SUMMIT COUNTY
COLORADO

OPEN SPACE & TRAILS DEPARTMENT

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0037 Peak One Dr. | PO Box 5660
Frisco, CO 80443

December 12, 2017

Mr. Matt Montgomery
U.S. Army Corps of Engineers
Sacramento District
400 Rood Avenue, Room 224
Grand Junction, Colorado 81501

RE: Swan River Restoration Project: As-Built & One-Year Monitoring Report (SPK-2015-00780)

Dear Mr. Montgomery,
Included herewith, please find the as-built and one-year Monitoring Report for the Swan River Restoration Project (Action ID: SPK-2015-00780) permitted under Nationwide Permit Number 27 – Aquatic Habitat Restoration, Establishment, and Enhancement Activities.

Please do not hesitate to contact me should you need any additional information.

Best regards,

Jason Lederer

Jason Lederer
Senior Resource Specialist

Encl: As-Built and One-Year Monitoring Report

cc: (w/ encls)
Mr. David Blauch, Ecological Resource Consultants, via email: Dave@erccolorado.net
Mr. Troy Thompson, Ecological Resource Consultants, via email: Dave@erccolorado.net
Mr. Don Reimer, Summit County Planning Department, via email: Don.Reimer@SummitCountyCO.gov
Mr. Brian Lorch, Summit County Open Space and Trails, via email: Brian.Lorch@SummitCountyCO.gov

Monitoring Report – Swan River Restoration Project
Summit County, Colorado
As-Built & One-Year Monitoring

i. Project Overview	
1. USACE #	**#SPK-2015-00780**
2. Permitee	Summit County Open Space and Trails (0037 Peak One Drive, Frisco, Colorado 80443) Jason Lederer, Senior Resource Specialist (jason.lederer@SummitCountyCO.gov)
Monitoring By:	Summit County Open Space and Trails (OST) - Jason Lederer, Senior Resource Specialist (720) 467-8589 (*Jason.Lederer@SummitCountyCO.gov*) Ecological Resource Consultants Inc. (ERC) – Troy Thompson (303) 679-4820 (*Troy@ERCColorado.net*)
3. Project Description	The primary purpose of this project is to relocate approximately 2,504 linear feet of channelized Swan River, resulting in the re-establishment of approximately 4,800 linear feet of stream channel. This segment of river has been highly modified and degraded from historic dredge boat mining and remaining spoils left onsite. Restoration of the natural channel form, and reconnection of the stream to its floodplain and groundwater interaction, as well as large-scale revegetation efforts, has enhanced riparian and wetland vegetation across the site. A new open bottom culvert bridge has eliminated a major fish barrier and now better accommodates a dynamic channel and annual peak flows. The project was specifically developed with the objectives of; 1) eliminating historic channelization, 2) reestablishing appropriate channel dimensions, pattern and profile for the valley type, 3) restoring floodplain connectivity, 4) promoting bedform diversity, 5) restoring riparian/wetland vegetation to the floodplain.
4. Location	The project area is located in the upper Swan River drainage northeast of the Town of Breckenridge. The Project Area is centered at Latitude: 39.5232397° North, Longitude: , -105.9662198° West in S ½ of Section 14, Township 6 South, Range 77 West, Summit County, Colorado.
5. Completion Date	Channel shaping November 2016; Revegetation August 21, 2017
6. Performance Standards Met	2017 As-built condition. Evaluation of performance standards to continue in 2018
7. Corrective Actions	As-built condition. No corrective or remedial actions required.
8. Recommendations	As-built condition. No recommendations at this time. Monitoring will continue in 2018
Notes: a. This monitoring report has been completed in accordance with USACE RGL No. 08-03. b. Construction commenced on June 1, 2016 and was completed on August 21, 2017.	

ii. Monitoring Requirements

The Permit requires submission of a brief annual monitoring report for a period of five years, beginning one year from the completion of project construction. Per permit requirements, monitoring reports shall include a narrative describing the status of both the channel restoration work and the success of the target objectives of the project.

Summary of Monitoring Protocol

In accordance with the Colorado Water Conservation Board (CWCB) standard Operating Procedures (SOP), the goal and purpose of this monitoring protocol is to collect high quality, reproducible survey data that can be; 1) used to track and assess stream condition changes within the project site over time, and 2) assess trends and assist in determination if restoration goals are being met. As part of the USACE CWA 404 PCN it was stated that the primary purpose of the project is restoration of aquatic resource function and services to a previously channelized and high degraded section of the Swan River and valley ecosystem. The project intent is to reestablish natural channel functions and processes that originally occurred in the valley prior to the channelization and dredge mining. Restoration efforts focused on establishing a natural form of the channel, maintaining correct geomorphic parameters, reconnecting the stream to its floodplain, reestablishing groundwater interactions and developing appropriate biological characteristics as well as reclaim the surrounding upland valley to a natural upland ecosystem.

Two individual physical parameters and one qualitative parameter have been selected for annual monitoring based on the ability to effectively and cost effectively measure the project conditions. These parameters include the following: Parameter 1 Channel Profile, Parameter 2 Channel Cross-section, Parameter 3 Visual Observation and Photo Documentation. Collection of this data on an annual basis will allow for direct comparison of the project condition and development over time. Each parameter, the method of data collection, and success criteria are summarized below.

Parameter 1: Channel Profile

Method of Measurement – A continuous channel profile survey will be completed along the thalweg (deepest portion of the channel) through the project reach. Survey points will be collected along the entire channel profile at key grade breaks and bed features. The data will be recorded on the Monitoring Map and compiled into an excel file table and graphed.

Evaluating Results – The restored system is intended to be able to function as a natural stream. This means that except on the upstream and downstream ends of the restored reach, no artificial means were included to lock the channel in place. Rather the stream was designed and constructed to allow it to evolve in response to flow and sediment load in the way that a natural channel would. With the project intended natural channel design, local adjustments to the channel profile are expected from year-to-year. This will be especially true following 2018 seasonal high flows as this will be the time when the natural system (flows, sediment, substrate, and overall stream gradient) adjusts the constructed system and in future years where higher than average flows occur. The channel profile provides a good indication of the overall channel bed stability and bed form diversity. The restoration will be viewed successful if, over time, the constructed profile remains relatively constant, exhibits no unnatural areas of aggradation or degradation, and maintains bed form diversity.

Parameter 2: Channel Cross-section

Method of Measurement – Four permanent channel cross-sectional monitoring locations were established by installing rebar set in concrete along the banks to denote the surveyed locations. The elevations along the cross-sections were tied into a relative datum (CP-1) to allow for comparison in future

years. Cross-section locations are recorded on the Monitoring Map and survey data compiled into an excel file table are graphed. Elevation control was established as part of the cross-section survey. Nine (9) elevation control points were established in the field (2-per each cross-section plus a separate control point) that are tied to the construction and design elevations. Control points consist of 2-foot rebar set into concrete into the ground surface. Control points are identified and labeled in the field and GPS mapped and located on the Monitoring Map.

Evaluating Results – As summarized in Parameter 1, no artificial means were included to lock the channel into place and the stream was designed and constructed to allow it to evolve in response to flow and sediment load in the way that natural channel would. With the project intended natural channel design, local adjustments to the channel profile are expected from year-to-year. This is especially true from the 2016 to 2017 surveys as this was the time when the natural system (flows, sediment, substrate, and overall stream gradient) adjusted the constructed system and in future years where higher than average flows occur. The channel profile provides a good indication of the overall channel bed stability and bed form diversity. The restoration will be viewed successful if, over time, the constructed profile remains relatively constant, exhibits no unnatural areas of aggradation or degradation, and maintains bed form diversity.

Parameter 3: Visual Observation and Photo Documentation

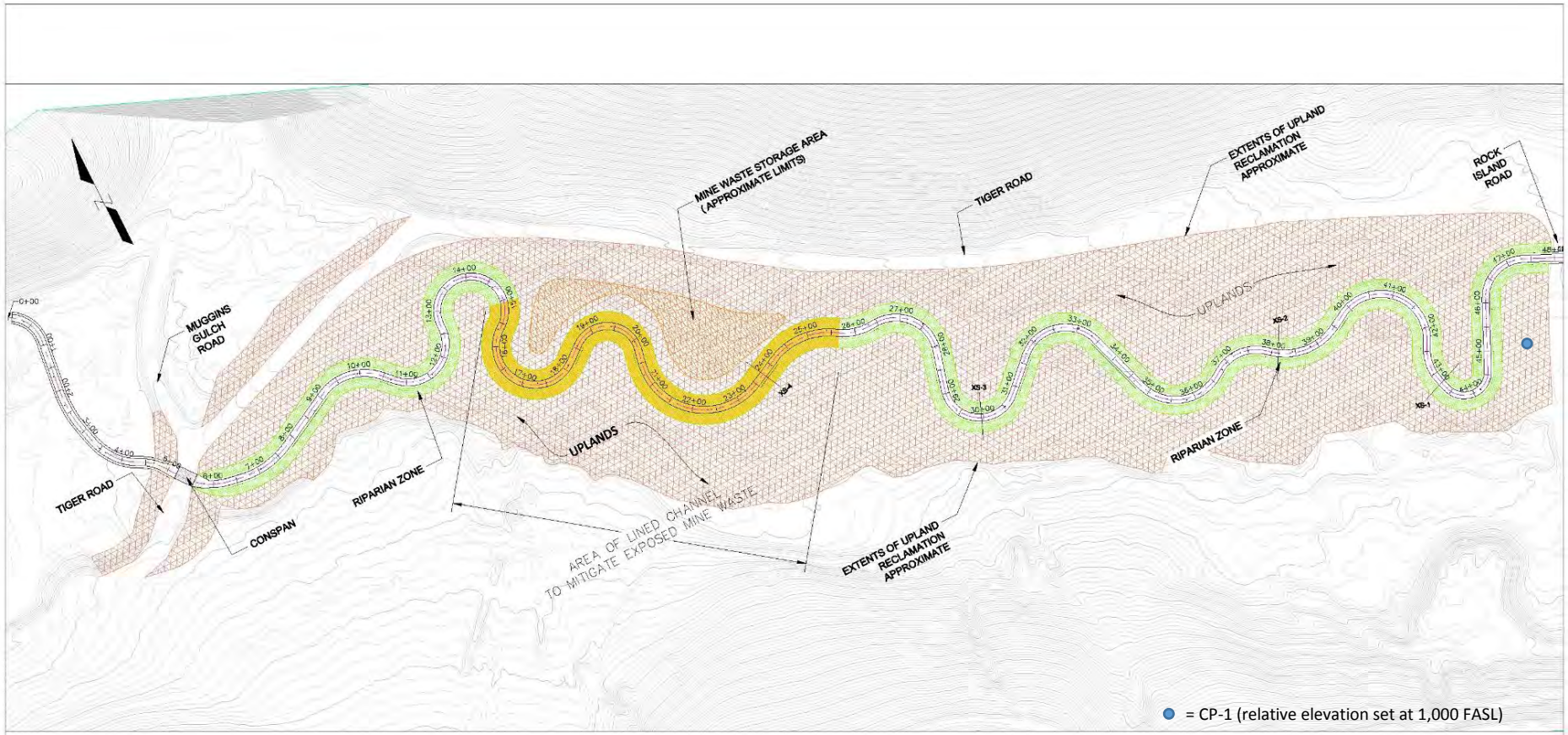
Method of Measurement – Visual observations should note and photograph general condition of the site. This parameter is intended to be more qualitative and provide a general overview of channel conditions. Permanent photo points have been established at ten (10) locations around the project area. In addition, representative photographs are taken at cross-section locations simultaneous with data collection. Permanent photo point locations are shown on the Photo Point Map.

Evaluating Results – The condition of the project area and channel will be compared from year-to-year to determine whether the constructed habitat is in place and continuing to function as designed. This parameter is the most subjective and results will be given in a qualitative manner to identify an areas of particular interest or concerns.

iii. Summary Data

The following graphs, tables, and photographs provide a summary of data collected as part of the monitoring requirements and protocol outlined about. Detailed survey data is provided in Appendix A.

Monitoring Map: Swan River as-built planview showing stationing and cross-section locations.



1 CHANNEL PLANVIEW

REV	DATE	DESCRIPTION
D	02/17/17	ISSUE FOR RECORD OF CONSTRUCTION
C	08/10/16	RE-ISSUE FOR CONSTRUCTION – REVISED ALIGNMENT
B	06/22/16	ISSUED FOR CONSTRUCTION
A	03/25/16	ISSUED FOR UTILITIES & BRIDGE DESIGN

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PREPARED BY
ECOLOGICAL RESOURCES CONSULTANTS, INC
35715 US HIGHWAY 40, SUITE D204
EVERGREEN, CO 80439

CLIENT
SUMMIT COUNTY OPEN SPACE AND TRAILS

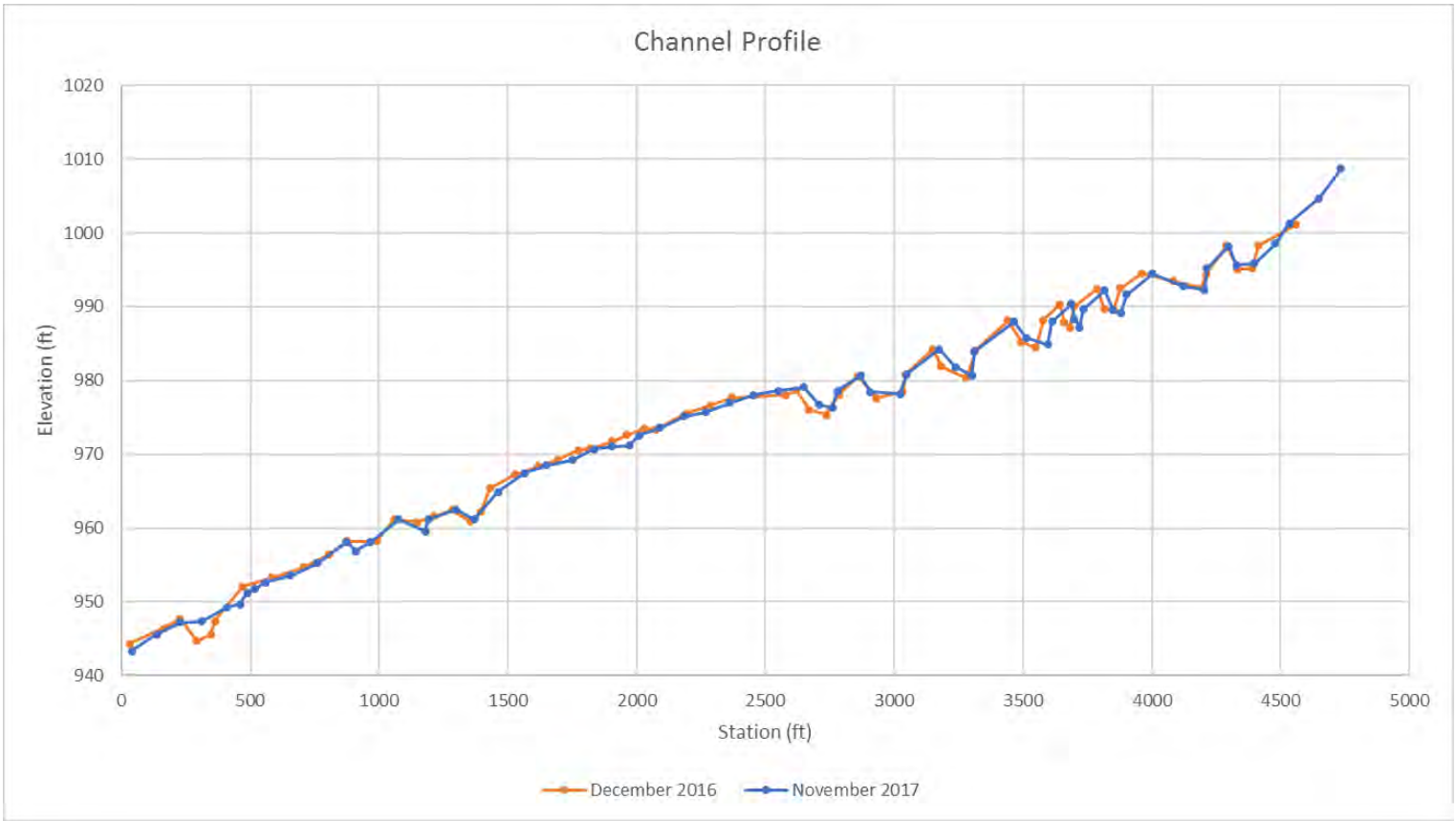
PROJECT
SWAN RIVER RESTORATION PROJECT

TITLE
RIVER AS-BUILT PLANVIEW

SHEET NO
03A

G:\Dropbox (ERC Colorado)\ERC\01 PROJECTS\1035 Summit County\1501 Swan River\02 ACAD\Working\Swan As-Built.dwg, 12/5/2017 12:20:19 PM

Parameter 1. Channel Profile Survey (As-built & One-Year)



Representative photographs Swan River stream channel.

Photo 1. View of upstream end of channel from left bank looking northeast.

Photo 2. View of channel looking west from right bank at approximately STA 39+05.

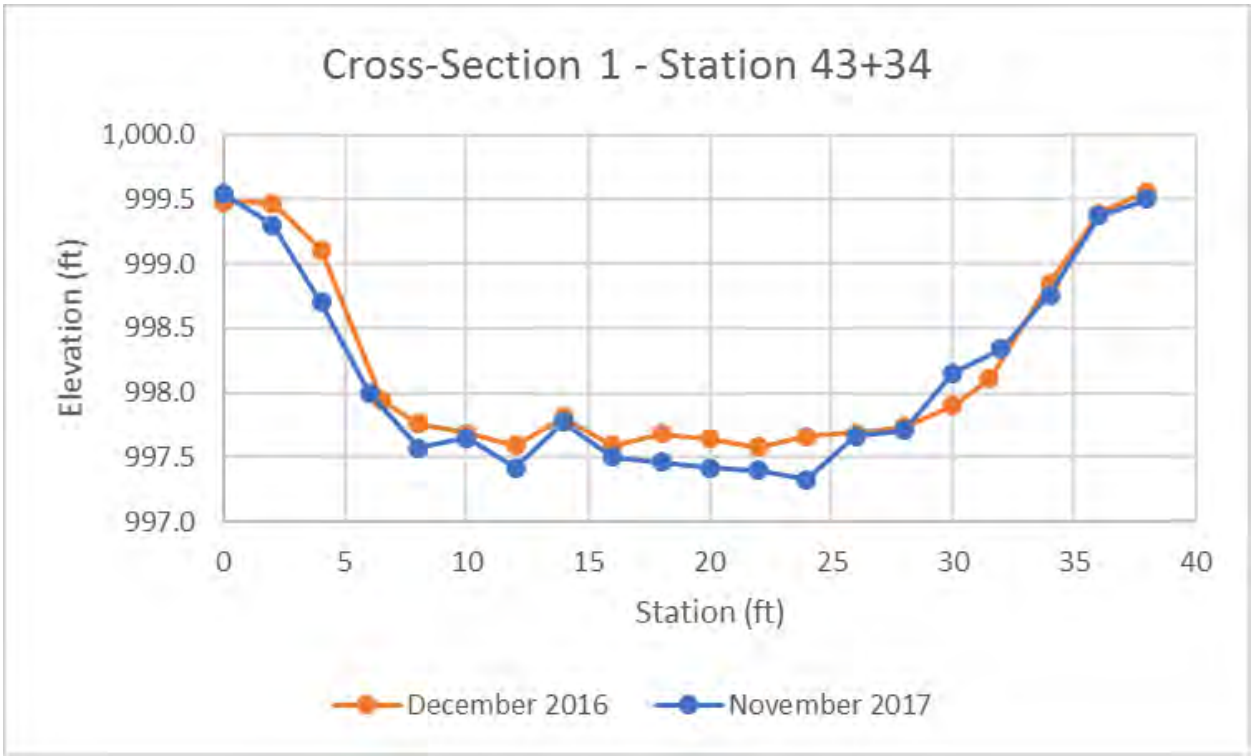
Photo 3. View of channel looking north from right bank at approximately STA 34+00.

Photo 4. View of channel looking north from right bank at approximately STA 25+00.

Photo 5. View of channel looking northeast from right bank at approximately STA 13+00

Photo 6. View of channel looking west from left bank at approximately STA 10+50

Parameter 2. Channel Cross-Section Survey (As-built & One-Year)

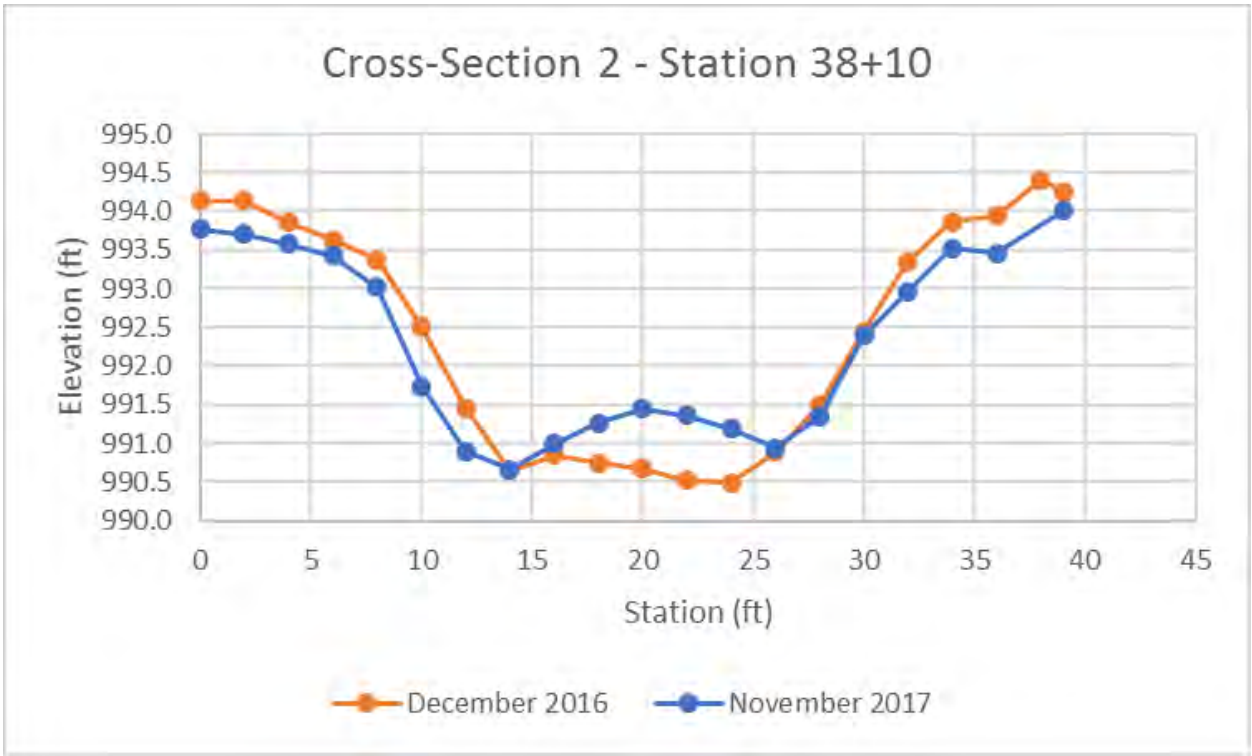


Cross-section graph includes top of rebar elevation control on either side.

Photo 7. View from right bank looking east towards the right bank at Cross Section 1 (XS-1).

Photo 8. View looking downstream from the right bank at XS-1.

Parameter 2. Channel Cross-Section Survey (As-built & One-Year)

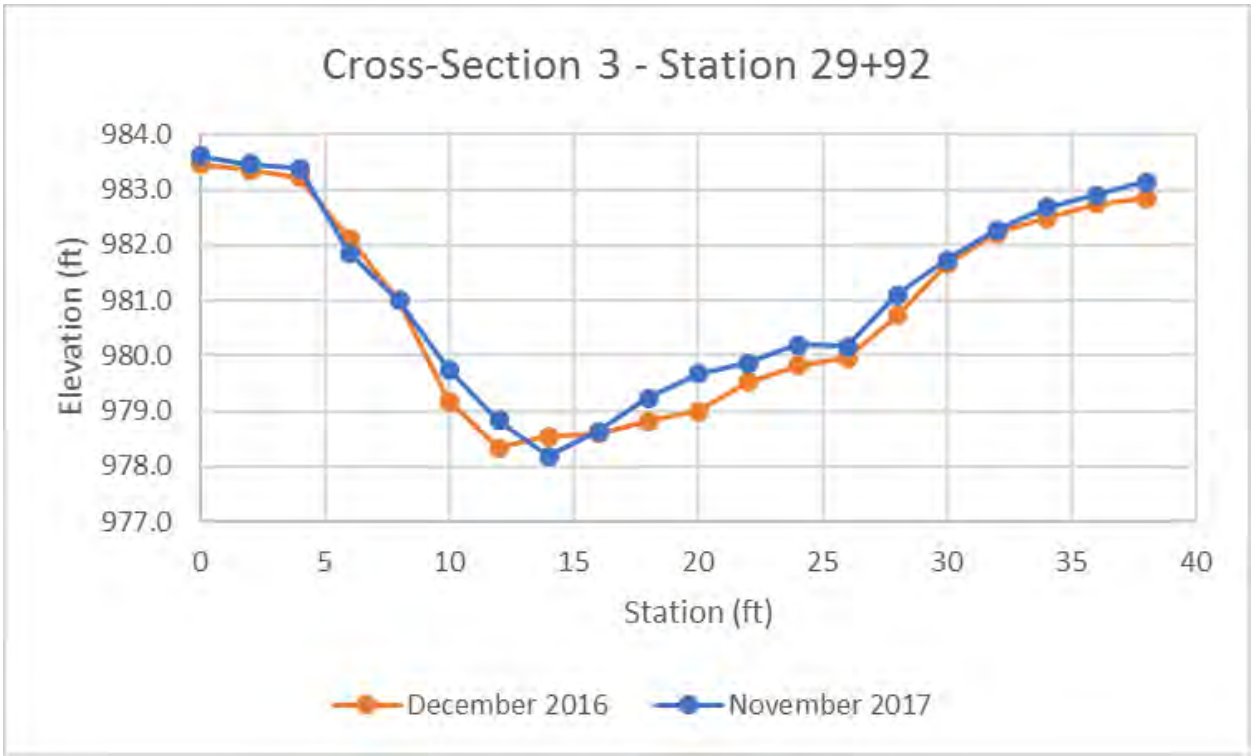


Cross-section graph includes top of rebar elevation control on either side.

Photo 9. View from the right bank looking north towards the left bank at Cross Section 2 (XS-2).

Photo 10. View looking upstream from the right bank at XS-2.

Parameter 2. Channel Cross-Section Survey (As-built & One-Year)

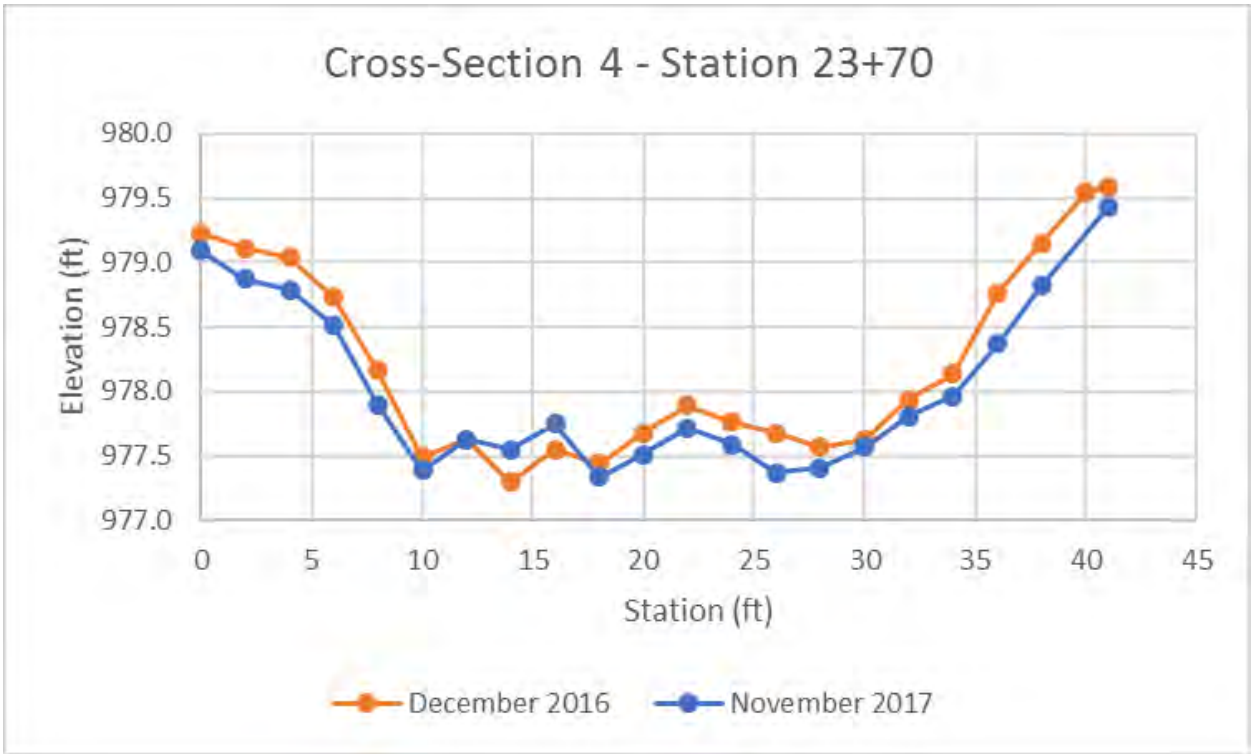


Cross-section graph includes top of rebar elevation control on either side.

Photo 11. View from the left bank looking north towards the right bank at Cross Section 3 (XS-3).

Photo 12. View looking downstream from the right bank at XS-3.

Parameter 2. Channel Cross-Section Survey (As-built & One-Year)



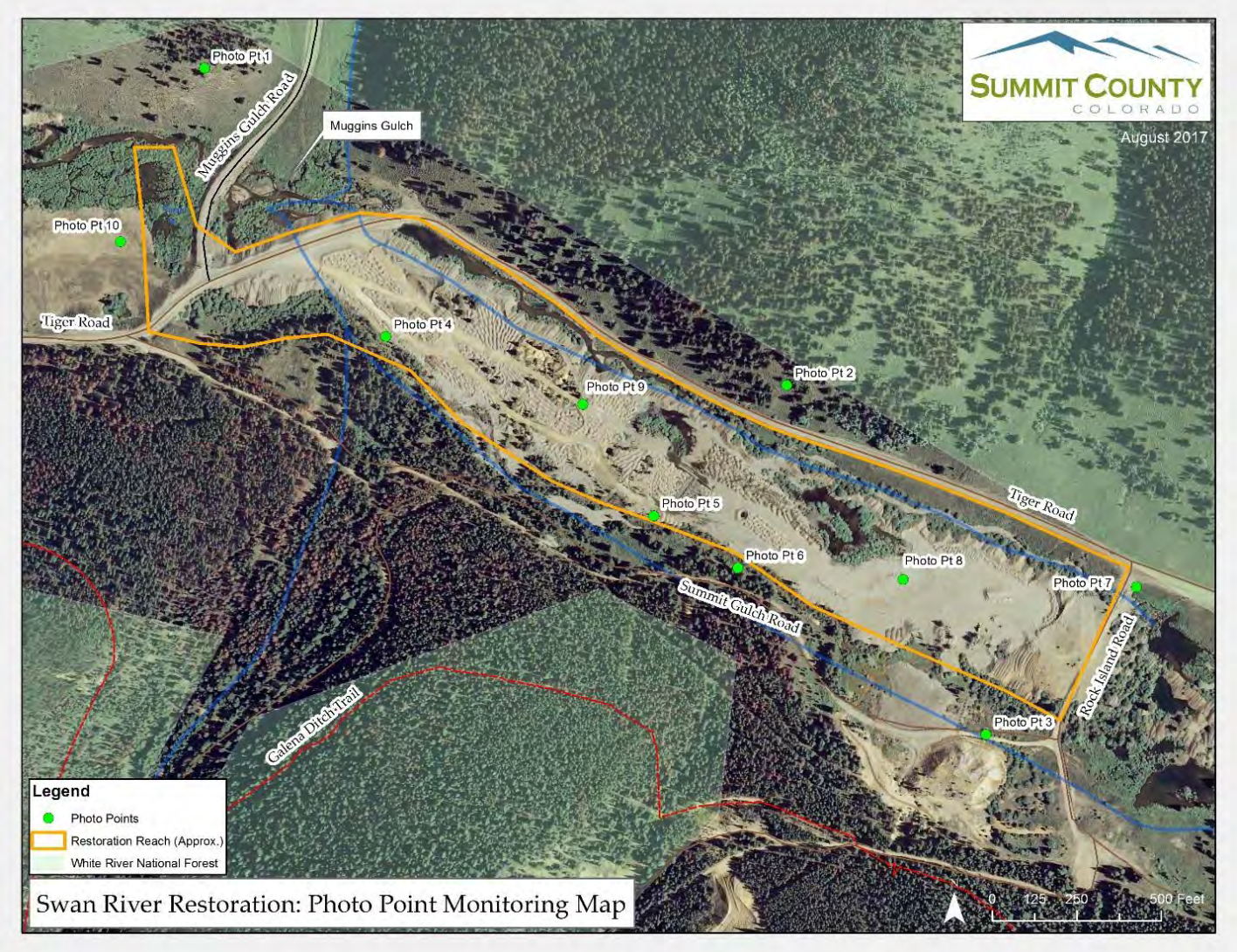
Cross-section graph includes top of rebar elevation control on either side.

Photo 13. View from the right bank looking northwest towards the left bank at Cross Section 4 (XS-4).

Photo 14. View looking upstream from the left bank at XS-4.

Parameter 3: Visual Observation and Photo Documentation

Visual observations of the site is ongoing. Representative pre- and post-construction photographs are included in Attachment B. A photo point monitoring map is included below.



iv. Conclusions

Summit County has prepared this 2017 As-built & One-Year Monitoring Report per special conditions specified in the USACE Permit (#SPK-2015-00780). This is the first of five anticipated annual monitoring reports. This monitoring report provides an evaluation of conditions and performance standards for the Swan River Restoration Project.

Notes:

1. Construction of the restoration commenced on June 1, 2016 and was completed on August 21, 2017. Overall, the constructed channel was built to plan.
2. Stream channel construction occurred in the wet in the approximately upstream half of the channel throughout the duration of construction – between approximately STA 27+00 and STA 48+00. Flow was diverted in to the approximate downstream half of the channel on November 5, 2016.
3. Tiger Road and Muggins Gulch Road alignments were built to plan.
4. Haul roads and stockpile areas were utilized consistently with the plans.
5. Survey results show that the channel has maintained very close to its as-built condition through the first year of high flows (spring 2017) with only minor variations to either sections or the profile.
6. Slight difference in the horizontal location (station) of some of the features occur towards the upstream end of the project in the vicinity of Station 26+00 to 40+00 where the 2017 data points are shifted slightly to the left (downstream) of the 2016 data points. We believe that this is attributed to slight difference in the GPS reading accuracies between the 2016 and 2017 monitoring events. Adjusting for these likely GPS accuracies, the stream has retained its constructed profile at one year of flows.
7. All disturbed soils were prepared and revegatated throughout the project site on October 3, 2016 and again between November 14 and November 15, 2016. Disturbed soil surfaces were prepared, soil amendments added, seeded, and then hydromulched. Ecologically appropriate native seed mixes were installed across the site based on site-specific riparian and upland conditions. Additional revegetation work occurred on June 13, 2017 and during much of August 2017.
8. The abandoned channel was backfilled with available spoils and revegetated. Residual water and saturated conditions remained in the backfilled area.
9. Parameter 1: Channel Profile Results - Results of the 2016 and 2017 as-built and 1-year channel profile surveys are presented in the Channel Profile graph, as well as in Tables 1 and 2 (see Appendix A). The channel profile was constructed to form distinct varying slopes creating the primary habitat features of riffles, pools, glides, and general bedform diversity. The as-built condition was implemented per plan with minor deviations and will be evaluated and compared in the future.
10. Parameter 2: Channel Cross-section Results – Results of the 2016 and 2017 as-built and 1-year channel cross-section surveys are presented in Cross-section Graphs 1 – 4 and Tables 3 – 10 (see Appendix A). The channel cross-section was constructed along the entire project reach to form a district and varying cross-section. The as-built condition was implemented per plan with minor deviations and will be evaluated and compared in the future.
11. Parameter 3: Visual Observation and Photopoint Documentation Results – Visual observations were made along the construction channel. The as-built condition has notably created physical characteristics as planned. The constructed channel provides varying flow velocities including fast

moving riffles, deep slower pools, and glides as well as instream cover. Trout were observed within the newly constructed channel upon completion.

12. No corrective actions are recommended at this time.

Appendix A Survey Data

TABLE 1. PROFILE SURVEY - AS-BUILT 2016		
Station	**ID**	**Elev**
4559	RB1	1001.13
4413	RE1	998.25
4390	P1	995.21
4334	G1	995.13
4289	RB2	998.25
4211	RE2	994.41
4194	P2	992.57
4082	G2	993.48
3962	RB3	994.51
3878	RE3	992.5
3852	P3	989.52
3815	G3	989.73
3789	RB4	992.45
3700	RE4	990.11
3682	P4	987.22
3660	G4	987.89
3644	RB5	990.32
3578	RE5	988.2
3550	P5	984.44
3493	G5	985.23
3442	RB6	988.09
3315	RE6	984.07
3280	P6	980.34
3182	G6	981.9
3150	RB7	984.24
3046	RE7	980.86
3032	P7	978.43
2931	G7	977.61
2860	RB8	980.54
2784	RE8	978.05
2735	P8	975.33
2670	G8	976.08
2620	T1	978.67
2580	T2	978.05
2370	T3	977.66
2288	T4	976.61
2194	T5	975.48
2075	T6	973.36

TABLE 1. PROFILE SURVEY - AS-BUILT 2016 (C'ont)		
Station	**ID**	**Elev**
2030	T7	973.49
1962	T8	972.59
1905	T9	971.75
1820	T10	970.75
1775	T11	970.55
1695	T12	969.26
1618	T13	968.35
1527	T14	967.22
1431	T15	965.43
1397	T16	962.22
1356	T17	960.9
1285	T18	962.47
1215	T19	961.56
1150	T20	960.84
1058	T21	961.16
990	T22	958.24
874	T23	958.21
804	T24	956.37
708	T25	954.66
584	T26	953.26
470	RB9	952.09
364	RE9	947.43
347	P9	945.58
292	G9	944.65
229	RB10	947.66
165	RM10	946.39
32	RE10	944.29

*Elevation relative to a benchmark set at 1,010 FASL located at CP-1

TABLE 2. PROFILE SURVEY ONE-YEAR 2017		
Station	**ID**	**Elev**
4735	CL1	1008.74
4650	CL2	1004.67
4535	RB1	1001.31
4480	RE1	998.58
4400	P1	995.91
4328	G1	995.7
4297	RB2	998.23
4213	RE2	995.19
4204	P2	992.3
4125	G2	992.8
4002	RB3	994.49
3902	RE3	991.65
3880	P3	989.1
3850	G3	989.52
3817	RB4	992.21
3735	RE4	989.65
3721	P4	987.19
3700	G4	988.36
3688	RB5	990.37
3612	RE5	988.01
3596	P5	984.87
3512	G5	985.81
3465	RB6	988.01
3312	RE6	983.93
3301	P6	980.72
3237	G6	981.83
3175	RB7	984.23
3050	RE7	980.84
3022	P7	978.15
2908	G7	978.44
2870	RB8	980.65
2780	RE8	978.6
2760	P8	976.25
2707	G8	976.74
2650	T1	979.07
2550	T2	978.61
2455	T3	978.03
2363	T4	977

TABLE 2. PROFILE SURVEY ONE-YEAR 2017 (Con't)		
Station	**ID**	**Elev**
2267	T5	975.67
2185	T6	975.11
2091	T7	973.58
2009	T8	972.5
1972	T9	971.16
1905	T10	971.07
1835	T11	970.7
1750	T12	969.23
1650	T13	968.52
1566	T14	967.46
1463	T15	964.92
1369	T16	961.17
1300	T17	962.5
1193	T18	961.19
1179	T19	959.56
1077	T20	961.15
965	T21	958.05
909	T22	956.88
875	T23	958.13
762	T24	955.22
657	T25	953.52
558	US Inv	952.6
520	DS Inv	951.74
488	P1	951.21
460	P2	949.67
411	P3	949.26
310	P4	947.34
228	P5	947.23
137	P6	945.61
40	P7	943.32

*Elevation relative to a benchmark set at 1,000 FASL located at CP-1.

Table 3. Cross-Section 1 – 2016 As-built	
Riffle at 43+34	
Station	Elevation
0	999.48
2	999.47
4	999.11
6.5	997.94
8	997.76
10	997.69
12	997.59
14	997.81
16	997.59
18	997.68
20	997.64
22	997.58
24	997.66
26	997.69
28	997.73
30	997.90
31.5	998.11
34	998.85
36	999.39
38	999.56

Table 4. Cross-Section 2 – 2016 As-built	
Glide at 38+10	
Station	Elevation
0	994.13
2	994.13
4	993.85
6	993.63
8	993.37
10	992.50
12	991.46
14	990.65
16	990.84
18	990.75
20	990.67
22	990.52
24	990.49
26	990.89
28	991.50
30	992.45
32	993.35
34	993.87
36	993.94
38	994.40
39	994.25

Table 5. Cross-Section 3 – 2016 As-built	
Pool at 29+92	
Station	Elevation
0	983.46
2	983.36
4	983.22
6	982.12
8	981.00
10	979.17
12	978.33
14	978.54
16	978.59
18	978.81
20	978.99
22	979.52
24	979.82
26	979.95
28	980.72
30	981.65
32	982.22
34	982.48
36	982.74
38	982.84

Table 6. Cross-Section 4 – 2016 As-built	
Tailings at 23+70	
Station	Elevation
0	979.23
2	979.11
4	979.04
6	978.73
8	978.16
10	977.49
12	977.63
14	977.30
16	977.55
18	977.44
20	977.68
22	977.89
24	977.76
26	977.68
28	977.57
30	977.63
32	977.94
34	978.14
36	978.76
38	979.15
40	979.54
41	979.59

*Elevation relative to a benchmark set at 1,000 FASL located at CP-1

Table 7. Cross-Section 1 – 2017 One-year	
Riffle at 43+34	
Station	Elevation
0	999.54
2	999.30
4	998.70
6	998.00
8	997.57
10	997.65
12	997.42
14	997.77
16	997.50
18	997.46
20	997.42
22	997.40
24	997.33
26	997.66
28	997.71
30	998.15
32	998.34
34	998.76
36	999.37
38	999.50

Table 8. Cross-Section 2 – 2017 One-year	
Glide at 38+10	
Station	Elevation
0	993.77
2	993.70
4	993.58
6	993.42
8	993.02
10	991.74
12	990.90
14	990.66
16	991.00
18	991.26
20	991.45
22	991.36
24	991.19
26	990.94
28	991.35
30	992.39
32	992.96
34	993.52
36	993.46
39	994.00

Table 9. Cross-Section 3 – 2017 One-year	
Pool at 29+92	
Station	Elevation
0	983.61
2	983.46
4	983.38
6	981.85
8	981.00
10	979.74
12	978.83
14	978.18
16	978.63
18	979.24
20	979.67
22	979.87
24	980.20
26	980.16
28	981.10
30	981.73
32	982.27
34	982.68
36	982.91
38	983.14

Table 10. Cross-Section 4 – 2017 One-year	
Tailings at 23+70	
Station	Elevation
0	979.09
2	978.87
4	978.79
6	978.51
8	977.90
10	977.39
12	977.63
14	977.55
16	977.75
18	977.34
20	977.51
22	977.72
24	977.59
26	977.37
28	977.41
30	977.57
32	977.81
34	977.96
36	978.37
38	978.82
41	979.43

*Elevation relative to a benchmark set at 1,000 FASL located at CP-1

Appendix B Representative Pre- and Post-Construction Photographs

Swan River Stream Restoration project (Phase 1)
Photo Point Monitoring – spring 2016 and summer 2017

Figures

Figure 1: Swan River Restoration; Photo Point Monitoring map providing an overview of the restoration area and ten photo monitoring point locations. *(Note that four additional photo monitoring points were added in February 2016.)*

Photo Points

Photo Point 1: Swan River; View east across the Phase 1 restoration reach from an adjacent hillside. Muggins Gulch is visible in the foreground.
Photo Point 2: Swan River; View south across the Phase 1 restoration reach from an adjacent hillside. Where visible, recently installed piezometers are circled in red.
Photo Point 3: Swan River; View north and west across the Phase 1 restoration reach from the top of a tailings pile adjacent to the Tiger Townsite.
Photo Point 4: Swan River; View north, east, and west across the Phase 1 restoration reach.
Photo Point 5: Swan River; View north, east, and west across the Phase 1 restoration reach.
Photo Point 6: Swan River; View north, east, and west across the Phase 1 restoration reach.
Photo Point 7: Swan River; View south and west across Phase 1 restoration reach.
Photo Point 8: Swan River; View north, west, and south across Phase 1 restoration reach from within the restoration site.
Photo Point 9: Swan River; View north, east, and south across Phase 1 restoration reach from within the restoration site.
Photo Point 10: Swan River; View south and west across portion of restoration reach to the west of Tiger Road.

Photo Point 1

May 31, 2016

August 30, 2017

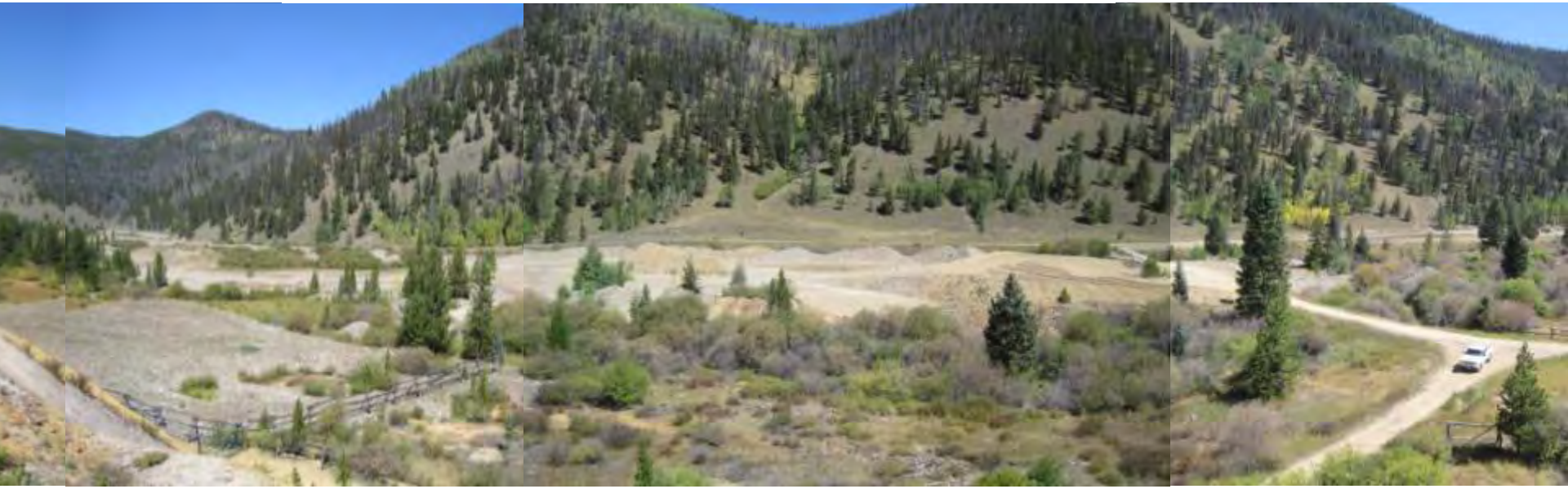
Photo Point 2

September 9, 2015

August 30, 2017

Photo Point 3

September 9, 2015



August 30, 2017

Photo Point 4

September 9, 2015

August 30, 2017

Photo Point 5

September 9, 2015

August 30, 2017

*Note: August 1, 2016 photo moved north into project site due to a construction-related berm obstructing view of project area.

Photo Point 6

September 9, 2015

August 30, 2017

Photo Point 7

May 31, 2016

August 30, 2017

Photo Point 8

May 31, 2016

August 30, 2017

Photo Point 9

May 31, 2016

August 30, 2017

Photo Point 10

May 31, 2016

August 30, 2017