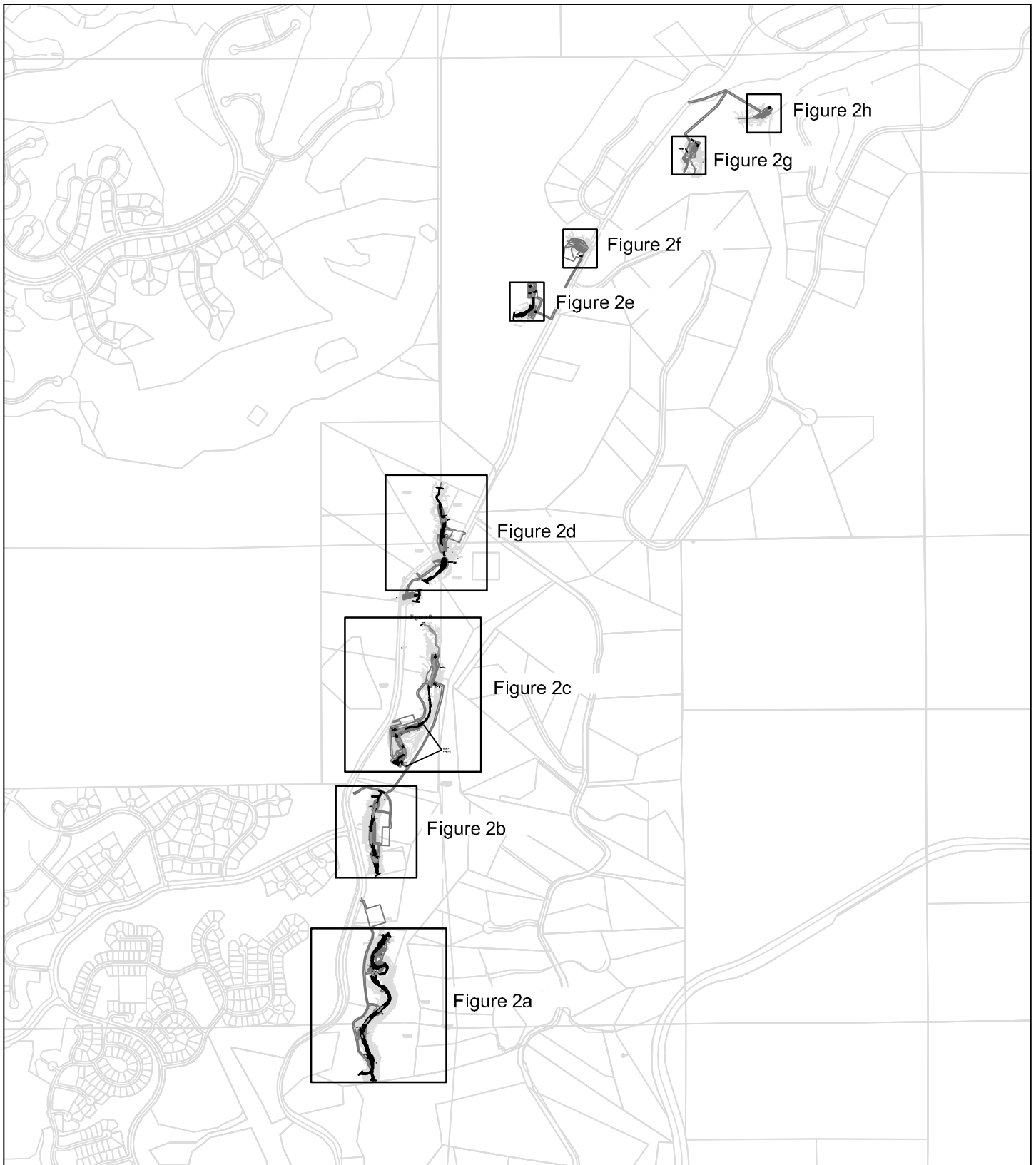
USGS Castle Rock North, CO Quadrangle

Douglas, Colorado

**Figure 1
 Site Location**

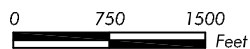
Prepared for: Muller Engineering
 File: 4723 figure 1.mxd [WH]
 November 2010





McMurdo Gulch Stabilization

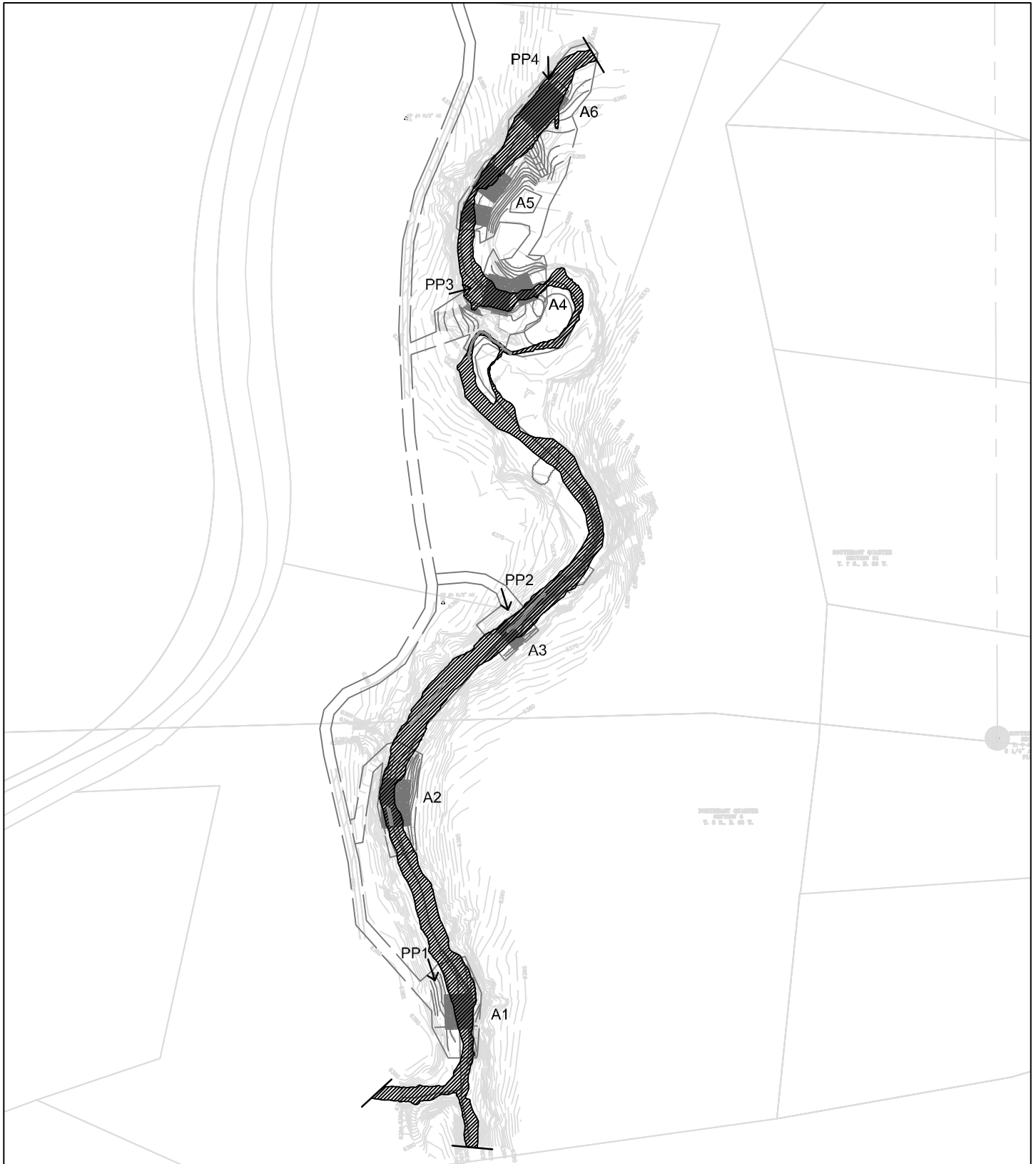
Base Data Provided by: Muller Engineering



**Figure 2
Photo Points Index**

Produced for: Muller Engineering
 File: 4723 McMurdo Photo Points 2012 .dwg (GS)
 March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

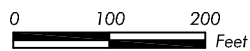


Figure 2a
Photo Points, Reach A

Produced for: Muller Engineering
 File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
 March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

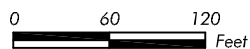



Figure 2b
Photo Points, Reach B

Produced for: Muller Engineering
File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

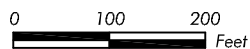
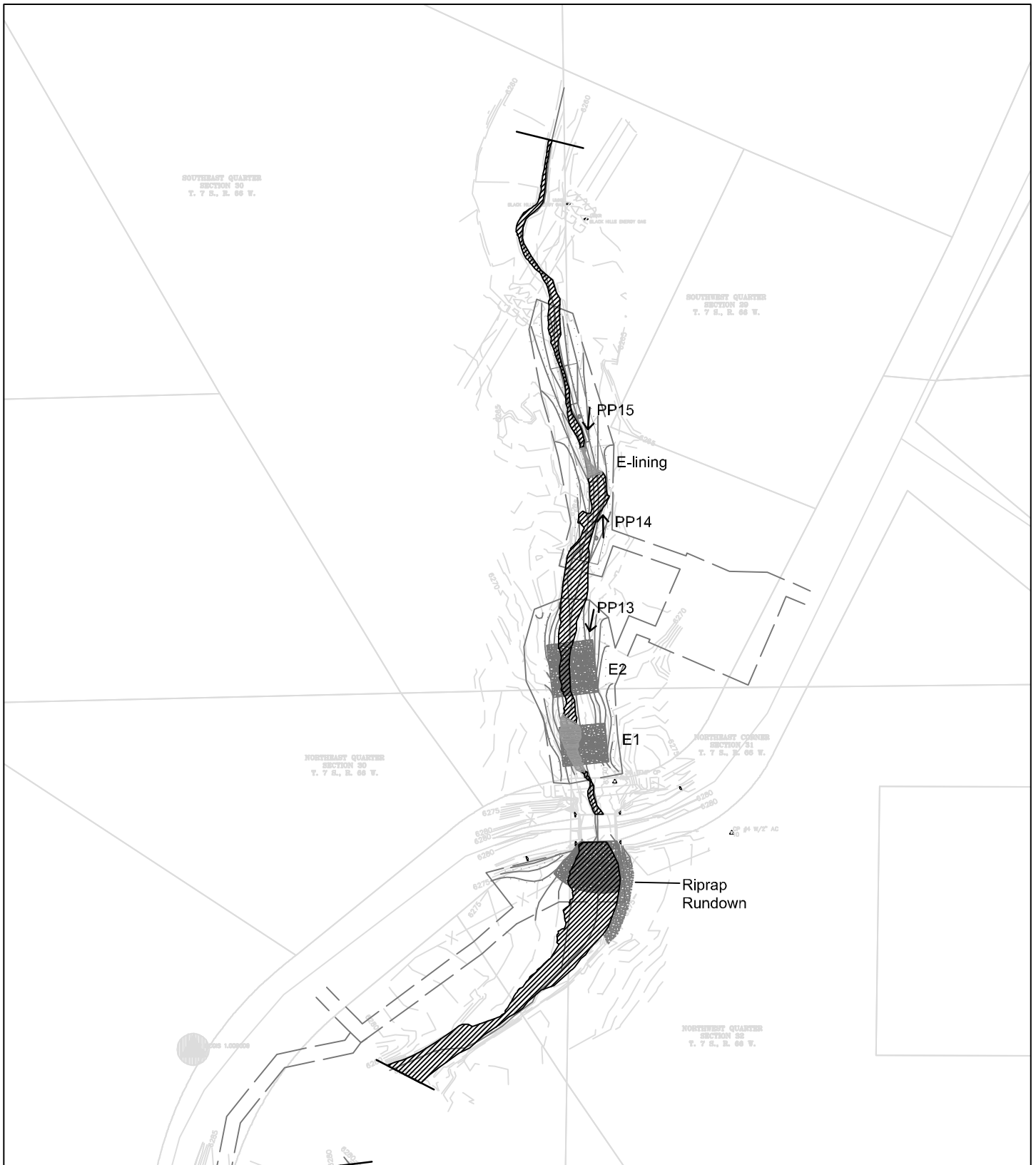


Figure 2c
Photo Points, Reach C

Produced for: Muller Engineering
 File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
 March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

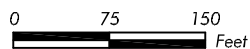
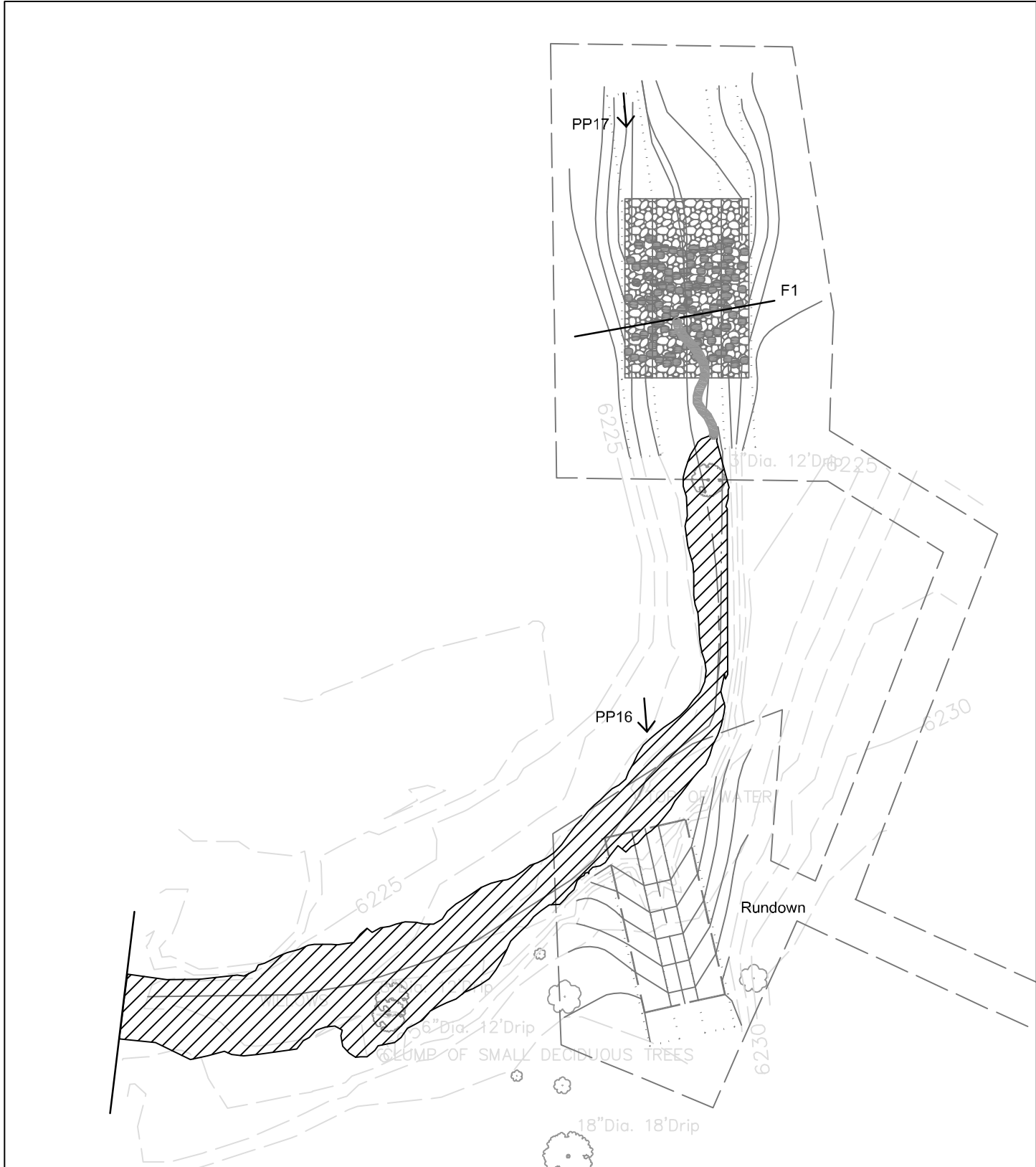



Figure 2d
Photo Points, Reach E

Produced for: Muller Engineering
 File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
 March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

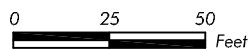
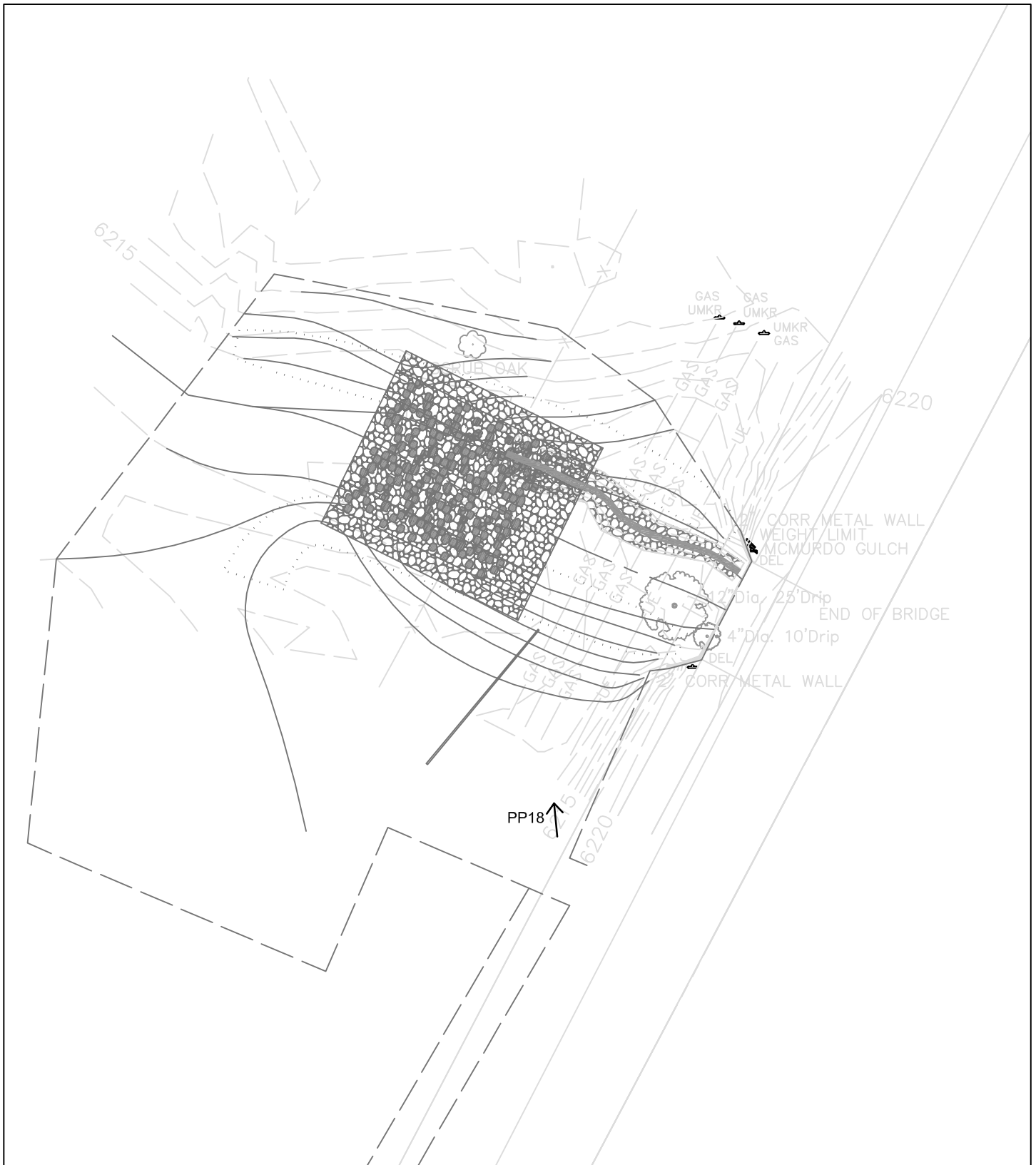




Figure 2e
Photo Points, Reach F

Produced for: Muller Engineering
File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

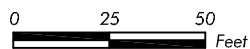
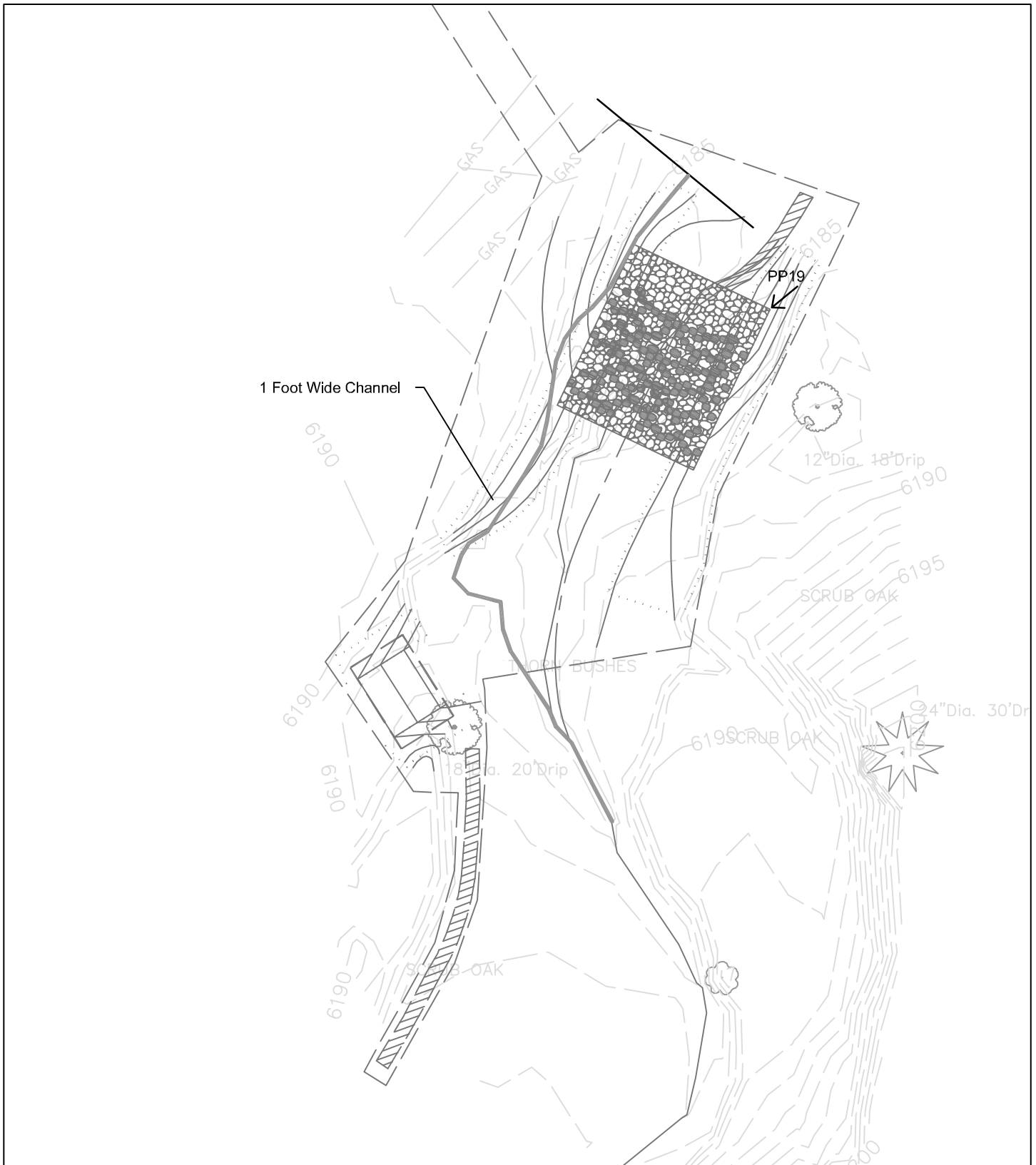


Figure 2f
Photo Points, Reach G

Produced for: Muller Engineering
 File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
 March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

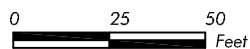
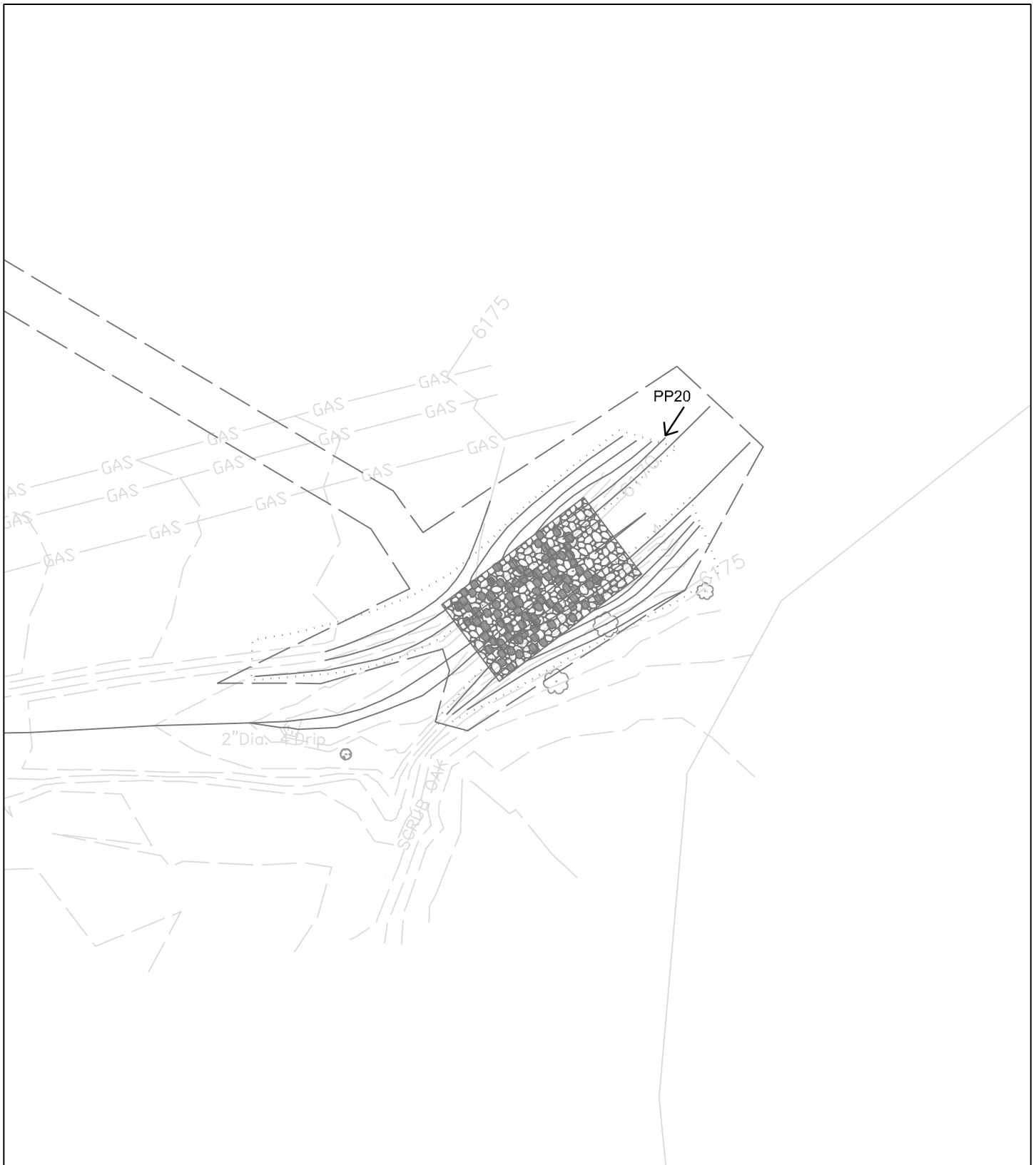


Figure 2g
Photo Points, Reach H

Produced for: Muller Engineering
File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
March 2013





McMurdo Gulch Stabilization

-  Wetland
-  Waters of the U.S.
-  Photo Point

Base Data Provided by: Muller Engineering

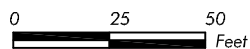


Figure 2h
Photo Points, Reach I

Produced for: Muller Engineering
 File: 4723 McMurdo Wetlands Monitoring.dwg (GS)
 March 2013



PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 1a - View to the southeast of wetlands along McMurdo Gulch at Reach A-1 prior to construction.



Photo 1b - View to the southeast of wetland vegetation establishing in the channel at Reach A-1.



Photo 2a - View to the south of wetlands along McMurdo Gulch at Reach A-3 prior to construction.



Photo 2b - View to the south of wetland vegetation establishing in the channel at Reach A-3.



Photo 3a - View to the east of wetlands along McMurdo Gulch at Reach A-4 prior to construction.



Photo 3b - View to the east of wetland vegetation establishing within Reach A-4.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 4a - View to the south of wetlands and willows at the downstream end of Reach A-6 prior to construction.



Photo 4b - View to the south of wetland vegetation and willows establishing at the downstream end of Reach A-6 following construction.



Photo 5a - View to the northwest of wetlands within the upstream portion of Reach B prior to construction.



Photo 5b - View to the northwest of wetland vegetation establishing in the drop structure and channel bottom within the upstream portion of Reach B.



Photo 6a - View to the south of wetlands within the downstream portion of Reach B prior to construction.



Photo 6b - View to the south of wetland vegetation establishing in the channel within the downstream portion of Reach B.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 7a - View to the north of woody vegetation within the upstream portion of Upper Reach C prior to construction.



Photo 7b - View to the north of planted trees and wetland vegetation establishing in the channel within the upstream portion of Upper Reach C.



Photo 8a - View to the southeast of woody vegetation within the middle portion of Upper Reach C prior to construction.



Photo 8b - View to the southeast of wetland vegetation establishing in the channel within the middle portion of Upper Reach C.



Photo 9a - View to the east of existing vegetation along McMurdo Gulch within the middle portion of Upper Reach C prior to construction.



Photo 9b - View to the east of planted trees and wetland vegetation establishing in the channel within the middle portion of Upper Reach C.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 10a - View to the southwest of existing vegetation along McMurdo Gulch at the downstream end of Upper Reach C prior to construction.



Photo 10b - View to the east of planted trees and wetland vegetation establishing in the channel at the downstream end of Upper Reach C.



Photo 11a - View to the north of existing vegetation along McMurdo Gulch at the upstream end of Reach C-lining prior to construction.



Photo 11b - View to the north of channel lining and vegetation along the channel banks at the upstream end of Reach C-lining.



Photo 12a - View to the south of existing vegetation along McMurdo Gulch at the downstream end of Reach C-lining prior to construction.



Photo 12b - View to the south of channel lining and displaced riprap at the downstream end of Reach C-lining.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 13a - View to the southwest of existing vegetation along McMurdo Gulch within the middle portion of Reach E prior to construction.



Photo 13b - View to the southwest of drop structure within the middle portion of Reach E.



Photo 14a - View to the northwest of existing vegetation along McMurdo Gulch within the middle portion of Reach E prior to construction.



Photo 14b - View to the northwest of bank erosion and displaced riprap within the middle portion of Reach E.



Photo 15a - View to the south of existing vegetation along McMurdo Gulch within the downstream portion of Reach E prior to construction.



Photo 15b - View to the south of bank erosion and displaced riprap within the downstream portion of Reach E.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 16a - View to the south of the rundown within Reach F during construction.



Photo 16b - View to the south of restored wetlands downstream of the rundown within Reach F.



Photo 17a - View to the south during construction of the drop structure within Reach F.



Photo 17b - View to the south of bank erosion and displaced riprap downstream of the drop structure at Reach F.



Photo 18a - View to the north during construction of the rundown structure within Reach G.



Photo 18b - View to the north of minor erosion and upland vegetation establishing in the channel at Reach G.

PHOTO LOG
McMURDO GULCH RECLAMATION PROJECT
2012 ANNUAL MITIGATION MONITORING
SEPTEMBER 18, 2012



Photo 19a - View to the southwest during construction of the drop structure within Reach H.



Photo 19b - View to the southeast of vegetation establishing in the uplands and sediment deposition within the drop structure and channel bottom at Reach H.



Photo 20a - View to the southwest during construction of the drop structure within Reach I.



Photo 20b - View to the southeast of bank erosion and displaced boulders downstream of the drop structure at Reach I.