Prior Lake Spring Lake
WATERSHED DISTRICT

January 4, 2011

Mr. Craig Wills, South Metro Area Hydrologist
Metro Region of Waters
Department of Natural Resources
1200 Warner Road
St. Paul, Minnesota 55106

2010 Prior Lake Outlet Channel Annual Operations Report

Dear Mr. Wills:

Enclosed is the Annual Operations Report for the Prior Lake Outlet Channel for the year 2010. If you have any questions or need additional information please contact me at (952) 447-4166 or mkinney@plslwd.org.

Sincerely,

Michael Kinney
District Administrator

Attachment: 2010 PLOC Operations Report

CC:
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2010 Prior Lake Outlet Channel Operations

Introduction

The Prior Lake Outlet Structure and Outlet Channel were constructed in 1983 under DNR permit 79-6016 to address high lake level issues on Prior Lake which does not have a natural outlet. The Prior Lake Outlet Channel (PLOC) is utilized by the Watershed District in managing lake levels on Prior Lake as well as a trunk storm water system for the Cities of Prior Lake and Shakopee, and the Shakopee Mdewakanton Sioux Community.

To address these needs and plan for future development in the watershed, the PLSLWD formed a Joint Powers Agreement/Memorandum of Agreement (JPA/MOA) with the Cities of Prior Lake and Shakopee, and the Shakopee Mdewakanton Sioux Community for the operation, maintenance and use of the Prior Lake Outlet Channel. It was determined that while the channel and outlet have worked well since their inception, if modified in several places, they could operate more efficiently, reduce long term maintenance and enhance the environment. With this in mind, the cooperators have undertaken a project to restore and enhance the PLOC. The PLOC has been divided into 8 planning and management areas referred to as Segments. Segment 1 is on the southern end beginning at the Prior Lake Outlet Structure, while Segment 8 is on the northern end and flows into the Minnesota River in Shakopee. In addition to the PLOC restoration and enhancement project, the PLSLWD recently replaced the Prior Lake Outlet Structure with a more efficient and structurally sound design.

According to Scott SWCD records, the 30-year county wide average annual precipitation is 29.19 inches. Following the drought laden years of 2008 and 2009, where the PLSLWD only received an average of 23.88 and 27.41 inches respectively, the PLSLWD and many portions of the state saw 2010 precipitation totals well above average. Reacting to the above average 2010 precipitation, the elevation of Prior Lake rose from an 18-year low of 898.98 feet in late 2009 to a high of 902.78 feet in December of 2010. Attachments E and F show Prior Lake elevations throughout 2010 and Attachment G summarizes the precipitation recorded within the District.

Moderate lake elevations in Spring Lake toward the end of 2009, and the consistently above average rainfall throughout the summer and fall months of 2010, contributed to the continuous outflow from Spring Lake into Prior Lake through nearly all of 2010. Flows through the Spring Lake outlet were first observed during snow melts in late March. Flows were estimated at a level of 6 cfs on April 7th and proceeded to slowly taper down to a trickle in late spring. Flows then increased with the rainfall and continued at various levels through the rest of the year. Flow from Spring Lake into Prior Lake was last estimated to be at 20 cfs in mid December.

The existing Prior Lake Outlet Structure was replaced during 2010 with a new, more efficient and self-operating design. The new structure was in place and fully operational

prior to water levels reaching the discharge elevation of 902.50 feet. Water began to discharge on November 29 and continued throughout the remainder of the year. Excluding 2009, the Prior Lake Outlet Structure has been operated, at least partially, every year since 1999. More information on the yearly and cumulative discharges from the Prior Lake Outlet can been seen in Attachment D.

Outlet Operations

As stated in the introduction, the new Prior Lake Outlet Structure was in operation for only a short time in 2010. The Notice of Operation of likely discharge of water was issued on November 15th as required by the current Prior Lake Outlet operation manual.

Before and during operations, the District is required to perform inspections of the Outlet Structure and the PLOC. Despite the Outlet Structure not being utilized at the time, the District performed a complete inspection of the outlet system during early April. It was determined that the PLOC was in acceptable condition to handle the stormwater discharges and surface flows anticipated from downstream of the Prior Lake Outlet Structure. Partial inspections were also made during monitoring visits throughout the spring and summer. Additional inspections were made as the elevation of Prior Lake neared and exceeded 902.50 feet to ensure the channel was able to handle discharge flows.

The spring of 2010 marked the second season of focused monitoring on the PLOC. The primary goals for monitoring included providing a base line of water quality data by taking grab samples and utilizing multi-parameter sondes, as well as verifying the JPA/MOA modeling through obtaining flow measurements. Due to the Prior Lake Outlet Structure not being operated during the monitoring season, there was only occasional continual flow throughout the length of the channel due to stormwater; therefore, the nine dates of grab samples and seven dates of flow measurements taken were indicative of stormwater flows only. Multi-parameter sondes were used to monitor the flows that were within the channel on eleven dates over the course of the spring and early summer, with additional week long deployed monitoring done on five occasions. The sondes measured pH, temperature, dissolved oxygen, turbidity, and conductivity. The data will be compiled with the 2009 data and used to identify hotspots and to guide more intensive monitoring in future years. Plans are in place for similar monitoring to take place in 2011, given that there is flow within the channel.

Aside from the reconstruction project work, which will be addressed later, there were few minor maintenance items to address within the PLOC during 2010. Removal of small organic debris from culverts to ensure free flows was the primary extent of the maintenance that occurred.

No permits were issued by the District for PLOC crossings during 2010. However, work continued on previous permits for both the Riverside Bluffs development in Segment 5a and the Scott County Highway Department extension of County Road 21 in Segment 5c. By the end of 2010 both crossings had culverts replaced and flows were unhindered;

however minor side slope stabilization issues were still being addressed with the contractors.

Outlet Structure Reconstruction

The Prior Lake Outlet structure was originally installed in and has been operated since 1983. The design of the structure was such that it required manual operation to open and close the flow. This design posed safety concerns for operation during high water levels. Additionally, there were inefficiencies in the structure's design in that the 36 inch pipe connected to the structure did not reach its maximum flow of 65 cfs until lake levels well surpassed the outlet elevation. Over the years the structure had also developed wear and required minor maintenance.

Given these conditions, plans and designs for a replacement outlet structure were pursued by the District. Groundbreaking for the project began on January 11th with the demolition and removal of the existing outlet structure. Following this a surcharge was put in place until mid April. Over the next weeks the concrete for the structure was poured, the structure was connected to the outlet pipe, plantings were installed and site restoration was completed. After a period, the inner components and weir structure were installed and though a few final cosmetic items were pending, the new Prior Lake Outlet Structure was fully operational prior to the lake rising to the discharge elevation.

The new outlet structure will increase the efficiency of discharging water by allowing the outlet pipe to reach capacity sooner. The new structure has also proven to provide safer conditions for staff during inspections and maintenance, and is self-operating, which will reduce overall operations and maintenance costs. A schematic of the new structure is provided in Attachment A and a graph showing the stage-discharge relationship can bee seen in Attachment C.

Outlet Channel Construction and Maintenance

Over the last few years the PLSLWD and the other JPA/MOA cooperators have undertaken a project to restore and enhance the PLOC. The purpose of the project has been to maintain hydrologic capacity, reduce maintenance needs, provide long-term stability, improve water quality, increase aesthetics, provide improved habitat and provide consistency with city and county plans for parks and greenways. Several portions of this project were completed in previous years. Work completed on Segment 1 in 2006 consisted of bank stabilizations, increased native plantings and a creation of a spillway between Upper and Lower Jeffers Ponds. A basin was excavated and sinuosity was added to the channel in Segment 5c prior to entering Dean Lake during the early portion of 2007. Work in 2009 included the replacement of an undersized culvert on the northern end of Segment 8; banks were reshaped, in addition to toe stabilization and weir reinforcements put in place on Segment 7a; toe stabilization, bank protections and flow realignment were completed in Segment 3; and work to build up the channel bed and

reconnect it to the floodplain in Segment 2 had begun but was halted due to frozen conditions.

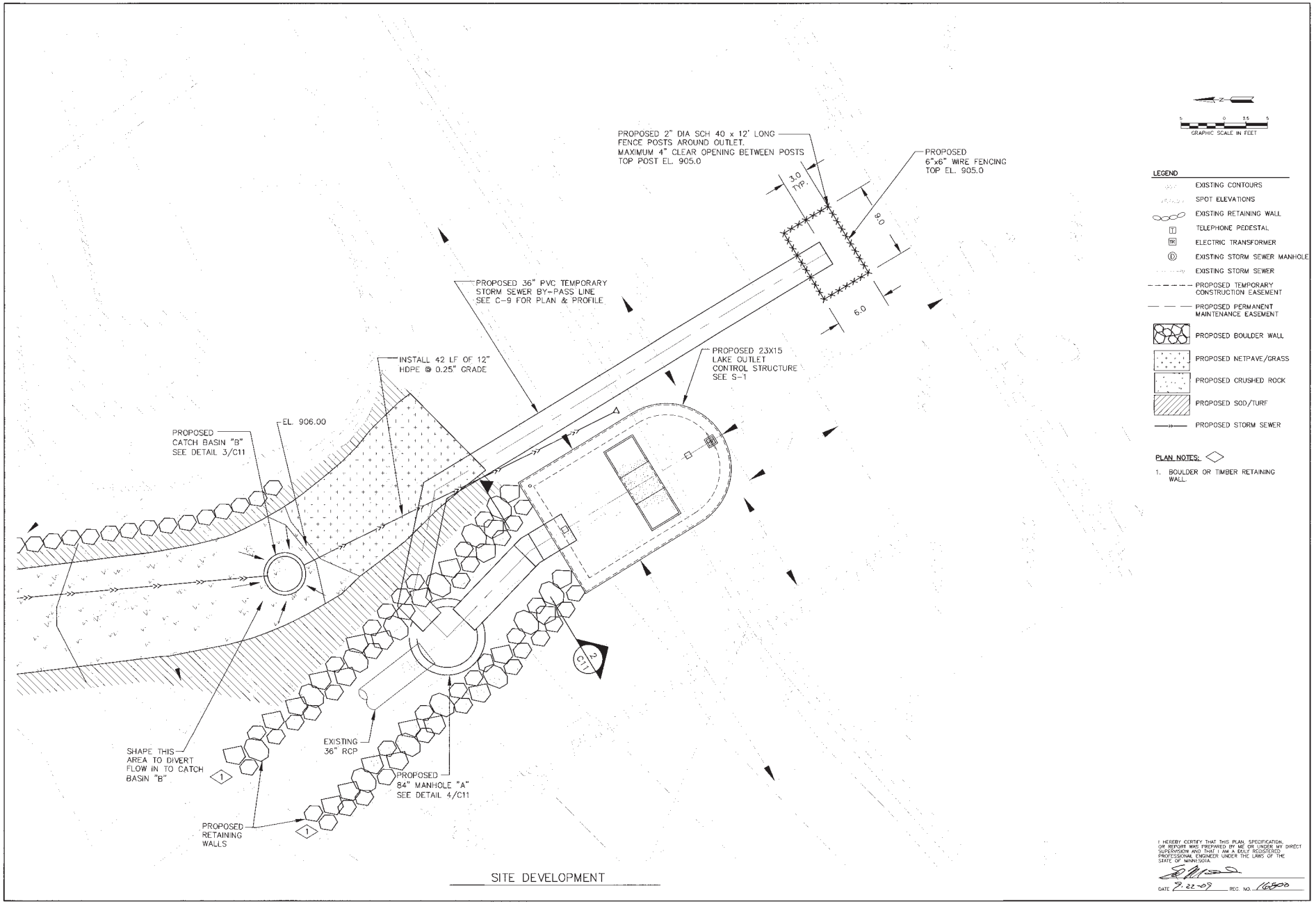
During 2010 project work on Segments 3 and 7 were completed in the spring with vegetation plantings and final site stabilizations. Additional site checks were made throughout the year to ensure stability against erosion and vegetation survival. The completion of the work in Segment 2 was planned to occur in the spring of 2010 but was pushed back until late fall due to flows within the channel. Segment 2 will continue to be monitored for vegetation survival and stability in 2011.

Designs are underway for construction work in Segments 4 and 7b for the year 2011. Segment 4 will include bank stabilizations, grade controls, cattle exclusion fencing and vegetation plantings within the bank and riparian area. Segment 7b is planned to have toe stabilizations and bank protection installed. Plans are being discussed to add an additional vegetation maintenance component and cross sectional surveys to the PLOC management in 2011. These additional items will be addressed with the JPA/MOA cooperators.

Attachments:

A. Prior Lake Outlet Structure Diagram
B. 2010 Outlet Operations
C. Stage-Discharge Relationship (New Structure)
D. Volumes Discharged from Prior Lake
E. Prior Lake Elevations and Precipitation
F. Prior Lake Elevations Graph
G. Summary of Precipitation within PLSLWD

Attachment A: Prior Lake Outlet Structure Diagram

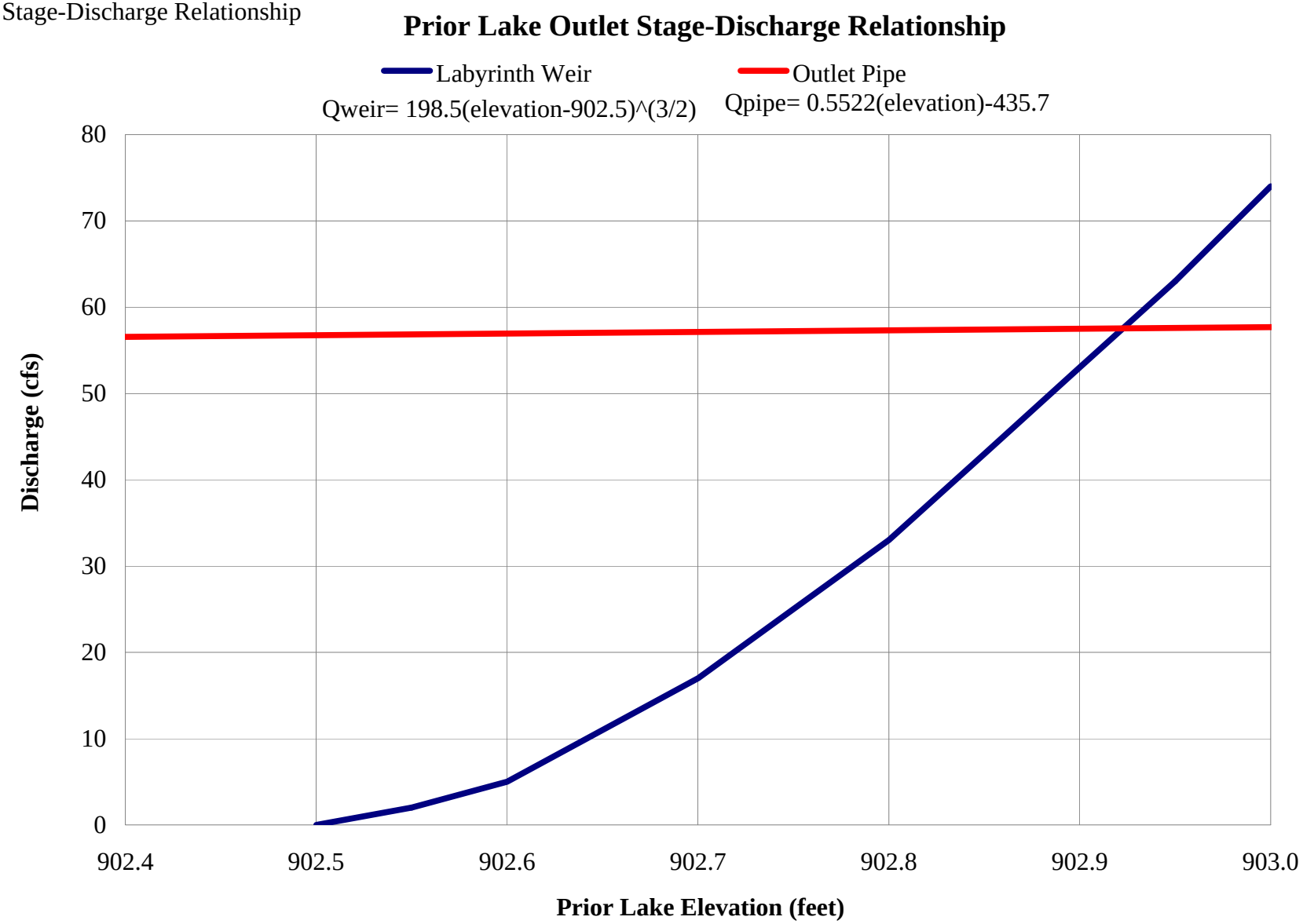


Attachment B:
2010 Outlet Operations

Date	Elevation	Outlet Activity	Channel Activity
1/11/2010		Closed	Outlet Structure demolition began
1/14/2010	899.38	Closed	Outlet Structure demolition complete
2/1/2010		Closed	Outlet Structure coffer dam in place, surcharge placed
3/10/2010	899.62	Closed	Partial inspection- synoptic monitoring
3/17/2010	899.74	Closed	Flows and samples taken, Seg 1 and 5
3/24/2010	900.66	Closed	Partial inspection- synoptic monitoring
3/31/2010	900.81	Closed	Flows and samples taken, Seg 1 and 5
4/1/2010	900.81	Closed	Inspection- Seg 4, 5, 7, 8
4/2/2010	900.81	Closed	Inspection- Seg 1, 2, 3
4/7/2010	901.09	Closed	Partial inspection- synoptic monitoring
4/21/2010	901.24	Closed	Partial inspection- synoptic monitoring
4/29/2010	901.18	Closed	Outlet Structure surcharge removed. Beginning construction of new stucture.
***Various spot checks as needed. Minimal flows in channel.*			
8/13/2010	901.60	Closed	Partial inspection due to large rain events
11/29/2010	902.52	Freely flowing	Lake reached outlet elevation on the new outlet. Outlet is fully operational.
12/10/2010	902.68	Freely flowing	Partial inspection
12/16/2010	902.65	Freely flowing	Partial inspection- portions frozen or snow covered
12/23/2010	902.78	Freely flowing	Partial inspection- portions frozen or snow covered
12/29/2010	902.74	Freely flowing	Partial inspection- portions frozen or snow covered

*Construction oversight and inspection dates are not included in this table.

Attachment C:
Stage-Discharge Relationship



Attachment D:
Volumes Discharged from Prior Lake

Volumes Discharged from the Prior Lake Outlet and Associated Elevations

Year	Volume Discharged (ac*ft)	Depth Eliminated from Lake (ft)	Min Elevation for the Year	Date of Min Elev	Max Elevation for the Year	Date of Max Elev	Max Elevation without the Outlet	Average Rainfall
2010	1110	0.95	899.38	1/14/2010	902.78	12/23/2010	903.73	37.41
2009	0	0.00	898.98	9/30/2009	900.44	4/29/2009	900.44	27.41
2008	4993	4.28	900.28	12/29/2008	902.90	5/8/2008	907.18	23.88
2007	1395	1.20	900.55	8/10/2007	902.78	4/23/2007	903.98	28.59
2006	4331	3.71	900.50	12/14/2006	903.27	4/7/2006	906.98	27.77
2005	2299	1.97	900.71	1/18/2005	903.10	10/18/2005	905.07	38.02
2004	13	0.01	900.50	4/15/2004	902.79	7/12/2004	902.80	32.96
2003	5921	5.07	900.62	12/30/2003	903.17	5/23/2003	908.24	23.00
2002	9520	8.16	900.70	3/4/2002	903.60	9/10/2002	911.76	41.96
2001	8692	7.45	901.04	12/28/2001	904.28	5/7/2001	911.73	28.52
2000	80	0.07	901.52	2/20/2000	903.00	7/11/2000	903.07	26.09
1999	6240	5.35	902.00	11/25/1999	904.78	5/27/1999	910.13	33.29
1998			902.05*	1/1/1998*	903.90*	4/13/1998*		35.00◆
1997	4150	3.56	901.20	2/28/1997	902.90	4/21/1997	906.46	32.36◆
1996			900.77*	11/4/1996*	902.98*	4/10/1996*		26.52◆
1995			902.26*	9/26/1995*	903.25*	3/30/1995*		30.62◆
1994	1760+		901.90	9/7/1994	903.05	10/24/1994	903.05	35.28◆
1993	10,000+		902.00	3/9/1993	904.49	7/14/1993	904.49	36.40◆
1992	8331	7.14	899.95	2/19/1992	903.16	10/12/1992	910.30	35.86
1991			898.11*	4/1/1991*	900.92*	6/13/1991*		
1990			895.46*	4/24/1990*	899.38*	8/10/1990*		
1989			895.49*	11/27/1989*	897.15*	4/3/1989*		
1988			896.90*	11/11/1988*	899.63*	1/1/1988*		
1987			899.63*	12/31/1987*	901.54*	3/6/1987*		
1986			901.22*	2/14/1986*	903.96*	5/15/1986*		
1985			902.23*	9/12/1985*	903.93*	4/25/1985*		
1984			901.75*	10/9/1984*	903.60*	6/24/1984*		
1983	Outlet Installed		901.76*	1/17/1983*	905.68*	7/20/1983*		
1982			900.06*	3/24/1982*	902.56*	5/21/1982*		
1981			898.91*	7/31/1981*	899.88*	9/17/1981*		
1980			899.92*	12/29/1980*	902.60*	4/18/1980*		
Averages	**4302**	**3.49**	**900.27**	**--**	**902.63**	**--**	**--**	**31.63**

Unless otherwise noted, data is taken from annual outlet operations reports

◆ Rainfall data is from MN Climatology office for 115N, 22W, 15 Prior Lake; all other rainfall as recorded at PLSLWD office

* Data from PLSLWD Historic Lake Level Volunteer Collected Data

Attachment E:
Prior Lake Elevations and Precipitation

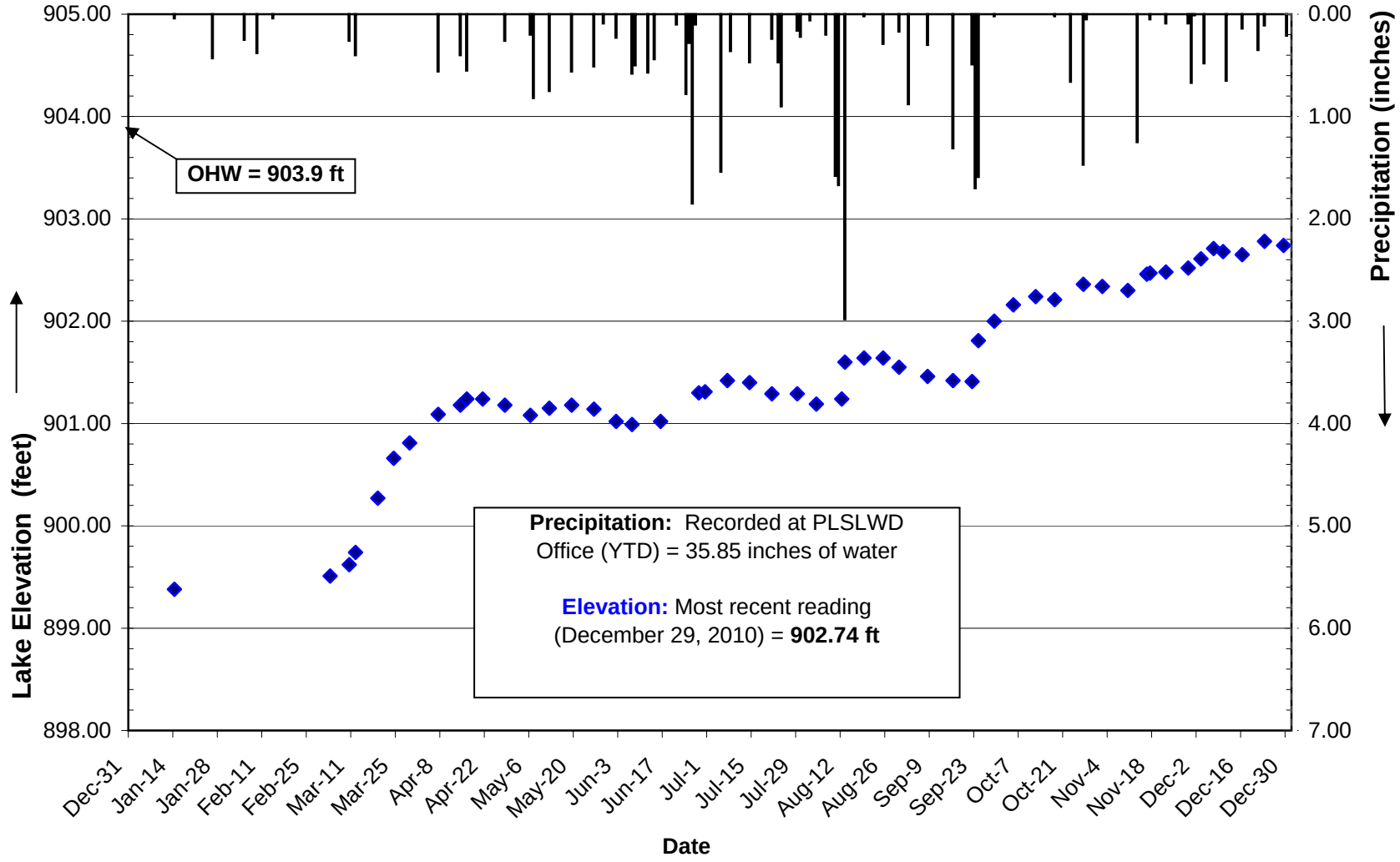
2010	Prior Lake Elevation	Precipitation b/w readings (office only)	Monthly Total
12/23/09 9:00	899.22		
1/14/10 14:00	899.38	0.04	
1/26/10 8:00		0.43	0.47
2/5/10 15:00		0.25	
2/9/10 7:00		0.38	
2/14/10 7:00		0.04	0.67
3/4/10 15:00	899.51		
3/10/10 14:00	899.62	0.26	
3/12/10 13:00	899.74	0.40	
3/19/10 0:00	900.27		
3/24/10 8:00	900.66		
3/29/10 12:30	900.81		0.66
4/7/10 11:30	901.09	0.56	
4/14/10 7:45	901.18	0.40	
4/16/10 11:30	901.24	0.55	
4/21/10 11:45	901.24		
4/28/10 9:15	901.18	0.26	1.77
5/6/10 6:55	901.08	0.20	
5/7/10 0:00		0.82	
5/12/10 6:58	901.15	0.75	
5/19/10 12:15	901.18	0.56	
5/26/10 7:00	901.14	0.51	
5/29/10 0:00		0.09	2.93
6/2/10 12:00	901.02	0.23	
6/7/10 6:55	900.99	0.58	
6/8/10 0:00		0.50	
6/12/10 0:00		0.57	
6/14/10 0:00		0.44	
6/16/10 7:00	901.02		
6/21/10 0:00		0.10	
6/24/10 0:00		0.78	
6/25/10 0:00		0.28	
6/26/10 0:00		1.85	
6/27/10 0:00		0.10	
6/28/10 10:35	901.30		
6/30/10 12:16	901.31		5.43
7/5/10 0:00		1.54	
7/7/10 6:50	901.42		
7/8/10 7:00		0.36	
7/14/10 12:00	901.40	0.47	
7/21/10 6:50	901.29	0.24	
7/23/10 0:00		0.47	
7/24/10 0:00		0.90	
7/29/10 6:50	901.29	0.16	
7/30/10 0:00		0.22	4.36

2010	Prior Lake Elevation	Precipitation b/w readings (office only)	Monthly Total
8/2/10 7:00		0.06	
8/4/10 6:50	901.19		
8/7/10 7:00		0.20	
8/10/10 12:00		1.58	
8/11/10 7:00		1.67	
8/12/10 7:00	901.24		
8/13/10 7:00	901.60	2.98	
8/19/10 6:57	901.64	0.02	
8/25/10 6:50	901.64	0.29	
8/30/10 6:52	901.55	0.17	6.97
9/2/10 0:00		0.88	
9/8/10 6:50	901.46	0.30	
9/16/10 6:50	901.42	1.31	
9/22/10 6:50	901.41	0.49	
9/23/10 7:00		1.70	
9/24/10 6:50	901.81	1.59	
9/29/10 6:55	902.00	0.02	6.29
10/5/10 8:10	902.16		
10/12/10 8:00	902.24		
10/18/10 9:00	902.21	0.02	
10/23/10 7:00		0.66	
10/27/10 11:45	902.36	1.47	
10/28/10 7:00		0.05	2.20
11/2/10 7:30	902.34		
11/10/10 13:40	902.30		
11/13/10 0:00		1.25	
11/16/10 7:00	902.46		
11/17/10 10:00	902.47	0.05	
11/22/10 11:00	902.48	0.09	
11/29/10 7:00	902.52	0.09	
11/30/10 7:00		0.67	2.15
12/1/10 7:00		0.01	
12/3/10 9:15	902.61		
12/4/10 0:00		0.48	
12/7/10 3:00	902.71		
12/10/10 11:00	902.68		
12/11/10 0:00		0.65	
12/16/10 8:00	902.65	0.14	
12/21/10 7:00		0.35	
12/23/10 12:00	902.78	0.11	
12/29/10 10:15	902.74		
12/30/10 15:00		0.21	1.95

Elevation		Precipitation	
Average	901.50	Yearly Total	35.85
Minimum	899.38	Maximum 1 Day	2.98
Maximum	902.78	Maximum Month	6.97

Attachment F:
Prior Lake Elevations Graph

Prior Lake Elevation
2010



Attachment G:
Summary of precipitation within PLSLWD

	PLSLWD 2010 Office readings	PLSLWD 2010 mo ave	PLSLWD 2010 YTD ave	SWCD Scott Co 30yr mo ave	SWCD Scott Co 30yr YTD ave	Monthly % Deviation	Monthly Numeric Deviation	YTD % Deviation	YTD Numeric Deviation
Jan	0.47	0.54	0.54	0.76	0.76	-28.9%	-0.22	-28.9%	-0.22
Feb	0.67	0.82	1.36	0.52	1.28	58.2%	0.30	6.4%	0.08
Mar	0.66	0.89	2.25	1.62	2.90	-45.2%	-0.73	-22.4%	-0.65
Apr	1.90	1.82	4.07	2.34	5.24	-22.4%	-0.53	-22.4%	-1.18
May	2.80	3.05	7.11	3.40	8.64	-10.4%	-0.36	-17.7%	-1.53
Jun	5.43	6.68	13.79	4.42	13.06	51.1%	2.26	5.6%	0.73
Jul	4.36	4.32	18.10	3.86	16.92	11.8%	0.46	7.0%	1.18
Aug	6.97	5.78	23.88	4.68	21.60	23.5%	1.10	10.6%	2.28
Sep	6.29	7.15	31.04	2.97	24.57	140.8%	4.18	26.3%	6.47
Oct	2.20	2.13	33.16	2.14	26.71	-0.6%	-0.01	24.2%	6.45
Nov	2.15	2.15	35.31	1.71	28.42	25.6%	0.44	24.2%	6.89
Dec	1.95	2.10	37.41	0.77	29.19	172.7%	1.33	28.2%	8.22
YTD	35.85	37.41		29.19				28.2%	8.22

*PLSLWD average is calculated based on four sites in the District

* Scott SWCD average is per the NWS site in Jordan

*Deviation is calculated by the difference between the current year PLSLWD average and the 30 year Scott SCWD average