

LAKE 17 WETLAND ENHANCEMENT PROJECT

Site History

Lake 17 is an artificial impoundment formed by the combination of a dam at the lake itself, and a diversion dam south of the lake. Both the diversion dam and the main dam at the lake were constructed in the 1920s with the intended purpose of supply for a planned irrigation system. The irrigation system was never developed and therefore utilization of the lake has been limited to watering stock in the adjacent range units. The large, shallow impoundment provides critical open water habitat and wetland habitat for a variety of waterfowl, shorebirds, wading birds, songbirds, upland birds, mammals, and a wide variety of amphibians, reptiles, and invertebrates. The Tribal Fish and Wildlife Department has documented a number of nesting mountain plovers (an important species of concern) in the area.

Over the last decade, the diversion dam has failed four times with the resulting effect of substantially reducing water delivery to the lake. During the summers of 2004-2008 the main pool was down to 30-40% of its historic size, and the wetland area south of the lake dried out to the point many of the cattails and other wetland vegetation was lost. The island on the south end of the lake, historically a very productive nesting area, has had a large increase in predation loss with the low water levels. Representatives of the Tribal Council, Fish and Wildlife Department, and Land Department contacted the NRCS in 2008 regarding assistance in repairing the diversion dam. The diversion dam provides an additional 46.1 square miles of drainage to the natural Lake 17 drainage of 18.9 square miles. This proposal was developed in conjunction with the Tribe, for the purpose of restoring and preventing further damage to the lake and associated wetlands. The project has been identified as a priority by the Fort Belknap Tribal Council.

Proposed Project

The Lake 17 Wetland Enhancement Project will ensure a watershed for Lake 17 of sufficient yield, a delivery system of adequate capacity, and a reservoir which operates within dam safety and NRCS criteria. As described above, a diversion dam has historically routed Little Suction Creek flows to Lake 17. This earthen structure has a length of 2000 feet and maximum height of 13 feet. Lake 17 is created from an earthen embankment with an effective height 16.1 feet. Its outlet works include a riser/barrel principal spillway and earthen auxiliary spillway. The pool

has a storage volume of 4111 acre-feet when the water surface is at the crest of the principal spillway.

Runoff (water yield) in north central Montana is generated from both snowmelt and rainfall events. In general, larger and more dependable yields are generated from snowmelt while flowrate peaks occur from intense, more sporadic, rainfall events. The Lake 17 watershed alone yields snowmelt volumes of 336 acre-feet and 1150 acre-feet for snowfall depths expected on a 5-year and 25-year frequency, respectively. Lake 17 has a storage volume of 612 acre-feet at a depth of 5 feet depth which increases to 4111 acre-feet at a depth of 12 feet depth. Twelve feet is the depth at which flow begins to spill into the principal spillway. These numbers illustrate the low likelihood of Lake 17 ever filling from its own watershed. This conclusion is further compounded by the fact a considerable evaporative loss (est. 25 inches net loss) occurs each year over the entire surface area of the pool.

Directing yields from Little Suction Creek into the Lake 17 watershed significantly increases the reliable yield realized by Lake 17. Snowmelt volume increases from 336 acre-feet to 868 acre-feet for a snowfall depth expected on a 5-year frequency. Similarly, the 25-year snowmelt volume increases from 1150 acre-feet to 3704 acre-feet. Increased pool volumes also mean increased perimeter length and surface area thus increasing the habitat value of the area. The Lake 17 pool perimeter increases by 9 miles and pool surface area increases by 460 acre as the depth increases from 5 feet to 12 feet.

Little Suction Creek Diversion

The 2000 feet long, 13 feet high, Little Suction Creek diversion is located in SW $\frac{1}{4}$ of Section 9, T26N R22E. It is an embankment constructed of homogenous earthfill that diverts all of the flow from Little Suction Creek to Lake 17. The diversion dam is free of conduits and/or water control structures which in turn minimizes efforts needed to manage the system.

History has shown that the existing diversion, when in-tact, has been effective at directing significant and effective water yields from Little Suction Creek to Lake 17. As of late, re-occurring washouts have rendered the diversion limited in its ability to function. On-site investigations and discussions with tribal members indicate that washouts have occurred primarily due to internal erosion. Moreover, water flowing along cracks that occur naturally

within the fill, results in erosion of the materials internal to the embankment. Eventually, and sometimes quickly, voids form and embankment failure occurs.

Proposed modifications at the diversion include installing a sand chimney filter and a 10 ft wide section of compacted earthfill against the sand filter along the entire length of the structure. The chimney filter will intercept any existing or future cracks and prevent failure by plugging with a thin cake of soil particles that are carried with the preferential flow of water in the cracks should they occur.

Additional modifications at the diversion site include constructing an earthen, vegetated, auxiliary spillway. While added flow is needed to fulfill Lake 17's potential for wildlife habitat and water storage, there is a limit beyond which flow volumes delivered result in upgrades to the reservoir that are beyond feasible. The auxiliary spillway will effectively direct excess flow away from the Lake 17 diversion when flowrates from Little Suction Creek exceed that from a 50-year storm type event. The spillway will be excavated into the side hill located beyond the south end of the embankment.

Reconstruction of the washout sites and minor fill on the embankment top will also be incorporated into the workplan for the diversion site.

Lake 17

The outlet works of the Lake 17 reservoir is comprised of a principal and auxiliary spillway. The existing principal spillway, located in NW1/4 SW1/4 Section 23, T27N R22E, is a 52 inch corrugated metal riser attached to a 36 inch corrugated metal barrel approximately 110 feet in length. The crest elevation is 3020.9. The auxiliary spillway, located in NE1/4 Section 26, T27N R22E, is a vegetated open channel. Its crest elevation, 3022.1, is set by a 10 feet wide dike, approximately 3 feet in height, placed across the channel width, presumably to raise the pool level. The top of dam, elevation 3025.5, is roughly 18 feet wide and also serves as a road that appears to be well traveled.

The principal spillway is in a state of dis-repair as a result of corrosion, blockage within the riser/barrel connection, and physical damage to the riser itself. The capacity of this structure should handle flow events that occur frequently and/or occur over a long duration. From a design perspective, capacity is also evaluated for the structure's ability, in a large flood event, to

draw the water level down to the permanent pool elevation in a relatively short (10 day) time period thus preparing the structure for the next potential event.

The existing principal spillway configuration has a flowrate capacity of 50 cfs when the pool level is at the crest of the auxiliary spillway. When the pool level rises to the top of the embankment, the principal spillway capacity increases to 106 cfs. Hydraulic modeling illustrates, assuming full pool conditions, the existing auxiliary spillway would begin flowing between a 10-year and 25-year storm event with a principal spillway of the existing size. NRCS policy requires the principal spillway be sized and auxiliary spillway elevation set such that the auxiliary spillway is not engaged until a precipitation event midway between a 25-year and 50-year event occurs. In order to meet NRCS criteria, the principal spillway capacity will be increased to approximately 280 cfs and the auxiliary spillway crest elevation will be raised one foot. The top of the dam will also be raised approximately one foot so that the auxiliary spillway can pass the design storm which, by policy, exceeds the 100-year precipitation event.

The principal spillway retrofit will involve replacing the existing corrugated metal structure with two, concrete structures. Each will have a 4.5 x 4.5 foot square concrete riser with a 48 inch diameter concrete barrel approximately 140 feet in length. The crest of each structure will be set at the same elevation as the existing structure. Included in the principal spillway retrofit will be construction of an impact basin, plunge pool or combination.

The auxiliary spillway retrofit will involve constructing an earthfill structure much larger than currently exists. The crest will be a minimum of 200 feet wide and 200 feet in length with long, gradually sloping entrance and exit slopes. The crest elevation of the new spillway will be set one foot higher than currently exists.

The top of dam will be raised one foot. The existing top of dam serves as a relatively well traveled road. For this reason, the existing top width and side slopes will be maintained. As a result, raising the top of dam one foot also involves placing a new lift of compacted earthfill along the downstream face. All earthfill placement will require the additional earthwork of stripping existing topsoil and vegetation.

Costs

Costs for this project were figured based on estimated quantities and unit cost figures. A preliminary bid schedule itemizing each bid item, its quantity, and estimated cost, is attached.

The Fort Belknap Tribal Government implements a TAERO tax whereby non-tribal contractors are charged a tax to work on tribal land. This tax is calculated at 5% of material and labor costs and \$100 per employee per two week working period. The bid schedule presents project costs with and without consideration for the TAERO tax.

Large over-runs or under-estimates of project costs are of critical nature due to the large overall cost of the project. For this reason, a working group comprised of the NRCS District Conservationist, Fort Belknap Tribal Council, NRCS Engineering Staff, and NRCS Programs Staff agreed the preferred approach for contracting would be to allocate and contract funds based on a project specific cost list. Integral to this decision was the agreement that the formal contract would incorporate provisions to cap payment based on actual costs.

Resource Benefits

Results of the project will be restoration of wetlands and open water areas of Lake 17 which will provide truly landscape-scale benefits to a wide variety of both upland and wetland wildlife. The large wetland area south of the lake, as well as all of the shallow margin areas of the lake will provide ideal wetland habitat for a variety of wetland wildlife, especially dabbling ducks and shorebirds. Although other, much smaller wetlands exist in this landscape, Lake 17 is unique in terms of its large surface area and watershed. In drought years, Lake 17 is one of the few large wetlands in the area that maintains water throughout the brood rearing season.

The Northern Great Plains is one of the richest grassland bird communities in North America; and north-central Montana is the center of species radiation of endemic prairie birds. The Montana Partners-In-Flight Bird Conservation Plan lists a number of declining grassland bird species needing conservation action. Many of these species inhabit north-central Montana. Grassland-wetland complexes in north-central and northeastern Montana have been identified as critical waterfowl habitat by the North American Waterfowl Management Plan, and both areas have been designated as Prairie Pothole Joint Venture Areas. The Nature Conservancy, in its ecoregional planning document, also recognizes the grasslands and wetlands north of the Missouri River as "Ecologically Significant Areas". Although Lake 17 is not a naturally formed

wetland, it has provided critical wetland habitat for nearly a century, and it's continued existence is inline with conservation priorities in the region.

Shallow water areas (up to 2-24 inches) provide critical foraging areas for waterfowl. Such wetlands warm up early in the spring stimulating rapid invertebrate production to feed migrating and breeding waterfowl and shorebirds. The lake has such a low overall water depth, that typically at least 250 acres of it's total area has water present in that 2-24" range in the critical brood rearing months between May and August. Typical breeding pair habitat includes small ponds, ditches, streams, and larger wetland basins, and these habitats would be provided by the diversion canal, Lake 17 shoreline areas, and other surrounding wetlands. Important qualities for brood-rearing habitat include permanent water and emergent vegetation cover. These species commonly nest in upland vegetation adjacent to the wetlands, lake, and on the island.

Mountain plovers migrate into the prairie pothole region by mid-April and seek out breeding areas containing short native prairie grasses, bare ground, and relatively flat topography. Lake 17 provides this mix of habitats, as evidenced by the fact that tribal fish and wildlife biologists have identified a number of nest sites for mountain plovers at the lake. In 1982, the U.S. Fish and Wildlife Service (USFWS) designated the Mountain Plover as a Category 2 candidate species under the U.S. Endangered Species Act, because more information was necessary to determine whether the species' status was declining, stable, or improving. A status report was subsequently prepared and the Mountain Plover was elevated to a Category 1 species in 1994. In 1997, the USFWS received a petition to list the Mountain Plover under the Endangered Species Act and published a proposed rule to list the Mountain Plover as threatened in 1999 and again in 2002. In September 2003, the USFWS withdrew the listing, because new information indicated that the threats to the species that had been included in the proposed listing were not as significant as earlier believed. However, as a result of a court settlement regarding the 2003 action, USFWS is currently in the process of reconsidering the listing decision.

Tribal Input

The Tribal Government as well as Tribal programs including the Tribal Environmental Protection Office, Tribal Water Resources, Tribal Natural Resources and the Tribal Fish and Wildlife Department are very interested in preserving and enhancing Lake 17. Historically the lake has provided good habitat for shore birds as well as migrating waterfowl, mammals and

song birds. Many enrolled members have fond memories of a lake that contained many of these species and now lament the reduction of the habitat due to the breach of the diversion and lack of adequate water for the wildlife. Many enrolled members have contacted the local NRCS office on the reservation, inquiring about the progress on Lake 17. Some of the enquiries are from enrolled member contactors who would like to be involved in the project as well as enrolled members who just want the project to proceed. This project would not only benefit the land resource but would also provide jobs for an area with high unemployment rates. There has been discussion about involving Social Services General Assistance participants as well as Vocational Rehabilitation participants who could provide some of the needed labor for the project and in return may spark an interest in construction type work. Currently, there is a lack of contractors on the reservation who can install water developments and irrigation projects that have been funded through EQIP.

**Lake 17 Principal Spillway
SCHEDULE OF WORK**

<u>ITEM NO.</u>	<u>WORK / MATERIAL</u>	<u>SPEC. NO.</u>	<u>QUANTITY</u>	<u>UNIT</u>		
1	Mob and Demob	Spec. Prov.	Job	LS		
2	Reinforced Concrete	Spec. Prov.	110	Cu Yd		
3	Concrete Pipe Bedding	Spec. Prov.	137	Cu Yd		
4	Sand Filter Diaphram	Spec. Prov.	125	Cu Yd		
5	48" RC Pipe CL IV	Spec. Prov.	300	Cu Yd		
6	Rock Riprap	Spec. Prov.	1,000	Cu Yd		
7	Excavation Principal Spillway	Spec. Prov.	4,000	Cu Yd		
8	Excavation Plunge Pool	Spec. Prov.	1,100	Cu Yd		
9	Earthfill Principal Spillway	Spec. Prov.	4,000	Cu Yd		
10	Moisture for Earthfill	Spec. Prov.	210,000	gal		
11	Stripping - Excavation	Spec. Prov.	161	Cu Yd	<u>Estimated</u>	<u>Estimated</u>
12	Seeding	Spec. Prov.	0.2	Acre	<u>Cost</u>	<u>Cost w/ 5% TERO Tax</u>
Total for Lake 17 Principal Spillway					\$414,993	\$435,743

**Lake 17 Earthwork
Auxiliary Spillway and Top of Dam
SCHEDULE OF WORK**

<u>ITEM NO.</u>	<u>WORK / MATERIAL</u>	<u>SPEC. NO.</u>	<u>QUANTITY</u>	<u>UNIT</u>		
1	Mob and Demob	Spec. Prov.	Job	LS		
2	Earthfill Lake 17 Dam	Spec. Prov.	8,000	Cu Yd		
3	Earthfill Auxiliary Spillway	Spec. Prov.	21,000	Cu Yd		
4	Moisture for Earthfill	Spec. Prov.	1,520,000	gal		
5	Stripping - Excavation	Spec. Prov.	5,647	Cu Yd	<u>Estimated</u>	<u>Estimated</u>
6	Seeding	Spec. Prov.	7	Acre	<u>Cost</u>	<u>Cost w/ 5% TERO Tax</u>
Total for Lake 17 Earthwork					\$324,271	\$340,485

**Little Suction Creek Diversion
SCHEDULE OF WORK**

<u>ITEM NO.</u>	<u>WORK / MATERIAL</u>	<u>SPEC. NO.</u>	<u>QUANTITY</u>	<u>UNIT</u>		
1	Mob and Demob	Spec. Prov.	Job	LS		
2	Excavation Auxiliary Spillway	Spec. Prov.	10,000	Cu Yd		
3	Earthfill Auxiliary Spillway	Spec. Prov.	500	Cu Yd		
4	Sand Filter Diaphragm	Spec. Prov.	3,800	Cu Yd		
5	Earthfill on Dwnstm Face	Spec. Prov.	11,000	Cu Yd		
6	Earthfill on Top of Diversion	Spec. Prov.	444	Cu Yd		
7	Excavation for Breach Repair	Spec. Prov.	2,560	Cu Yd		
8	Earthfill for Breach Repair	Spec. Prov.	2,560	Cu Yd		
9	Moisture for Earthfill	Spec. Prov.	740,000	gal		
10	Stripping - Excavation	Spec. Prov.	4,300	Cu Yd	Estimated	Estimated
11	Seeding	Spec. Prov.	5.3	Acre	Cost	Cost w/ 5% TERO Tax
Total for Diversion					\$519,030	\$544,982
	<u>ITEM</u>				<u>AMOUNT</u>	<u>AMOUNT w TAERO Tax</u>
	LAKE 17 PRINCIPAL SPILLWAY				\$414,993	\$435,743
	LAKE 17 EARTHWORK	(Top of Dam and Auxiliary Spillway)			\$324,271	\$340,485
	LITTLE SUCTION CREEK DIVERSION DAM				\$519,030	\$544,982
	TOTAL PROJECT COST				\$1,258,294	\$1,321,210

Onacko, Gene

From: Becker, Steve - Bozeman, MT [Steve.Becker@mt.usda.gov]
Sent: Friday, September 24, 2010 1:35 PM
To: Onacko, Gene; Fisher, Christi - Great Falls, MT; Buck, Terry - Harlem, MT; Hoffman, Karen - Bozeman, MT; Yerger, Mark - Bozeman, MT; Berg, Kris - Bozeman, MT
Cc: Philipps, Phyllis - Great Falls, MT; Nadwornick, Ronald - Bozeman, MT; Swartzendruber, Joyce - Bozeman, MT
Subject: Lake 17 Meeting
Importance: High

Gene, Christi, Terry, Karen, Mark and Kris:

I would like to schedule a meeting in the Lewistown NRCS Field Office on Wednesday, September 29 around 10:00 am to discuss the hydrology/hydraulic routing results on the Lake 17 dam and Little Suction Creek diversion. We'll have a chance to lay out the standards that apply to this work, and present some alternatives that can be pursued through an EQIP special initiative application (funding) which is due October 1. I think it is important that Terry Buck attend to ensure that we are meeting the planning objectives of the tribe. Gene Onacko needs to review this information from a BIA dam safety perspective. Kris Berg has some insight into contracting and funding approval from the chief. Perhaps Ron can send someone from Technology.

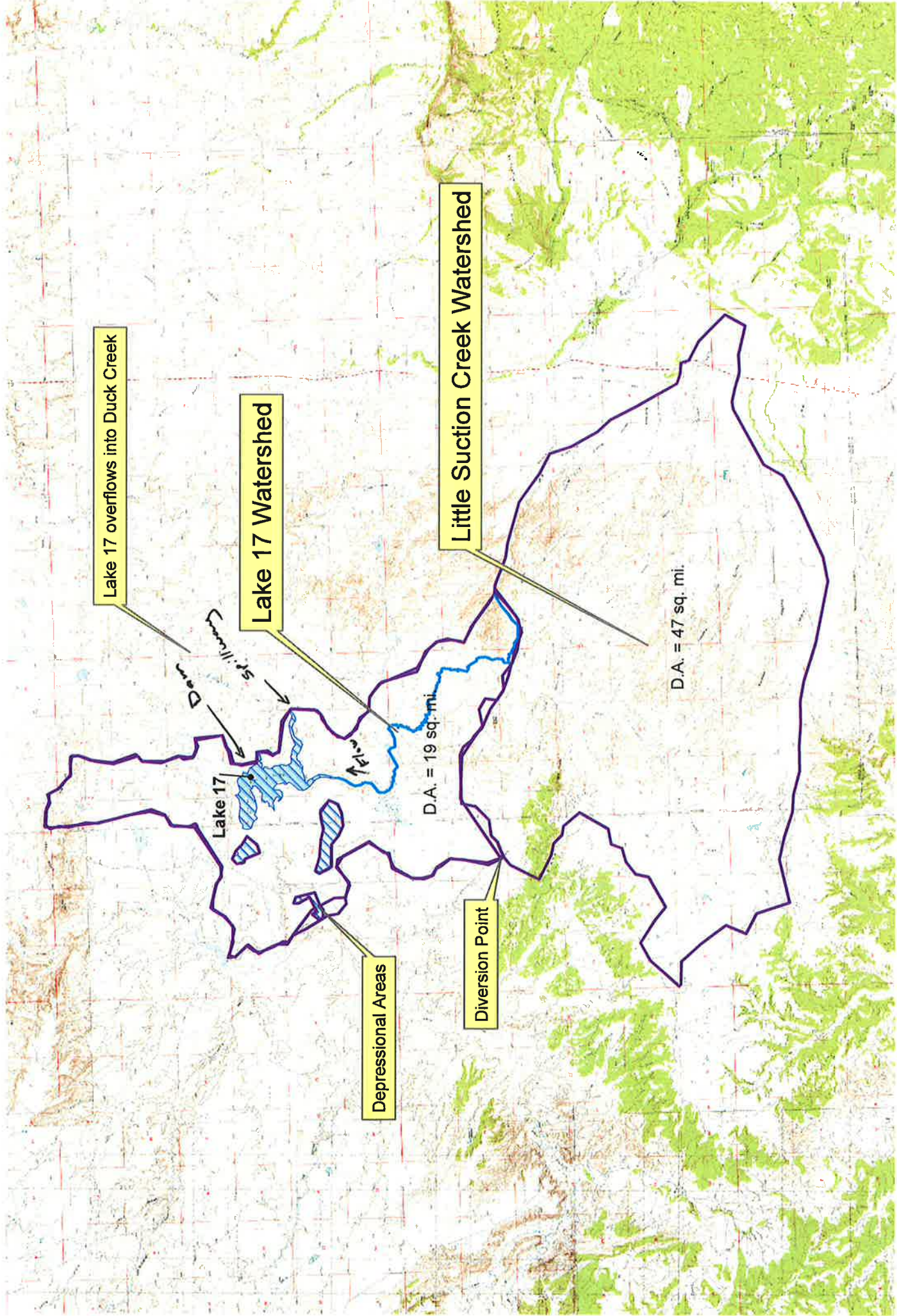
I apologize for the delay. We had some priority diversions from this task. But generally speaking, this was a very complex analysis that required a significant amount of time and attention to ensure that we get some responsible results.

If we can build some consensus on a work plan, I would propose that we split the written narrative for a special initiative. Karen can write up of a technical summation of work with approximate costs, and Terry can write-up the planning objectives and justification for the project.

I think we have some flexibility in this meeting time/date/place, so please let me know if you have scheduling conflicts.

Thank you.

Steve Becker
State Conservation Engineer
Bozeman, MT
406-587-6828 work
406-600-2113 cell



Lake 17 overflows into Duck Creek

Lake 17 Watershed

Little Suction Creek Watershed

D.A. = 19 sq. mi.

D.A. = 47 sq. mi.

Depressional Areas

Diversion Point

Lake 17

Dam

S. Williams