SAMPLING AND ANALYSIS PLAN

Bitter and Killpecker Creek Watershed Study
Supplemental Sampling
Fiscal Year 2013-2014

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1.0 BACKGROUND

Segments of Bitter and Killpecker Creeks in Sweetwater County have been listed on the Wyoming Department of Environmental Quality (WDEQ) 303d list (in 2000 and in 2008) for fecal coliform/E. coli and chloride. To address water quality issues related to these impairment listings, the Sweetwater County Conservation District (SWCCD), under the guidance and leadership of the Bitter Creek Killpecker Creek Watershed Advisory Group (BKWAG), has conducted:

- An inventory of historical water quality related information and data (2003).
- Water quality sampling and analysis studies to confirm the 2000 impairment listings within the Bitter Creek watershed (2004-2005).
- Reporting on 2004-2005 Bitter Creek watershed study (2006).
- Supplemental sampling to refine report findings (2006-2008).
- Water quality sampling and analysis studies to confirm the 2008 impairment extensions within the Bitter Creek watershed (2009-2010).
- Water quality sampling and analysis to track impairment status and provide support for WDEQ total maximum daily load (TMDL) development in the Bitter Creek watershed (2011-2013).

During 2004 and 2005 the SWCCD implemented a Sampling and Analysis Plan (SAP) designed to determine specifically what reaches and tributaries of Bitter Creek and Killpecker Creek are impaired, and impaired for what constituents. From 2006 through 2013 the SAP has been updated and refined periodically in order to support supplemental monitoring and data collection used to provide continued evaluations of water quality trends within the Bitter Creek watershed.

In 2014 and 2015 the SWCCD will conduct work with guidance from the BKWAG and WDEQ to continue water quality and quantity monitoring within the Bitter Creek watershed that allows:

- Refinement of data and analysis in preparation of the development of TMDL assignment within the impairments.
- Continued evaluation of quality and flow trends at select locations within the watershed.

The project will continue to be monitored and managed by the project sponsor, the SWCCD (designated the: Natural Resources District Coordinator), with oversight by the BKWAG. As a political subdivision of Wyoming State Government the SWCCD is an appropriate organization to sponsor, manage, and monitor this project pursuant to Wyoming State Statutes. The SWCCD is qualified to conduct the project. The SWCCD will utilize the expertise and experience of the District Supervisors, the Advisory group, WDEQ, and consultants, to fulfill the projects objectives. EDE Consultants (EDE) of Sheridan Wyoming has conducted the project sampling/monitoring, data collection-

compilation, data analysis, and reporting to date. EDE will continue in this role for the project work outlined within this SAP update. The Wyoming Association of Conservation Districts (WACD), the Wyoming Department of Agriculture (WDA), and the Natural Resources Conservation Service (NRCS) will be available to provide assistance if necessary and as requested.

The content and structure of this SAP was determined by:

1. The recommended format and content requirements for a SAP as presented in the WDEQ, Water Quality Division (WQD), Watershed Program Manual of Standard Operating Procedures for Sample Collection and Analysis, 2012.

2. This SAP follows the content recommendations of the DEQ.

3. The recommended SAP components as presented within the WDEQ WQD Wyoming's Method for Determining Surface Water Quality Condition and TMDL Prioritization, 2014.

4. Goals and objectives of the SWCCD, BKWAG, and the WDEQ. These have been developed through a series of advisory group meetings with technical assistance from the WDEQ and a watershed planning/water quality consultant (EDE).

2.0 PURPOSE STATEMENT

Monitoring will focus on cataloging and confirming concentrations of chloride and E. coli bacteria within reaches of interest, as identified by previous sampling and analysis, within the Killpecker Creek and Bitter Creek watersheds. The purpose of this monitoring is to obtain water quality data for use in WDEQ TMDL development, establishing watershed water quality trends, and implementing best management practices as possible.

This SAP is covered by the WDEQ Water Quality Division (WQD), Watershed Protection Program Monitoring Quality Assurance Project Plan (QAPP), 2001.

3.0 CREDIBLE DATA LEGISLATION

The WDEQ WQD has specific requirements for the collection and analysis of data for use in the classification and periodic assessment of the condition of surface waters. The drafting of a SAP is a part of these requirements. Monitoring performed under this SAP complies with Wyoming State Statutes 35-11-103, and 35-11-302 (b) (i) and (ii), commonly known as the Credible Data Legislation.

WDEQ is required to use "…scientifically valid chemical, physical and biological monitoring data collected under an accepted sampling and analysis plan including quality control, quality assurance procedures and available historical data." As a result of the legislation, conservation districts, local governments, local interest groups, volunteer monitors, individuals and land management organizations that want their water quality data accepted and used by the WQD, Watershed Program, must collect that data under an approved SAP.

Statute 35-11-302 requires that "The rules, regulations and standards shall prescribe: The use of credible data in determining water body's attainment of designated uses. The exception to the use of credible data may be in instances where numeric standards are exceeded, or in ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible."

4.0 CORRECTIVE ACTIONS

If problems arise with sampling locations, number of samples per site, number/type of Quality Control (QC) samples, sampling methods/Standard Operating Procedure (SOP), number of sites, database application program, or any other aspect of the SAP, it will be reported to the Project Manager (SWCCD). The Project Manager will initiate a SAP update through a formal modification and will notify all co-signers of the SAP. Filing instructions will be included with each modification instructing the filer to place the modification in its relevant section. The modifications will also include a notice of the amendment, which will be posted in the front of the SAP, before the title page. The most recent modification will be posted on top of former modifications. A log page, which will include modification number, date, general description of the modification, and the initials of the filer will be located in front of all the modifications. All sampling personnel in active status at the time of the modification will be verbally informed of the change(s) and paper copies will be provided.

5.0 SAMPLING

5.1 Sampling Design, Purpose, and Objectives

This project sampling design is somewhat unique in that preliminary sampling was completed prior to 2004, baseline studies were completed in 2004 and 2005, and initial reconnaissance sampling for this 2014-2015 supplemental work was completed during 2006-2013.

The purpose of 2014 and 2015 sampling is to continue collection of water quality, flow, and stream characteristic data at select project sampling locations for continued tracking of E. coli and chloride level trends.

The monitoring objective of 2014 and 2015 sampling within the Bitter Creek watershed is to evaluate whether conclusions reached in the previous sampling and studies remain appropriate, and to collect surface water quality paired with flow for development of constituent load relationships to augment the project database and WDEQ TMDL development.

The purposes and objectives of this sampling plan drive the sampling design. The sampling design is focused on sampling of select sites that allow meaningful interim data collection which can provide information to verify or refute prior conclusions, and provide paired water quality/flow relationships.

5.2 Sampling Personnel and Training

All personnel engaged in any facet of the implementation of this sampling and analysis plan should at a minimum:

1. Have completed the Wyoming Association of Conservation Districts Water Quality training and Certification program or equivalent;
2. Have the equivalent training and/or experience in water quality monitoring and assessment or;
3. Work under the direct supervision of a person whom qualifies under 1 or 2.

SWCCD will retain EDE Consultants to conduct project field work to include monitoring activities as the project Water Quality Technical Staff. All EDE employees conducting monitoring will be qualified under the above guidelines. The primary samplers for the project are anticipated to be Bruce Nelson (BNN) and Russ Hamilton (RWH), and Cheryl Naus (CAN) will serve as substitute, all of whom have conducted previous monitoring for this or similar projects and have qualifications to conduct the required sampling under item 2 above as described in Table 5.1.

EDE's office information is as follows:
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Sheridan, WY 82801
(307) 672-3793
EDEconsultants.com

Table 5.1 - Sampling Personnel

Sampler Name and Organization	Type of Sampler	Type of Training	Previous Sampling Experience
Bruce Nelson Civil Engineer EDE Consultants	Primary Sampler	Qualifying experience in surface, groundwater, and soil sampling design, sample collection, data analysis, and data reporting.	SWCCD sampling program 2004-2012. Previous surface water monitoring and sampling for WDEQ reporting for WY conservation districts. Ongoing surface water and groundwater monitoring and sampling for WDEQ reporting for WY mineral industries and municipalities.
Russell Hamilton Environmental Engineer EDE Consultants	Primary Sampler	Qualifying experience in surface, groundwater, and soil sampling design, sample collection, data analysis, and data reporting.	SWCCD sampling program 2004-2012. Previous surface water monitoring and sampling for WDEQ reporting for WY conservation districts. Ongoing surface water and groundwater monitoring and sampling for WDEQ reporting for WY mineral industries and municipalities.
Cheryl Naus Geologist EDE Consultants	Substitute Sampler	Qualifying experience in surface, groundwater, and soil sampling design, sample collection, data analysis, and data reporting.	Previous surface water monitoring and sampling for WDEQ reporting for WY conservation districts. Ongoing surface water and groundwater monitoring and sampling for WDEQ reporting for WY mineral industries and municipalities.

5.3 Sampling Locations and ID Codes

Killpecker Creek (WYGR 14040105-066) and Bitter Creek (WYGR 14040105-023) are located in Sweetwater County. The watershed segments to be monitored are primarily:

1. Killpecker Creek from the confluence with Bitter Creek in Rock Springs upstream to the Highway 191 crossing.
2. Bitter Creek from approximately the downstream extents of the town of Rock Springs, upstream to the approximate upstream limits of the town of Point of Rocks.

Additional reconnaissance, sampling, and recording of flow conditions may be made during this project in other areas of both watersheds as possible/warranted, based on observations of flow or activities within the watershed during sampling rounds. This would occur only at sites previously designated for the project and having proper access and sampling agreements in place.

The elevations within the project area range from 6,150 ft AMSL at the downstream end of Bitter Creek to approximately 8,700 ft. AMSL in the upper reaches of the Bitter Creek watershed. The population estimate in the area included in this project is about 43,806 (Sweetwater County 2010 census). The climate is considered high arid desert with an average annual precipitation of 8.7" and an average annual temperature of 45º F with average extremes of 27º in the winter and 80º in the summer.

The surficial geography consists of gently rolling foothills, clay buttes, and vast areas of relatively flat desert land. Streams have associated alluvial deposits as flood plains and terraces. Most soils found in the watershed are underlain by soft bedrock of sedimentary origin; sandstone and shale are more susceptible and prone to wind

erosion than water erosion. Loam and sandy loam soil textures without adequate vegetated cover or litter are highly susceptible to wind erosion. When above normal precipitation or intense storm events occur on these soils there is water erosion associated with the steeper sloped soils. These soils are well to excessively drained, and range from shallow to very deep. Bedrock may occur within 10 inches of the surface to deeper than 60 inches. Soil textures are sandy, course loamy, and loamy. Permeability is moderate to rapid.

Within the project area private, municipal, State, and Federal land are found. Some of the lands within these watersheds are “checkerboard”, effectively dividing the land ownership between private interests, railroad, and BLM lands that are often leased for a variety of uses. A substantial portion of the project area sites are located within the metropolitan development area of the City of Rock Springs, WY and the immediate outlying areas.

Sampling sites for this project were selected with the guidance of the BKWAG, SWCCD, WDEQ and EDE Consultants. Sites were selected from the sites already developed and used for the SWCCD program from 2004-2013. Criteria for sampling site location includes site and access landowner/manager permission, differentiation of land use and management, mixing zone distance from confluences, acceptable flow regime, and ease of physical access. Note that sampling may not occur at all sites due to lack of sufficient flow and that some sites in the program may only be visited to record condition, not for sampling. Sample location codes, latitude/longitude (determined from GPS), and general descriptions are presented in Table 5.2.

Sites presented in Table 5.2 are subject to be monitored for both E. coli and chloride as conditions may warrant during the study period. However, the site parameter designation denoted in the table is anticipated to be generally adhered to during the study.

Site and site access ownership is reviewed during sampling design selection and permissions and access agreements are established or renewed as necessary prior to sampling activities. Site ownership is denoted in Table 5.2. 2014 -2015 project sampling sites and access routes have been reviewed and current sampling and access agreement permissions are maintained on file at the SWCCD office and with the designated consultant. These agreements allow the SWCCD to collect samples and to share data obtained from those samples and site visits with the WDEQ.

The current sampling design proposes samples be collected at sites BC-2, BC-4, BC-5, BC-6, KC-1, KC-2, and KC-5. Additional sample sites from the project site list in Table 5.2 may be monitored during sampling rounds in the course of this project.

Table 5.2 - Sampling Locations

Site Code	Site Description	Sample	Lat. WGS 84 Deg.	Lon. WGS 84 Deg.	Ownership	HUC
Bitter Creek - Upstream to Downstream						
BC-7	Bitter Creek channel downstream of crossing at Road 4410 south of Bitter Creek town site	C,E,F	41.505215	-108.532536	BLM	1404010505
BC-15	Bitter Creek channel just upstream of first crossing upstream of Bitter Creek town site	C,F	41.545802	-108.547280	BLM	1404010505
PD-1	Patrick Draw near Bitter Creek town site - dry, not sampled	F	41.558875	-108.552898	Anadarko E&P CO LLP	1404010505
BC-14	Bitter Creek channel upstream of Black Butte Coal, 50' downstream of power line crossing	C,F	41.510167	-108.639847	BLM	1404010505
BC-13	Bitter Creek channel downstream of Black Butte Coal where road shoulder is eroded by creek	C,F	41.603622	-108.727686	Anadarko E&P CO LLP	1404010505
BCS-6	Bitter Creek seep from base of cliff SE of Point of Rocks (south seep - upstream)	C,F	41.664439	-108.765105	Anadarko E&P CO LLP	1404010505
BCS-5	Bitter Creek seep from base of cliff SE of Point of Rocks (north seep - downstream)	C,F	41.665968	-108.765284	Anadarko E&P CO LLP	1404010505
BC-17	Bitter Creek channel upstream of BC-DM confluence, 300' upstream of south RR bridge	C,F	41.671260	-108.770592	Anadarko E&P CO LLP	1404010505
BLM Spring	Artesian well on BLM land upstream of Bridger Coal, start of perennial flow in Ten Mile Draw	C,F	41.733845	-108.605948	BLM	1404010505
TM-2	Ten Mile Draw channel upstream of TM-1 where two track crossing used to be	C,F	41.685155	-108.711260	Anadarko E&P CO LLP	1404010505
TM-1	Ten Mile Draw channel upstream of convergence with Deadman Wash	C,E,F	41.678159	-108.732742	BLM	1404010505
DM-1	Deadman Wash channel downstream of BLM wetland ponds near Point of Rocks	C,E,F	41.680028	-108.733892	BLM	1404010505
DM-2	Deadman Wash channel upstream of BC-DM confluence, downstream of I-80 at Point of Rocks	C,F	41.674871	-108.763170	Anadarko E&P CO LLP	1404010505
BC-6	Bitter Creek channel downstream of railroad bridge near Point of Rocks	C,E,F	41.674091	-108.777291	BLM	1404010505
BC-19	Bitter Creek downstream of Point of Rocks sewage lagoons	C,E,F	41.675593	-108.787291	Union Pacific Railroad	1404010505
BC-18	Bitter Creek upstream of Point of Rocks sewage lagoons	C,E,F	41.677265	-108.787291	Union Pacific Railroad	1404010505
BC-12	Bitter Creek channel 1/4 mile downstream of road crossing at Point of Rocks, north of picket	C,E,F	41.678378	-108.793172	BLM	1404010505
BC-11	Bitter Creek channel just upstream of headcut and irrigation ditch	C,F	41.664263	-108.952528	Anadarko E&P CO LLP	1404010505
BC-10 HOBO	Bitter Creek channel upstream of county road crossing east of Salt Wells Creek	F	41.649180	-108.996912	BLM	1404010505
BC-10	Bitter Creek channel upstream of county road crossing east of Salt Wells Creek	C,E,F	41.648610	-108.997859	BLM	1404010505
SWC-1	Salt Wells Creek channel downstream of Road 48 crossing	C,E,F	41.630841	-108.988068	BLM	1404010505
BC-5	Bitter Creek channel downstream of highway bridge where Airport Rd crosses Bitter Creek	C,E,F	41.602933	-109.128779	Rock Springs Grazing Assn.	1404010505
BC-9	Bitter Creek channel upstream of railroad bridge just upstream of Rock Springs	E, F	41.591716	-109.196548	Missouri Pacific Railroad	1404010505
BC-SYN 4	Bitter Creek channel underneath S Side Belt Route bridge	C,E,F	41.594961	-109.204361	City of Rock Springs	1404010505
BC-SYN 3	Bitter Creek channel 200' downstream of S Side Belt Route bridge (steel culvert in N bank)	E, F	41.595180	-109.205086	City of Rock Springs	1404010505
BC-8	Bitter Creek channel between Dead Horse Canyon and low water crossing near Pear St. park	C,E,F	41.592437	-109.213714	City of Rock Springs	1404010505
BC-SYN 2	30" steel culvert, ground level in bank of Bitter Creek channel just upstream of DHC confluence	E, F	41.592585	-109.213958	City of Rock Springs	1404010505
DHC-1	In engineered channel at corner of Pearl St. and N. Front St. upstream of BC confluence	C,E,F	41.590951	-109.213716	Union Pacific Railroad	1404010505
BC-SYN 1	30" concrete pipe high on north bank of Bitter Creek channel downstream of "N" Street bridge	E, F	41.593520	-109.219452	City of Rock Springs	1404010505
BC-4	Bitter Creek channel upstream of confluence of Bitter/Killpecker Creeks behind Toyota dealer	C,E,F	41.591769	-109.225768	City of Rock Springs	1404010505
BCW-1	At corner of fence along south bank of Bitter Cr between U-Haul and Bank of the West	E, F	41.589002	-109.226229	Rock Springs College Hill Inv.	1404010505
BCS-4	Old Bitter Cr. channel on south side of Bitter Creek in 48" culvert behind Meadow Gold Dairy	E, F	41.588579	-109.226705	Rock Springs College Hill Inv.	1404010505
BCS-3	Seep flowing from south bank of Bitter Cr. upstream of Dewar/Center St. bridge	E, F	41.584826	-109.226722	City of Rock Springs	1404010505
BCW-2	In street surface of Mead St. west of Wy Analytical Lab building near curb, 1.5" well marked water	E, F	41.584145	-109.225036	City of Rock Springs	1404010505
BC-16	Bitter Creek channel west of Stevens Park at end of Center St. in Rock Springs	C,E,F	41.581170	-109.226707	City of Rock Springs	1404010505
SPS-1	3 channels flowing from base of rail bed just south of Stevens Park at end of Center St. in RS	C,F	41.581341	-109.226120	Union Pacific Railroad	1404010505
BCS-2	Pond surrounded by snow fence inside Bunning Transfer yard	E, F	41.578614	-109.225341	Bunning John Co.	1404010505
BC-3A	Sweetwater Creek just upstream of confluence with Bitter Creek near site BC-3	C,E,F	41.573026	-109.240796	City of Rock Springs	1404010505
BC-3	Bitter Creek channel at crest gauge behind Nissan Dealer (upstream of BCS-1)	C,E,F	41.573092	-109.241136	City of Rock Springs	1404010505
BCS-1	Dug out seep 50 yards downstream of BC-3	E, F	41.572873	-109.241579	City of Rock Springs	1404010505
BC-20	Bitter Creek channel upstream of BC-RSTrib-2 discharge	C,E,F	41.572691	-109.262393	Union Pacific Railroad	1404010505
BC-RSTrib-2	Bitter Creek tributary from culvert near SW corner of intersection at Dewar Dr. and Sunset Blvd.	E, F	41.576452	-109.250905	City of Rock Springs	1404010505
BC-RSTrib-1	Bitter Creek tributary from 3 culverts between Kmart and La Quinta Inn on Dewar Dr.	E, F	41.580269	-109.259608	Daniel G Kamin R. S LL Dept.	1404010505
BC-21	Bitter Creek channel upstream of Interchange Road bridge	C,E,F	41.567691	-109.273030	Nelson McThomas Inv.	1404010505
LBC-1	Little Bitter Creek just upstream of Bitter Creek confluence	C,E,F	41.560091	-109.290868	BLM	1404010505
BC-2	Bitter Creek channel downstream of RR crossing downstream of Rock Springs WWTP	C,E,F	41.560257	-109.291724	Anadarko E&P CO LLP	1404010505
BC-1	Bitter Creek channel 1.5 miles upstream of confluence with Green River	C,E,F	41.518926	-109.427437	BLM	1404010505
Killpecker Creek - Upstream to Downstream						
BT well	Groundwater well just north (~0.25 mi.) of Boar's Tusk, foot access only for several hundred feet	C,F	41.966623	-109.199688	BLM	1404010508
MH well	Groundwater well at broken windmill east of Matthew's Hill (~1.75 mi. SE of Boars Tusk)	C,F	41.949868	-109.168689	BLM	1404010508
KC-10	Killpecker Creek where County Road a-17 comes closest south of Boars Tusk, dry, not sampled	F	41.925668	-109.197169	BLM	1404010508
KC-9	Killpecker Creek ~ 0.5 mi. southeast of Chilton Rd County Rd 17 intersection, dry, not sampled	F	41.840721	-109.211331	BLM	1404010508
LC-1	Long Canyon channel ~3.5 miles east of Chilton Road, dry, not sampled	F	41.776452	-109.183966	BLM	1404010508
14 Mile	Killpecker Tributary north of Chilton's Cutoff Rd, ~0.5 mi. west of KC-3, dry, not sampled	F	41.757465	-109.263335	BLM	1404010508
KC-3	Killpecker Creek channel downstream of two track crossing downstream of 14 Mile confluence	C,E,F	41.757740	-109.253380	BLM	1404010508
KC-7	Killpecker Creek channel just upstream of Chilton Road Crossing	C,F	41.729029	-109.244298	BLM	1404010508
KC-12	Killpecker Creek channel at historic RR crossing ~1.75 mi. upstream of KC-11, dry, not sampled	F	41.685860	-109.228781	BLM	1404010508
R-2	Killpecker Tributary east of Reliance at County Road 44 crossing, dry, not sampled	F	41.671754	-109.174917	Anadarko E&P CO LLP	1404010508
R-1	Killpecker Tributary just northwest of Reliance sewer lagoons, dry, not sampled	F	41.669903	-109.207516	Anadarko E&P CO LLP	1404010508
KC-11	Killpecker Creek channel off Stansbury Road west of mobile home area, dry, not sampled	F	41.660610	-109.225826	Regency of Wyoming Inc.	1404010508
KC-6	Discharge from mobile home area sewer lagoons, 0.22 mi. upstream of HWY 191 crossing	E, F	41.658669	-109.226283	Regency of Wyoming Inc.	1404010508
KC-2 HOBO	Killpecker Creek channel at HWY 191 bridge near Reliance	F	41.656327	-109.227476	Doak Living Trust	1404010508
KC-2	Killpecker Creek channel at HWY 191 bridge near Reliance	C,E,F	41.656009	-109.228012	Doak Living Trust	1404010508
KC-1H	Killpecker Creek channel upstream of golf course	C,F	41.648980	-109.231545	BLM	1404010508
KC-1G	Killpecker Creek channel east of golf course	C,F	41.643116	-109.231906	Anadarko E&P CO LLP	1404010508
KC-13	Killpecker Creek channel east of, and just upstream of, events complex collection pond	C,E,F	41.635274	-109.231795	Anadarko E&P CO LLP	1404010508
KCS-2	Pipe entering collection pond next to bmx track at the events complex	C,F	41.635084	-109.234089	Sweetwater County	1404010508
KC-1F	Progress rail above storm drain, across creek from Simons	C,E,F	41.629939	-109.237681	Missouri Pacific Railroad	1404010508
KCS-1	Seep/trib east of rail road tracks along rail siding, north of Yellowstone Rd	C,F	41.629911	-109.237816	Vista Alta LLC	1404010508
KC-5	Killpecker Creek channel just upstream of Yellowstone Rd. crossing	C,E,F	41.624058	-109.236397	1006 LLC	1404010508
KC-1E	Bridge at Yellowstone Road crossing	C,F	41.623899	-109.236432	1006 LLC	1404010508
KC-4	Killpecker creek channel just upstream of KCS-3 side tributary	C,E,F	41.617339	-109.240863	Schlumberger Tech. Corp.	1404010508
KCS-8	Upper reach of same tributary as KCS-3, upstream of horse coral on Antelope Dr.	C,F	41.642754	-109.281835	BLM	1404010508
KCS-7	Middle reach of same tributary as KCS-3 west of Foothills Blvd.	C,F	41.624035	-109.267395	BLM	1404010508
KCS-3	West side un-named upstream tributary across from Mineral Dr./industrial park north of I-80	C,F	41.617311	-109.241332	City of Rock Springs	1404010508
KC-1D	End of Industrial Drive, north of Schlumberger Lot	C,F	41.615887	-109.241252	Schlumberger Tech. Corp.	1404010508
KCS-10	Killpecker Tributary headwaters east of K Street	C,F	41.617227	-109.247828	BLM	1404010508
KCS-4	West side un-named downstream tributary across from Mineral Dr./industrial park north of I-80	C,F	41.615755	-109.241341	Schlumberger Tech. Corp.	1404010508
KCS-9	Upstream point of emergence for KCS-6 tributary, east side of Foothills Blvd. near transformer	C,F	41.614236	-109.245815	BLM	1404010508
KCS-6	Killpecker Tributary 500 yds downstream from KCS 4, subs ~300 yds before entering KC	C,F	41.614378	-109.243675	BLM	1404010508
KC-14	Killpecker Creek channel at south end of Mineral Drive	C,E,F	41.613991	-109.238537	Neeff Lance A	1404010508
KC-1C	Killpecker Creek channel off Production Drive, Halliburton Fuel	C,F	41.614874	-109.234716	Neeff Lance A	1404010508
KCS-5	Seep/pond on raised marsh between industrial park and trailer park on west side of KC	C,F	41.614640	-109.234284	Neeff Lance A	1404010508
KC-1B	Killpecker Creek channel upstream of Stagecoach Drive bridge	C,E,F	41.609826	-109.232074	Archland Property I LLC	1404010508
KCRStrib-1	Killpecker Tributary that crosses Elk St. north of Gases Plus	C,E,F	41.600371	-109.230544	Elk Properties LLC	1404010508
KC-1A	Killpecker Creek channel 140 feet upstream of Springs Drive bridge	C,F	41.599469	-109.232221	Harold and Lois A. Williams	1404010508
KC-1	Killpecker Creek channel behind and upstream of Wyoming Wool Warehouse on Bellevue Drive	C,E,F	41.595221	-109.232914	City of Rock Springs	1404010508
KC-15	Killpecker Creek channel 75 feet upstream of Bitter Creek confluence	C,E,F	41.591156	-109.226994	Rock Springs College Hill Inv.	1404010508
C	**Chloride/Inorganic Sampling Site**					
E	**E. Coli Sampling Site**					
F	**Flow Conditions Site**					

5.4 Parameters, Units, Analytical Methods, SOP's, Preservatives, Holding Times

The parameters to be analyzed are focused towards specific parameters previously found to be water quality issues. These are chloride and E. coli. Additional parameters will be measured or analyzed for completeness in characterizing the water chemistry. The sampling will consist of surface water samples and flow measurement, and periodic soils samples. A summary of sampling parameters, methodology, and holding times is presented in Table 5.3. The three data components comprising these samples include physical, chemical, and bacteriological parameters. Sampling field report forms and chain of custody examples are presented in Appendix A.

5.4.1 Physical Parameters

Field data including discharge, temperature, pH, conductivity, dissolved oxygen, and turbidity will be collected during each surface water sample event as applicable. General observations regarding the water visual appearance will be recorded.

5.4.2 Chemical Parameters

Water samples will be analyzed for:	Soil samples will be analyzed for:
chloride	chloride
calcium	calcium
magnesium	magnesium
sodium	sodium
potassium	potassium
electrical conductance	electrical conductance
total dissolved solids	pH
pH	sulfate
carbonate	total alkalinity
bicarbonate	sodium absorption ratio
sulfate	percent saturation
fluoride	cation exchange capacity
nitrate	
nitrite	
total alkalinity	
hardness	
dissolved oxygen	

5.4.3 Bacteriological Parameters

Water samples to have analysis for E. coli will be collected at each sampling event for those sites identified as bacteriological sampling locations. Data Quality Objectives (DQO) are used to limit data uncertainty to an acceptable level. DQO for E. coli monitoring consist of precision and completeness. Precision is the degree of agreement of duplicate samples and is found using a relative percent difference (RPD) statistic. The precision DQO for E. coli is 50%. Completeness is the comparison of valid samples collected to the number of samples scheduled to be collected. The completeness DQO for E. coli is 95%.

Table 5.3 - Summary of Parameters Holding Time, Preservatives						
Parameter	**Method**	**Detection Limit**	**Holding Time**	**Preservative**	**Analysis Location**	**Sample Type**
Lab pH	**SM4500 H+B**	**0.1 mg/l**	**N/A**	**Ice to 4 C**	**Lab**	**grab**
Lab EC	**SM 2510B**	**5 umhos/cm**	**N/A**	**Ice to 4 C**	**Lab**	**grab**
TDS @ 180	**SM 2540C**	**10 mg/l**	**7 days**	**Ice to 4 C**	**Lab**	**grab**
TDS calc.	**SM 1030F**	**10 mg/l**	**N/A**	**N/A**	**Lab**	**N/A**
Alkalinity as CaCO3	**SM 2320B**	**1.0 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Hardness as CaCO3	**SM 2340B**	**1.0 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Bicarbonate as HCO3	**SM 2320B**	**1.0 mg/l**	**28 days**	**Ice to 4 C**	**Lab**	**grab**
Carbonate as CO3	**SM 2320B**	**1.0 mg/l**	**28 days**	**Ice to 4 C**	**Lab**	**grab**
Chloride	**SM 2320B**	**1.0 mg/l**	**28 days**	**Ice to 4 C**	**Lab**	**grab**
Nitrate + Nitrite as N	**SM 2320B**	**0.01 mg/l**	**28 days**	**H2S04 and Ice to 4 C**	**Lab**	**grab**
Sulfate	**SM 2320B**	**1 mg/l**	**28 days**	**Ice to 4 C**	**Lab**	**grab**
Calcium	**EPA 200.8**	**1 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Magnesium	**EPA 200.8**	**1 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Potassium	**EPA 200.8**	**1 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Sodium	**EPA 200.8**	**0.2 mg/l**	**6 months**	**Ice to 4 C**	**Lab**	**grab**
Cations	**SM 1030F**	**N/A**	**N/A**	**N/A**	**Lab**	**calculated**
Anions	**SM 1030F**	**N/A**	**N/A**	**N/A**	**N/A**	**calculated**
Balance	**SM 1030F**	**N/A**	**N/A**	**N/A**	**N/A**	**calculated**
Escherichia *coli*	**SM9223**	**1 MPN/100 ml**	**6 hours**	**Ice to 4 Deg. C**	**Lab**	**grab**
Temperature	**Deg. C**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**
Conductance	**SM2510B**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**
Dissolved Oxygen	**mg/l**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**
Field pH	**Std. Units**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**
Discharge	**cfs**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**
Stage	**feet**	**NA**	**NA**	**NA**	**In-situ**	**instantaneous**

5.5 Sampling Schedule

To determine if chloride and E. coli are introduced into Bitter and Killpecker Creeks from surrounding ground surface or sub-surface areas and if those concentrations of chloride or bacteria are exceeding the standards, two primary water chemistry and water bacteriology sampling events are proposed each year. The first sampling event will coincide with the end of spring runoff in late May or early June. The second sampling event will occur in August/September, which is the time of year where flows represent seasonal low-flow/base flow conditions and are most likely to have their source as groundwater discharge. An additional event may be conducted between the spring and fall sampling events, as circumstances allow, to provide supplemental information. The sample events will be conducted at the primary sites listed above (BC-2, BC-4, BC-5, BC-6, KC-1, KC-2, and KC-5) as field conditions allow.

A consideration when determining sampling frequency is the WDEQ E. coli standards against which data obtained during implementation of this monitoring regime may be evaluated. The numeric criteria for E. coli are compared against a geometric mean of sample results during a consecutive 60 day period. In order to represent the entire 60-day period, WDEQ requires that a minimum of five samples be collected and that they be separated by a minimum of 10 days. However, WDEQ recommends collecting more than five samples when resources allow. When more than five samples are collected, samples within ten day periods must be averaged before being used to calculate the 60 day geometric mean.

Sampling to be conducted during the two to three proposed sampling events is planned to be conducted to attain synoptic results from as many sites as practical, and E. coli monitoring will be done as single samples paired with flow monitoring information to aid in TMDL flow loading data collections. This deviation from geomean sampling was implemented with BKWAG, SWCCD, and WDEQ input, (beginning in 2012) and is intended to provide needed flow loading information for TMDL development, and a means to gauge general water quality trends and track impairment status at project legacy sites with minimal effort and cost.

5.6 Safety

Safety is a primary concern at all times and in all sampling situations for field sampling personnel. In any marginal or questionable situation, samplers are required to assume worst-case conditions and use safety precautions and equipment appropriate to that situation. Samplers who encounter conditions which, in their best professional judgment, may exceed the protection of their safety equipment or may in any way represent a potential hazard to human health and safety should immediately leave the area and contact their supervisor.

Protective gloves should be worn when sampling surface water. Samplers should thoroughly wash hands and arms with bacterial soap after sampling and before eating or drinking.

Samplers are strongly encouraged to carry a cell phone. Samplers will inform a supervisor or co-worker when they leave for the field, where they will be sampling, and their estimated time of return. The supervisor or co-worker will initiate the emergency action plan below if the samplers have not returned to the office within the allotted amount of time. To avoid worry and concern, samplers will call the office if they are running behind schedule.

5.6.1 Emergency Action Plan

Either Tom Burris chair of the BKWAG, or Mary Thoman chair of the SWCCD, or both, will be notified of the departure time of each sampling trip, know the itinerary, persons involved, map of route taken, vehicle type and color, license plate of vehicle

taken, and the estimated time of return. This information will also be sent to the SWCCD office staff (Karen Pecheny – District Clerk).

Tom Burris - Ph (307) 273-5579, cell (307) 389-3541, tburris@swccd.us
Mary Thoman – Ph (307) 877-3718, cell (307) 870-8062 mthoman@hughes.net
SWCCD – Ph (307) 362-3062 #4, karenpecheny@swccd.us

The contact person(s) will know whom to contact to initiate rescue efforts. If samplers have not returned or reported to the supervisor, personnel on duty will contact the BKWAG/SWCCD chairs and then Sweetwater County Search & Rescue 307-352-6720 or 307-872-6350 if necessary.

5.7 Sample Labeling

Each sample will be labeled with a permanent, waterproof marking pen, such as a "Sharpie" on waterproof paper such as write-in-rain™ paper. The sample identification will be recorded on the bottle, on the Chain of Custody (COC) form (Appendix A), on the lab's analytical report, and in the field logbook. At a minimum, sample labels must include:

1. Date and Time (24 hour time).
2. Sampler's name and/or initials as recorded in the field log book.
3. Station ID #. Consisting of Station location codes (Table 5.1), analysis type, day of year, year, and sample type (regular, duplicate, or blank).

An example label is provided in Appendix B.

5.8 Sample Shipping

Typically, only inorganic chemical water quality samples will be shipped for this project (to Wyoming Department of Agriculture Analytical Services, Laramie, WY). E. coli samples will be delivered by the sampler to Wyoming Analytical Laboratories, Rock Springs WY the day of sampling. Soil samples will typically be delivered by the sampler to Intermountain Laboratories, Sheridan WY.

Inorganic samples will be shipped by the sampler the day of sampling (or as necessary to meet holding time requirements) via next day United Parcel Service in insulated coolers, and will be shipped with ice packs to keep the samples chilled at 4 degrees Celsius. Samples will be packed firmly in the cooler to prevent breakage or accidental leakage. Shipping receipts will be maintained on file by the sampler.

5.9 Waste Disposal

Little waste generation is anticipated. Used gloves, towels, sample bottles, will be discarded as conventional solid waste for disposal in a municipal landfill.

5.10 References and/or Information Collected

A watershed wide sampling site location map is presented in Appendix C. Individual site maps showing site access for primary proposed project sites BC-2, BC-4, BC-5, BC-6, KC-1, KC-2 and KC-5 are also presented in Appendix C. References and information collected for project review and sampling plan development are presented in Appendix D.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This section outlines the quality assurance/quality control (QAQC) procedures to be followed during the project. Chloride (inorganic) sampling, E. coli sampling, soil sampling, and flow measurement methodology for this project will adhere to WDEQ procedures and data quality objectives (DQO) as outlined in the WDEQ Manual of Standard Procedures for Sample Collection and Analysis (2012), unless noted in the following sections or the project quality assurance project plan (QAPP) in Appendix F.

6.1 Field Log Books/Data Sheets

Field notebooks will be kept by SWCCD's consultant. Copies of the log books will be kept in a secure location within the SWCCD office as per the Data Archiving section of this SAP. Calibration information, sampler names, date, time, weather conditions, field observations, equipment condition, sampling location information, and narrative information concerning any special circumstances or corrective action including any need to modify the SAP or SOPs will be recorded in the field notebooks.

6.2 Calibration Standards

All field instrumentation will be calibrated according to the manufacturers instructions provided with the instrument. Calibration standards and solutions used will be consistent with the recommendations of the manufacturer. Calibration standards will be checked for expiration date prior to use and only valid standards will be used.

6.3 Chain of Custody

Samples will be cooled, preserved and packed as directed according to SOP prior to shipment and MUST be accompanied by a completed COC form. In general, the samplers will use the COC forms provided by the commercial laboratories. Examples of these COC forms are included in Appendix A.

Chain of custody includes:

1. It is mandatory to submit completed signed COC forms with the samples.
2. Lab receives sample shipment with the completed COC form and signs it.
3. Lab returns a copy of the signed and completed COC form to the SWCCD.
4. The district or consultant files the original in the COC file and maintains it indefinitely.

6.4 Equipment/Equipment Maintenance and Calibration Logs

The Water Quality Technician will be responsible for all equipment calibration and maintenance. All equipment will be calibrated according to the manufacturer's recommendations. A calibration log will be kept in the consultant's office to record calibrations completed. An example of the Calibration and Maintenance Logs is included in Appendix A. The log will include the dates of calibration, calibration solutions, expiration dates, and the initials of the person performing the calibrations as well as copies of the equipment manuals, and calibration solution re-ordering

information. Manuals will also be kept with the equipment for field use (excepting cameras). The following equipment is proposed for use on this project.

Hanna Instruments Water Proof Probe; Model HI98129, SN: none

Parameter	Units	Calibration	Maintenance	Schedule
Conductance, Specific	mhos/cm	Solution	Replace Battery	As needed
TDS	ppt	Solution	Replace Battery	As needed
pH	Std. Units	Buffer Solutions 7/10	Replace Battery	As needed
Temperature	°C	Mercury Glass Thermometer	Replace Battery	As needed

Flow measurement - Price AA SN: none, Pygmy Meter SN: none, Global Water FP111 SN: 1216002939

Parameter	Units	Calibration	Maintenance	Schedule
Velocity	ft^3/sec	Spin count	Replace Battery	As needed

Turbidimeter – Lamotte, Model 2020, SN: 4501-2803

Parameter	Units	Calibration	Maintenance	Schedule
Turbidity	NTU	Solutions	Replace Battery	As needed

Dissolved Oxygen – Oakton Model 35640, SN: 488169

Parameter	Units	Calibration	Maintenance	Schedule
Dissolved Oxygen	mg/l	Open Air	Replace Battery	As needed

WTW – pH, Eh, and Temperature – Model 330i, SN: 01480253

Parameter	Units	Calibration	Maintenance	Schedule
pH, Eh, Temperature	Std Units, mV, Centigrade	Solutions	Replace Batteries Clean Probe	As needed

Camera – Kodak Easy Share C533, SN: KCFFR61415707

Parameter	Calibration	Maintenance	Schedule
Photo Documentation	None	3 V Lithium Battery	As Needed

Camera – Kodak DC 290, SN: none

Parameter	Calibration	Maintenance	Schedule
Photo Documentation	None	AA Batteries	As Needed

GPS - Garmin e-Trex, SN: 89828633

Parameter	Calibration	Maintenance	Schedule
Location	None	Battery Replacement	As Needed

6.5 Data Verification and Validation

Sampling personnel (Section 5.2) will be responsible for reviewing the data sheets and field log books, checking for omissions in identification, decimal placement, dates, times, units reported, and comments. Water quality technical staff (sampling personnel, Section 5.2) collecting data will be contacted immediately if there are data gaps or if scheduled sampling times were missed. It is the water quality technical staff's responsibility to evaluate raw data generated by the contract laboratories for appropriate numeric reduction, data quality, and accuracy. All data will be reviewed and reported in units specified at the detection level of the analysis methods used. To reduce data point loss, data that is reported as "less than" detection level should be incorporated at a value of 1/2 the detection level (or otherwise noted). Once data is generated, it will be compiled in a database file. During this data transfer, the information will be reviewed and verified in accordance with data quality objectives.

Data generated in the laboratory will be validated by performance checks such as duplicates, spikes, and blanks. Data will be reported in the units that have been designated to each parameter in the Analytical Methods, Holding Times, Parameters, and Sample Collection Methods section tables. Scientific notation will be used and significant figures will correlate with detection levels. Both graphing and narrative conclusions will be used to describe the water quality results and trend variations.

6.6 Field Quality Control Samples

The water quality technical staff will be responsible for understanding the Quality Assurance/Quality Control (QA/QC) Plan from each contract laboratory and for collecting samples appropriately. The QAPP is presented in Appendix F and adheres to procedures in the WDEQ QAPP and is incorporated by reference herein as Table 6.1.

Table 6.1 - Example Quality Control Protocols

Parameter	QC Check	Frequency	Acceptable Range	Corrective Actions
Blanks	Contamination which might affect analytical results	1 trip and 1 field blank every 9 or fewer samples collected (e.g. 1 each for 1 to 9 samples collected, 2 each for 10 to 18 samples collected, etc.). 1 laboratory blank every 10 samples analyzed, or once if fewer than 10 samples are analyzed (E. coli requires 1 laboratory blank per uninterrupted lot).	Pass/Fail	Notify sampler and appropriate management; repeat blank with another bottle from same lab and retest; find contamination source; Water Quality Technical Staff decides whether to accept or disallow data.
Chain of Custody Form	Laboratory Supervisor notes errors and omissions on sheet and in laboratory database	Each group of samples shipped to the lab	No errors or omissions	Notify sampler and appropriate management; audit and train the field sampler; test results from samples which are sent to the laboratory without a Chain of Custody form are not suitable for use in legal actions
Chain of Custody Seal	Laboratory Supervisor records on Chain of Custody Form and in Laboratory database	Each container of samples shipped to the lab	No errors or omissions	Notify sampler and appropriate management; audit and train the field sampler; test results from samples which do not have a seal are not suitable for legal actions
Dissolved Oxygen	Written record of altitude; meter measures temperature and auto-calibrates	Site specific; before each use	Instrument specific; generally $\pm$0.1mg/l	Verify altitude; if still not correct return meter to manufacturer for repair or replacement
Duplicates	Required	1 per parameter every 10 or fewer samples collected (e.g. 1 duplicate for 1 to 10 samples, 2 duplicates for 11 to 20 samples, etc.).	Required	Notify sampler and appropriate management if missing; audit and train field sampler. Water Quality Technical Staff decides whether to accept or disallow data.
pH	2 point meter check with pH 7 and 10 buffer standards	Once a day	$\pm$5%	Repeat field check; if still not correct return meter to manufacturer for repair or replacement
Sample Preservation	Sample label and Chain of Custody agrees with parameter SOP; Laboratory Supervisor notes errors or omissions on Chain of Custody Form	All samples	No errors or omissions	Notify sampler and appropriate management; audit and train sampler; resample; data is flagged to indicate that it should not be entered in a database or used for decision making
Sample Labeling	Labels contain required information	All bottles	No errors or omissions	Audit and train sampler
Temperature	Annual calibration against a thermometer traceable to an NBS thermometer	Annually	On the calibration mark	Repeat measurement with different thermometer; if not correct contact manufacturer

6.7 Sampling Methods

The methods and procedures for the Bitter/Killpecker watershed water quality monitoring program are provided in this section. The sampling protocols are consistent with the protocols described in the WDEQ-WQD "Manual of Standard Operating Procedures for Sample Collection and Analysis", 2012.

Water quality data must be obtained in such a manner as to be deemed credible. Adherence to the components of the sampling protocols, statistical design, scale, parameters, methods, location, type, frequency and duration provided in this section will assure that credible data will be obtained. The conservation district and its representatives will collect credible data comprised of physical, chemical, and biological parameters according to credible data legislation. To ensure defensible and credible data, collection procedures for each parameter will be completed according to established WDEQ standard collection protocols and are incorporated by reference herein. Standard Operating Procedures specific to this project are in Appendix E.

6.8 Assessment and Response Actions

To identify any quality assurance or quality control problems in a timely manner the SWCCD will conduct a self-assessment with the Internal Review of Procedures using the relative quality assurance SOPs following each sampling round. If a major problem exists, corrective action will be immediately taken and documented. In those situations where independent expertise is needed to assess a certain aspect of the project, the District will request technical assistance. The WDEQ Project Officer may conduct any type of assessment at any time during the length of the project. This includes assessments of any contractor or sub-contractor performing sampling, analysis, or any other activity directly related to the program.

7.0 LABORATORIES

7.1 Laboratory QA/QC Plans

This project will employ only EPA and DEQ certified and/or approved laboratories. Such certification and/or approval serves as appropriate indication that the laboratory QA/QC is adequate to meet credible data requirements.

7.2 Contract Laboratories

Notify labs for specific packing and delivery instructions at least two weeks prior to initiating sampling events. The labs to be used for this project are found below:

WYOMING DEPARTMENT OF AGRICULTURE ANALYTICAL SERVICES 1174 Snowy Range Road Laramie, Wyoming 82070 Telephone: (307) 742-2984 aslab@state.wy.us	Parameters: Water Chemistry
WYOMING ANALYTICAL LABORATORIES, Inc. 625 Center St. Rock Springs, Wyoming 82901 307-362-3176 walrspgs@aol.com	Parameters: Bacteria
INTER-MOUNTAIN LABORATORIES, Inc. 1673 Terra Avenue Sheridan, Wyoming 82801 307-672-8945 ksecor@imlinc.com	Parameters: Soil Chemistry

7.3 Laboratory Results

Laboratory results will be reported by the laboratory directly to the Consultant and/or the District in electronic and/or paper copy. The laboratory data will be reviewed immediately by the Consultant and/or the District to determine if the data appears to be reasonable and contains no detectable errors. Apparent errors will be reported to the laboratory immediately for reconciliation. Samples may be re-analyzed if possible/necessary.

8.0 DATA

Data management is an important part of the project. This includes entry of data into the field forms and log books as well as entering that data to electronic format for analysis and reporting. Data review and validation procedures are outlined in the QAPP attached in Appendix F.

8.1 Data Entry

Entry of data into electronic format will require that the data entry technician enter the data into the water quality spreadsheet or database specified by the consultant and/or the District staff. Once entered, the data will be cross checked against the data source, whether this is the field log book or the field data sheets. Errors, if any, in the data entry should be corrected. Once the data entry is verified this should be noted in the electronic file naming.

8.1.1 Data Archiving

Data archiving parameters are presented in Table 8.1.

Table 8.1 - Data Archiving

Record Type	Storage Location Original/Copy	Storage Length	Responsible Party
Calibration Verification	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Chain of Custody	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Field Log Book	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Lab Results	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Maps	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Reports	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
SAP, QAPP, SOP	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Spreadsheets	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator
Database Management System	Consultant/SWCCD	Indefinite	WQ Tech, Natural Resource District Coordinator

Electronic data will be backed up on Tape, CD or DVD media and stored with the paper logs and documentation.

8.2 Statistical Analysis

Various sampling designs produce data with varying statistical outcomes, the choice of which design to use is based upon the project's goals and objectives. The E. coli concentrations and the levels of chloride found in both the Bitter Creek and Killpecker Creek drainages are the water quality issues of this project. The goal includes determining water quality and quantity within the impairments and then utilizing the data

to help WDEQ develop TMDLs for the impairments and to mitigate using best management practices as possible.

To address the water quality issue, baseline water quality data was acquired from across the Bitter Creek and Killpecker Creek watersheds to supplement existing historical water chemistry data. This provided an opportunity to statistically verify or refute the preliminary WDEQ impairment conclusions. This data was then used to develop the proposed quality/quantity based sampling design to be used to determine the magnitude and/or extent of the water quality issues within various stream reaches within impairment areas. Based on the data acquired WDEQ is poised to finalize TMDL assignment to the Bitter and Killpecker Creek impairments. Additionally, locations for long-term (trend) monitoring stations have been identified and established based upon project data accumulated, for use in revisiting the TMDLs in the future and monitoring water quality trends in the interim. Trend stations are used to monitor trends in water quality, with the goal of improving or maintaining the existing quality of the waters found within the watersheds, as applicable.

9.0 REPORTS

9.1 Data Verification Report

A consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for analyzing and presenting the data as necessary. Data verification will be conducted for each sampling round immediately following the sampling and receipt of the laboratory data. This information will be incorporated into a final report to be submitted to the SWCCD and the BKWAG prepared at the conclusion of this monitoring program.

9.2 Data Validation Report

A consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for analyzing and presenting the data as necessary. Data validation will be conducted for each sampling round immediately following the sampling and receipt of the laboratory data. This information will be incorporated into a final report to be submitted to the SWCCD and the BKWAG prepared at the conclusion of this monitoring program.

9.3 Quarterly Report

A consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for analyzing the data and prepare, as necessary, a quarterly report. Detailed quarterly reports are assumed to typically not be necessary for the level of monitoring proposed within the program, and occasional e-mail or phone correspondence with the SWCCD on monitoring progress will be sufficient instead.

9.4 Corrective Actions Report

A consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for analyzing the data and prepare as necessary a corrective actions report following each sampling round.

9.5 Laboratory Report

The commercial laboratories will be responsible for providing the laboratory data reports and the QA/QC reports following each sampling round. These reports will be used as the source for laboratory data input and this data will undergo data validation and verification. This information will be incorporated into a final report to be submitted to the SWCCD and the BKWAG prepared at the conclusion of this monitoring program.

9.6 Assessment Report

A consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for analyzing the data and prepare, as necessary, an assessment report of the project following each sampling round.

9.7 Final Report

At the conclusion of the monitoring, the consultant and/or water quality technician technically proficient in water quality monitoring will analyze all lab reports and field data and will be responsible for preparing a final report to be submitted to the SWCCD and the BKWAG.

Appendix A – Forms

Combined Inorganic, Bacteria, or Soil Sample Site Visit Form

Project: SWCCD Bitter Creek/Killpecker Watershed Assessment
Stream Name:
Personnel:
Land Owner:
Site:
Date:
Time:
Flow Depth:
Flow Rate:
Crest Gage:
Rain Gage:
Sampled:
Sample Method:
Calibrated Instruments:
Sample Name:

Field Parameters:

pH	
Temperature (°C)	
Redox (mV)	
Conductivity (uS)	
Dissolved Oxygen (mg/L@%)	
Turbidity (NTU)	

Container	Number	Preservative	Sample Type	Lab

Date Dropped Off At Lab: _____ **Date Shipped To Lab:** _____

Ship To:	Wyoming Department of Agriculture Analytical Services, Laramie, WY 82070, (307) 742-	**A**
Drop Off At:	Wyoming Analytical Laboratories, Inc., Rock Springs, WY 82901, (307) 362-3176	**B**
Drop Off At:	Inter-Mountain laboratories, Inc., Sheridan, WY 82801, (307) 672-8945	**C**

Comments:

WYOMING DEPARTMENT OF AGRICULTURE
ANALYTICAL SERVICES

1174 Snowy Range Road
Telephone: (307)-742-2984 Laramie, WY 82070
E-mail: aslab@state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm

SURFACE WATER COLLECTION &
OFFICIAL ANALYSIS REPORT

Sweetwater County Conservation District
79 Winston Dr. Suite 110
Rock Springs, WY 82901

Phone: 307-362-3062 ext. #4 EDE: 307-672-3793
'E-mail: rhamilton@edeconsultants.com

LAB No:

D/T REC: **BY:**

DATE COMPLETED:

COLLECTION DATA & FIELD MEASUREMENTS			
Date Collected		Conductivity	
Time Collected		Dissolved O_2	
Discharge		Turbidity	
Temperature		pH	

Sample ID	
Sampled By	
Comments:	
Invoice #	**VOSR**
Amount	**$55.00**

PARAMETER	UNITS	RESULT	PARAMETER	UNITS	RESULT
Calcium	mg/L		Carbonate	mg/L	
Magnesium	mg/L		Bicarbonate	mg/L	
Sodium	mg/L		Fluoride	mg/L	
Potassium	mg/L		Chloride	mg/L	
			Nitrate as N	mg/L	
			Nitrite as N	mg/L	
pH, Lab	Units		Sulfate	mg/L	
Conductivity, Lab	umhos/cm				
			Hardness as $CaCO_3$	mg/L	
			Total Alkalinity as $CaCO_3$	mg/L	

Analyst's Remarks:	S	R	Bottle
	[1]	[ ]	1L Plain
	[ ]	[ ]	250ml Plain
	[ ]	[ ]	250ml HNO_3
	[ ]	[ ]	250ml H_2SO_4

Elect. File **Sweetwater-CCD01**

Analysts:

I hereby certify the above was analyzed by myself or my assistant.

Section Supervisor

Laboratory Manager

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Page_____ of _____

Please PRINT all information:

Wyoming Analytical Laboratories, Inc.
1660 Harrison St. Laramie, WY 82070 (307) 742-7995 FAX: (307) 721-8956
625 Center Street Rock Springs, WY 82901 (307) 362-3176 FAX: (307) 362-3581

Client Contact _____
E-mail Results y / n
FAX Results y / n

Project_____ # _____
Send Report To_____
Address_____
City_____ State_____ Zip_____
Telephone:_____
FAX:_____ E-mail_____

Sample I.D.	Date/Time	**MATRIX	Number of Containers	Organic Analysis: Base/Neutral/Acids/Organics GC/MS 625/8270	Volatile Organics GC/MS 8260A	BTEX, GRO, DRO, FUEL ID	Total Petroleum Hydrocarbons - 418.1	Total Organic Halides (TOX) 415/9020	Total Organic Carbon (TOC) 415/9060	TCLP - VOA, BNA, Pesticides, Herbicides		Inorganic Analysis: Metals (total or dissolved) List Below	Nitrogen No_2+No_3, NH_3, NO_2, NO_3	pH, Cond, Cl, So^4, P-ortho (circle) F, Br,	COD, Total-P, (circle) TDS, TSS	TCLP - Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag		Assigned Lab No.

Sample Transfer Record	PO #	Sample Receipt
RELINQUISHED BY: (PRINT)	Hard copies will be mailed with invoice	Shipped VIA
SIGNATURE:	Turnaround Required*	Seals Intact Temp.
DATE / TIME:	*(expedited turnaround subject to additional fee)	Condition
RECEIVED BY: (PRINT)	SPECIAL INSTRUCTIONS / COMMENTS	
SIGNATURE:		
DATE / TIME:		
	**MATRIX: W-Water S-Soil SL-Sludge O-Oil G-Gaseous X-Other Specify Type_____	
	Preservation: ☐ 4°C ☐ Acid ☐ None ☐ Other _____	

Inter-Mountain Labs
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

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Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #

Report Address	Contact Name
	Email
Invoice Address	Phone
	Purchase Order # / Quote #

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	ANALYSES / PARAMETERS	REMARKS
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME

SHIPPING INFO
- ❑ UPS
- ❑ Fed Express
- ❑ US Mail
- ❑ Hand Carried
- ❑ Other _____

MATRIX CODES

Water	WT
Soil	SL
Solid	SD
Filter	FT
Other	OT

TURNAROUND TIMES
Check desired service
- ❑ Standard turnaround
- ❑ **RUSH - 5 Working Days**
- ❑ **URGENT** - < 2 Working Days

Rush & Urgent Surcharges will be applied

COMPLIANCE INFORMATION
- Compliance Monitoring? Y / N
- Program (SDWA, NPDES,...)
- PWSID / Permit #
- Chlorinated? Y / N
- Sample Disposal: Lab / Client

ADDITIONAL REMARKS

Inter-Mountain Labs, Inc. www.intermountainlabs.com Rev 4.6

Equipment Calibration Log Examples

Conductivity Calibration Log

Equipment Model	Serial #	Date	Time	Standard	Lot #	Expiration Date	Staff Initials	Comments

pH Calibration Log

Equipment Model	Serial #	Date	Time	pH 7 Standard	Lot #	Expiration Date	pH 10 Standard	Lot #	Expiration Date	Staff Initials	Comments

Dissolved Oxygen Calibration Log

Equipment Model	Serial #	Date	Time	Elevation	Temp/%Saturation	Staff Initials	Comments

Turbidity Calibration Log

Equipment Model	Serial #	Date	Time	Standard	Lot #	Expiration Date	Staff Initials	Comments

Discharge Meter Calibration Log

Equipment Model	Serial #	Date	Time	Velocity	Staff Initials	Comments

Appendix B – Sample Labeling (example)

EXAMPLE SAMPLE LABEL

Surface Water Chemistry Sample
Date: **5/27/14** Time: **14:45**
Sampler: **RWH**
Sample ID #: **BC1-B-147-14-01**

Explanation of Sample ID

Sample ID #: **BC1-B-147-14-01**

BC1 = Sample Site BC-1 (**B**itter **C**reek **1**)

B = Bacteria Sample (I = Inorganic Sample, S = Soil Sample)

147 = Day of Year Sampled Equivalent to May 27, 2014

14 = Last Two Digits of Year Sampled (2014)

01 = normal sample as opposed to a blank or duplicate sample

Quality Control Duplicate Example

Sample ID: **BC1-B-147-14-02**

02 = Duplicate sample

Quality Control Field Blank Example

Sample ID: **BC1-B-147-14-03**

03 = Blank sample

Quality Control Trip Blank Example

Sample ID: **T1-147-14-03**

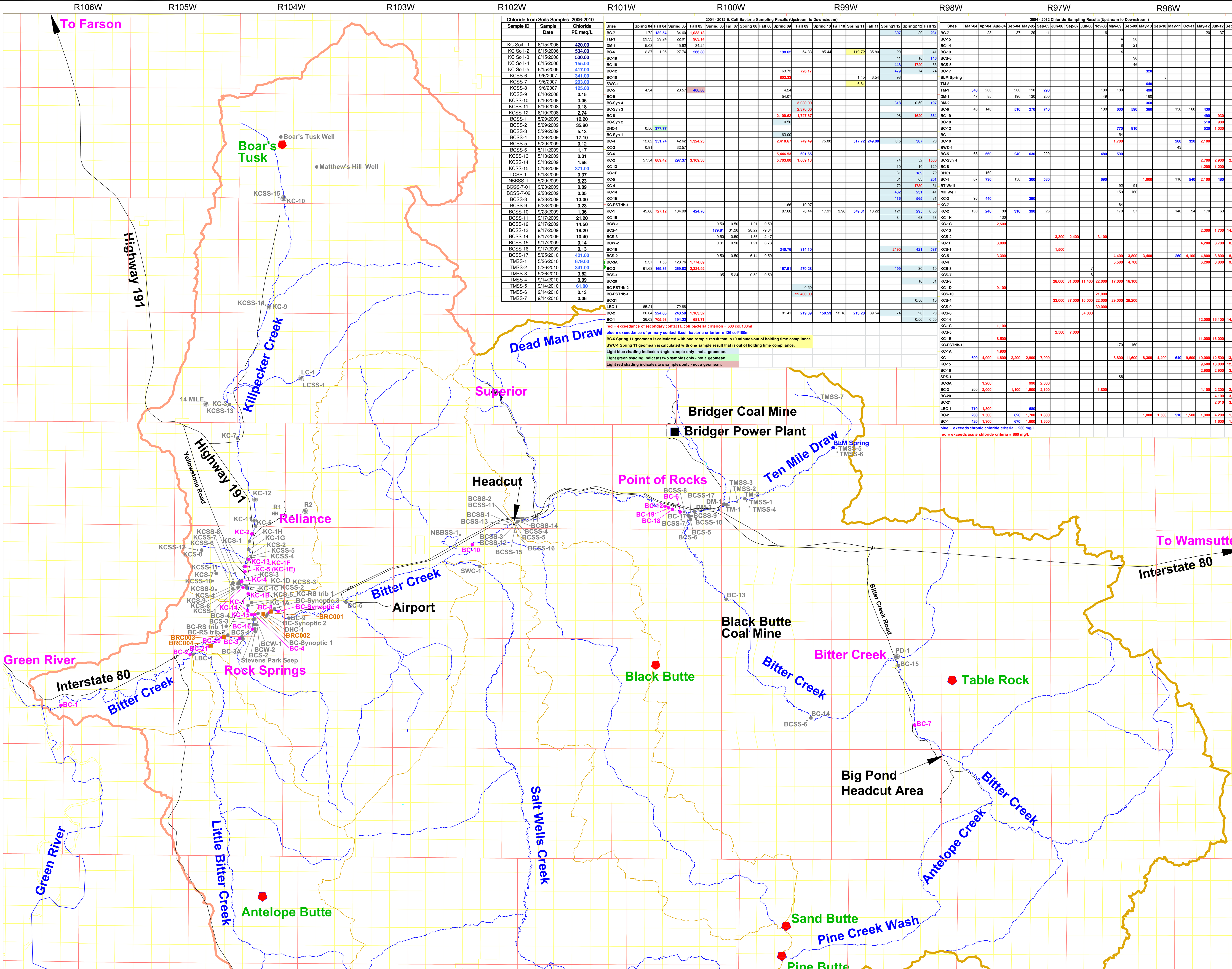
T = Trip Blank

T1 = 1st Trip Blank

T2 = 2nd Trip Blank, etc.

03 = Blank sample

Appendix C – Sampling Site Location Maps



Chloride from Soils Samples 2006-2010		
Sample ID	Sample Date	Chloride PE meq/L
KC Soil - 1	6/15/2006	420.00
KC Soil -2	6/15/2006	534.00
KC Soil -3	6/15/2006	530.00
KC Soil -4	6/15/2006	155.00
KC Soil -5	6/15/2006	417.00
KCSS-6	9/6/2007	341.00
KCSS-7	9/6/2007	203.00
KCSS-8	9/6/2007	125.00
KCSS-9	6/10/2008	0.15
KCSS-10	6/10/2008	3.05
KCSS-11	6/10/2008	0.18
KCSS-12	6/10/2008	2.74
BCSS-1	5/29/2009	12.20
BCSS-2	5/29/2009	35.80
BCSS-3	5/29/2009	5.13
BCSS-4	5/29/2009	17.10
BCSS-5	5/29/2009	0.12
BCSS-6	5/11/2009	1.17
KCSS-13	5/13/2009	0.31
KCSS-14	5/13/2009	1.68
KCSS-15	5/13/2009	371.00
LCSS-1	5/13/2009	0.37
NBBSS-1	5/29/2009	5.23
BCSS-7-01	9/23/2009	0.09
BCSS-7-02	9/23/2009	0.05
BCSS-8	9/23/2009	13.00
BCSS-9	9/23/2009	0.23
BCSS-10	9/23/2009	1.36
BCSS-11	9/17/2009	21.20
BCSS-12	9/17/2009	14.50
BCSS-13	9/17/2009	19.20
BCSS-14	9/17/2009	10.40
BCSS-15	9/17/2009	0.14
BCSS-16	9/17/2009	0.13
BCSS-17	5/25/2010	421.00
TMSS-1	5/26/2010	679.00
TMSS-2	5/26/2010	341.00
TMSS-3	5/26/2010	3.62
TMSS-4	9/14/2010	0.09
TMSS-5	9/14/2010	61.80
TMSS-6	9/14/2010	0.13
TMSS-7	9/14/2010	0.06

2004 - 2012 E. Coli Bacteria Sampling Results (Upstream to Downstream)

Sites	Spring 04	Fall 04	Spring 05	Fall 05	Spring 06	Fall 07	Spring 08	Fall 08	Spring 09	Fall 09	Spring 10	Fall 10	Spring 11	Fall 11	Spring1 12	Spring2 12	Fall 12
BC-7	1.72	132.54	34.60	1,033.13											307	20	231
TM-1	29.33	29.24	22.01	963.14													
DM-1	5.03		15.92	34.24													
BC-6	2.37	1.05	27.74	266.80					198.62	54.33	85.44		119.72	35.80	20		41
BC-19															41	10	146
BC-18															448	1720	63
BC-12									63.73	726.17					479	74	74
BC-10									803.33				1.45	6.54	98		
SWC-1													6.61				
BC-5	4.34		28.57	406.00					4.24								
BC-9									54.07								
BC-Syn 4										3,030.00					318	0.50	197
BC-Syn 3										2,370.00							
BC-8									2,100.62	1,747.67					98	1620	364
BC-Syn 2									0.50								
DHC-1	0.50	377.77															
BC-Syn 1									63.00								
BC-4	12.62	351.74	42.62	1,324.25					2,410.67	749.49	75.88		517.72	249.00	0.5	307	20
KC-3	0.91		32.57														
KC-6									5,446.53	601.65							
KC-2	57.54	889.42	297.37	3,109.38					5,703.00	1,669.13					74	52	1560
KC-13															10	10	120
KC-1F															31	189	72
KC-5															61	63	201
KC-4															72	1780	51
KC-14															432	231	41
KC-1B															416	565	31
KC-RSTrib-1									1.66	19.97							
KC-1	45.68	727.12	104.90	424.76					87.68	70.44	17.91	3.98	549.31	10.22	121	295	0.50
KC-15															84	63	63
BCW-1					0.50	0.50	1.21	0.50									
BCS-4					179.81	31.26	28.22	79.34									
BCS-3					0.50	0.50	1.86	2.47									
BCW-2					0.91	0.50	1.21	3.78									
BC-16									340.76	314.10					2490	421	537
BCS-2					0.50	0.50	6.14	0.50									
BC-3A	2.37	1.56	123.76	1,774.69													
BC-3	61.68	169.86	269.83	2,324.92					167.91	570.28					499	30	10
BCS-1					1.05	5.24	0.50	0.50									
BC-20																10	31
BC-RSTrib-2										0.50							
BC-RSTrib-1										22,400.00							
BC-21																0.50	10
LBC-1	65.21		72.88														
BC-2	26.04	224.85	243.58	1,163.32					81.41	219.39	150.53	52.18	213.20	89.54	74	20	20
BC-1	26.03	705.98	194.22	681.71												0.50	0.50

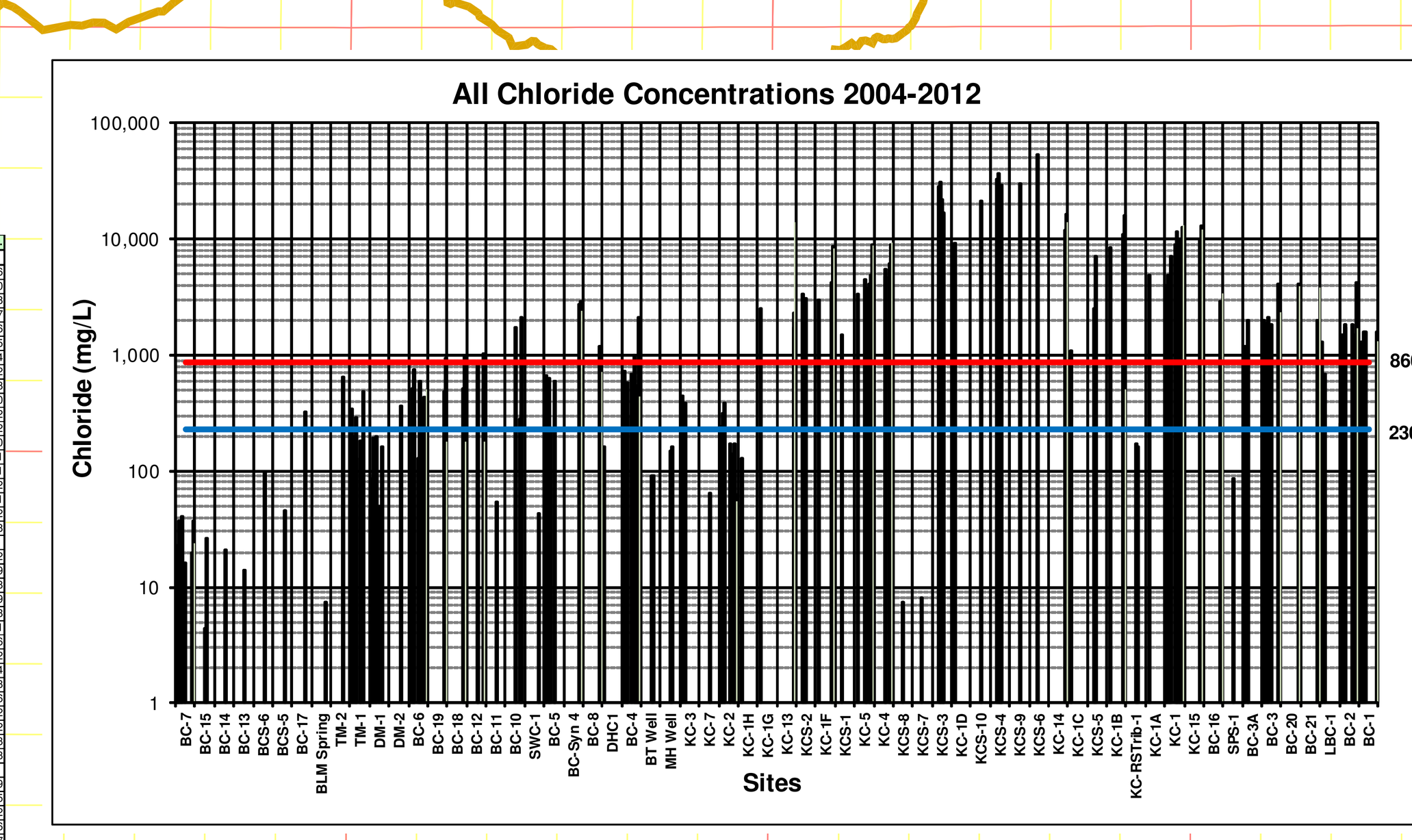
red = exceedance of secondary contact E.coli bacteria criterion = 630 col/100ml
blue = exceedance of primary contact E.coli bacteria criterion = 126 col/100ml
BC-6 Spring 11 geomean is calculated with one sample result that is 10 minutes out of holding time compliance.
SWC-1 Spring 11 geomean is calculated with one sample result that is out of holding time compliance.
Light blue shading indicates single sample only - not a geomean.
Light green shading indicates two samples only - not a geomean.
Light red shading indicates two samples only - not a geomean.

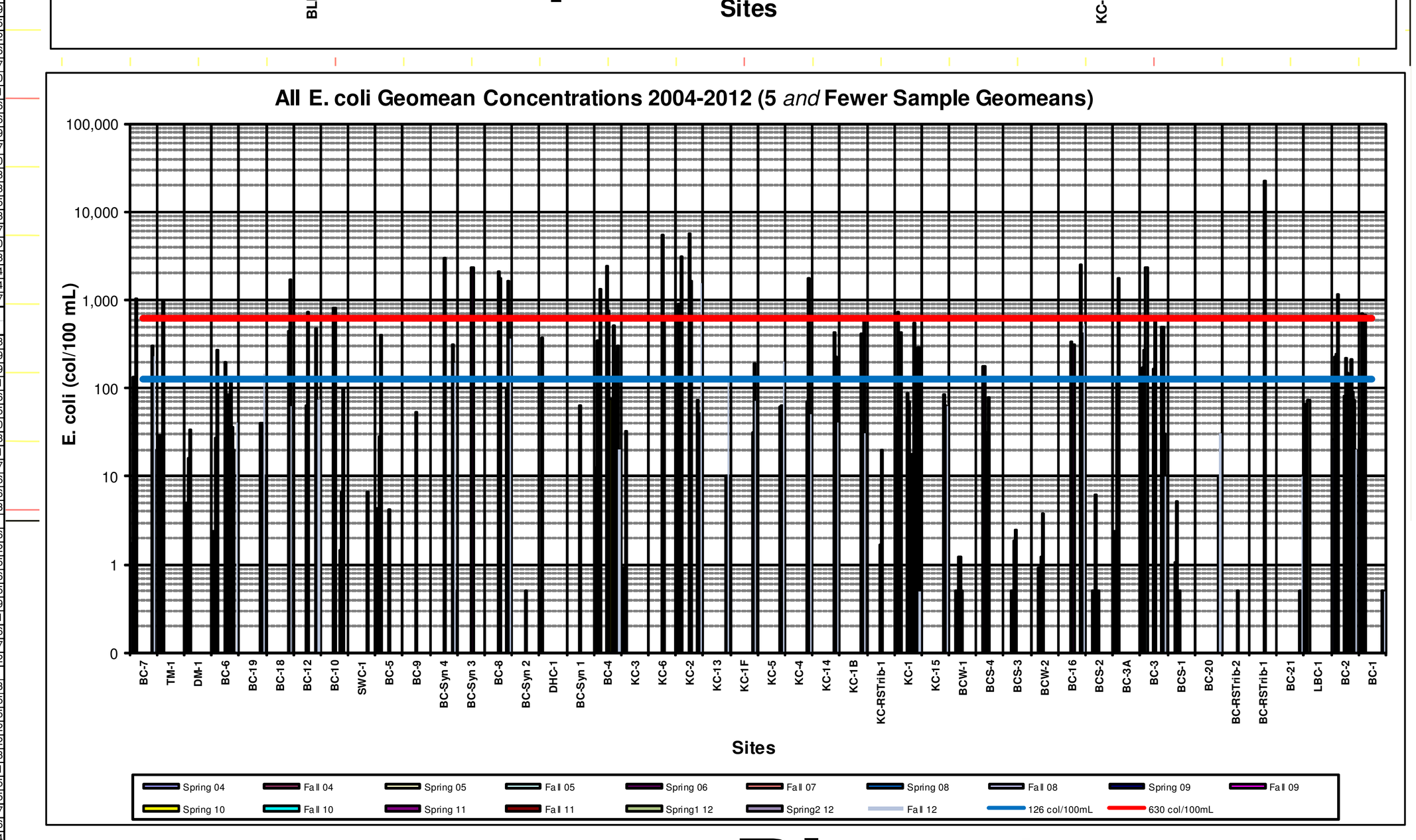
2004 - 2012 Chloride Sampling Results (Upstream to Downstream)

Sites	Mar-04	Apr-04	Aug-04	Sep-04	May-05	Sep-05	Jun-06	Sep-07	Jun-08	Nov-08	May-09	Sep-09	May-10	Sep-10	May-11	Oct-11	May-12	Jun-12	Sep-12
BC-7	4	23		37	29	41				16							20	37	24
BC-15											4	26							
BC-14											8	21							
BC-13											14								
BCS-6												96							
BCS-5												46							
BC-17													320						
BLM Spring														8					
TM-2													640						
TM-1	340	200		200	190	290				130	180		490						
DM-1	47	85		190	130	200				49			160						
DM-2													360						
BC-6	43	140		510	270	740				130	600	590	380		150	160	430		510
BC-19																	490	930	180
BC-18																	510	980	180
BC-12											770	810					520	1,030	180
BC-11											54								
BC-10											1,700				280	320	2,100		
SWC-1															43				
BC-5	68	660		240	630	220				480	590								
BC-Syn 4																	2,700	2,900	2,400
BC-8																	1,200	1,200	720
DHC1		160																	
BC-4	67	730		150	300	580				690			1,000		110	540	2,100	480	440
BT Well											92	91							
MH Well											150	160							
KC-3	98	440			390														
KC-7											64								
KC-2	130	240	80	310	390	26					170	37			140	54	170	63	55
KC-1H			130																
KC-1G			2,500																
KC-13																	2,300	1,700	14,000
KCS-2							3,300	2,400		3,100									
KC-1F			3,000														4,200	8,700	8,300
KCS-1							1,500												
KC-5			3,300								4,400	3,800	3,400		260	4,100	4,800	8,800	8,800
KC-4											5,500	4,700					6,200	8,800	9,300
KCS-8									7										
KCS-7									8										
KCS-3							28,000	31,000	11,400	22,000	17,000	16,100							
KC-1D			9,100																
KCS-10										21,000									
KCS-4							33,000	37,000	16,000	22,000	29,000	29,200							
KCS-9										30,000									
KCS-6									54,000										
KC-14																	12,000	16,100	14,000
KC-1C			1,100																
KCS-5							2,500	7,000											
KC-1B			8,500														11,000	16,000	510
KC-RSTrib-1											170	160							
KC-1A			4,900																
KC-1	600	4,000	4,800	2,200	2,900	7,000					8,800	11,600	8,300	4,400	640	9,600	10,000	12,500	13,000
KC-15																	9,600	13,000	12,000
BC-16																	2,900	2,900	3,400
SPS-1											86								
BC-3A		1,200			990	2,000													
BC-3	200	2,000		1,100	1,900	2,100				1,800							4,100	2,300	2,300
BC-20																		4,100	3,900
BC-21																		2,010	3,800
LBC-1	710	1,300			680														
BC-2	260	1,500		820	1,700	1,800							1,800	1,500	510	1,500	1,300	4,200	1,700
BC-1	420	1,300		670	1,600	1,600												1,600	1,300

blue = exceeds chronic chloride criteria = 230 mg/L
red = exceeds acute chloride criteria = 860 mg/L

Site	Site Description	Bacteria	Inorganic	Lat. WGS 84 Deg.	Lon. WGS 84 Deg.
Bitter Creek - Upstream to Downstream					
BC-7	Bitter Creek channel downstream of crossing at Road 4410 south of Bitter Creek town site	X	X	41.505215	-108.532536
BC-15	Bitter Creek channel just upstream of first crossing upstream of Bitter Creek town site		X	41.545802	-108.547280
PD-1	Patrick Draw near Bitter Creek town site - dry, not sampled			41.558875	-108.552898
BC-14	Bitter Creek channel upstream of Black Butte Coal, 50' downstream of power line crossing		X	41.510167	-108.639847
BC-13	Bitter Creek channel downstream of Black Butte Coal where road shoulder is eroded by creek		X	41.603622	-108.727686
BCS-6	Bitter Creek seep from base of cliff SE of Point of Rocks (south seep - upstream)		X	41.664439	-108.765105
BCS-5	Bitter Creek seep from base of cliff SE of Point of Rocks (north seep - downstream)		X	41.665968	-108.765284
BC-17	Bitter Creek channel upstream of BC-DM confluence, 300' upstream of south RR bridge		X	41.671260	-108.770592
BLM Spring	Artesian well on BLM land upstream of Bridger Coal, start of perennial flow in Ten Mile Draw		X	41.733845	-108.605948
TM-2	Ten Mile Draw channel upstream of TM-1 where two track crossing used to be		X	41.685155	-108.711260
TM-1	Ten Mile Draw channel upstream of convergence with Deadman Wash	X	X	41.678159	-108.732742
DM-1	Deadman Wash channel downstream of BLM wetland ponds near Point of Rocks	X	X	41.680028	-108.733892
DM-2	Deadman Wash channel upstream of BC-DM confluence, downstream of I-80 at Point of Rocks		X	41.674871	-108.763170
BC-6	Bitter Creek channel downstream of railroad bridge near Point of Rocks	X	X	41.674091	-108.777291
BC-6 HOBO	Bitter Creek channel downstream of railroad bridge near Point of Rocks			41.674091	-108.777291
BC-19	Bitter Creek downstream of Point of Rocks sewage lagoons	X	X	41.677265	-108.790972
BC-18	Bitter Creek upstream of Point of Rocks sewage lagoons	X	X	41.675593	-108.787291
BC-12	Bitter Creek channel 1/4 mile downstream of road crossing at Point of Rocks, north of picket	X	X	41.678378	-108.793172
BC-11	Bitter Creek channel just upstream of headcut and irrigation ditch		X	41.664263	-108.952528
Headcut					
BC-10 HOBO	Bitter Creek channel upstream of county road crossing east of Salt Wells Creek			41.649180	-108.996912
BC-10	Bitter Creek channel upstream of county road crossing east of Salt Wells Creek	X	X	41.648610	-108.997859
SWC-1	Salt Wells Creek channel downstream of Road 48 crossing	X	X	41.630841	-108.988068
BC-5	Bitter Creek channel downstream of highway bridge where Airport Rd crosses Bitter Creek	X	X	41.602933	-109.128779
BC-9	Bitter Creek channel upstream of railroad bridge just upstream of Rock Springs	X		41.591716	-109.196548
BC-SYN 4	Bitter Creek channel underneath S Side Belt Route bridge	X	X	41.594961	-109.204361
BC-SYN 3	Bitter Creek channel 200' downstream of S Side Belt Route bridge (steel culvert in N bank)	X		41.595180	-109.205086
BRC001	WDEQ 2012-2013, Bitter Creek channel 40' upstream of BC-8	X		41.592447	-109.217062
BC-8	Bitter Creek channel between Dead Horse Canyon and low water crossing near Pearl St. Park	X	X	41.592437	-109.213714
BC-SYN 2	30" steel culvert, ground level in bank of Bitter Creek channel just upstream of DHC confluence	X		41.592585	-109.213958
DHC-1	In engineered channel at corner of Pearl St. and N. Front St. upstream of BC confluence	X	X	41.590951	-109.213716
BRC002	WDEQ 2012-2013, Bitter Creek channel southwest of 9th St. and Pearl St. intersection.	X		41.593463	-109.217062
BC-SYN 1	30" concrete pipe high on north bank of Bitter Creek channel downstream of "N" Street bridge	X		41.593520	-109.219452
BC-4	Bitter Creek channel upstream of confluence of Bitter/Killpecker Creeks behind Toyota dealer	X	X	41.591769	-109.225768
BC-4 HOBO	Bitter Creek channel upstream of confluence of Bitter/Killpecker Creeks behind Toyota dealer			41.591769	-109.225768
Killpecker Creek Confluence					
BCW-1	At corner of fence along south bank of Bitter Cr between U-Haul and Bank of the West	X		41.589002	-109.226229
BCS-4	Old Bitter Cr. channel on south side of Bitter Creek in 48" culvert behind Meadow Gold Dairy	X		41.588579	-109.226705
BCS-3	Seep flowing from south bank of Bitter Cr. upstream of Dewar/Center St. bridge	X		41.584826	-109.226722
BCW-2	In street surface of Mead St. west of Wy Analytical Lab building near curb, 1.5" well marked water	X		41.584145	-109.225036
BC-16	Bitter Creek channel west of Stevens Park at end of Center St. in Rock Springs	X	X	41.581170	-109.226707
SPS-1	3 channels flowing from base of rail bed just south of Stevens Park at end of Center St. in RS		X	41.581341	-109.226120
BCS-2	Pond surrounded by snow fence inside Bunning Transfer yard	X		41.578614	-109.225341
BC-3A	Sweetwater Creek just upstream of confluence with Bitter Creek near site BC-3	X	X	41.573026	-109.240796
BC-3	Bitter Creek channel at crest gauge behind Nissan Dealer (upstream of BCS-1)	X	X	41.573092	-109.241136
BCS-1	Dug out seep 50 yards downstream of BC-3	X		41.572873	-109.241579
SWCCD HOBO	Pressure transducer located in SWCCD offices			41.577333	-109.247797
BRC003	WDEQ 2012-2013, Bitter Creek channel 90' upstream of BC-20	X		41.572842	-109.262090
BC-20	Bitter Creek channel upstream of BC-RSTrib-2 discharge	X	X	41.572691	-109.262393
BC-20 HOBO	Bitter Creek channel upstream of BC-RSTrib-2 discharge			41.572691	-109.262393
BC-RSTrib-2	Bitter Creek tributary from culvert near SW corner of intersection at Dewar Dr. and Sunset Blvd.	X		41.576452	-109.250905
BC-RSTrib-1	Bitter Creek tributary from 3 culverts between Kmart and La Quinta Inn on Dewar Dr.	X		41.580269	-109.259608
BRC004	WDEQ 2012-2013, Bitter Creek channel 275' upstream of BC-21	X		41.568083	-109.272197
BC-21	Bitter Creek channel upstream of Interchange Road bridge	X	X	41.567691	-109.273030
LBC-1	Little Bitter Creek just upstream of Bitter Creek confluence	X	X	41.560091	-109.290868
BC-2	Bitter Creek channel downstream of RR crossing downstream of Rock Springs WWTP	X	X	41.560257	-109.291724
BC-2 HOBO	Bitter Creek channel downstream of RR crossing downstream of Rock Springs WWTP			41.560257	-109.291724
BC-1	Bitter Creek channel 1.5 miles upstream of confluence with Green River	X	X	41.518926	-109.427437
Killpecker Creek - Upstream to Downstream					
BT well	Groundwater well just north (~0.25 mi.) of Boar's Tusk, foot access only for several hundred feet		X	41.966623	-109.199688
MH well	Groundwater well at broken windmill east of Matthew's Hill (~1.75 mi. SE of Boars Tusk)		X	41.949868	-109.168689
KC-10	Killpecker Creek where County Road a-17 comes closest south of Boars Tusk, dry, not sampled			41.925668	-109.197169
KC-9	Killpecker Creek ~ 0.5 mi. southeast of Chilton Rd County Rd 17 intersection, dry, not sampled			41.840721	-109.211331
LC-1	Long Canyon channel ~3.5 miles east of Chilton Road, dry, not sampled			41.776452	-109.183966
14 Mile	Killpecker Tributary north of Chilton's Cutoff Rd, ~0.5 mi. west of KC-3, dry, not sampled			41.757465	-109.263335
KC-3	Killpecker Creek channel downstream of two track crossing downstream of 14 Mile confluence	X	X	41.757740	-109.253380
KC-7	Killpecker Creek channel just upstream of Chilton Road Crossing		X	41.729029	-109.244298
KC-12	Killpecker Creek channel at historic RR crossing ~1.75 mi. upstream of KC-11, dry, not sampled			41.685860	-109.228781
R-2	Killpecker Tributary east of Reliance at County Road 44 crossing, dry, not sampled			41.671754	-109.174917
R-1	Killpecker Tributary just northwest of Reliance sewer lagoons, dry, not sampled			41.669903	-109.207516
KC-11	Killpecker Creek channel off Stansbury Road west of mobile home area, dry, not sampled			41.660610	-109.225826
KC-6	Discharge from mobile home area sewer lagoons, 0.22 mi. upstream of HWY 191 crossing	X		41.658669	-109.226283
HWY 191 Crossing					
KC-2 HOBO	Killpecker Creek channel at HWY 191 bridge near Reliance			41.656327	-109.227476
KC-2	Killpecker Creek channel at HWY 191 bridge near Reliance	X	X	41.656009	-109.228012
KC-1H	Killpecker Creek channel upstream of golf course		X	41.648980	-109.231545
KC-1G	Killpecker Creek channel east of golf course		X	41.643116	-109.231906
KC-13	Killpecker Creek channel east of, and just upstream of, events complex collection pond	X	X	41.635274	-109.231795
KCS-2	Pipe entering collection pond next to bmx track at the events complex		X	41.635084	-109.234089
KC-1F	Progress rail above storm drain, across creek from Simons	X	X	41.629939	-109.237681
KCS-1	Seep/trib east of rail road tracks along rail siding, north of Yellowstone Rd		X	41.629911	-109.237816
KC-5	Killpecker Creek channel just upstream of Yellowstone Rd. crossing	X	X	41.624058	-109.236397
KC-1E	Bridge at Yellowstone Road crossing		X	41.623899	-109.236432
Yellowstone Road Crossing					
KC-4	Killpecker creek channel just upstream of KCS-3 side tributary	X	X	41.617339	-109.240863
KCS-8	Upper reach of same tributary as KCS-3, upstream of horse coral on Antelope Dr.		X	41.642754	-109.281835
KCS-7	Middle reach of same tributary as KCS-3 west of Foothills Blvd.		X	41.624035	-109.267395
KCS-3	West side un-named upstream tributary across from Mineral Dr./industrial park north of I-80		X	41.617311	-109.241332
KC-1D	End of Industrial Drive, north of Schlumberger Lot		X	41.615887	-109.241252
KCS-10	Killpecker Tributary headwaters east of K Street		X	41.617227	-109.247828
KCS-4	West side un-named downstream tributary across from Mineral Dr./industrial park north of I-80		X	41.615755	-109.241341
KCS-9	Upstream point of emergence for KCS-6 tributary, east side of Foothills Blvd. near transformer		X	41.614236	-109.245815
KCS-6	Killpecker Tributary 500 yds downstream from KCS 4, subs ~300 yds before entering KC		X	41.614378	-109.243675
KC-14	Killpecker Creek channel at south end of Mineral Drive	X	X	41.613991	-109.238537
KC-1C	Killpecker Creek channel off Production Drive, Halliburton Fuel		X	41.614874	-109.234716
KCS-5	Seep/pond on raised marsh between industrial park and trailer park on west side of KC		X	41.614640	-109.234284
KC-1B	Killpecker Creek channel upstream of Stagecoach Drive bridge	X	X	41.609826	-109.232074
I 80 Crossing					
KCRStrib-1	Killpecker Tributary that crosses Elk St. north of Gases Plus	X	X	41.600371	-109.230544
KC-1A	Killpecker Creek channel 140 feet upstream of Springs Drive bridge		X	41.599469	-109.232221
KC-1	Killpecker Creek channel behind and upstream of Wyoming Wool Warehouse on Bellevue Drive	X	X	41.595221	-109.232914
KC-1 HOBO	Killpecker Creek channel behind and upstream of Wyoming Wool Warehouse on Bellevue Drive			41.595221	-109.232914
KC-15	Killpecker Creek channel 75 feet upstream of Bitter Creek confluence	X	X	41.591156	-109.226994
Bitter Creek - Upstream to Downstream					
BCSS-6	Taken from upper bench along creek near inorganics site BC-14		X	41.510064	-108.640042
BCSS-10	Top of bluff on E side of BC-DM confluence near Point of Rocks		X	41.668801	-108.765869
BCSS-9	1/2 way up bluff on E side of BC-DM confluence near Point of Rocks		X	41.671290	-108.766192
TMSS-1	Bench on south side of stream at head of alluvial fan near TM-2 (where 2 track ends)		X	41.684678	-108.710913
TMSS-2	Bench on south side of stream 1/2 way downstream between TM-2 and TM-1		X	41.682569	-108.717620
TMSS-3	Bench on south side of stream near TM-1		X	41.678010	-108.732436
TMSS-4	Bluff face several hundred yards south of TM-2		X	41.679250	-108.707333
TMSS-5	At BLM Spring on Ten Mile Draw upstream of BCC		X	41.733770	-108.605686
TMSS-6	First small bluff SW of BLM Spring at toe of bluff		X	41.732634	-108.604495
TMSS-7	Upstream of 2 track crossing, upstream of BLM Spring at first major tributary		X	41.747972	-108.602339
Deadman Wash Confluence					
BCSS-17	40' E of stream on upper bench 300' upstream of south RR bridge near Point of Rocks		X	41.671117	-108.770439
BCSS-8	Adjacent to inorganics site BC-6 near Point of Rocks		X	41.673902	-108.776731
BCSS-7-01	W side of Black Butte Rd, S of inorganics site BC-6 near Point of Rocks		X	41.670628	-108.773971
Headcut					
BCSS-14	Stream bed substrate approximately 300 yds upstream of headcut		X	41.665309	-108.951310
BCSS-4	Taken in Bitter Creek channel 150' upstream of irrigation diversion at headcut		X	41.664579	-108.952602
BCSS-5	Taken about 200' south east of headcut on Bitter Creek		X	41.664191	-108.951825
BCSS-15	1/2 way up bluff on S side of headcut		X	41.662012	-108.952351
BCSS-16	Top of bluff on S side of headcut		X	41.661450	-108.951923
BCSS-3	Taken in upper strata of headcut wall approximately above BCSS-2		X	41.664082	-108.952977
BCSS-2	Taken in lower strata of headcut wall approximately 2' above water level		X	41.664071	-108.952998
BCSS-11	Lower strata of S side of headcut wall approximately 100' downstream of headcut		X	41.664020	-108.953039
BCSS-13	Upper strata of S side of headcut directly above BCSS-11		X	41.663986	-108.953058
BCSS-1	Taken in Bitter Creek channel 150' downstream of headcut		X	41.664240	-108.953185
BCSS-12	Stream bed substrate approximately 300 yds downstream of headcut		X	41.664636	-108.954578
NBBSS-1	North of I-80, west of wrecking yard, in line with drainage under I-80 but not in salt flat		X	41.654406	-109.016362
Killpecker Creek - Upstream to Downstream					
KCSS-15	Taken 100' west of Killpecker Creek channel upstream of 15 Mile Res by inorganics site KC-10		X	41.925921	-109.197822
KCSS-14	Taken 50' west of Killpecker Creek channel near inorganics site KC-9		X	41.840733	-109.211546
LCSS-1	Taken 50' south of Long Canyon Creek channel near inorganics site LC-1		X	41.776340	-109.183685
KCSS-13	Taken 100' west of Killpecker Creek channel near inorganics site KC-3		X	41.757629	-109.253482
HWY 191 Crossing					
KC Soil-5	Flats east of Killpecker Creek downstream of KC-2		X	41.638298	-109.229835
KC Soil-4	Flats east of Killpecker Creek downstream of KC-2		X	41.637913	-109.229971
Yellowstone Road Crossing					
KCSS-12	Approx 100' west of KCS-8 tributary where it enters horse coral off Antelope Dr.		X	41.642787	-109.282187
KCSS-8	East side of Foothills Blvd. north of KCS-3 tributary		X	41.623540	-109.245291
KCSS-11	100' north of KCS-7 tributary halfway between base of White Mountain and Foothills Blvd.		X	41.624583	-109.267457
KCSS-7	East side of Foothills Blvd. between KCS-4 and KCS-3 tributaries		X	41.619908	-109.247017
KC Soil-3	Killpecker banks between KCS-3 and KCS-4		X	41.615172	-109.241032
KC Soil-2	Killpecker banks between KCS-3 and KCS-4		X	41.614583	-109.240139
KCSS-10	Vicinity of dry channel north of KCSS-9 between base of White Mountain and Foothills Blvd.		X	41.619151	-109.268293
KCSS-9	Vicinity of several dry channels halfway between base of White Mountain and Foothills Blvd.		X	41.610475	-109.268947
KCSS-6	East side of Foothills Blvd. south of KCS-4 tributary		X	41.616028	-109.249320
KC Soil-1	Killpecker banks between KCS-3 and KCS-4		X	41.614182	-109.240438
I 80 Crossing					





Legend

Bitter Creek Drainage Area Boundary	
Sub-Drainage Area Boundary	
Landmark	Table Rock
Major Roadway	
Stream	
City/Town	Superior
2012 Bacteria Monitoring Site Location	KC-6
2012 Inorganic Monitoring Site Location	BC-7
2012 Bacteria and Inorganic Monitoring Site Location	BC-6
2012 Soil Monitoring Site Location	n/a
2013 WDEQ Bacteria Monitoring Site Location	BRC004
Project Water Monitoring Site Location pre - 2012	BC-1
Project Soil Monitoring Site Location pre - 2012	KCSS-11
Killpecker Creek Drainage Area	
Attempted Spring 2009 Bacteria Monitoring Site, too Dry	Attempted Bacteria
Attempted Spring 2009 Inorganic Monitoring Site, too Dry	Attempted Inorganic

Plate 1

SWEET WATER COUNTY CONSERVATION DISTRICT
79 Winston Drive, Suite 110, Rock Springs, WY 82801

BITTER CREEK KILLPECKER CREEK WATERSHED MANAGEMENT PLAN AND IMPLEMENTATION PROJECT

MONITORING SITE LOCATIONS AND 2004-2012 DATA SUMMARIES

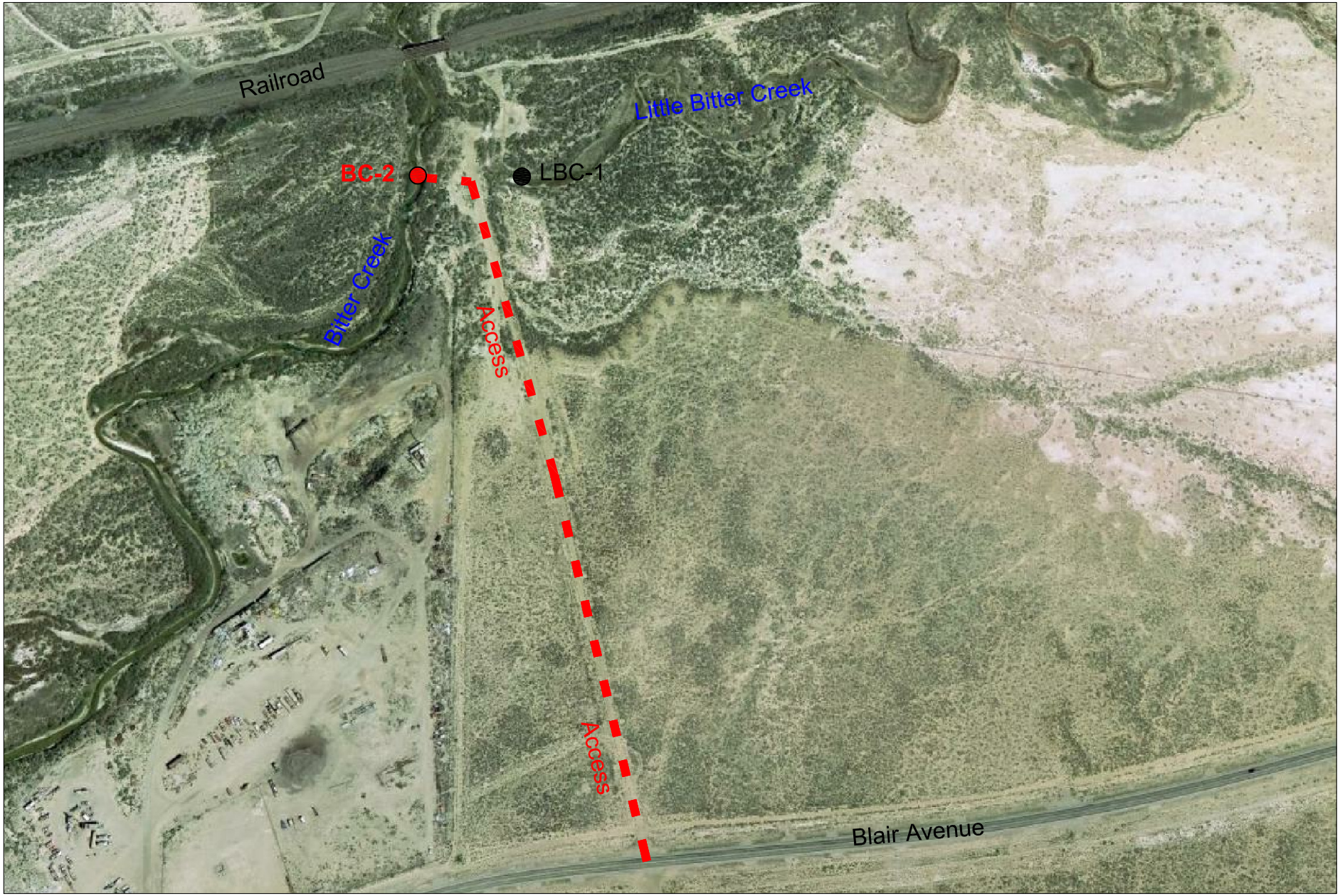
DATE: 01/30/2014
DRAWING BY: RWH
DESIGN BY: RWH
REVIEWED BY: RWH
PROJ OR REF. SWC1301

PREPARED BY:
EDE CONSULTANTS
SHERIDAN, WYOMING
PHONE: (307)672-3793

EDE DWG # Plate 1

SCALE: AS NOTED

SHEET: 1 OF 1



N

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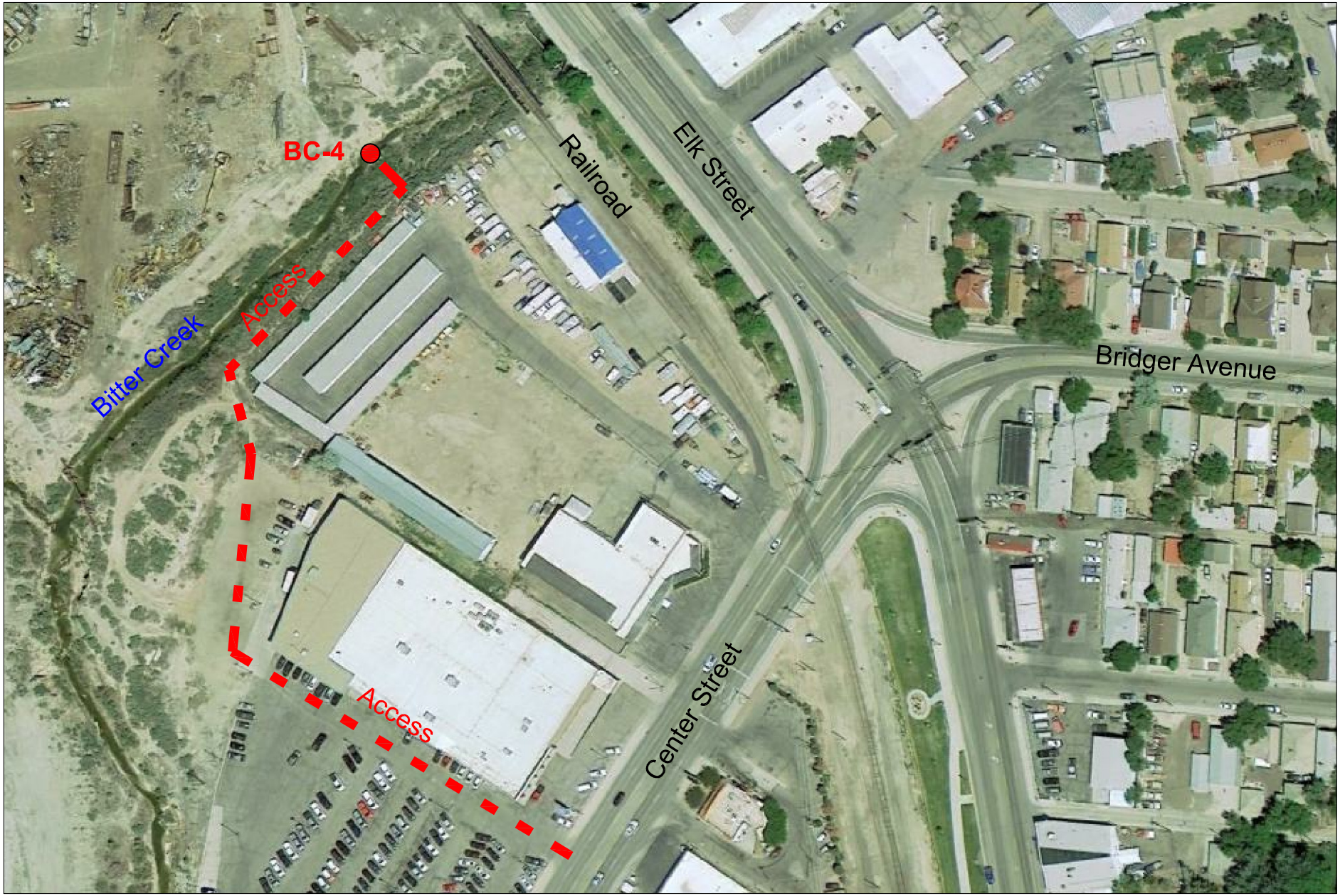
T18N R105W NE1/4 of NE1/4 Section 7

BC-2 Site Location



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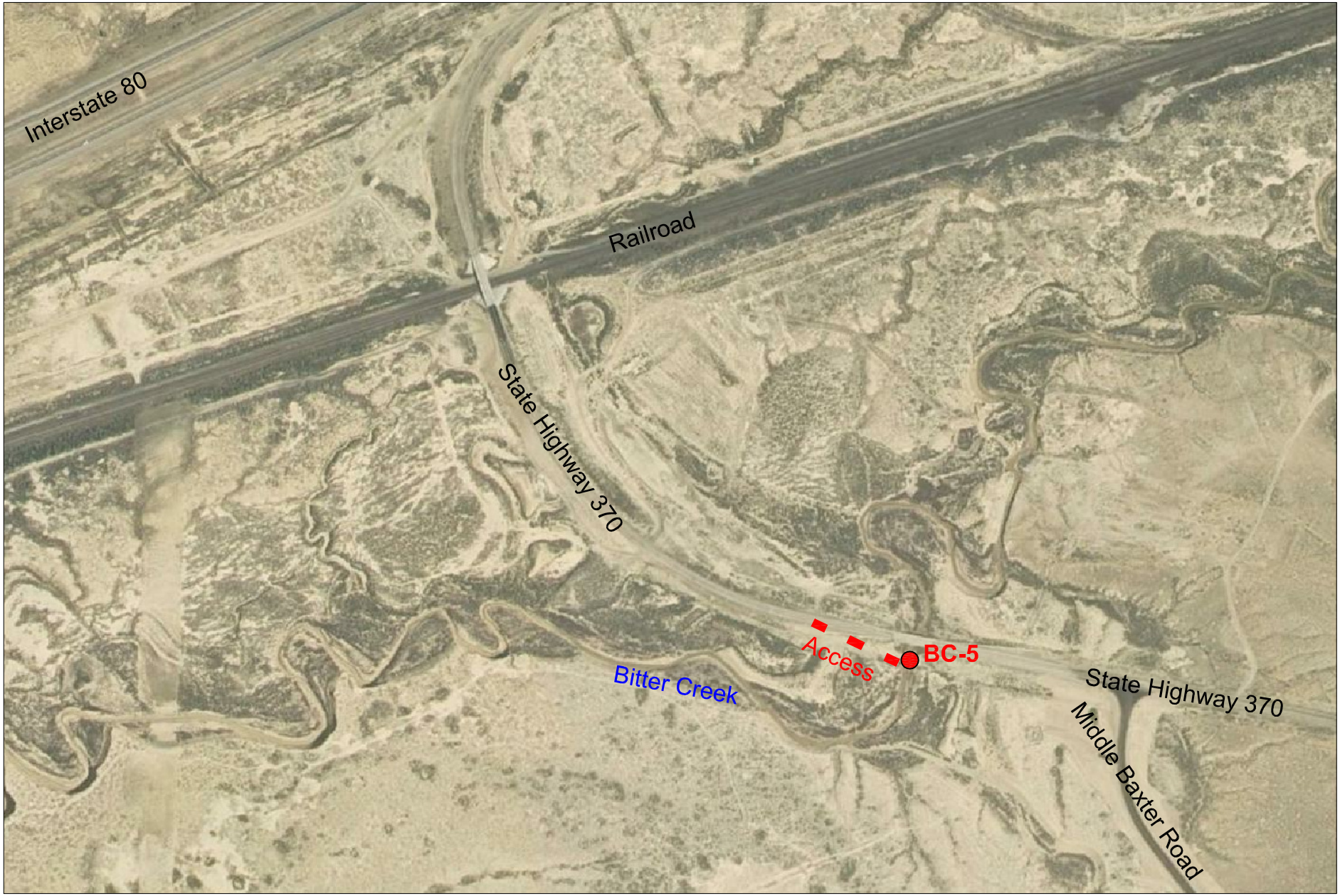
T19N R105W SE1/4 of SW1/4 Section 26

BC-4 Site Location



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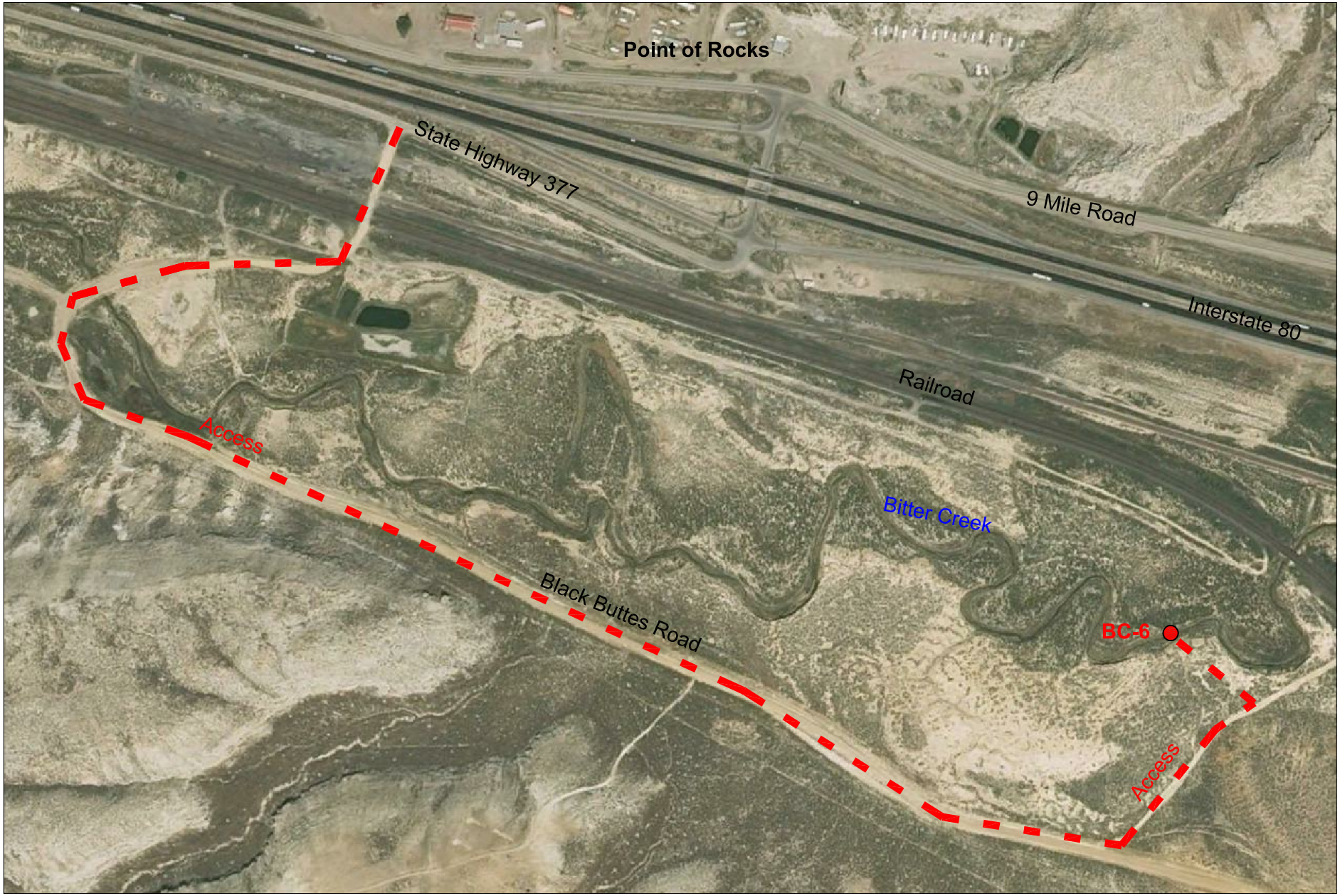
T19N R104 NE1/4 of NW1/4 Section 27

BC-5 Site Location



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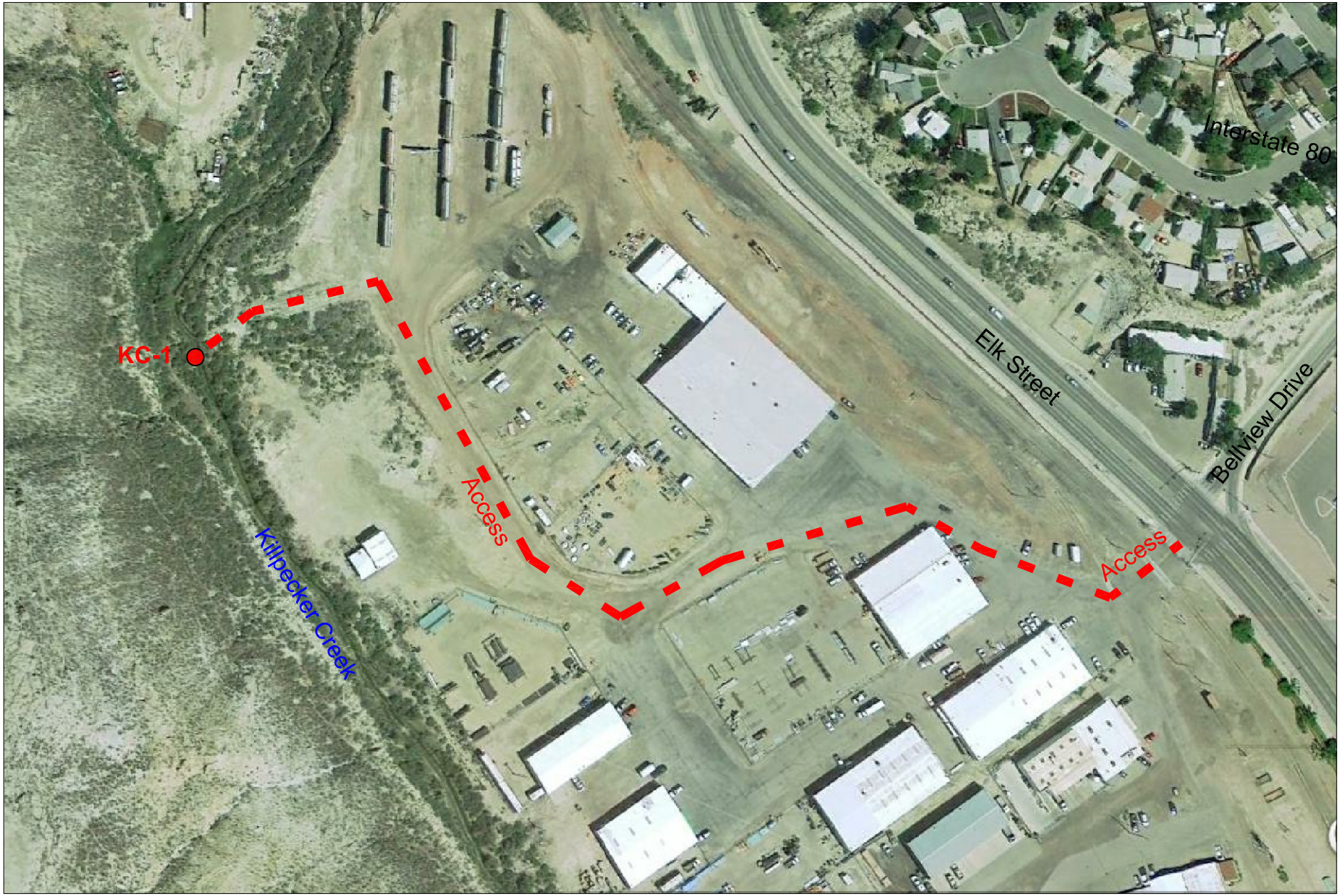
T20N R101W NE1/4 of NE1/4 Section 34

BC-6 Site Location



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T19N R105W NE1/4 of SE1/4 Section 27

KC-1 Site Location

N

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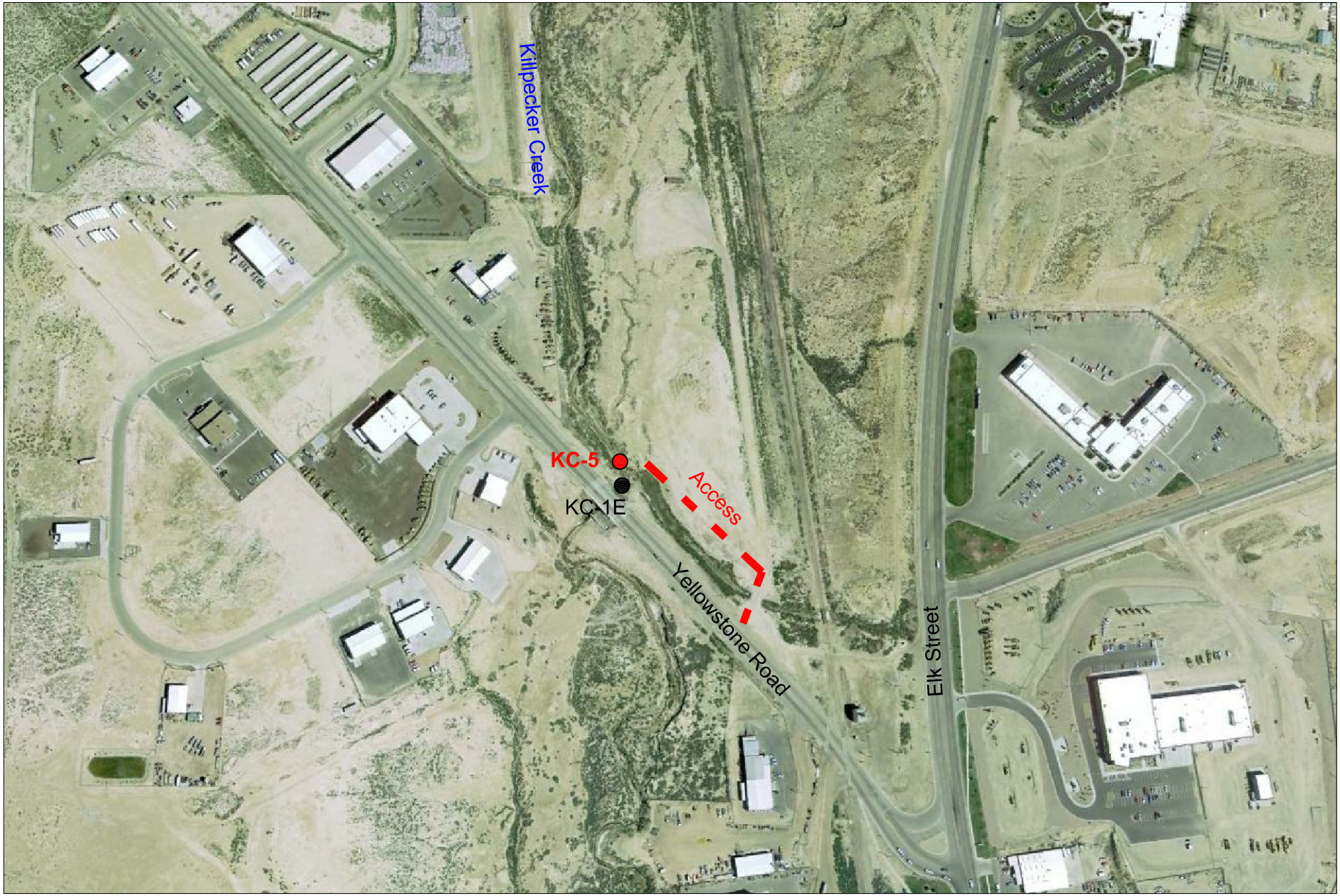
T19N R105W SE1/4 of NW1/4 Section 2

KC-2 Site Location



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Latitude: 41.624058
Longitude: -109.236397
T19N R105W NE1/4 of SE1/4 Section 15

KC-5 Site Location

Appendix D – References and Information Resources

Bitter/Killpecker Watershed Advisory Group & The Sweetwater County Conservation District, 2006, Bitter and Killpecker Creeks Watershed Management Plan.

Environmental Protection Agency, 2003, Guidance for Geospatial Data Quality Assurance Project Plans.

Environmental Protection Agency, 2002, National Recommended Water Quality Criteria.

Environmental Protection Agency, 1983, Methods for Chemical Analysis of Water and Wastes.

Environmental Protection Agency, 2002, Guidance on Choosing a Sampling Design for Environmental Data Collection for use in Developing a Quality Assurance Project Plan.

Natural Resources Conservation Service, 2001, National Handbook of Water Quality Monitoring.

Environmental Protection Agency, 2000, Guidance for Data Quality Assessment.

Environmental Protection Agency, 2002, Guidance on Environmental Data Verification and Validation.

Environmental Protection Agency, 2001, Guidance for Preparing Standard Operating Procedures (SOPs).

Environmental Protection Agency, 2002, Guidance for Quality Assurance Project Plans.

Environmental Protection Agency, 2000, EPA Quality Manual for Environmental Programs.

Wyoming Department of Environmental Quality, 2002, Method for Determining Water Quality Condition of Surface Waters.

Appendix E – SOPs and Methods

STANDARD OPERATION PROCEDURE FOR SURFACE WATER SAMPLING

PURPOSE: The sampling of surface water is an important part of the determination of areas having elevated chloride and E. coli in the Bitter Creek watershed. The following procedure is a simple outline of the means of collecting the surface water sample for transport to the laboratory for chemical analysis. The sampling is specifically conducted to examine the surface water for chloride and E. coli bacteria and relate concentrations to the WDEQ TMDL development process for the Bitter Creek/Killpecker Creek watersheds.

PROCEDURE: Determination of the presence or absence of chloride and E. coli bacteria in surface water in the study area requires pulling grab samples of flowing surface water at the monitoring sites located on reaches of Bitter and Killpecker Creek. This requires taking two separate samples, one for chloride in a sterile plastic bottle and one for E. coli in a sterile plastic bottle. Additional samples may be warranted to collect duplicates and blanks.

1. Upon arrival at the sample site, document the location with the GPS (first visit).
2. Record a general description of the area and the channel and equipment condition in the log book and sample form (Appendix A).
3. Calibrate field parameter measuring equipment per Appendix E and rinse with de-ionized water.
4. Put on new latex gloves.
5. Prepare sample bottles (1,000 ml raw/chloride, and 250 ml E. coli) provided by laboratories (additional bottles may be necessary for inorganic suite and will be provided by the laboratory if necessary - prepare and collect water in these in the same manner as for the 1,000 ml bottle).
6. Handle samples per DEQ-SOP manual.
7. Collect E. coli sample in 250 ml bottle by submerging bottle in flowing water, opening, filling, and capping bottle while submerged, and withdrawing bottle and locking cap.
8. Collect raw water sample for chloride and inorganics in 1,000 ml bottle (and others if supplied) and seal with cap.
9. Collect water for field parameters at same time and from same source as raw water sample, and measure field parameters and record in log book and on site form.
10. Label the bottles per Appendix B and finalize field form and COC.
11. Place the sample in the sample cooler and maintain 4^{o} C until delivery to the laboratory.
12. Clean and store equipment for transit.
13. Remove gloves and place in sealed waste container.

14. Wash with antibacterial soap.
15. Transport samples to laboratory or to shipping as appropriate.

STANDARD OPERATION PROCEDURE FOR SOIL SAMPLING

PURPOSE: The sampling of soils is an important part of the determination of areas having elevated chloride in the Bitter Creek watershed. The following procedure is a simple outline of the means of collecting the soils samples for transport to the laboratory for chemical analysis. The sampling is specifically conducted to examine the soil for chloride and relate concentrations to the WDEQ TMDL development process for the Bitter Creek/Killpecker Creek watersheds.

PROCEDURE: Determination of the presence or absence of chloride in soils in the study area requires pulling sub-surface grab samples of soils at monitoring sites located near reaches of Bitter and Killpecker Creek. This requires a single sample bag in which the sample is placed and sealed for transit. Additional samples may be warranted to collect duplicates.

1. Upon arrival at the sample site, document the location with the GPS (first visit).
2. Record a general description of the area in the log book and on the sample form (Appendix A).
3. Prepare sampling trowel by cleaning and rinsing with distilled water.
4. Put on new latex gloves.
5. Prepare sample bag (1 gallon Ziploc or similar).
6. Handle samples per DEQ-SOP manual.
7. Collect soil sample in bag by first removing the top 6 inches of soil over the soil sample location and then placing approximately 2 pounds of the sub-surface soil in the bag, and sealing the bag.
8. Label the bag per Appendix B and finalize field form and COC.
9. Place the sample in a cooler or other protective, clean, container for delivery to the laboratory.
10. Clean and store equipment for transit.
11. Remove gloves and place in sealed waste container.
12. Wash with antibacterial soap.
13. Transport samples to laboratory or to shipping as appropriate.

Appendix F – Quality Assurance Project Plan (QAPP)

Introduction

This Quality Assurance Project Plan (QAPP) is written to meet the Quality Assurance/Quality Control requirements of the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ-WQD), Watershed Program and the United States Environmental Protection Agency (USEPA) for water samples collected under volunteer water quality monitoring which meets the requirements of Wyoming State Statutes 35-11-103, and 35-11-302 (b) (i) and (ii), commonly known as the Credible Data Legislation.

This document sets guidelines for quality control and quality assurance for all water quality monitoring projects proposed by the Sweetwater County Conservation District (SWCCD), Rock Springs, Wyoming. The current Bitter/Killpecker Creeks Watershed Sampling and Analysis Plan meets all the requirements described in this document and are cited by reference.

When applicable, samples will be collected using the methods, procedures and protocols described in either the Sample Analysis Plan and/or the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program, Manual of Standard Operating Procedures for Sample Collection and Analysis, 2012. See the Standard Operating procedures section in this document for an explanation of SOPs to be used by the sampling staff. Additional reference material applicable to this QAPP is listed in the Reference section of this document.

QAPP Changes and Review

When conditions and requirements change during water quality monitoring project data operations, the QAPP must be reviewed and approved in the same manner as the original QAPP. For multi-year programs or projects, the QAPP must be reviewed at least annually. Reviews will be conducted and corrective actions described and taken by the SWCCD Natural Resources District Coordinator. A report documenting review and corrective actions will be added as an appendix to this document for reviews necessitating changes to the QAPP.

Project Organization and Quality Control and Assurance Tasks

The Bitter Creek/Killpecker Creek Watershed Advisory Group (BKWAG) and the SWCCD Board of Supervisors will be responsible for all decisions concerning the data, results, and the approval of final reports. Quality assurance and quality control (QA/QC) activities for projects will be performed at three levels when all three aspects are a part of a specific project: in the field during sampling, in the laboratory, and at the SWCCD office in Rock Springs, Wyoming (or at designated qualified consultant offices). The SWCCD will acquire technical staff or procure a qualified consultant to act as field project leader (Water Quality Technician) and who will be responsible for ensuring QA/QC activities are performed in the field and the laboratory and will be responsible for

performing quality control as described in the Quality Assurance Plan. The SWCCD Natural Resources District Coordinator will supervise office related QA/QC, such as data analysis and reporting (Table 1).

Finally, an annual audit will be performed to investigate any errors, omissions, and completeness and recommend corrective actions, if necessary. Careful project planning, field crew training, and strict adherence to standard operating procedures are essential for valid, high quality data and are emphasized throughout this document.

Field Audits

A field audit is an in-person observation period of sampling activities, QA/QC, and records to ascertain that the activities, procedures, methods, QA/QC, and analysis described in your SAP are being followed, SOPs are being followed, and the records are kept as stated. Field audits should be conducted every four years. If requested, the SWCCD will work with the Wyoming DEQ QA/QC officer or other third-party entity to complete a field audit.

Table 1. *Quality Assurance Personnel Responsibilities*

Title	QA Duties and Responsibilities
SWCCD Board & BKWAG	Meets to review the watershed monitoring progress; confirms or refutes whether project objectives are being met and makes changes in project if necessary.
Natural Resources District Coordinator	Supervises all project personnel. Coordinates project by establishing priorities and accomplishing objectives within given time frames and budgets. Responsible for completion and coordination of all aspects of data processing, analysis, and documentation on schedule. Coordinates all aspects of data reporting, editing, and data interpretation.
Water Quality Technician	Coordinates with project personnel to develop appropriate project designs, which meet all objectives. Coordinates staff training, evaluates performance and recommends corrective action when necessary. Evaluates data review, documentation, and reporting for quality control procedures. Supervise all other field personnel. Ensure sampling crew follows SOP and QA/QC requirements and completes all necessary documentation. Ensures quality control procedures are followed and maintained throughout the project.
Project QA/QC Officer	Performs a yearly systems audit of sampling and data analysis procedures. Performs QC evaluations to ensure procedures are followed throughout the field season. Performs QC evaluations to ensure quality control throughout data analysis process..
Laboratory	Refer to Laboratory SOP's.

Manager and QC Officer

Project Description

Components

The SWCCD will utilize the detailed Sampling and Analysis Plan (SAP) for the Bitter/Killpecker Creeks Watershed and for any other project components that support the purpose of the monitoring project. For purpose statement, see the current Bitter/Killpecker Creeks Watershed SAP, which meets all the guidelines and requirements described in this document. If the SWCCD modifies the Bitter/Killpecker Creeks Watershed SAP or writes a supplemental SAP for supporting water quality monitoring projects it must meet the requirements in this document and contain the following principal components:

. List of persons conducting the sampling
. List of parameters being sampled
. Locations of sampling sites
. Purpose of sampling
. Time frame of sampling
. Sampling methods

Detail on each of these components will be in each project's SAP. All lab related analyses for a project, specific water chemistry test method names, analysis, and QA/QC procedures can be found in each of the pertinent laboratories QAP.

Standard Operating Procedures

Samples will be collected using the methods, procedures and/or protocols in the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program Manual of Standard Operating Procedures (SOP) for Sample Collection and Analysis (2012) or later drafts as they become available unless otherwise noted in the project SOP. SWCCD has a list of Standard Operating Procedures attached as an appendix to the current Bitter/Killpecker Creeks Watershed SAP. As different methods are needed that do not conform to or exist in the current list of SOP's, new SOPs will be written and submitted to WDEQ for approval. Incorporated by reference in this Quality Assurance Project Plan are existing WDEQ, Watershed Program's policies and procedures for QA/QC. QA/QC requirements for projects not covered by the WDEQ Watershed Program will be described as needed in that project's SAP. All laboratory QA/QC procedures will follow guidelines outlined in the laboratory's Quality Assurance Plan.

Data Quality Objectives

Monitoring Program Objectives

The main objectives of each water quality monitoring project will be detailed in the project SAP. A detailed discussion on project objectives and the rationale behind and importance of each parameter being measured for any SWCCD Water Quality Monitoring Project will be in the specific project SAP.

Staff Training and Field Personnel

Persons responsible for data collection will have prior field experience and water quality monitoring training from either the WDEQ, Watershed Program, BURP monitoring personnel, the WACD water quality training program or a person qualified to perform water quality monitoring as defined in Wyoming credible data legislation. This will help reduce errors during field data collection. The Water Quality Technician will supervise and ensure that the crew follows all standard operating procedures and QA/QC procedures. Each project SAP should describe the experience and training of the water quality monitoring team.

Data Quality Objectives

SWCCD water quality projects will follow the SOPs for each particular project as needed. Data quality objectives in terms of accuracy, precision, and completeness for project parameters must be described in each project's SAP. Examples of data quality objectives for physical/habitat parameters, water quality metrics, and biological parameters are listed below in Table 2. The laboratory's QAP details their data quality objectives for all the water chemistry parameters.

Definitions for data accuracy (bias) and precision are in the "Quality Control Measures, Summary of SOP" in the SWCCD list of Laboratory SOP's. Completeness is defined as the percentage of data collected which is valid and usable.

Table 2. Data Quality Objectives

Parameter	**Precision**	**Accuracy**	**Completeness**	**Method Reference**
Temperature	+ 10%	*	95%	170.1; EPA 1983
pH	+5%	*	95%	150.1; EPA 1983
Conductivity	+10%	*	95%	120.1; EPA 1983
Dissolved oxygen	+20%	*	95%	360.2; EPA 1983
Turbidity	+ 10%	*	95%	180.1; EPA 1983
Bacterial analysis	n/a	n/a	95%	Bacterial Sampling Methods (SAP)
Macroinvertebrates				
Abundance	+50%	-	95%	Platkin et a1. 1989
Number of Taxa	+15%	-	95%	Platkin et a1. 1989
Habitat Assessment				
Total Assessment	+20%	-	95%	King 1992b

* Accuracy for parameters calibrated to a known standard is assumed.

Sampling Process Design

The SAP of any SWCCD water quality monitoring project must present an explanation of its sampling process design. Detailed information on the location of sampling sites, the parameters to be sampled, and the sampling schedule must be included. Site selection criteria and rationale for choosing all measurement parameters

will be discussed in the SAP. A plan of anticipated yearly project activities must be included, presenting the time of year each activity will take place and for how long.

Sampling Methods Requirements

A description of all parameters, containers, preservation methods, holding times, and procedures must be detailed for any SAP conducted under this QAPP. The SOP for each parameter must also be included as an appendix in the SAP. If any changes in methods are necessary in the field due to extreme site variation or crew safety, the field crew must get approval from the Water Quality Technician and document how the methods used differed from those in the SOP, SAP, or this QAPP.

Sample Handling and Custody Requirements

Sample Labeling

Water chemistry sample containers will be labeled on the outside with an adhesive label. Macroinvertebrate samples will be labeled on the outside of the container, also with an adhesive label. Additionally, a labeled paper tag (made of Rite-in-the-Rain paper) with the date, site, and observer initials written in #2 pencil by field personnel will be placed inside the containers holding macroinvertebrate samples. The field crew will record the following information with a waterproof pen or marker on every container label: Site name, date and time of collection, observer, type of sample, and preservative. Duplicate and blank samples will be labeled according to the project's SAP. Rite-in-the-Rain™ paper and adhesive container labels will be provided by SWCCD. The laboratories pre-label the water sample collection containers and field personnel fill in the labels at the time the sample is collected. Examples of labels are available in the current Bitter/Killpecker Creeks Watershed SAP.

Once samples are collected and containers are sealed and labeled, field personnel complete a chain of custody form. SWCCD project SAP's must outline the procedures that will be used concerning chain of custody and sample delivery and include a chain of custody SOP. Personnel will follow the chain of custody SOP in the field and when sending samples to laboratories [see the current SWCCD SAP list of SOPs for example]. Chain of custody is a means of tracking and documenting sample collection and handling until the sample arrives at a laboratory. Chain of custody forms, with the appropriate signatures, dates, times, and data, will be filed permanently according to the Bitter/Killpecker Creeks Watershed SAP.

Analytical Methods Requirements

The chemical, physical, and biological analytical methods requirements for every SWCCD water quality monitoring project will be outlined in each project's SAP. Test method names will be listed for chemical analyses and the appropriate SOPs for physical and biological analysis will be attached or referenced in the SAP. All laboratory analyses are described in the laboratory QAP. The SWCCD will receive QA/QC plans from each contract laboratory to be used and determine whether or not the lab work will meet specified data quality objectives and QA/QC requirements.

Quality Control Requirements

Quality control requirements will be followed which apply to field collection methods, water sample analysis in the field and in the laboratory, specimen collection analysis as well as data analysis, as outlined in each project's SOPs and the SAP. Additional activities for future project quality control requirements not yet listed here must be outlined in each project's SAP. An essential element for quality control is a well-trained field crew supported by a Water Quality Technician who can supervise field sampling. The requirements below are established to ensure that the data quality objectives (in terms of precision, accuracy, and completeness) described earlier in this report are met.

Field methods

Field Personnel will collect duplicate water and biological samples at a minimum of 10% of all sampling sites to measure variation in collection effort and ensure consistency.

When feasible, at 10% of all sites field personnel will repeat sample collections and biological assessments using separate field crew members to minimize inter-observer bias and to ensure consistent bioassessment.

The field crew will be trained in every task and when feasible different crew members will perform different tasks throughout the field season, thereby minimizing bias and ensuring each person accomplishes each task in a similar manner.

To minimize variability among crew members when assessing the physical habitat, responses to habitat questions will be discussed and answered by the entire field crew.

The field crew will ensure completeness by double-checking that field data sheets are complete and accurate before leaving the sampling sites.

Water sample collection and analysis

Laboratory Analysis of Water Samples

Containers used to collect water samples that will be sent to a laboratory for analysis are supplied by the laboratory, pre-cleaned, and sealed in boxes. They remain sealed and stored at the SWCCD office or with the designated sampling personnel until the time of sample collection. Containers will be transported to the sampling sites in a sealed plastic bag or sealed cooler and then from the sampling site to the laboratory in a sealed cooler. The QAP for the laboratories used for all projects will be available for reference in each project SAP.

Field Analysis of Water Samples

The chemical analysis of water samples in the field is in itself a quality check and comparison for the laboratory chemical analysis. The greatest possible care will be taken to ensure precision and accuracy by closely following all test methods, see specific project SOPs. Quality control for parameters measured only in the field (water temperature, dissolved oxygen, and pH) will rely predominantly on accurate calibration of equipment. Equipment will be calibrated, maintained, and cleaned up to standards (see discussion on calibration in project SAP).

Analysis of Water Samples for E. Coli or Inorganic Parameters

Following the proposed E. Coli and Inorganic SOP, which describes the procedure for the use of sterilized collection containers, sample contamination will be eliminated. At 10% of all sampling sites, an additional set of replicate samples will be collected for analysis. At 10% of all sampling sites, an additional blank sample will be created using de-ionized water and transferred and shipped side by side with all other collected samples to the laboratory for identical analysis.

These data will be supplemented by on site analysis of water pH, dissolved oxygen, temperature and conductivity. The pH, dissolved oxygen and conductivity instrument(s) will be calibrated against standards prior to their use at sampling locations. Factory specifications for precision and accuracy are available in each project SAP. Expert interpretation and data review will determine if errors exist and which results are significant or due to error or bias. The amount of data that is valid and usable must be 95% of that initially expected in order for the data set to be considered complete.

Biological specimen collection and analysis

All specimen collection containers will be uncontaminated as they will be stored in sealed boxes in the SWCCD office or with the designated sampling personnel once delivered by the laboratory. Containers will be transported to the sampling site in sealed boxes and are not opened until the time of collection. Containers will be immediately closed after sample collection and no containers will be reused (see project SAP's for further detail and the SOP on sample containers).

Macroinvertebrate Identification

A trained taxonomist will analyze the macro invertebrate collections. The laboratory will be equipped with appropriate taxonomic references and the necessary equipment. Representative specimens will be used as voucher specimens to create a voucher specimen collection.

Data Management and Analysis

Data will be entered into a computer spreadsheet as it is collected or as a minimum following the field season when it was collected. The Water Quality Technician or the Natural Resources District Coordinator will proof a minimum of ten percent (10%) of the data entered into a computer using the original copies of the data forms. All data analysis should be peer reviewed after initial review by the SWCCD water quality monitoring teams. Numerical outliers and totals, unusual species, and odd numbers will be examined closely for errors.

If outliers appear during data interpretation, concerning any project parameter, the raw data used in the interpretation will be proofed a second time against the hard copies of data forms. If no discrepancy is discovered calibration logs and field notebooks will also be checked to discover whether or not equipment calibration was successful or if there was any other reason which might explain the outlier. If equipment calibration was conducted properly and the specific SAP, SOPs, and QA/QC requirements were followed the data will be accepted as valid. Statistical tests assist with the interpretation of outliers and may aid in perceiving patterns in the data that are not immediately obvious. The SWCCD will subject all project results to statistical tests of significance. Only experienced and trained personnel will perform the statistical analysis.

If errors are found in data entry, the incorrect entry will be corrected and all the entered data will be subject to spot checks for accuracy against the original data sheets. If errors are discovered in calibration methods the data will be considered invalid. All calibration logs will then be checked to ensure other data is correct. If field samplers did not follow the project SAP, SOPs, or QA/QC requirements for the given parameter the Water Quality Technician and technical team will decide whether or not the data should be rejected as invalid or qualified. This decision is dependent on how and why the field crew deviated from the SAP, SOPs, or QA/QC requirements. Qualified data may be used in the interpretation of results but all result reports and summaries must note the reason it had been subject to question and why and how it had been qualified and considered usable.

Whether the data is accepted, rejected or qualified, the Water Quality Technician and the Natural Resources District Coordinator are responsible for documenting (in project reports) which outliers were checked and how, what (if any) errors were discovered, whether or not those errors made the data invalid, or how the data was qualified. All summary reports and presentations will be scrutinized by the SWCCD project technical team and reviewed again by peers. If a summary report does not accurately present project findings the report will be rejected and rewritten. By agreeing upon and following a standard format for data reporting, errors will be minimized and completeness ensured.

Instrument Calibration and Frequency

To ensure accurate data collection, field crew members must calibrate all equipment following the SOP on calibration and the equipment manufacturers' specific instructions. A complete equipment list, an SOP on calibration, and the maintenance and calibration manuals for equipment being used on a project must be in that project's SAP. Laboratory instruments and calibration procedures will be described in the laboratory's QAP.

Assessments and Response Actions

When a contract laboratory is used for a project, the laboratory QAP will describe the type and frequency of audits that will be conducted in the laboratory. In addition to routine internal quality control checks, the Water Quality Technician will plan a systems audit to review project field sampling procedures and data analysis. The systems audit will involve the Natural Resources District Coordinator and when requested a WDEQ, Water Quality Division, Watershed Program auditor. The auditor will determine whether or not the field crew is following the project's standard operating procedures, completing the required quality control checks, and whether or not data analysis is being conducted properly. The systems audit will be conducted on site, and later at the office, at least once a year for multi-year projects. All Audit Reports will be given to the Natural Resources District Coordinator and the SWCCD Board of Supervisors. Audit reports should include whether or not personnel are:

- Following project SOPs and SAP
- Following project QA/QC requirements and procedures
- Ensuring safety remains a priority at all times
- Ensuring field data sheets and chain of custody forms are properly completed
- Ensuring all water samples are analyzed within the required holding times
- Using appropriate methods and statistical tests for data analysis

Audit reports should also recommend immediate or long term error correction if necessary. The Natural Resources District Coordinator and Water Quality Technician will ensure the necessary corrections are made and followed.

Data Review, Validation, and Verification Requirements

Data Review

Data entry and interpretation and project summary reports must be reviewed. Data review will be coordinated through the Natural Resources District Coordinator with the Water Quality Technician. Field data forms and field logbooks will be utilized for all field observations. Once completed, data sheets will be kept in the SWCCD office, or with the designated sampling consultant, where they will be double-checked for errors or missing information. Field data sheets will be converted into an electronic format utilizing a computer spreadsheet. Once converted, the Water Quality Technician will proof at least 10% of the data for errors. Finally, the data will be reduced into the best format for interpretation. The person responsible for data entry will date and initial data

sheets as they are proofed against the data in the computers. Laboratory results, from the original chain of custody forms, will also be entered into the database and 100% of the entries will be proofed against the original forms. The hard copies of field forms and chain of custody forms will be filed at the SWCCD office. If, during statistical analysis, any outliers or unusual results are found, the hard copies will be reviewed against the entered data a second time for errors.

The Water Quality Technician will create reports and presentations with the project data. The data and the interpretation of the results in the reports will be reviewed and edited by the water quality technical team, SWCCD staff and Board of Supervisors.

Data Verification

Data verification will be used to evaluate whether the collected data can be used to address the project objectives outlined in the project SAP to present accurate data interpretations and project conclusions. The Natural Resources District Coordinator is responsible for ensuring this process takes place.

Data Validation

The process of data validation will be used to qualify, reject, or accept the data as valid. Several steps are required during the data validation process. All of the following must be reviewed:

- Sampling process design
- Sample collection and handling procedures
- Analytical methods and procedures
- Field QC procedures and results
- Lab QC procedures and results
- Field equipment calibration and calibration records
- Data entry, processing, reduction steps, problems, and results

During the validation review, any deviation from SOPs, the project-specific SAP or this QAPP must be documented. Their potential effect on the usability and quality of the monitoring data must be evaluated and documented. Any deviations must also be evaluated for the potential effect they may have on any decision making based on the monitoring data, and the conclusions documented. If data was gathered without following the SOPs or SAP, it will be rejected or possibly qualified, depending on the circumstances. The Water Quality Technician is responsible for coordinating this process.

Quality control data checks will be performed on a daily basis by the Water Quality Technician and on a yearly basis by a WDEQ Program Auditor. Any need for project-related issue resolution will be addressed by the SWCCD Board of Supervisors through periodic project meetings. Quality control sampling and analysis checks will be performed objectively with corrections in

methodology made as needed and documented. Field equipment calibration will be tracked by referring to a field calibration log. Calibration methods and frequency will be checked during the systems audit and changes in methods will be made as needed and documented. If the project SAP, SOPs, or QA/QC requirements were not followed, the data will be rejected or qualified, depending on the specific situation.

Reconciliation with Data Quality Objectives and Project Objectives

The Natural Resources District Coordinator, Water Quality Technician, and the project technical team, will determine whether or not the data quality objectives of a project were met. The data gathered will be compared to the list of data quality objectives (broadly outlined in this QAPP and specifically identified in each project SAP). If the data quality objectives are not met, the possible reasons will be listed and the reviewers will decide whether the data should be qualified or rejected and if the objectives should be altered. The Natural Resources District Coordinator, Water Quality Technician, and the project technical team will examine the initial list of project objectives for the monitoring and the field chemistry analysis. If any of the project objectives were not met the reviewers will decide whether the objectives should be altered for future projects, or if other changes can be made to ensure all objectives are reached in the future. The Water Quality Technician will document the data quality objectives and project objectives review, conclusions, and any changes in objectives that may be made.

References

1. Sweetwater County Conservation District, Bitter Creek/Killpecker Creek Watershed SAP, April 2003

2. Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program. 2012. Manual of Standard Operating Procedures for Sample Collection and Analysis.

3. Wyoming Department of Environmental Quality, Water Quality Division (prepared by Kurt King). January 1993 (Revised 1999). A Bioassessment Method for Use in Wyoming Stream, and River Water Quality Monitoring, Draft. Cheyenne, WY.

4. United States Environmental Protection Agency. 1995. Generic Quality Assurance Project Plan Guidance for Programs Using Community Level Biological Assessment in Wadeable Streams and Rivers. EPA 841-B-95-00

5. Natural Resources Conservation Service. May 1998. National Handbook of Water Quality Monitoring.