

## Bryce Armstrong - Snowbird: Final WCMP

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**From:** "Budge, Wade" <@swlaw.com>  
**To:** Bryce Armstrong <@utahcounty.gov>, Robert Moore <@utahcount...>  
**Date:** 4/8/2016 4:15 PM  
**Subject:** Snowbird: Final WCMP  
**CC:** "Weston, John" <@swlaw.com>  
**Attachments:** WQMP Mary Ellen Gulch Creek\_23643596\_15-FINAL 4-7-16.pdf

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Bryce, Robert,

Thanks for all of your work on the Snowbird applications. Attached is the final version of the WQMP. AFC has received the same copy and confirmed receipt.

-Wade

**WATER QUALITY MONITORING PLAN FOR:**

**MARY ELLEN GULCH CREEK**

**AMERICAN FORK CANYON**

April 7, 2016

Prepared for:  
Snowbird Ski Resort

Prepared by:  
Cirrus Ecological Solutions  
965 South 100 West, Suite 200  
Logan, UT

## **DISTRIBUTION LIST**

Bryce Armstrong, Associate Director  
Utah County Department of Community Development  
51 South University Ave., No. 117, Provo, UT 84601

## **ACRONYMS AND ABBREVIATIONS**

CUP – Conditional Use Permit

Utah DEQ – Utah Department of Environmental Quality

Utah DWQ – Utah Division of Water Quality

NFRAP – No Further Remedial Action Planned

CERCLIS – Comprehensive Environmental Response, Compensation and Liability Information System

EPA – U.S. Environmental Protection Agency

QA/QC – Quality Assurance Quality Control

GPS – Geographic Positioning System

HDPE – High Density Polyethylene

TDS – Total Dissolved Solids

WQMP – Water Quality Monitoring Plan

## **1. Introduction**

This water quality monitoring plan (WQMP) was prepared in accordance with the format developed by the Utah Division of Water Quality (Utah DWQ; *Quality Assurance Program Plan for Environmental Data Operations*, Final Plan Revision No. 1.0. Effective September 5, 2014). Suggested content is listed at the beginning of each section.

Similar to many drainages along the Wasatch Front, American Fork Canyon is highly mineralized. Historic mining activities created surface deposits of mine waste rock material, milled tailings and, in some cases, water discharge from mine portals, all of which can potentially increase naturally occurring metals concentrations in the American Fork River and its tributaries. Mining occurred in Mary Ellen Gulch starting in the 1860s and continuing through the 1940s (Calkins and Butler 1943), and the resulting conditions have contributed to metal loading in Mary Ellen Creek, an American Fork tributary that is the focus of this monitoring effort.

Concerns about mining-related impacts on water quality in the upper American Fork watershed emerged in the 1980s, and studies by the U.S. Forest Service (e.g., Merritt 1988) and other agencies led to the U.S. Environmental Protection Agency (EPA) designation in 1992 of a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site (UTD988074951). The EPA issued a determination of No Further Remedial Action Planned (NFRAP) in 2002. The CERCLIS site was archived in 2003. It was moved to active status in 2005 because of Forest Service concerns about the Pacific Mine (in lower Mineral Basin). The Pacific Mine repository was completed in 2006. The NFRAP classification remains to date.

Studies completed from the late 1980s through 2000, concluding with a U.S. Geological Survey synoptic tracer study conducted in 2000 (Kimball et al. 2009) identified the location of major sources of mine waste in American Fork Canyon and evaluated water quality concerns. These included the Mary Ellen Mines.

The Mary Ellen Mines, which include the Live Yankee Mine, left a number of mine dumps and processed tailings in Mary Ellen Gulch. The steep, bare slopes of the piles show evidence of erosion and runoff from precipitation events.

The Mary Ellen Mines' adits and tailings are the primary source of trace metals in Mary Ellen Creek. However, water quality measurements collected immediately above the confluence with the North Fork of the American Fork River show that all State-assigned water quality standards are being met.

Despite the EPA's determination of NFRAP, remediation projects were completed for the three primary areas of concern. In 1997, Snowbird started re-routing discharge from the Live Yankee Mine north adit around the tailings piles. The 2000 USGS study indicated that downstream water quality was significantly better than in years before the project. In 2003, the Forest Service constructed the Dutchman Flat repository, combining material from the Bog Mine and several other nearby sources. In 2006, Snowbird and Trout Unlimited built a similar repository on private land for material from the Pacific Mine and other nearby mines. In 2008, Snowbird and Trout Unlimited again collaborated to install a more permanent drainage system at the Live Yankee north adit.

Utah DWQ continues to monitor surface water quality on Mary Ellen Creek and the American Fork River above and below their confluence. Utah DWQ has confirmed the "...status of the American Fork River, Segment 2, from Tibble Fork Reservoir to headwaters. From the latest Integrated Report this segment is placed in Assessment Category 3, 'Insufficient Data with Exceedances' (Chapter 5 – 303(d) List of Rivers and Streams, 2014). The river has not been assessed as impaired nor has it been assessed as fully supporting its designated beneficial uses due to the lack of sufficient data to make a full assessment. The exceedances refer to a single sample collected from Mary Ellen Gulch that exceeded the chronic criteria for Cadmium in 2009." (Utah DWQ Feb. 17, 2016 Letter.)

In December 2015, Snowbird Ski and Summer Resort (Snowbird) requested two conditional use permits (CUPs) from Utah County's Board of Adjustment to construct accessory ski lifts, replace and increase the height of some existing ski lift towers and construct some associated mountain resort facilities on their private land in Utah County (Mineral Basin and Mary Ellen Gulch, which adjoin the existing ski area). The proposed development is called "the 2016 Project." During the public comment phase of the review process, American Fork City submitted a letter to the Board of Adjustment expressing concern over possible impacts on the quality of their municipal water supply and requesting, among other things that Snowbird develop a water quality monitoring plan. Without conceding that there are or will be any impacts on water quality from its project, Snowbird has prepared this WQMP in response to American Fork City's comments.

This WQMP has been developed to guide water quality monitoring on Mary Ellen Creek. This effort is a voluntary effort by Snowbird and is not required by federal, state, or local regulations.

Figure 1 to this WQMP shows the Mary Ellen Creek watershed, the 2016 Project Area, and the six sampling locations identified for this WQMP. Site 1 is on the western headwater, upstream from the mined area in Mary Ellen Gulch, providing a background reference location. Site 2 is a second background reference location on the eastern headwater outside the project area. Site 3 is on the western headwater below the Quartzite claim tailings piles and above the confluence with the other headwaters. Site 4 is below the confluence of the headwaters and below all project construction activities. Site 5 is a downstream biological monitoring site (see Section 2 below). Site 6 is further downstream, near the confluence with the North Fork of the American Fork River. Sites 2, 4, 5, and 6 coincide with established Utah DWQ monitoring sites.

## **2. Objectives and Design**

The objective of this monitoring effort is to determine whether the development proposed in Snowbird's CUP applications, if permitted and implemented, adversely affects water quality in Mary Ellen Creek. Identification of any degradation of water quality not allowed by Snowbird's permits would provide a basis for remedial actions as required by applicable law.

The monitoring will be conducted in accordance with sample protocols established by Utah DWQ. Surface water sampling will occur at a point on Mary Ellen Gulch Creek immediately downstream of Snowbird's project area boundary to evaluate water quality in surface flows draining from areas above this point where ski area development occurs. This effort will identify seasonal patterns and long-term trends in water quality.

Field sampling will occur during conditions that allow safe and reasonably efficient sample collection. Sampling will be postponed due to hazards created by extreme cold or wind, risk of avalanche, and wildfire. In the event the creek is dry or frozen during regularly scheduled sampling visits, these conditions will be noted in the project file.

Water quality parameters included in this analysis are those associated with the State-assigned beneficial uses of Mary Ellen Creek and the American Fork River (i.e., secondary contact recreation, coldwater aquatic life, and agriculture) as well as several other parameters of concern identified in previous studies. Table 1 identifies all water quality parameters that will be tested by a State-certified laboratory including, test methods, detection limits, and sample holding times that will be used. Flow and pH will also be measured in the field at each monitoring site when samples are collected.

<b>Table 1. Water quality parameters to be measured by State-certified laboratory and Test Methods, Detection Limits, and Hold Times for each parameter.</b>			
<b>Parameter</b>	<b>EPA Test Method</b>	<b>Method Detection Limit (mg/L)</b>	<b>Hold Time (days)</b>
Aluminum	200.7	0.05	14
Arsenic	200.8	0.0005	14
Cadmium	200.8	0.0002	14
Chromium	200.8	0.0005	14
Copper	200.8	0.001	14
Iron	200.7	0.02	14
Lead	200.8	0.0005	14
Mercury	200.8	0.0002	14
Nickel	200.8	0.0005	14
Selenium	200.8	0.0005	14
Silver	200.8	0.0005	14
Zinc	200.7	0.01	14
TDS	SM2540C	10	7
Hardness	200.7	1.0	2

Baseline water quality conditions will be established using two methods. First historic monitoring data for Mary Ellen Creek will be compiled and summarized. Second, samples will be collected from Mary Ellen Creek on a monthly basis (as conditions allow) for 2 years after the CUPs are granted, presumably beginning in Spring of 2016. This 2-year baseline period will precede any development activity in Mary Ellen Gulch. All monthly samples will be collected at a minimum of 2 weeks apart. This sampling frequency will identify seasonal patterns and provide a detailed view of variation in water quality between months. These results will then be compared to the historic data summary to identify any differences from long-term concentrations and fluctuation patterns to validate the baseline condition.

Monthly monitoring will continue during construction in Mary Ellen Gulch. Once construction is complete, monitoring will shift to a quarterly regime (winter, spring, summer, and fall). The post-baseline monitoring period (during and after construction) will total 8 years.

In accordance with Utah DWQ standards, field duplicates and field blanks will be collected on 10 percent of the samples collected annually, as part of the quality control effort. A field duplicate is a second sample collected at the same time as the primary water sample. Analysis of a field duplicate indicates the reliability of field sample collection.

A field blank is a sample of analyte-free water poured into the container in the field and then preserved and shipped to the laboratory with the samples. A field blank indicates whether there was contamination from field conditions during sampling.

Biological monitoring will also be conducted annually at the second sampling location during the base flow monitoring period. Biological monitoring can account for the impact of all pollutants and how they interact to affect stream health (Karr 1981). Aquatic macroinvertebrates are a particularly good indicator of stream health as they spend the majority of their life in aqueous environments at a single location and are capable of integrating water quality impacts over time. As a result, their health indicates the influence of past conditions (Karr and Dudley 1981).

The method used to assess the results of macroinvertebrate monitoring will rely on the ratio of observed:expected species for a given location. This approach is currently utilized by Utah DWQ to evaluate stream health and impairment, and a detailed discussion of this methodology is found in Utah's 2010 Integrated Report (Utah DWQ 2010).

### **3. Special Precautions and Safety Plan**

Conditions accessing and at the monitoring site could result in safety concerns. Some of the physical hazards include steep terrain, snow avalanche hazards, and slick surfaces produced by ice, compact snow, and wet soil. Health hazards include extreme cold and other conditions leading to hypothermia or frostbite.

All field efforts will comply with safety protocol established by Snowbird to protect lift operators, ski patrol, and other employees working in an outdoor setting. Personnel involved in collecting water quality samples will be trained by Snowbird on this protocol. When conditions are adverse, sampling personnel will work in pairs. Monitoring visits during winter will account for avalanche control operations and short-term weather forecasts. All monitoring visits will be coordinated with the Snowbird General Manager.

Prior to field work, all personnel collecting samples will be trained on any invasive aquatic species concerns related to water resources in American Fork Canyon and invasive weeds species monitored by Snowbird or the Wasatch-Cache National Forest.

### **4. Field Sampling Methods and Documentation**

All data will be collected in accordance with guidelines found in Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations* (Utah DWQ 2014) that pertain to cooperative monitoring of chemical water quality and will obtain any training from Utah DWQ required therein. Laboratory QA/QC methods and documentation can be obtained from a State-certified laboratory used to process water quality samples collected under this WQMP. Field forms and example chain-of-custody forms are provided in Appendix A.

Sampling personnel will be trained to collect monitoring samples in accordance with Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations*. Sampling personnel will collect water samples when environmental conditions permit safe access to Mary Ellen Creek and the monitoring location. Sample equipment and any necessary safety equipment will be checked against a checklist prior to the site visit. Field staff will record environmental conditions that may influence water quality in the short- or long-term on field forms during the visit (i.e., air temperature, precipitation, flow estimate, bank stability, etc.).

Each sample will be collected in clean, laboratory-supplied sample bottles. Samples will be collected at the monitoring site from a location that appears well-mixed. Generally, this will be the deepest part of the stream channel near the middle of the water column. All sample bottles will be labeled with information including the date and time the sample was collected, and the location will be recorded using a GPS unit.

All sample bottles will be handled according to protocol guidelines from the State-certified laboratory used to process water quality samples. All sample containers will be preserved (as needed), stored on ice in a cooler and delivered to the laboratory within the maximum holding time for each parameter. A chain-of-custody form will be maintained with the samples at all times. As part of the field QA/QC program, field blanks and field duplicates (see Section 2 above) will be collected and submitted to the laboratory (roughly one for every 10 analyses).

The following sample equipment will be used for field work:

- General:
  - GPS unit with loaded maps and sample location.
  - Rite-In-Rain field notebook.
  - Field forms.
  - Cell phone.
  - Camera.
- Water Chemistry Sampling:
  - Chain-of-custody forms.
  - Sample bottles, pre-cleaned and appropriate size and number.
  - Fine-point Sharpie pens.
  - Weatherproof bottle labels and spare bottle labels.
  - Gloves, powderless, dye-free.
  - Cooler, nonmetallic, with white interior for transporting samples.
  - pH water quality sensor.
  - Portable electronic flow measurement device.

Corrective actions will be taken, if necessary to obtain a complete dataset, including resampling within the required monitoring window.

## **5. Laboratory Sample Handling Procedures**

Sample containers, preservatives, minimum sample volume, and necessary preservation are shown in Table 2. Sample hold times are included above in Table 1.



<b>Parameter</b>	<b>Analytical Method</b>	<b>Minimum Sample Volume</b>	<b>Sample Bottle</b>	<b>Sample Preservation</b>
All Dissolved Metals	EPA 200.7, EPA 200.8	250 ml	HDPE	Chilled <4°C
TDS	SM2540C	250 ml	HDPE	Chilled <4°C
Hardness	EPA 200.7	250 ml	HDPE	None

A copy of a chain-of-custody form is included in **Appendix A** to this WQMP. A chain-of-custody form will be maintained with the laboratory samples at all times. A copy of each chain-of-custody form will be included in the project file. All sample labels will be filled out entirely for each sample using permanent ink, just prior to sample collection. At a minimum, each label will include sample date, time, location, and name of person collecting the sample.

Each sample will be stored on ice, in a non-metallic, insulated container, and transported or shipped to a State-certified laboratory within the required holding time. Each sample will be accompanied by a chain-of-custody form. The original form will be given to the laboratory and Snowbird will keep a copy for their records.

## **6. Analytical Methods and Laboratory Documentation**

The list of water quality parameters, EPA test methods, and detection limits are included in Section 2, Table 1, above. Standard Operating Procedures and analytical methods will be provided by the State-certified laboratory used to process samples. The laboratory will also provide printed and electronic copies of all results, and will maintain a file of original chain-of-custody forms. Printed laboratory results will include a signed cover letter and all results will appear on certifiable letterhead paper. Printed results will also include a work order receipt report and a copy of the chain-of-custody report.

## **7. Project Quality Control Requirements**

The project manager will review field forms, laboratory results, and data validation results (i.e., field duplicates and trip blanks) after each visit. All data will be reviewed and verified or validated as appropriate. In addition to the laboratory QA/QC analysis, the project manager will conduct additional QA/QC procedures including but not limited to: periodic checks of chain-of-custody forms, review of all electronic results and comparison to printed copies, comparison of results to field blanks and duplicate sample results, and identification of outliers. If inconsistencies are found, the project manager will consult with the laboratory to identify potential sources of error before removing the data point from further use.

Monitoring results that are identified as below minimum detection level (MDL) will be used in a manner that complies with Utah DWQ protocol and analysis. This result is in response to concentrations that are detected but cannot be quantified due to technology limits of the testing method. Although the actual concentration is subject to a high degree of quantitative uncertainty, the levels are low enough that compliance with standards can be determined in most instances. The MDL indicated in Table 1 will identify if parameters exceed State water quality standards with the exception of Mercury. The Mercury parameter has a standard protecting cold water aquatic life of 0.000012 mg/L, which is less than the MDL. The State is currently aware of the conflict between standards and measurement technology, and is working to resolve this issue.

## **8. Data Analysis, Record Keeping, and Reporting Requirements**

Establishment of the 2-year baseline condition in Mary Ellen Creek is described above in Section 2. All data collected following project implementation will be compared to that baseline. The data collected under this WQMP is expected to be variable based on previous investigations and ongoing monitoring. The question to be answered through this analysis is whether or not the variability of dissolved metals and TDS falls within historic data ranges for Mary Ellen Creek.

To answer this question, data collected in year three and each subsequent, post implementation years will be averaged for each water quality constituent. Inferential statistical analyses (t-test) will be completed to determine whether each annual mean is significantly different ( $P = 0.10$ ) from the baseline value. Depending on the amount of variability in the data, and given the small sample size, a nonparametric trend-line method may be substituted for the inferential analysis. This would be subject to approval by Utah County.

Snowbird will prepare a quarterly report on the monitoring results. Beginning after the first four quarters of monitoring data results after the CUPs are issued to Snowbird, each quarterly monitoring report will include a four-quarter rolling average of collected data. Quarterly reports will summarize the data, identify any statistically significant differences from the 2-year baseline conditions, and note any deviations from this WQMP. Laboratory reports will be included as appendices. Reports will be provided to Utah County, Utah DWQ, and American Fork City.

## **9. Schedule**

Sample collection will begin following issuance of the CUPs by the Utah County Board of Adjustment. As noted in Section 2, samples will be collected on a monthly basis for a period of 2 years from the first sample visit, presumably in spring 2016, to establish a baseline. Monthly sampling will be continued through construction periods. During intervals between construction periods and once construction is complete, water samples will be collected on a quarterly basis (i.e., winter, spring, summer, fall). The total monitoring period will be 8 years beyond the end of 2-year baseline monitoring.

All costs of implementing this WQMP, including laboratory costs, will be borne by Snowbird. Laboratory services will be provided by a State-certified facility and approved by Utah County, which initially will be Chemtech-Ford Analytical Laboratory in Sandy, Utah.

## **10. Project Team and Responsibilities**

Snowbird has engaged an environmental project manager for this WQMP. The project manager will ensure that data collection and analytical procedures outlined herein are followed and reports are submitted in a timely fashion.

The sampling, data analysis, and reporting procedures outlined herein will be completed by a qualified third-party contractor engaged and paid for by Snowbird following CUP approval by Utah County. This contractor will be supported by Snowbird's project manager, who will ensure that all provisions of this WQMP are met.

The laboratory analysis of water quality samples will be completed by a State-certified facility selected by Snowbird and approved by Utah County, which initially shall be Chemtech-Ford Analytical Laboratory.

American Fork City will have the option of sending representatives to observe the collection of the monitoring samples collected pursuant to this WQMP; however, American Fork City and its representatives have elected not to take samples on real property that Snowbird owns, leases, or is permitted to use at this time. In the event American Fork City or its representatives desire to collect water samples hereafter from real property that Snowbird owns, leases, or is permitted to use as depicted in Figure 1, Snowbird and American Fork City shall first agree in writing upon the protocols for sampling, analysis, and reporting. Snowbird will provide American Fork with a minimum of 24-hours advance notice of when it will collect samples pursuant to this WQMP. Snowbird will provide notice via email to [erniej50@gmail.com](mailto:erniej50@gmail.com) or to such other email that American Fork City provides to Snowbird.

### **11. Sharing Information**

Snowbird will submit quarterly reports of water monitoring results to Utah County, Utah DWQ, and American Fork City not more than 10 business days following receipt by Snowbird of the last set of laboratory reports included in each report.

Within 5 business days of submitting building permit applications for this project to Utah County, Snowbird will provide copies of those applications to American Fork City. At American Fork City's request, Snowbird will meet at a mutually agreeable time and place to discuss these permit submittals.

Within 5 business days of submitting to the Utah DWQ a notice of intent for Snowbird's project to be covered by the Utah Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities No. UTRC00000, Snowbird will provide a copy of such notice of intent to Utah County and American Fork City. The notice of intent form for permit coverage is to be obtained via the following DWQ webpage:

<http://www.deq.utah.gov/Permits/water/updes/stormwatercon.htm>.

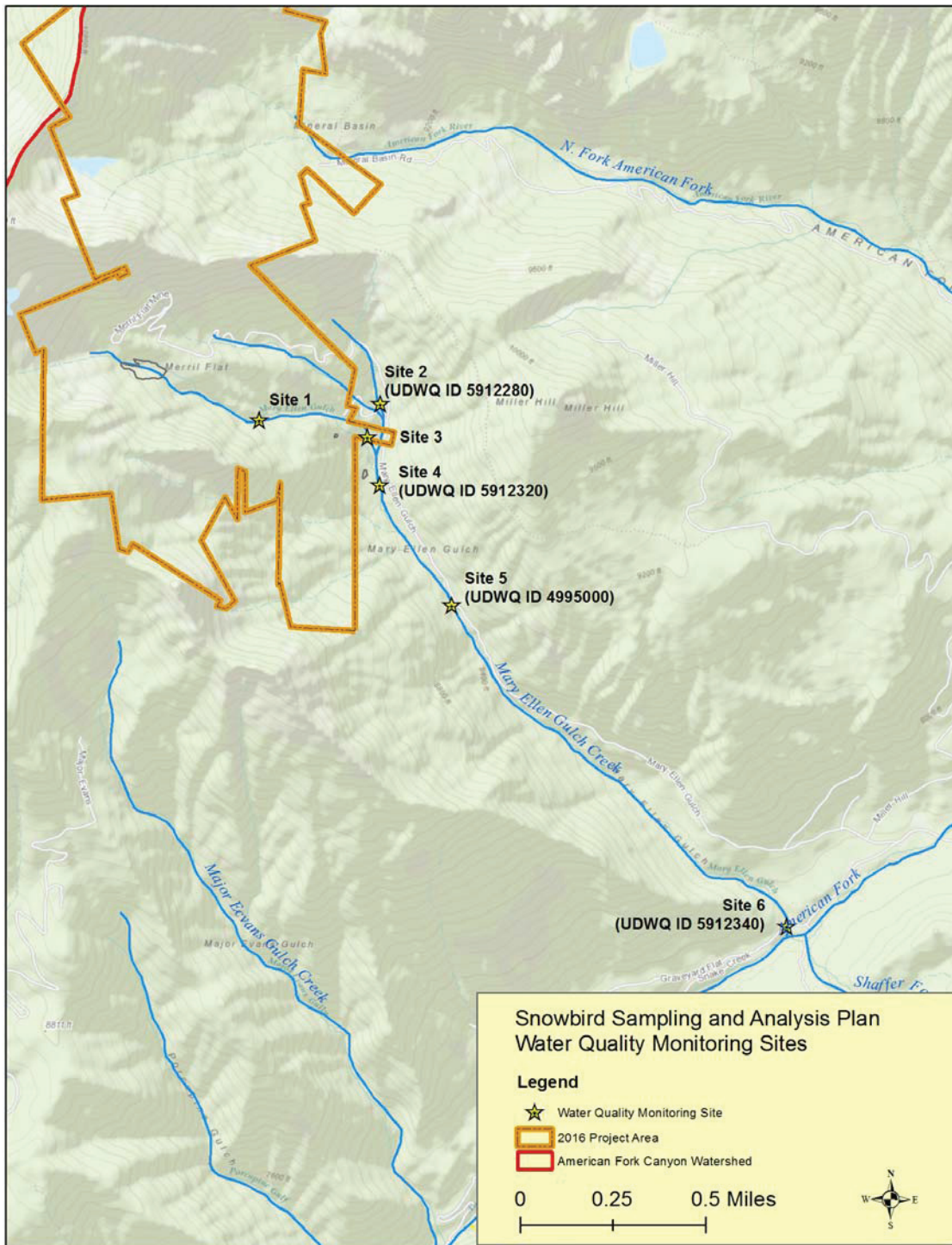
### **12. Responsive Action**

In the event that the monitoring outlined in this WQMP demonstrates that construction or operation of the 2016 Project degrades water quality relative to baseline conditions, Snowbird will complete any remediation required by applicable permit requirements, laws, and regulations.

## **References**

- Calkins and Butler. 1943. Geology and Ore Deposits of the Cottonwood-American Fork Area, Utah. Professional Paper 201. United States Department of the Interior. Harold L. Ickes, Secretary. Geological Survey W.E. Wrather, Director.
- Lidstone & Anderson, Inc. 1993. American Fork Hydrology and Water Quality Study. Prepared for: Utah Division of Oil, Gas, and Mining Abandoned Mine Reclamation Program and the United States Forest Service Uintah National Forest. Fort Collins, CO. February 3.
- Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6:21-27.
- Karr, J.R. and D.R. Dudley. 1981. Ecological perspectives on water quality goals. Environmental Management 5(1):55-68.
- Kimball, B.A., Runkel, R.L., and Gerner, L.J. 2009. Methods and basic data from mass-loading studies in American Fork, October 1999, and Mary Ellen Gulch, Utah, September 2000: U.S. Geological Survey Data Series 443, 33p. Available at <http://pubs.usgs.gov/ds/443>.
- Merritt, L.B. 1988. Preliminary Survey of Water Quality in Mine Drain in Sheeprock Mountains and North Fork of the American Fork River. Prepared for the Uinta National Forest. Provo, Utah. July.
- Utah DWQ (Division of Water Quality). 2010. Draft 2010 Utah Integrated Report Water Quality Assessment 305(b) Report. Utah Division of Water Quality Utah Department of Environmental Quality.
- Utah DWQ. 2014. Quality Assurance Program Plan for Environmental Data Operations. Final Plan. Revision No. 1.0, Effective September 5, 2014. Utah Division of Water Quality, Utah Department of Environmental Quality. 195 North 1950 West, Salt Lake City, Utah 84116.

Figure 1



**Appendix A**

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## Field Form - Water Quality Sample Collection

Mary Ellen Gulch Sample Analysis Plan

Date

---

Sample Location

---

Surveyor Name

---

**Field Conditions (check all that apply)**

Dry

Clear

Rain

Partly Cloudy

Snow

Mostly Cloudy

Overcast

**Site Photo ID**

Upstream

---

Downstream

---

No. of samples collected

---

Sample IDs

---

**Comments**

(brief description of sample collection along with any conditions that may influence water quality; i.e. surface runoff, storm event, channel disturbance, etc.)







**From:** Hilary Arens <@snowbird.com>  
**To:** Bryce Armstrong <@utahcounty.gov>  
**CC:** Robert May <@utahcounty.gov>  
**Date:** 4/25/2016 2:27 PM  
**Subject:** RE: Minor changes to WQMP for Mary Ellen Gulch Creek and Updated Version (4.19.2016)

Great. Thank you, Bryce. I will include you and Robert on all future Mary Ellen Gulch correspondences for the Utah County contacts.

Best,?

-Hilary

Hilary Arens  
Director of Water Resources & Environmental Programs  
Snowbird Ski and Summer Resort

Office: (801) 933-  
Snowbird Extension  
www.snowbird.com<<http://www.snowbird.com/>>  
[cid:5C76D699-0DA1-46C3-8B49-D1EE33700479]

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From: Bryce Armstrong <@utahcounty.gov>  
Sent: Monday, April 25, 2016 2:18 PM  
To: Hilary Arens  
Cc: Robert May  
Subject: Re: Minor changes to WQMP for Mary Ellen Gulch Creek and Updated Version (4.19.2016)

Hilary,

Thanks for the update on the water quality monitoring plan. I will include this updated copy in the file.

Myself and Robert May will be the contact person(s) for Utah County Community Development going forward. You can continue to send correspondence to me and I will distribute as needed.  
Thanks,

Bryce Armstrong  
Associate Director  
Utah County Community Development  
(801)851- >>> Hilary Arens <@snowbird.com> 4/25/2016 11:54 AM >>>  
All-

Attached is the updated "Water Quality Monitoring Plan for Mary Ellen Gulch Creek American Fork Canyon (WQMP)". There are a few MINOR changes since the April 7th draft, and they are as follows:

1) Upon communication with DWQ, Site 1 is synonymous with an existing DWQ monitoring location. Site

1 is now 5992274.

2) Upon communication? with DWQ, DWQ created a new monitoring location for Site 3. ? Site 3 is now MLID 5912317 and is called: "Mary Ellen Gulch west headwater bl quartzite mine claim tailing piles & ab confl w/other headwaters"

3) The following sentence has been added: "Sites 1, 2, 3, 4, 5, and 6 coincide with preexisting or newly established Utah DWQ monitoring sites."

4) Figure 1 (map) now reflects these updated monitoring location ID's.

5) Section 2, page 4, second to last paragraph before Section 3:

The sentence:

"Biological monitoring will also be conducted annually at the second sampling location during the base flow monitoring period."

Has now been change to:

"Biological monitoring will also be conducted annually at Site 5 sampling location during the base flow monitoring period."

This was an oversight in the latter drafts of the WQMP as more sampling locations sites were added.

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Please note: This attached document has been updated to reflect these minor changes and is now dated April 19, 2016.

Please share with additional appropriate parties as necessary and let me know if you have any questions.

Bryce: I am not sure who the appropriate Utah County contact is now for this project. Please advise to whom future correspondences should be sent.

Nestor and Ernie: If there is an additional appropriate American Fork City contact that future correspondences should also be sent to, please let me know.

Thank you,

Hilary

**From:** Neal Artz [REDACTED]@cirruses.com>  
**To:** Hilary Arens [REDACTED]@snowbird.com>, [REDACTED]@swlaw.com" [REDACTED]@swlaw.c...  
**CC:** "Colby Rollins" <[REDACTED]@aicpvt.com>, Bob Bonar <[REDACTED]@snowbird.com>, "...  
**Date:** 4/26/2016 10:00 AM  
**Subject:** Re: Minor changes to WQMP for Mary Ellen Gulch Creek and Updated Version (4.19.2016)

Maybe you should send out a Doodle Poll...

Neal E. Artz, PhD, Owner  
 Cirrus Ecological Solutions, LC  
 965 S. 100 W., Suite 200  
 Logan, UT 84321  
 Office: (435) 787-[REDACTED]  
 Fax: (435) 787-1495  
 Mobile: (435) 757-[REDACTED]  
 www.cirruses.com <<http://www.cirruses.com/>>

On 4/26/16, 7:06 AM, "Nestor Gallo" [REDACTED]@afcity.net> wrote:

>Good morning Hilary,  
 >  
 >I am very sorry for taking this long to respond to your emails.  
 >Thank you for inviting me to help with the water sampling program ... as you may know, I am always ready to learn something new from professionals with your experience.  
 >  
 >My work schedule is incredibly busy so I was wondering if you could schedule the water sampling for a Thursday afternoon ... I am not sure how long it takes to hike to the area where the monitoring stations are located ... is 4 or 5 hours on a Thursday afternoon enough time to collect the water samples?  
 >  
 >Also, where should we meet?  
 >Is Tibble Fork a good location to gather and start hiking up to the sites?  
 >Could you, please, consult with your team and let me know?  
 >Thank you for all your help.  
 >Best regards,  
 >  
 >Nestor Gallo, P.E.  
 >City Engineer  
 >Engineering Division  
 >Public Works Department  
 >American Fork City  
 >(801) 854-[REDACTED]  
 >  
 >-----Original Message-----  
 >From: Hilary Arens [mailto:[REDACTED]@snowbird.com]  
 >Sent: Monday, April 25, 2016 11:54 AM  
 >To: [REDACTED]@swlaw.com; [REDACTED]@swlaw.com; [REDACTED]@swlaw.com; Nestor Gallo <[REDACTED]@afcity.net>; Carl Adams <[REDACTED]@utah.gov>; [REDACTED]@utahcounty.gov; Ernest John <[REDACTED]@gmail.com>  
 >Cc: 'Colby Rollins' <[REDACTED]@aicpvt.com>; Bob Bonar <[REDACTED]@snowbird.com>; Neal Artz

<[REDACTED]@cirrus.com>; [REDACTED]@cirrus.com; 'Keith Hanson' <[REDACTED]@canyonwater.com>; [REDACTED]@cirrus.com

>Subject: Minor changes to WQMP for Mary Ellen Gulch Creek and Updated Version (4.19.2016)

>

>All-

>

>

>Attached is the updated "Water Quality Monitoring Plan for Mary Ellen Gulch Creek American Fork Canyon (WQMP)". There are a few MINOR changes since the April 7th draft, and they are as follows:

>

>

>1) Upon communication with DWQ, Site 1 is synonymous with an existing DWQ monitoring location. Site 1 is now 5992274.

>

>2) Upon communication? with DWQ, DWQ created a new monitoring location for Site 3. ? Site 3 is now MLID 5912317 and is called: "Mary Ellen Gulch west headwater bl quartzite mine claim tailing piles & ab confl w/other headwaters"

>

>3) The following sentence has been added: "Sites 1, 2, 3, 4, 5, and 6 coincide with preexisting or newly established Utah DWQ monitoring sites."

>

>

>4) Figure 1 (map) now reflects these updated monitoring location ID's.

>

>5) Section 2, page 4, second to last paragraph before Section 3:

>

>The sentence:

>

>"Biological monitoring will also be conducted annually at the second sampling location during the base flow monitoring period."

>

>Has now been change to:

>

>"Biological monitoring will also be conducted annually at Site 5 sampling location during the base flow monitoring period."

>

>

>This was an oversight in the latter drafts of the WQMP as more sampling locations sites were added.

>

>

>\*\*\*

>

>Please note: This attached document has been updated to reflect these minor changes and is now dated April 19, 2016.

>

>

>Please share with additional appropriate parties as necessary and let me know if you have any questions.

>

>

>Bryce: I am not sure who the appropriate Utah County contact is now for this project. Please advise to whom future correspondences should be sent.

>

>

>Nestor and Ernie: If there is an additional appropriate American Fork City contact that future correspondences should also be sent to, please let me know.

>  
>  
>Thank you,  
>  
>Hilary  
>  
>  
>

**From:** Hilary Arens <[REDACTED]@snowbird.com>  
**To:** Carl Adams <[REDACTED]@utah.gov>, "[REDACTED]@utahcounty.gov" <[REDACTED]@utahcou...>  
**CC:** "Weston, John" <[REDACTED]@swlaw.com>, "[REDACTED]@swlaw.com" <[REDACTED]@swlaw.com...>  
**Date:** 5/5/2016 10:42 AM  
**Subject:** Updated WQMP.5.4.2016 FINAL  
**Attachments:** WQMP Mary Ellen Gulch Creek.5.4.2016.FINAL.docx

All-

Please update your files that this is the current FINAL for the WQMP dated May 4, 2016.

EDIT TO THIS DRAFT:

Site 2 was assigned the wrong DWQ MLID in previous drafts of 5912280.  
?

Working with DWQ:

Site 2 is now DWQ MLID 5912277 "Mary Ellen Gulch eastern tributary AB middle tributary confl & AB USFS 011 road xing" and is reflected on the map.

?

My apologies for the multiple drafts to get to this point. I do not anticipate any additional changes.

Best,

-Hilary

Hilary Arens  
Director of Water Resources & Environmental Programs  
Snowbird Ski and Summer Resort

Office: (801) 933-[REDACTED]  
Snowbird Extension [REDACTED]  
www.snowbird.com<<http://www.snowbird.com/>>  
[cid:5C76D699-0DA1-46C3-8B49-D1EE33700479]

**From:** Hilary Arens <[REDACTED]@snowbird.com>  
**To:** Nestor Gallo <[REDACTED]@afcity.net>, Carl Adams <[REDACTED]@utah.gov>, "[REDACTED]"  
**CC:** "Weston, John" <[REDACTED]@swlaw.com>, "[REDACTED]@swlaw.com"  
<[REDACTED]@swlaw.com...>  
**Date:** 5/9/2016 8:56 AM  
**Subject:** RE: Updated WQMP.5.4.2016 FINAL  
**Attachments:** WQMP Mary Ellen Gulch Creek.5.4.2016.FINAL.docx

Thank you for the update, Nestor. I have incorporated your changes into the attached version dated May 4, 2016.

Until further edits or changes are requested or made, let's consider this version the most up-to-date.

Thanks  
Hilary

Hilary Arens  
Director of Water Resources & Environmental Programs  
Snowbird Ski and Summer Resort

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Snowbird Extension [REDACTED]  
www.snowbird.com

---

From: Nestor Gallo <[REDACTED]@afcity.net>  
Sent: Friday, May 6, 2016 2:43 PM  
To: Hilary Arens; Carl Adams; [REDACTED]@utahcounty.gov; Ernest John  
Cc: Weston, John; [REDACTED]@swlaw.com; Cahoon, Brad; [REDACTED]@cirruses.com; 'Keith Hanson'; Bob Bonar; Neal Artz; Jay Brems; Dale Goodman  
Subject: RE: Updated WQMP.5.4.2016 FINAL

Hi Hilary,

I am attaching an amended version of the WQMP ... some minor comments on section 10 in which we request that the water sampling results be submitted to the Public Works Director, Mr. Dale Goodman, and the Water Superintendent, Mr. Jay Brems.

Thank you for all your help.  
Have a great week-end!  
Regards,

Nestor

-----Original Message-----

From: Hilary Arens [mailto:[REDACTED]@snowbird.com]  
Sent: Thursday, May 05, 2016 10:42 AM  
To: Carl Adams <[REDACTED]@utah.gov>; [REDACTED]@utahcounty.gov; Ernest John <[REDACTED]@gmail.com>; Nestor Gallo <[REDACTED]@afcity.net>  
Cc: Weston, John <[REDACTED]@swlaw.com>; [REDACTED]@swlaw.com; Cahoon, Brad <[REDACTED]@swlaw.com>; [REDACTED]@cirruses.com; 'Keith Hanson' <[REDACTED]@canyonwater.com>; Bob Bonar <[REDACTED]@snowbird.com>; Neal Artz <[REDACTED]@cirruses.com>

Subject: Updated WQMP.5.4.2016 FINAL

All-

Please update your files that this is the current FINAL for the WQMP dated May 4, 2016.

EDIT TO THIS DRAFT:

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?

My apologies for the multiple drafts to get to this point. I do not anticipate any additional changes.

Best,

-Hilary

Hilary Arens

Director of Water Resources & Environmental Programs Snowbird Ski and Summer Resort

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[cid:5C76D699-0DA1-46C3-8B49-D1EE33700479]



**FINAL**

**WATER QUALITY MONITORING PLAN FOR:**

**MARY ELLEN GULCH CREEK**

**AMERICAN FORK CANYON**

May 4, 2016

Prepared for:  
Snowbird Ski Resort

Prepared by:  
Cirrus Ecological Solutions  
965 South 100 West, Suite 200  
Logan, UT

## **DISTRIBUTION LIST**

Bryce Armstrong, Associate Director  
Utah County Department of Community Development  
51 South University Ave., No. 117, Provo, UT 84601

## **ACRONYMS AND ABBREVIATIONS**

CUP – Conditional Use Permit

Utah DEQ – Utah Department of Environmental Quality

Utah DWQ – Utah Division of Water Quality

NFRAP – No Further Remedial Action Planned

CERCLIS – Comprehensive Environmental Response, Compensation and Liability Information System

EPA – U.S. Environmental Protection Agency

QA/QC – Quality Assurance Quality Control

GPS – Geographic Positioning System

HDPE – High Density Polyethylene

TDS – Total Dissolved Solids

WQMP – Water Quality Monitoring Plan

## **1. Introduction**

This water quality monitoring plan (WQMP) was prepared in accordance with the format developed by the Utah Division of Water Quality (Utah DWQ; *Quality Assurance Program Plan for Environmental Data Operations*, Final Plan Revision No. 1.0. Effective September 5, 2014). Suggested content is listed at the beginning of each section.

Similar to many drainages along the Wasatch Front, American Fork Canyon is highly mineralized. Historic mining activities created surface deposits of mine waste rock material, milled tailings and, in some cases, water discharge from mine portals, all of which can potentially increase naturally occurring metals concentrations in the American Fork River and its tributaries. Mining occurred in Mary Ellen Gulch starting in the 1860s and continuing through the 1940s (Calkins and Butler 1943), and the resulting conditions have contributed to metal loading in Mary Ellen Creek, an American Fork tributary that is the focus of this monitoring effort.

Concerns about mining-related impacts on water quality in the upper American Fork watershed emerged in the 1980s, and studies by the U.S. Forest Service (e.g., Merritt 1988) and other agencies led to the U.S. Environmental Protection Agency (EPA) designation in 1992 of a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site (UTD988074951). The EPA issued a determination of No Further Remedial Action Planned (NFRAP) in 2002. The CERCLIS site was archived in 2003. It was moved to active status in 2005 because of Forest Service concerns about the Pacific Mine (in lower Mineral Basin). The Pacific Mine repository was completed in 2006. The NFRAP classification remains to date.

Studies completed from the late 1980s through 2000, concluding with a U.S. Geological Survey synoptic tracer study conducted in 2000 (Kimball et al. 2009) identified the location of major sources of mine waste in American Fork Canyon and evaluated water quality concerns. These included the Mary Ellen Mines.

The Mary Ellen Mines, which include the Live Yankee Mine, left a number of mine dumps and processed tailings in Mary Ellen Gulch. The steep, bare slopes of the piles show evidence of erosion and runoff from precipitation events.

The Mary Ellen Mines' adits and tailings are the primary source of trace metals in Mary Ellen Creek. However, water quality measurements collected immediately above the confluence with the North Fork of the American Fork River show that all State-assigned water quality standards are being met.

Despite the EPA's determination of NFRAP, remediation projects were completed for the three primary areas of concern. In 1997, Snowbird started re-routing discharge from the Live Yankee Mine north adit around the tailings piles. The 2000 USGS study indicated that downstream water quality was significantly better than in years before the project. In 2003, the Forest Service constructed the Dutchman Flat repository, combining material from the Bog Mine and several other nearby sources. In 2006, Snowbird and Trout Unlimited built a similar repository on private land for material from the Pacific Mine and other nearby mines. In 2008, Snowbird and Trout Unlimited again collaborated to install a more permanent drainage system at the Live Yankee north adit.

Utah DWQ continues to monitor surface water quality on Mary Ellen Creek and the American Fork River above and below their confluence. Utah DWQ has confirmed the "...status of the American Fork River, Segment 2, from Tibble Fork Reservoir to headwaters. From the latest Integrated Report this segment is placed in Assessment Category 3, 'Insufficient Data with Exceedances' (Chapter 5 – 303(d) List of Rivers and Streams, 2014). The river has not been assessed as impaired nor has it been assessed as fully supporting its designated beneficial uses due to the lack of sufficient data to make a full assessment. The exceedances refer to a single sample collected from Mary Ellen Gulch that exceeded the chronic criteria for Cadmium in 2009." (Utah DWQ Feb. 17, 2016 Letter.)

In December 2015, Snowbird Ski and Summer Resort (Snowbird) requested two conditional use permits (CUPs) from Utah County's Board of Adjustment to construct accessory ski lifts, replace and increase the height of some existing ski lift towers and construct some associated mountain resort facilities on their private land in Utah County (Mineral Basin and Mary Ellen Gulch, which adjoin the existing ski area). The proposed development is called "the 2016 Project." During the public comment phase of the review process, American Fork City submitted a letter to the Board of Adjustment expressing concern over possible impacts on the quality of their municipal water supply and requesting, among other things that Snowbird develop a water quality monitoring plan. Without conceding that there are or will be any impacts on water quality from its project, Snowbird has prepared this WQMP in response to American Fork City's comments.

This WQMP has been developed to guide water quality monitoring on Mary Ellen Creek. This effort is a voluntary effort by Snowbird and is not required by federal, state, or local regulations.

Figure 1 to this WQMP shows the Mary Ellen Creek watershed, the 2016 Project Area, and the six sampling locations identified for this WQMP. Site 1 is on the western headwater, upstream from the mined area in Mary Ellen Gulch, providing a background reference location. Site 2 is a second background reference location on the eastern headwater outside the project area. Site 3 is on the western headwater below the Quartzite claim tailings piles and above the confluence with the other headwaters. Site 4 is below the confluence of the headwaters and below all project construction activities. Site 5 is a downstream biological monitoring site (see Section 2 below). Site 6 is further downstream, near the confluence with the North Fork of the American Fork River. All sites coincide with established Utah DWQ monitoring sites.

## **2. Objectives and Design**

The objective of this monitoring effort is to determine whether the development proposed in Snowbird's CUP applications, if permitted and implemented, adversely affects water quality in Mary Ellen Creek. Identification of any degradation of water quality not allowed by Snowbird's permits would provide a basis for remedial actions as required by applicable law.

The monitoring will be conducted in accordance with sample protocols established by Utah DWQ. Surface water sampling will occur at a point on Mary Ellen Gulch Creek immediately downstream of Snowbird's project area boundary to evaluate water quality in surface flows draining from areas above this point where ski area development occurs. This effort will identify seasonal patterns and long-term trends in water quality.

Field sampling will occur during conditions that allow safe and reasonably efficient sample collection. Sampling will be postponed due to hazards created by extreme cold or wind, risk of avalanche, and wildfire. In the event the creek is dry or frozen during regularly scheduled sampling visits, these conditions will be noted in the project file.

Water quality parameters included in this analysis are those associated with the State-assigned beneficial uses of Mary Ellen Creek and the American Fork River (i.e., secondary contact recreation, coldwater aquatic life, and agriculture) as well as several other parameters of concern identified in previous studies. Table 1 identifies all water quality parameters that will be tested by a State-certified laboratory including, test methods, detection limits, and sample holding times that will be used. Flow and pH will also be measured in the field at each monitoring site when samples are collected.

<b>Table 1. Water quality parameters to be measured by State-certified laboratory and Test Methods, Detection Limits, and Hold Times for each parameter.</b>			
<b>Parameter</b>	<b>EPA Test Method</b>	<b>Method Detection Limit (mg/L)</b>	<b>Hold Time (days)</b>
Aluminum	200.7	0.05	14
Arsenic	200.8	0.0005	14
Cadmium	200.8	0.0002	14
Chromium	200.8	0.0005	14
Copper	200.8	0.001	14
Iron	200.7	0.02	14
Lead	200.8	0.0005	14
Mercury	200.8	0.0002	14
Nickel	200.8	0.0005	14
Selenium	200.8	0.0005	14
Silver	200.8	0.0005	14
Zinc	200.7	0.01	14
TDS	SM2540C	10	7
Hardness	200.7	1.0	2

Baseline water quality conditions will be established using two methods. First historic monitoring data for Mary Ellen Creek will be compiled and summarized. Second, samples will be collected from Mary Ellen Creek on a monthly basis (as conditions allow) for 2 years after the CUPs are granted, presumably beginning in Spring of 2016. This 2-year baseline period will precede any development activity in Mary Ellen Gulch. All monthly samples will be collected at a minimum of 2 weeks apart. This sampling frequency will identify seasonal patterns and provide a detailed view of variation in water quality between months. These results will then be compared to the historic data summary to identify any differences from long-term concentrations and fluctuation patterns to validate the baseline condition.

Monthly monitoring will continue during construction in Mary Ellen Gulch. Once construction is complete, monitoring will shift to a quarterly regime (winter, spring, summer, and fall). The post-baseline monitoring period (during and after construction) will total 8 years.

In accordance with Utah DWQ standards, field duplicates and field blanks will be collected on 10 percent of the samples collected annually, as part of the quality control effort. A field duplicate is a second sample collected at the same time as the primary water sample. Analysis of a field duplicate indicates the reliability of field sample collection.

A field blank is a sample of analyte-free water poured into the container in the field and then preserved and shipped to the laboratory with the samples. A field blank indicates whether there was contamination from field conditions during sampling.

Biological monitoring will also be conducted annually at the Site 5 sampling location during the base flow monitoring period. Biological monitoring can account for the impact of all pollutants and how they interact to affect stream health (Karr 1981). Aquatic macroinvertebrates are a particularly good indicator of stream health as they spend the majority of their life in aqueous environments at a single location and are capable of integrating water quality impacts over time. As a result, their health indicates the influence of past conditions (Karr and Dudley 1981).

The method used to assess the results of macroinvertebrate monitoring will rely on the ratio of observed:expected species for a given location. This approach is currently utilized by Utah DWQ to evaluate stream health and impairment, and a detailed discussion of this methodology is found in Utah's 2010 Integrated Report (Utah DWQ 2010).

### **3. Special Precautions and Safety Plan**

Conditions accessing and at the monitoring site could result in safety concerns. Some of the physical hazards include steep terrain, snow avalanche hazards, and slick surfaces produced by ice, compact snow, and wet soil. Health hazards include extreme cold and other conditions leading to hypothermia or frostbite.

All field efforts will comply with safety protocol established by Snowbird to protect lift operators, ski patrol, and other employees working in an outdoor setting. Personnel involved in collecting water quality samples will be trained by Snowbird on this protocol. When conditions are adverse, sampling personnel will work in pairs. Monitoring visits during winter will account for avalanche control operations and short-term weather forecasts. All monitoring visits will be coordinated with the Snowbird General Manager.

Prior to field work, all personnel collecting samples will be trained on any invasive aquatic species concerns related to water resources in American Fork Canyon and invasive weeds species monitored by Snowbird or the Wasatch-Cache National Forest.

### **4. Field Sampling Methods and Documentation**

All data will be collected in accordance with guidelines found in Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations* (Utah DWQ 2014) that pertain to cooperative monitoring of chemical water quality and will obtain any training from Utah DWQ required therein. Laboratory QA/QC methods and documentation can be obtained from a State-certified laboratory used to process water quality samples collected under this WQMP. Field forms and example chain-of-custody forms are provided in Appendix A.

Sampling personnel will be trained to collect monitoring samples in accordance with Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations*. Sampling personnel will collect water samples when environmental conditions permit safe access to Mary Ellen Creek and the monitoring location. Sample equipment and any necessary safety equipment will be checked against a checklist prior to the site visit. Field staff will record environmental conditions that may influence water quality in the short- or long-term on field forms during the visit (i.e., air temperature, precipitation, flow estimate, bank stability, etc.).

Each sample will be collected in clean, laboratory-supplied sample bottles. Samples will be collected at the monitoring site from a location that appears well-mixed. Generally, this will be the deepest part of the stream channel near the middle of the water column. All sample bottles will be labeled with information including the date and time the sample was collected, and the location will be recorded using a GPS unit.

All sample bottles will be handled according to protocol guidelines from the State-certified laboratory used to process water quality samples. All sample containers will be preserved (as needed), stored on ice in a cooler and delivered to the laboratory within the maximum holding time for each parameter. A chain-of-custody form will be maintained with the samples at all times. As part of the field QA/QC program, field blanks and field duplicates (see Section 2 above) will be collected and submitted to the laboratory (roughly one for every 10 analyses).

The following sample equipment will be used for field work:

- General:
  - GPS unit with loaded maps and sample location.
  - Rite-In-Rain field notebook.
  - Field forms.
  - Cell phone.
  - Camera.
- Water Chemistry Sampling:
  - Chain-of-custody forms.
  - Sample bottles, pre-cleaned and appropriate size and number.
  - Fine-point Sharpie pens.
  - Weatherproof bottle labels and spare bottle labels.
  - Gloves, powderless, dye-free.
  - Cooler, nonmetallic, with white interior for transporting samples.
  - pH water quality sensor.
  - Portable electronic flow measurement device.

Corrective actions will be taken, if necessary to obtain a complete dataset, including resampling within the required monitoring window.

## **5. Laboratory Sample Handling Procedures**

Sample containers, preservatives, minimum sample volume, and necessary preservation are shown in Table 2. Sample hold times are included above in Table 1.

<b>Parameter</b>	<b>Analytical Method</b>	<b>Minimum Sample Volume</b>	<b>Sample Bottle</b>	<b>Sample Preservation</b>
All Dissolved Metals	EPA 200.7, EPA 200.8	250 ml	HDPE	Chilled <4°C
TDS	SM2540C	250 ml	HDPE	Chilled <4°C
Hardness	EPA 200.7	250 ml	HDPE	None

A copy of a chain-of-custody form is included in **Appendix A** to this WQMP. A chain-of-custody form will be maintained with the laboratory samples at all times. A copy of each chain-of-custody form will be included in the project file. All sample labels will be filled out entirely for each sample using permanent ink, just prior to sample collection. At a minimum, each label will include sample date, time, location, and name of person collecting the sample.

Each sample will be stored on ice, in a non-metallic, insulated container, and transported or shipped to a State-certified laboratory within the required holding time. Each sample will be accompanied by a chain-of-custody form. The original form will be given to the laboratory and Snowbird will keep a copy for their records.

## **6. Analytical Methods and Laboratory Documentation**

The list of water quality parameters, EPA test methods, and detection limits are included in Section 2, Table 1, above. Standard Operating Procedures and analytical methods will be provided by the State-certified laboratory used to process samples. The laboratory will also provide printed and electronic copies of all results, and will maintain a file of original chain-of-custody forms. Printed laboratory results will include a signed cover letter and all results will appear on certifiable letterhead paper. Printed results will also include a work order receipt report and a copy of the chain-of-custody report.

## **7. Project Quality Control Requirements**

The project manager will review field forms, laboratory results, and data validation results (i.e., field duplicates and trip blanks) after each visit. All data will be reviewed and verified or validated as appropriate. In addition to the laboratory QA/QC analysis, the project manager will conduct additional QA/QC procedures including but not limited to: periodic checks of chain-of-custody forms, review of all electronic results and comparison to printed copies, comparison of results to field blanks and duplicate sample results, and identification of outliers. If inconsistencies are found, the project manager will consult with the laboratory to identify potential sources of error before removing the data point from further use.

Monitoring results that are identified as below minimum detection level (MDL) will be used in a manner that complies with Utah DWQ protocol and analysis. This result is in response to concentrations that are detected but cannot be quantified due to technology limits of the testing method. Although the actual concentration is subject to a high degree of quantitative uncertainty, the levels are low enough that compliance with standards can be determined in most instances. The MDL indicated in Table 1 will identify if parameters exceed State water quality standards with the exception of Mercury. The Mercury parameter has a standard protecting cold water aquatic life of 0.000012 mg/L, which is less than the MDL. The State is currently aware of the conflict between standards and measurement technology, and is working to resolve this issue.



## **8. Data Analysis, Record Keeping, and Reporting Requirements**

Establishment of the 2-year baseline condition in Mary Ellen Creek is described above in Section 2. All data collected following project implementation will be compared to that baseline. The data collected under this WQMP is expected to be variable based on previous investigations and ongoing monitoring. The question to be answered through this analysis is whether or not the variability of dissolved metals and TDS falls within historic data ranges for Mary Ellen Creek.

To answer this question, data collected in year three and each subsequent, post implementation years will be averaged for each water quality constituent. Inferential statistical analyses (t-test) will be completed to determine whether each annual mean is significantly different ( $P = 0.10$ ) from the baseline value. Depending on the amount of variability in the data, and given the small sample size, a nonparametric trend-line method may be substituted for the inferential analysis. This would be subject to approval by Utah County.

Snowbird will prepare a quarterly report on the monitoring results. Beginning after the first four quarters of monitoring data results after the CUPs are issued to Snowbird, each quarterly monitoring report will include a four-quarter rolling average of collected data. Quarterly reports will summarize the data, identify any statistically significant differences from the 2-year baseline conditions, and note any deviations from this WQMP. Laboratory reports will be included as appendices. Reports will be provided to Utah County, Utah DWQ, and American Fork City.

## **9. Schedule**

Sample collection will begin following issuance of the CUPs by the Utah County Board of Adjustment. As noted in Section 2, samples will be collected on a monthly basis for a period of 2 years from the first sample visit, presumably in spring 2016, to establish a baseline. Monthly sampling will be continued through construction periods. During intervals between construction periods and once construction is complete, water samples will be collected on a quarterly basis (i.e., winter, spring, summer, fall). The total monitoring period will be 8 years beyond the end of 2-year baseline monitoring.

All costs of implementing this WQMP, including laboratory costs, will be borne by Snowbird. Laboratory services will be provided by a State-certified facility and approved by Utah County, which initially will be Chemtech-Ford Analytical Laboratory in Sandy, Utah.

## **10. Project Team and Responsibilities**

Snowbird has engaged an environmental project manager for this WQMP. The project manager will ensure that data collection and analytical procedures outlined herein are followed and reports are submitted in a timely fashion.

The sampling, data analysis, and reporting procedures outlined herein will be completed by a qualified third-party contractor engaged and paid for by Snowbird following CUP approval by Utah County. This contractor will be supported by Snowbird's project manager, who will ensure that all provisions of this WQMP are met.

The laboratory analysis of water quality samples will be completed by a State-certified facility selected by Snowbird and approved by Utah County, which initially shall be Chemtech-Ford Analytical Laboratory.

American Fork City will have the option of sending representatives to observe the collection of the monitoring samples collected pursuant to this WQMP; however, American Fork City and its representatives have elected not to take samples on real property that Snowbird owns, leases, or is permitted to use at this time. In the event American Fork City or its representatives desire to collect water samples hereafter from real property that Snowbird owns, leases, or is permitted to use as depicted in Figure 1, Snowbird and American Fork City shall first agree in writing upon the protocols for sampling, analysis, and reporting. Snowbird will provide American Fork with a minimum of 24-hours advance notice of when it will collect samples pursuant to this WQMP. Snowbird will provide notice via email to American Fork City representative Ernest John at [erniej50@gmail.com](mailto:erniej50@gmail.com) or to such other representatives and email addresses that American Fork City provides to Snowbird.

### **11. Sharing Information**

Snowbird will submit quarterly reports of water monitoring results to Utah County, Utah DWQ, and American Fork City not more than 10 business days following receipt by Snowbird of the last set of laboratory reports included in each report.

Within 5 business days of submitting building permit applications for this project to Utah County, Snowbird will provide copies of those applications to American Fork City. At American Fork City's request, Snowbird will meet at a mutually agreeable time and place to discuss these permit submittals.

Within 5 business days of submitting to the Utah DWQ a notice of intent for Snowbird's project to be covered by the Utah Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities No. UTRC00000, Snowbird will provide a copy of such notice of intent to Utah County and American Fork City. The notice of intent form for permit coverage is to be obtained via the following DWQ webpage:

<http://www.deq.utah.gov/Permits/water/updes/stormwatercon.htm>.

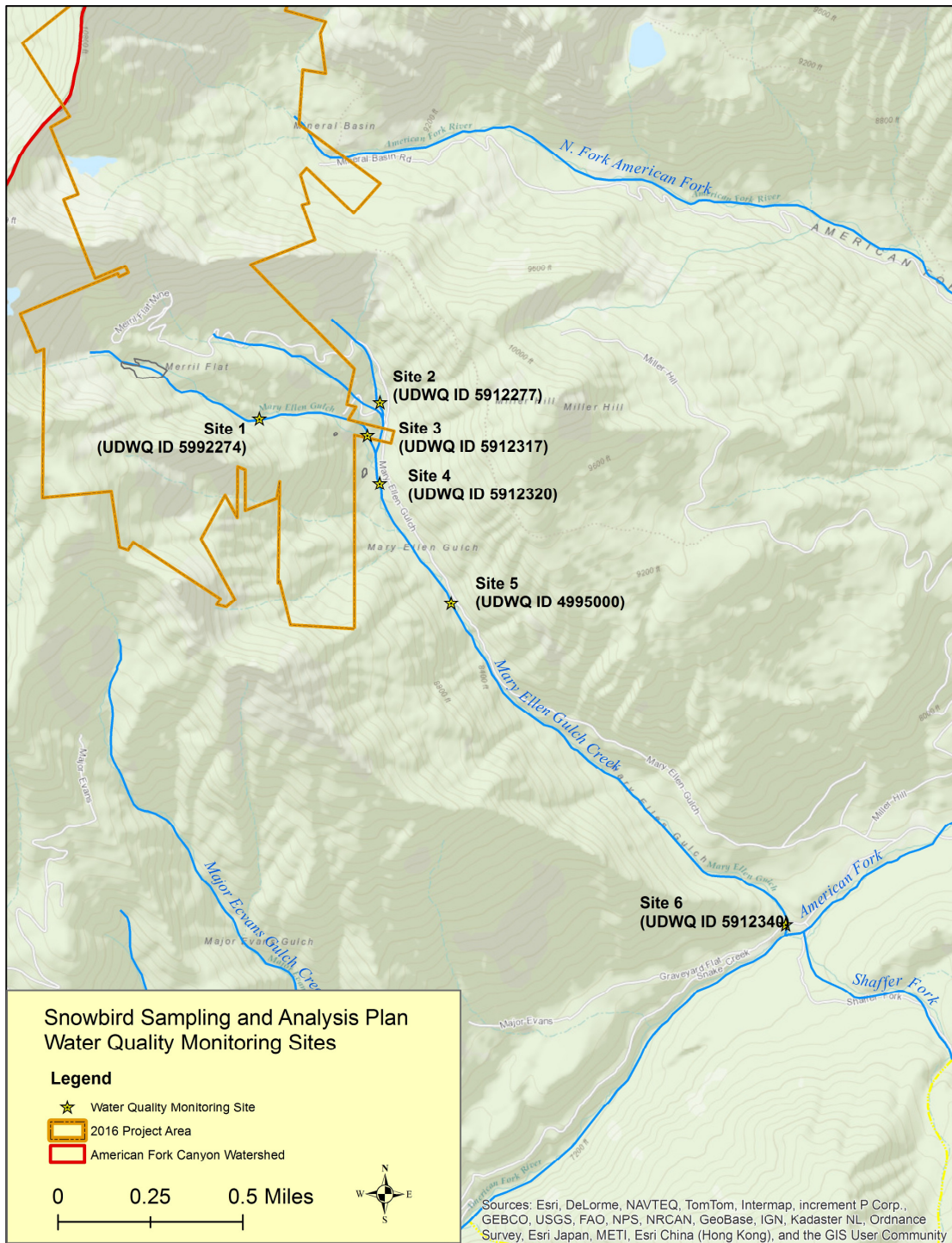
### **12. Responsive Action**

In the event that the monitoring outlined in this WQMP demonstrates that construction or operation of the 2016 Project degrades water quality relative to baseline conditions, Snowbird will complete any remediation required by applicable permit requirements, laws, and regulations.

## **References**

- Calkins and Butler. 1943. Geology and Ore Deposits of the Cottonwood-American Fork Area, Utah. Professional Paper 201. United States Department of the Interior. Harold L. Ickes, Secretary. Geological Survey W.E. Wrather, Director.
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- Karr, J.R. and D.R. Dudley. 1981. Ecological perspectives on water quality goals. *Environmental Management* 5(1):55-68.
- Kimball, B.A., Runkel, R.L., and Gerner, L.J. 2009. Methods and basic data from mass-loading studies in American Fork, October 1999, and Mary Ellen Gulch, Utah, September 2000: U.S. Geological Survey Data Series 443, 33p. Available at <http://pubs.usgs.gov/ds/443>.
- Merritt, L.B. 1988. Preliminary Survey of Water Quality in Mine Drain in Sheeprock Mountains and North Fork of the American Fork River. Prepared for the Uinta National Forest. Provo, Utah. July.
- Utah DWQ (Division of Water Quality). 2010. Draft 2010 Utah Integrated Report Water Quality Assessment 305(b) Report. Utah Division of Water Quality Utah Department of Environmental Quality.
- Utah DWQ. 2014. Quality Assurance Program Plan for Environmental Data Operations. Final Plan. Revision No. 1.0, Effective September 5, 2014. Utah Division of Water Quality, Utah Department of Environmental Quality. 195 North 1950 West, Salt Lake City, Utah 84116.

**Figure 1**



**Appendix A**

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# Field Form - Water Quality Sample Collection

Mary Ellen Gulch Sample Analysis Plan

Date \_\_\_\_\_

Sample Location \_\_\_\_\_

Surveyor Name \_\_\_\_\_

**Field Conditions (check all that apply)**

Dry

Clear

Rain

Partly Cloudy

Snow

Mostly Cloudy

Overcast

**Site Photo ID**

Upstream \_\_\_\_\_

Downstream \_\_\_\_\_

No. of samples collected \_\_\_\_\_

Sample IDs \_\_\_\_\_

**Comments**

(brief description of sample collection along with any conditions that may influence water quality; i.e. surface runoff, storm event, channel disturbance, etc.)

**CHEMTECH - FORD ANALYTICAL LABORATORY**

**CHAIN OF CUSTODY**

COMPANY: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 CITY/STATE/ZIP: \_\_\_\_\_  
 PHONE #: \_\_\_\_\_ FAX: \_\_\_\_\_  
 CONTACT: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
 EMAIL: \_\_\_\_\_

BILLING ADDRESS: \_\_\_\_\_  
 BILLING CITY/STATE/ZIP: \_\_\_\_\_  
 PURCHASE ORDER #: \_\_\_\_\_



TURNAROUND REQUIRED:\* \_\_\_\_\_  
\* Expedited turnaround subject to additional charge

Lab Use Only	CLIENT SAMPLE INFORMATION				
	LOCATION / IDENTIFICATION	DATE	TIME	MATRIX	Field: Residual Chlorine
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

TESTS REQUESTED														Bacteria			
														Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. Coli Only

Sampled by: [print]		Sampled by: [signature]		ON ICE		NOT ON ICE		Temp (C°):	
Special Instructions:				Samples received outside the EPA recommended temperature range of 0-6 C° may be rejected.					
Relinquished by: [signature]			Date/Time		Received by: [signature]			Date/Time	
Relinquished by: [signature]			Date/Time		Received by: [signature]			Date/Time	
Relinquished by: [signature]			Date/Time		Received by: [signature]			Date/Time	

**CHEMTECH-FORD**  
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 Sandy, UT 84070

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 866.792.0093 FAX  
 www.chemtechford.com

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agrees to pay collection costs and attorney's fees.

**From:** Hilary Arens <[REDACTED]@snowbird.com>  
**To:** Nestor Gallo <[REDACTED]@afcity.net>, Carl Adams <[REDACTED]@utah.gov>, [REDACTED]  
**CC:** "Weston, John" <[REDACTED]@swlaw.com>, [REDACTED]@swlaw.com"  
 <[REDACTED]@swlaw.com...  
**Date:** 5/9/2016 9:57 AM  
**Subject:** Updated WQMP.5.9.2016 FINAL  
**Attachments:** WQMP Mary Ellen Gulch Creek.5.9.2016.FINAL.docx

All-  
 My apologies. I did not incorporate all of Nestor's changes into the 5.4.2016 version. Please use this one, dated 5.9.2016 as the most up-to-date version of the WQMP.

Thank you,  
 Hilary

Hilary Arens  
 Director of Water Resources & Environmental Programs  
 Snowbird Ski and Summer Resort

Office: (801) 933-[REDACTED]  
 Snowbird Extension [REDACTED]  
 www.snowbird.com

---

From: Hilary Arens  
 Sent: Monday, May 9, 2016 8:56 AM  
 To: Nestor Gallo; Carl Adams; [REDACTED]@utahcounty.gov; Ernest John  
 Cc: Weston, John; [REDACTED]@swlaw.com; Cahoon, Brad; [REDACTED]@cirruses.com; 'Keith Hanson'; Bob Bonar; Neal Artz; Jay Brems; Dale Goodman  
 Subject: RE: Updated WQMP.5.4.2016 FINAL

Thank you for the update, Nestor. I have incorporated your changes into the attached version dated May 4, 2016.

Until further edits or changes are requested or made, let's consider this version the most up-to-date.

Thanks  
 Hilary

Hilary Arens  
 Director of Water Resources & Environmental Programs  
 Snowbird Ski and Summer Resort

Office: (801) 933-[REDACTED]  
 Snowbird Extension [REDACTED]  
 www.snowbird.com

From: Nestor Gallo <[REDACTED]@afcity.net>  
 Sent: Friday, May 6, 2016 2:43 PM  
 To: Hilary Arens; Carl Adams; [REDACTED]@utahcounty.gov; Ernest John  
 Cc: Weston, John; [REDACTED]@swlaw.com; Cahoon, Brad; [REDACTED]@cirruses.com; 'Keith Hanson'; Bob Bonar; Neal Artz; Jay Brems; Dale Goodman  
 Subject: RE: Updated WQMP.5.4.2016 FINAL

Hi Hilary,

I am attaching an amended version of the WQMP ... some minor comments on section 10 in which we request that the water sampling results be submitted to the Public Works Director, Mr. Dale Goodman, and the Water Superintendent, Mr. Jay Brems.

Thank you for all your help.  
 Have a great week-end!  
 Regards,

Nestor

-----Original Message-----

From: Hilary Arens [mailto:[REDACTED]@snowbird.com]  
 Sent: Thursday, May 05, 2016 10:42 AM  
 To: Carl Adams <[REDACTED]@utah.gov>; [REDACTED]@utahcounty.gov; Ernest John <[REDACTED]@gmail.com>; Nestor Gallo <[REDACTED]@afcity.net>  
 Cc: Weston, John <[REDACTED]@swlaw.com>; [REDACTED]@swlaw.com; Cahoon, Brad <[REDACTED]@swlaw.com>; [REDACTED]@cirruses.com; 'Keith Hanson' <[REDACTED]@canyonwater.com>; Bob Bonar <[REDACTED]@snowbird.com>; Neal Artz <[REDACTED]@cirruses.com>  
 Subject: Updated WQMP.5.4.2016 FINAL

All-

Please update your files that this is the current FINAL for the WQMP dated May 4, 2016.

EDIT TO THIS DRAFT:

Site 2 was assigned the wrong DWQ MLID in previous drafts of 5912280.  
 ?

Working with DWQ:

Site 2 is now DWQ MLID 5912277 "Mary Ellen Gulch eastern tributary AB middle tributary confl & AB USFS 011 road xing" and is reflected on the map.

?

My apologies for the multiple drafts to get to this point. I do not anticipate any additional changes.

Best,

-Hilary

Hilary Arens  
 Director of Water Resources & Environmental Programs Snowbird Ski and Summer Resort



Office: (801) 933-  
Snowbird Extension  
www.snowbird.com<<http://www.snowbird.com/>>  
[cid:5C76D699-0DA1-46C3-8B49-D1EE33700479]

**FINAL**

**WATER QUALITY MONITORING PLAN FOR:**

**MARY ELLEN GULCH CREEK**

**AMERICAN FORK CANYON**

May 9, 2016

Prepared for:  
Snowbird Ski Resort

Prepared by:  
Cirrus Ecological Solutions  
965 South 100 West, Suite 200  
Logan, UT

## **DISTRIBUTION LIST**

Bryce Armstrong, Associate Director  
Utah County Department of Community Development  
51 South University Ave., No. 117, Provo, UT 84601

## **ACRONYMS AND ABBREVIATIONS**

CUP – Conditional Use Permit

Utah DEQ – Utah Department of Environmental Quality

Utah DWQ – Utah Division of Water Quality

NFRAP – No Further Remedial Action Planned

CERCLIS – Comprehensive Environmental Response, Compensation and Liability Information System

EPA – U.S. Environmental Protection Agency

QA/QC – Quality Assurance Quality Control

GPS – Geographic Positioning System

HDPE – High Density Polyethylene

TDS – Total Dissolved Solids

WQMP – Water Quality Monitoring Plan

## **1. Introduction**

This water quality monitoring plan (WQMP) was prepared in accordance with the format developed by the Utah Division of Water Quality (Utah DWQ; *Quality Assurance Program Plan for Environmental Data Operations*, Final Plan Revision No. 1.0. Effective September 5, 2014). Suggested content is listed at the beginning of each section.

Similar to many drainages along the Wasatch Front, American Fork Canyon is highly mineralized. Historic mining activities created surface deposits of mine waste rock material, milled tailings and, in some cases, water discharge from mine portals, all of which can potentially increase naturally occurring metals concentrations in the American Fork River and its tributaries. Mining occurred in Mary Ellen Gulch starting in the 1860s and continuing through the 1940s (Calkins and Butler 1943), and the resulting conditions have contributed to metal loading in Mary Ellen Creek, an American Fork tributary that is the focus of this monitoring effort.

Concerns about mining-related impacts on water quality in the upper American Fork watershed emerged in the 1980s, and studies by the U.S. Forest Service (e.g., Merritt 1988) and other agencies led to the U.S. Environmental Protection Agency (EPA) designation in 1992 of a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site (UTD988074951). The EPA issued a determination of No Further Remedial Action Planned (NFRAP) in 2002. The CERCLIS site was archived in 2003. It was moved to active status in 2005 because of Forest Service concerns about the Pacific Mine (in lower Mineral Basin). The Pacific Mine repository was completed in 2006. The NFRAP classification remains to date.

Studies completed from the late 1980s through 2000, concluding with a U.S. Geological Survey synoptic tracer study conducted in 2000 (Kimball et al. 2009) identified the location of major sources of mine waste in American Fork Canyon and evaluated water quality concerns. These included the Mary Ellen Mines.

The Mary Ellen Mines, which include the Live Yankee Mine, left a number of mine dumps and processed tailings in Mary Ellen Gulch. The steep, bare slopes of the piles show evidence of erosion and runoff from precipitation events.

The Mary Ellen Mines' adits and tailings are the primary source of trace metals in Mary Ellen Creek. However, water quality measurements collected immediately above the confluence with the North Fork of the American Fork River show that all State-assigned water quality standards are being met.

Despite the EPA's determination of NFRAP, remediation projects were completed for the three primary areas of concern. In 1997, Snowbird started re-routing discharge from the Live Yankee Mine north adit around the tailings piles. The 2000 USGS study indicated that downstream water quality was significantly better than in years before the project. In 2003, the Forest Service constructed the Dutchman Flat repository, combining material from the Bog Mine and several other nearby sources. In 2006, Snowbird and Trout Unlimited built a similar repository on private land for material from the Pacific Mine and other nearby mines. In 2008, Snowbird and Trout Unlimited again collaborated to install a more permanent drainage system at the Live Yankee north adit.

Utah DWQ continues to monitor surface water quality on Mary Ellen Creek and the American Fork River above and below their confluence. Utah DWQ has confirmed the "...status of the American Fork River, Segment 2, from Tibble Fork Reservoir to headwaters. From the latest Integrated Report this segment is placed in Assessment Category 3, 'Insufficient Data with Exceedances' (Chapter 5 – 303(d) List of Rivers and Streams, 2014). The river has not been assessed as impaired nor has it been assessed as fully supporting its designated beneficial uses due to the lack of sufficient data to make a full assessment. The exceedances refer to a single sample collected from Mary Ellen Gulch that exceeded the chronic criteria for Cadmium in 2009." (Utah DWQ Feb. 17, 2016 Letter.)

In December 2015, Snowbird Ski and Summer Resort (Snowbird) requested two conditional use permits (CUPs) from Utah County's Board of Adjustment to construct accessory ski lifts, replace and increase the height of some existing ski lift towers and construct some associated mountain resort facilities on their private land in Utah County (Mineral Basin and Mary Ellen Gulch, which adjoin the existing ski area). The proposed development is called "the 2016 Project." During the public comment phase of the review process, American Fork City submitted a letter to the Board of Adjustment expressing concern over possible impacts on the quality of their municipal water supply and requesting, among other things that Snowbird develop a water quality monitoring plan. Without conceding that there are or will be any impacts on water quality from its project, Snowbird has prepared this WQMP in response to American Fork City's comments.

This WQMP has been developed to guide water quality monitoring on Mary Ellen Creek. This effort is a voluntary effort by Snowbird and is not required by federal, state, or local regulations.

Figure 1 to this WQMP shows the Mary Ellen Creek watershed, the 2016 Project Area, and the six sampling locations identified for this WQMP. Site 1 is on the western headwater, upstream from the mined area in Mary Ellen Gulch, providing a background reference location. Site 2 is a second background reference location on the eastern headwater outside the project area. Site 3 is on the western headwater below the Quartzite claim tailings piles and above the confluence with the other headwaters. Site 4 is below the confluence of the headwaters and below all project construction activities. Site 5 is a downstream biological monitoring site (see Section 2 below). Site 6 is further downstream, near the confluence with the North Fork of the American Fork River. All sites coincide with established Utah DWQ monitoring sites.

## **2. Objectives and Design**

The objective of this monitoring effort is to determine whether the development proposed in Snowbird's CUP applications, if permitted and implemented, adversely affects water quality in Mary Ellen Creek. Identification of any degradation of water quality not allowed by Snowbird's permits would provide a basis for remedial actions as required by applicable law.

The monitoring will be conducted in accordance with sample protocols established by Utah DWQ. Surface water sampling will occur at a point on Mary Ellen Gulch Creek immediately downstream of Snowbird's project area boundary to evaluate water quality in surface flows draining from areas above this point where ski area development occurs. This effort will identify seasonal patterns and long-term trends in water quality.

Field sampling will occur during conditions that allow safe and reasonably efficient sample collection. Sampling will be postponed due to hazards created by extreme cold or wind, risk of avalanche, and wildfire. In the event the creek is dry or frozen during regularly scheduled sampling visits, these conditions will be noted in the project file.

Water quality parameters included in this analysis are those associated with the State-assigned beneficial uses of Mary Ellen Creek and the American Fork River (i.e., secondary contact recreation, coldwater aquatic life, and agriculture) as well as several other parameters of concern identified in previous studies. Table 1 identifies all water quality parameters that will be tested by a State-certified laboratory including, test methods, detection limits, and sample holding times that will be used. Flow and pH will also be measured in the field at each monitoring site when samples are collected.

<b>Table 1. Water quality parameters to be measured by State-certified laboratory and Test Methods, Detection Limits, and Hold Times for each parameter.</b>			
<b>Parameter</b>	<b>EPA Test Method</b>	<b>Method Detection Limit (mg/L)</b>	<b>Hold Time (days)</b>
Aluminum	200.7	0.05	14
Arsenic	200.8	0.0005	14
Cadmium	200.8	0.0002	14
Chromium	200.8	0.0005	14
Copper	200.8	0.001	14
Iron	200.7	0.02	14
Lead	200.8	0.0005	14
Mercury	200.8	0.0002	14
Nickel	200.8	0.0005	14
Selenium	200.8	0.0005	14
Silver	200.8	0.0005	14
Zinc	200.7	0.01	14
TDS	SM2540C	10	7
Hardness	200.7	1.0	2

Baseline water quality conditions will be established using two methods. First historic monitoring data for Mary Ellen Creek will be compiled and summarized. Second, samples will be collected from Mary Ellen Creek on a monthly basis (as conditions allow) for 2 years after the CUPs are granted, presumably beginning in Spring of 2016. This 2-year baseline period will precede any development activity in Mary Ellen Gulch. All monthly samples will be collected at a minimum of 2 weeks apart. This sampling frequency will identify seasonal patterns and provide a detailed view of variation in water quality between months. These results will then be compared to the historic data summary to identify any differences from long-term concentrations and fluctuation patterns to validate the baseline condition.

Monthly monitoring will continue during construction in Mary Ellen Gulch. Once construction is complete, monitoring will shift to a quarterly regime (winter, spring, summer, and fall). The post-baseline monitoring period (during and after construction) will total 8 years.

In accordance with Utah DWQ standards, field duplicates and field blanks will be collected on 10 percent of the samples collected annually, as part of the quality control effort. A field duplicate is a second sample collected at the same time as the primary water sample. Analysis of a field duplicate indicates the reliability of field sample collection.

A field blank is a sample of analyte-free water poured into the container in the field and then preserved and shipped to the laboratory with the samples. A field blank indicates whether there was contamination from field conditions during sampling.

Biological monitoring will also be conducted annually at the Site 5 sampling location during the base flow monitoring period. Biological monitoring can account for the impact of all pollutants and how they interact to affect stream health (Karr 1981). Aquatic macroinvertebrates are a particularly good indicator of stream health as they spend the majority of their life in aqueous environments at a single location and are capable of integrating water quality impacts over time. As a result, their health indicates the influence of past conditions (Karr and Dudley 1981).

The method used to assess the results of macroinvertebrate monitoring will rely on the ratio of observed:expected species for a given location. This approach is currently utilized by Utah DWQ to evaluate stream health and impairment, and a detailed discussion of this methodology is found in Utah's 2010 Integrated Report (Utah DWQ 2010).

### **3. Special Precautions and Safety Plan**

Conditions accessing and at the monitoring site could result in safety concerns. Some of the physical hazards include steep terrain, snow avalanche hazards, and slick surfaces produced by ice, compact snow, and wet soil. Health hazards include extreme cold and other conditions leading to hypothermia or frostbite.

All field efforts will comply with safety protocol established by Snowbird to protect lift operators, ski patrol, and other employees working in an outdoor setting. Personnel involved in collecting water quality samples will be trained by Snowbird on this protocol. When conditions are adverse, sampling personnel will work in pairs. Monitoring visits during winter will account for avalanche control operations and short-term weather forecasts. All monitoring visits will be coordinated with the Snowbird General Manager.

Prior to field work, all personnel collecting samples will be trained on any invasive aquatic species concerns related to water resources in American Fork Canyon and invasive weeds species monitored by Snowbird or the Wasatch-Cache National Forest.

### **4. Field Sampling Methods and Documentation**

All data will be collected in accordance with guidelines found in Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations* (Utah DWQ 2014) that pertain to cooperative monitoring of chemical water quality and will obtain any training from Utah DWQ required therein. Laboratory QA/QC methods and documentation can be obtained from a State-certified laboratory used to process water quality samples collected under this WQMP. Field forms and example chain-of-custody forms are provided in Appendix A.

Sampling personnel will be trained to collect monitoring samples in accordance with Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations*. Sampling personnel will collect water samples when environmental conditions permit safe access to Mary Ellen Creek and the monitoring location. Sample equipment and any necessary safety equipment will be checked against a checklist prior to the site visit. Field staff will record environmental conditions that may influence water quality in the short- or long-term on field forms during the visit (i.e., air temperature, precipitation, flow estimate, bank stability, etc.).

Each sample will be collected in clean, laboratory-supplied sample bottles. Samples will be collected at the monitoring site from a location that appears well-mixed. Generally, this will be the deepest part of the stream channel near the middle of the water column. All sample bottles will be labeled with information including the date and time the sample was collected, and the location will be recorded using a GPS unit.

All sample bottles will be handled according to protocol guidelines from the State-certified laboratory used to process water quality samples. All sample containers will be preserved (as needed), stored on ice in a cooler and delivered to the laboratory within the maximum holding time for each parameter. A chain-of-custody form will be maintained with the samples at all times. As part of the field QA/QC program, field blanks and field duplicates (see Section 2 above) will be collected and submitted to the laboratory (roughly one for every 10 analyses).

The following sample equipment will be used for field work:

- General:
  - GPS unit with loaded maps and sample location.
  - Rite-In-Rain field notebook.
  - Field forms.
  - Cell phone.
  - Camera.
- Water Chemistry Sampling:
  - Chain-of-custody forms.
  - Sample bottles, pre-cleaned and appropriate size and number.
  - Fine-point Sharpie pens.
  - Weatherproof bottle labels and spare bottle labels.
  - Gloves, powderless, dye-free.
  - Cooler, nonmetallic, with white interior for transporting samples.
  - pH water quality sensor.
  - Portable electronic flow measurement device.

Corrective actions will be taken, if necessary to obtain a complete dataset, including resampling within the required monitoring window.

## **5. Laboratory Sample Handling Procedures**

Sample containers, preservatives, minimum sample volume, and necessary preservation are shown in Table 2. Sample hold times are included above in Table 1.



<b>Table 2. Sample containers and preservatives.</b>				
<b>Parameter</b>	<b>Analytical Method</b>	<b>Minimum Sample Volume</b>	<b>Sample Bottle</b>	<b>Sample Preservation</b>
All Dissolved Metals	EPA 200.7, EPA 200.8	250 ml	HDPE	Chilled <4°C
TDS	SM2540C	250 ml	HDPE	Chilled <4°C
Hardness	EPA 200.7	250 ml	HDPE	None

A copy of a chain-of-custody form is included in **Appendix A** to this WQMP. A chain-of-custody form will be maintained with the laboratory samples at all times. A copy of each chain-of-custody form will be included in the project file. All sample labels will be filled out entirely for each sample using permanent ink, just prior to sample collection. At a minimum, each label will include sample date, time, location, and name of person collecting the sample.

Each sample will be stored on ice, in a non-metallic, insulated container, and transported or shipped to a State-certified laboratory within the required holding time. Each sample will be accompanied by a chain-of-custody form. The original form will be given to the laboratory and Snowbird will keep a copy for their records.

## **6. Analytical Methods and Laboratory Documentation**

The list of water quality parameters, EPA test methods, and detection limits are included in Section 2, Table 1, above. Standard Operating Procedures and analytical methods will be provided by the State-certified laboratory used to process samples. The laboratory will also provide printed and electronic copies of all results, and will maintain a file of original chain-of-custody forms. Printed laboratory results will include a signed cover letter and all results will appear on certifiable letterhead paper. Printed results will also include a work order receipt report and a copy of the chain-of-custody report.

## **7. Project Quality Control Requirements**

The project manager will review field forms, laboratory results, and data validation results (i.e., field duplicates and trip blanks) after each visit. All data will be reviewed and verified or validated as appropriate. In addition to the laboratory QA/QC analysis, the project manager will conduct additional QA/QC procedures including but not limited to: periodic checks of chain-of-custody forms, review of all electronic results and comparison to printed copies, comparison of results to field blanks and duplicate sample results, and identification of outliers. If inconsistencies are found, the project manager will consult with the laboratory to identify potential sources of error before removing the data point from further use.

Monitoring results that are identified as below minimum detection level (MDL) will be used in a manner that complies with Utah DWQ protocol and analysis. This result is in response to concentrations that are detected but cannot be quantified due to technology limits of the testing method. Although the actual concentration is subject to a high degree of quantitative uncertainty, the levels are low enough that compliance with standards can be determined in most instances. The MDL indicated in Table 1 will identify if parameters exceed State water quality standards with the exception of Mercury. The Mercury parameter has a standard protecting cold water aquatic life of 0.000012 mg/L, which is less than the MDL. The State is currently aware of the conflict between standards and measurement technology, and is working to resolve this issue.

## **8. Data Analysis, Record Keeping, and Reporting Requirements**

Establishment of the 2-year baseline condition in Mary Ellen Creek is described above in Section 2. All data collected following project implementation will be compared to that baseline. The data collected under this WQMP is expected to be variable based on previous investigations and ongoing monitoring. The question to be answered through this analysis is whether or not the variability of dissolved metals and TDS falls within historic data ranges for Mary Ellen Creek.

To answer this question, data collected in year three and each subsequent, post implementation years will be averaged for each water quality constituent. Inferential statistical analyses (t-test) will be completed to determine whether each annual mean is significantly different ( $P = 0.10$ ) from the baseline value. Depending on the amount of variability in the data, and given the small sample size, a nonparametric trend-line method may be substituted for the inferential analysis. This would be subject to approval by Utah County.

Snowbird will prepare a quarterly report on the monitoring results. Beginning after the first four quarters of monitoring data results after the CUPs are issued to Snowbird, each quarterly monitoring report will include a four-quarter rolling average of collected data. Quarterly reports will summarize the data, identify any statistically significant differences from the 2-year baseline conditions, and note any deviations from this WQMP. Laboratory reports will be included as appendices. Reports will be provided to Utah County, Utah DWQ, and American Fork City.

## **9. Schedule**

Sample collection will begin following issuance of the CUPs by the Utah County Board of Adjustment. As noted in Section 2, samples will be collected on a monthly basis for a period of 2 years from the first sample visit, presumably in spring 2016, to establish a baseline. Monthly sampling will be continued through construction periods. During intervals between construction periods and once construction is complete, water samples will be collected on a quarterly basis (i.e., winter, spring, summer, fall). The total monitoring period will be 8 years beyond the end of 2-year baseline monitoring.

All costs of implementing this WQMP, including laboratory costs, will be borne by Snowbird. Laboratory services will be provided by a State-certified facility and approved by Utah County, which initially will be Chemtech-Ford Analytical Laboratory in Sandy, Utah.

## **10. Project Team and Responsibilities**

Snowbird has engaged an environmental project manager for this WQMP. The project manager will ensure that data collection and analytical procedures outlined herein are followed and reports are submitted in a timely fashion.

The sampling, data analysis, and reporting procedures outlined herein will be completed by a qualified third-party contractor engaged and paid for by Snowbird following CUP approval by Utah County. This contractor will be supported by Snowbird's project manager, who will ensure that all provisions of this WQMP are met.

The laboratory analysis of water quality samples will be completed by a State-certified facility selected by Snowbird and approved by Utah County, which initially shall be Chemtech-Ford Analytical Laboratory.

American Fork City will have the option of sending representatives to observe the collection of the monitoring samples collected pursuant to this WQMP; however, American Fork City and its representatives have elected not to take samples on real property that Snowbird owns, leases, or is permitted to use at this time. In the event American Fork City or its representatives desire to collect water samples hereafter from real property that Snowbird owns, leases, or is permitted to use as depicted in Figure 1, Snowbird and American Fork City shall first agree in writing upon the protocols for sampling, analysis, and reporting. Snowbird will provide American Fork with a minimum of 24-hours advance notice of when it will collect samples pursuant to this WQMP. Snowbird will provide notice via email to American Fork City representative Ernest John at erniej50@gmail.com or to such other representatives and email addresses that American Fork City provides to Snowbird.

### **11. Sharing Information**

Snowbird will submit quarterly reports of water monitoring results to Utah County, Utah DWQ, and American Fork City not more than 10 business days following receipt by Snowbird of the last set of laboratory reports included in each report.

Within 5 business days of submitting building permit applications for this project to Utah County, Snowbird will provide copies of those applications to American Fork City. At American Fork City's request, Snowbird will meet at a mutually agreeable time and place to discuss these permit submittals.

Within 5 business days of submitting to the Utah DWQ a notice of intent for Snowbird's project to be covered by the Utah Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities No. UTRC00000, Snowbird will provide a copy of such notice of intent to Utah County and American Fork City. The notice of intent form for permit coverage is to be obtained via the following DWQ webpage:

<http://www.deq.utah.gov/Permits/water/updes/stormwatercon.htm>.

Snowbird will provide copies of the information required above via email to American Fork City Public Works Director Dale Goodman (dgoodman@afcity.net) and Water Division Superintendent Jay Brems (jbrems@afcity.net) or to such other representatives and email addresses that American Fork City provides to Snowbird.

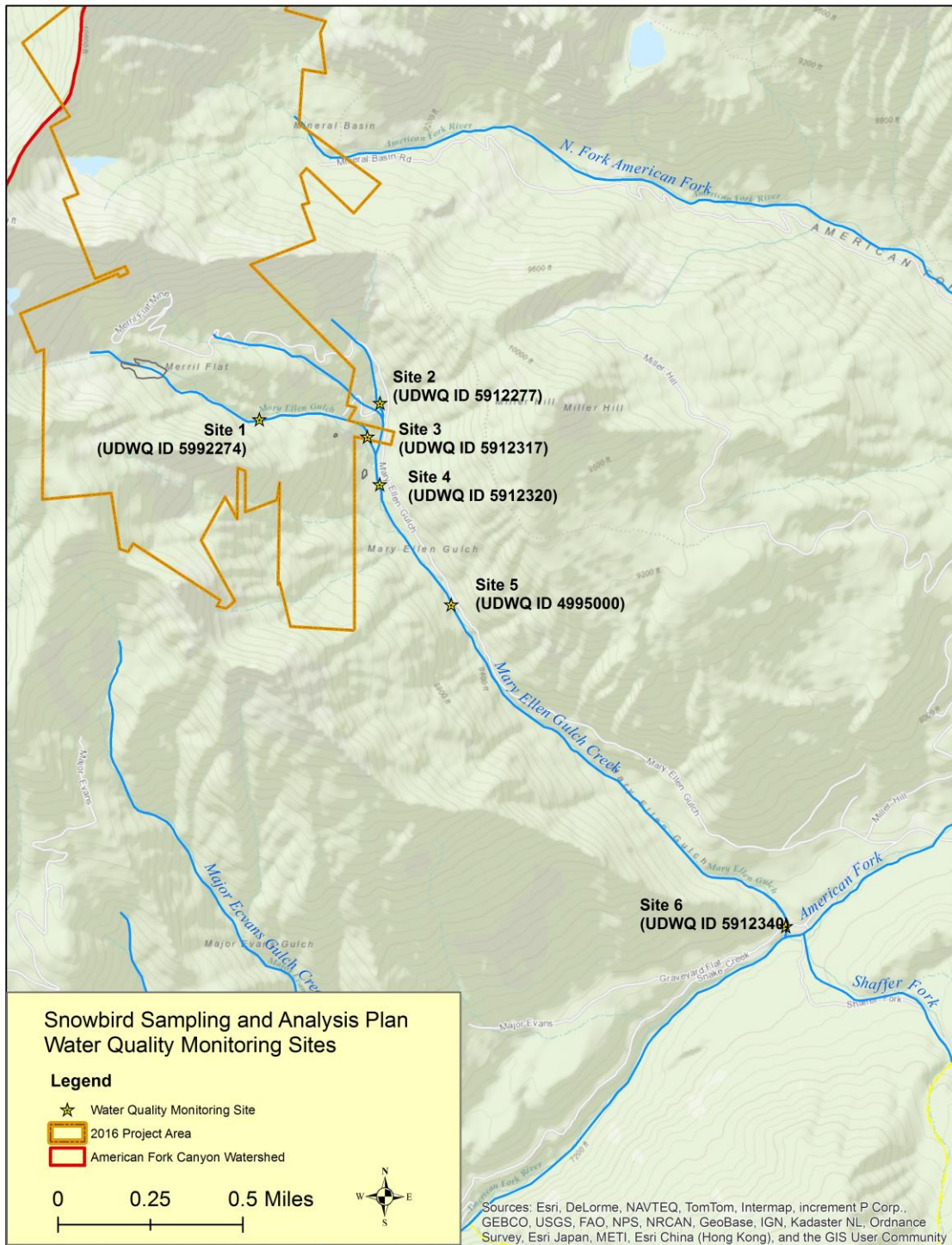
### **12. Responsive Action**

In the event that the monitoring outlined in this WQMP demonstrates that construction or operation of the 2016 Project degrades water quality relative to baseline conditions, Snowbird will complete any remediation required by applicable permit requirements, laws, and regulations.

## **References**

- Calkins and Butler. 1943. Geology and Ore Deposits of the Cottonwood-American Fork Area, Utah. Professional Paper 201. United States Department of the Interior. Harold L. Ickes, Secretary. Geological Survey W.E. Wrather, Director.
- Lidstone & Anderson, Inc. 1993. American Fork Hydrology and Water Quality Study. Prepared for: Utah Division of Oil, Gas, and Mining Abandoned Mine Reclamation Program and the United States Forest Service Uintah National Forest. Fort Collins, CO. February 3.
- Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6:21-27.
- Karr, J.R. and D.R. Dudley. 1981. Ecological perspectives on water quality goals. *Environmental Management* 5(1):55-68.
- Kimball, B.A., Runkel, R.L., and Gerner, L.J. 2009. Methods and basic data from mass-loading studies in American Fork, October 1999, and Mary Ellen Gulch, Utah, September 2000: U.S. Geological Survey Data Series 443, 33p. Available at <http://pubs.usgs.gov/ds/443>.
- Merritt, L.B. 1988. Preliminary Survey of Water Quality in Mine Drain in Sheeprock Mountains and North Fork of the American Fork River. Prepared for the Uinta National Forest. Provo, Utah. July.
- Utah DWQ (Division of Water Quality). 2010. Draft 2010 Utah Integrated Report Water Quality Assessment 305(b) Report. Utah Division of Water Quality Utah Department of Environmental Quality.
- Utah DWQ. 2014. Quality Assurance Program Plan for Environmental Data Operations. Final Plan. Revision No. 1.0, Effective September 5, 2014. Utah Division of Water Quality, Utah Department of Environmental Quality. 195 North 1950 West, Salt Lake City, Utah 84116.

**Figure 1**



**Appendix A**

---

# Field Form - Water Quality Sample Collection

Mary Ellen Gulch Sample Analysis Plan

Date \_\_\_\_\_

Sample Location \_\_\_\_\_

Surveyor Name \_\_\_\_\_

**Field Conditions (check all that apply)**

Dry

Clear

Rain

Partly Cloudy

Snow

Mostly Cloudy

Overcast

**Site Photo ID**

Upstream \_\_\_\_\_

Downstream \_\_\_\_\_

No. of samples collected \_\_\_\_\_

Sample IDs \_\_\_\_\_

**Comments**

(brief description of sample collection along with any conditions that may influence water quality; i.e. surface runoff, storm event, channel disturbance, etc.)

**CHEMTECH - FORD ANALYTICAL LABORATORY**

COMPANY: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 CITY/STATE/ZIP: \_\_\_\_\_  
 PHONE #: \_\_\_\_\_ FAX: \_\_\_\_\_  
 CONTACT: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
 EMAIL: \_\_\_\_\_

**CHAIN OF CUSTODY**

BILLING ADDRESS: \_\_\_\_\_  
 BILLING CITY/STATE/ZIP: \_\_\_\_\_  
 PURCHASE ORDER #: \_\_\_\_\_



TURNAROUND REQUIRED:\* \_\_\_\_\_  
\* Expedited turnaround subject to additional charge

Lab Use Only	CLIENT SAMPLE INFORMATION					TESTS REQUESTED																Bacteria									
	LOCATION / IDENTIFICATION	DATE	TIME	MATRIX	Field: Residual Chlorine																					Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. Coli Only		
	1.																														
	2.																														
	3.																														
	4.																														
	5.																														
	6.																														
	7.																														
	8.																														
	9.																														
	10.																														
Sampled by: [print]		Sampled by: [signature]		ON ICE																NOT ON ICE		Temp (C°):									
Special Instructions:																Samples received outside the EPA recommended temperature range of 0-6 C° may be rejected.															
Relinquished by: [signature]				Date/Time		Received by: [signature]				Date/Time																					
Relinquished by: [signature]				Date/Time		Received by: [signature]				Date/Time																					
Relinquished by: [signature]				Date/Time		Received by: [signature]				Date/Time																					

**CHEMTECH-FORD**  
 9632 South 500 West  
 Sandy, UT 84070  
 801.262.7299 PHONE  
 866.792.0093 FAX  
 www.chemtechford.com

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agrees to pay collection costs and attorney's fees.