NOVA Consultants, Inc.

Professional Engineering, Environmental, and Energy Services

21580 Novi Road, Suite 300
Novi, Michigan 48375
(248) 347-3512 • FAX (248) 347-4152

May 10, 2016

Mr. Christopher Barnes, P.E.
City Engineer
City of Portage Transportation/Utilities Department
7719 S. Westnedge Avenue
Portage, MI 49002

Dear Mr. Barnes:

NOVA Consultants, Inc. (NOVA) conducted two groundwater elevation events, one IDEP observation event and one stormwater outfall sampling event as part of the ongoing City of Portage Retention Basins and Surface Water Monitoring Program in 2015. This report presents our findings, data collected, and remarks regarding the project.

GROUNDWATER ELEVATION EVENTS

Two groundwater elevation events were conducted on July 28, 2015 and October 5, 2015. A total of twenty-three (23) semi-annual testing locations (34 monitoring wells) were visited during each groundwater elevation event pursuant to the City of Portage Project Concept Statement. Groundwater elevations were obtained utilizing a groundwater water level indicator. Monitoring wells were allowed to stabilize prior to elevation readings by opening the monitoring wells for a period of time prior to collecting the elevation readings.

The following table identifies the monitoring well locations which were visited during the July 28, 2015 and October 5, 2015 groundwater elevation collection events.

Basin	Location	Well
53	4731 Andover Wood Ct	MW-1, MW-2
37	8160 Black Forest	MW-1, MW-2, Staff Gauge
29	2917 Bynmawr	MW-1
9	3210 Coachlite	MW-1
13	2217 Hickory Point	MW-1, MW-2
20	6140 Marlow-Milam Woods	MW-1
5	6101 Oakland Dr. – Fire Station	MW-1, MW-2, MW-3, MW-4
16	7550 Oakland Dr. – Park	MW-1
18	1105 E. Centre – Greenhouse	MW-1
21	10137 S. Westnedge Access	MW-1
26	1326 Schuring Rd	MW-1, MW-2, MW-3
40	10270 Shuman	MW-1, MW-2
2	Sturgeon Bay @I-94	MW-1
10	6700 Sunburst	MW-1
42	8420-8440 Valleywood Dr.	MW-1
6	NE Corner VanHoesen & Ohio	MW-1
7	SW Corner VanHoesen & Ohio	MW-1
22	3655 Westcove	MW-1
3	2220 Winters Drive	MW-1
31	Lori Court – Access 8905 Lori	MW-1
86	North Montego Bay	MW-1, MW-2
86	7235 Jamaica Lane (N. Montego Bay)	MW-1
49	7919 Wapiti	MW-4

Data summary tables which show depth to groundwater and groundwater elevations are contained in **Appendix A** as **Tables 1 & 2**. Groundwater depth and elevation was unable to be collected at monitoring wells MW-1 at Valleywood Dr., MW-1 at Lori Court and MW-1 at Sturgeon Bay due to the monitoring well locations not being determined. Monitoring well MW-2 at the Black Forest location did not have well lid or skirting. Monitoring well MW-4 at 6101 Oakland Drive stickup casing was heavily rusted and has compromised the well casing.

Groundwater Contour Maps

Three monitoring points are needed to generate a localized groundwater contour map. Groundwater contour maps were generated for the Oakland Drive Fire Station location and the

Shuring Drive location. Groundwater contour maps for the groundwater elevation collection events are contained in **Appendix B** of this report as **Figures 1-4.**

Groundwater contours show groundwater to flow in a Northwesterly direction at the Oakland Drive Fire Station location and in a North-Northwesterly direction at the Shuring Drive location.

Graphs Plotting Water Level vs. Time

Graphs plotting water level versus time for all the monitoring wells visited during the 2015 semi-annual monitoring events are contained in **Appendix C** of this report.

Generally, the graphs show groundwater elevations declining in 2015 compared to (recent) historical groundwater levels. However, monitoring well MW-2 at the Black Forest location and monitoring well MW-1 at the N. Montego Bay location were observed at their highest elevation on July 28, 2015, since monitoring began.

STORMWATER OUTFALL SAMPLING OVERVIEW

Four out of the five sampling locations were sampled on October 15, 2015. National Pollutant Discharge Elimination (NPDES) location 16SES1 located near 7901 Shaver Road was unable to be sampled due to the outfall pipe being dry. The following locations were sampled during the October 15, 2015 sampling event:

NPDES Outfall	Location	Pipe Diameter
01SES1	East of Berwick Street	36"
16NWS2	Behind 1223 Woodland Ave	36"
16SES1	7901 Shaver Road	36"
21NWS3	865 Lenox Drive	36"
15NWS1	7320 Garden Lane	72"

All samples collected during the sampling event were discrete, grab samples and are not necessarily representative of "first-flush" conditions at each outfall location. Stormwater samples were sent to an independent analytical laboratory within 24-hours of the collection time for the analysis of total dissolved nitrogen, total phosphorus, total suspended solids, and E.coli. Field

measurements of dissolved oxygen, temperature, pH, and specific conductivity were recorded at each sample location utilizing a low-flow groundwater sampling cell and meter.

Analytical Results

All field measured data and analytical laboratory results are summarized in **Table 3** in **AppendixA** of this report. Water temperatures ranged from 10.4°C to 10.92°C, dissolved oxygen ranged from 23.1% to 71.6%, pH ranged from 6.94 to 7.73, and specific conductivity ranged from 400 us/cm to 1,100 us/cm.

Reported total phosphorus concentrations ranged from 0.042 mg/L to 0.65 mg/L. The U.S. Environmental Protection Agency's (EPA) National Urban Runoff Program (NURP) reported an event mean concentration (EMC) for total phosphorus at 0.47 mg/L, 0.24 mg/L, and 0.33 mg/L for residential, commercial and mixed urban settings, respectively.

The stormwater total phosphorus analytical results for outfalls 16NWS2, and 21NWS3 were below the NURP EMC values. The total phosphorus analytical results for outfall 01SES1 was above the NURP EMC values for commercial and mixed urban settings, and below the NURP EMC values for residential settings. The total phosphorus analytical results for outfall 15NWS1 was above the NURP EMC values for all settings.

Reported total nitrate and total nitrite concentrations ranged from less than 0.10 mg/L to 1.0 mg/L. Total nitrogen stormwater EMCs reported in the NURP study were 3.31 mg/L, 2.11 mg/L, and 1.91 mg/L for residential, commercial and mixed urban settings, respectively. The stormwater total nitrogen analytical results were all below the NURP EMC values.

Concentrations of total suspended solids in the collected stormwater outfall samples ranged from 1.3 mg/L to 110 mg/L. The NURP reported stormwater runoff EMCs for total suspended solids at 140 mg/L, 91 mg/L, and 102 mg/L for residential, commercial and mixed urban settings, respectively. The stormwater total suspended solids analytical results for outfalls 01SES1, 16NWS2, and 21NWS3 were below NURP EMC values. The stormwater total suspended solids for outfall 15NWS1 was above NURP EMC values for commercial and mixed urban settings and

below the NURP EMC values for residential settings.

Contaminant Concentration versus Time

The concentration of contaminants over time is summarized in **Appendix D** of this report.

RECOMMENDATIONS

The current sampling approach may not provide analytical concentrations fully representative of an entire stormwater event. Stormwater outfall conditions are highly variable and dependent on rainfall volume, local variability in rainfall patterns, previous rainfall amounts, and peak rainfall timing in relation to sample collection. NOVA would recommend conducting seasonal sampling of the outfall instead of annually sampling. Seasonal sampling of the outfalls, such as a sampling event in spring, summer, and early winter, would capture more representative samples over the year. Results could then be more closely connected to rainfall and land cover, with relationships established that better predict outflows, pollutant concentrations and loads.

To ensure correct gauging of each monitoring well, NOVA recommends to the City of Portage to collect latitude and longitude data for each groundwater monitoring well in order to quickly locate the wells for future gauging events. NOVA also recommends abandoning MW-2 and possible reinstalling at 8160 Black Forest due to the monitoring well sustaining damage during grass cutting activities at the site.

Three monitoring wells (8420 Valleywood Dr., Sturgeon Bay @I-94 and Lori Court – Access 8905 Lori) were unable to be located during the two gauging events. NOVA suggests removing them from the list of monitoring wells which are required to be sampled during the semi-annual gauging events.

NOVA recommends that the City of Portage implement best management practices (BMPs) to treat pollutants from transportation infrastructure, maintenance areas, storage yards, sand and salt storage areas, and waste transfer stations.

We hope this report meets with your current needs. If the City of Portage wishes to discuss the recommendations presented in this report NOVA would be happy to present a further detailed work plan and estimated cost. If you have any questions regarding the sampling summary, groundwater elevation collection, or any other work which was performed during the annual monitoring, please contact our office at (248) 347-3512.

Thank you.

Sincerely,
NOVA Consultants, Inc.

Brian Finley
Staff Scientist

APPENDIX A
GW ELEVATION TABLES &
CHEM ANALYSIS

Groundwater Elevation Data Summary July 28, 2015 City of Portage Stormwater Retention Basin Monitoring

Basin Location	Basin Number	Monitoring Well	Total Well Depth (ft)	Top of Casing Elevation (ft)	Depth to Water (ft)	Water Level Elevation (ft)	Observations & Notes
4731 Andover Wood Ct.	53	MW-1	35.81	901.09	29 91	871.18	
4731 Andover Wood Ct.	53	MW-2	27 51	901 11	22 82	878 29	
8149 Black Forest	37	MW-1	16.38	861.32	7.35	853.97	
8149 Black Forest*	37	MW-2	16 34	859 71	5 01	854 7	Needs a new well cover Cover and skirting is missing
8149 Black Forest	37	Staff Gauge	N/A	N/A	0 9	N/A	
2917 Bynnawr	29	MW-1	66 92	923 06	60 7	862.36	
3210 Conchlete	9	MW-1	35.06	897.25	30 85	866.4	
2217 Hickory Point	13	MW-1	19 17	874 54	13 02	861 52	
2217 Hickory Point	13	MW-2	32	892.89	DRY	#VALUE!	Located outside on the the west side of fence
6140 Marlow-Milham Woods	20	MW-1	54 33	902 92	47 54	855 38	
6101 Oakland Drive-Fire Station	5	MW-1	60.94	908 92	50.43	858.49	
6101 Oakland Drive-Fire Station	5	MW-2	60.75	910 79	52.39	858 4	
6101 Oakland Drive-Fire Station	5	MW-3	59.79	907.85	49.13	858.72	
6101 Oakland Drive-Fire Station	5	MW-4	51 48	902 59	43 2	859 39	
7750 Oakland Drive - Park	16	MW-1	14.67	869.43	9.88	859.55	
1105 E. Centro-Greenhouse	18	MW-1	34 13	874 16	24 98	849 18	
10137 S. Westnedge	21	MW-1	22.1	872.74	16.49	856.25	
1326 Schuring Rd	26	MW-1	12 83	861 57	6 12	855 45	
1326 Schuring Rd	26	MW-2	13 9	862 91	8.51	853 8	
1326 Schuring Rd	26	MW-3	12.1	862 09	10 33	851 76	
10270 Shuman	40	MW-1	13.04	864.33	4 98	859 35	
10270 Shuman	40	MW-2	13 88	863 31	5 43	857 88	
Sturgeon Bay	2	MW-1	60.57	920.69		920.69	CNF
6700 Sunburst	10	MW-1	42	905 66	35 38	870 28	
3420 Valleywood Dr.	42	MW-1	7.75	855.66		855 66	cnf
VanHoesen-Ohio (NE)	6	MW-1	21 91	863 17	13 89	849 28	
VanHoesen-Ohio (SW)	7	MW-1	18	860.54	11.11	849.43	
3655 Westcove	22	MW-1	37 1	900 61	33	867 61	
2220 Winters Dr	3	MW-1	33.2	866.55	23 89	842.66	
8905 Lori Ct.	31	MW-1	28 33	889 01		889 01	CNF
N. Montego Bay	86	MW-1	15.2	864.38	11.54	852.84	Lock removed
7235 Jamaica Lane (N Montego Bay)	86	MW-4	11 07	859 4	7.21	852 19	7235 Jamaica Lane
7919 Wapiti	49	MW-1	15.25	863.01	8.7	854 31	
7919 Wapiti	49	MW-2	15 02	863 41	8 19	855 22	

Groundwater Elevation Data Summary October 5, 2015 - City of Portage Stormwater Retention Basin Monitoring

Basin Location	Basin Number	Monitoring Well	Total Well Depth (ft)	Top of Casing Elevation (ft)	Depth to Water (ft)	Water Level Elevation (ft)	Observations & Notes
4731 Andover Wood Ct.	53	MW-1	35.81	901.09	29.68	871.41	
4731 Andover Wood Ct.	53	MW-2	27.51	901.11	22.53	878.58	
8149 Black Forest	37	MW-1	16.38	861.32	7.49	853.83	
8149 Black Forest*	37	MW-2	16.34	859.71	6.98	852.73	Needs a new well cover. Cover and skirting is missing
8149 Black Forest	37	Staff Gauge	N/A	N/A	1.7	N/A	
2917 Byrnawr	29	MW-1	66.92	923.06	61	862.06	
3210 Conchita	9	MW-1	35.06	897.25	31.23	866.02	
2217 Hickory Point	13	MW-1	19.17	874.54	13.54	861	
2217 Hickory Point	13	MW-2	32	892.89	DRY	#VALUE!	Located outside on the the west side of fence
6140 Marlow-Milham Woods	20	MW-1	54.33	902.92	49.36	853.56	
6101 Oakland Drive-Fire Station	5	MW-1	60.94	908.92	50.73	858.19	
6101 Oakland Drive-Fire Station	5	MW-2	60.75	910.79	52.67	858.12	
6101 Oakland Drive-Fire Station	5	MW-3	59.79	907.85	49.45	858.4	
6101 Oakland Drive-Fire Station	5	MW-4	51.48	902.59	43.5	859.09	
7950 Oakland Drive - Park	16	MW-1	14.67	869.43	10.22	859.21	
1105 E. Centre-Greenhouse	18	MW-1	34.13	874.16	23.39	850.77	
10137 S. Westnedge	21	MW-1	22.1	872.74	17.39	855.35	
1326 Schuring Rd	26	MW-1	12.83	861.57	5.48	856.09	
1326 Schuring Rd.	26	MW-2	13.9	862.31	6.83	855.48	
1326 Schuring Rd	26	MW-3	12.1	862.09	9.39	852.7	
10270 Shuman	40	MW-1	13.04	864.33	6.83	857.5	
10270 Shuman	40	MW-2	13.88	863.31	6.24	857.07	
Sturgeon Bay	2	MW-1	60.57	920.69		920.69	CNF
6700 Sunburst	10	MW-1	42	905.66	35.66	870	
8420 Valleywood Dr.	42	MW-1	7.75	855.66		855.66	cnf
VanHoosen-Ohio (NE)	6	MW-1	21.91	863.17	14.33	848.84	
VanHoosen-Ohio (SW)	7	MW-1	18	860.54	11.55	848.99	
3655 Westcove	22	MW-1	37.1	900.61	33.3	867.31	
2220 Winters Dr.	3	MW-1	33.2	866.55	25.11	841.44	
8905 Lori Ct.	31	MW-1	28.53	889.01		889.01	CNF
N. Montego Bay	86	MW-1	15.2	864.38	12.92	851.46	Lock removed
7235 Jamaica Lane (N Montego Bay)	86	MW-4	11.07	859.4	8.37	851.03	7235 Jamaica Lane
7919 Wapiti	49	MW-1	19.25	863.01	10.04	852.97	
7919 Wapiti	49	MW-2	15.02	863.41	9.56	853.85	

Bio-Chem LABORATORIES, INC.

1049 - 28th Street SE
Grand Rapids, MI 49508
Ph: 616/248-4900
Toll Free: 800/362-LABS
Fax: 616/248-4904

October 22, 2015

Jeff Eckhout
NOVA Consultants
21580 Novi Rd.
Ste 300
Novi, MI 48375

TEL: (248) 347-3512
FAX (248) 347-4152

RE: Portage

Dear Jeff Eckhout: Order No.: 1510117

BIO-CHEM Laboratories, Inc. received 4 samples on 10/15/2015 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative.

If you have any questions regarding these tests results, please feel free to call.

Please note that unless otherwise instructed, residual samples will be held for sixty (60) days from the original report date. At that time, all non-hazardous samples will be disposed of in accordance with federal, state and local regulations and ordinances, and hazardous samples shall be returned to you. Please contact the laboratory within thirty (30) days if other arrangements for sample retention need to be made.

Sincerely,

Cindy Euwema

Cindy Euwema
Office Manager

Working with you to ensure a better tomorrow.

15 10117

Bio-Chem LABORATORIES, INC.

Chain of Custody

1049 28th Street SE • Grand Rapids, MI 49508
Ph: (616) 248-4900 • Toll Free: 800-362-LABS
Fax: (616) 248-4904

Project Number

Date | Date Due

Firm Name: NOVA Consultants
Turn around time: Standard
Firm Address: 21580 Novi Rd. Ste. 300
Project Name: Portage
City, State, Zip: Novi, MI 48375
State Samples Taken From: MI
Phone: 248-347-3512
Fax: 248-347-4152
Contact Person: Jeff Eckhout

Item No.	Lab I.D.	Client Sample Number	Date Taken	Time Taken	Sample Description (sample type: water, soil, other)	Number of Containers	E. Coli	Nitrate, Nitrite	PhOS	TKN	TSS	pH, conductivity			Remarks
1		01SES1	10/15/15	1100	Water	6	X	X	X	X	X	X			
2		15NWS1	10/15/15	1200	Water	6	X	X	X	X	X	X			
3		16NWS2	10/15/15	1330	Water	6	X	X	X	X	X	X			
4		21NWS3	10/15/15	1430	Water	6	X	X	X	X	X	X			
5															
6															
7															
8															
9															
10															

15NWS1

Released by	Received by	Date	Time
[signature]	Cindy Euwema	10-15-15	3:10

Laboratory use only
☐ Blue Ice ____°
☒ Regular Ice
☐ No Coolant

Drop Off

BIO-CHEM Laboratories, Inc.

Date: *22-Oct-15*

CLIENT: NOVA Consultants
Project: Portage
Lab Order: 1510117

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collection Date	Date Received
1510117-01A	01SES1	Aqueous	10/15/2015	10/15/2015
1510117-02A	15NWS1	Aqueous	10/15/2015	10/15/2015
1510117-03A	16NWS2	Aqueous	10/15/2015	10/15/2015
1510117-04A	21NWS3	Aqueous	10/15/2015	10/15/2015

BIO-CHEM Laboratories, Inc.

Date: *22-Oct-15*

CLIENT: NOVA Consultants
Project: Portage
Lab Order: 1510117

CASE NARRATIVE

Samples are routinely analyzed using methods outlined in the following references:

(SW) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Ed.
(E) Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.
(A) Standard Methods for the Examination of Water and Wastewater, APHA, 18th Ed.
(D) Annual Book of ASTM Standards.

Specific methods utilized for this project are provided in the analytical report and are identified by the reference document abbreviation ( ) followed by the method number.

All QA/QC and sample analyses met method, laboratory and/or regulatory data quality objectives unless otherwise specified below.

No data qualifications required.

BIO-CHEM Laboratories, Inc.

Date: *10/22/2015*

ANALYTICAL REPORT

CLIENT: NOVA Consultants
Lab Order: 1510117
Project: Portage
Lab Sample ID: 1510117-01A

Project Number: N/A
Client Sample ID: 01SES1
Collection Date: 10/15/2015
Matrix: AQUEOUS

Analyses	Method Ref.	Result	Q	PQL	Units	DF	Analyst	Date
Anions by Ion Chromatography								
1. Nitrogen, Nitrate (As N)	E300.0	1.0		0.10	mg/L	1	WDM	10/16/2015
2. Nitrogen, Nitrite (As N)	E300.0	< 0.1		0.10	mg/L	1	WDM	10/16/2015
Coliform by Membrane Filtration								
1. Escherichia Coli	H10029	< 1.0		1.0	CFU/100 mL	1	SCL	10/15/2015
Total Kjeldahl Nitrogen								
1. Nitrogen, Total Kjeldahl (TKN)	E351.4	2.0		0.10	mg/L	1	SCL	10/16/2015
Conductance								
1. Specific Conductance	E120.1	750		1.0	µmhos/cm	1	BDW	10/15/2015
pH (Potentiometric)								
1. pH	E150.1	6.94		0	pH units	1	BDW	10/15/2015
Phorphorus by UV/VIS Spec.								
1. Phosphorus, Total (As P)	E365.3	0.38		0.010	mg/L	1	RHS	10/22/2015
Suspended Solids (Gravimetric)								
1. Suspended Solids (Residue, Non-Filterable)	E160.2	2.8		1.0	mg/L	1	BDW	10/21/2015
Total Nitrogen by Calculation								
1. Nitrogen, Total	NA	3.0		0	mg/L	1	RHS	10/22/2015

Definitions: PQL - Practical Quantitation Limit
DF - Dilution Factor

Qualifiers (Q): J - Detected below PQL but above MDL. Estimated
S - Spike Recovery Outside Acceptance Limits
B - Analyte detected in associated Method Blank
N - See case narrative for explanation

This report shall not be reproduced except in full, without the written approval of BIO-CHEM Laboratories, Inc.

Note: The sample results reported are based on the sample aliquot(s) tested.

BIO-CHEM Laboratories, Inc.

Date: *10/22/2015*

ANALYTICAL REPORT

CLIENT: NOVA Consultants
Lab Order: 1510117
Project: Portage
Lab Sample ID: 1510117-02A

Project Number: N/A
Client Sample ID: 15NWS1
Collection Date: 10/15/2015
Matrix: AQUEOUS

Analyses	Method Ref.	Result	Q	PQL	Units	DF	Analyst	Date
Anions by Ion Chromatography								
1. Nitrogen, Nitrate (As N)	E300.0	< 0.1		0.10	mg/L	1	WDM	10/16/2015
2. Nitrogen, Nitrite (As N)	E300.0	< 0.1		0.10	mg/L	1	WDM	10/16/2015
Coliform by Membrane Filtration								
1. Escherichia Coli	H10029	< 1.0		1.0	CFU/100 mL	1	SCL	10/15/2015
Total Kjeldahl Nitrogen								
1. Nitrogen, Total Kjeldahl (TKN)	E351.4	5.3		0.10	mg/L	1	SCL	10/16/2015
Conductance								
1. Specific Conductance	E120.1	1,100		1.0	µmhos/cm	1	BDW	10/15/2015
pH (Potentiometric)								
1. pH	E150.1	7.11		0	pH units	1	BDW	10/15/2015
Phorphorus by UV/VIS Spec.								
1. Phosphorus, Total (As P)	E365.3	0.65		0.010	mg/L	1	RHS	10/22/2015
Suspended Solids (Gravimetric)								
1. Suspended Solids (Residue, Non-Filterable)	E160.2	110		1.0	mg/L	1	BDW	10/21/2015
Total Nitrogen by Calculation								
1. Nitrogen, Total	NA	5.3		0	mg/L	1	RHS	10/22/2015

Definitions: PQL - Practical Quantitation Limit
DF - Dilution Factor

Qualifiers (Q): J - Detected below PQL but above MDL; Estimated
S - Spike Recovery Outside Acceptance Limits
B - Analyte detected in associated Method Blank
N - See case narrative for explanation

This report shall not be reproduced except in full, without the written approval of BIO-CHEM Laboratories, Inc.

Note: The sample results reported are based on the sample aliquot(s) tested.

BIO-CHEM Laboratories, Inc.

Date: *10/22/2015*

ANALYTICAL REPORT

CLIENT: NOVA Consultants
Lab Order: 1510117
Project: Portage
Lab Sample ID: 1510117-03A

Project Number: N/A
Client Sample ID: 16NWS2
Collection Date: 10/15/2015
Matrix: AQUEOUS

Analyses	Method Ref.	Result	Q	PQL	Units	DF	Analyst	Date
Anions by Ion Chromatography								
1. Nitrogen, Nitrate (As N)	E300.0	0.77		0.10	mg/L	1	WDM	10/16/2015
2. Nitrogen, Nitrite (As N)	E300.0	< 0.1		0.10	mg/L	1	WDM	10/16/2015
Coliform by Membrane Filtration								
1. Escherichia Coli	H10029	< 1.0		1.0	CFU/100 mL	1	SCL	10/15/2015
Total Kjeldahl Nitrogen								
1. Nitrogen, Total Kjeldahl (TKN)	E351.4	1.2		0.10	mg/L	1	SCL	10/16/2015
Conductance								
1. Specific Conductance	E120.1	400		1.0	µmhos/cm	1	BDW	10/15/2015
pH (Potentiometric)								
1. pH	E150.1	7.70		0	pH units	1	BDW	10/15/2015
Phorphorus by UV/VIS Spec.								
1. Phosphorus, Total (As P)	E365.3	0.042		0.010	mg/L	1	RHS	10/22/2015
Suspended Solids (Gravimetric)								
1. Suspended Solids (Residue, Non-Filterable)	E160.2	1.6		1.0	mg/L	1	BDW	10/21/2015
Total Nitrogen by Calculation								
1. Nitrogen, Total	NA	2.0		0	mg/L	1	RHS	10/22/2015

Definitions: PQL - Practical Quantitation Limit
DF - Dilution Factor

Qualifiers (Q): J - Detected below PQL but above MDL, Estimated
S - Spike Recovery Outside Acceptance Limits
B - Analyte detected in associated Method Blank
N - See case narrative for explanation

This report shall not be reproduced except in full, without the written approval of BIO-CHEM Laboratories, Inc.

Note: The sample results reported are based on the sample aliquot(s) tested.

BIO-CHEM Laboratories, Inc.

Date: *10/22/2015*

ANALYTICAL REPORT

CLIENT: NOVA Consultants
Lab Order: 1510117
Project: Portage
Lab Sample ID: 1510117-04A

Project Number: N/A
Client Sample ID: 21NWS3
Collection Date: 10/15/2015
Matrix: AQUEOUS

Analyses	Method Ref.	Result	Q	PQL	Units	DF	Analyst	Date
Anions by Ion Chromatography								
1. Nitrogen, Nitrate (As N)	E300.0	0.77		0.10	mg/L	1	WDM	10/16/2015
2. Nitrogen, Nitrite (As N)	E300.0	< 0.1		0.10	mg/L	1	WDM	10/16/2015
Coliform by Membrane Filtration								
1. Escherichia Coli	H10029	< 1.0		1.0	CFU/100 mL	1	SCL	10/15/2015
Total Kjeldahl Nitrogen								
1. Nitrogen, Total Kjeldahl (TKN)	E351.4	0.98		0.10	mg/L	1	SCL	10/16/2015
Conductance								
1. Specific Conductance	E120.1	400		1.0	µmhos/cm	1	BDW	10/15/2015
pH (Potentiometric)								
1. pH	E150.1	7.73		0	pH units	1	BDW	10/15/2015
Phorphorus by UV/VIS Spec.								
1. Phosphorus, Total (As P)	E365.3	0.042		0.010	mg/L	1	RHS	10/22/2015
Suspended Solids (Gravimetric)								
1. Suspended Solids (Residue, Non-Filterable)	E160.2	1.3		1.0	mg/L	1	BDW	10/21/2015
Total Nitrogen by Calculation								
1. Nitrogen, Total	NA	1.8		0	mg/L	1	RHS	10/22/2015

Definitions: PQL - Practical Quantitation Limit
DF - Dilution Factor

Qualifiers (Q): J - Detected below PQL but above MDL. Estimated
S - Spike Recovery Outside Acceptance Limits
B - Analyte detected in associated Method Blank
N - See case narrative for explanation

This report shall not be reproduced except in full, without the written approval of BIO-CHEM Laboratories, Inc.

Note: The sample results reported are based on the sample aliquot(s) tested.

BIO-CHEM Laboratories, Inc. *10/22/2015*

Lab Order: 1510117
Client: NOVA Consultants
Project: Portage

ANALYTICAL DETAIL REPORT

Sample ID	Client Sample ID	Matrix	Test Name	Date Sampled	TCLP/SPLP Date	Prep Date	QC Batch	Analysis Date	Analytical Batch
1510117-01A	01SES1	Aqueous	Anions by Ion Chromatography	10/15/2015			R83019	10/16/2015	IC_A_151016A
	01SES1	Aqueous	Coliform by Membrane Filtration	10/15/2015			R83015	10/15/2015	SCW_151015A
	01SES1	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	01SES1	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	01SES1	Aqueous	pH (Potentiometric)	10/15/2015			R83006	10/15/2015	POTENTIAL_151015B
	01SES1	Aqueous	Phorphorus by UV/VIS Spec.	10/15/2015			R83048	10/22/2015	SPEC_A_151022A
	01SES1	Aqueous	Suspended Solids (Gravimetric)	10/15/2015			R83050	10/21/2015	GRAVIMETRIC_151021A
	01SES1	Aqueous	Total Kjeldahl Nitrogen	10/15/2015			R83016	10/16/2015	SCW_151016A
	01SES1	Aqueous	Total Nitrogen by Calculation	10/15/2015			R83049	10/22/2015	GRAVIMETRIC_151022A
1510117-02A	15NWS1	Aqueous	Anions by Ion Chromatography	10/15/2015			R83019	10/16/2015	IC_A_151016A
	15NWS1	Aqueous	Coliform by Membrane Filtration	10/15/2015			R83015	10/15/2015	SCW_151015A
	15NWS1	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	15NWS1	Aqueous	pH (Potentiometric)	10/15/2015			R83006	10/15/2015	POTENTIAL_151015B
	15NWS1	Aqueous	Phorphorus by UV/VIS Spec.	10/15/2015			R83048	10/22/2015	SPEC_A_151022A
	15NWS1	Aqueous	Suspended Solids (Gravimetric)	10/15/2015			R83050	10/21/2015	GRAVIMETRIC_151021A
	15NWS1	Aqueous	Suspended Solids (Gravimetric)	10/15/2015			R83050	10/21/2015	GRAVIMETRIC_151021A
	15NWS1	Aqueous	Total Kjeldahl Nitrogen	10/15/2015			R83016	10/16/2015	SCW_151016A
	15NWS1	Aqueous	Total Nitrogen by Calculation	10/15/2015			R83049	10/22/2015	GRAVIMETRIC_151022A
1510117-03A	16NWS2	Aqueous	Anions by Ion Chromatography	10/15/2015			R83019	10/16/2015	IC_A_151016A
	16NWS2	Aqueous	Coliform by Membrane Filtration	10/15/2015			R83015	10/15/2015	SCW_151015A
	16NWS2	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	16NWS2	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	16NWS2	Aqueous	pH (Potentiometric)	10/15/2015			R83006	10/15/2015	POTENTIAL_151015B
	16NWS2	Aqueous	Phorphorus by UV/VIS Spec.	10/15/2015			R83048	10/22/2015	SPEC_A_151022A
	16NWS2	Aqueous	Suspended Solids (Gravimetric)	10/15/2015			R83050	10/21/2015	GRAVIMETRIC_151021A

Lab Order: 1510117
Client: NOVA Consultants
Project: Portage

ANALYTICAL DETAIL REPORT

Sample ID	Client Sample ID	Matrix	Test Name	Date Sampled	TCLP/SPLP Date	Prep Date	QC Batch	Analysis Date	Analytical Batch
1510117-03A	16NWS2	Aqueous	Total Kjeldahl Nitrogen	10/15/2015			R83016	10/16/2015	SCW_151016A
	16NWS2	Aqueous	Total Nitrogen by Calculation	10/15/2015			R83049	10/22/2015	GRAVIMETRIC_151022A
1510117-04A	21NWS3	Aqueous	Anions by Ion Chromatography	10/15/2015			R83019	10/16/2015	IC_A_151016A
	21NWS3	Aqueous	Coliform by Membrane Filtration	10/15/2015			R83015	10/15/2015	SCW_151015A
	21NWS3	Aqueous	Conductance	10/15/2015			R83005	10/15/2015	POTENTIAL_151015A
	21NWS3	Aqueous	pH (Potentiometric)	10/15/2015			R83006	10/15/2015	POTENTIAL_151015B
	21NWS3	Aqueous	Phorphorus by UV/VIS Spec	10/15/2015			R83048	10/22/2015	SPEC_A_151022A
	21NWS3	Aqueous	Suspended Solids (Gravimetric)	10/15/2015			R83050	10/21/2015	GRAVIMETRIC_151021A
	21NWS3	Aqueous	Total Kjeldahl Nitrogen	10/15/2015			R83016	10/16/2015	SCW_151016A
	21NWS3	Aqueous	Total Nitrogen by Calculation	10/15/2015			R83049	10/22/2015	GRAVIMETRIC_151022A

APPENDIX B

GROUNDWATER CONTOUR MAPS

FIGURE 1
GROUNDWATER FLOW MAP
SCHURING ROAD-BASIN #26
PORTAGE, MI
7/28/2015

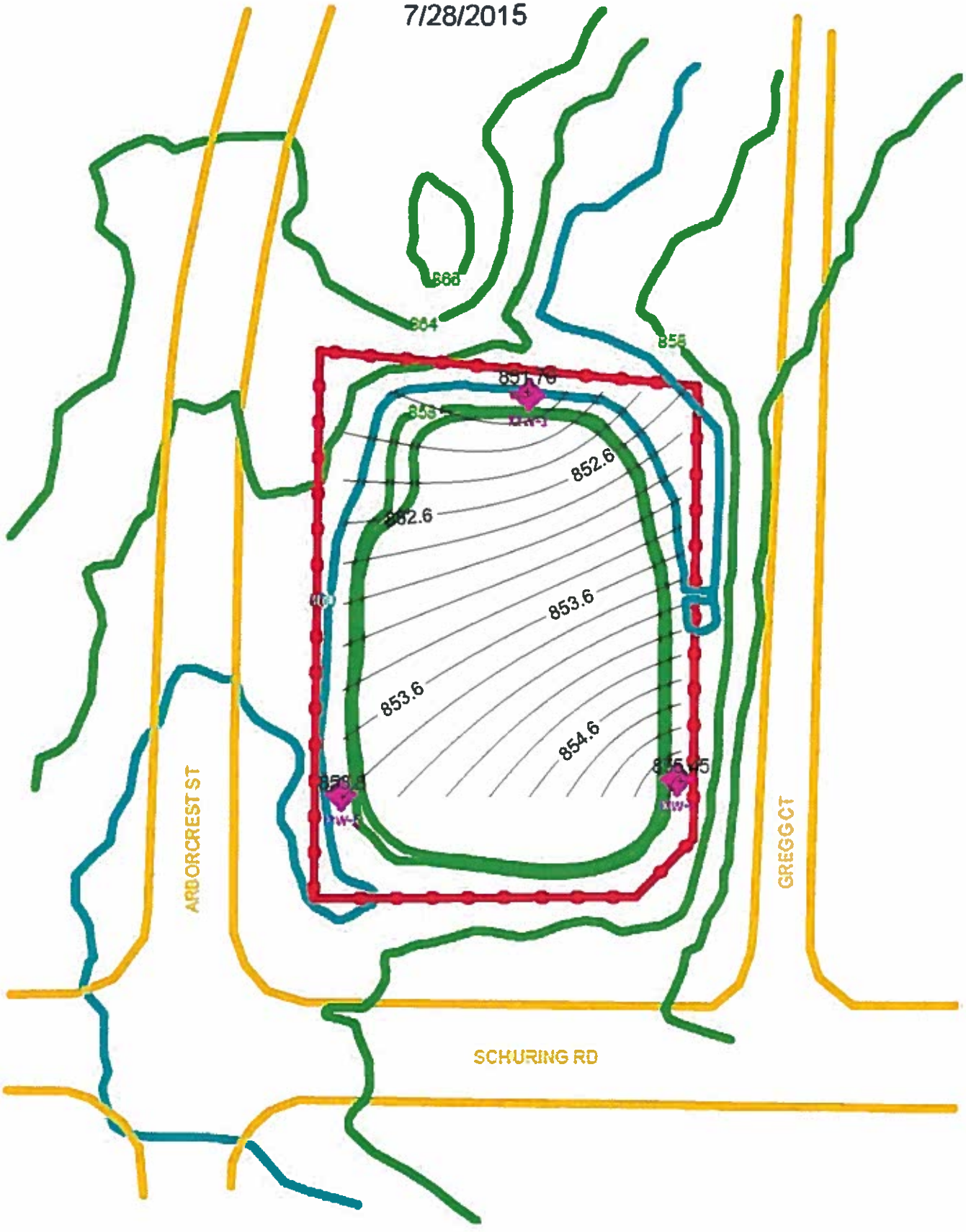


FIGURE 2

GROUNDWATER FLOW MAP
SCHURING ROAD-BASIN #26
PORTAGE, MI

10/5/2015

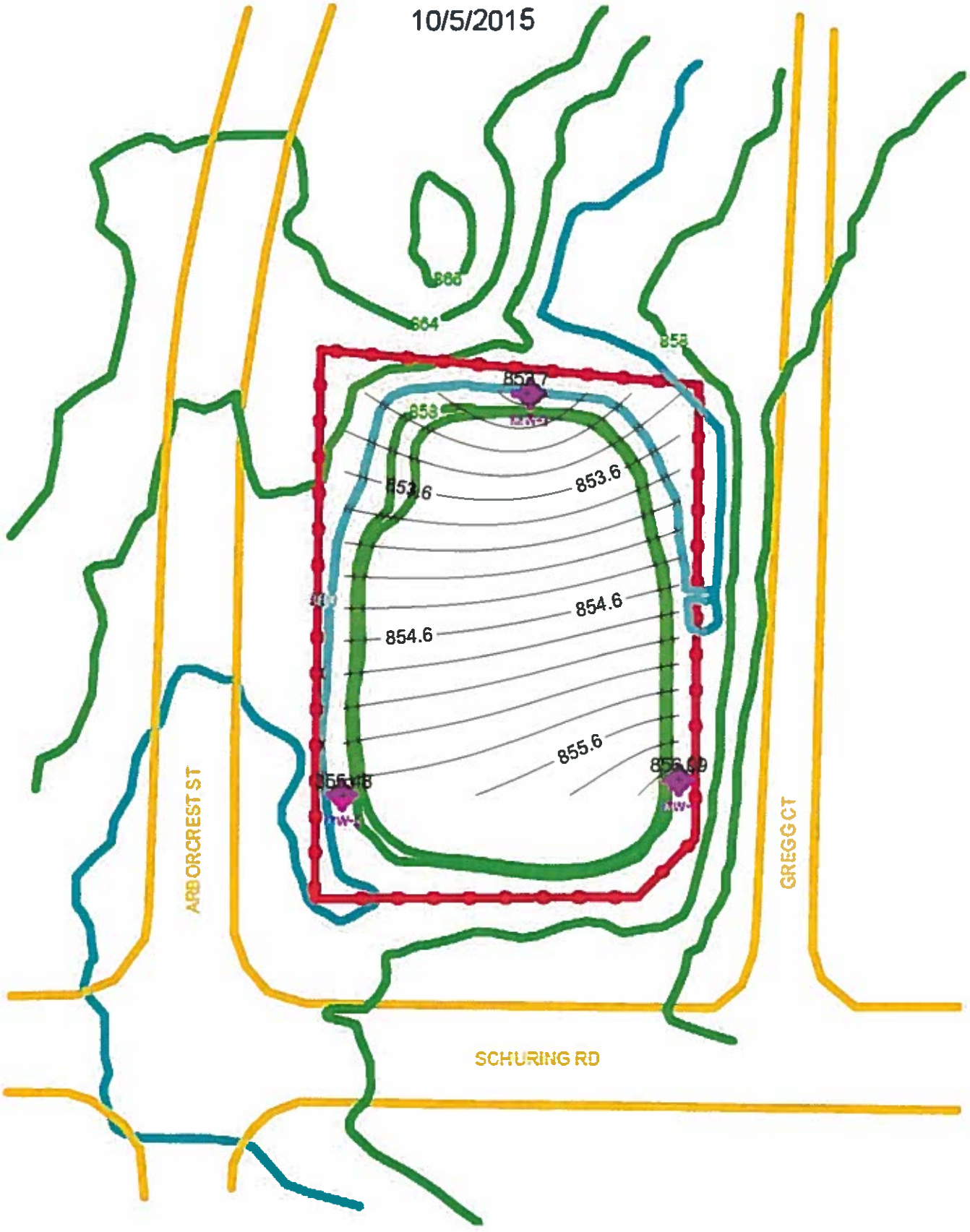


FIGURE 3
GROUNDWATER FLOW MAP
OAKLAND DRIVE FIRE STATION-BASIN #5
PORTAGE, MI

7-28-2015

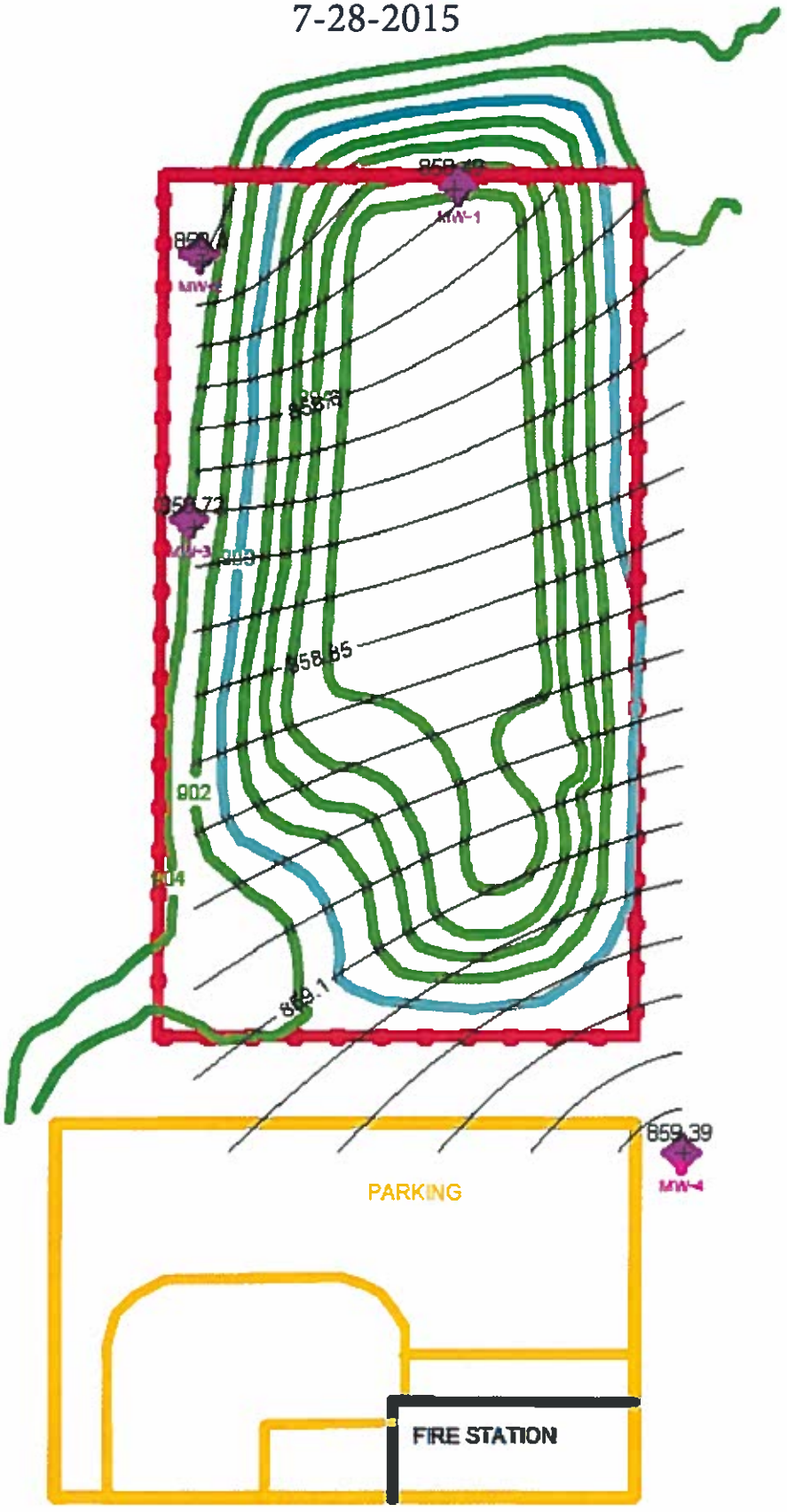
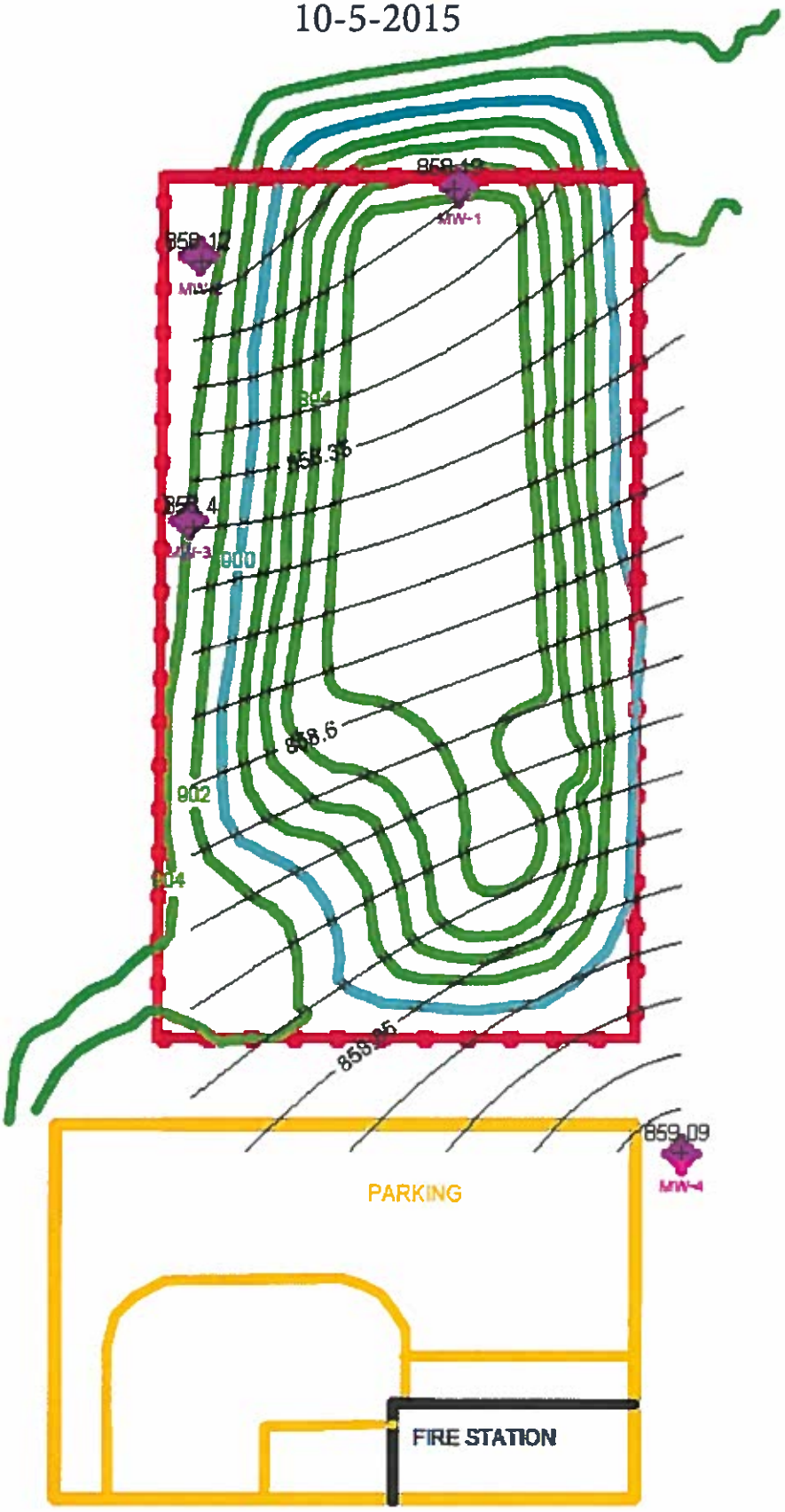


FIGURE 4
GROUNDWATER FLOW MAP
OAKLAND DRIVE FIRE STATION-BASIN #5
PORTAGE, MI

10-5-2015



APPENDIX C

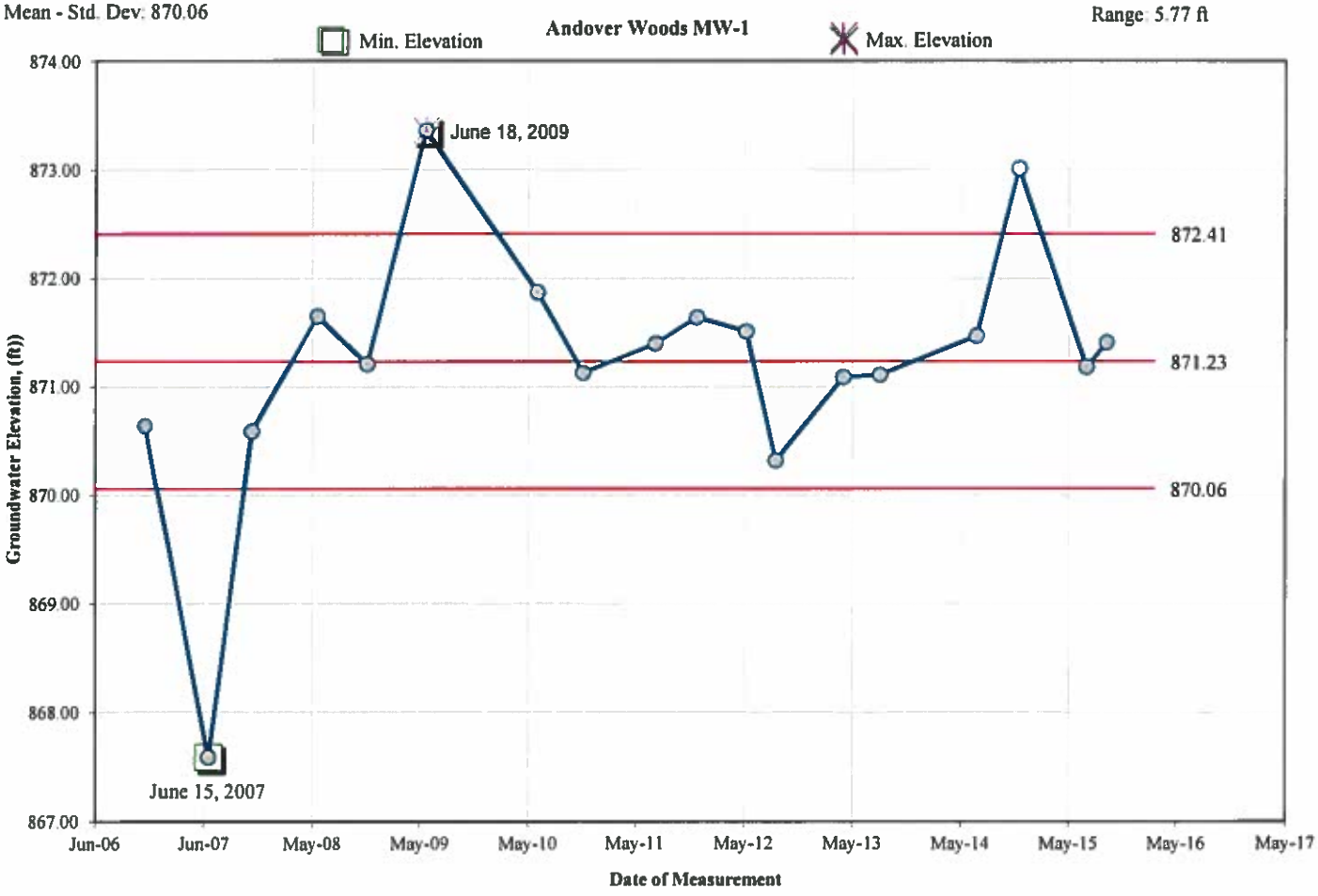
WATER LEVEL VS. TIME GRAPHS

City of Portage Retention Basins

Historic Summary of Elevation Data

Mean + Std. Dev: 872.41
Mean: 871.23
Mean - Std. Dev: 870.06

Observed Max: 873.36
Observed Min: 867.59
Range: 5.77 ft

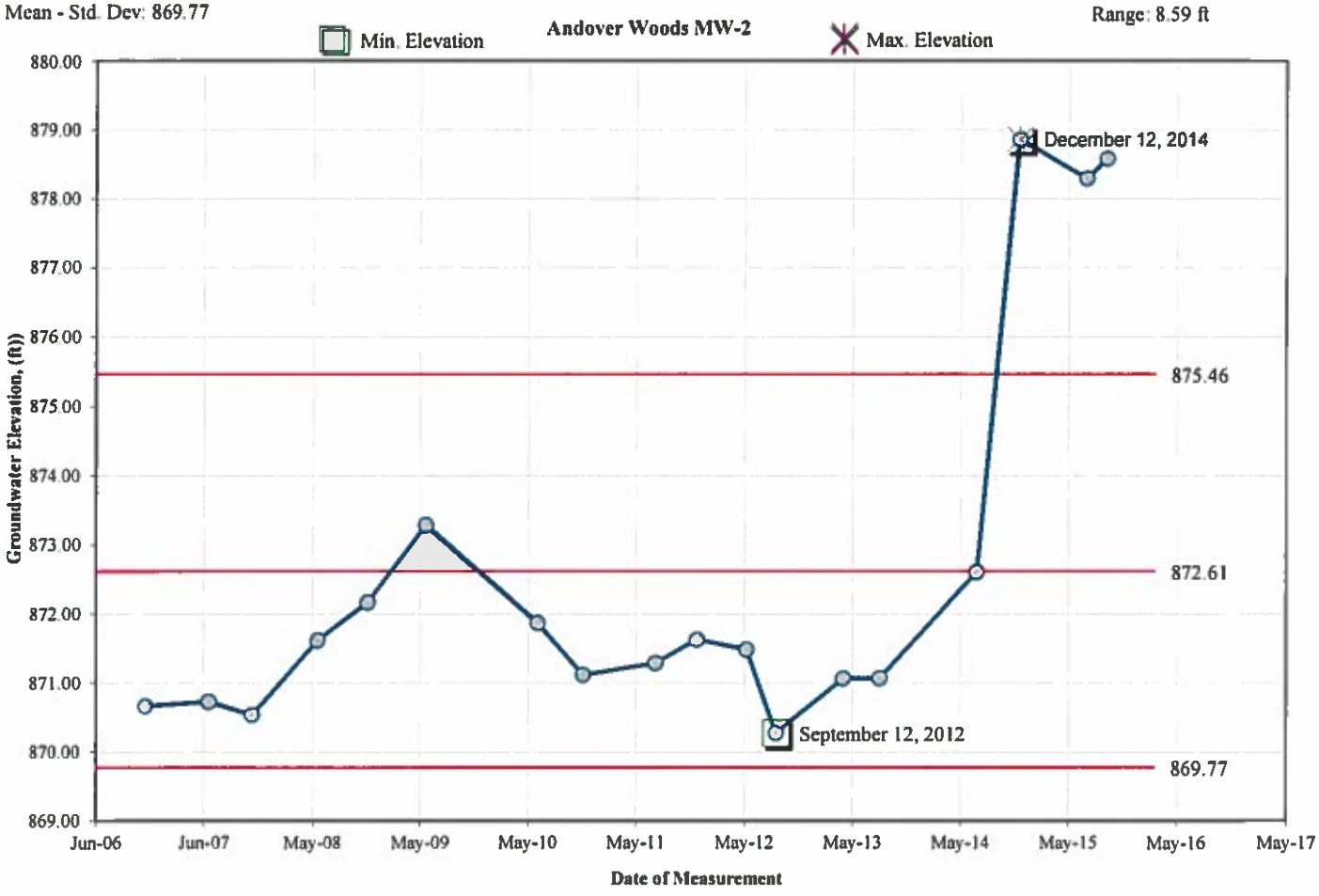


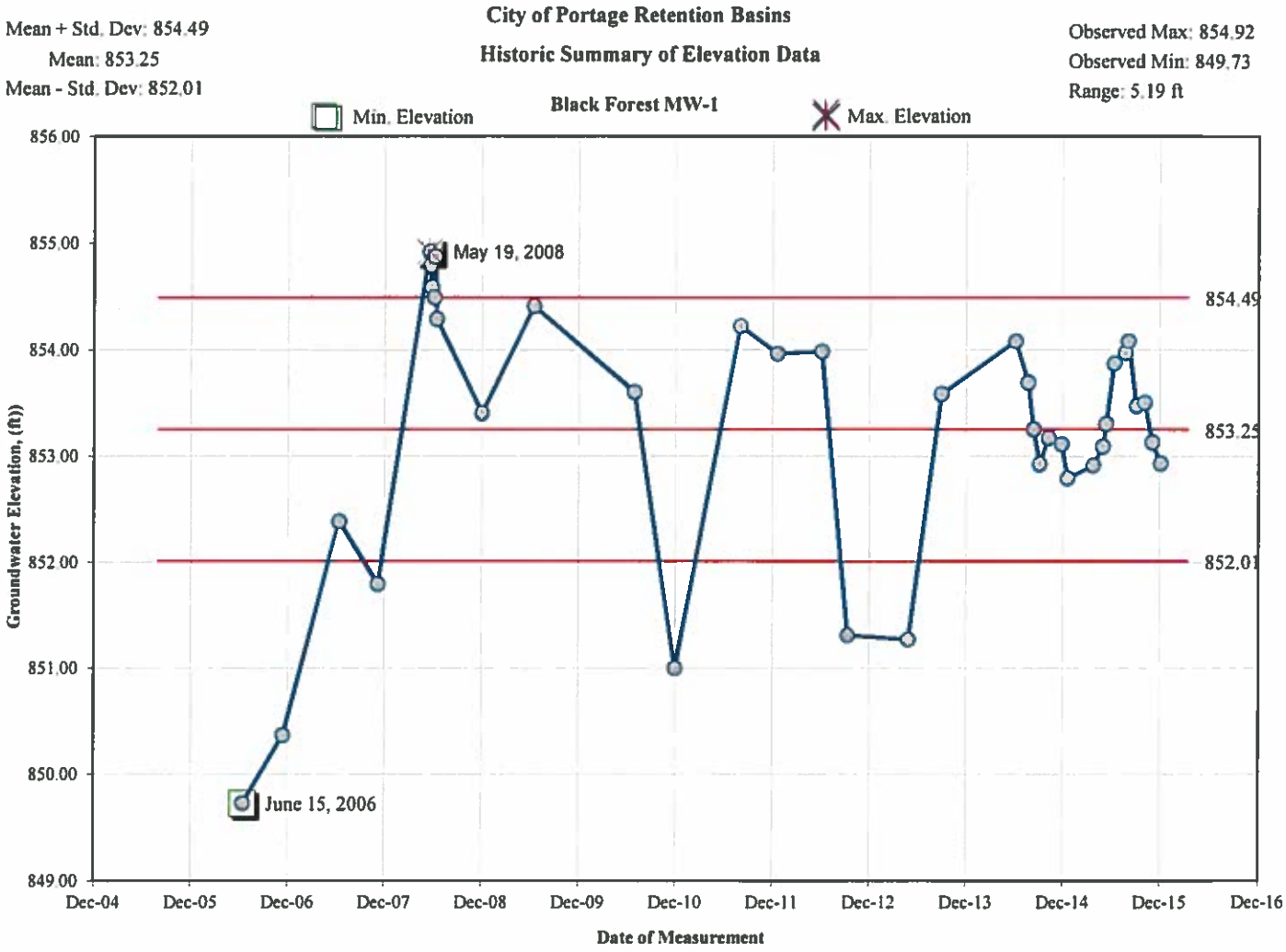
Mean + Std. Dev: 875.46
Mean: 872.61
Mean - Std. Dev: 869.77

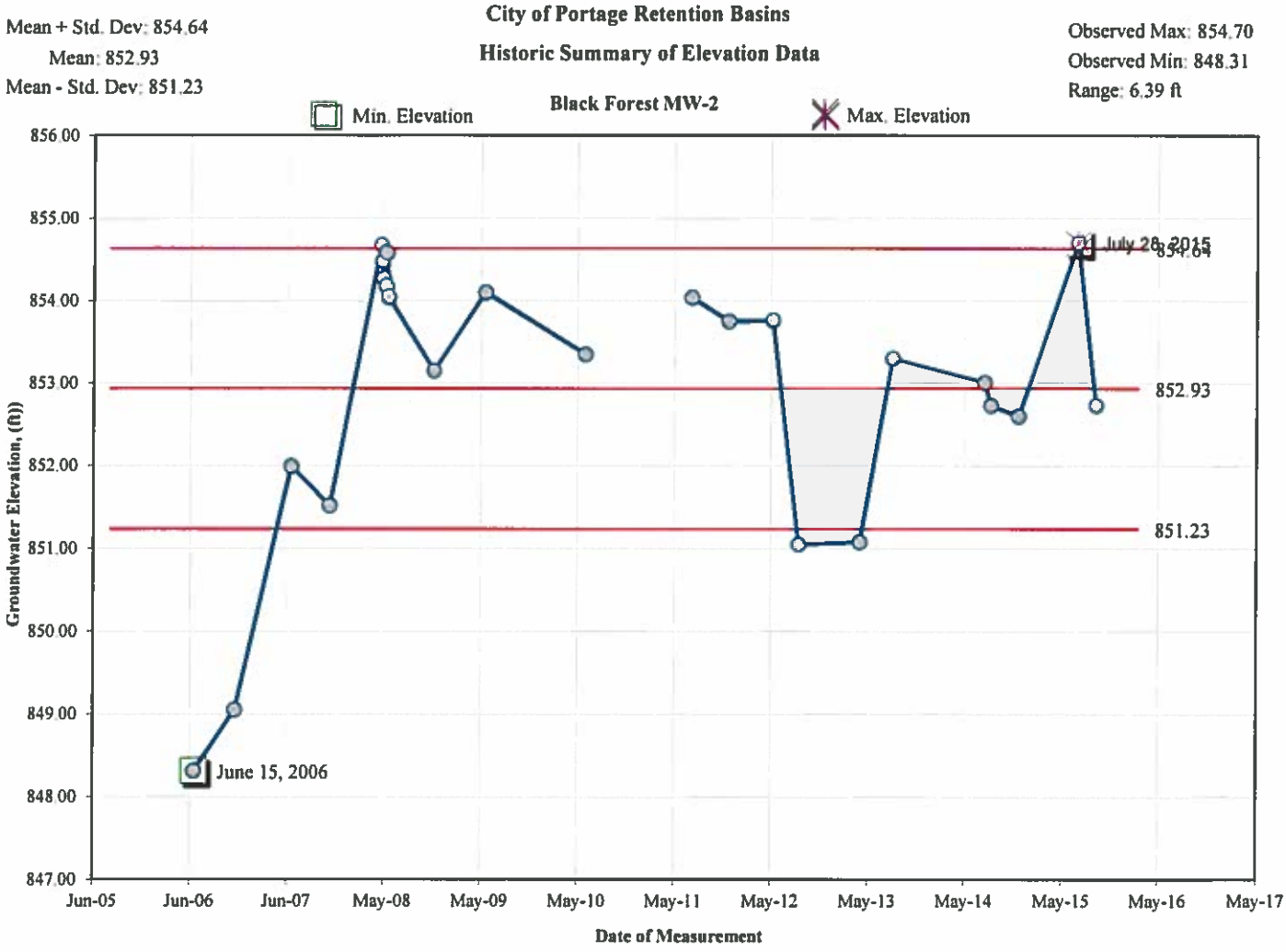
City of Portage Retention Basins

Historic Summary of Elevation Data

Observed Max: 878.86
Observed Min: 870.27
Range: 8.59 ft




City of Portage Retention Basins
Historic Summary of Elevation Data
Black Forest MW-1
Mean + Std. Dev: 854.49
Mean: 853.25
Mean - Std. Dev: 852.01
Observed Max: 854.92
Observed Min: 849.73
Range: 5.19 ft
Min. Elevation
Max. Elevation
May 19, 2008
June 15, 2006
854.49
853.25
852.01
Groundwater Elevation, (ft))
Date of Measurement
856.00
855.00
854.00
853.00
852.00
851.00
850.00
849.00
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16

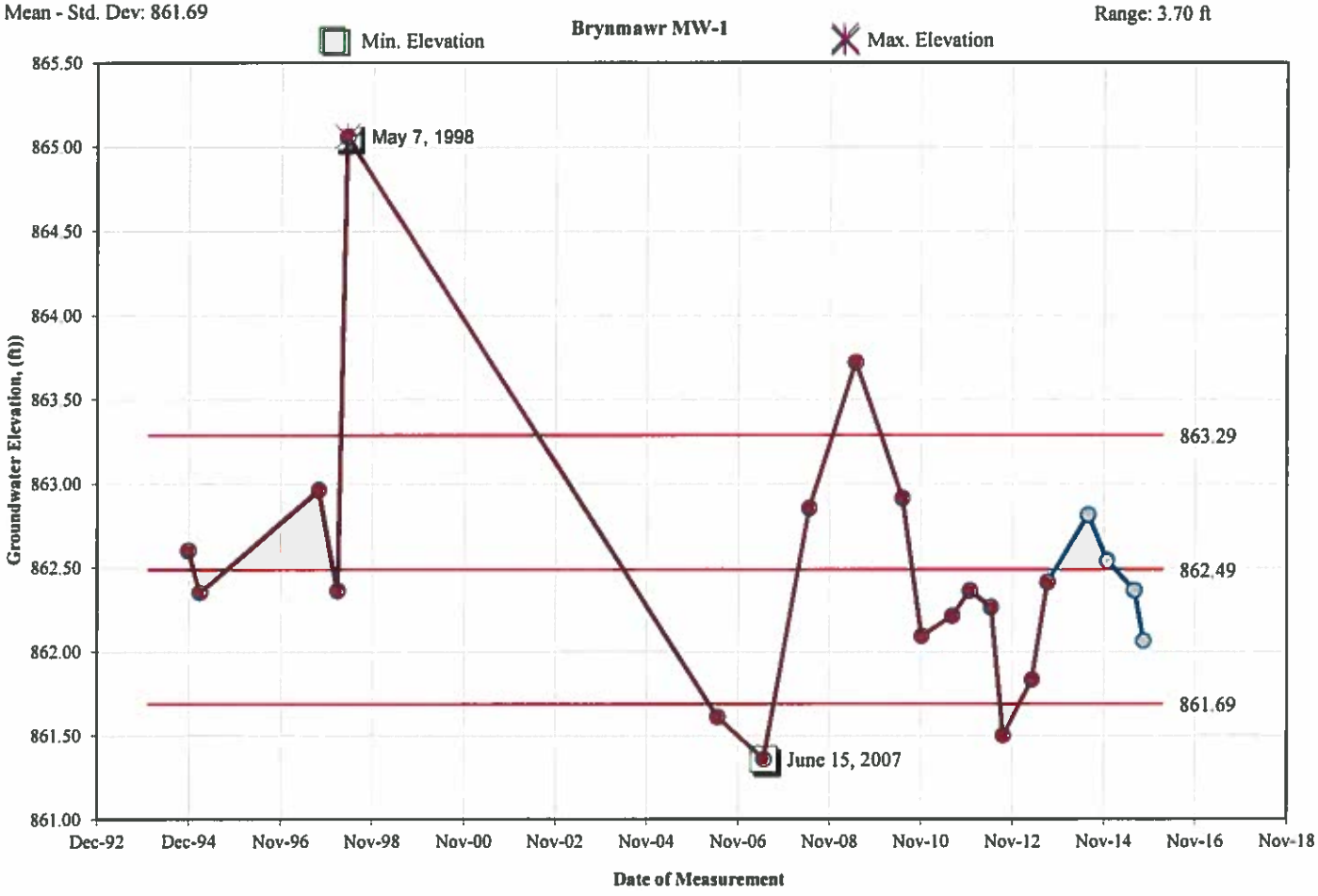

City of Portage Retention Basins
Historic Summary of Elevation Data
Black Forest MW-2
Mean + Std. Dev: 854.64
Mean: 852.93
Mean - Std. Dev: 851.23
Observed Max: 854.70
Observed Min: 848.31
Range: 6.39 ft
Min. Elevation
Max. Elevation
July 28, 2015
854.64
852.93
851.23
June 15, 2006
Groundwater Elevation, (ft))
Date of Measurement
856.00
855.00
854.00
853.00
852.00
851.00
850.00
849.00
848.00
847.00
Jun-05
Jun-06
Jun-07
May-08
May-09
May-10
May-11
May-12
May-13
May-14
May-15
May-16
May-17

City of Portage Retention Basins

Historic Summary of Elevation Data

Mean + Std. Dev: 863.29
Mean: 862.49
Mean - Std. Dev: 861.69

Observed Max: 865.06
Observed Min: 861.36
Range: 3.70 ft

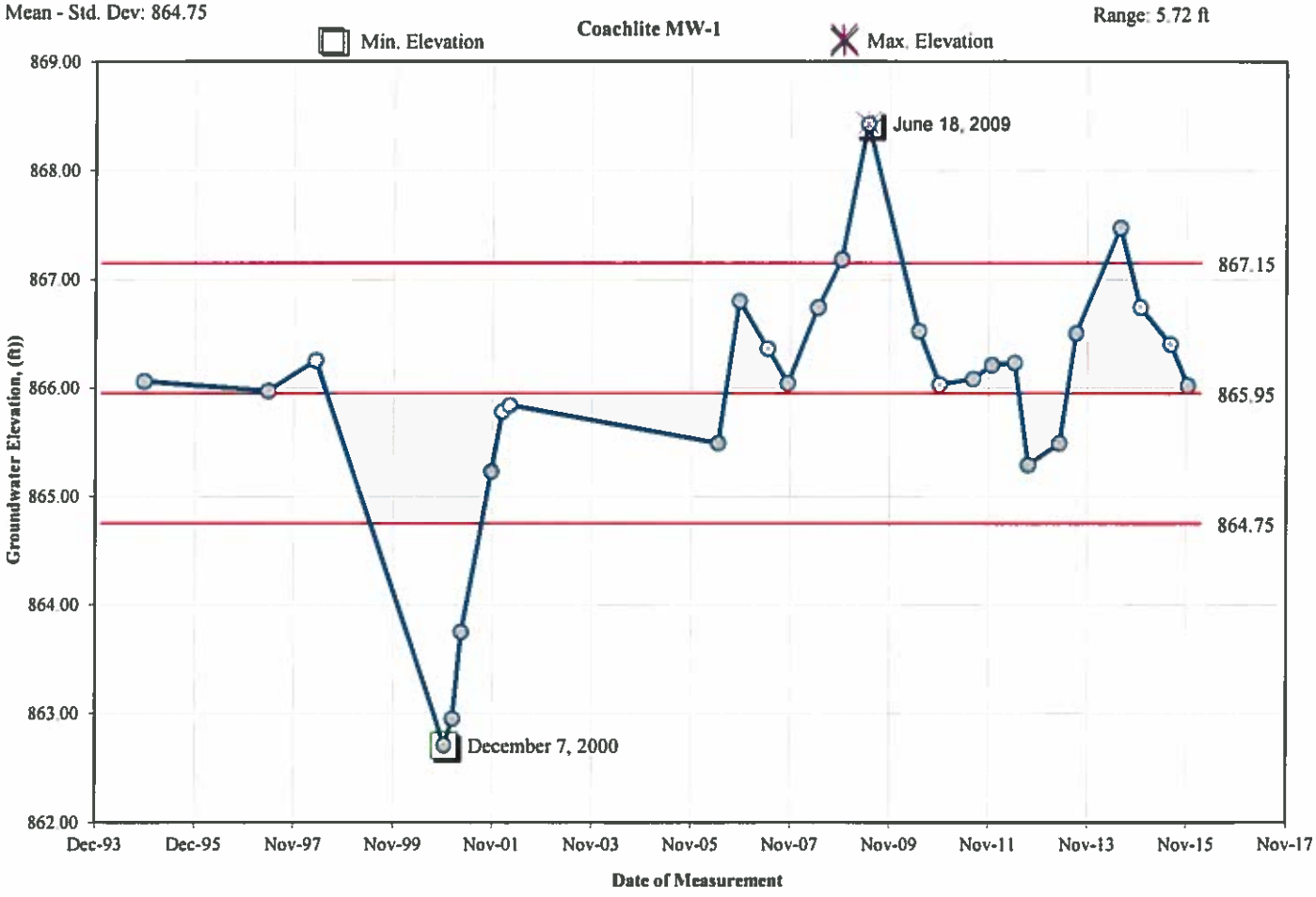


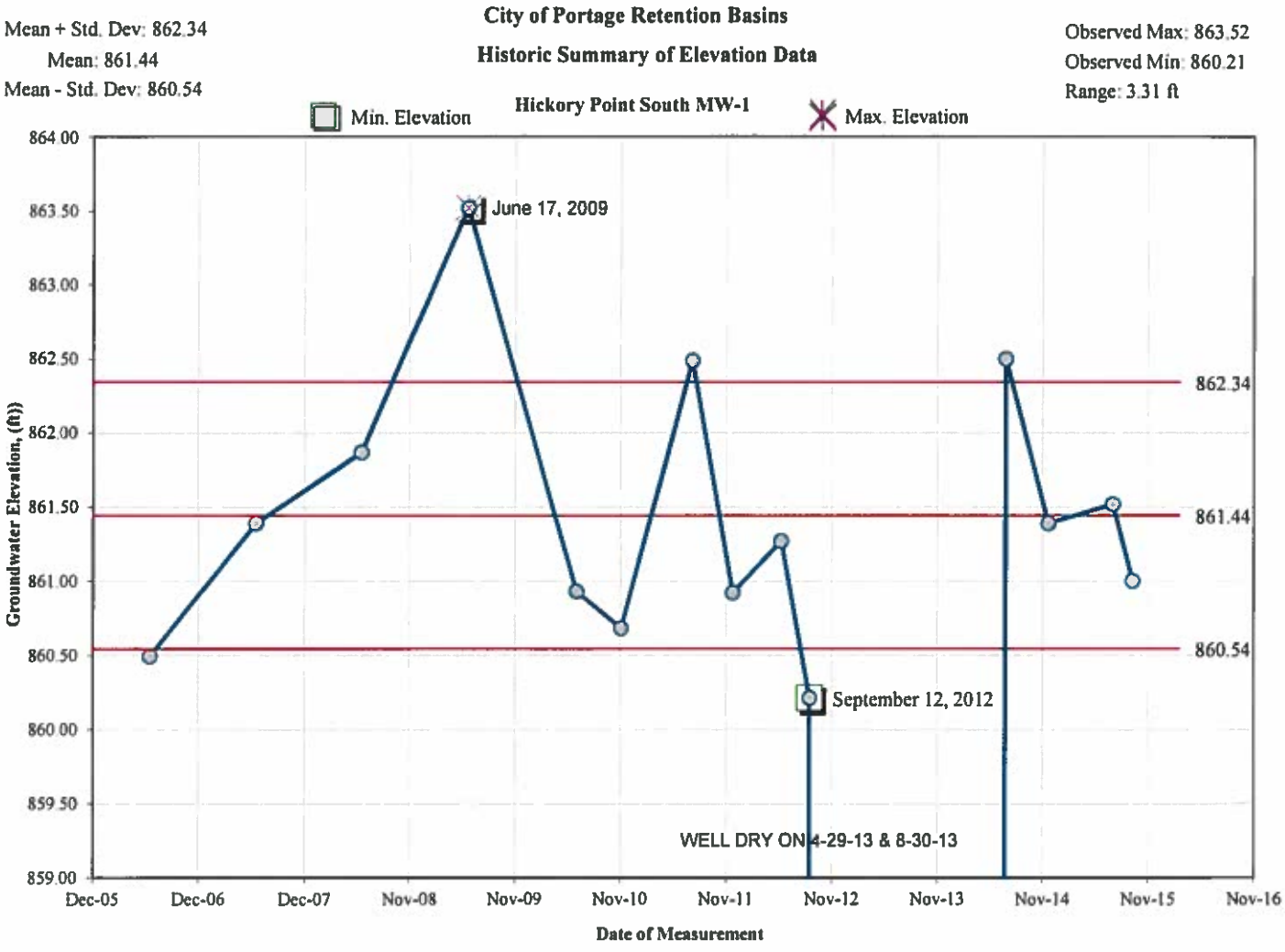
City of Portage Retention Basins

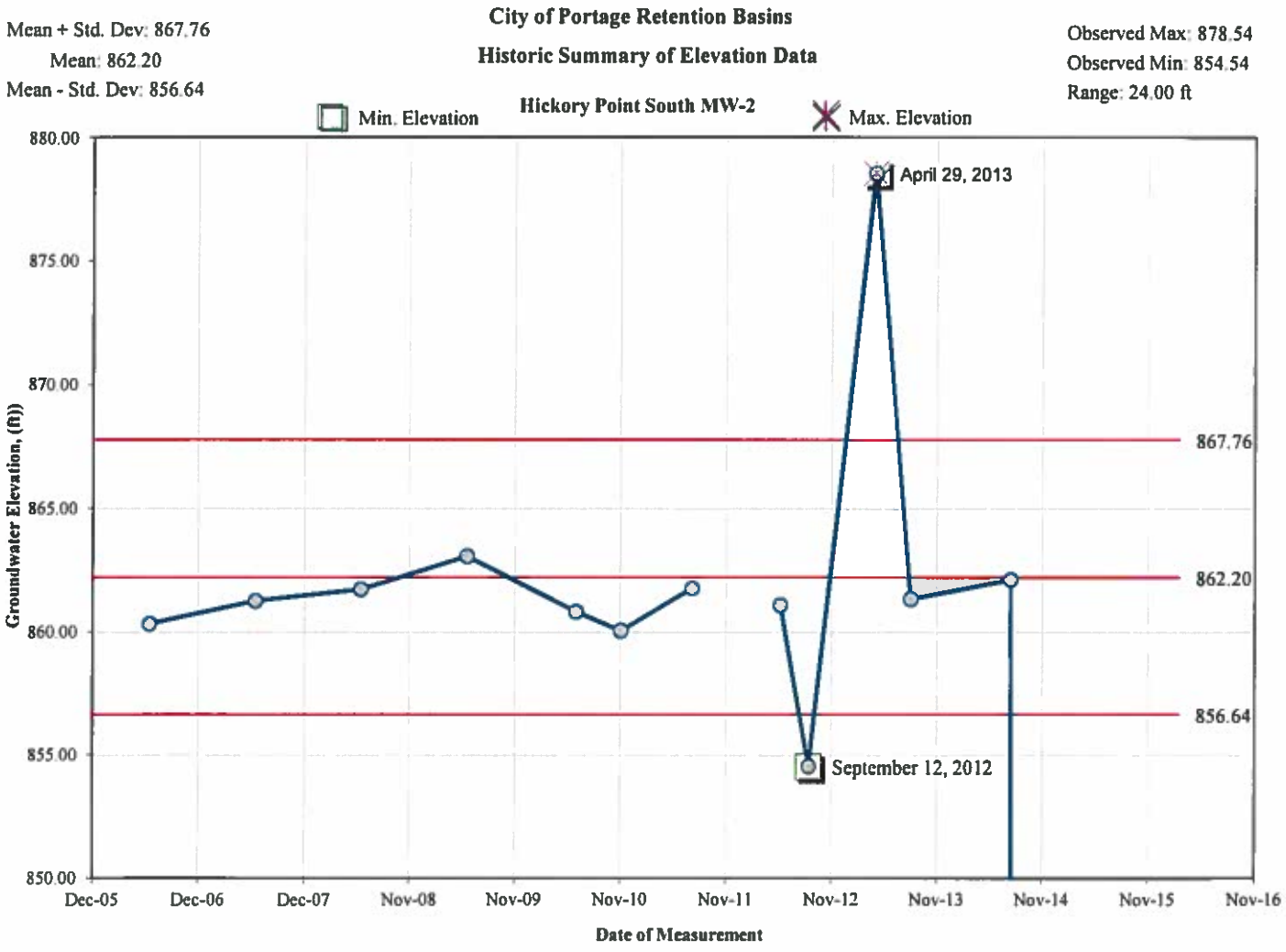
Historic Summary of Elevation Data

Mean + Std. Dev: 867.15
Mean: 865.95
Mean - Std. Dev: 864.75

Observed Max: 868.43
Observed Min: 862.71
Range: 5.72 ft




City of Portage Retention Basins
Historic Summary of Elevation Data
Hickory Point South MW-1
Mean + Std. Dev: 862.34
Mean: 861.44
Mean - Std. Dev: 860.54
Observed Max: 863.52
Observed Min: 860.21
Range: 3.31 ft
Min. Elevation
Max. Elevation
June 17, 2009
September 12, 2012
WELL DRY ON 4-29-13 & 8-30-13
862.34
861.44
860.54
Groundwater Elevation, (ft))
Date of Measurement
864.00
863.50
863.00
862.50
862.00
861.50
861.00
860.50
860.00
859.50
859.00
Dec-05
Dec-06
Dec-07
Nov-08
Nov-09
Nov-10
Nov-11
Nov-12
Nov-13
Nov-14
Nov-15
Nov-16

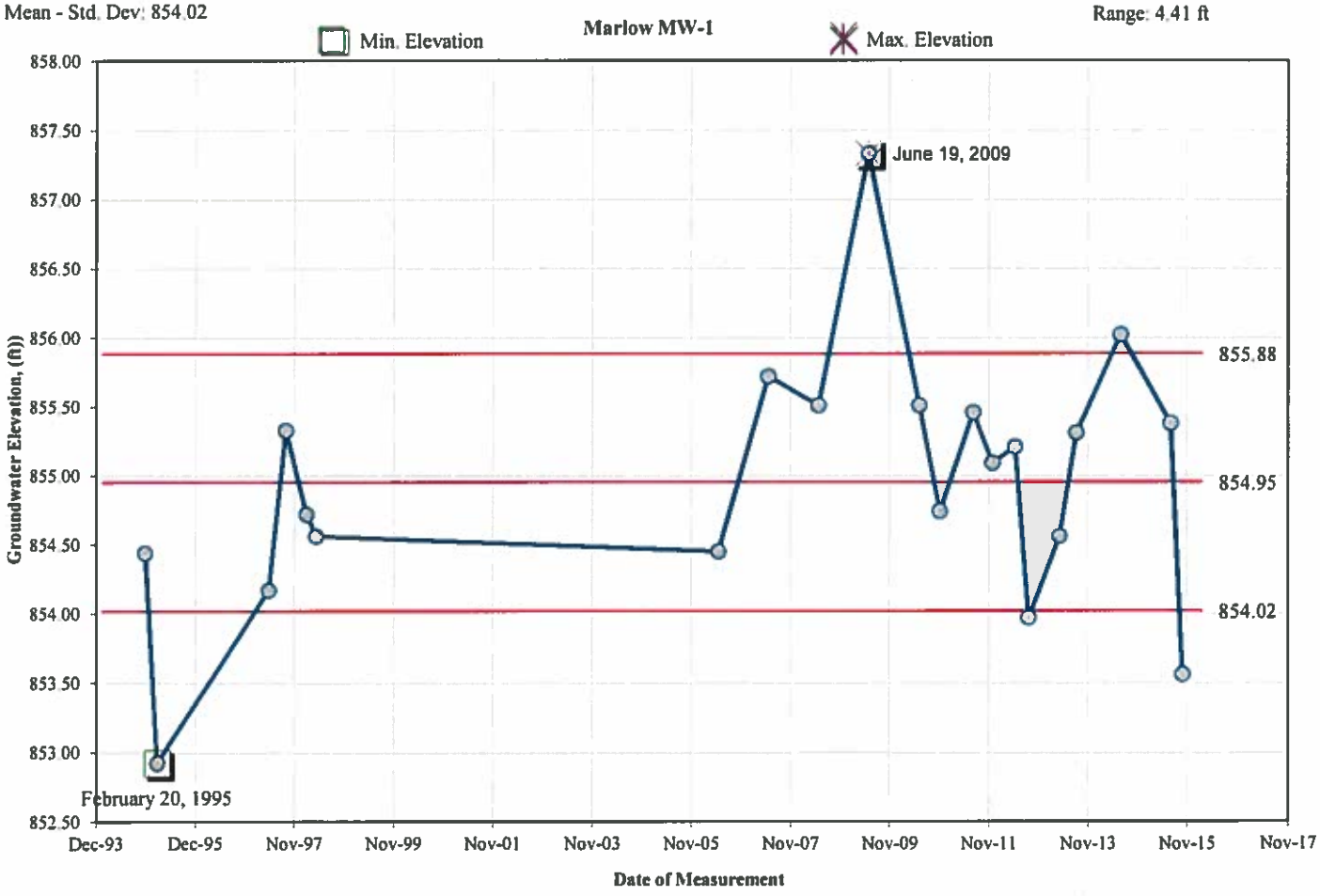

City of Portage Retention Basins
Historic Summary of Elevation Data
Hickory Point South MW-2
Mean + Std. Dev: 867.76
Mean: 862.20
Mean - Std. Dev: 856.64
Observed Max: 878.54
Observed Min: 854.54
Range: 24.00 ft
Min. Elevation
Max. Elevation
April 29, 2013
September 12, 2012
867.76
862.20
856.64
880.00
875.00
870.00
865.00
860.00
855.00
850.00
Groundwater Elevation, (ft))
Dec-05
Dec-06
Dec-07
Nov-08
Nov-09
Nov-10
Nov-11
Nov-12
Nov-13
Nov-14
Nov-15
Nov-16
Date of Measurement

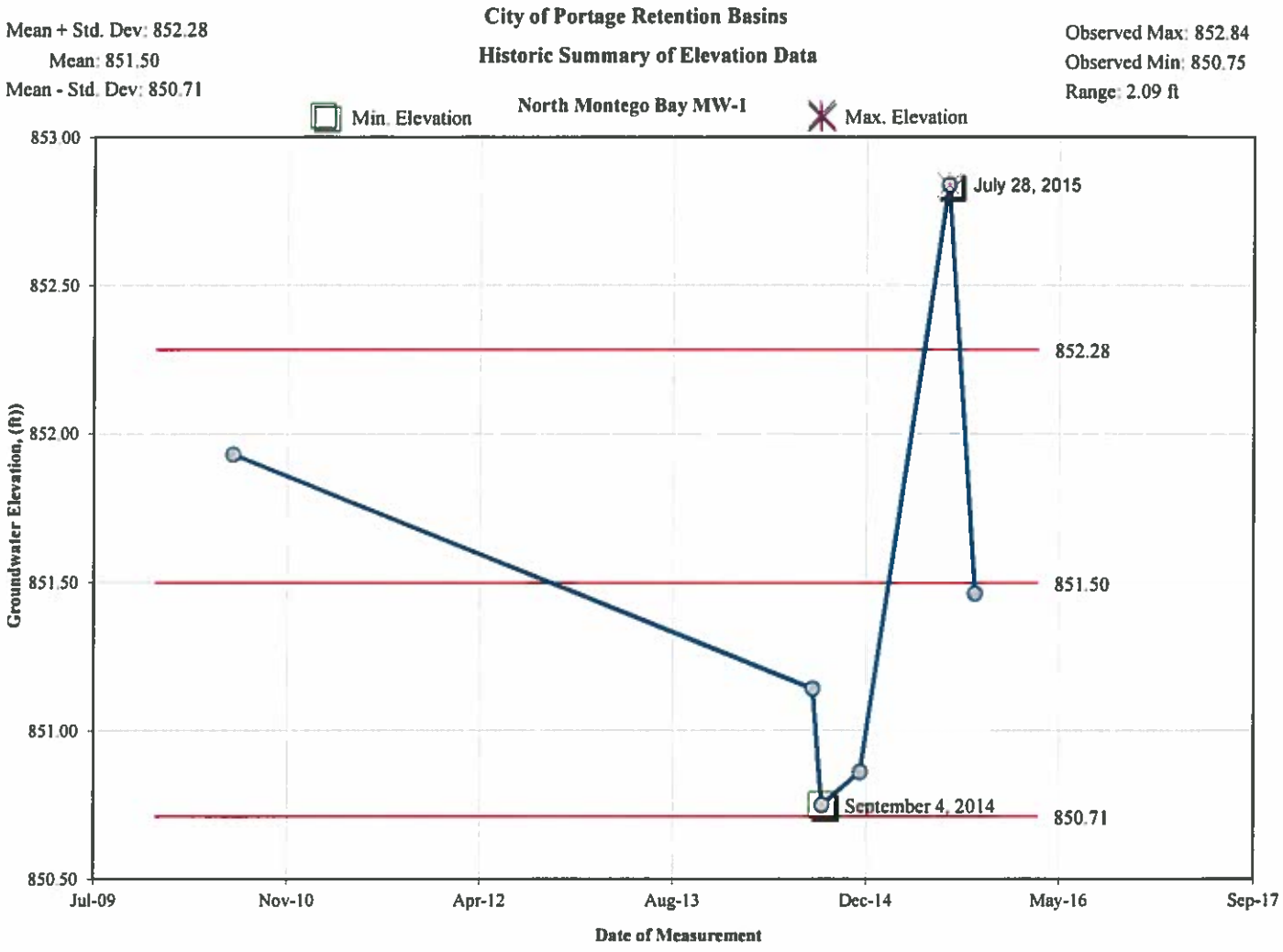
City of Portage Retention Basins

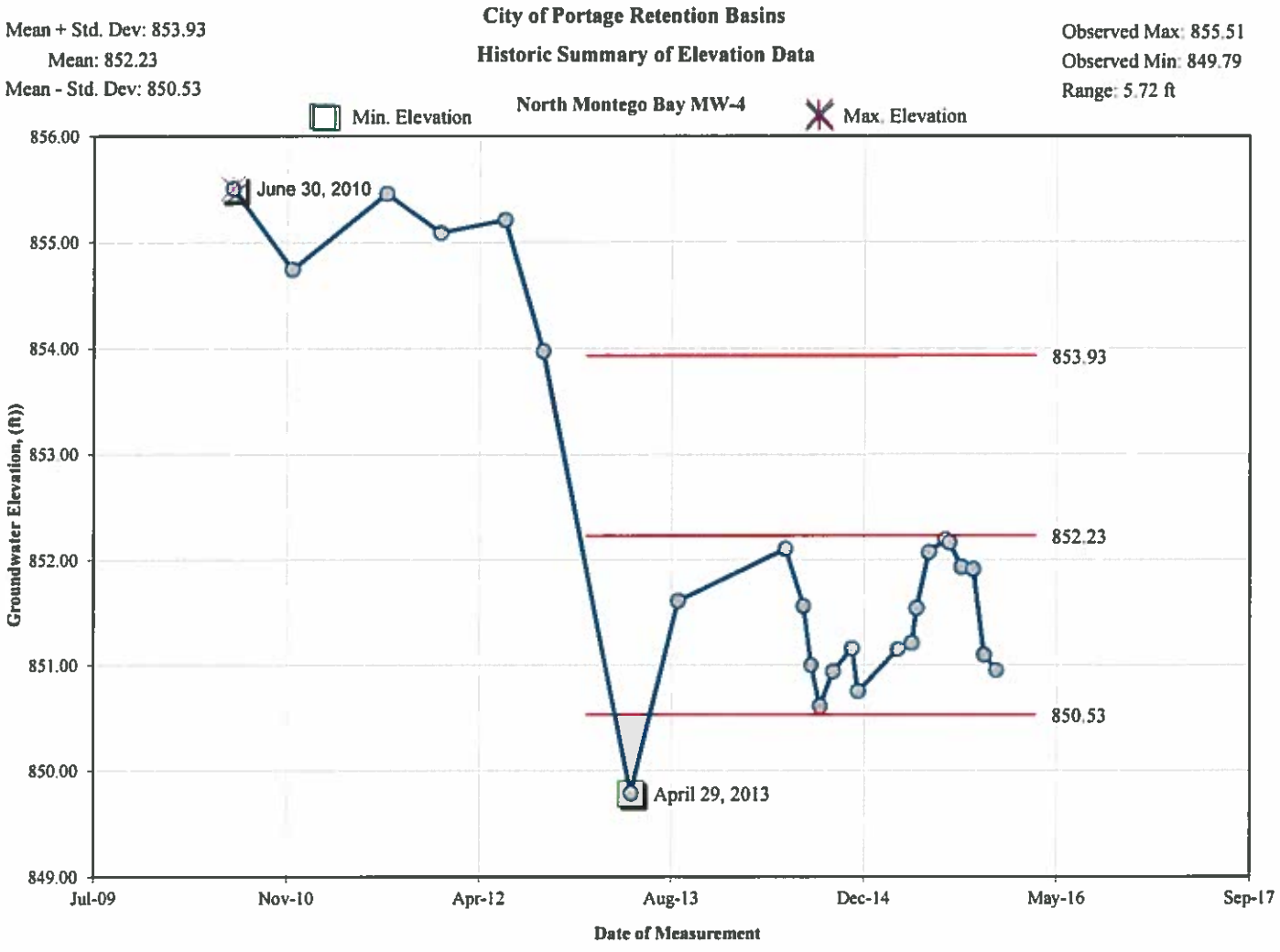
Historic Summary of Elevation Data

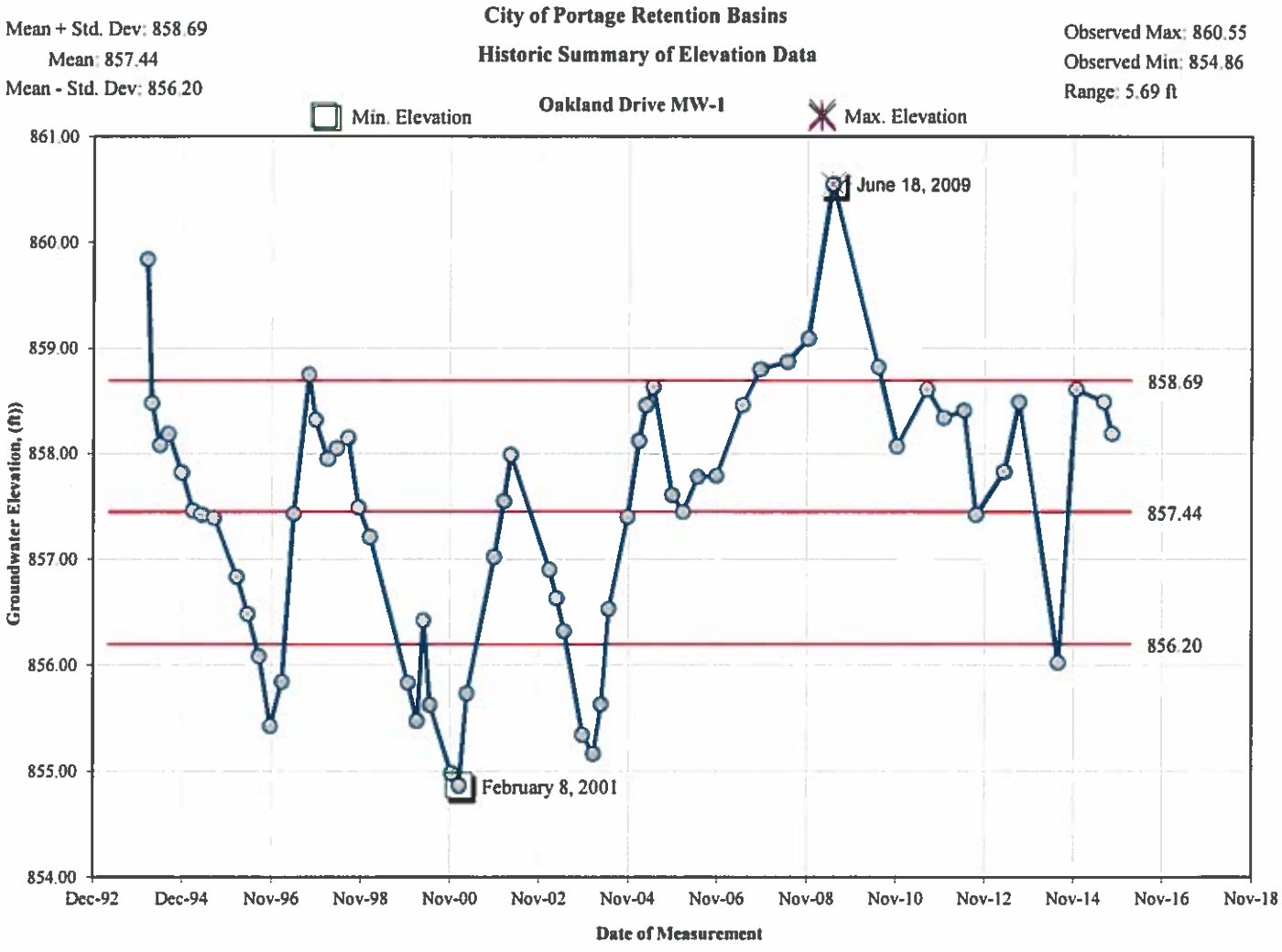
Mean + Std. Dev: 855.88
Mean: 854.95
Mean - Std. Dev: 854.02

Observed Max: 857.33
Observed Min: 852.92
Range: 4.41 ft




City of Portage Retention Basins
Historic Summary of Elevation Data
North Montego Bay MW-1
Mean + Std. Dev: 852.28
Mean: 851.50
Mean - Std. Dev: 850.71
Observed Max: 852.84
Observed Min: 850.75
Range: 2.09 ft
Min. Elevation
Max. Elevation
July 28, 2015
September 4, 2014
852.28
851.50
850.71
Groundwater Elevation, (ft))
Date of Measurement
853.00
852.50
852.00
851.50
851.00
850.50
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17


City of Portage Retention Basins
Historic Summary of Elevation Data
North Montego Bay MW-4
Mean + Std. Dev: 853.93
Mean: 852.23
Mean - Std. Dev: 850.53
Observed Max: 855.51
Observed Min: 849.79
Range: 5.72 ft
Min. Elevation
Max. Elevation
June 30, 2010
April 29, 2013
853.93
852.23
850.53
Groundwater Elevation, (ft))
Date of Measurement
856.00
855.00
854.00
853.00
852.00
851.00
850.00
849.00
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17

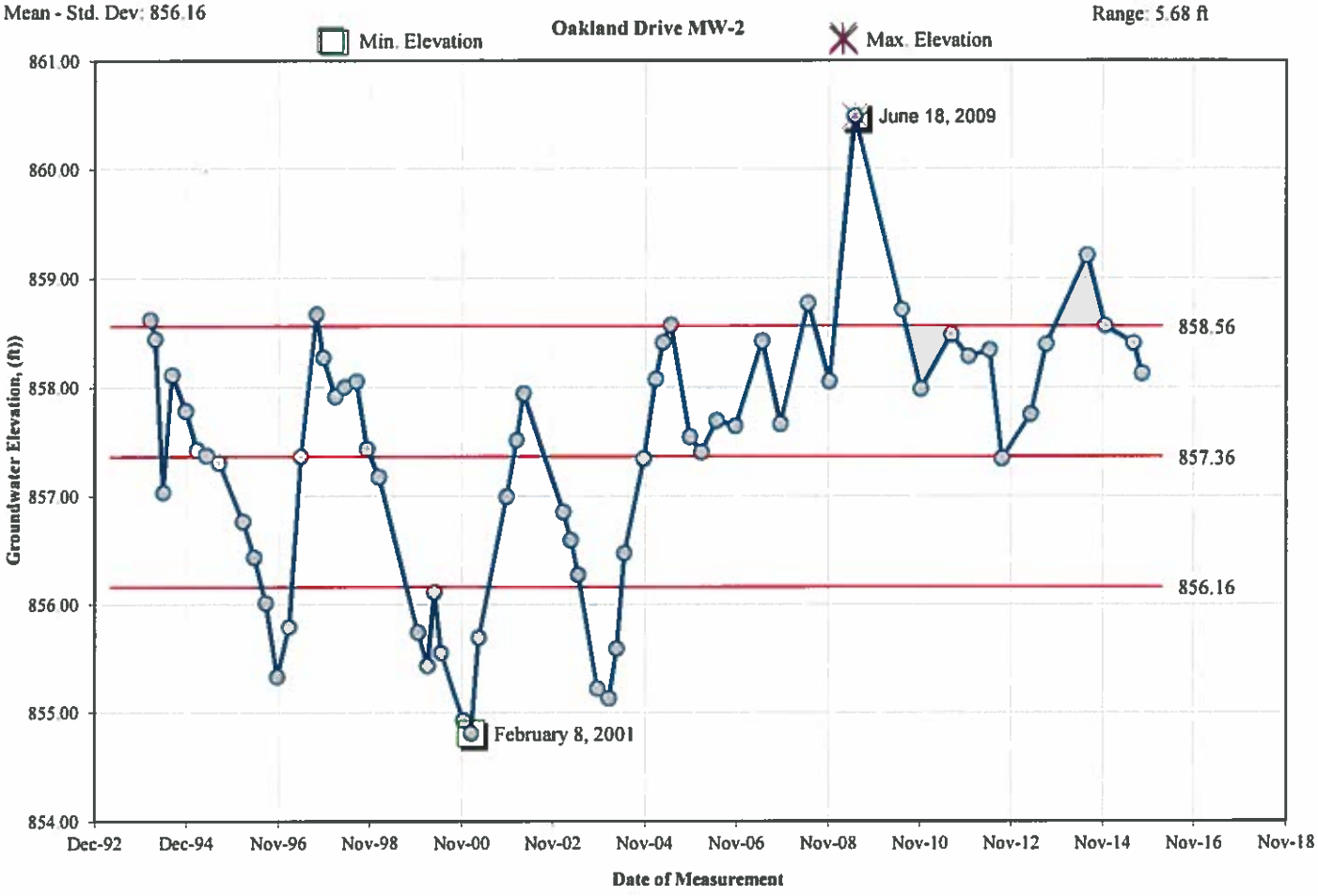

City of Portage Retention Basins
Historic Summary of Elevation Data
Oakland Drive MW-1
Mean + Std. Dev: 858.69
Mean: 857.44
Mean - Std. Dev: 856.20
Observed Max: 860.55
Observed Min: 854.86
Range: 5.69 ft
Min. Elevation
Max. Elevation
June 18, 2009
February 8, 2001
858.69
857.44
856.20
Groundwater Elevation, (ft))
Date of Measurement
861.00
860.00
859.00
858.00
857.00
856.00
855.00
854.00
Dec-92
Dec-94
Nov-96
Nov-98
Nov-00
Nov-02
Nov-04
Nov-06
Nov-08
Nov-10
Nov-12
Nov-14
Nov-16
Nov-18

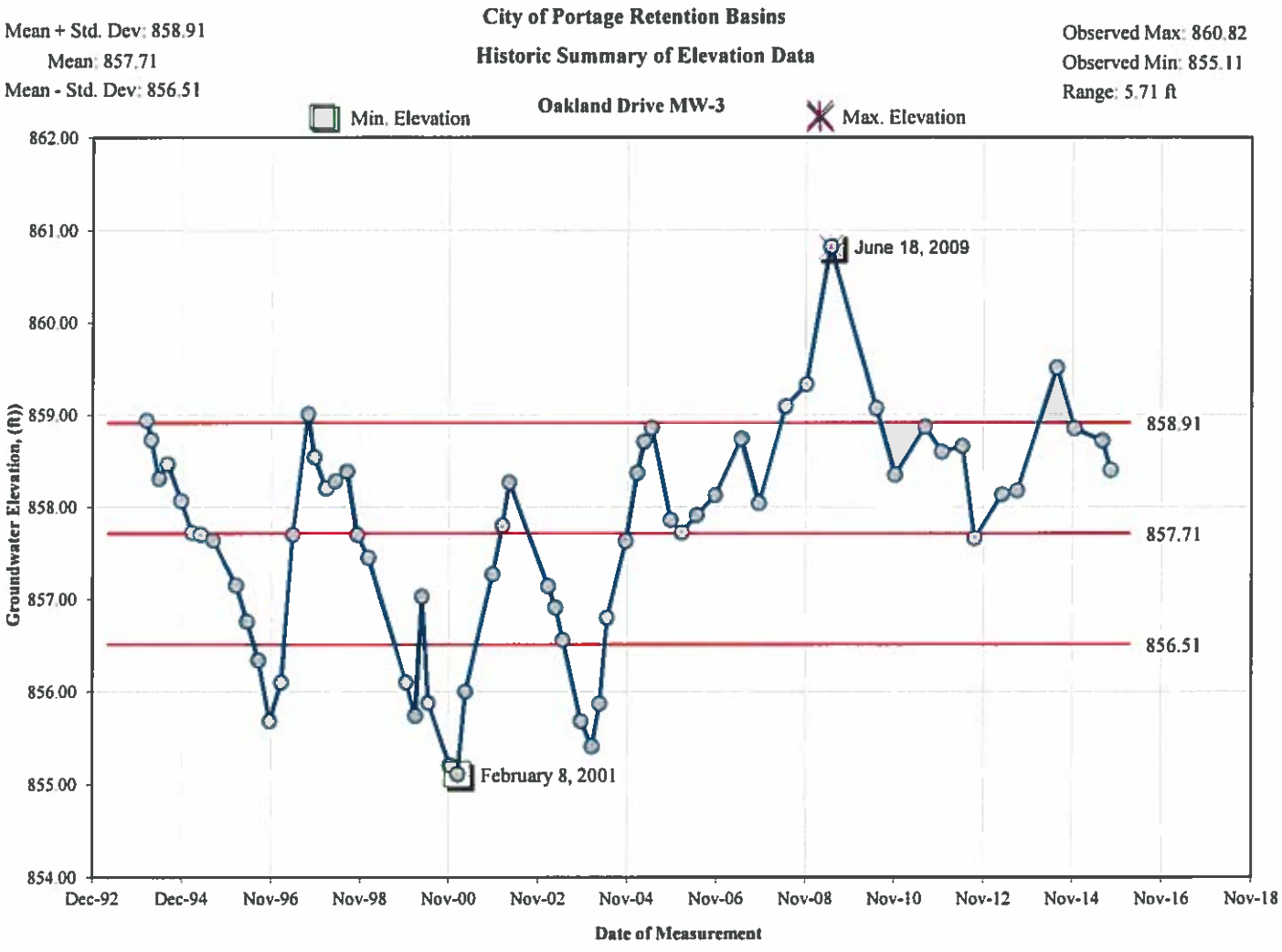
City of Portage Retention Basins

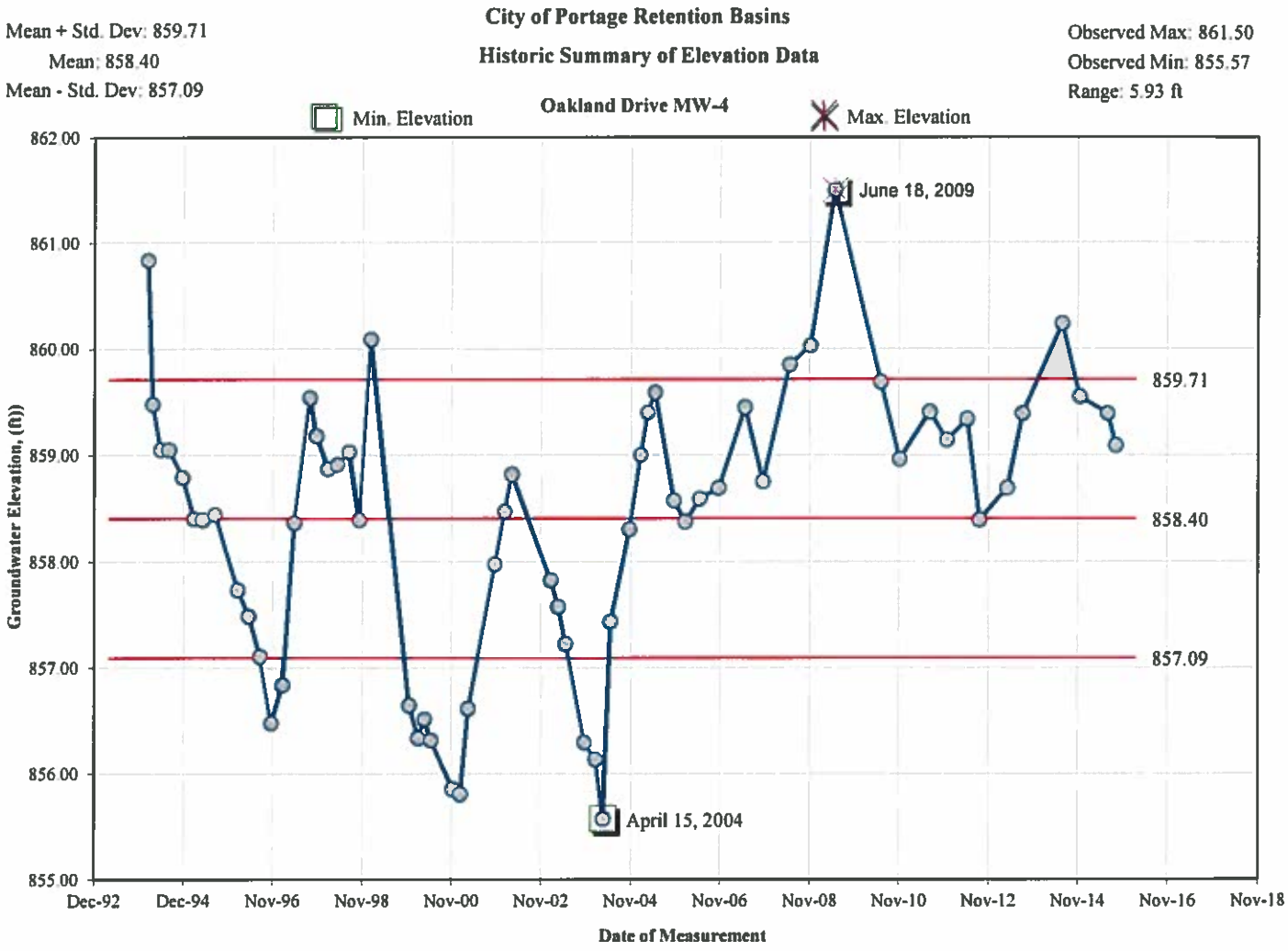
Historic Summary of Elevation Data

Mean + Std. Dev: 858.56
Mean: 857.36
Mean - Std. Dev: 856.16

Observed Max: 860.49
Observed Min: 854.81
Range: 5.68 ft




City of Portage Retention Basins
Historic Summary of Elevation Data
Oakland Drive MW-3
Mean + Std. Dev: 858.91
Mean: 857.71
Mean - Std. Dev: 856.51
Observed Max: 860.82
Observed Min: 855.11
Range: 5.71 ft
Min. Elevation
Max. Elevation
June 18, 2009
February 8, 2001
858.91
857.71
856.51
Groundwater Elevation, (ft))
Date of Measurement
862.00
861.00
860.00
859.00
858.00
857.00
856.00
855.00
854.00
Dec-92
Dec-94
Nov-96
Nov-98
Nov-00
Nov-02
Nov-04
Nov-06
Nov-08
Nov-10
Nov-12
Nov-14
Nov-16
Nov-18


City of Portage Retention Basins
Historic Summary of Elevation Data
Oakland Drive MW-4
Mean + Std. Dev: 859.71
Mean: 858.40
Mean - Std. Dev: 857.09
Observed Max: 861.50
Observed Min: 855.57
Range: 5.93 ft
Min. Elevation
Max. Elevation
June 18, 2009
April 15, 2004
859.71
858.40
857.09
Groundwater Elevation, (ft))
Date of Measurement
862.00
861.00
860.00
859.00
858.00
857.00
856.00
855.00
Dec-92
Dec-94
Nov-96
Nov-98
Nov-00
Nov-02
Nov-04
Nov-06
Nov-08
Nov-10
Nov-12
Nov-14
Nov-16
Nov-18

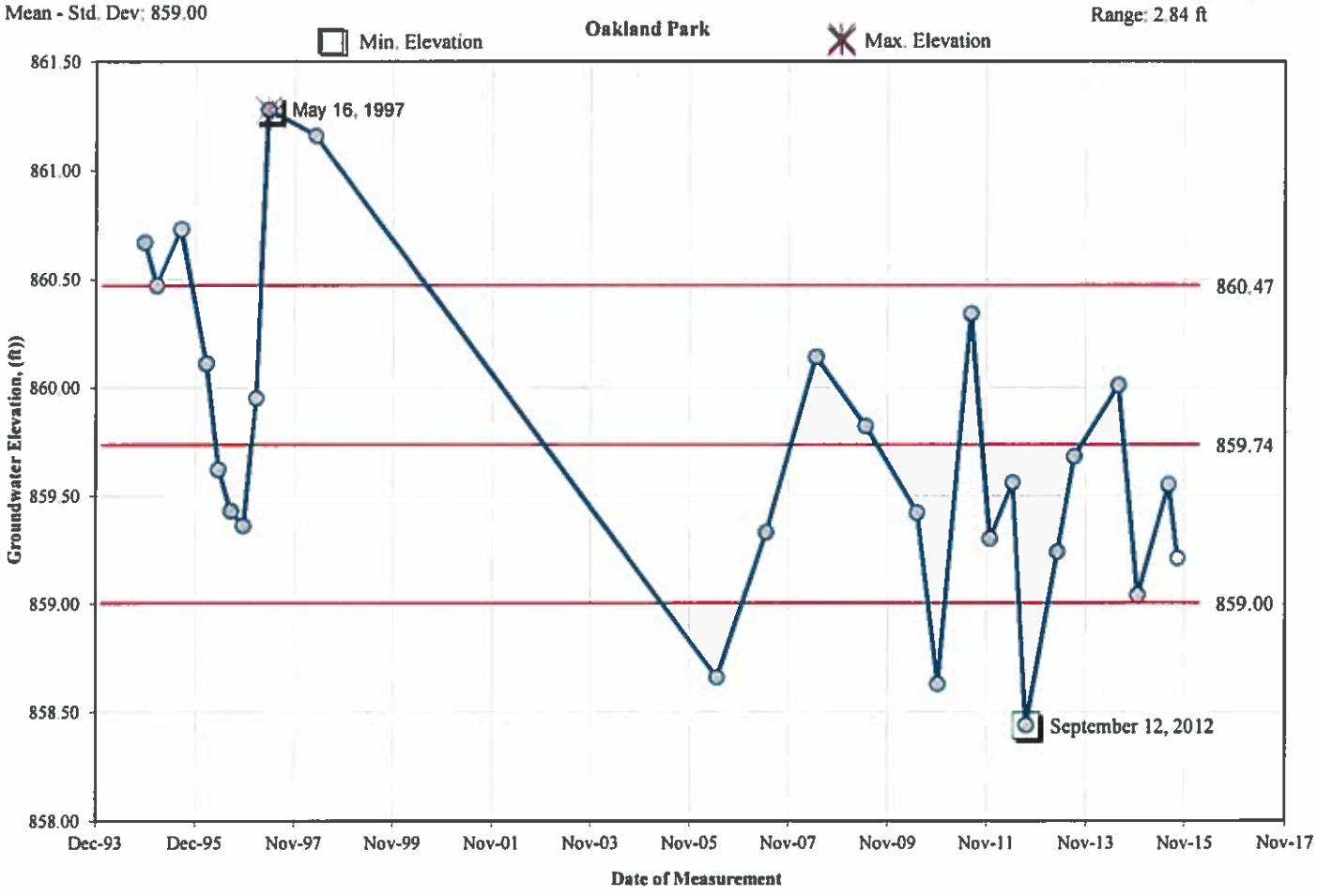
City of Portage Retention Basins

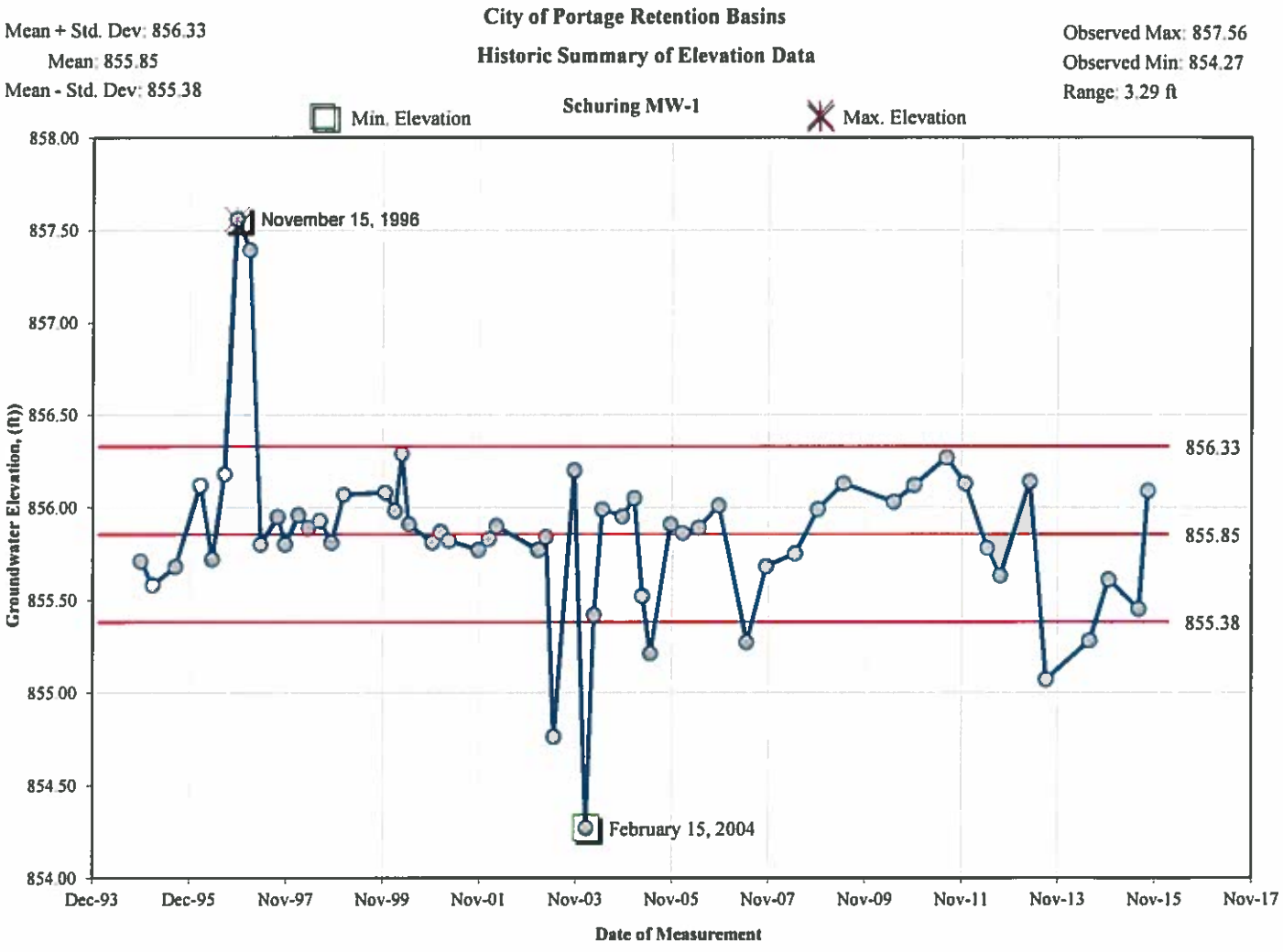
Historic Summary of Elevation Data

Oakland Park

Mean + Std. Dev: 860.47
Mean: 859.74
Mean - Std. Dev: 859.00

Observed Max: 861.28
Observed Min: 858.44
Range: 2.84 ft




City of Portage Retention Basins
Historic Summary of Elevation Data
Schuring MW-1
Mean + Std. Dev: 856.33
Mean: 855.85
Mean - Std. Dev: 855.38
Observed Max: 857.56
Observed Min: 854.27
Range: 3.29 ft
Min. Elevation
Max. Elevation
November 15, 1996
February 15, 2004
856.33
855.85
855.38
Groundwater Elevation, (ft))
Date of Measurement
858.00
857.50
857.00
856.50
856.00
855.50
855.00
854.50
854.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

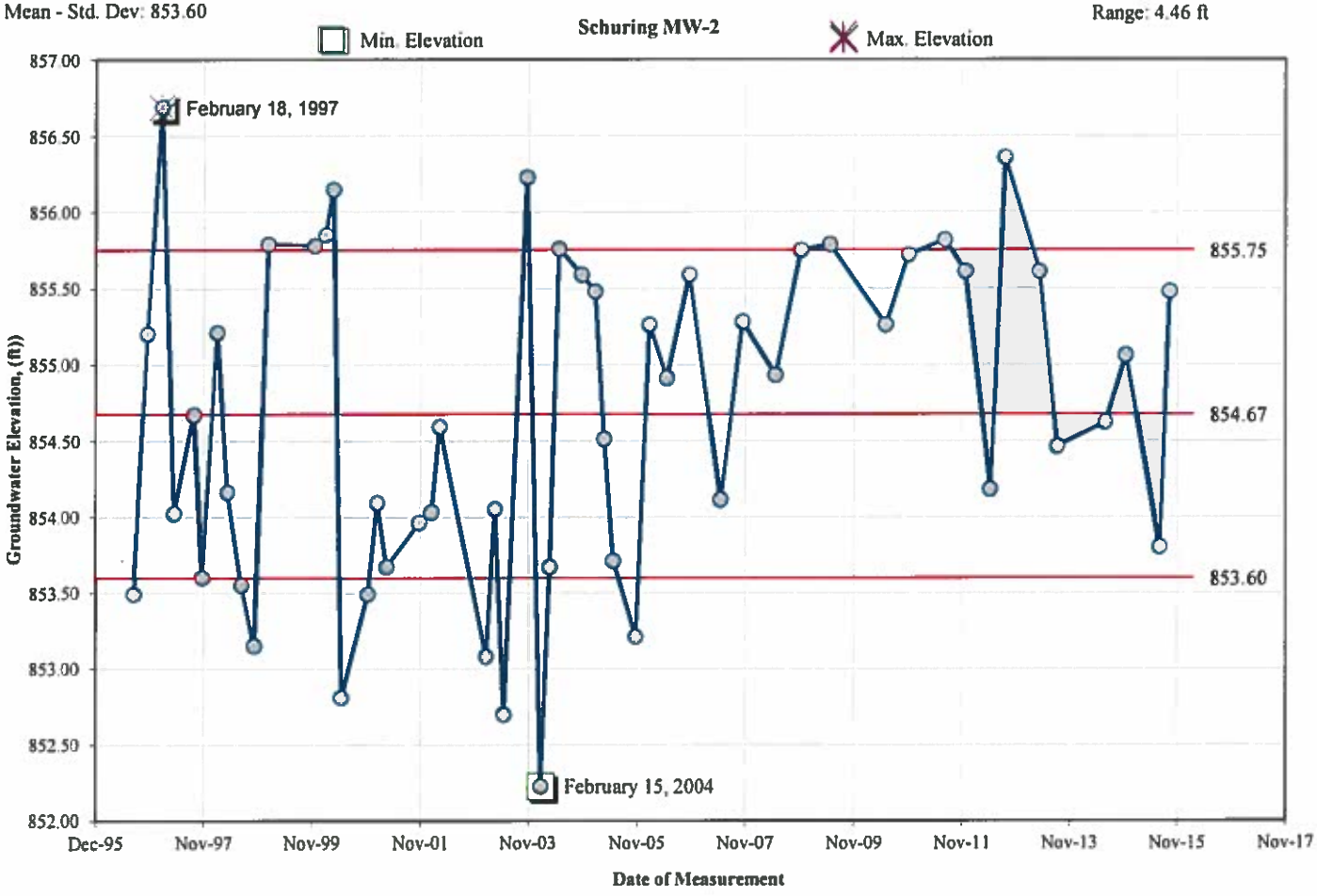
City of Portage Retention Basins

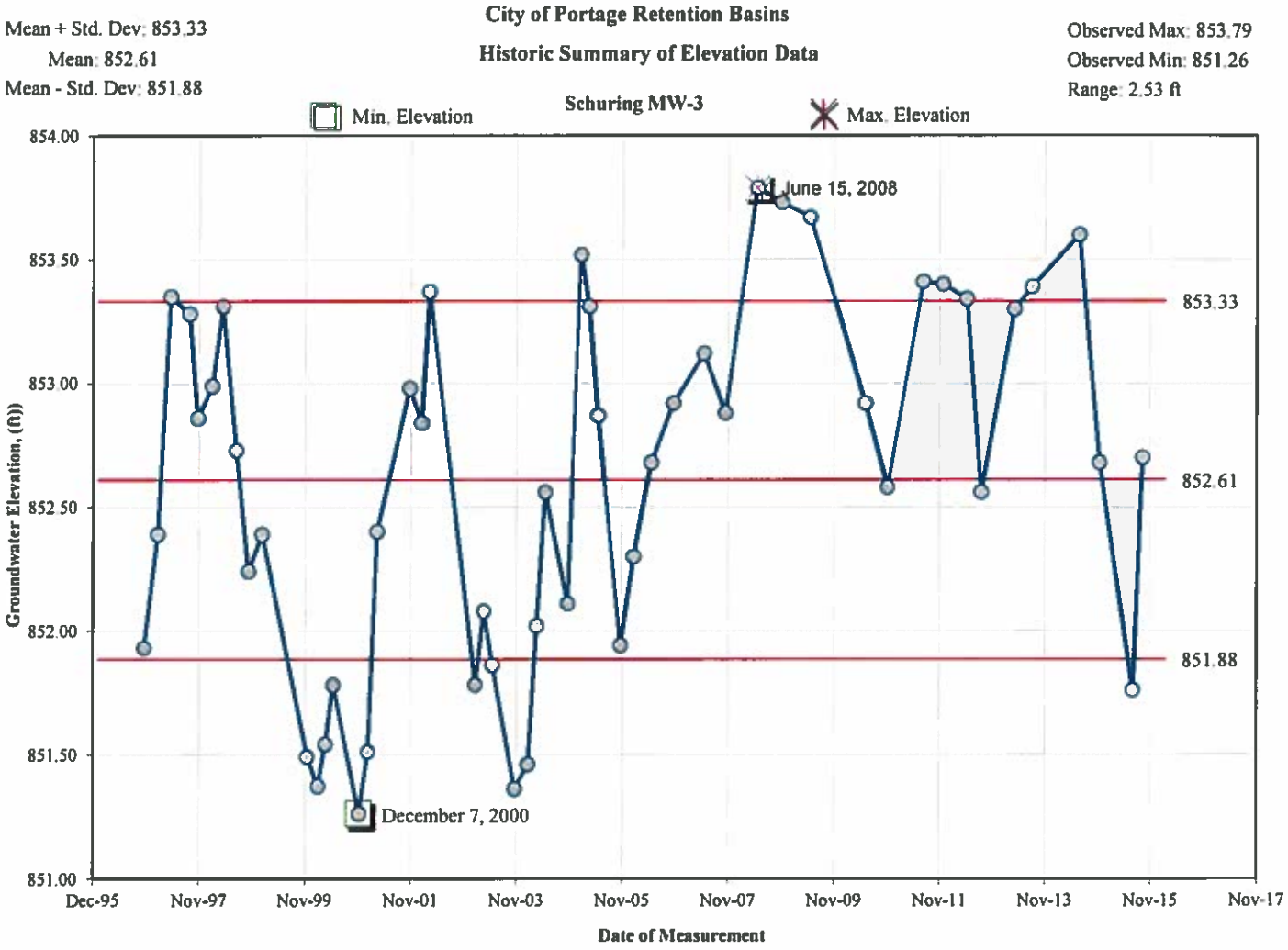
Historic Summary of Elevation Data

Schuring MW-2

Mean + Std. Dev: 855.75
Mean: 854.67
Mean - Std. Dev: 853.60

Observed Max: 856.69
Observed Min: 852.23
Range: 4.46 ft



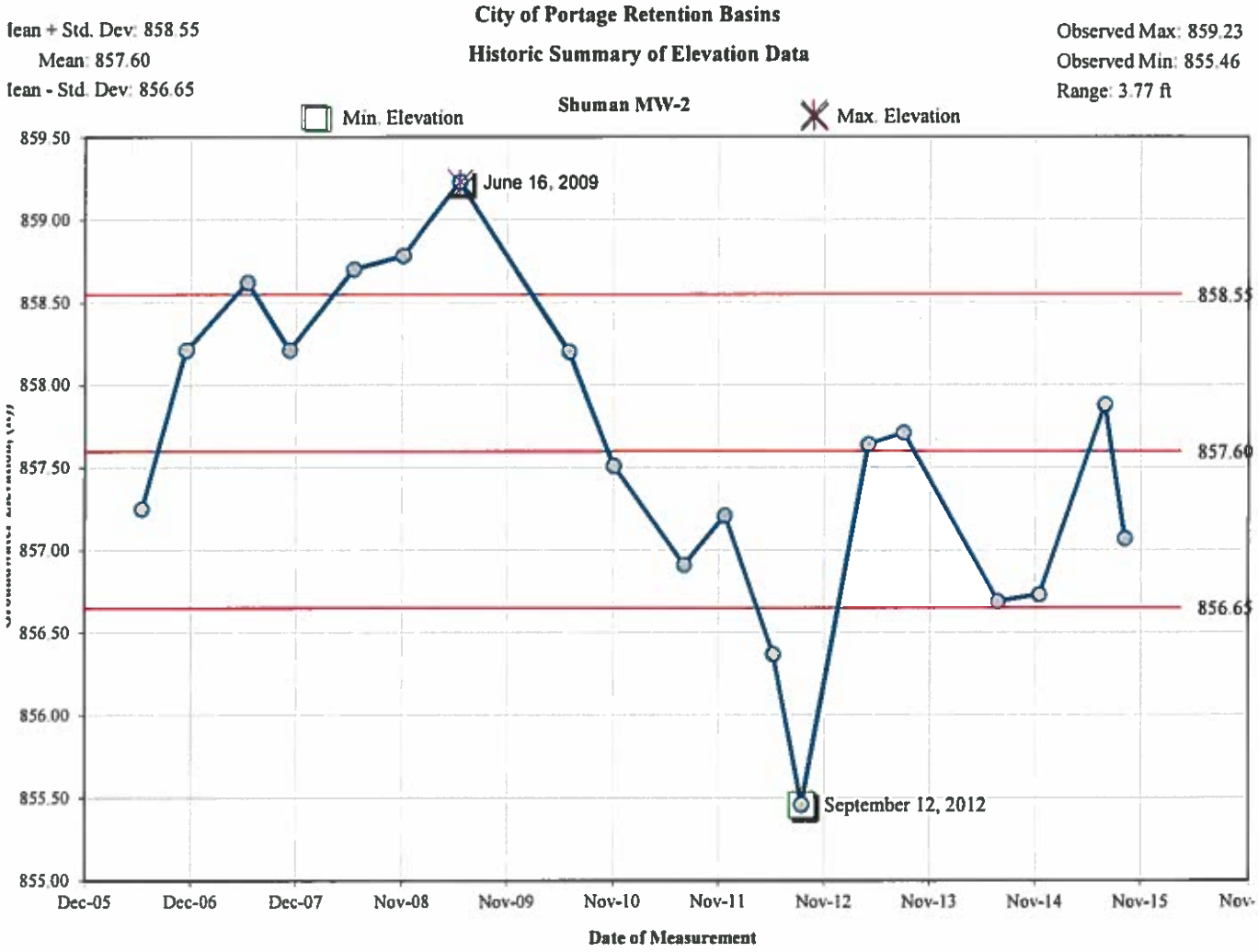

City of Portage Retention Basins
Historic Summary of Elevation Data
Schuring MW-3
Mean + Std. Dev: 853.33
Mean: 852.61
Mean - Std. Dev: 851.88
Observed Max: 853.79
Observed Min: 851.26
Range: 2.53 ft
Min. Elevation
Max. Elevation
June 15, 2008
December 7, 2000
853.33
852.61
851.88
Groundwater Elevation, (ft))
Date of Measurement
854.00
853.50
853.00
852.50
852.00
851.50
851.00
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

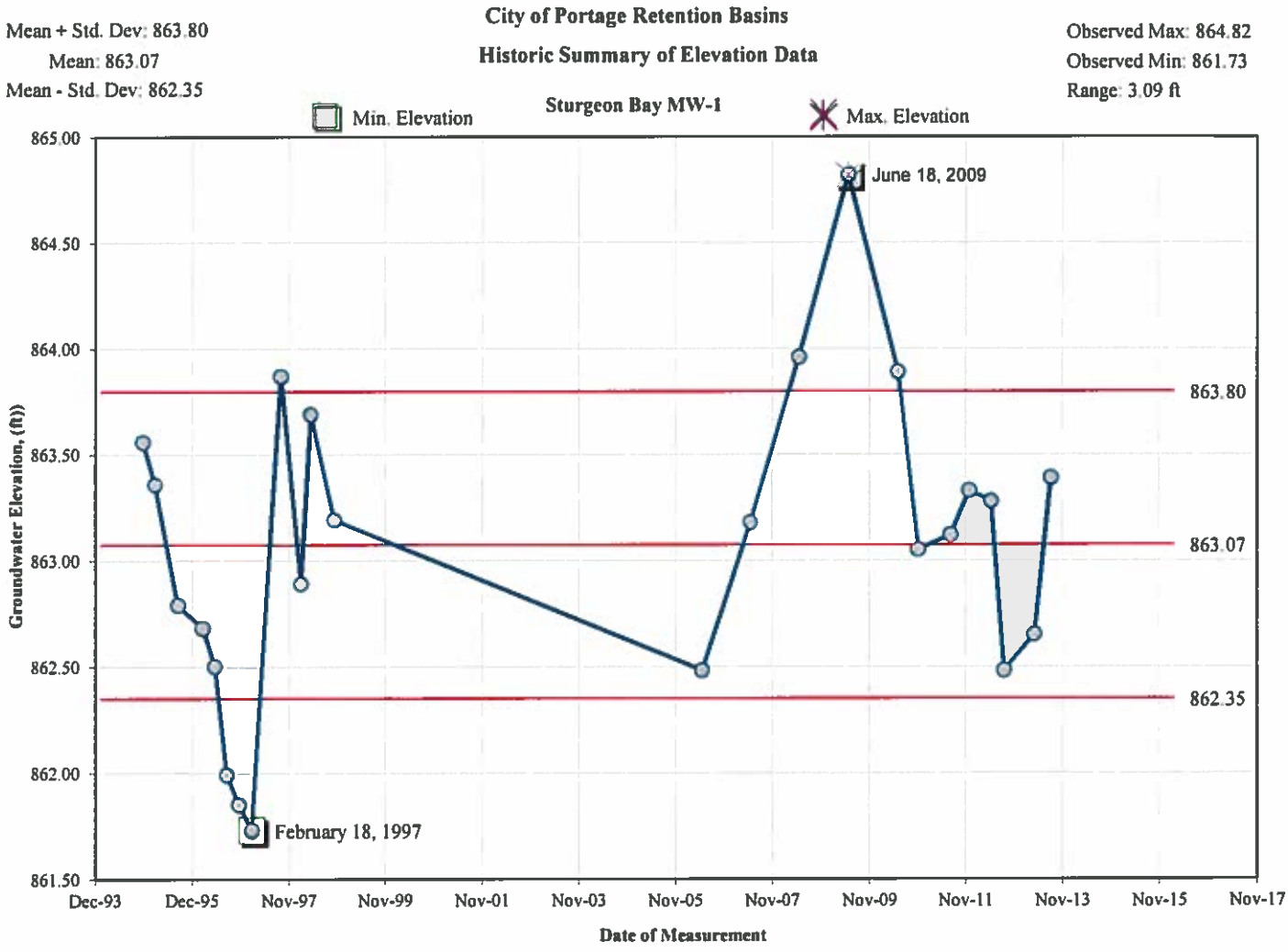
City of Portage Retention Basins

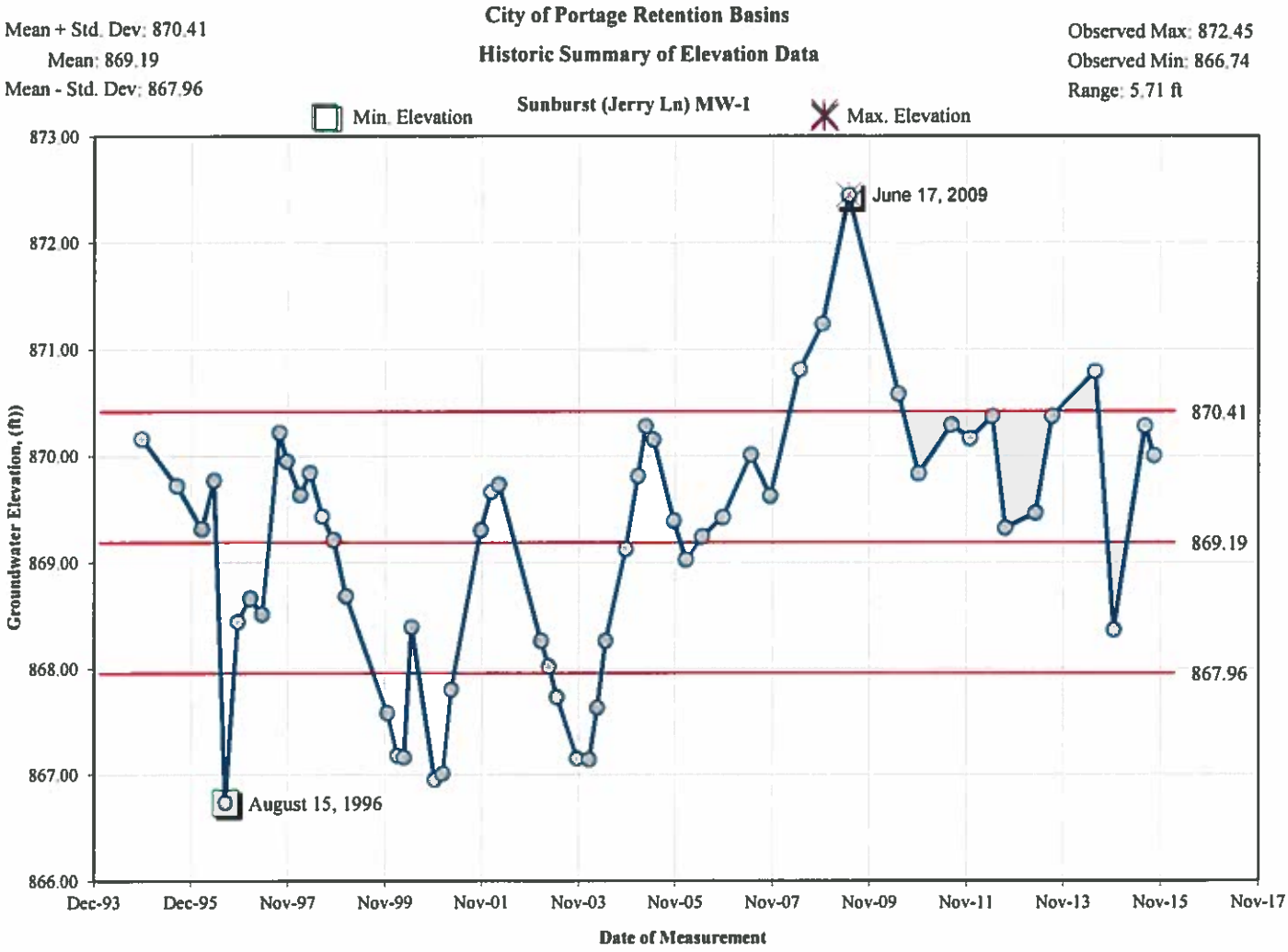
Historic Summary of Elevation Data

Mean + Std. Dev: 858.74
Mean: 857.80
Mean - Std. Dev: 856.86

Observed Max: 859.35
Observed Min: 855.49
Range: 3.86 ft


City of Portage Retention Basins
Historic Summary of Elevation Data
Shuman MW-2
lean + Std. Dev: 858.55
Mean: 857.60
lean - Std. Dev: 856.65
Observed Max: 859.23
Observed Min: 855.46
Range: 3.77 ft
Min. Elevation
Max. Elevation
June 16, 2009
September 12, 2012
858.55
857.60
856.65
859.50
859.00
858.50
858.00
857.50
857.00
856.50
856.00
855.50
855.00
Dec-05
Dec-06
Dec-07
Nov-08
Nov-09
Nov-10
Nov-11
Nov-12
Nov-13
Nov-14
Nov-15
Date of Measurement


City of Portage Retention Basins
Historic Summary of Elevation Data
Sturgeon Bay MW-1
Mean + Std. Dev: 863.80
Mean: 863.07
Mean - Std. Dev: 862.35
Observed Max: 864.82
Observed Min: 861.73
Range: 3.09 ft
Min. Elevation
Max. Elevation
June 18, 2009
February 18, 1997
863.80
863.07
862.35
Groundwater Elevation, (ft))
Date of Measurement
865.00
864.50
864.00
863.50
863.00
862.50
862.00
861.50
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

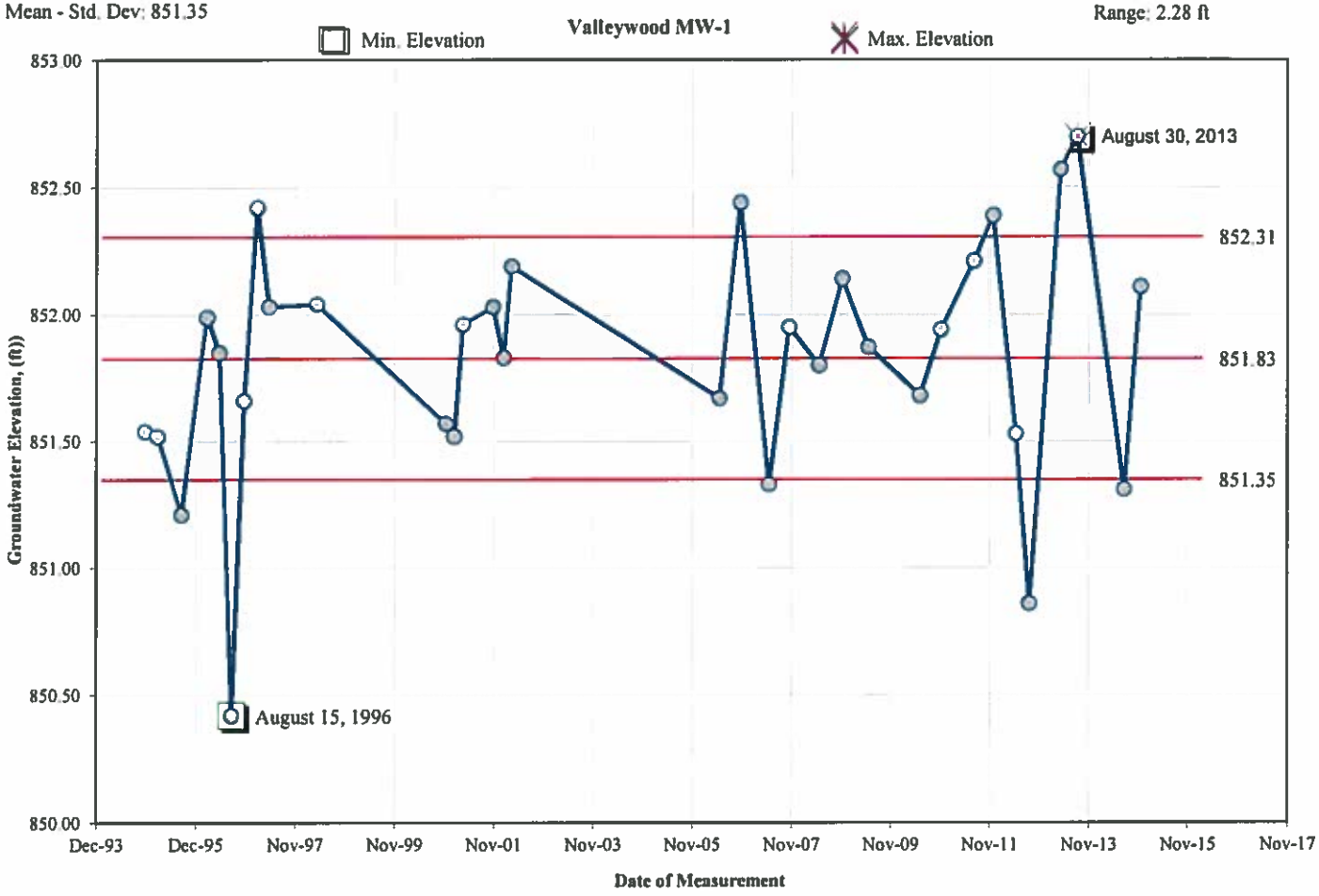

City of Portage Retention Basins
Historic Summary of Elevation Data
Sunburst (Jerry Ln) MW-1
Mean + Std. Dev: 870.41
Mean: 869.19
Mean - Std. Dev: 867.96
Observed Max: 872.45
Observed Min: 866.74
Range: 5.71 ft
Min. Elevation
Max. Elevation
June 17, 2009
August 15, 1996
870.41
869.19
867.96
Groundwater Elevation, (ft))
Date of Measurement
873.00
872.00
871.00
870.00
869.00
868.00
867.00
866.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

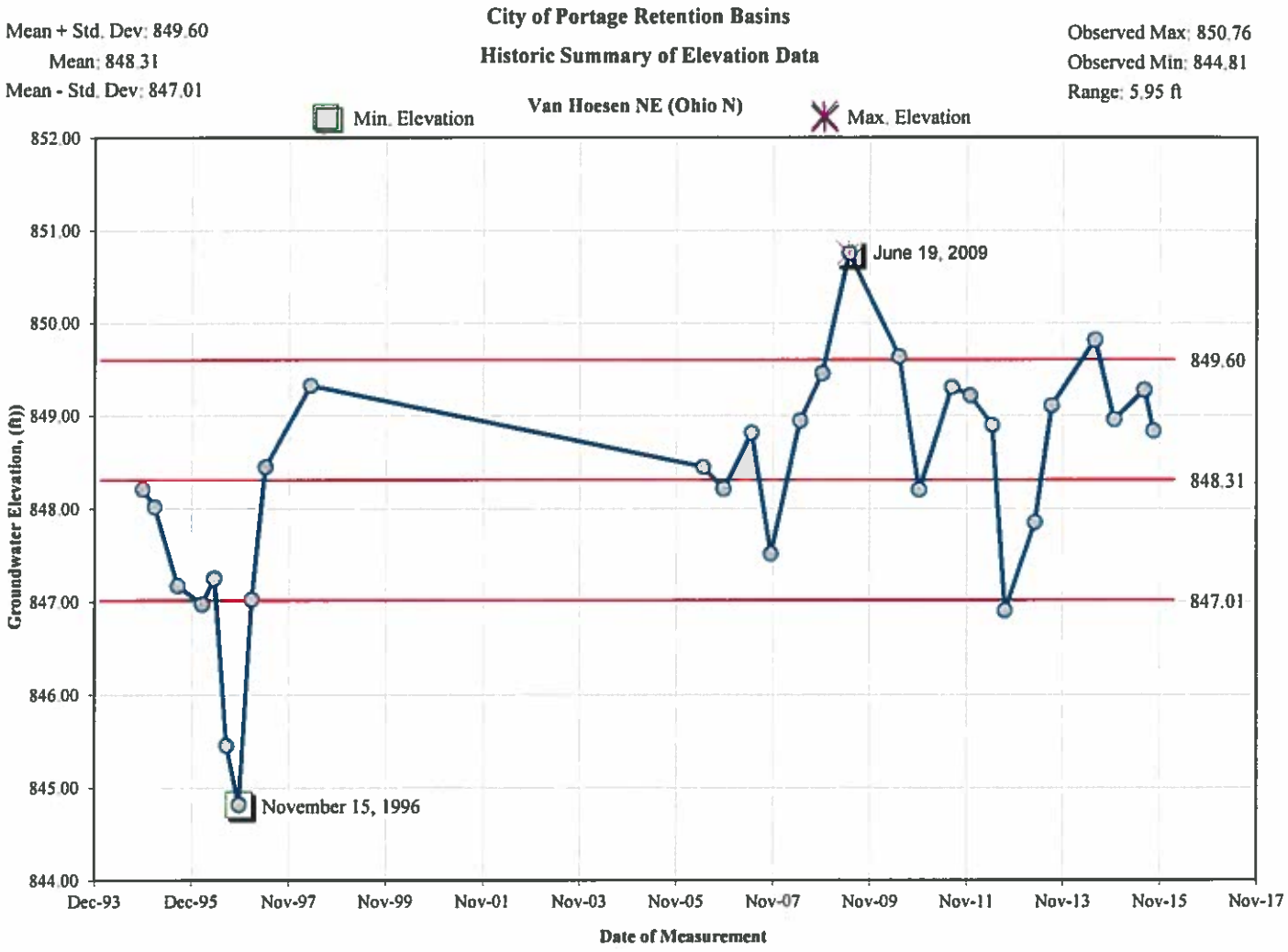
City of Portage Retention Basins

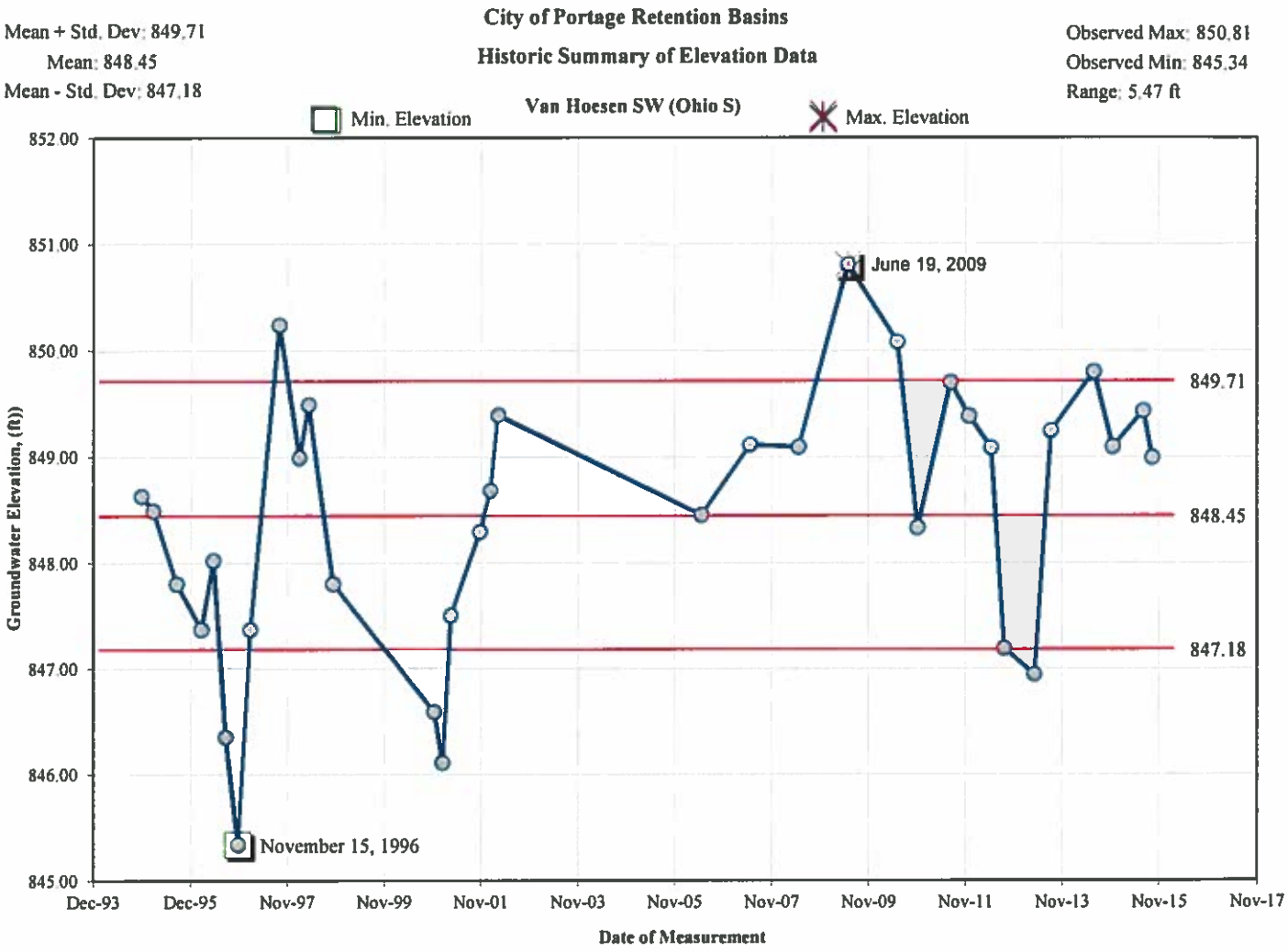
Historic Summary of Elevation Data

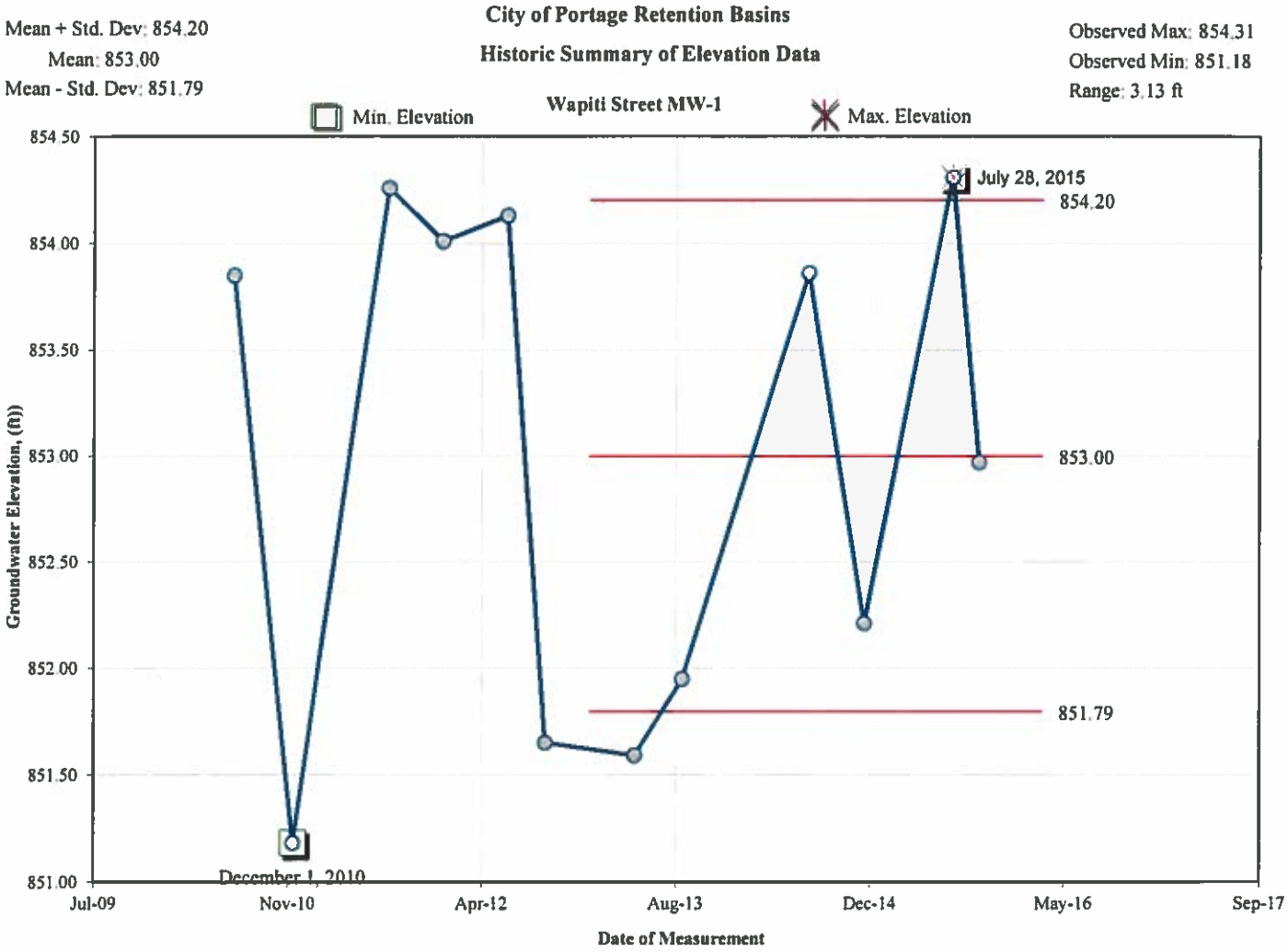
Mean + Std. Dev: 852.31
Mean: 851.83
Mean - Std. Dev: 851.35

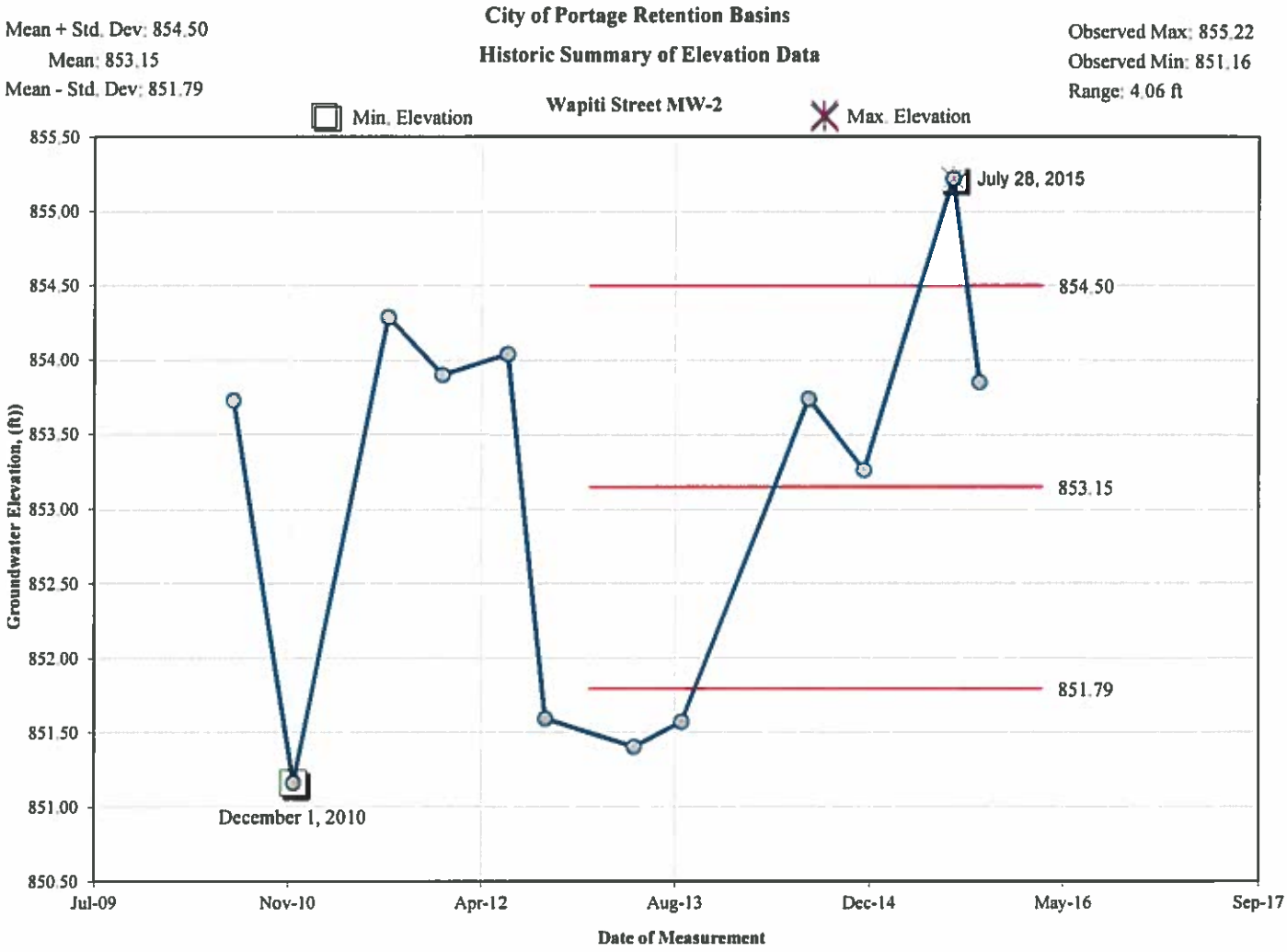
Observed Max: 852.70
Observed Min: 850.42
Range: 2.28 ft

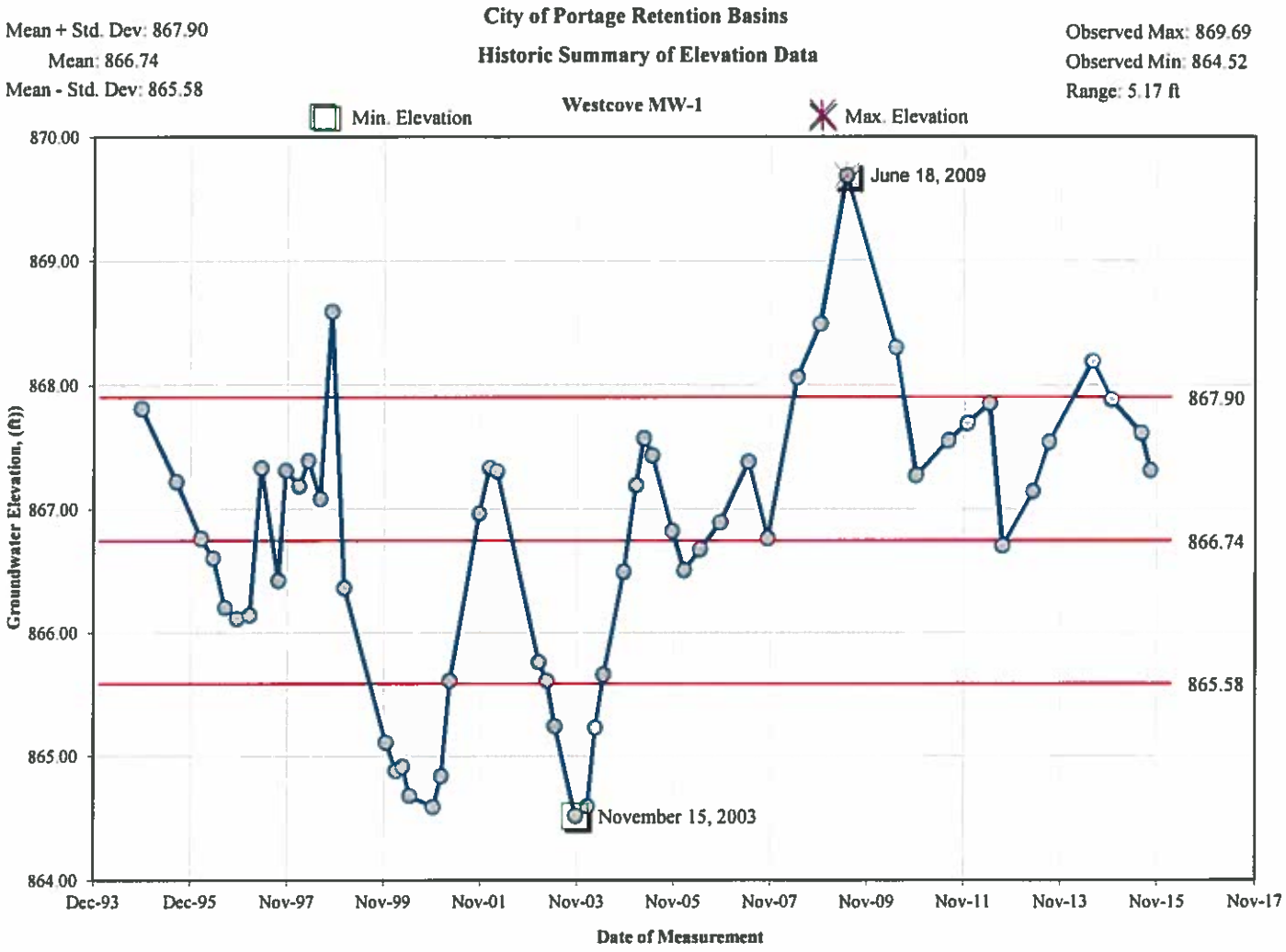


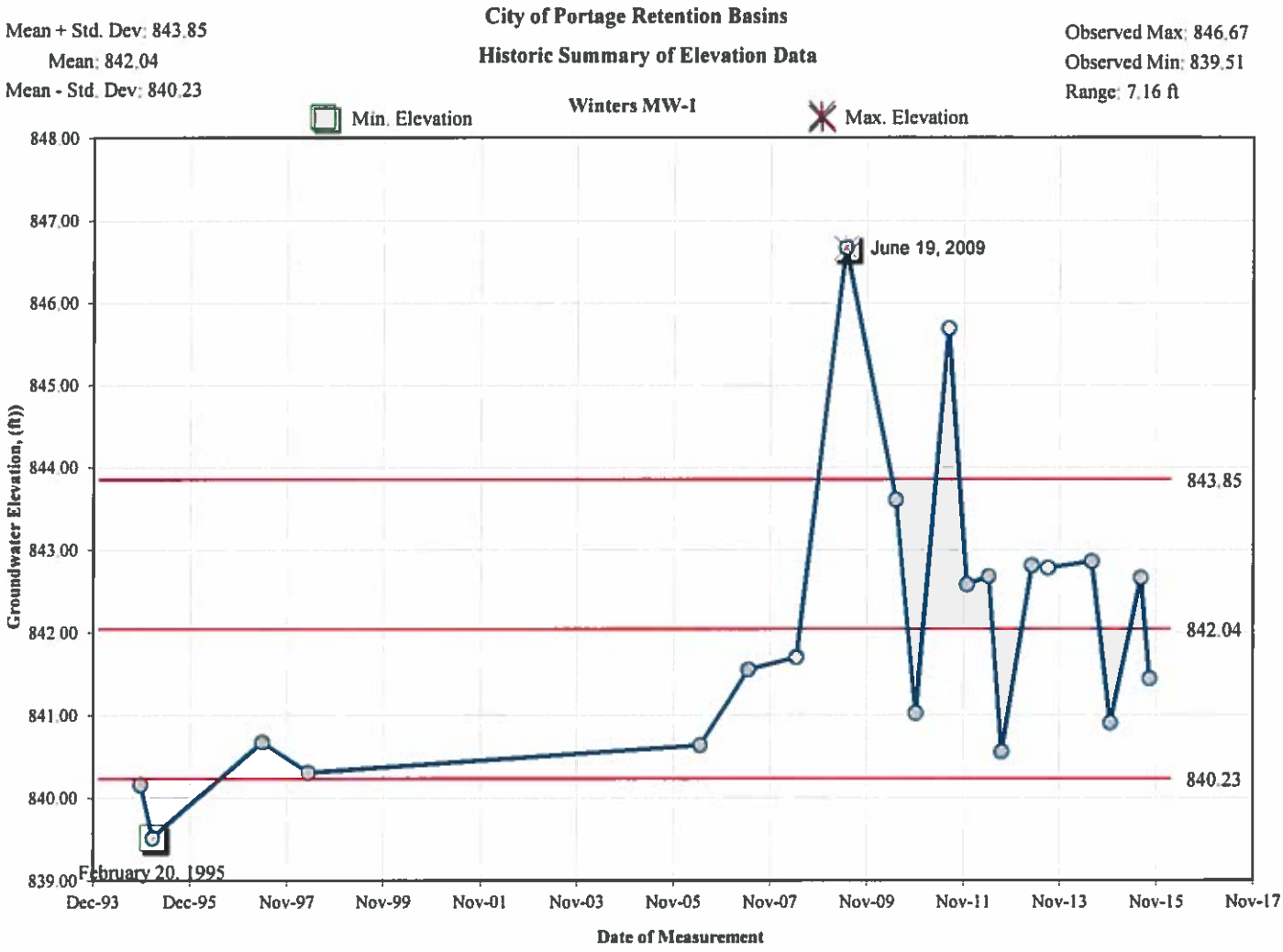

City of Portage Retention Basins
Historic Summary of Elevation Data
Van Hoesen NE (Ohio N)
Mean + Std. Dev: 849.60
Mean: 848.31
Mean - Std. Dev: 847.01
Observed Max: 850.76
Observed Min: 844.81
Range: 5.95 ft
Min. Elevation
Max. Elevation
June 19, 2009
November 15, 1996
849.60
848.31
847.01
Groundwater Elevation, (ft))
Date of Measurement
852.00
851.00
850.00
849.00
848.00
847.00
846.00
845.00
844.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

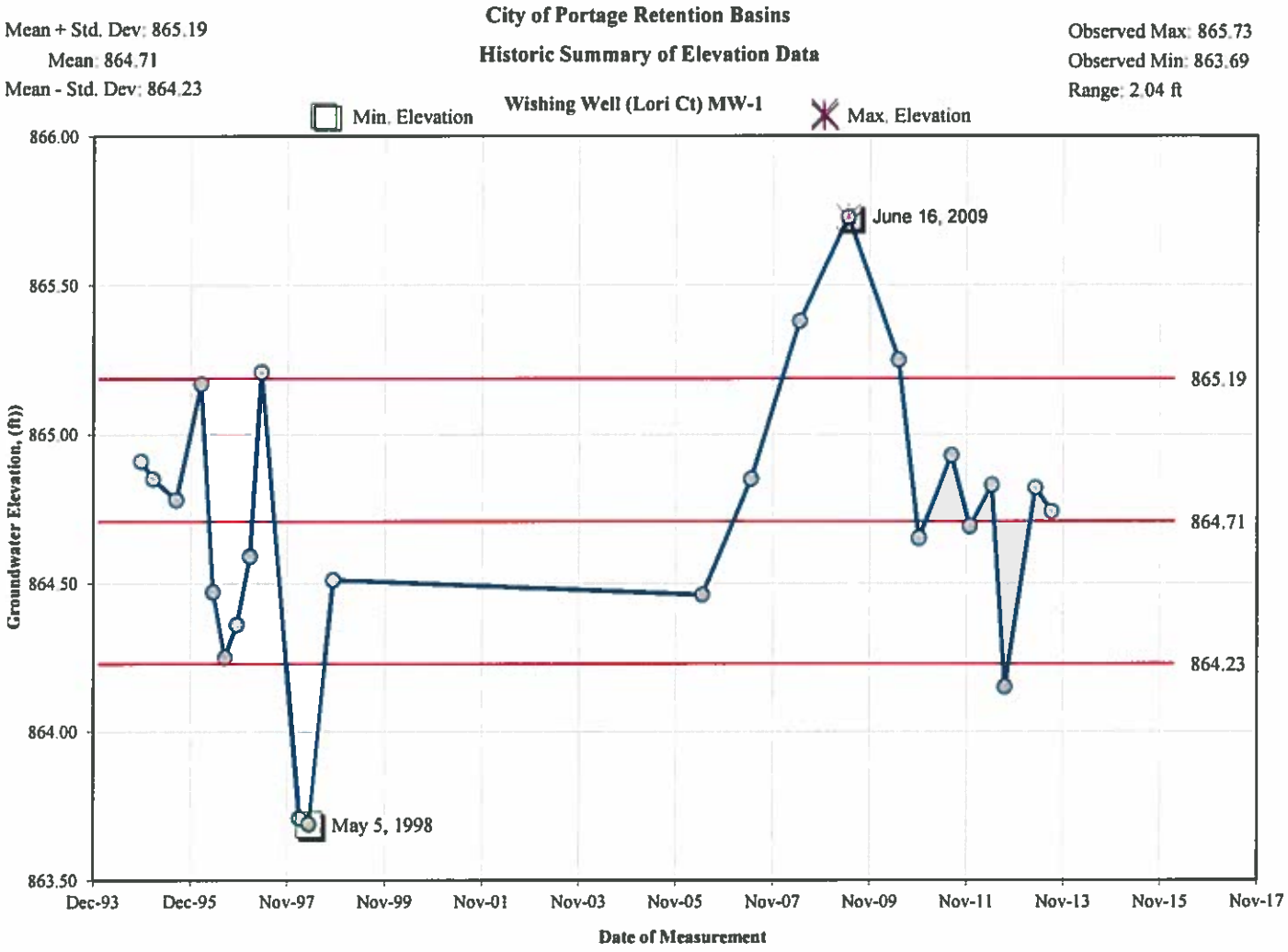

City of Portage Retention Basins
Historic Summary of Elevation Data
Van Hoesen SW (Ohio S)
Mean + Std. Dev: 849.71
Mean: 848.45
Mean - Std. Dev: 847.18
Observed Max: 850.81
Observed Min: 845.34
Range: 5.47 ft
Min. Elevation
Max. Elevation
June 19, 2009
November 15, 1996
849.71
848.45
847.18
Groundwater Elevation, (ft))
Date of Measurement
852.00
851.00
850.00
849.00
848.00
847.00
846.00
845.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17


City of Portage Retention Basins
Historic Summary of Elevation Data
Wapiti Street MW-1
Mean + Std. Dev: 854.20
Mean: 853.00
Mean - Std. Dev: 851.79
Observed Max: 854.31
Observed Min: 851.18
Range: 3.13 ft
Min. Elevation
Max. Elevation
July 28, 2015
854.20
853.00
851.79
December 1, 2010
Groundwater Elevation, (ft))
854.50
854.00
853.50
853.00
852.50
852.00
851.50
851.00
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Date of Measurement


City of Portage Retention Basins
Historic Summary of Elevation Data
Wapiti Street MW-2
Mean + Std. Dev: 854.50
Mean: 853.15
Mean - Std. Dev: 851.79
Observed Max: 855.22
Observed Min: 851.16
Range: 4.06 ft
Min. Elevation
Max. Elevation
July 28, 2015
December 1, 2010
854.50
853.15
851.79
Groundwater Elevation, (ft))
Date of Measurement
855.50
855.00
854.50
854.00
853.50
853.00
852.50
852.00
851.50
851.00
850.50
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17


City of Portage Retention Basins
Historic Summary of Elevation Data
Westcove MW-1
Mean + Std. Dev: 867.90
Mean: 866.74
Mean - Std. Dev: 865.58
Observed Max: 869.69
Observed Min: 864.52
Range: 5.17 ft
Min. Elevation
Max. Elevation
June 18, 2009
November 15, 2003
867.90
866.74
865.58
Groundwater Elevation, (ft))
Date of Measurement
870.00
869.00
868.00
867.00
866.00
865.00
864.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17


City of Portage Retention Basins
Historic Summary of Elevation Data
Winters MW-1
Mean + Std. Dev: 843.85
Mean: 842.04
Mean - Std. Dev: 840.23
Observed Max: 846.67
Observed Min: 839.51
Range: 7.16 ft
Min. Elevation
Max. Elevation
June 19, 2009
February 20, 1995
843.85
842.04
840.23
Groundwater Elevation, (ft))
Date of Measurement
848.00
847.00
846.00
845.00
844.00
843.00
842.00
841.00
840.00
839.00
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17


City of Portage Retention Basins
Historic Summary of Elevation Data
Wishing Well (Lori Ct) MW-1
Mean + Std. Dev: 865.19
Mean: 864.71
Mean - Std. Dev: 864.23
Observed Max: 865.73
Observed Min: 863.69
Range: 2.04 ft
Min. Elevation
Max. Elevation
June 16, 2009
May 5, 1998
865.19
864.71
864.23
Groundwater Elevation, (ft))
Date of Measurement
866.00
865.50
865.00
864.50
864.00
863.50
Dec-93
Dec-95
Nov-97
Nov-99
Nov-01
Nov-03
Nov-05
Nov-07
Nov-09
Nov-11
Nov-13
Nov-15
Nov-17

APPENDIX D

CONTAMINANT CONCENTRATION TABLES

Portage Outfall Sampling
Portage, MI
01SES1
Chemical Concentration Data

Chemical Concentrations of Interests	Nitrogen, Nitrate	Nitrogen, Nitrite	E-Coli	TKN	Specific Conductance	pH	Phosphorus	Suspended Solids	Inorganic Nitrogen	
Reporting Limit	0.10	0.10	1.0	0.10	1.00	0	0.01	1.0	0.10	
Date										
12/29/2014	0.83	<0.1	60	2.4	470	7.40	0.05	11	3.2	
10/15/2015	1.0	<0.1	<1.0	2	750	6.94	0.38	2.8	3.0	

DF: Dilution Factor
* - DF:10

Portage Outfall Sampling
Portage, MI
15NWS1
Table 3: Chemical Concentration Data

Chemical Concentrations of Interests	Nitrogen, Nitrate	Nitrogen, Nitrite	E-Coli	TKN	Specific Conductance	pH	Phosphorus	Suspended Solids	Inorganic Nitrogen	
Reporting Limit	0.10	0.10	1.0	0.10	1.00	0	0.01	1.0	0.10	
Date										
10/15/2015	<0.1	<0.1	<1.0	5.3	1100	7.11	0.65	110	5.3	

DF: Dilution Factor
* - DF:10

Portage Outfall Sampling
Portage, MI
16NWS2
Table 3: Chemical Concentration Data

Chemical Concentrations of Interests	Nitrogen, Nitrate	Nitrogen, Nitrite	E-Coli	TKN	Specific Conductance	pH	Phosphorus	Suspended Solids	Inorganic Nitrogen	
Reporting Limit	0.10	0.10	1.0	0.10	1.00	0	0.01	1.0	0.10	
Date										
12/29/2014	0.82	<0.1	NA	2.2	100	7.07	0.082	3.1	3	
10/15/2015	0.77	<0.1	<1.0	1.2	400	7.7	0.042	1.6	2	

DF: Dilution Factor
* - DF:10

Portage Outfall Sampling
Portage, MI
16SES1
Table 3: Chemical Concentration Data

Chemical Concentrations of Interests	Nitrogen, Nitrate	Nitrogen, Nitrite	E-Coli	TKN	Specific Conductance	pH	Phosphorus	Suspended Solids	Inorganic Nitrogen	
Reporting Limit	0.10	0.10	1.0	0.10	1.00	0	0.01	1.0	0.10	
Date										
12/29/2014	0.94	<0.1	1900	2.2	220	7.13	0.073	6	3.1	

DF: Dilution Factor
* - DF:10

Portage Outfall Sampling
Portage, MI
21NWS3
Table 3: Chemical Concentration Data

Chemical Concentrations of Interests	Nitrogen, Nitrate	Nitrogen, Nitrite	E-Coli	TKN	Specific Conductance	pH	Phosphorus	Suspended Solids	Inorganic Nitrogen	
Reporting Limit	0.10	0.10	1.0	0.10	1.00	0	0.01	1.0	0.10	
Date										
12/29/2014	0.84	<0.1	32	1.2	550	7.73	0.039	2.1	2	
10/15/2015	0.77	<0.1	<1.0	0.98	400	7.73	0.042	1.3	1.8	

DF: Dilution Factor
* - DF:10