

# RECLAMATION

*Managing Water in the West*

## High Lakes Stabilization Project Construction Report

Uinta Basin Replacement Project

### Swift Creek Basin

Water Lily Lake, Farmers Lake, White Miller Lake



U.S. Department of the Interior  
Bureau of Reclamation  
Provo Area Office  
Provo, Utah

September 2008

# **High Lakes Stabilization Project Construction Report**

**Uinta Basin Replacement Project**

## **Swift Creek Basin**

**Water Lily Lake, Farmers Lake, White Miller Lake**

*prepared by*

**Provo Area Office  
Upper Colorado Region**

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## Introduction

The Uinta Basin Replacement Project (UBRP Project) was authorized by Section 203 of the Central Utah Project Completion Act [CUPCA: Titles II through VI of P.L. 102-575].

A component of the UBRP Project is that 13 high mountain lakes formerly used to store water rights would be stabilized at No-Hazard levels and the water rights transferred downstream for storage in the enlarged Big Sand Wash Reservoir, another feature of the UBRP Project. The stabilization of the thirteen reservoirs is mitigation for the enlargement of Big Sand Wash Reservoir.

Stabilization of the thirteen high mountain lakes at No-Hazard levels will provide constant lake water levels year-round. Nine of these lakes (Bluebell, Drift, Five Point, Superior, Water Lily, Farmers, East Timothy, White Miller, and Deer) are located in the upper Yellowstone River watershed and four (Brown Duck, Island, Kidney and Clements) are in the Brown Duck Basin portion of upper Lake Fork watershed.

The work accomplished in the Swift Creek Drainage portion of the upper Yellowstone River watershed in 2006 was to stabilize Water Lily Lake, plug the Farmers Lake Tunnel, and remove the outlet structure at White Miller Lake. Appendix A contains design drawings showing location maps for each of the lakes. Construction Record drawings are provided with applicable details only for Water Lily Lake, as no substantial changes were made to White Miller or Farmers lakes that require drawings.

## Water Lily Lake

Water Lily Lake is located in the Swift Creek drainage about 0.5 miles above the Yellowstone River. A small dam was constructed on the outlet of Water Lily Lake in 1920 by Farmers Irrigation Company. The dam is a homogeneous embankment approximately 9 feet high and has a 24-inch diameter low-level outlet located near the right abutment. It has a surface area of about 15 acres at the existing spillway and held approximately 71 acre-feet of water. The outlet works was removed and a stabilized outlet channel constructed. No formal survey work was performed at Water Lily Lake. Topographical maps indicate the existing spillway elevation is 9,346. The spillway breach inlet is also set to be at elevation 9,346.

Aug. 6-Aug. 12      Activities at Water Lily Lake began on Monday, Aug. 7, 2006. One Utah Conservation Corps (UCC) crew hiked in and set up camp. UCC supplied two crews of four people each to work at the lakes. Crew #1 went to Farmer's Lake, and crew #2 went to Water Lily. Tuesday

morning a small excavator and a small skid-steer loader were air lifted to the dam by helicopter (See Figure 1). Camping supplies for the equipment operator and work crew were flown in at the same time (See Figure 2). The equipment operator from the Bureau of Reclamation (BOR) hiked in and set up his camp. He then moved the equipment over to the dam and started excavating for removal of the outlet pipe. The UCC crew hiked out on Friday and one person hiked in to assist the equipment operator through the weekend.

The spillway over the existing outlet was excavated with the mini-excavator to the dimensions shown on the drawings. The embankment material was over-excavated to account for the thickness of the rock protection layer to be placed at final grade, and the outlet pipe and cutoff collars removed. Bedrock was not encountered during the excavation of the outlet works.

Aug. 13-Aug. 19 Work continued at Water Lily Lake with the arrival of a Student Conservation Association (SCA) crew of three on Tuesday, the 15<sup>th</sup>. Mike Talbot and Rick Sweat from the Bureau of Reclamation, and Teresa Fraser from the Forest Service also hiked in to observe the work for the day. One gabion basket was placed at the upstream end of the excavation and wrapped with an EDPM rubber liner to act as grade control and erosion protection (See Figure 5). Backfilling the bottom and side-slopes with rock was begun with placing an approximate 1-foot thick layer. The back-filling was accomplished by hand with the aid of the skid-steer loader. The armoring of the invert and side slopes provides protection against erosion and will ensure stable and permanent side slopes.

The spillway configuration for this dam was minimized to the greatest extent possible. The spillway bottom width of 5 feet, coupled with 2.5 horizontal to 1 vertical side slopes was selected to eliminate as much earthwork as possible while still maintaining a functional spillway.

The crew and operator worked through Thursday the 17<sup>th</sup>, and then hiked out.

Aug. 20-Aug. 26 Work continued at Water Lily Lake with the arrival of a Student Conservation Association (SCA) crew of four and the BOR operator on Tuesday, the 22<sup>nd</sup>. Lining of the spillway with rock continued. Finishing touches and rehabilitation work was completed and the crew and operator hiked out on Friday. The disturbed areas were reseeded with a Forest Service approved high altitude mix. Matt Lindon from the Sate Dam Safety Office hiked to the lake on Tuesday and gave his approval.



Figure 1. Skid-steer loader being air lifted.



Figure 2. Supplies being air lifted.



Figure 3: Excavation of the spillway.



Figure 4: Excavated channel, looking upstream.



Note rubber liner wrapped around gabion basket

Figure 5. Preparing gabion basket wall.



Figure 6. New spillway, looking downstream.



- Aug. 27-Sept. 2 The BOR operator came back to the lake to service the machine, pack up his camp, and do some additional rehabilitation. Ken Straley hiked in to determine completion and gave his approval.
- Sept. 3-Sept. 9 The work at Water Lily Lake took four weeks to finish and the equipment was flown out via helicopter on Tuesday, Sept. 5, 2006. Mike Talbot and Rick Sweat from the BOR hiked in on Tuesday to take finish photos.

## Farmers Lake

Farmers Lake is located in the Swift Creek Drainage approximately 5.7 miles from the Swift Creek Trailhead. The outlet for Farmers Lake is an approximately 4-foot high by 2-foot wide by 180-foot long tunnel which has been excavated through existing rock. The tunnel was excavated in 1920 by Farmers Irrigation Company. The inlet to the tunnel has collapsed with the rock from the ceiling of the tunnel. The tunnel has two air intakes along the length of the alignment which also allowed access to the tunnel. The upstream air intake is approximately 6.5 feet square and 17 feet deep. The second or downstream air intake is approximately 9 feet long by 5 feet wide and 5 feet deep. The air intakes were partially filled with rubble and earth materials prior to the start of the stabilization project.

The original plan for addressing the inlet was to construct a 5-foot high by 3-foot wide by 8-inch thick reinforced concrete plug. Rock removal around the inlet would have been required to enable construction of the concrete plug in competent rock. It was anticipated that a concrete plug might not be feasible in the outlet tunnel. In the event that it was not possible to install a concrete plug, a contingency plan would be implemented. This is in fact what happened. Instead of a concrete plug, the inlet to the tunnel was instead blocked off with sorted sand/gravel/rock/rubble in a layered fashion. The outlet of the tunnel was also filled with rock/rubble fill to prevent access into the outlet.

- Aug. 6-Aug. 12 Activities at Farmer's Lake began on Monday, Aug. 7, 2006. One Utah Conservation Corps (UCC) crew hiked in and set up camp. UCC supplied two crews of four people each to work at the lakes. Crew #1 went to Farmer's Lake, and crew #2 went to Water Lily Lake. The crew started by locating the three shafts to be filled in. The shafts were found to be partially collapsed already. The crew worked on several other small projects in preparation for other work. The crew hiked out on Thursday afternoon, the 10<sup>th</sup> of August.
- Aug. 13-Aug. 19 Work at Farmer's Lake was discontinued for the week due to lack of personnel.

Aug. 20-Aug. 26 Activity continued at Farmer's Lake on Wednesday, the 23<sup>rd</sup> with the arrival of a field trip of representatives from various agencies on their way to Deer and East Timothy Lakes. It was also discussed that filling in the shafts as the first step would hamper the inlet area work by backing up the water. There was much discussion regarding the apparent difficulty the crews will have in cleaning out the upstream inlet for placement of a concrete plug. There was concern about placing fresh concrete in the hole because of its toxicity to fish. The crew hiked in on Friday the 26<sup>th</sup>. Their supplies and materials had been packed in previously.



Figure 7. Upstream end of outlet tunnel.

Aug. 27-Sept. 2 Work at Farmer's Lake continued on Sunday, Aug. 27<sup>th</sup>. The crew started removing some of the existing water and debris from the inlet area. On Monday morning they reported having removed 1500 gallons of water with no apparent effect on water level in the hole. They were instructed to try and construct a cofferdam upstream from the inlet to prevent water from entering the hole. That afternoon the crew reported having no luck moving the large cobbles and boulders.

There was also a conference call on Monday to discuss the options for filling in the inlet. Participants were the following: Mark Holden (Utah Reclamation Mitigation and Conservation Commission), Matt Lindon (Utah Division of Water Rights – Dam Safety Division), and Don Marchant, Val Mortensen, Tom Watson, Mike Elson, Ken Straley, and Teresa Fraser (U.S. Forest Service). It was decided that due to the problems associated with filling the inlet hole with a concrete plug, the acceptable solution would be to fill the hole with soil and rock, starting with a finer mix of sand and gravel and progressing to larger gravel and cobbles as the area was filled.



Figure 8: Looking down into inlet hole, note debris clogging inlet.

Sept. 3-Sept. 9 No work was done at Farmer's Lake this week because the crew was at White Miller Lake.

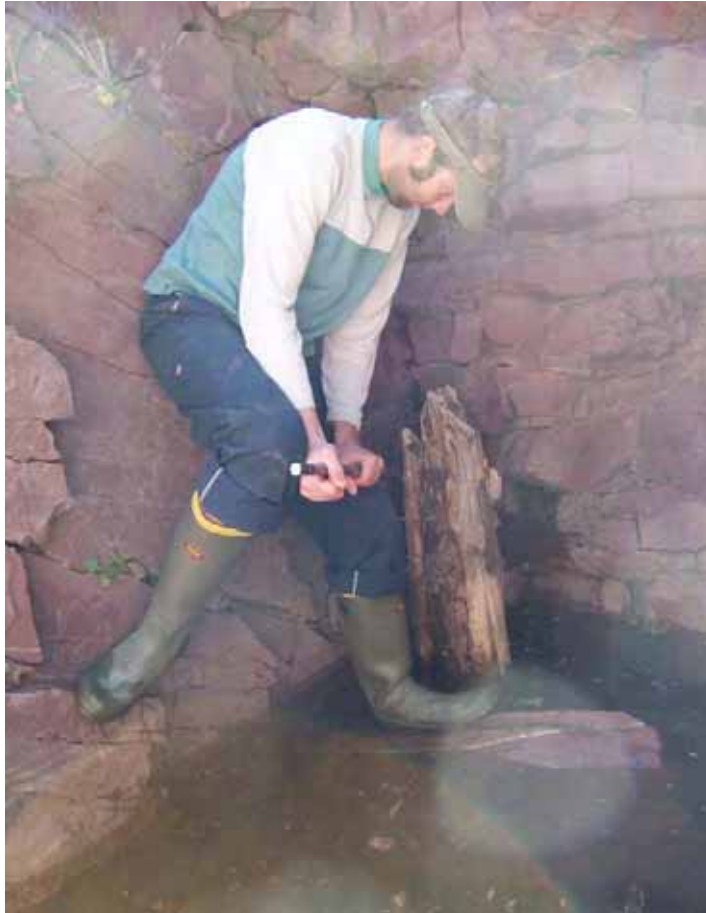


Figure 9: Working to remove debris from inlet area.

Sept. 10-Sept. 16 The SCA crew continued work on Monday Sept. 11. The last of the log debris were cleared from the hole and the process of filling in the hole with sand and gravel began (See Figure 10). Work continued until Thursday, when filling work was finished (See Figure 11).



Figure 10. Crews pushing fill into inlet area.



Figure 11. Finished inlet area.



Figure 12. Finished outlet area

## White Miller Lake

White Miller Lake is located in the Swift Creek Drainage just below Farmers Lake, about 6.7 miles north of the Swift Creek campground. The dam was constructed in about 1926 by Farmers Irrigation Company. The outlet to the lake is a small wooden structure at the south end of the lake. The wooden structure was removed with minimal effects on the water routing through the lake. This allows the dam to be classified as a No-Hazard dam. No other work was required.

Aug. 27-Sept. 2 Activities at White Miller Lake began on Tuesday, Aug. 29, 2006. Justin Kooyman, the coordinator of the SCA crews, hiked into the lake in the afternoon. The crews reported that they had removed one log from the channel bottom, but were having trouble because of a sill the logs were resting under. Substantial progress was made on Wednesday. The crew worked to lay the banks back at a 2:1 slope. Crews hiked out on Thursday.

Sept. 3-Sept. 9 Crews continued removing logs from the outlet channel. They also continued laying back the bank to insure unobstructed flow.



Figure 13. Pre-work outlet channel.



Figure 14: Removing logs from channel bank.



Figure 15. 2:1 slope on bank.

Sept. 10-Sept. 16 Crews continued removing logs from the outlet channel. They finished the rehabilitation work and seeded the disturbed areas.



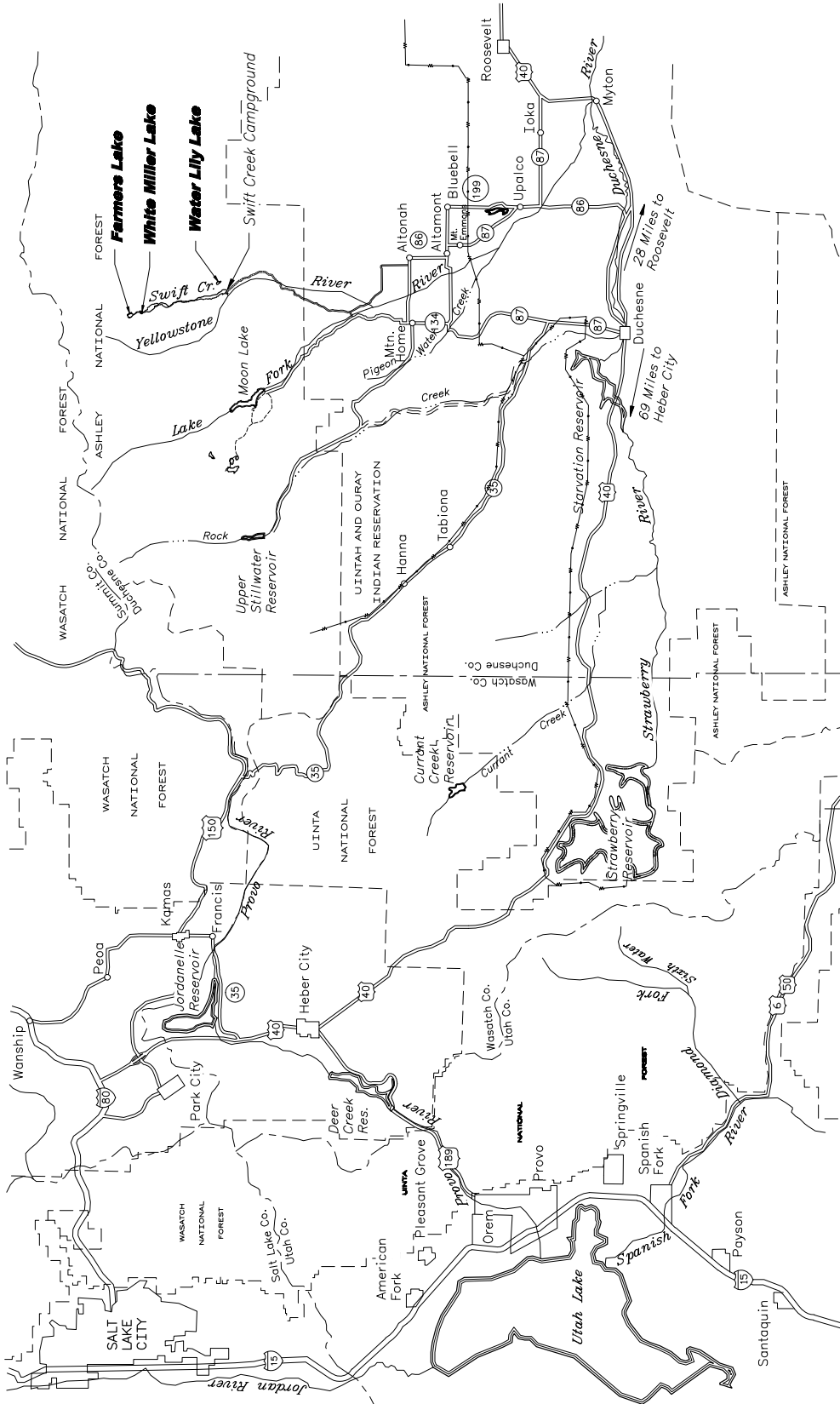
Figure 16. Removing logs from channel, sloped bank in background.





Figure 17: Finished channel.

## **Appendix A – Design Drawings**



ALWAYS THINK SAFETY

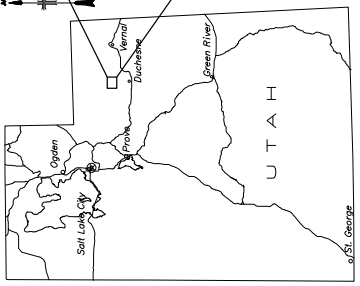
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
PROJECT USER OFFICE  
PROVO, UTAH

LOCATIONS MAP  
SWIFT CREEK DRAINAGE LAKES

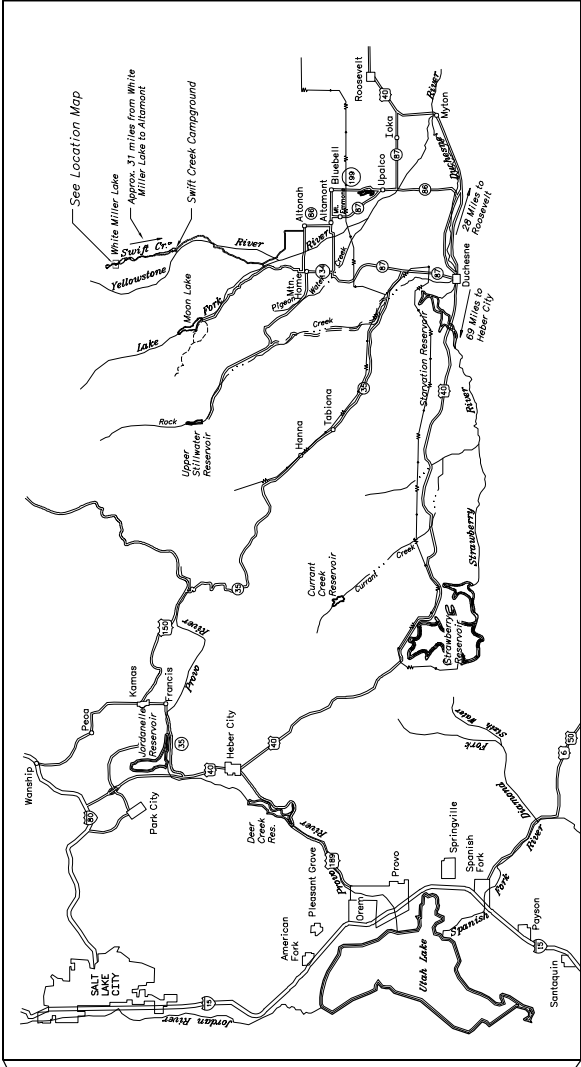
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DRAWN: \_\_\_\_\_  
CHECKED: TECH. APPR. \_\_\_\_\_  
APPROVED: \_\_\_\_\_  
DATE: 2008-05-23  
PROJECT: 00000000

DWG. NO.

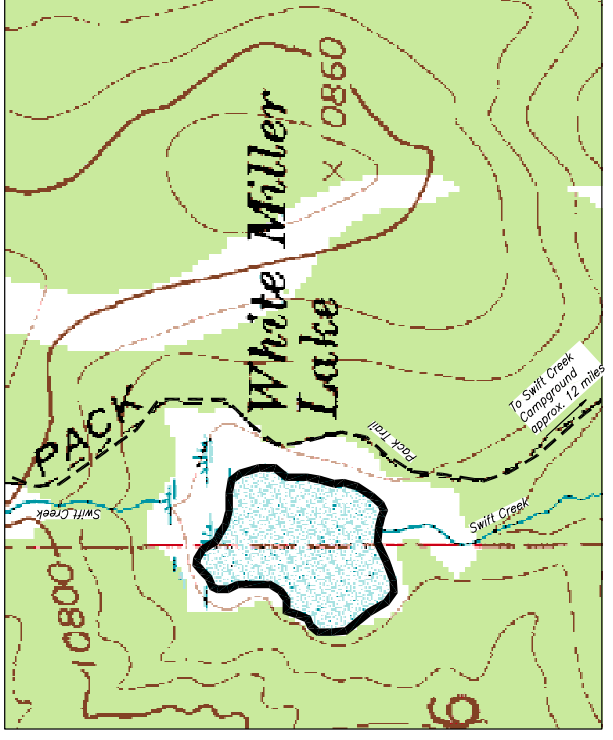
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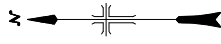
KEY MAP



LOCATION MAP  
NOT TO SCALE



VICINITY MAP



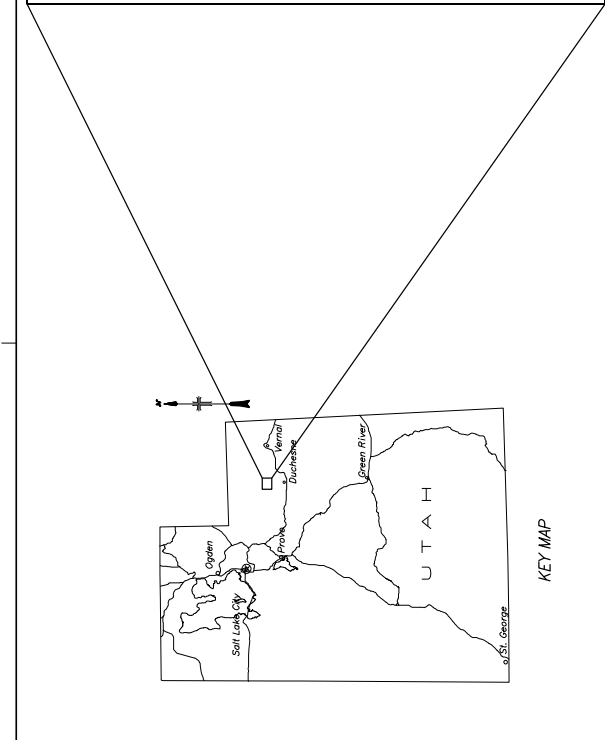
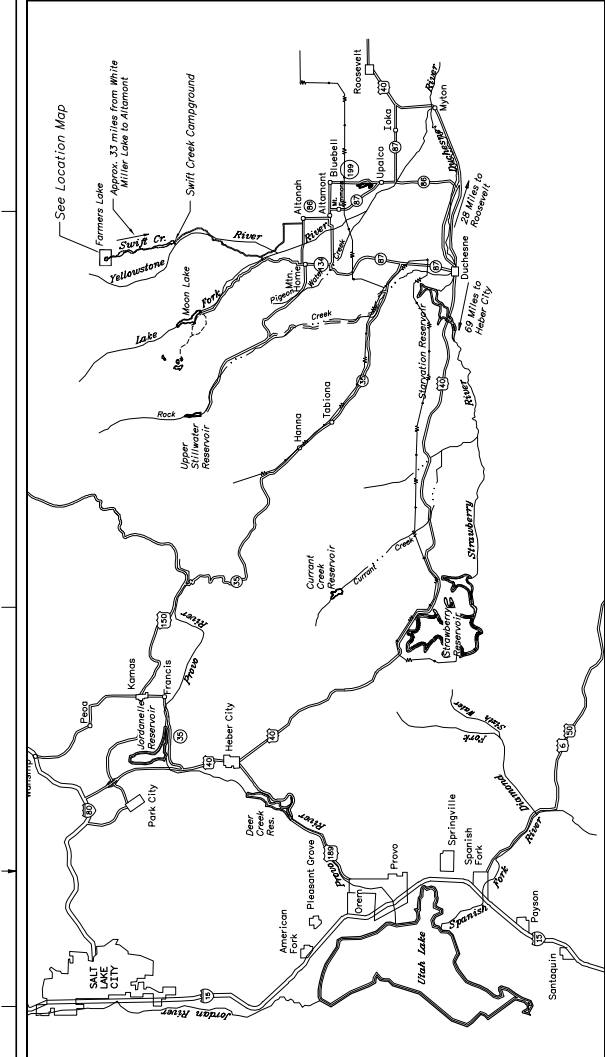
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UNITED STATES  
DEPARTMENT OF TRANSPORTATION  
FEDERAL BUREAU OF SURVEILLATION  
PHOTO AREA OFFICE  
PROVO, UTAH

**WHITE MILLER LAKE DAM STABILIZATION**  
VICINITY AND LOCATION MAP

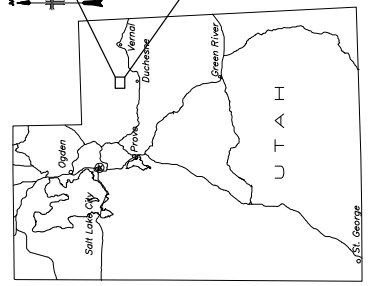
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DRAWN	TEST APPR.	
APPROVED	DATE	
PROJECT NUMBER: 28864-02-25		
DWG. NO.		

XXX



VICINITY MAP  
SCALE OF MILES

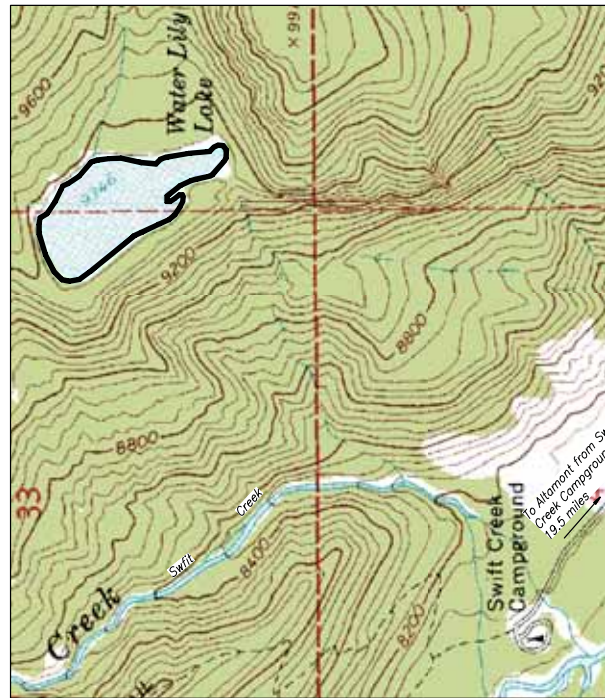
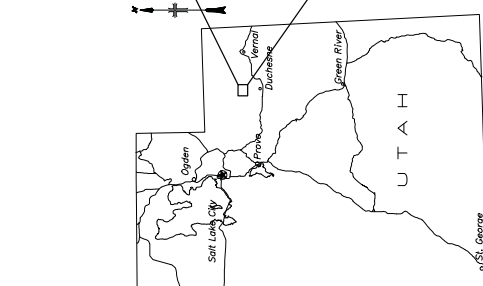
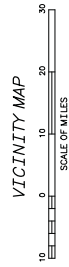
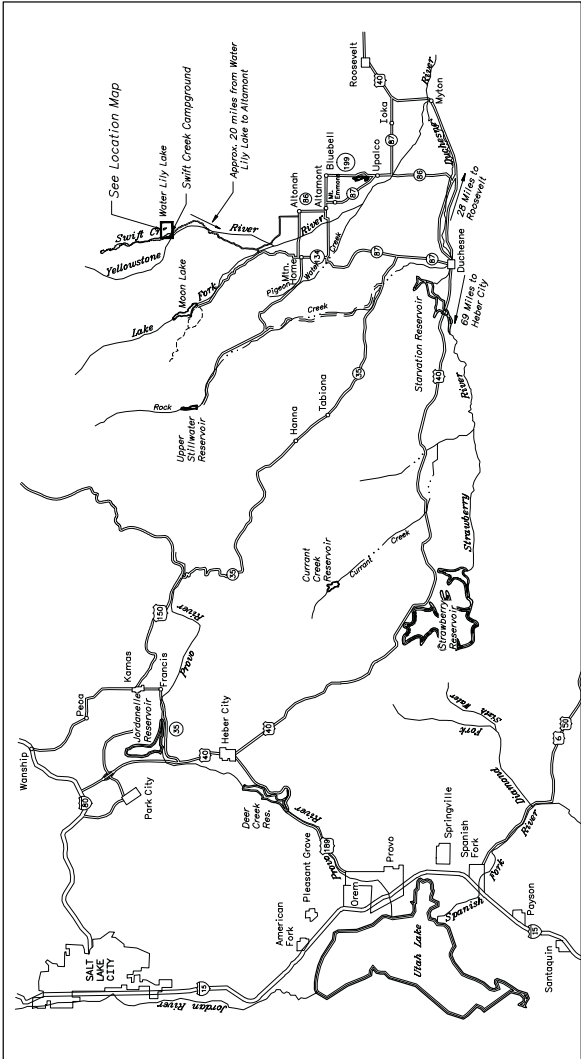
LOCATION MAP  
NOT TO SCALE



KEY MAP

ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF TRANSPORTATION FEDERAL BUREAU OF SURVEYING PHOTO AREA OFFICE PROVO, UTAH	
DESIGNED: _____ DRAWN: _____ CHECKED: _____ APPROVED: _____ PHOTO AREA OFFICE PROVO, UTAH	DWG. NO.

DATE: 12/20/00  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]



LOCATION MAP  
NOT TO SCALE

**ALWAYS THINK SAFETY**

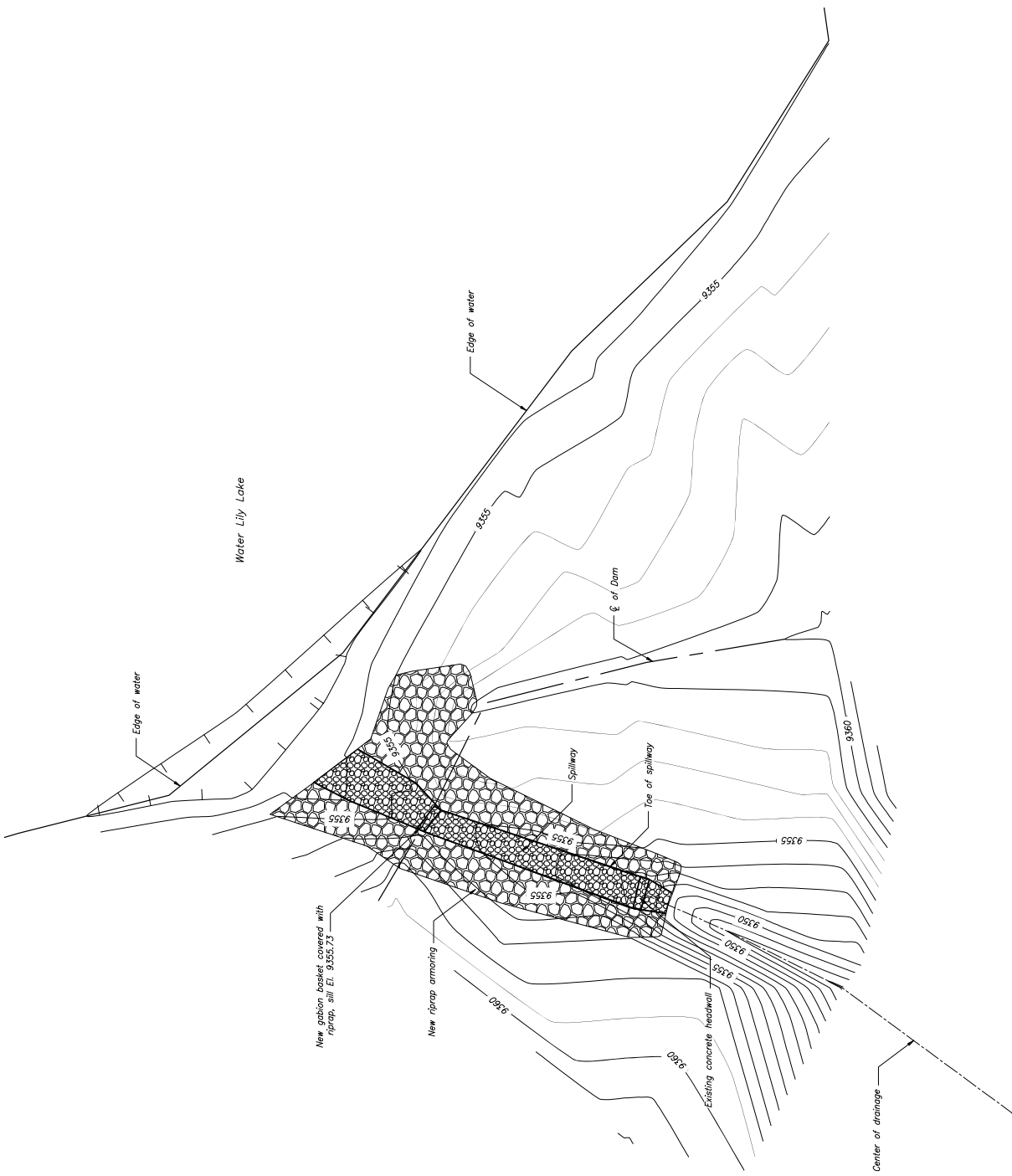
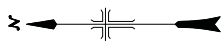
UNITED STATES  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF TRANSPORTATION  
PROVID AREA OFFICE  
PROVO, UTAH

**WATER LILY LAKE DAM STABILIZATION**  
VICINITY AND LOCATION MAP

DESIGNED BY: /S/ DANIEL LOTT  
CHECKED BY: /S/ CAROL SPURTHORN  
DRAWN BY: /S/ DANIEL LOTT  
TECH. APPR. BY: /S/ BILLY SCOTT, P.E.  
APPROVED BY: /S/ CLIVE THOMAS, P.E.  
DATE: 11/15/2018  
PROJECT NUMBER: 2018-20-018

PROVO, UTAH

OA58-418-64



**NOTES**

1. Contour interval is 1 foot
2. Contour interval is 1 foot in September 2006.
3. Grid Factor = 0.9995425
4. Survey datum = MAD27/NGVD29

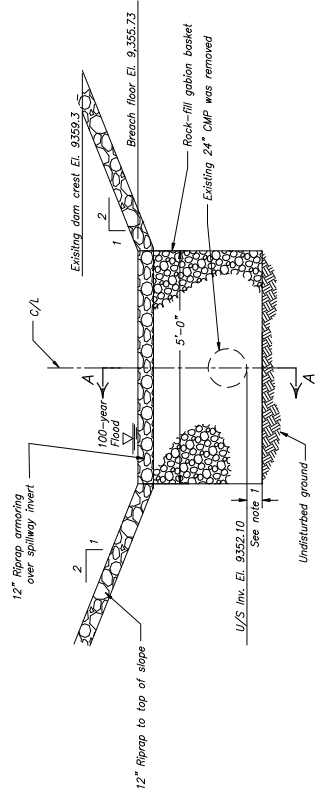
**ALWAYS THINK SAFETY**

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION

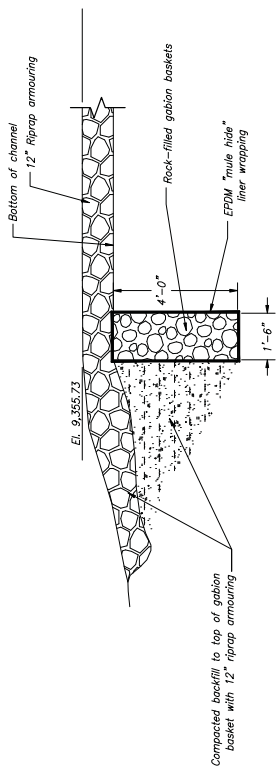
FRONT AREA OFFICE  
PROJECT UNIT

**SWIFT CREEK BASIN**  
WATER LILY SPILLWAY MODIFICATION  
CONTRACT RECORD PLAN

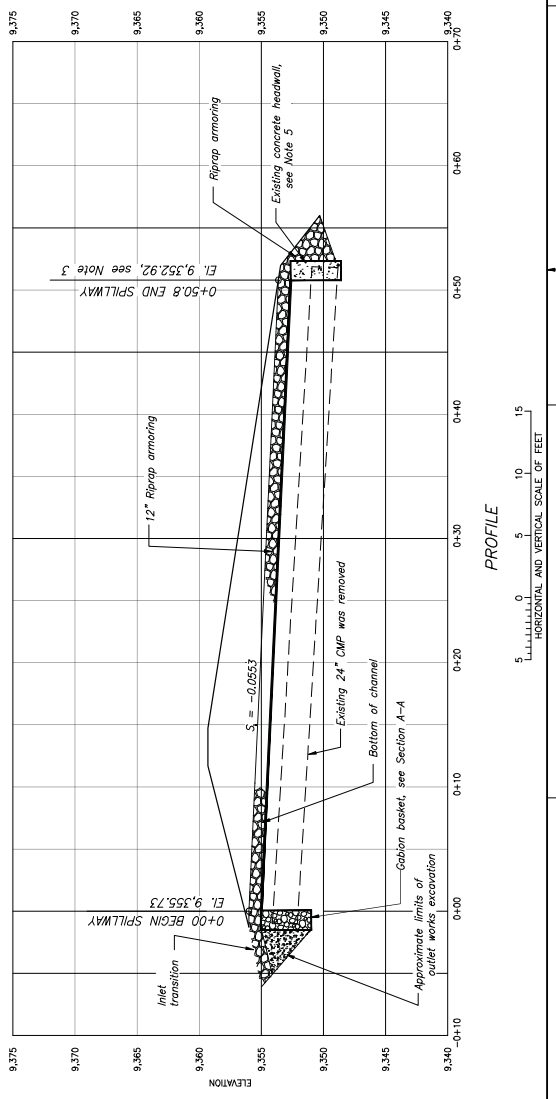
DESIGNED - J/S/MIKE THURSTON - CHECKED - J/S/BOBIE WINTERKORN, P.E.  
DRAWN - J/S/DAVID LOTT - TECH. APPR. - J/S/DAVID SCOTT/STEPHEN LEE  
APPROVED - CLAUDE THOMAS, P.E.  
PROJECT NO. 2007-09-29  
DRAWING NO. 0A58-418-83



SPILLWAY CHANNEL ELEVATION AT STA. 0+00  
Not to scale



SECTION A-A  
GABION BASKET WALL  
NOT TO SCALE



- NOTES**
1. Excavated a minimum of 12 inches beyond edge of existing outlet works on bottom and sides for gabion placement.
  2. The original (natural) lake elevation is at \_\_\_\_\_.
  3. Laylight spillway invert to match existing ground.
  4. Provide riprap armoring from end of spillway to existing ground to prevent headcutting and erosion.
  5. Dam crest elevation obtained from Utah State data as a downstream grade control.

**ALWAYS THINK SAFETY**

UNITED STATES  
DEPARTMENT OF AGRICULTURE  
BUREAU OF RECLAMATION  
PROJECT NO. 104  
PROCESS 104

**SWIFT CREEK BASIN**  
WATER LIFT SPILLWAY MODIFICATION  
PROFILE, ELEVATION, AND SECTION A-A

DESIGNED BY: W. W. TAYLOR  
DRAWN BY: S. J. DAVINE, L.P.  
CHECKED BY: S. J. DAVINE, L.P.  
APPROVED BY: S. J. DAVINE, L.P.  
2008-03-28

PROJECT NO. OA58-418-82



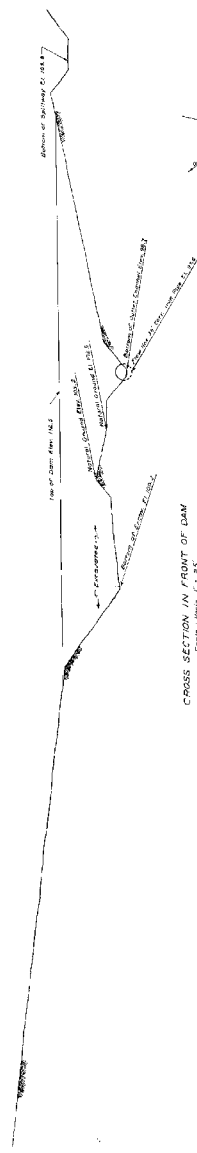
## **Appendix B – Historical Drawings**

BROWN DUCK & LILY PAD LAKES  
RES. SITES

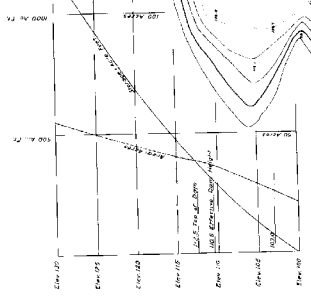
SURVEYED BY U S INDIAN SERVICE

STATE OF UTAH  
OFFICE STATE ENGINEER

9 - 2



CROSS SECTION IN FRONT OF DAM  
Scale: 1" = 10'

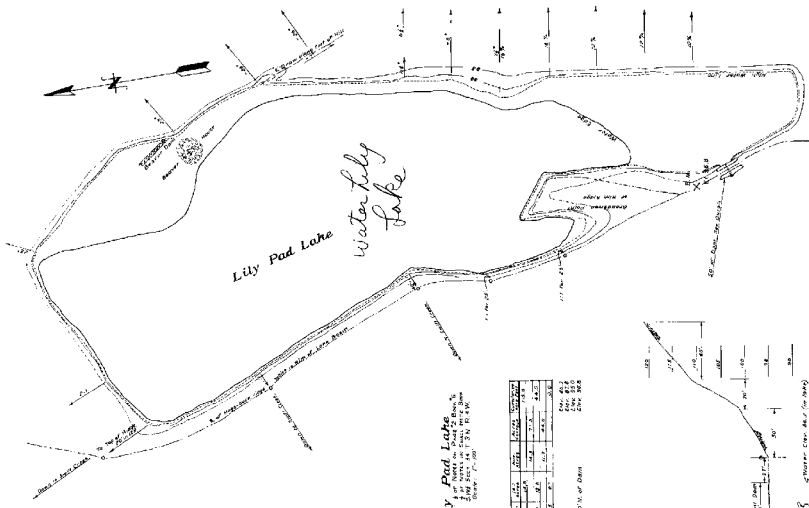


STORAGE & AREA CURVES

**Brown Duck Lake**  
LOCATION: 10 miles N. of Hatch, Blaine Co., N.M.  
SURVEYED BY: U.S. INDIAN SERVICE

CONTINGENT	AREA	PERCENT	AREA	PERCENT	AREA	PERCENT
10.0	3,327	57.3	2,171	36.3	1,385	23.4
11.0	2,756	47.1	1,787	30.1	1,100	18.8
12.0	2,411	41.5	1,583	26.8	980	16.7
13.0	2,115	36.1	1,385	23.4	835	14.3
14.0	1,875	32.0	1,200	20.3	720	12.3
15.0	1,678	28.8	1,050	17.8	630	10.7
16.0	1,500	25.7	920	15.5	550	9.3

Volume of Water Behind Dam at Above Date: 1,000  
 Area of Dam: 1,000  
 Area of Dam at Base of Dam: 1,000  
 Area of Dam at Top of Dam: 1,000  
 Area of Dam at Middle of Dam: 1,000  
 Area of Dam at Bottom of Dam: 1,000  
 Area of Dam at Surface of Dam: 1,000  
 Area of Dam at Inside of Dam: 1,000  
 Area of Dam at Outside of Dam: 1,000  
 Area of Dam at Front of Dam: 1,000  
 Area of Dam at Back of Dam: 1,000  
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 Area of Dam at Right of Dam: 1,000  
 Area of Dam at North of Dam: 1,000  
 Area of Dam at South of Dam: 1,000  
 Area of Dam at East of Dam: 1,000  
 Area of Dam at West of Dam: 1,000  
 Area of Dam at Center of Dam: 1,000  
 Area of Dam at Periphery of Dam: 1,000  
 Area of Dam at Core of Dam: 1,000  
 Area of Dam at Shell of Dam: 1,000  
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 Area of Dam at Rim of Dam: 1,000  
 Area of Dam at Hoop of Dam: 1,000  
 Area of Dam at Hub of Dam: 1,000  
 Area of Dam at Spoke of Dam: 1,000  
 Area of Dam at Nave of Dam: 1,000  
 Area of Dam at Felloe of Dam: 1,000  
 Area of Dam at Tread of Dam: 1,000  
 Area of Dam at Flange of Dam: 1,000  
 Area of Dam at Gudgeon of Dam: 1,000  
 Area of Dam at Pin of Dam: 1,000  
 Area of Dam at Bolt of Dam: 1,000  
 Area of Dam at Nut of Dam: 1,000  
 Area of Dam at Washer of Dam: 1,000  
 Area of Dam at Cotter Pin of Dam: 1,000  
 Area of Dam at Lock Washer of Dam: 1,000  
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 Area of Dam at Conical Lock Washer of Dam: 1,000  
 Area of Dam at Flat Lock Washer of Dam: 1,000  
 Area of Dam at Round Lock Washer of Dam: 1,000  
 Area of Dam at Square Lock Washer of Dam: 1,000  
 Area of Dam at Hexagonal Lock Washer of Dam: 1,000  
 Area of Dam at Octagonal Lock Washer of Dam: 1,000  
 Area of Dam at Elliptical Lock Washer of Dam: 1,000  
 Area of Dam at Triangular Lock Washer of Dam: 1,000  
 Area of Dam at Trapezoidal Lock Washer of Dam: 1,000  
 Area of Dam at Circular Lock Washer of Dam: 1,000  
 Area of Dam at Rectangular Lock Washer of Dam: 1,000  
 Area of Dam at Square Lock Washer of Dam: 1,000  
 Area of Dam at Hexagonal Lock Washer of Dam: 1,000  
 Area of Dam at Octagonal Lock Washer of Dam: 1,000  
 Area of Dam at Elliptical Lock Washer of Dam: 1,000  
 Area of Dam at Triangular Lock Washer of Dam: 1,000  
 Area of Dam at Trapezoidal Lock Washer of Dam: 1,000  
 Area of Dam at Circular Lock Washer of Dam: 1,000  
 Area of Dam at Rectangular Lock Washer of Dam: 1,000



**Lily Pad Lake**  
LOCATION: 10 miles N. of Hatch, Blaine Co., N.M.  
SURVEYED BY: U.S. INDIAN SERVICE

CONTINGENT	AREA	PERCENT	AREA	PERCENT	AREA	PERCENT
10.0	3,327	57.3	2,171	36.3	1,385	23.4
11.0	2,756	47.1	1,787	30.1	1,100	18.8
12.0	2,411	41.5	1,583	26.8	980	16.7
13.0	2,115	36.1	1,385	23.4	835	14.3
14.0	1,875	32.0	1,200	20.3	720	12.3
15.0	1,678	28.8	1,050	17.8	630	10.7
16.0	1,500	25.7	920	15.5	550	9.3

PROFILE OF DAM DETAILS

CONTINGENT INTERVAL: 1.5 FT  
 SCALE: 1" = 10'

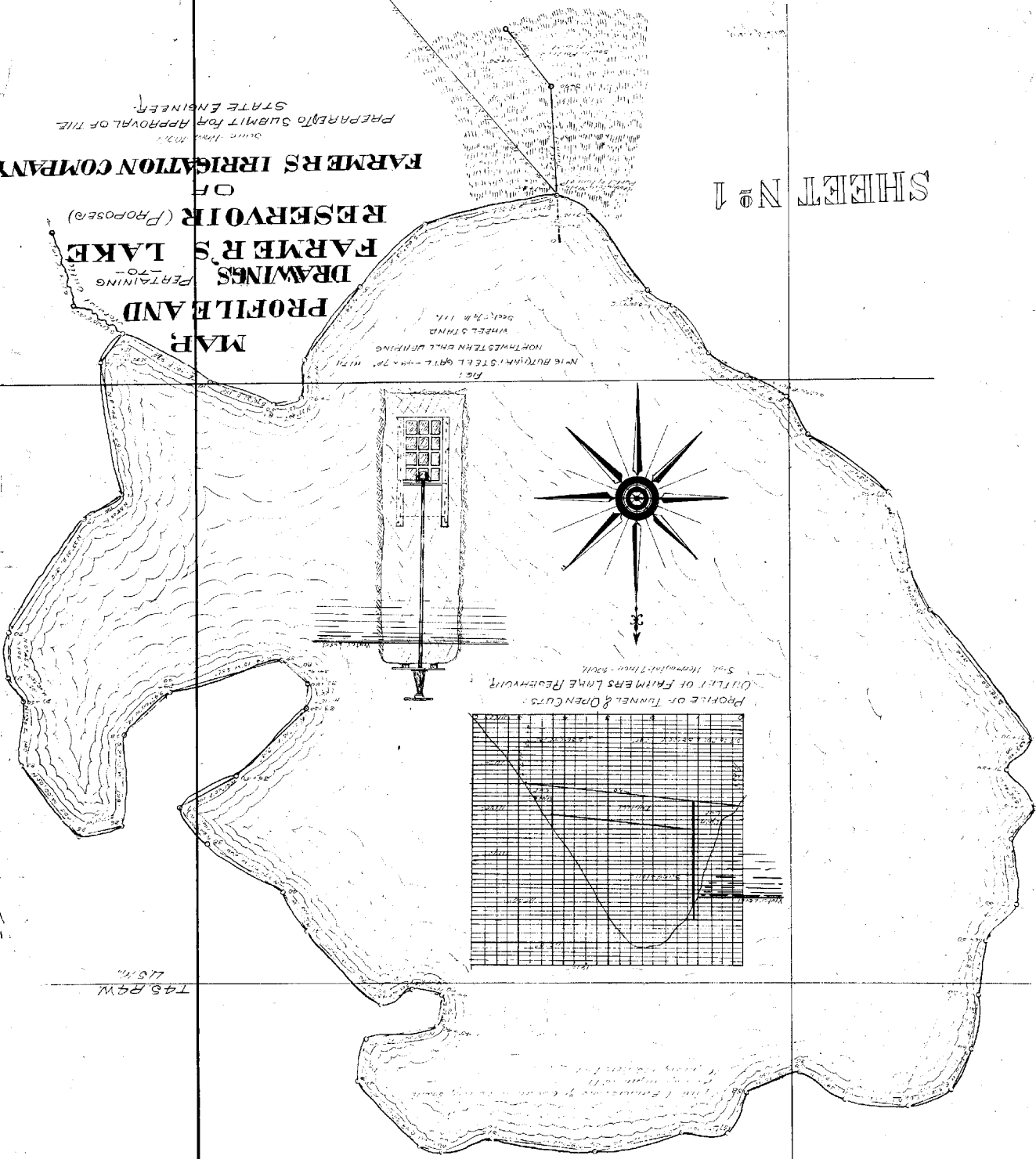
*Brown Duck Lake and Lily Pad Lake*  
 U.S. INDIAN SERVICE  
 1911



SHEET No 1

MAP  
PROFILE AND  
DRAWINGS  
FARMER'S LAKE  
RESERVOIR (Proposed)  
FARMERS IRRIGATION COMPANY

PREPARED TO SUBMIT FOR APPROVAL OF THE  
STATE ENGINEER



PROFILE OF TUNNEL & OPEN CUTS  
OUTLET OF FARMER'S LAKE RESERVOIR

Fig. 1  
N-16 BUTTRESS STEEL GATE - 44' x 72' WITH  
NORTHWESTERN CHILL DESIGN  
WHEEL STAND  
SECT. 2/16 111.

T-9 R-9 W  
4.5 m.