

SHALDA CREEK BEAVER DAM STUDY



5/13/2015

Little Traverse Lake Property Owners
Association

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Shalda Creek Beaver Dam Study

LITTLE TRAVERSE LAKE PROPERTY OWNERS ASSOCIATION

PURPOSE

The purpose of this study is to determine how the Shalda Creek system responds to modifications to beaver dam restrictions present in the system. Observations will be made to the water levels at various locations in the system and lake levels will be observed and compared to reported levels where property damage has been reported.

INVESTIGATION

The study began with an inventory of the existing beaver dam restrictions in the Shalda Creek system. Four beaver dams were identified by Little Traverse Lake residents. Photos of the dams along and GPS coordinates of their locations are appended at the end of this report. After the inventory, gauges were installed upstream of dam #4, downstream of dam #2, and upstream of dam #2. Gauges had previously been installed by the Road Commission at the upstream and downstream ends of the culverts at County Road 669 (CR 669) and Traverse Lake Road (TL Rd). All gauges were surveyed and correlated to the NAVD 88 vertical elevation datum. Reported elevations in this report are given in that datum. Flow measurements at the culverts were also done at the beginning of the investigation. Those measurements along with measurements made in May of 2014 are shown in the Observations section.

Modifications to the dams were made starting at dam #1 on 9/19/2014. Modifications to dam #2 were completed on 9/26/2014. Modifications to dam #4 were done on 10/9/2014. Dam #3 was relatively minor in comparison to the other dams and modifications to it were completed with dam #2. Dam locations were monitored throughout the study period and modifications were maintained as needed.

All of the recorded data and graphs of the data are appended to this report.

OBSERVATIONS

September 17, 2014 through May 7, 2015

1. Measured Flows

Summary of Flow Calculations (from measured velocity)

| CULVERT LOCATION | SIZE | AREA (SFT) | 5/7/14 FLOW (CFS) | | 9/17/14 FLOW (CFS) | | 9/24/14 FLOW (CFS) | |
|-----------------------|------------|------------|-------------------|-------|--------------------|------|--------------------|------|
| | | | U/S | D/S | U/S | D/S | U/S | D/S |
| W. Traverse Lake Road | 64x43 Arch | 15.08 | 72.8 | 96.4 | 45.4 | 54.7 | 53.5 | 73.6 |
| CR 669 | 71x47 Arch | 18.18 | 60.0 | 118.2 | 56.4 | 53.6 | 62.7 | 90.9 |
| Lake Michigan Road | 64x43 Arch | 15.08 | 60.7 | 55.4 | 32.2 | 35.8 | 33.5 | 49.7 |
| | 42" Dia | 9.62 | 28.9 | 31.6 | 9.7 | 11.6 | 13.5 | 18.9 |

2. LT Lake levels

- a. At start of study (9/4/2014): 595.35
- b. Highest recorded (10/18/2014): 596.16
 - i. Reported structure flooding elev: 595.65
- c. Lowest recorded (5/6/2015): 595.06
- d. Current (5/6/2015): 595.06

| | |
|---------------------------|-----------------------------------|
| 3. Rainfall Observations: | <u>Measured</u> (<u>Normal</u>) |
| a. September 2014 | 2.3 in. (3.91 in.) |
| b. October 2014 | 9.04 in. (3.80 in.) |
| c. November 2014 | 5.15 in. (3.26 in.) |
| d. December 2014 | 1.57 in. (3.02 in.) |
| e. January 2015 | 2.02 in. (2.43 in.) |
| f. February 2015 | 1.37 in. (1.70 in.) |
| g. March 2015 | .99 in. (1.84 in.) |
| h. April 2015 | 1.76 in. (2.81 in.) |
| i. May 2015 (thru 5/7) | .05 in. (2.67 in.) |

-Rainfall reported thru 11/16/2014 is measured at 3970 S. Manitou Trail. After 11/16/14 rainfall as reported by NOAA Online Weather Data for Maple City, MI. "Normal" also per NOAA data. Snowfall not included. (<http://www.weather.gov/climate/xmacis.php?wfo=apx>)

4. Significant water level observation prior to beaver dam modifications:
 - a. Initial dam #4 reading of 589.62 was on 9/17/2014. Rain of 6.35 inches was recorded from 9/17/2014 until 10/7/2014 when dam #4 reading was 590.09 (.47" increase)
 - b. Change in downstream gage reading at dam #2 during the same period was 592.6 to 592.92 (0.32' increase)
 - c. Change in US Traverse Lake Rd. culvert reading during same period was 595.52 to 595.85 (0.33' increase)

5. With dams #1 and #2 removed/maintained and prior to #4 modifications, rainfall events translate relatively even from dam #2 gauge to LT Lake
 - a. Rainfall on from 10/2 and 10/3 of 3.1 inches:
 - i. 0.30' increase @ dam #2
 - ii. 0.23' increase @ DS CR 669
 - iii. 0.30' increase @ US CR 669
 - iv. 0.24' increase @ DS Traverse Lake Rd
 - v. 0.28' increase @ US Traverse Lake Rd

6. Dam # 4 modified on 10/9/2014. Initial drop of .46' measured on 10/11/2014. Dam #2 dropped .32' when measured on 10/13/2014 after dam #4 modifications.

7. 3.41 inches of rain from 10/13/2014 through 10/15/2014 caused dam #4 gauge reading to increase .16'. Over the same period, increases at the following gauges were observed:
 - a. Dam #2: .65'
 - b. DS CR 669: .26'
 - c. US CR 669: .39'
 - d. DS Traverse Lake Rd.: .30'
 - e. US Traverse Lake Rd.: .36'

8. Water level from US 669 to DS LT Culvert appear to move together and match change at dam #2:
 - a. Difference on 10/1/14 0.78'
 - b. Difference on 10/6/14 after rain (1.35", 1.75", .95") 0.71'
 - c. Difference on 10/15/14 after more rain (.15, .2, 1.26, 2.15) 0.64'

9. After heavy rain events on 10/15/2014 and with dam #4 modifications, the gauge reading at dam #4 dropped 1' over as measured on 10/21/2014 while the reading at dam #2 only dropped .05' over the same period. From 10/21/2014 through 10/30/2014, dam #4 dropped another .2' while dam #2 also dropped .2'
10. Following the heavy rains of October, the differences in water level between inlets and outlets of each culvert are greatest. As the fall and winter progress, the differences retreat through mid march and tick back up slightly as the snow melt ensues.

| | <u>9/18</u> | <u>10/5</u> | <u>10/20</u> | <u>11/1</u> | <u>12/3</u> | <u>1/1</u> | <u>2/11</u> | <u>3/13</u> | <u>4/15</u> |
|--------|-------------|-------------|--------------|-------------|-------------|------------|-------------|-------------|-------------|
| CR 669 | .18' | .26' | .38' | .24' | .23' | .19' | .11' | .12' | .18' |
| TL Rd | .20' | .26' | .37' | .25' | .25' | .20' | .18' | .16' | .21' |

11. The general long term trends reflect that the water level readings upstream of dam #4 at dam #2 follow the readings at dam #4, but not to the same degree. Gauge readings upstream of dam #2 more closely follow the change in readings at the dam #2 gauge. Readings at gauges from several dates are shown below with the corresponding difference from the previous reading in (parenthesis). Elevations noted with an asterisk (*) are interpolated.

| | <u>Dam #4</u> | <u>Dam #2</u> | <u>U/S CR 669</u> | <u>U/S TL Rd.</u> |
|-------|----------------|---------------|-------------------|-------------------|
| 10/30 | 588.59 | 593.0 | 594.75 | 595.76 |
| 11/28 | 588.64 (.05) | 593.10 (.10) | 594.76 (.01) | 595.80 (.04) |
| 12/21 | 588.40* (-.24) | 592.85 (-.25) | 594.48 (-.28) | 595.50 (-.30) |
| 3/23 | 587.50 (-.9) | 592.59*(-.26) | 594.18 (-.30) | 595.17 (-.33) |
| 4/20 | 587.54 (.04) | 592.58 (-.01) | 594.28 (.10) | 595.20 (.03) |
| 5/7 | 587.09 (-.45) | - | 594.18 (-.10) | 595.06 (-.14) |

CONCLUSIONS

The water level in Little Traverse Lake is influenced both by beaver dams in Shalda Creek and culvert restrictions at Traverse Lake Road and CR 669.

High flow events during the study period were documented to increase the lake level 6" to 8" above "naturally occurring" creek levels due to the existing culverts.

Modifications and maintenance of beaver dams #1 and #2 were found to lower the creek levels by 6" and lower the lake level by 6" during period of "normal" flow. Changes at dam #2 were found to have a direct correlation to lake level.

Changes at dam #4 did not yield a direct correlated change in the lake level. However, water surface changes at dam #4 were reflected up to dam #2, but not at a one to one correlation. In fact, an 18" change at dam #4 only yielded a 6" change at dam #2.

The modification of dam #1 and #2 has attenuated flood conditions in the spring of 2015. Had the modifications to dam #2 not occurred, lake levels would be 6" higher, or elevation 595.7, the elevation at which crawl space flooding occurred last fall.

APPENDIX

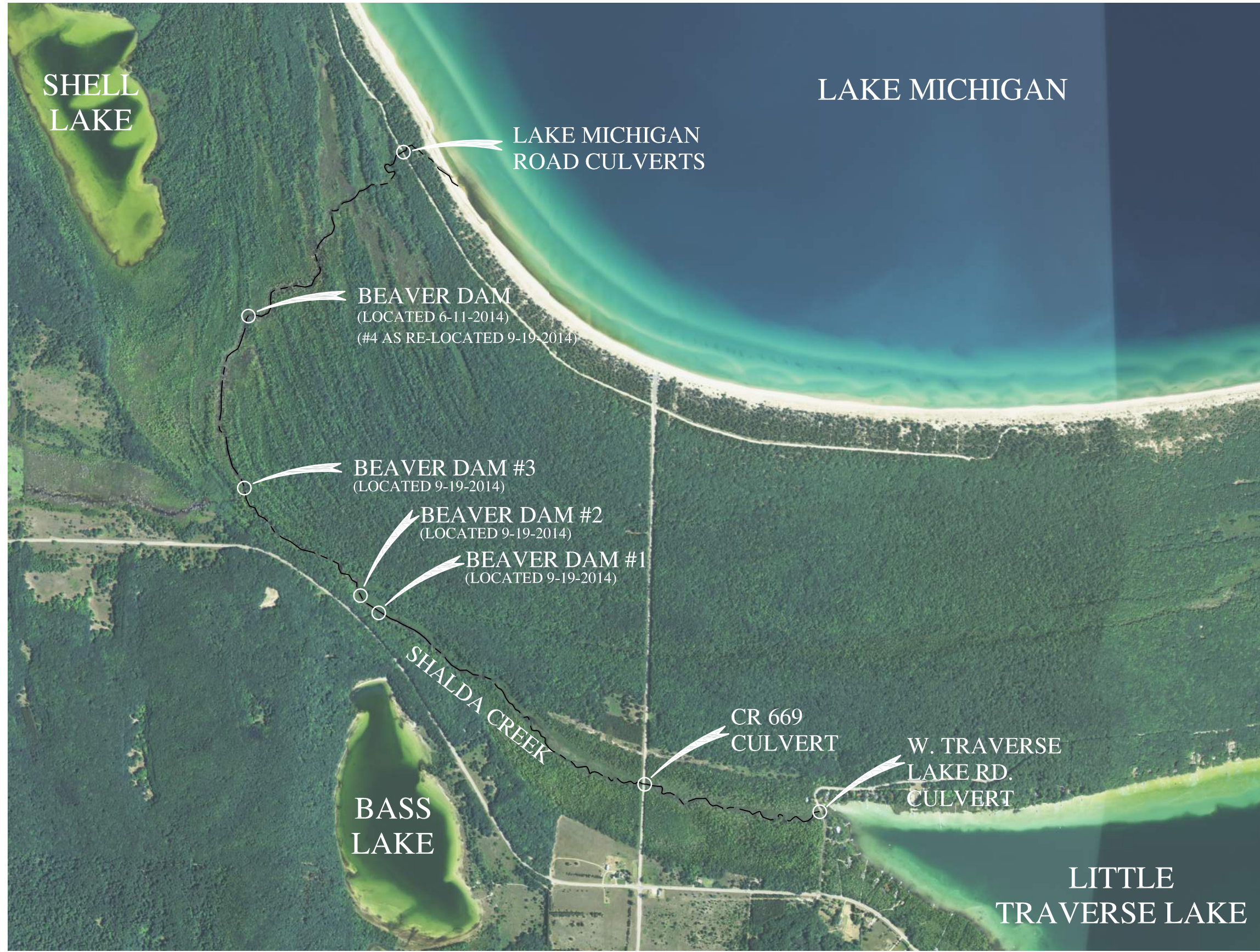
CONTENTS

OVERALL STUDY AREA MAP

DAM PHOTOS AND LOCATION COORDINATES

STUDY DATA & GRAPHS

P:\2014462.01\CADD-Data\201446201 Water Level Survey.dwg Tab: PLAN Saved by: rmverschaeve 10/14/2014 10:46 AM Plotted by: Bob Verschaeve 4/20/2015 5:18 PM



OVERALL STUDY AREA
SCALE: 1"=1/4 MILE (1320 FT)

Location: SECTIONS 9 AND 10
T29N, R13W
CLEVELAND TOWNSHIP
LEELANAU COUNTY, MICHIGAN
Sheet 1

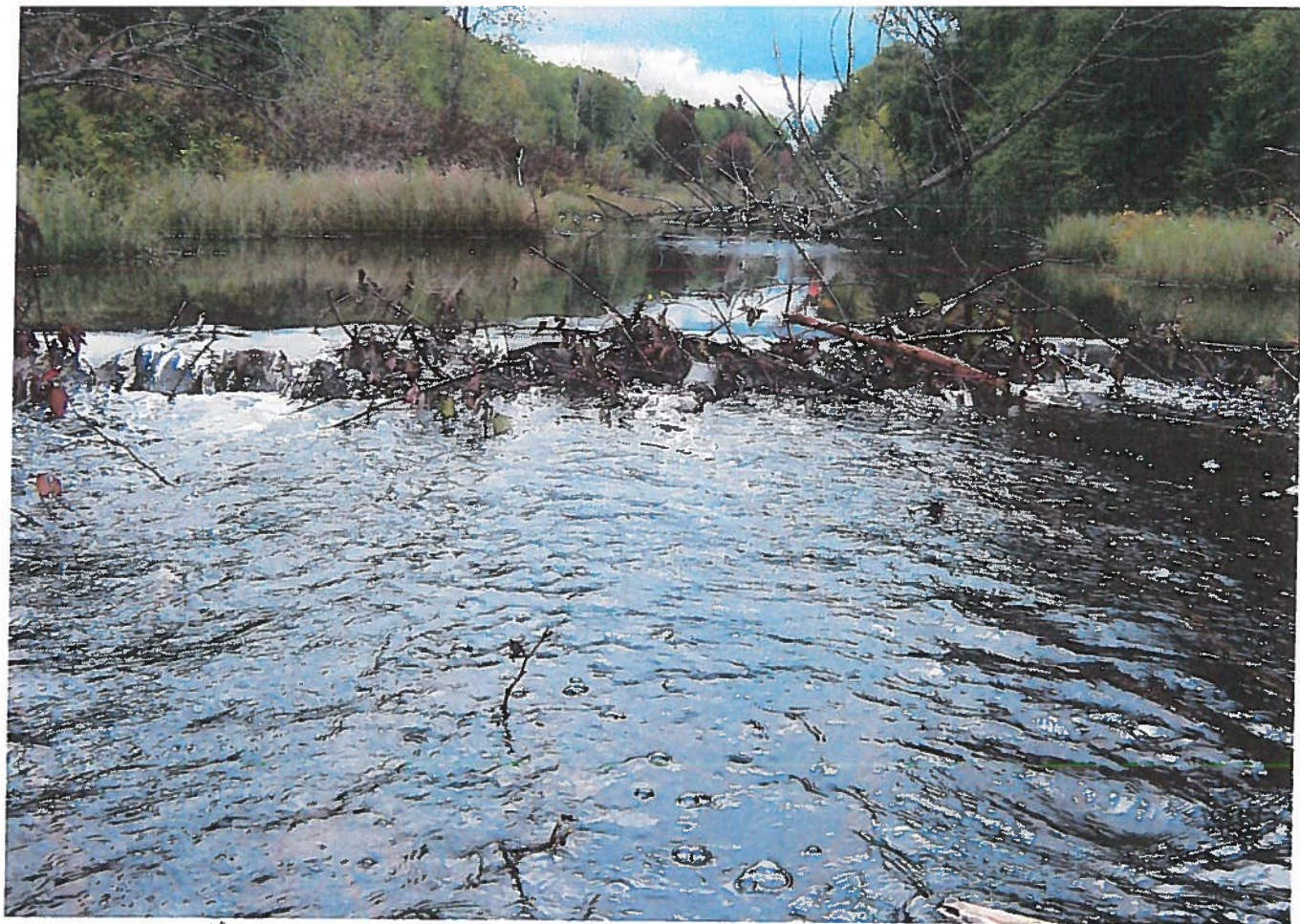
OVERALL STUDY AREA
LITTLE TRAVERSE LAKE P.O.A.
CULVERT STUDY

Job #: 2014462.01
Date: 06-03-2014
Scale: AS NOTED
Drawn: R/W/
Chk'd: DAC
Rev: 09-20-2014



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- Surveyors
- Environmental Services
- Landscape Architecture



" DAM #1 ~ 6"-8" DROP IN WATER ELEVATION

$44^{\circ} 55.87' N$ $44.93167 = 44^{\circ} 55' 52.2''$
 $085^{\circ} 53.151' W$ $85.88585 = 85^{\circ} 53' 09.06''$

N 4330 FT DOWNSTREAM OF CR 669



" DAM #3 " ~ 2" DROP IN WATER ELEVATION

44° 56.124 N 44.9354 : 44° 56' 07.4"
085° 53.538 W 85.8923 85° 53' 32.3"

N 2150 FT DOWNSTREAM OF # 2



11
DAM # 4 ~ 40" DROP IN WATER ELEVATION
44° 56.463 N 44.94105 = 44° 56' 27.8"
085° 53.543 W 85.89238 = 85° 53' 32.6"

THIS IS THE "LARGE" DAM KNOWN TO
EXIST. THIS ONE IS ~ 2300 FT DOWNSTREAM
OF #3

| | | NAVD88 DATUM | | | | | | | | |
|------|------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | Dam #2 | | Dam #4 | | RAIN |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2014 | 9/1 | - | - | - | - | | | | | |
| | 9/2 | - | - | - | - | | | | | |
| | 9/3 | - | - | - | - | | | | | |
| | 9/4 | 595.35 | 595.16 | - | - | | | | | |
| | 9/5 | 595.60 | 595.50 | 594.85 | 594.65 | | | | | |
| | 9/6 | 595.50 | 595.45 | 594.60 | 594.40 | | | | | |
| | 9/7 | 595.60 | 595.50 | 594.60 | 594.40 | | | | | |
| | 9/8 | 595.60 | 595.45 | 594.55 | 594.45 | | | | | |
| | 9/9 | 595.70 | 595.50 | 594.55 | 594.45 | | | | | |
| | 9/10 | 595.70 | 595.50 | 594.69 | 594.50 | | | | | |
| | 9/11 | 595.70 | 595.50 | - | - | | | | | |
| | 9/12 | 595.50 | 595.45 | - | - | | | | | |
| | 9/13 | 595.65 | 595.45 | 594.50 | 594.45 | | | | | |
| | 9/14 | 595.65 | 595.46 | 594.60 | 594.44 | | | | | |
| | 9/15 | 595.61 | 595.44 | 594.58 | 594.42 | | | | | |
| | 9/16 | 595.58 | 595.41 | 594.55 | 594.40 | | | | | |
| | 9/17 | 595.52 | 595.38 | 594.52 | 594.38 | 593.1 | 592.6 | 589.62 | | |
| | 9/18 | 595.50 | 595.30 | 594.58 | 594.40 | | | | | |
| | 9/19 | 595.30 | 595.28 | 594.55 | 594.40 | 593.1 | 592.6 | | | |
| | 9/20 | 595.46 | 595.28 | 594.52 | 594.36 | | | | | 0.9 |
| | 9/21 | 595.60 | 595.40 | 594.74 | 594.52 | 593.22 | 592.87 | | | 1.1 |
| | 9/22 | 595.60 | 595.40 | 594.65 | 594.45 | | | | | |
| | 9/23 | 595.60 | 595.40 | 594.64 | 594.30 | 593.18 | 592.78 | | | |
| | 9/24 | 595.60 | 595.38 | 594.62 | 594.42 | 593.16 | 592.76 | | | |
| | 9/25 | 595.58 | 595.37 | 594.60 | 594.42 | 593.15 | 592.75 | 589.94 | | |
| | 9/26 | 595.56 | 595.45 | 594.58 | 594.40 | | | | | |
| | 9/27 | 595.54 | 595.32 | 594.36 | 594.10 | 592.65 | 592.65 | | | |
| | 9/28 | 595.50 | 595.30 | 594.50 | 594.35 | 592.6 | 592.6 | | | |
| | 9/29 | 595.48 | 595.30 | 594.50 | 594.32 | | | | | 0.3 |
| | 9/30 | 595.48 | 595.28 | 594.50 | 594.34 | 592.62 | 592.62 | | | |

| | | NAVD88 DATUM | | | | | | | | |
|------|-------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | Dam #2 | | Dam #4 | | RAIN |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2014 | 10/1 | 595.46 | 595.26 | 594.48 | 594.32 | | | | | |
| | 10/2 | 595.42 | 595.26 | 594.48 | 594.32 | | | | | 1.35 |
| | 10/3 | 595.56 | 595.35 | 594.52 | 594.44 | | | | | 1.75 |
| | 10/4 | 595.76 | 595.52 | 594.80 | 594.57 | 592.92 | 592.92 | | | |
| | 10/5 | 595.84 | 595.58 | 594.88 | 594.62 | 592.94 | 592.94 | | | 0.95 |
| | 10/6 | 595.85 | 595.58 | 594.87 | 594.62 | | | | | |
| | 10/7 | 595.85 | 595.58 | 594.82 | 594.55 | 592.92 | 592.92 | 590.09 | | |
| | 10/8 | 595.80 | 595.57 | 594.80 | 594.55 | 592.9 | 592.9 | | | |
| | 10/9 | 595.80 | 595.45 | 594.78 | 594.54 | 592.92 | 592.92 | | | |
| | 10/10 | 595.80 | 595.52 | 594.78 | 594.52 | | | | | 0.15 |
| | 10/11 | 595.80 | 595.52 | 594.75 | 594.52 | | | 589.63 | | 0.20 |
| | 10/12 | 595.75 | 595.50 | 594.75 | 594.52 | | | | | |
| | 10/13 | 595.74 | 595.48 | 594.75 | 594.50 | 592.6 | 592.6 | | | 1.26 |
| | 10/14 | 595.88 | 595.60 | 594.94 | 594.70 | | | | | |
| | 10/15 | 596.10 | 595.78 | 595.14 | 594.76 | 593.25 | 593.25 | 589.79 | | 2.15 |
| | 10/16 | 596.15 | 595.78 | 595.10 | 594.74 | 593.2 | 593.2 | | | |
| | 10/17 | 596.14 | 595.78 | 595.10 | 594.72 | 593.2 | 593.2 | | | 0.35 |
| | 10/18 | 596.16 | 595.80 | 595.10 | 594.78 | 593.25 | 593.25 | 589.19 | | |
| | 10/19 | - | - | - | - | | | | | |
| | 10/20 | 596.12 | 595.75 | 595.08 | 594.70 | 593.2 | 593.2 | | | 0.1 |
| | 10/21 | 596.08 | 595.75 | 595.05 | 594.70 | 593.2 | 593.2 | 588.79 | | |
| | 10/22 | 596.06 | 595.72 | 594.90 | 594.69 | | | | | |
| | 10/23 | 596.02 | 595.70 | 595.00 | 594.69 | 593.18 | 593.18 | | | |
| | 10/24 | 595.99 | 595.68 | 594.97 | 594.62 | | | | | |
| | 10/25 | 595.98 | 595.65 | 594.94 | 594.62 | 593.15 | 593.15 | 588.79 | | |
| | 10/26 | 595.90 | 595.60 | 594.88 | 594.60 | | | | | |
| | 10/27 | 595.87 | 595.58 | 594.85 | 594.58 | 593.1 | 593.1 | | | 0.38 |
| | 10/28 | 595.86 | 595.58 | 594.84 | 594.58 | | | | | |
| | 10/29 | 595.80 | 595.54 | 594.78 | 594.54 | 593.05 | 593.05 | | | 0.02 |
| | 10/30 | 595.76 | 595.50 | 594.75 | 594.50 | 593 | 593 | 588.59 | | |
| | 10/31 | 595.86 | 595.50 | 594.76 | 594.50 | | | | | 0.38 |

| | | NAVD88 DATUM | | | | Dam #2 | | Dam #4 | | RAIN |
|------|-------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | U/S | D/S | U/S | D/S | (in) |
| | | Inlet | Outlet | Inlet | Outlet | | | | | |
| 2014 | 11/1 | 595.73 | 595.48 | 594.72 | 594.48 | | | | | |
| | 11/2 | 595.69 | 595.46 | 594.68 | 594.45 | 592.95 | 592.95 | | | |
| | 11/3 | 595.66 | 595.43 | 594.65 | 594.45 | | | 588.59 | | |
| | 11/4 | 595.70 | 595.46 | 594.70 | 594.50 | 593 | 593 | | | 0.76 |
| | 11/5 | 595.65 | 595.44 | 594.66 | 594.46 | | | | | |
| | 11/6 | 595.70 | 595.48 | 594.72 | 594.50 | | | | | 0.7 |
| | 11/7 | 595.70 | 595.48 | 594.70 | 594.48 | | | | | |
| | 11/8 | - | - | - | - | | | | | |
| | 11/9 | - | - | - | - | | | | | 0.84 |
| | 11/10 | 595.74 | 595.50 | 594.75 | 594.50 | | | | | 0.38 |
| | 11/11 | - | - | - | - | | | | | 0.22 |
| | 11/12 | 595.78 | 595.52 | 594.77 | 594.52 | 593 | 593 | | | |
| | 11/13 | - | - | - | - | | | | | |
| | 11/14 | 595.76 | 595.52 | 594.75 | 594.50 | | | | | 0.26 |
| | 11/15 | - | - | - | - | | | | | |
| | 11/16 | - | - | - | - | | | | | 0.39 |
| | 11/17 | - | - | - | - | | | | | 0.14 |
| | 11/18 | 595.71 | 595.48 | 594.68 | 594.46 | | | | | 0.05 |
| | 11/19 | 595.70 | 595.48 | 594.68 | 594.46 | | | | | |
| | 11/20 | - | - | - | - | | | | | 0.1 |
| | 11/21 | 595.68 | 595.46 | 594.66 | 594.45 | | | | | 0.05 |
| | 11/22 | - | - | - | - | | | | | |
| | 11/23 | - | - | - | - | | | | | 0.14 |
| | 11/24 | 595.72 | 595.48 | 594.76 | 594.52 | 593.1 | 593.1 | | | 0.71 |
| | 11/25 | - | - | - | - | | | | | 0.27 |
| | 11/26 | - | - | - | - | | | | | |
| | 11/27 | - | - | - | - | | | | | 0.07 |
| | 11/28 | 595.80 | 595.55 | 594.76 | 594.52 | | | 588.64 | | 0.07 |
| | 11/29 | - | - | - | - | | | | | |
| | 11/30 | - | - | - | - | | | | | |

| | | NAVD88 DATUM | | | | | | | | |
|------|-------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | Dam #2 | | Dam #4 | | RAIN |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2014 | 12/1 | - | - | - | - | | | | | |
| | 12/2 | - | - | - | - | | | | | |
| | 12/3 | 595.73 | 595.48 | 594.70 | 594.47 | | | | | |
| | 12/4 | 595.68 | 595.45 | 594.67 | 594.45 | | | | | |
| | 12/5 | 595.64 | 595.42 | 594.65 | 594.43 | | | | | |
| | 12/6 | - | - | - | - | | | | | |
| | 12/7 | 595.63 | 595.39 | 594.60 | 594.39 | | | | | |
| | 12/8 | 595.60 | 595.37 | 594.58 | 594.38 | | | | | 0.23 |
| | 12/9 | 595.52 | 595.30 | 594.50 | 594.32 | | | | | |
| | 12/10 | - | - | - | - | | | | | |
| | 12/11 | - | - | - | - | | | | | |
| | 12/12 | 595.52 | 595.30 | 594.50 | 594.32 | 592.86 | 592.86 | | | |
| | 12/13 | - | - | - | - | | | | | |
| | 12/14 | 595.48 | 595.28 | 594.48 | 594.30 | | | | | |
| | 12/15 | - | - | - | - | | | | | |
| | 12/16 | - | - | - | - | | | | | 0.16 |
| | 12/17 | 595.48 | 595.28 | 594.46 | 594.30 | | | | | 0.2 |
| | 12/18 | - | - | - | - | | | | | |
| | 12/19 | - | - | - | - | | | | | |
| | 12/20 | - | - | - | - | | | | | |
| | 12/21 | 595.50 | 595.30 | 594.48 | 594.00 | 592.85 | 592.85 | | | |
| | 12/22 | - | - | - | - | | | | | |
| | 12/23 | - | - | - | - | | | | | 0.44 |
| | 12/24 | - | - | - | - | | | | | 0.15 |
| | 12/25 | - | - | - | - | | | | | |
| | 12/26 | 595.54 | 595.32 | 594.51 | 594.32 | | | | | |
| | 12/27 | - | - | - | - | | | | | 0.34 |
| | 12/28 | - | - | - | - | | | | | 0.02 |
| | 12/29 | - | - | - | - | | | | | |
| | 12/30 | - | - | - | - | | | | | |
| | 12/31 | - | - | - | - | | | | | 0.03 |

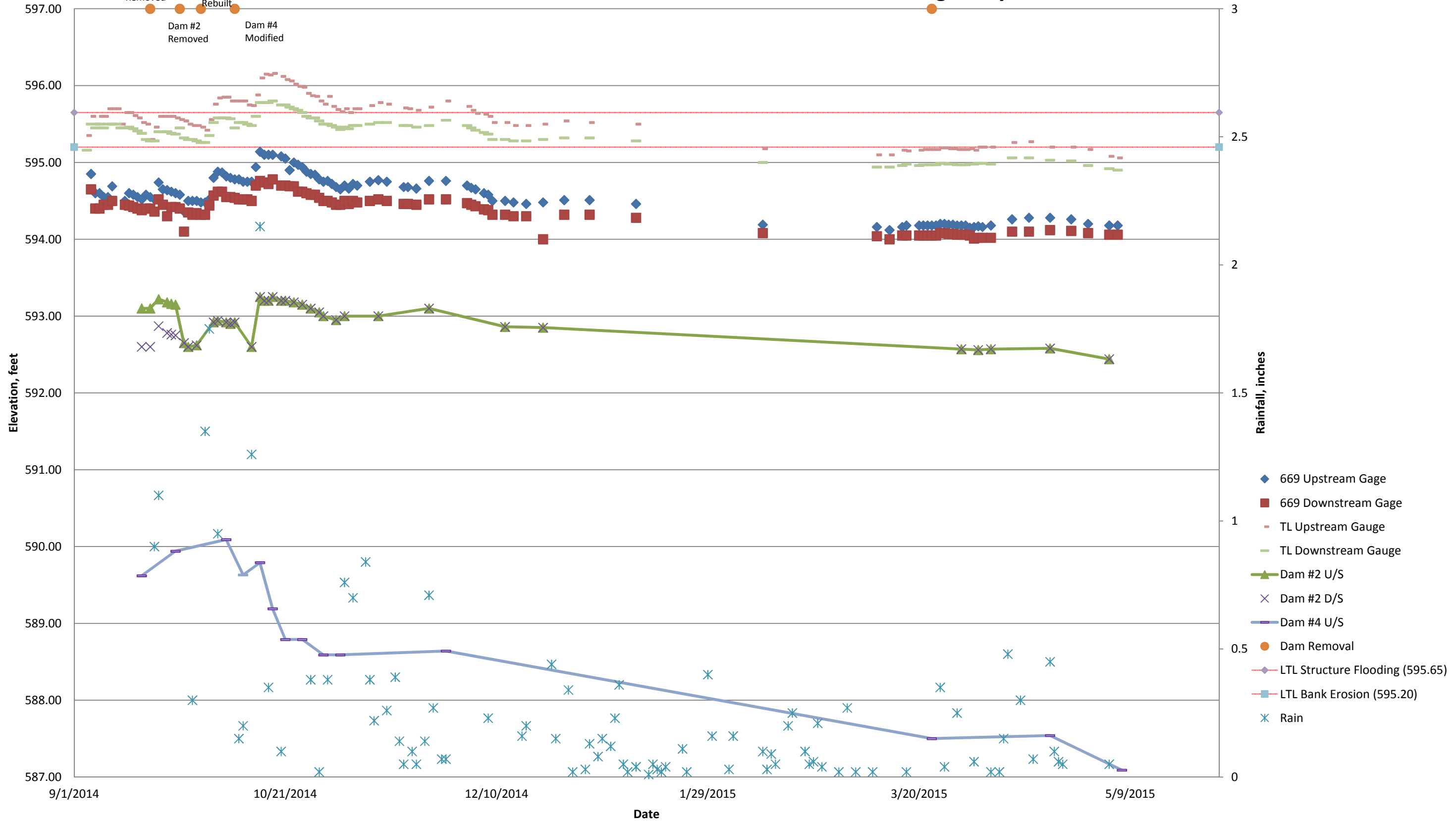
| | | NAVD88 DATUM | | | | Dam #2 | | Dam #4 | | RAIN |
|------|------|----------------------|--------|--------|--------|--------|-----|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | U/S | D/S | U/S | D/S | (in) |
| | | Inlet | Outlet | Inlet | Outlet | | | | | |
| 2015 | 1/1 | 595.52 | 595.32 | 594.51 | 594.32 | | | | | 0.13 |
| | 1/2 | - | - | - | - | | | | | |
| | 1/3 | - | - | - | - | | | | | 0.08 |
| | 1/4 | - | - | - | - | | | | | 0.15 |
| | 1/5 | - | - | - | - | | | | | |
| | 1/6 | - | - | - | - | | | | | 0.12 |
| | 1/7 | - | - | - | - | | | | | 0.23 |
| | 1/8 | - | - | - | - | | | | | 0.36 |
| | 1/9 | - | - | - | - | | | | | 0.05 |
| | 1/10 | - | - | - | - | | | | | 0.02 |
| | 1/11 | - | - | - | - | | | | | |
| | 1/12 | 595.50 | 595.28 | 594.46 | 594.28 | | | | | 0.04 |
| | 1/13 | - | - | - | - | | | | | |
| | 1/14 | - | - | - | - | | | | | |
| | 1/15 | - | - | - | - | | | | | 0.01 |
| | 1/16 | - | - | - | - | | | | | 0.05 |
| | 1/17 | - | - | - | - | | | | | 0.03 |
| | 1/18 | - | - | - | - | | | | | 0.02 |
| | 1/19 | - | - | - | - | | | | | 0.04 |
| | 1/20 | - | - | - | - | | | | | |
| | 1/21 | - | - | - | - | | | | | |
| | 1/22 | - | - | - | - | | | | | |
| | 1/23 | - | - | - | - | | | | | 0.11 |
| | 1/24 | - | - | - | - | | | | | 0.02 |
| | 1/25 | - | - | - | - | | | | | |
| | 1/26 | - | - | - | - | | | | | |
| | 1/27 | - | - | - | - | | | | | |
| | 1/28 | - | - | - | - | | | | | |
| | 1/29 | - | - | - | - | | | | | 0.4 |
| | 1/30 | - | - | - | - | | | | | 0.16 |
| | 1/31 | - | - | - | - | | | | | |

| | | NAVD88 DATUM | | | | Dam #2 | | Dam #4 | | RAIN |
|------|------|----------------------|--------|--------|--------|--------|-----|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | | | | | |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2015 | 2/1 | - | - | - | - | | | | | |
| | 2/2 | - | - | - | - | | | | | |
| | 2/3 | - | - | - | - | | | | | 0.03 |
| | 2/4 | - | - | - | - | | | | | 0.16 |
| | 2/5 | - | - | - | - | | | | | |
| | 2/6 | - | - | - | - | | | | | |
| | 2/7 | - | - | - | - | | | | | |
| | 2/8 | - | - | - | - | | | | | |
| | 2/9 | - | - | - | - | | | | | |
| | 2/10 | - | - | - | - | | | | | |
| | 2/11 | 595.18 | 595.00 | 594.19 | 594.08 | | | | | 0.1 |
| | 2/12 | - | - | - | - | | | | | 0.03 |
| | 2/13 | - | - | - | - | | | | | 0.09 |
| | 2/14 | - | - | - | - | | | | | 0.05 |
| | 2/15 | - | - | - | - | | | | | |
| | 2/16 | - | - | - | - | | | | | |
| | 2/17 | - | - | - | - | | | | | 0.2 |
| | 2/18 | - | - | - | - | | | | | 0.25 |
| | 2/19 | - | - | - | - | | | | | |
| | 2/20 | - | - | - | - | | | | | |
| | 2/21 | - | - | - | - | | | | | 0.1 |
| | 2/22 | - | - | - | - | | | | | 0.05 |
| | 2/23 | - | - | - | - | | | | | 0.06 |
| | 2/24 | - | - | - | - | | | | | 0.21 |
| | 2/25 | - | - | - | - | | | | | 0.04 |
| | 2/26 | - | - | - | - | | | | | |
| | 2/27 | - | - | - | - | | | | | |
| | 2/28 | - | - | - | - | | | | | |

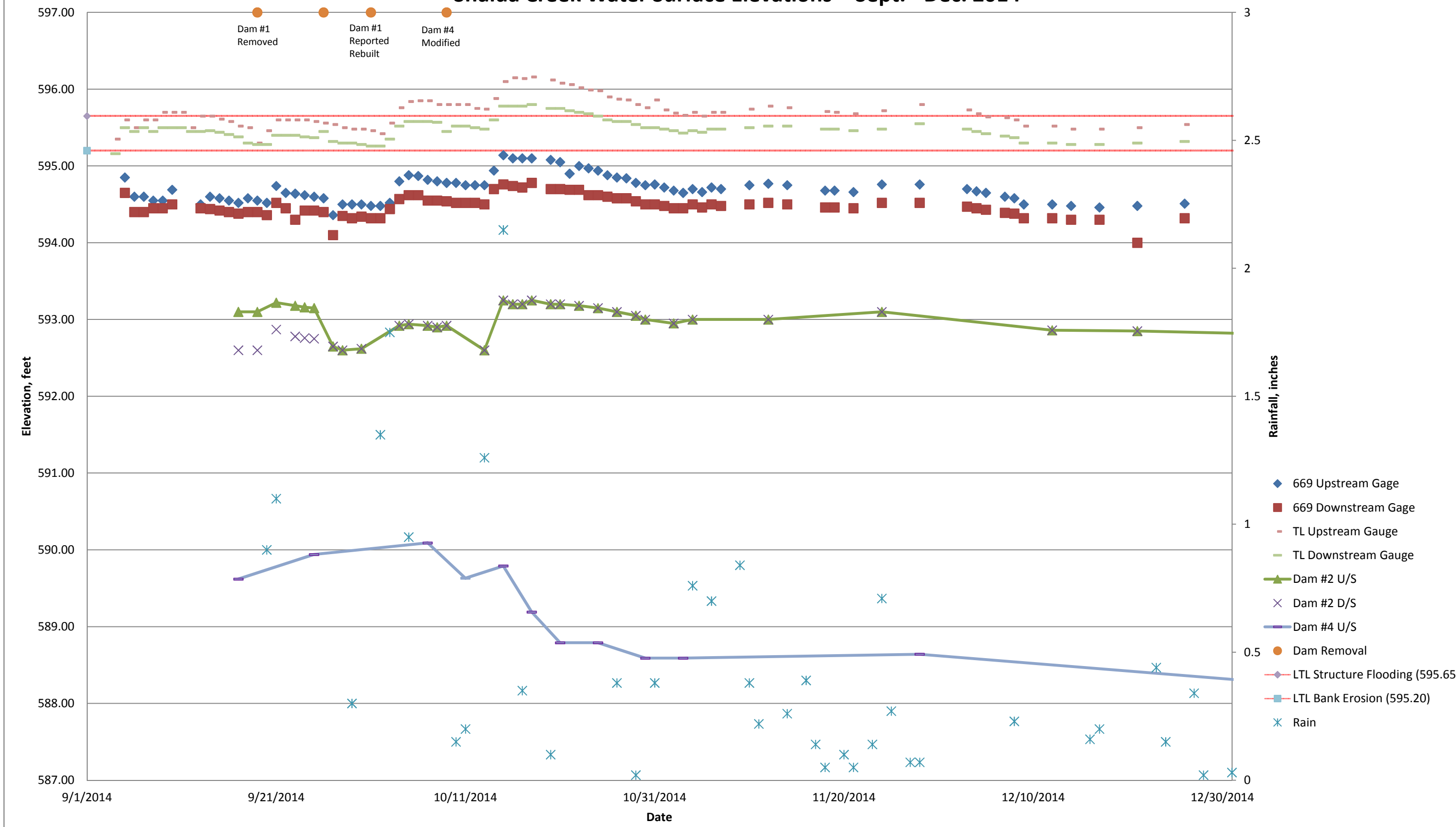
| | | NAVD88 DATUM | | | | | | | | |
|------|------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | Dam #2 | | Dam #4 | | RAIN |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2015 | 3/1 | - | - | - | - | | | | | 0.02 |
| | 3/2 | - | - | - | - | | | | | |
| | 3/3 | - | - | - | - | | | | | 0.27 |
| | 3/4 | - | - | - | - | | | | | |
| | 3/5 | - | - | - | - | | | | | 0.02 |
| | 3/6 | - | - | - | - | | | | | |
| | 3/7 | - | - | - | - | | | | | |
| | 3/8 | - | - | - | - | | | | | |
| | 3/9 | - | - | - | - | | | | | 0.02 |
| | 3/10 | 595.10 | 594.94 | 594.16 | 594.04 | | | | | |
| | 3/11 | - | - | - | - | | | | | |
| | 3/12 | - | - | - | - | | | | | |
| | 3/13 | 595.10 | 594.94 | 594.12 | 594.00 | | | | | |
| | 3/14 | - | - | - | - | | | | | |
| | 3/15 | - | - | - | - | | | | | |
| | 3/16 | 595.16 | 594.96 | 594.16 | 594.05 | | | | | |
| | 3/17 | 595.15 | 594.98 | 594.18 | 594.05 | | | | | 0.02 |
| | 3/18 | - | - | - | - | | | | | |
| | 3/19 | - | - | - | - | | | | | |
| | 3/20 | 595.16 | 594.96 | 594.18 | 594.05 | | | | | |
| | 3/21 | 595.17 | 594.97 | 594.18 | 594.05 | | | | | |
| | 3/22 | 595.17 | 594.97 | 594.18 | 594.05 | | | | | |
| | 3/23 | 595.17 | 594.97 | 594.18 | 594.05 | | | 587.5 | | |
| | 3/24 | 595.17 | 594.97 | 594.18 | 594.05 | | | | | |
| | 3/25 | 595.19 | 594.99 | 594.20 | 594.08 | | | | | 0.35 |
| | 3/26 | 595.19 | 594.99 | 594.20 | 594.08 | | | | | 0.04 |
| | 3/27 | 595.18 | 594.98 | 594.19 | 594.07 | | | | | |
| | 3/28 | 595.18 | 594.98 | 594.19 | 594.07 | | | | | |
| | 3/29 | 595.17 | 594.97 | 594.18 | 594.06 | | | | | 0.25 |
| | 3/30 | 595.17 | 594.97 | 594.18 | 594.06 | 592.57 | 592.57 | | | |
| | 3/31 | 595.17 | 594.97 | 594.18 | 594.06 | | | | | |

| | | NAVD88 DATUM | | | | | | | | |
|------|------|----------------------|--------|--------|--------|--------|--------|--------|-----|------|
| | | W. Traverse Lake Rd. | | CR 669 | | Dam #2 | | Dam #4 | | RAIN |
| | | Inlet | Outlet | Inlet | Outlet | U/S | D/S | U/S | D/S | (in) |
| 2015 | 4/1 | 595.18 | 594.98 | 594.15 | 594.05 | | | | | |
| | 4/2 | 595.16 | 594.98 | 594.16 | 594.01 | | | | | 0.06 |
| | 4/3 | 595.20 | 594.99 | 594.17 | 594.02 | 592.56 | 592.56 | | | |
| | 4/4 | 595.20 | 594.99 | 594.16 | 594.02 | | | | | |
| | 4/5 | - | - | - | - | | | | | |
| | 4/6 | 595.20 | 594.98 | 594.18 | 594.02 | 592.57 | 592.57 | | | 0.02 |
| | 4/7 | - | - | - | - | | | | | |
| | 4/8 | - | - | - | - | | | | | 0.02 |
| | 4/9 | - | - | - | - | | | | | 0.15 |
| | 4/10 | - | - | - | - | | | | | 0.48 |
| | 4/11 | 595.26 | 595.06 | 594.26 | 594.10 | | | | | |
| | 4/12 | - | - | - | - | | | | | |
| | 4/13 | - | - | - | - | | | | | 0.3 |
| | 4/14 | - | - | - | - | | | | | |
| | 4/15 | 595.27 | 595.06 | 594.28 | 594.10 | | | | | |
| | 4/16 | - | - | - | - | | | | | 0.07 |
| | 4/17 | - | - | - | - | | | | | |
| | 4/18 | - | - | - | - | | | | | |
| | 4/19 | - | - | - | - | | | | | |
| | 4/20 | 595.20 | 595.03 | 594.28 | 594.12 | 592.58 | 592.58 | 587.54 | | |
| | 4/21 | - | - | - | - | | | | | |
| | 4/22 | - | - | - | - | | | | | |
| | 4/23 | - | - | - | - | | | | | |
| | 4/24 | - | - | - | - | | | | | |
| | 4/25 | - | - | - | - | | | | | |
| | 4/26 | - | - | - | - | | | | | |
| | 4/27 | - | - | - | - | | | | | |
| | 4/28 | - | - | - | - | | | | | |
| | 4/29 | - | - | - | - | | | | | |
| | 4/30 | - | - | - | - | | | | | |

Shalda Creek Water Surface Elevations - Fall 2014 through May 2015



Shalda Creek Water Surface Elevations - Sept. - Dec. 2014



Shalda Creek Water Surface Elevations - Jan - May 2015

