One Stanton Street
Marinette, WI 54143-2542

Tele: 715-735-7411

December 6, 2017

Mr. Conor Neal
Hydrogeologist
Land & Chemicals Division
US Environmental Protection Agency, Mail Code LU-9J
77 West Jackson Blvd
Chicago, IL 60604-3590

RE: 2017 Pump Down Program Summary Report
Tyco Fire Products LP Site
Marinette, WI

Dear Mr. Neal:

The information provided herein is a summary of activities conducted at the Tyco Fire Products LP (Tyco) site associated with the Pump Down Program (PDP) conducted in 2017. The PDP is required as part of the Administrative Order on Consent between Tyco and U.S. Environmental Protection Agency (USEPA). Specifically, this report provides a summary of the groundwater recovery and disposal, groundwater treatment system testing, and additional treatment approaches being evaluated for the management of the former Salt Vault and 8th Street Slip groundwater.

Groundwater Recovery and Disposal

The components of the temporary groundwater recovery system associated with the PDP were reinstalled after the interim shut period on June 15, 2017. However, commencement of system operation did not commence until August 29, 2017 for the following reasons:

- Tyco, USEPA, and WDNR participated in a conference call on May 23, 2017 at which time Tyco presented the status of the PDP and the proposed approach to collection and evaluation of technical information during 2017 for development of a permanent groundwater management system for the PDP area. Following the discussion, USEPA provided their response to the Tyco proposal in a correspondence dated June 26, 2017. Additional discussion regarding the proposed approach occurred on July 25, 2017 at which time Tyco provided further details regarding the proposed approach. USEPA provided a written response to the meeting presentation on August 10, 2017 that presented the USEPA position to conduct PDP activities in 2017.
- Groundwater treatment system testing was determined to be necessary to assess the ability of the existing permanent treatment system to successfully treat the groundwater generated as part of the PDP. An operation testing procedure was submitted to WDNR on June 20, 2017, which outlined the activities to be conducted as part of the system testing. The operation testing procedure was approved by the WDNR on June 26, 2017.

- PDP operations were subsequently scheduled to commence on August 7, 2017 with a portion of the recovered groundwater being transferred to the groundwater treatment plant for testing activities and the remaining recovered groundwater transported to Vickery for off-site disposal. On August 4, 2017, Tyco was notified that Vickery was unable to receive the groundwater from the PDP due to mechanical problems with an injection well and no capacity available at the other injection wells at the facility. The inability or limited ability of Vickery to receive and dispose of the recovered groundwater remained an issue throughout pump down operations until the interim shut down occurred on November 1, 2017.
- Temporary storage tanks were ordered for storing groundwater recovered from the PDP area for use in the groundwater treatment system. As proposed the tanks were to be placed near the exterior of the groundwater treatment plant and, for spill protection, be of double wall construction. Shortly after ordering the tanks, the impacts of the rainy weather in the southern United States resulted in a shortage of the tanks. Therefore, delivery and installation of the tanks was delayed until August 29, 2017 and groundwater treatment system testing was able to proceed.

Initial combined pumping rate in the former Salt Vault was 8.7 gallons per minute (gpm) from the four extraction wells (EW-10, EW-11, EW-13, and EW-14) used during the pump down operations. The initial combined pumping rate in the former 8th Street Slip was 6.9 gpm from the two extraction wells (EW-8 and EW-9) used during the pump down operation. Due to the limited access to the groundwater disposal facility (Vickery), limited onsite storage capacity, and the planned limited treatment capacity at the site groundwater treatment system during the system testing, groundwater recovery in the PDP area was consequently conducted sporadically (i.e., consistent active pumping was not viable).

Graphs of groundwater elevation data collected during the implementation of the PDP is attached. The graphs clearly illustrate the rise in groundwater elevations during the interim shut down period followed by subsequent drawdown and equilibration rebound during the sporadic operation of the extraction wells.

The extraction of groundwater from the PDP area ceased on October 9, 2017, primarily due to the sustained inability to dispose of water at Vickery. To insure that all existing extracted groundwater could be removed from the site, Tyco diverted some tanker trucks normally used for transportation of disposal of existing groundwater treatment system concentrate (reject water) to assist in management and disposal of the groundwater extracted during PDP operations. As a result, Tyco was able to remove and dispose of all collected groundwater by October 27, 2017.

The volume of groundwater recovered during the 2017 PDP operations was approximately 129,558 gallons with approximately 96,690 gallons disposed offsite. An additional 32,868 gallons was treated through the on-site groundwater treatment system as part of the system testing program. Details of the system testing program are provided herein.

Groundwater Treatment System Testing

On August 31, 2017, Tyco commenced the system testing program. The initial influent rate of groundwater recovered from each pump down area cell (former Sault Vault and 8th Street Slip) into

the groundwater treatment system was approximately 0.25 gallons per minute (gpm). Periodically, and following effluent sampling and receipt of analytical testing results, the influent rate from each pump down area cell was incrementally increased to assess the ability of the system to effectively treat the groundwater contributed to the system from the pump down area. System testing ceased on October 6, 2017 following receipt of analytical testing results that documented a discharge criteria exceedence. The influent contribution rate from each pump down area cell at the time of system testing termination was approximately 2.5 gpm. The laboratory analytical results, influent feed rates, and approximate discharge quantities associated with the system testing are presented in the attached Table 1.

During the system testing period, it was observed that system fouling frequently occurred likely due to the increased chemistry needs (i.e., chemical addition) to effectively treat the groundwater. This resulted in more frequent system cleaning necessary to continue treatment system operations. The generation of system concentrate (reject water) also increased significantly during the system testing requiring additional off-site disposition of the water.

Based on the testing results, the existing groundwater treatment system appears capable of successfully treating groundwater with up to 1.5 gpm from each of the pump down area cells being combined into the total groundwater stream entering the treatment system. However, use of the existing groundwater treatment system for long-term management of the groundwater recovered from the pump down area does not appear viable at this time due to the following:

- The estimated recovery of groundwater necessary for maintenance of the target level within the pump down area is approximately 1.5 gpm from each area with pumping operations occurring the equivalent of 24 hours per day, seven days per week. Due to treatment system operational limitations and maintenance requirements, 24/7 operation of the existing system cannot be assumed. The ability to consistently and effectively treat groundwater with a contribution of approximately 2.25-2.5 gpm from the pump down area cells is more likely to be required to maintain the target elevation in each cell when taking into account the system limitations. The testing has demonstrated the successful treatment of a contribution of greater than approximately 2.0 gpm is not achievable.
- The arsenic concentrations in the groundwater contributed from the pump down area during the testing period appear to be relatively low when compared to historical sampling results from the monitoring wells in the area. As drawdown continues within the area to achieve the target elevation the arsenic concentrations will likely increase as more groundwater is contributed from the deeper portions of the aquifer. It is expected that as arsenic concentrations increase in the system influent, a reduction in the feed rate from the pump down area would likely need to occur to maintain compliance with the WDPES discharge criteria. A reduction in the feed rate introduces the likelihood that the target elevation may not be maintained long-term.
- The need for increased chemical addition to effectively remove the arsenic from the groundwater to achieve discharge criteria has been determined to severely “stress” the existing treatment system. Increased system maintenance, thereby, reducing system operational time, would be necessary due to the resulting system fouling (particularly in the reverse osmosis units).
- The increased chemical addition into the system has also resulted in the generation of significantly more reject water. The reject water is temporarily stored in an onsite tank

within the groundwater treatment building, which is offloaded into tanker trucks for off-site disposition as needed (currently approximately 5 times per week). The increase volume of reject water introduces the risk of limited availability of trucks for off-site disposition, which could further reduce system operational time necessary to allow maintenance of the target elevation.

Alternatives

Tyco continues to pursue options to effectively treat/manage the groundwater being removed from the pump down area. As has been previously presented, the following potential options remain to be evaluated:

- Design, installation, and operation of additional components to the existing groundwater treatment system to enhance the treatment capability of the system.
- Design, installation, and operation of a treatment system similar to the existing groundwater treatment system. The system would be used to only treat groundwater from the pump down area and likely provide an initial "knockdown" of the arsenic concentration in the groundwater followed by incorporation of the permeate into the existing treatment.
- Design, installation, and operation of a treatment system using alternative treatment technology (such as chemical precipitation or evaporation) to address arsenic concentrations in pump down area recovered water. Tyco has already initiated discussions, including on-going bench testing activities, with a treatment contractor to assess viability of these approaches.
- Incorporation of a portion of the recovered water into the existing groundwater treatment system coupled with a bypass to allow for direct transfer of the remaining recovered water into the reject water tank for off-site disposition.
- Groundwater recovery and off-site disposition of recovered water. This approach may be seasonal or permanent.

Following determination of the treatment/management approach for the recovered groundwater, a permanent collection and conveyance also will be designed and constructed, as necessary. The collection and conveyance system may include:

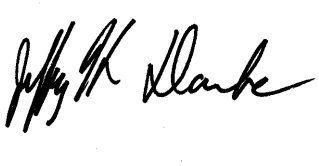
- Installation of permanent pumps in the existing extractions well coupled with underground conveyance to a centralized location.
- Installation of a horizontal well or well network coupled with pumps and associated underground conveyance to a centralized location.

Tyco continues to aggressively move forward on the PDP implementation. The alternatives described above are actively being evaluated with the goal of selection, implementation of the selected alternative(s), and compliance with the target elevation requirement by year end 2018.

Closing

I trust you will find the information provided herein informative and clearly documents Tyco's continued commitment to the project. If you have any questions regarding this report, please contact Jeff Danko at 262-951-6888 or jdanko@tycoint.com.

Sincerely,

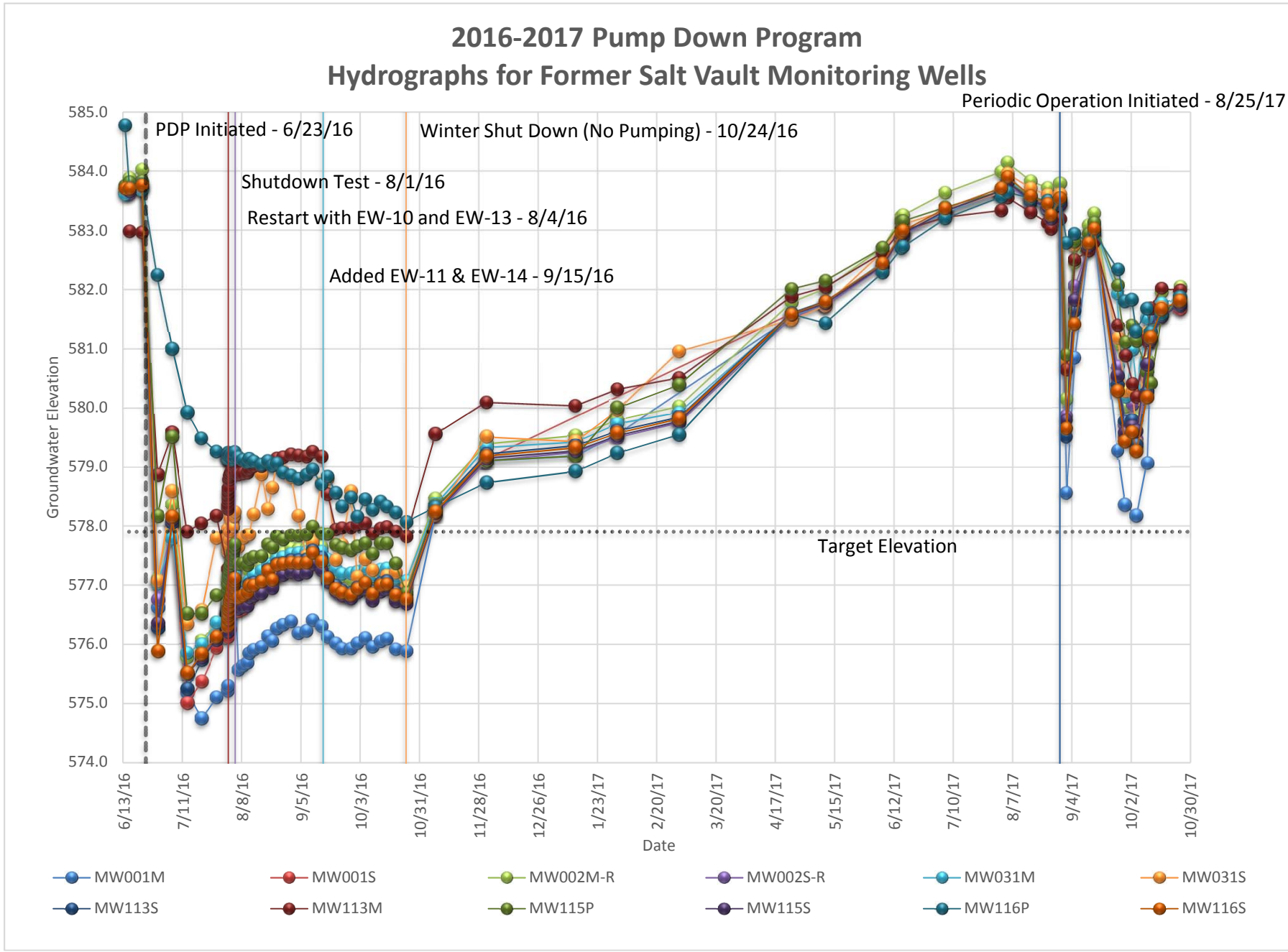


Jeff Danko
Environmental Project Geologist

Attachments:

2016 and 2017 Pump Down Program Groundwater Elevation Monitoring Graphs
Table 1 – Groundwater Treatment System Testing – Pump Down Program

cc: Kristin DuFresne – WDNR
Mark Stanek - WDNR
Joseph Janeczek – Johnson Controls
Richard Mator – Johnson Controls
Ryan Suennen – Tyco Fire Protection Products


2016-2017 Pump Down Program
Hydrographs for Former Salt Vault Monitoring Wells
Periodic Operation Initiated - 8/25/17
PDP Initiated - 6/23/16
Winter Shut Down (No Pumping) - 10/24/16
Shutdown Test - 8/1/16
Restart with EW-10 and EW-13 - 8/4/16
Added EW-11 & EW-14 - 9/15/16
Target Elevation
Groundwater Elevation
585.0
584.0
583.0
582.0
581.0
580.0
579.0
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574.0
6/13/16
7/11/16
8/8/16
9/5/16
10/3/16
10/31/16
11/28/16
12/26/16
1/23/17
2/20/17
3/20/17
4/17/17
5/15/17
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7/10/17
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9/4/17
10/2/17
10/30/17
Date
MW001M
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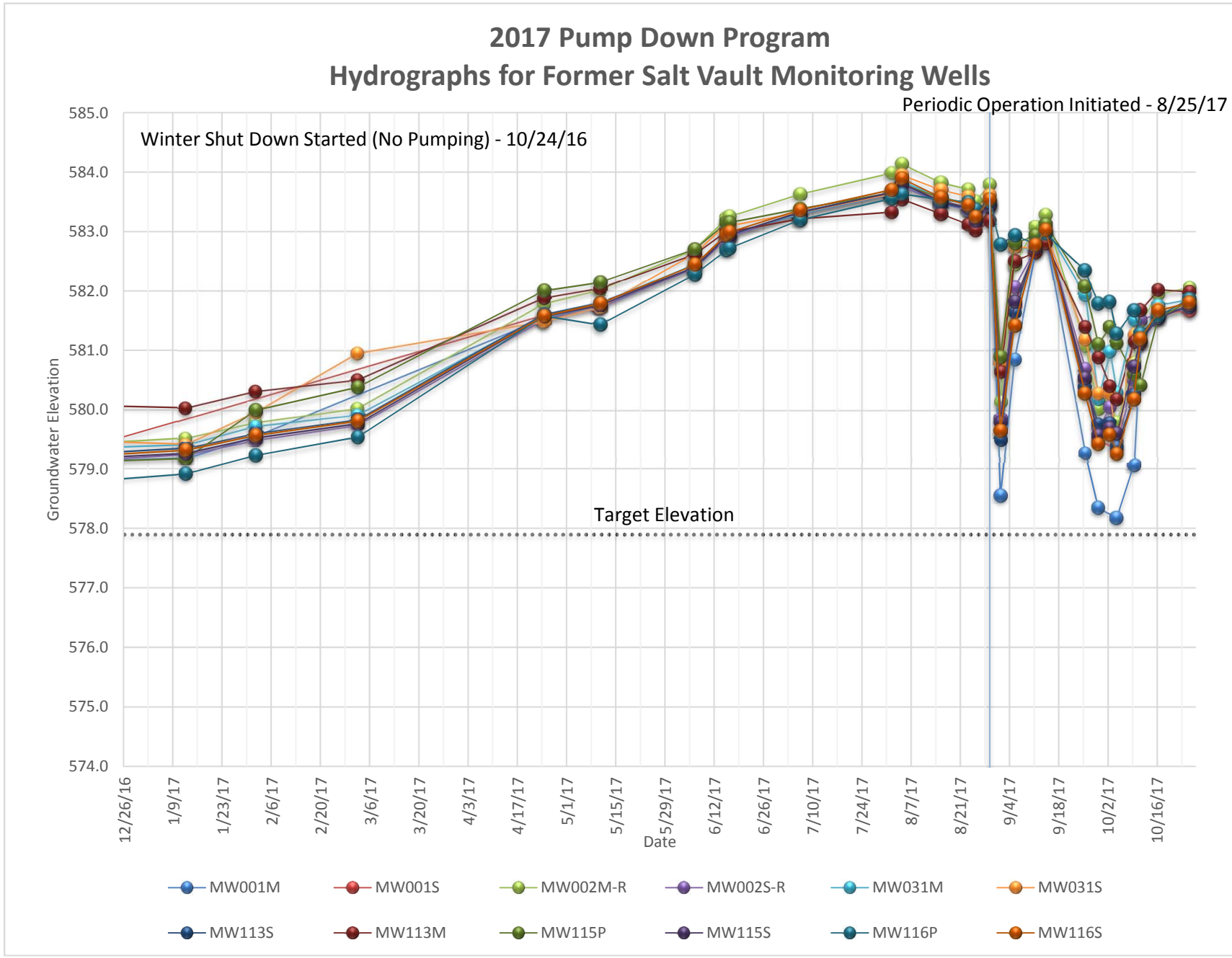
MW115S
MW116P
MW116S


2017 Pump Down Program
Hydrographs for Former Salt Vault Monitoring Wells
Periodic Operation Initiated - 8/25/17
Winter Shut Down Started (No Pumping) - 10/24/16
Target Elevation
Groundwater Elevation
585.0
584.0
583.0
582.0
581.0
580.0
579.0
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577.0
576.0
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2/6/17
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4/17/17
5/1/17
5/15/17
5/29/17
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8/7/17
8/21/17
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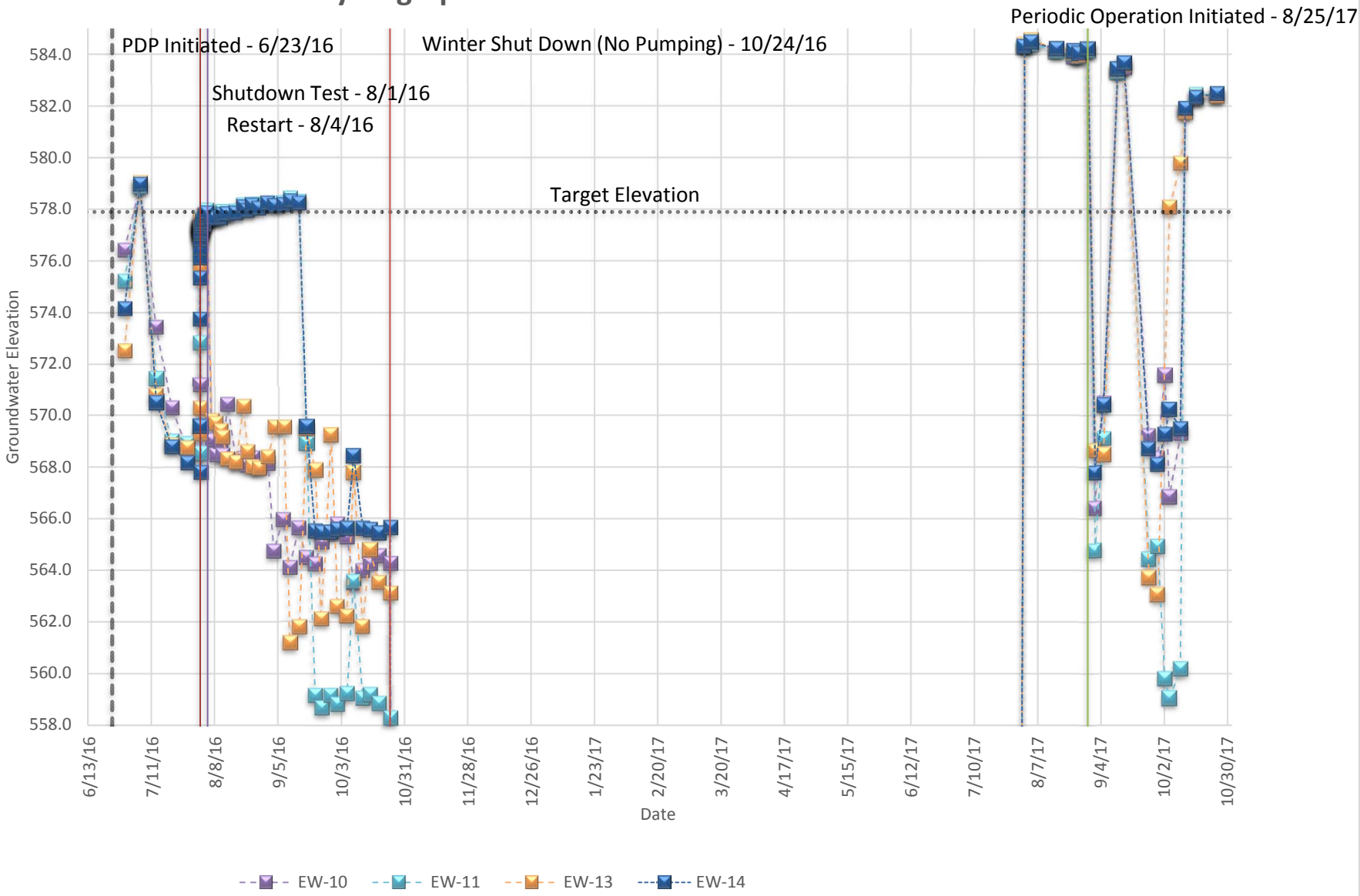
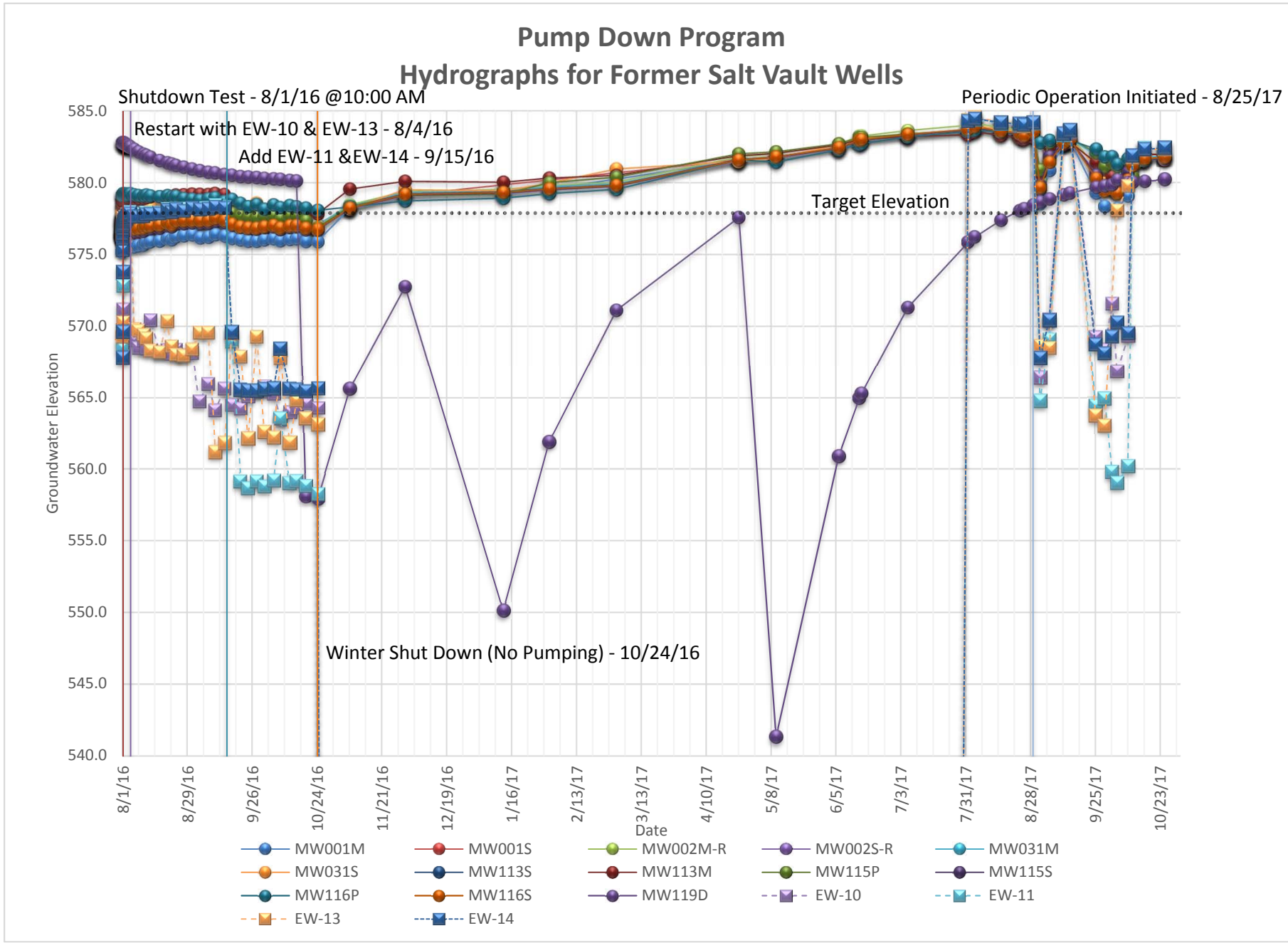
MW001S
MW002M-R
MW002S-R
MW031M
MW031S
MW113S
MW113M
MW115P
MW115S
MW116P
MW116S

2016-2017 Pump Down Program
Hydrographs for Former Salt Vault Extraction Wells




Pump Down Program
Hydrographs for Former Salt Vault Wells
Shutdown Test - 8/1/16 @10:00 AM
Periodic Operation Initiated - 8/25/17
Restart with EW-10 & EW-13 - 8/4/16
Add EW-11 &EW-14 - 9/15/16
Target Elevation
Winter Shut Down (No Pumping) - 10/24/16
Groundwater Elevation
585.0
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8/1/16
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MW001M
MW001S
MW002M-R
MW002S-R
MW031M
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MW113S
MW113M
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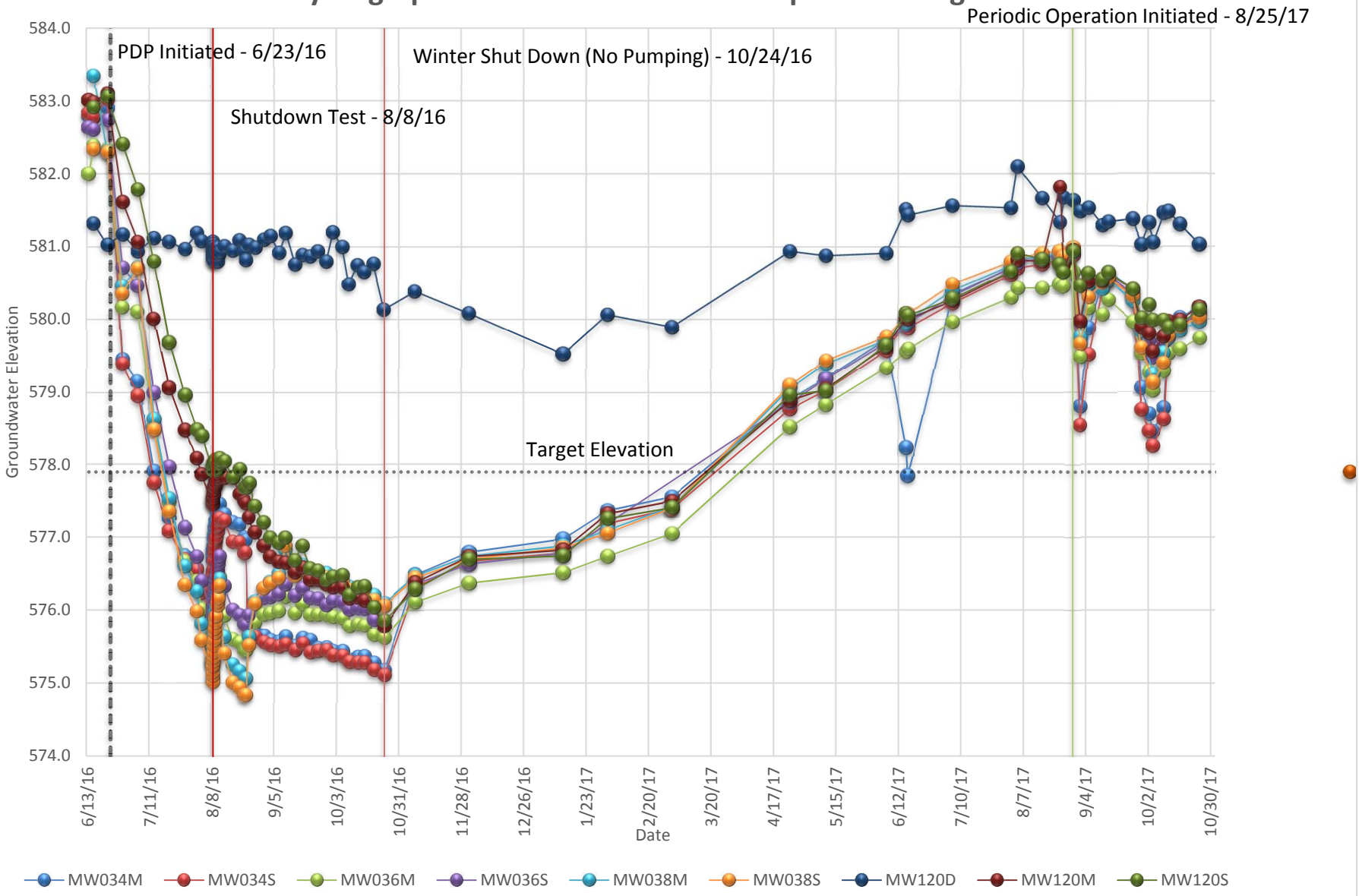
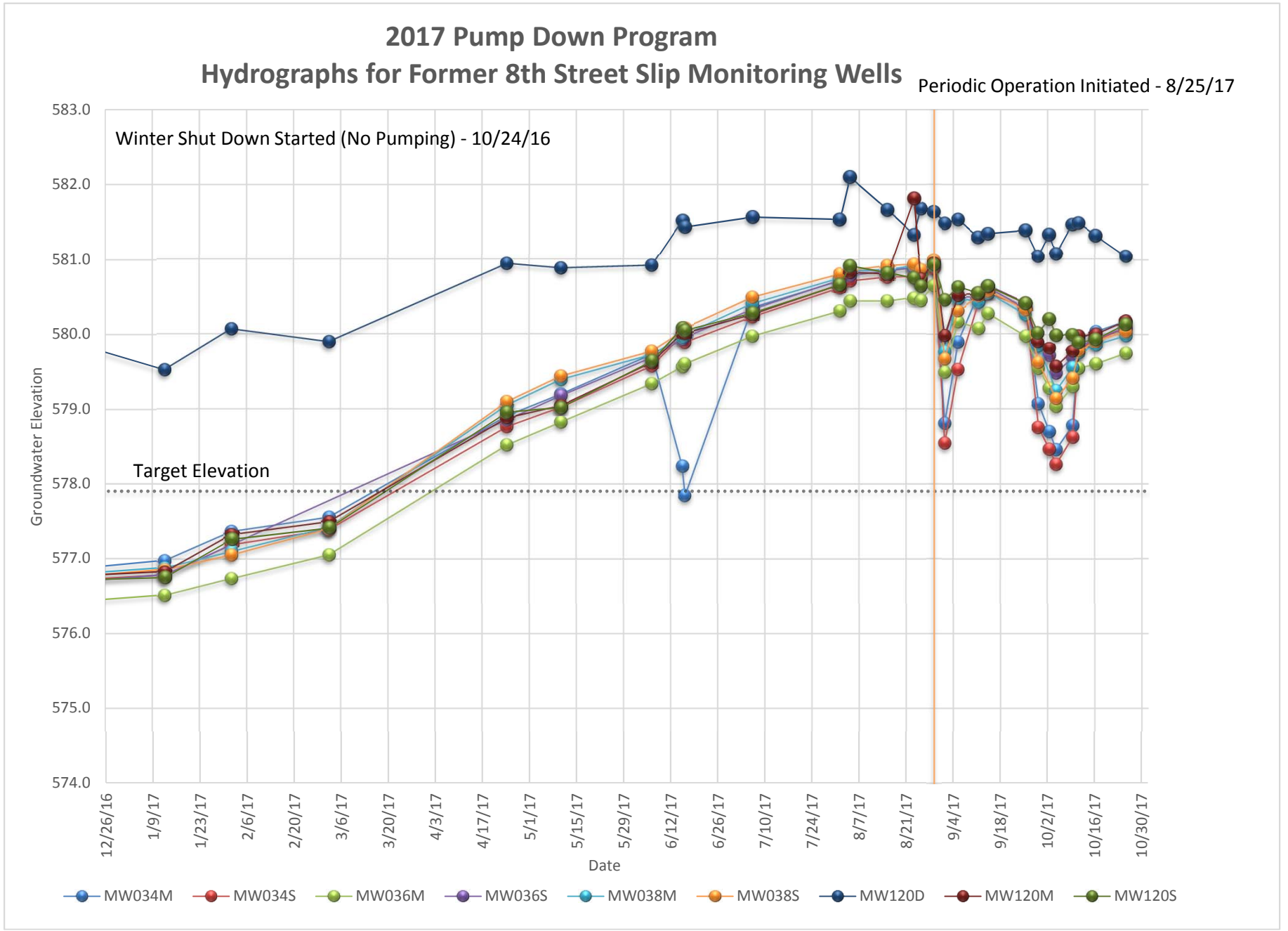
MW116S
MW119D
EW-10
EW-11
EW-13
EW-14

2016-2017 Pump Down Program
Hydrographs for Former 8th Street Slip Monitoring Wells




2017 Pump Down Program
Hydrographs for Former 8th Street Slip Monitoring Wells
Periodic Operation Initiated - 8/25/17
Winter Shut Down Started (No Pumping) - 10/24/16
Target Elevation
Groundwater Elevation
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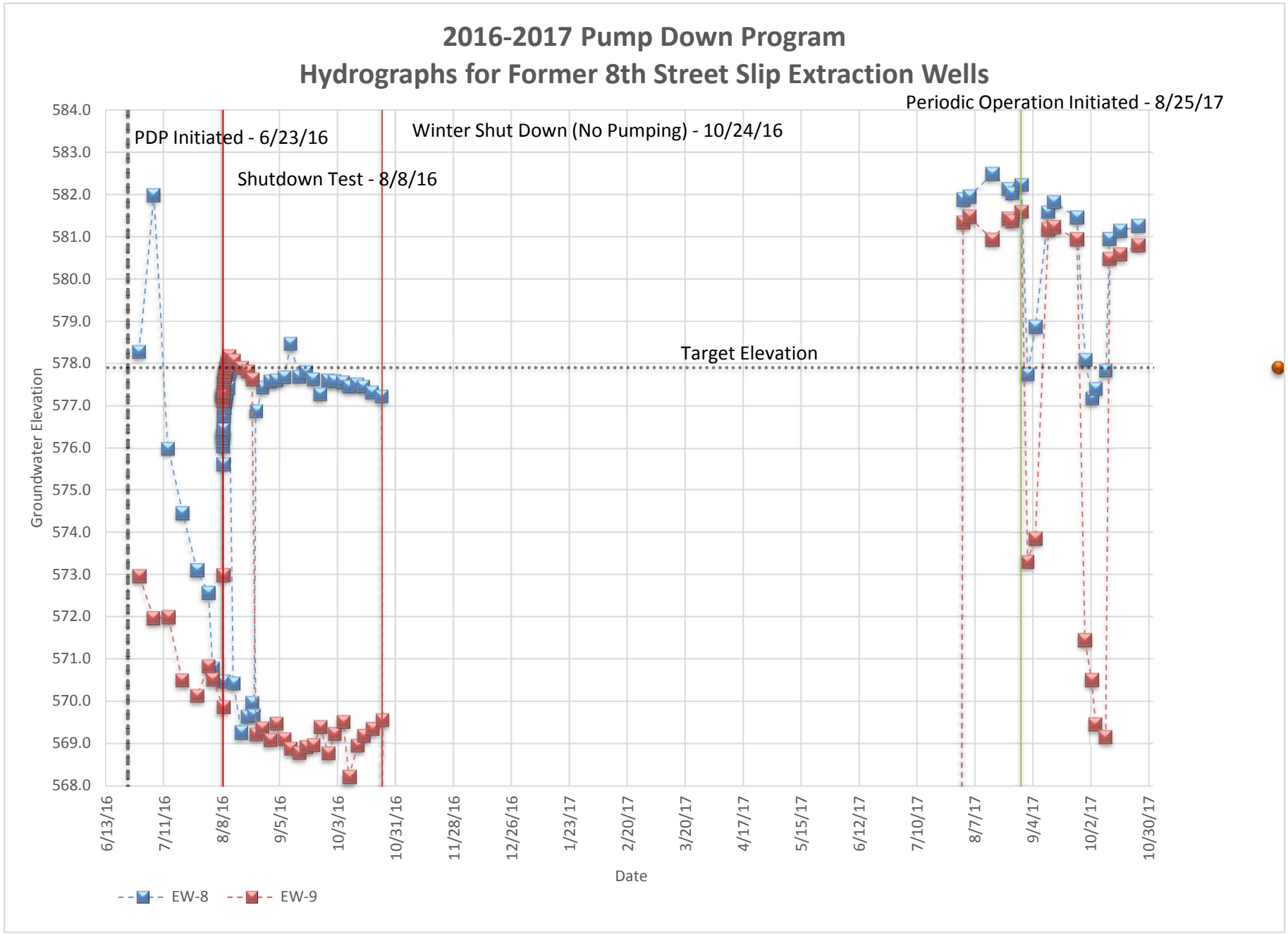
2016-2017 Pump Down Program
Hydrographs for Former 8th Street Slip Extraction Wells
Periodic Operation Initiated - 8/25/17
PDP Initiated - 6/23/16
Winter Shut Down (No Pumping) - 10/24/16
Shutdown Test - 8/8/16
Target Elevation
Groundwater Elevation
584.0
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EW-8
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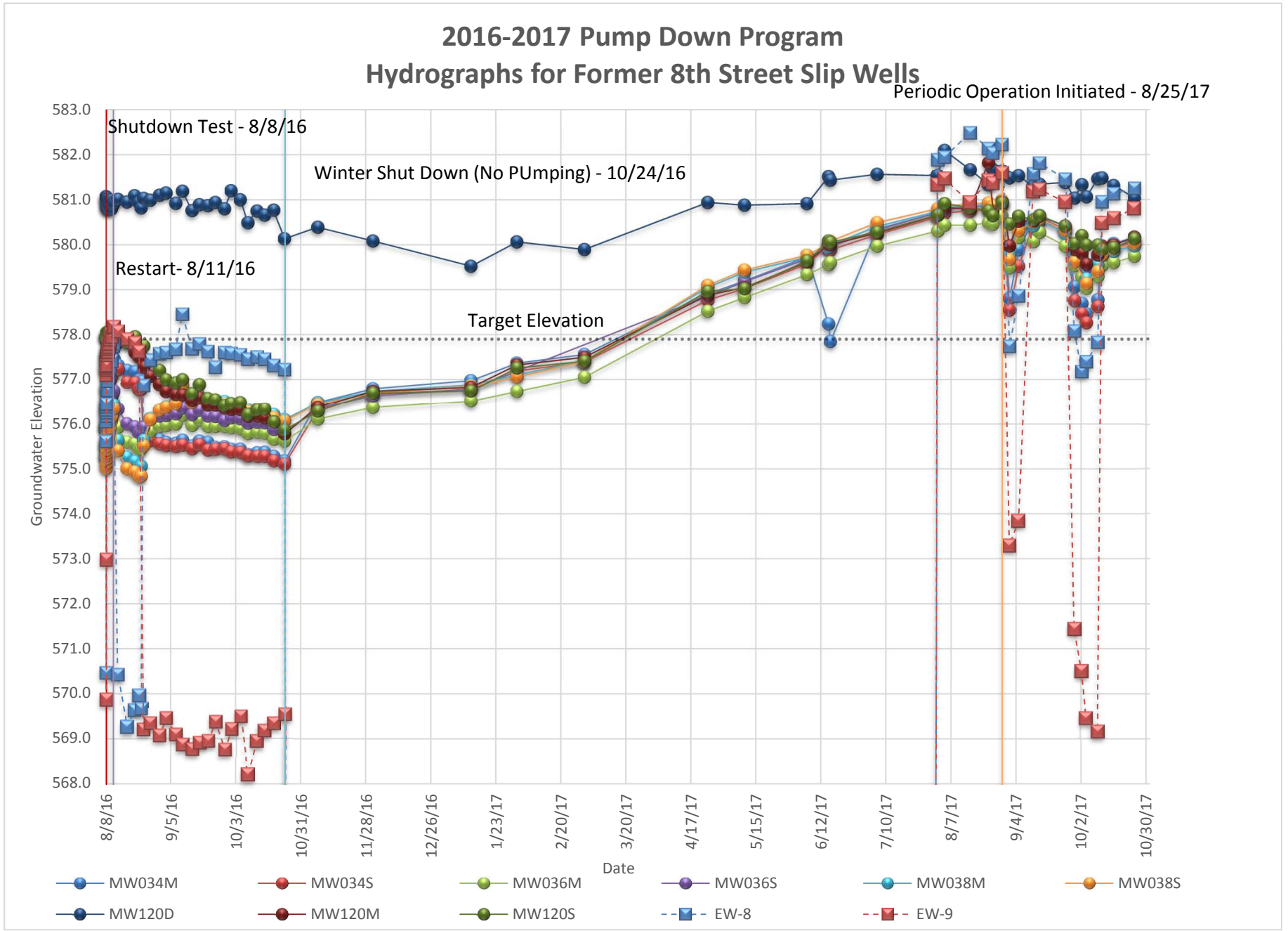
2016-2017 Pump Down Program
Hydrographs for Former 8th Street Slip Wells
Periodic Operation Initiated - 8/25/17
Shutdown Test - 8/8/16
Winter Shut Down (No PUmping) - 10/24/16
Restart- 8/11/16
Target Elevation
Groundwater Elevation
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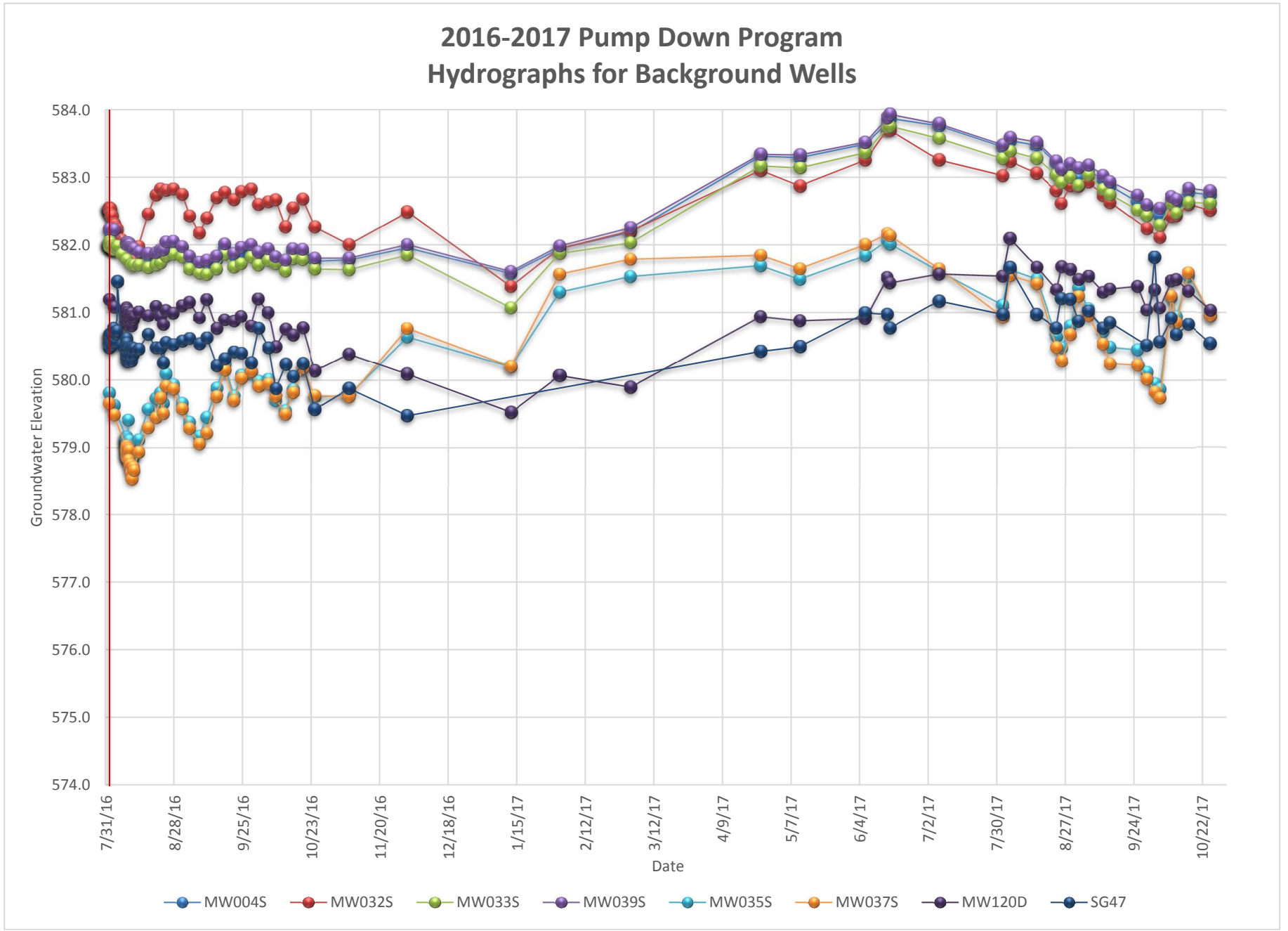
EW-9


2016-2017 Pump Down Program
Hydrographs for Background Wells
Groundwater Elevation
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MW035S
MW037S
MW120D
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Table 1
Groundwater Treatment System Testing - Pump Down Program
Total Arsenic Concentrations
Tyco Fire Products LP Site
Marinette, WI

Date	Sample ID	Salt Vault Influent Concentration	Sample ID	Slip Influent Concentration	Sample ID	Composite Influent Concentration	Sample ID	Effluent Concentration	Onsite Lab Effluent Concentration	System Test Rate* (gpm)	Volume Discharged (gallons)**
8/31/2017	20170831-SV-INF	280	20170831-SL-INF	86	20170831-COM-INF	29					
9/1/2017	20170901-SV-INF	280	20170901-SL-INF	84	20170901-COM-INF	31	20170901-EFF	2.1		0.25	13207
9/5/2017	20170905-SV-INF	290	20170905-SL-INF	84	20170905-COM-INF	16	20170905-EFF	1.6		0.25	9593
9/15/2017	20170915-SV-INF	230	20170915-SL-INF	72	20170915-COM-INF	50	20170915-EFF	0.086	0.169	0.5	51191
9/18/2017	20170918-SV-INF	270	20170918-SL-INF	68	20170918-COM-INF	110	20170918-EFF	0.1	0.153	0.5	0
9/19/2017	20170919-SV-INF	270	20170919-SL-INF	69	20170919-COM-INF	33	20170919-EFF	0.1	0.11	1	12001
9/20/2017	20170920-SV-INF	260	20170920-SL-INF	67	20170920-COM-INF	47	20170920-EFF	0.2	0.229	1	0
9/21/2017	Vault	270	Slip	70	Com Inf	22	Effluent Comp	0.32	0.352	1.5	20367
9/22/2017	Vault	270	Slip	60	Com Inf	14	Effluent	0.2	0.313	1.5	10402
9/25/2017	SV	260	Slip	59	Com Inf	30	Effluent	0.13	0.238	1.5	0
9/27/2017	20170927-SV-INF	270	20170927-SL-IINF	59	20170927-COM-INF	29	20170927-EFF	0.27	0.369	1.5	7321
9/29/2017	20170929-SV-INF	280	20170929-SL-INF	57	20170929-COM-INF	45	20170929-EFF	0.63		2	8956
10/3/2017	20171003-SV-INF	290	20171003-SL-INF	57	20171003-COM-INF	43	20171003-EFF	3		2	4050
10/4/2017	20171004-SV-INF	280	20171004-SL-INF	55	20171004-COM-INF	40	20171004-EFF	3		2	4130
10/5/2017	20171005-SV-INF	310	20171005-SL-INF	61	20171005-COM-INF	46	20171005-EFF	16		2	9292
10/6/2017							20171006-EFF	2.4		2.5	

Results expressed in milligrams per liter
* - approximate influent rate contributed to groundwater treatment system from each cell at time of effluent sample collection
** - volume discharge since prior sampling event
gpm - gallons per minute
ID - identification

Composite Influent represents concentration of influent resulting from incorporation of water from Extraction Wells 1, 4, 5, 6, and 7, former Slip water and and former Salt Vault water.
- effluent concentration exceeds WPDES discharge criteria (.68 mg/l)