Executive Summary 2018

This report represents a brief discussion on several research projects conducted by or with Parjana® Distribution in collaboration with various government, private, and educational entities to validate the efficacy of the Parjana® Energy-passive Groundwater Recharge Product (EGRP®) system. These individual research projects generated experimental data documenting how the EGRP® system performs in various applications. The overall aim of conducting these research projects is to determine the efficacy of the EGRP® system in eliminating standing surface water without disturbing ecological balance. There are seven independent research projects that have been conducted to date that are summarized in this report (Table 1). Overall, findings of these research reports suggest that the EGRP® system successfully reduces standing surface water, significantly increases surface infiltration and does not have an adverse effect on groundwater quality. Additional information and reports to supplement this summary are available upon request.

Summary List of Research Investigations and Goals

Lawrence Technological University, Southfield MI

- To implement, monitor, and evaluate the efficacy of the EGRP® in a systems-based approach.
- To analyze the effect of the EGRP® on groundwater elevation and recovery time as a result of increased infiltration.

Michigan State University, East Lansing MI

- To analyze the effect of the EGRP® system on volumetric water content and soil moisture stabilization.
- To study the possible related impact of the EGRP® on plant-available water and its correlation to crop yield.

Belle Isle Shelter 5, Detroit MI

- To determine the efficacy of EGRP® system in reducing standing surface water.
- To determine the efficacy of the EGRP® system in reducing the volume of runoff being delivered to Detroit Water & Sewerage Department as part of combined sewer system.
- To explore the effect of the EGRP® system on groundwater levels and quality.

Coleman A. Young International Airport, Detroit MI

- To evaluate how the EGRP® system enhances surface water infiltration
- To evaluate whether the EGRP® system acts a straight vertical conduit to lower soil layers that might allow surface contaminants to enter shallow groundwater tables

Mettetal Airport, Canton MI

- To determine if the EGRP® system could assist in draining an existing sediment forebay with long-term ponding

Geneva International Airport, Switzerland

- To determine the impact of the EGRP® system on soil moisture distribution and shallow water table response in an area without standing water problems

Edgabston Cricket Club

- To determine the influence of the EGRP® system on the infiltration, surface firmness and soil moisture on an athletic field.

Lawrence Technological University, Southfield MI

The *National Demonstration of Scalable Integrated Drainage System to Mitigate Parking Lot Stormwater Runoff*, involves retrofitting parking lot storm collection drains to mitigate at least a 1-inch rain event in 24 hours.

Lawrence Technological University (LTU) is leading a collaboration of industry partners in a multi-state demonstration project featuring the implementation of an innovative and scalable integrated drainage design that significantly mitigates polluted parking lot stormwater runoff. The integrated drainage system includes three separate patented technologies combined in a novel approach including a porous pavement surface (parking performance maintained), an underground engineered soil storage reservoir (for stormwater storage and water quality filtration) and the Energy-passive Groundwater Recharge Product (EGRP®) (to improve infiltration and reduce runoff).

The research demonstration at LTU is the first site to be implemented of an overall five, with the remaining four set to be installed in Ohio, California, Florida, and Washington, D.C.

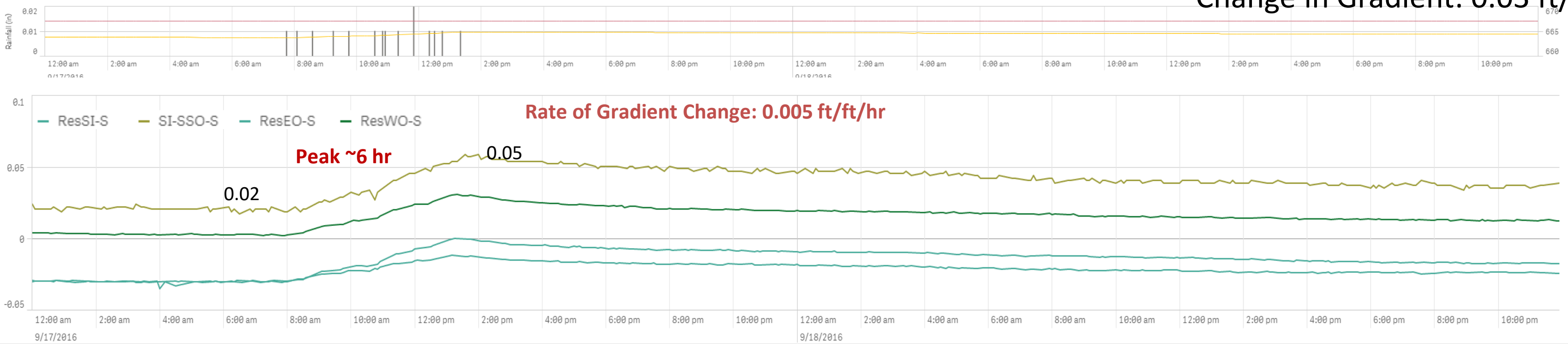
Lawrence Technological University, Southfield MI

Figure 1: Data Set 1 - Horizontal Hydraulic Gradients - Short Term

Sept. 17, 2016 vs Sept. 4, 2017

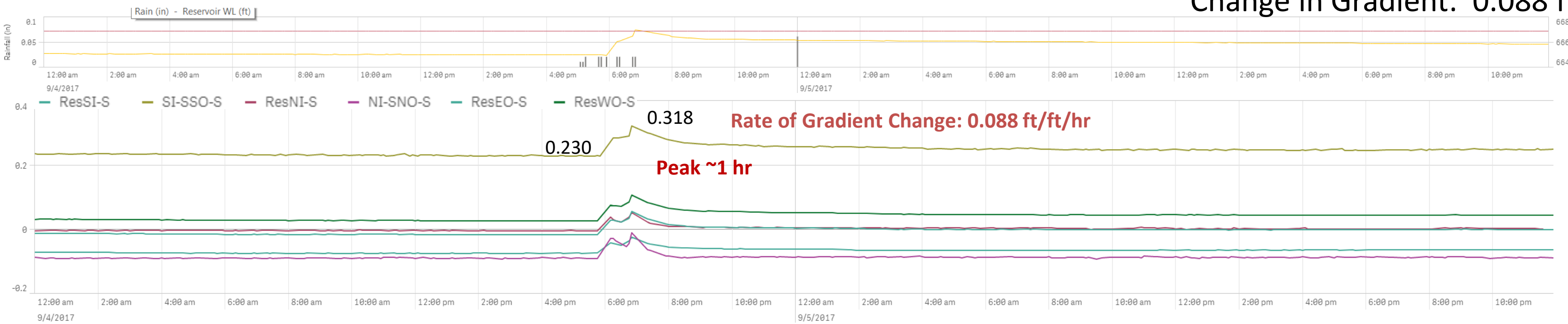
Total Precip: 0.21 in/8 hr
Change in Gradient: 0.03 ft/ft

Sept. 2016



Total Precip: 0.51 in/6 hr
Change in Gradient: 0.088 ft/ft

Sept. 2017



ResSI-S = Gradient between Reservoir and South Inside Shallow wells
SI-SSO-S = Horizontal Hydraulic Gradient between South Inside and Outside shallow wells
Applies for N, E, and W

*Preliminary data and modeling, courtesy of Drummond Carpenter, PLLC.
Graphs shown are not representative of final results.

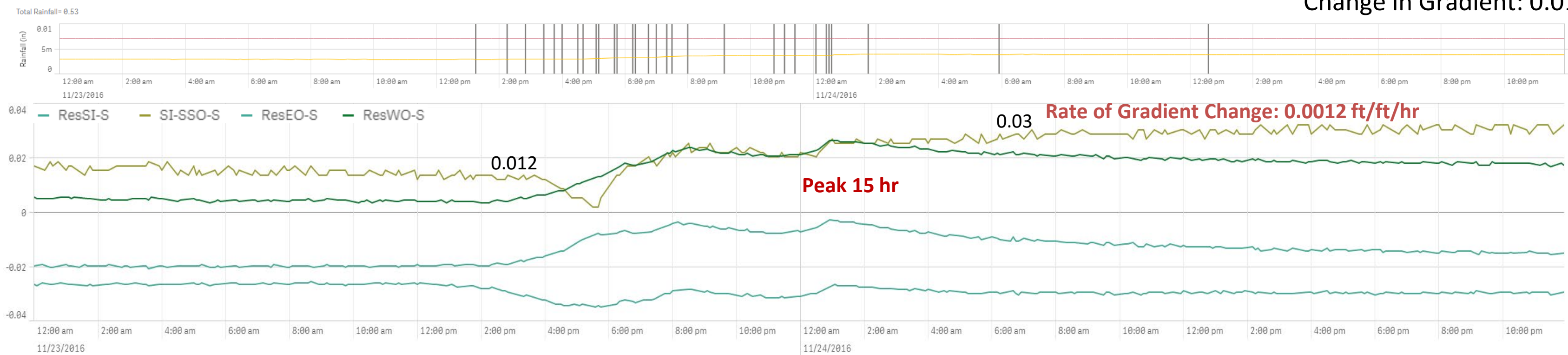
Lawrence Technological University, Southfield MI

Figure 2: Data Set 2 - Horizontal Hydraulic Gradients - Short Term

Nov. 23, 2016 vs Aug. 17, 2017

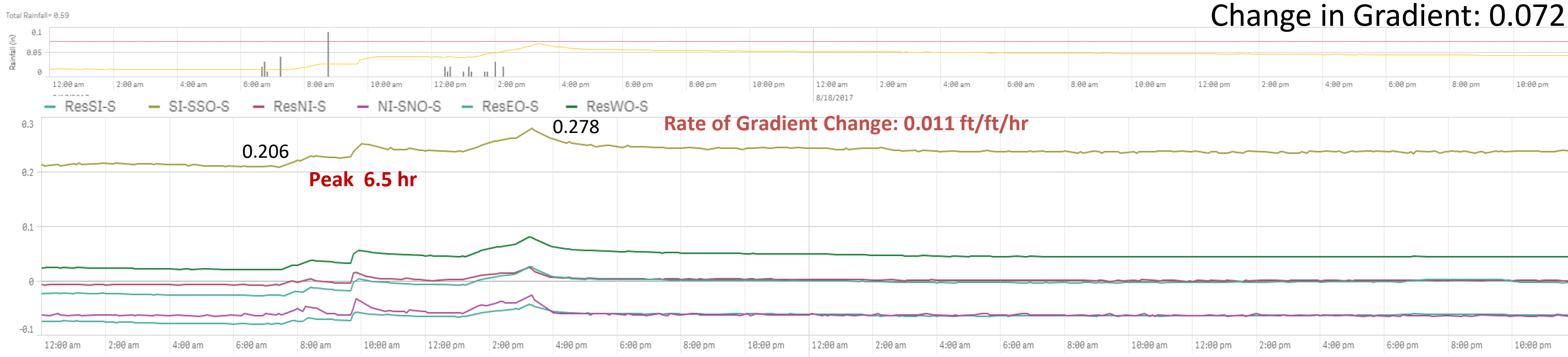
Total Precip: 0.51 in/13hr
Change in Gradient: 0.018 ft/ft

Nov. 2016



Total Precip: 0.59 in/8hr
Change in Gradient: 0.072 ft/ft

Aug. 2017



ResSI-S = Gradient between Reservoir and South Inside Shallow wells
SI-SSO-S = Horizontal Hydraulic Gradient between South Inside and Outside shallow wells
Applies for N, E, and W

*Preliminary data and modeling, courtesy of Drummond Carpenter, PLLC. Graphs shown are not representative of final results.

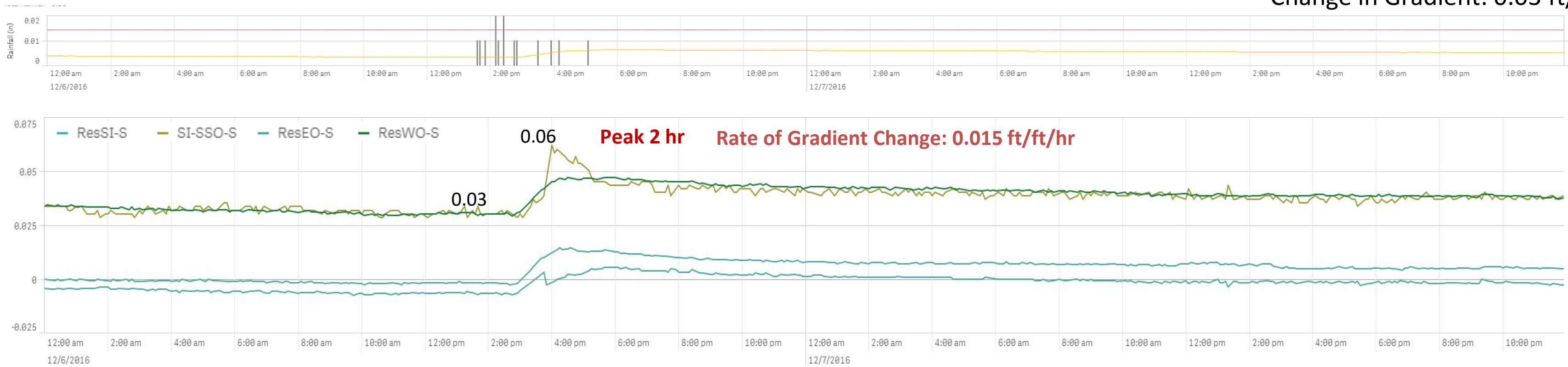
Lawrence Technological University, Southfield MI

Figure 3: Data Set 3 - Horizontal Hydraulic Gradients - Short Term

Dec. 6, 2016 vs Jul. 13, 2017

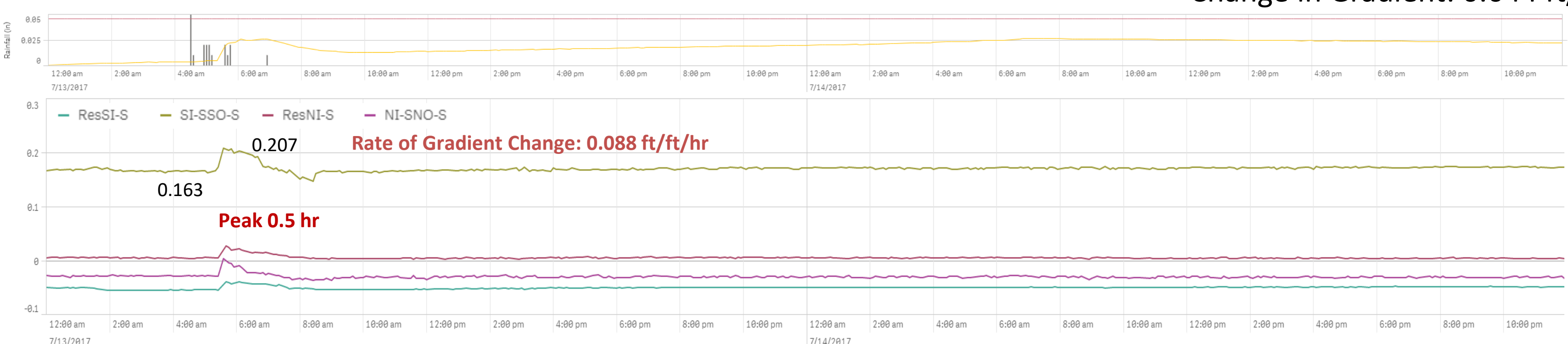
Total Precip: 0.21 in/3hr
Change in Gradient: 0.03 ft/ft

Dec. 2016



Total Precip: 0.30 in/3hr
Change in Gradient: 0.044 ft/ft

July 2017



ResSI-S = Horizontal hydraulic gradient between Reservoir and South Inside Shallow wells
SI-SSO-S = Horizontal hydraulic gradient between South Inside and Outside shallow wells
Applies for N

*Preliminary data and modeling, courtesy of Drummond Carpenter, PLLC. Graphs shown are not representative of final results.

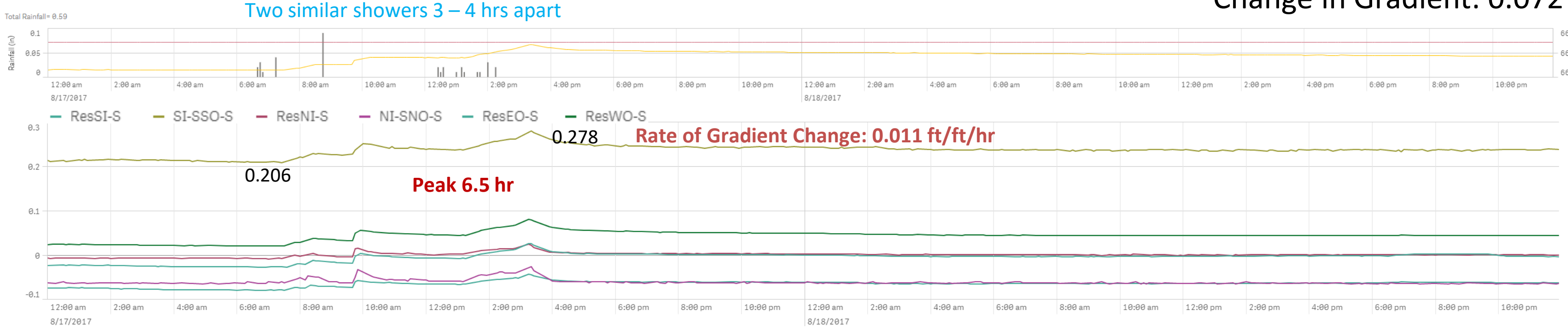
Lawrence Technological University, Southfield MI

Figure 4: Data Set 4 - Horizontal Hydraulic Gradients - Short Term

Aug. 17, 2017 vs Sept. 4, 2017

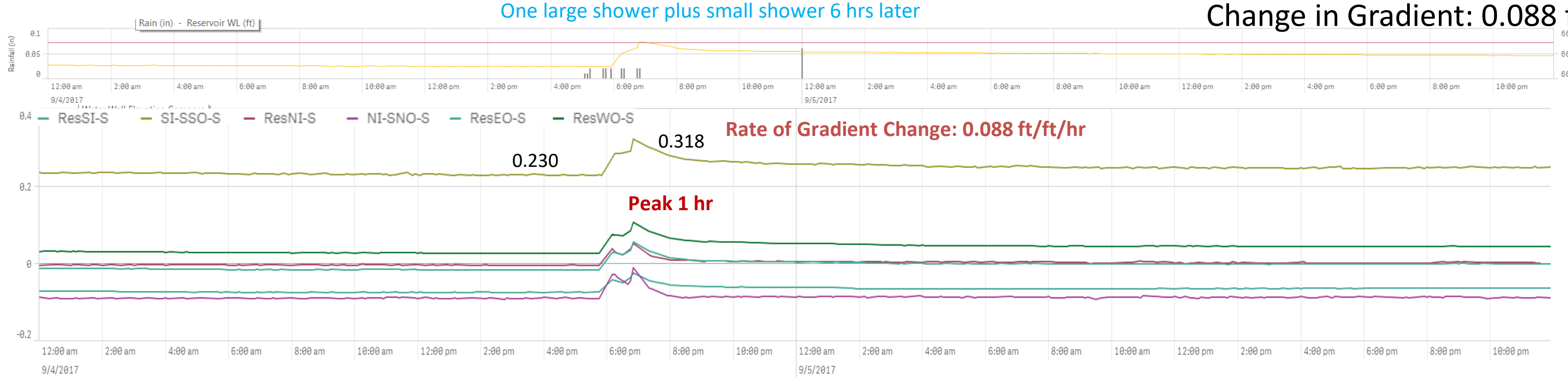
Total Precip: 0.59 in/8hr
Change in Gradient: 0.072 ft/ft

Aug. 2017



Total Precip: 0.51 in/6 hr
Change in Gradient: 0.088 ft/ft

Sept. 2017



ResSI-S = Gradient between Reservoir and South Inside Shallow wells
SI-SSO-S = Horizontal Hydraulic Gradient between South Inside and Outside shallow wells
Applies for N, E, and W

*Preliminary data and modeling, courtesy of Drummond Carpenter, PLLC. Graphs shown are not representative of final results.

Lawrence Technological University, Southfield MI

Results:

A preliminary, 3rd party evaluation of the impact of the EGRP® on groundwater elevation and recovery time at the Lawrence Technological University site was conducted and compiled by Drummond Carpenter, PLLC. Specific findings were:

- Magnitude of change in groundwater elevation was greater during storm events in 2017 vs. 2016
- Groundwater elevations increased more rapidly during storm events in 2017 vs. 2016
- Groundwater levels recover to baseline elevations faster in 2017 vs. 2016
- Horizontal hydraulic gradients measured in the wells increased more rapidly during rain events in 2017 vs. 2016

The conclusion drawn from these initial results were that EGRP® acclimation has an apparent affect on groundwater elevations and groundwater recovery times.

Testing and analysis is scheduled to continue throughout 2018 and 2019 to mimic the dates and rain events sampled in the previous two years' datasets, for consistency.

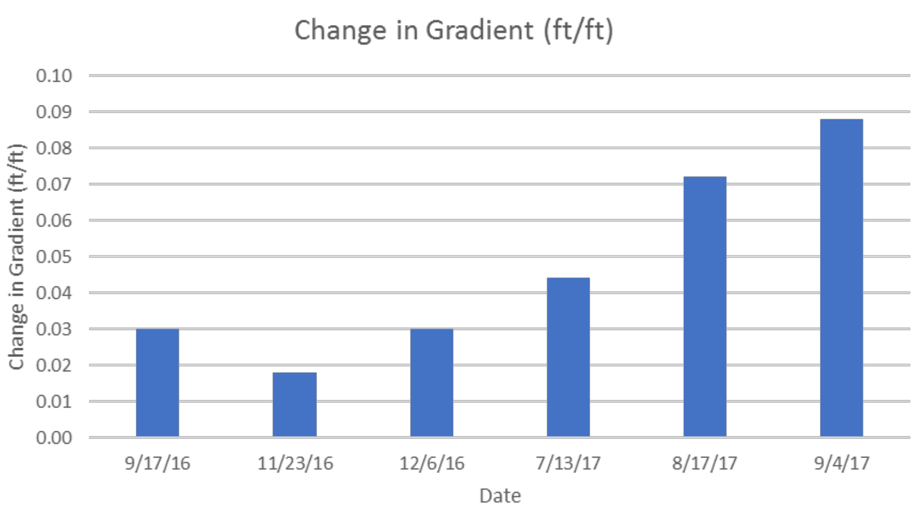


Figure 5: Change in hydraulic gradient (ft/ft) per date.

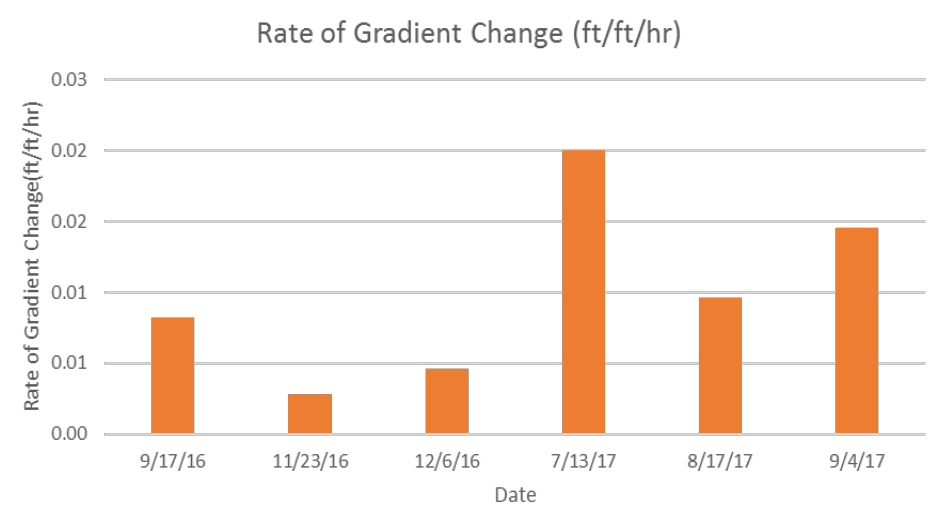


Figure 6: Rate of change in hydraulic gradient (ft/ft/hr) per date.

Michigan State University, East Lansing MI

A *2017 Statistical Analysis Summary* was submitted to Parjana® for research performed at Michigan State University (MSU) by Thomas A. Nikolai, Ph.D. The research study was first implemented at MSU's Hancock Turfgrass Research Center (HTRC) in October of 2015.

The EGRP® system was installed at the HTRC in a border area that had not previously been utilized for turfgrass research. The soil on the site is a Capac loam and the area was seeded in 2006 with a Rhino seed mix of 20% Raven Kentucky bluegrass (KBG), 20% Cascade chewings fescue, 20% Merit KBG, 20% Baron KBG, and 20% Stellar perennial ryegrass. The site received minimal fertility and pesticide inputs prior to the study and no fertilizer or pesticides have been applied to the site since installation of the product. The entire site, delineated in red in Figure 7, measures 210' by 85' (approximate latitude and longitude, for reference: 42°42'40.81"N, 84°28'20.17"W).

Figure 7: Site location relative to the Hancock Turfgrass Research Center.

The soil type at the project site is identified by the United States Department of Agriculture's Web Soil Survey as CaA – Capac loam, 0 to 4 percent slopes, C/D classification, and with a native infiltration rate between 0.01 and 0.14 inches per hour. The typical profile is represented as:

- Ap - 0 to 9 inches: loam
- B/E - 9 to 16 inches: clay loam
- Bt - 16 to 31 inches: clay loam
- C - 31 to 80 inches: loam

Surrounding soils are predominant other classifications of loams and sandy loams, including AnA – Aubbeenaubbee-Capac Sandy loams and Co – Colwood-Brookston loams.

The study is comprised of three replications of two treatments (Figure 8), which include: 20’ x 20’ plots with the EGRP® system installed and 20’ x 20’ plots with no drainage installed. Each 20’ x 20’ treatment plot replication is separated by 45’ east to west and 75’ north to south to minimize the effects, if any, of the sphere of influence the EGRP® system may have on drainage in a check plot. Toro Turf Guard sensors were placed in each plot as follows. A line was made with twine between the NW and the SE corners of each plot. Sensors were placed 7 feet into the plot from the SE corner marker on that diagonal line (Figure 4). The top of the sensors were buried at a 4-inch depth below the soil surface which means the Turf Guard sensors probes are approximately 5 inches and 10 inches from the soil surface. Turf Guard sensors measure and record the volumetric moisture content (VMC) on 5-minute intervals 24 hours per day.

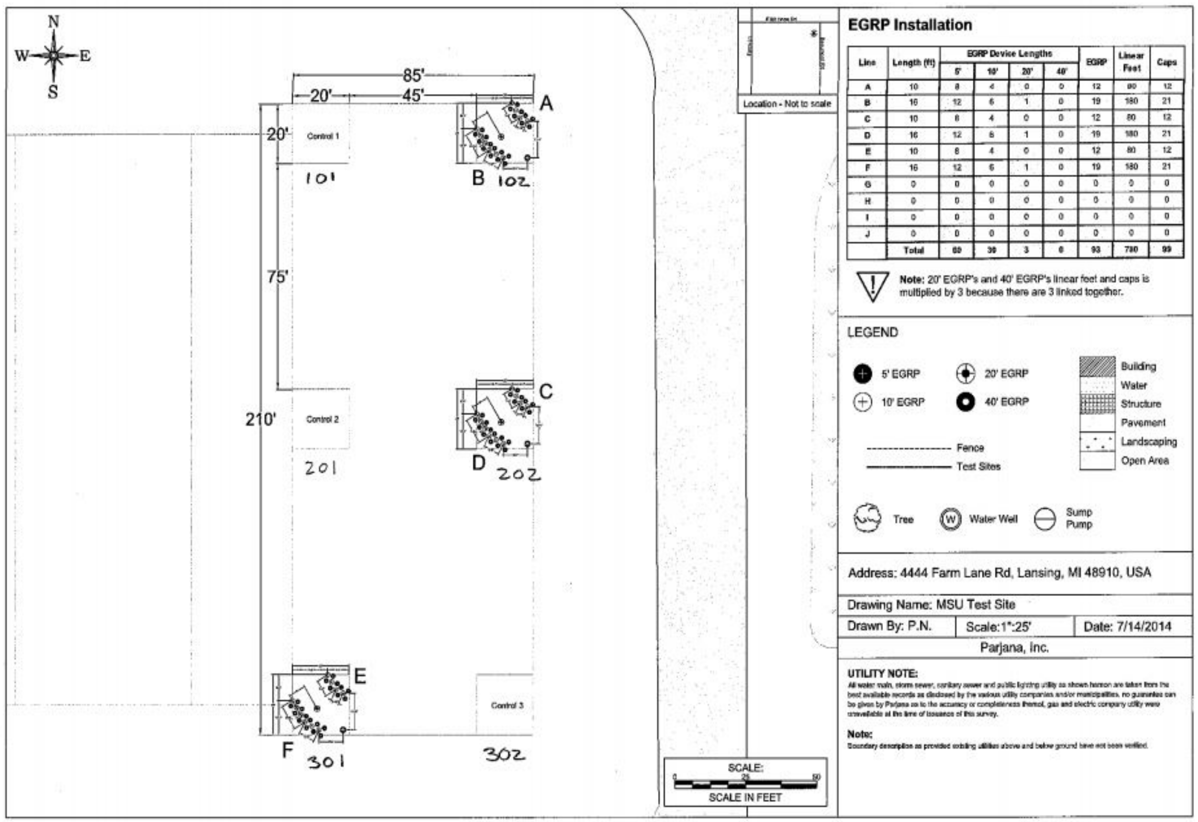


Figure 8: Site layout of the EGRP® installation at the Hancock Turfgrass Research Center.

Results:

24 VMC measurements are reported. Reported dates and times were chosen as they either followed, or were taken during, a rain event and VMC differences monitored via Site Vision® seemed apparent. It is pertinent to state that in the absence of a rain event there were little differences among the plots regarding moisture retention and that each treatment mean reported in the tables is the mean of three replications.

In Table 1, two dates, June 3 and 6 resulted in statistically significant differences within the 10% level and on both occasions the VMC in plots with the EGRP® system were drier. In Table 2, there are four dates with statistically significant data within the 10% level, July 21 and August 24, and two of those dates are also significant within the 5% level, July 10 and August 17. On all four of those occasions the VMC in plots with the EGRP ® system were drier compared to the control plots. In Table 3, there is a significant data set within the 5% level, September 22, and another within the 10% level, October 8, and on both occasions the VMC in plots with the EGRP ® system were drier. Though not statistically significant, of the remaining 16 measurements reported in Tables 1 through 3 each one resulted in VMC in plots with the EGRP ® lower than that of those without a drainage system.

Michigan State University, East Lansing MI

Table 1.

Volumetric moisture content obtained from a 5-inch depth.								
	June 1	June 3	June 6	June 9	June 18	June 19	June 20	June 21
Time of measurement	11:55 PM	5:00 AM	12:10 AM	12:25 AM	10:25 PM	12:15 AM	12:20 AM	12:25 AM
Condition	Drying	Drying	Drying	Drying	Raining	Drying	Drying	Drying
EGRP®	30.1	27.6	24.8	22.6	36.7	34.8	31.5	29.4
Control	34.8	33.4	31.2	30.6	38.5	42.0	39.9	37.7
LSD @ 0.05	8.3	6.5	10.1	13.6	26.9	18.5	15.2	13.8
Probability	0.13	0.06**	0.09**	0.12	0.80	0.23	0.14	0.12

* LSD - Least Significant Difference; p=0.05.
** Data is statistically significant within a probability of 0.10.

Table 2.

Volumetric moisture content obtained from a 5-inch depth.								
	July 7	July 10	July 21	July 27	Aug 15	Aug 16	Aug 17	Aug 24
Time of measurement	10:50 AM	7:55 AM	12:00 AM	12:50 PM	6:40 AM	11:30 AM	TIME	12:25
Condition	Raining	Drying	Drying	Drying	Raining	Drying	Drying	Drying
EGRP®	36.9	25.4 b	22.7	20.4	31.7	29	26.2 b	21.2
Control	41.8	33.5 a	31.8	29.6	32.8	34.9	33.3 a	29.8
LSD @ 0.05	6.3	6.2	11.9	15.9	6.6	13.8	3.3	12.9
Probability	0.44	0.03*	0.08**	0.13	0.86	0.21	0.01*	0.10**

* LSD - Least Significant Difference; p=0.05.
** Data is statistically significant within a probability of 0.05.
*** Data is statistically significant within a probability of 0.10.

Table 3.

Volumetric moisture content obtained from a 5-inch depth.								
	Aug 31	Sept 22	Sept 22	Oct 7	Oct 8	Oct 9	Oct 10	Oct 11
Time of measurement	11:50 PM	6:55 AM	11:45 PM	10:20 PM	1:55 AM	3:50 AM	12:20 AM	11:35 AM
Condition	Drying	Raining	Drying	Raining	Drying	Raining	Drying	Raining
EGRP®	19.4	27.4	24.9 b	39.8	36.7	44.7	38.4	52.7
Control	28.5	30.1	31.3 a	46.1	42.9	48.8	44.5	59.3
LSD @ 0.05	16.8	6.8	4.2	37.5	9.8	22.5	10.3	16.3
Probability	0.14	0.67	0.02**	0.54	0.10***	0.51	0.13	0.22

* LSD - Least Significant Difference; p=0.05.
** Data is statistically significant within a probability of 0.05.
*** Data is statistically significant within a probability of 0.10.

Belle Isle Shelter 5, Detroit MI

Belle Isle, a 985-acre island in the Detroit River near the mouth of Lake St. Clair, is considered one of the jewels of the city of Detroit. Having recently been leased to The State of Michigan for thirty years, the Department of Natural Resources (DNR) has primary authority over its management within the Michigan State Park system (Greene 2013). The DNR intends to spend up to $20 million for park improvements and infrastructure upgrades to further enhance visitors, experience on the island (Litcherman 2013). This demonstration project was made possible through a grant from the Michigan Economic Development Corporation (MEDC) and was intended to vastly mitigate the expense of managing stormwater by DWSD.

Installation on Belle Isle consisted of eleven lines of diamond pattern EGRP® (Figure 10). The location of the EGRP® lines can be seen in Figure 3 along with the overall study design information. Belle Isle consists predominantly of interbedded sands and silty clays to a depth of approximately 20 feet. The potentiometric surface varied from 0.5 to 6 feet below the surface depending on rainfall and piezometric well location (ECT 2016).

Purpose:

The primary goals of this investigation were to determine if the EGRP® system could eliminate standing water on an approximately 24 acre parcel and decrease the volume of stormwater delivered to DWSD through the municipal combined sewer drain system thereby alleviating the cost associated with treatment.

A secondary goal was to explore the effect the EGRP® system has on groundwater.

Belle Isle Shelter 5, Detroit MI

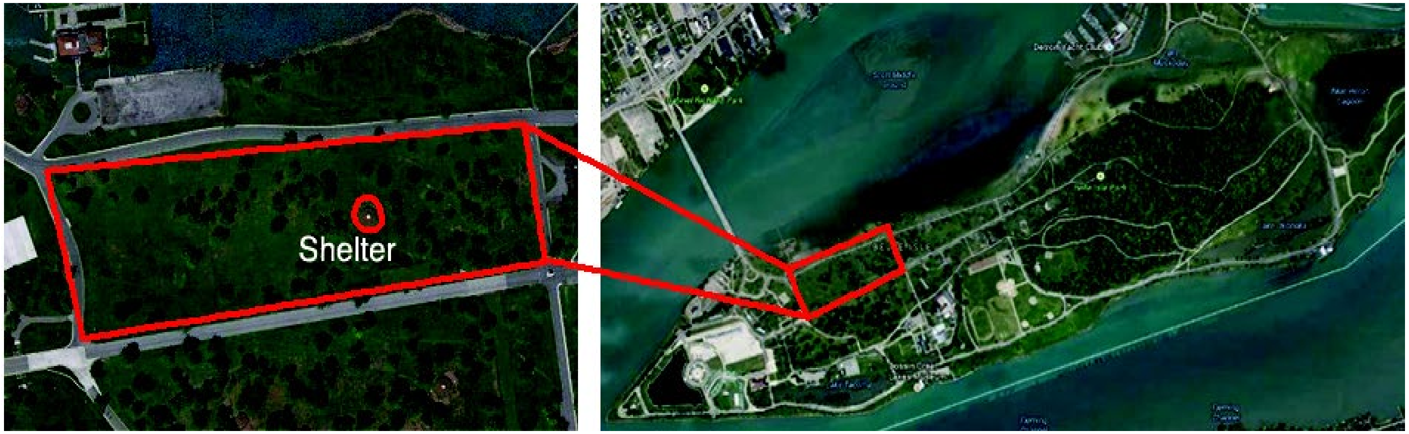


Figure 9: Test Area (Shelter 5) on Belle Isle

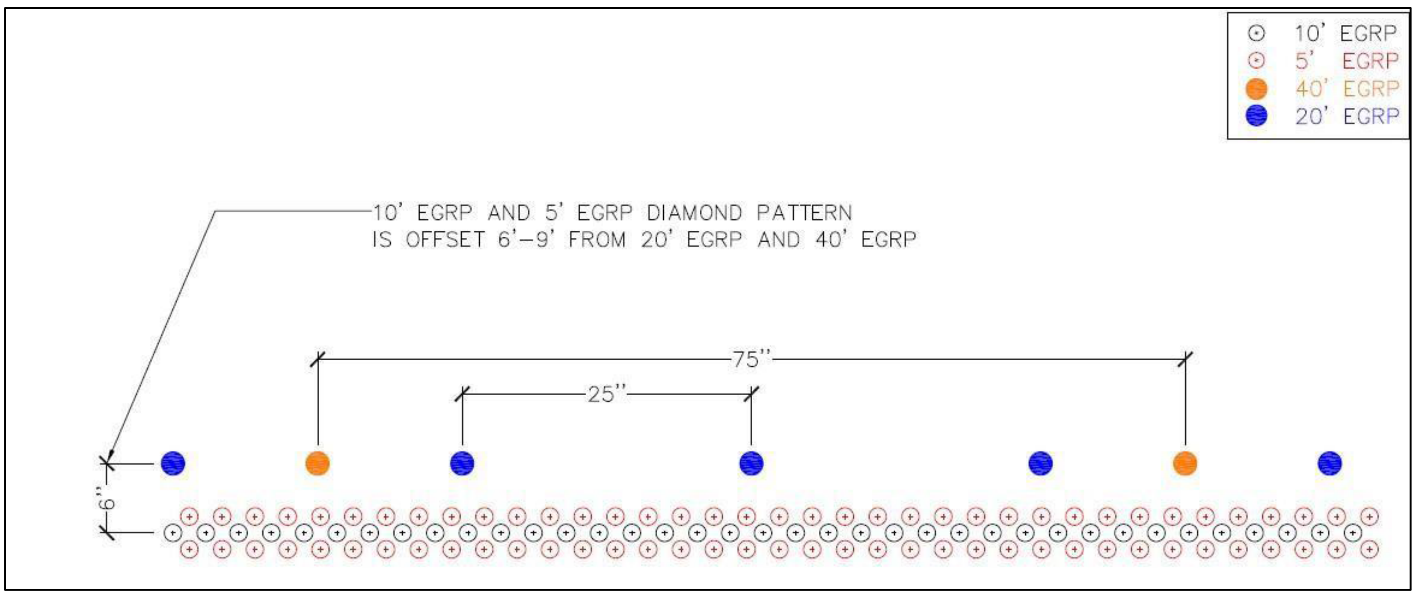


Figure 10: Configuration of EGRP® diamond pattern

Figure 11: Locations of grey infrastructure and flow direction on Belle Isle (ECT 2016).

Results:

Figure 12 and 13 represent total cumulative in-pipe flow from test site before and after installation. Both figures are separated into three distinct time periods (Pre-Installation, Post-Installation, and Performance) with the cumulative flow and precipitation initialized to zero at the beginning of each time period for ease of interpretation. These figures graphically depict the main findings of the investigation which include (ECT2016):

- Prior to installation, the amount of runoff volume was nearly double the amount of rainfall volume due to the pipe network capturing water from a larger area of the island and possibly influenced by the Detroit River.
- After installation, the runoff volume is much less than rainfall volume.
- The rainfall has less direct impact on the amount of runoff from the site when comparing control site versus test site.
- There was an 80% reduction in the total amount of runoff volume from the test site.

In addition to in-pipe flow monitoring, groundwater elevation monitoring was conducted in 10-minute intervals at five monitoring well locations (Figure 14). Results suggest no effect on the local groundwater elevation related to the presence of EGRP®s with groundwater elevation fluctuating similarly in response to rain events on both the test and control sites (ECT 2016). Finally, on October 10, 2014 groundwater was collected from locations both in the control and test sites and measured for total phosphorus, chloride, total dissolved solids, and E. coli and there was no discernable difference between the two locations (ECT 2016). While no definitive conclusions can be made from a single data point, it is encouraging that there was no measured detrimental effects to groundwater quality post installation.

Belle Isle Shelter 5, Detroit MI

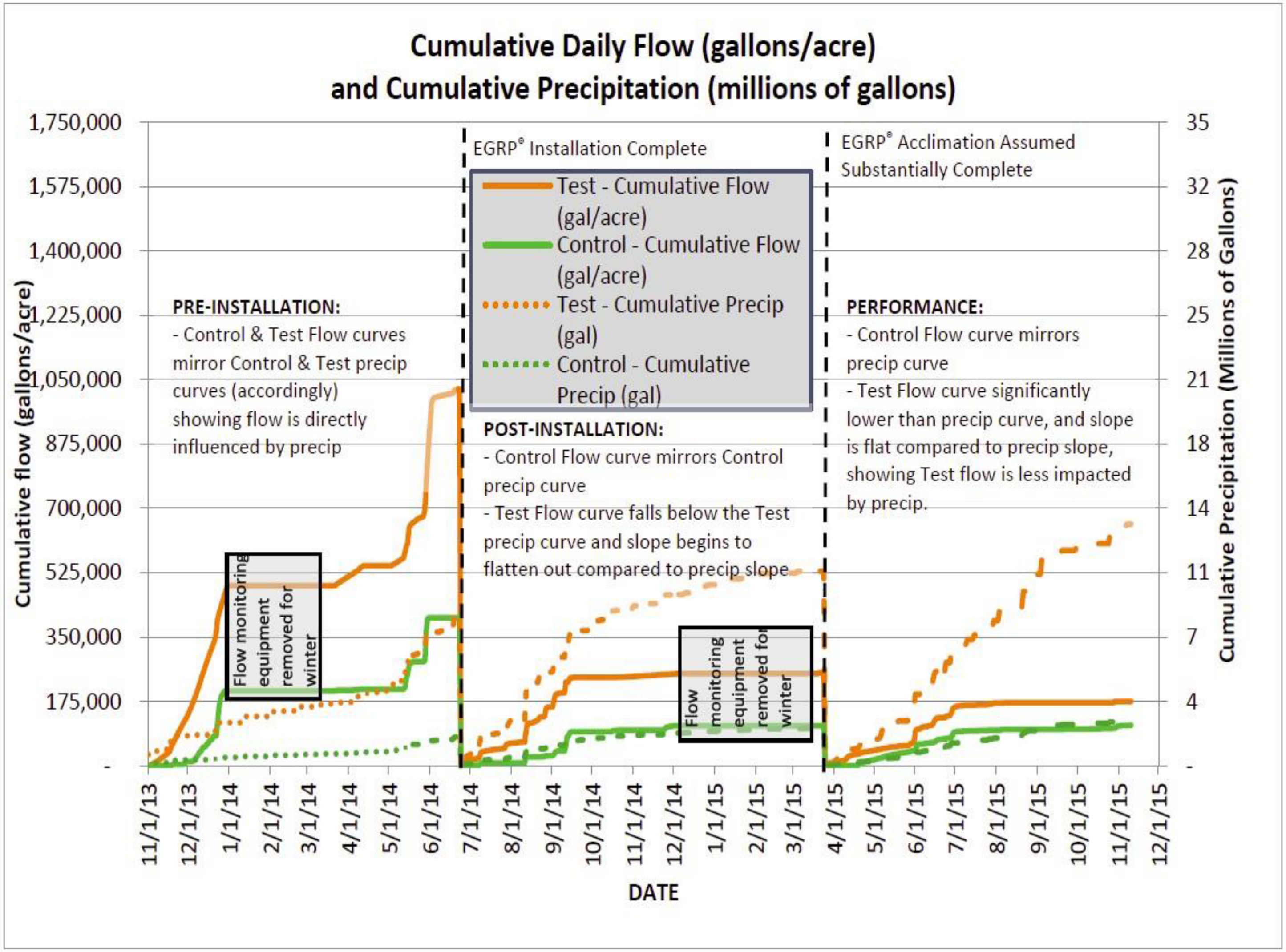


Figure 12: Cumulative daily flow and precipitation during study investigation (ECT 2016).

Belle Isle Shelter 5, Detroit MI

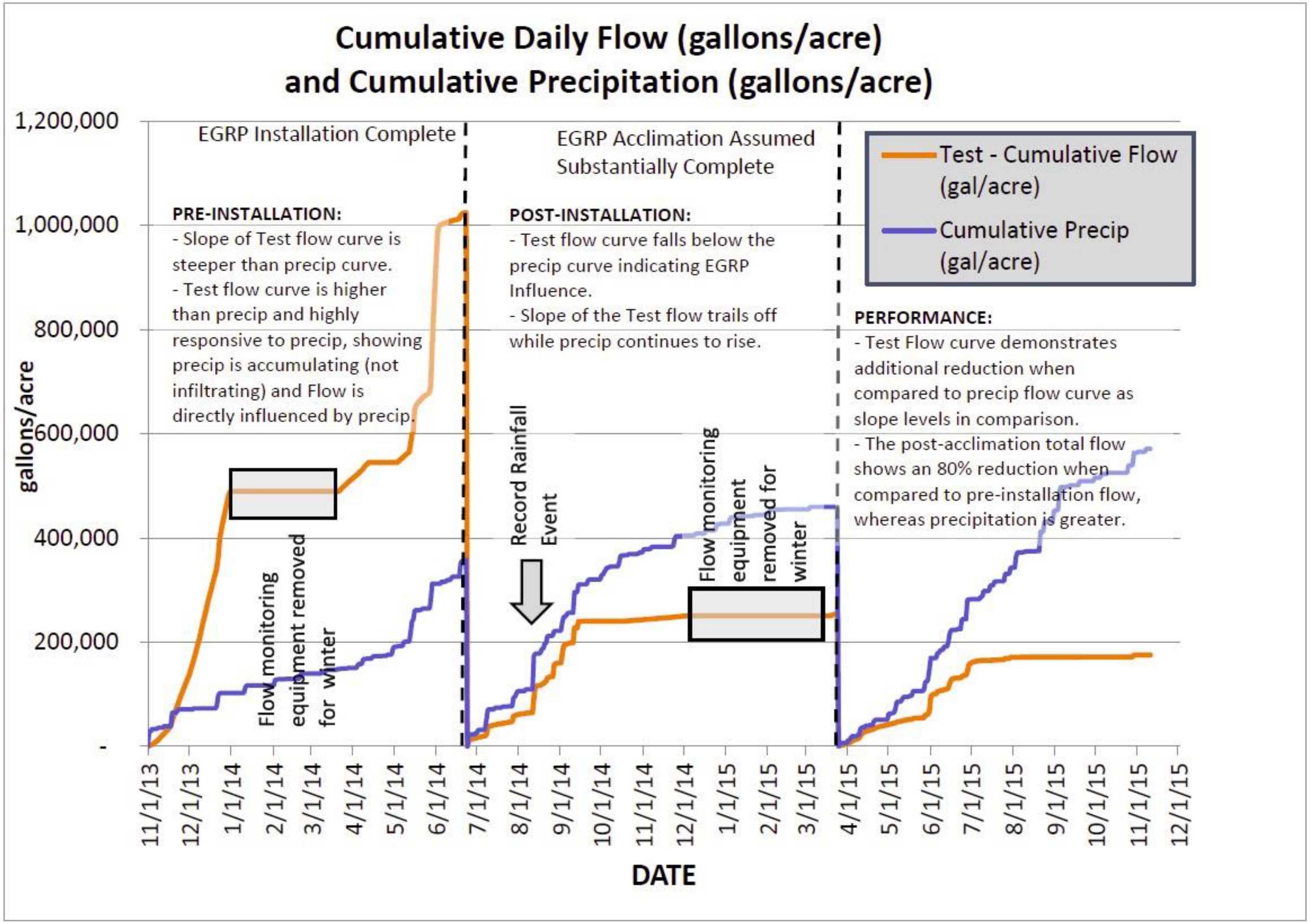


Figure 13: Cumulative daily flow and precipitation for test site during study investigation (ECT 2016).

Belle Isle Shelter 5, Detroit MI

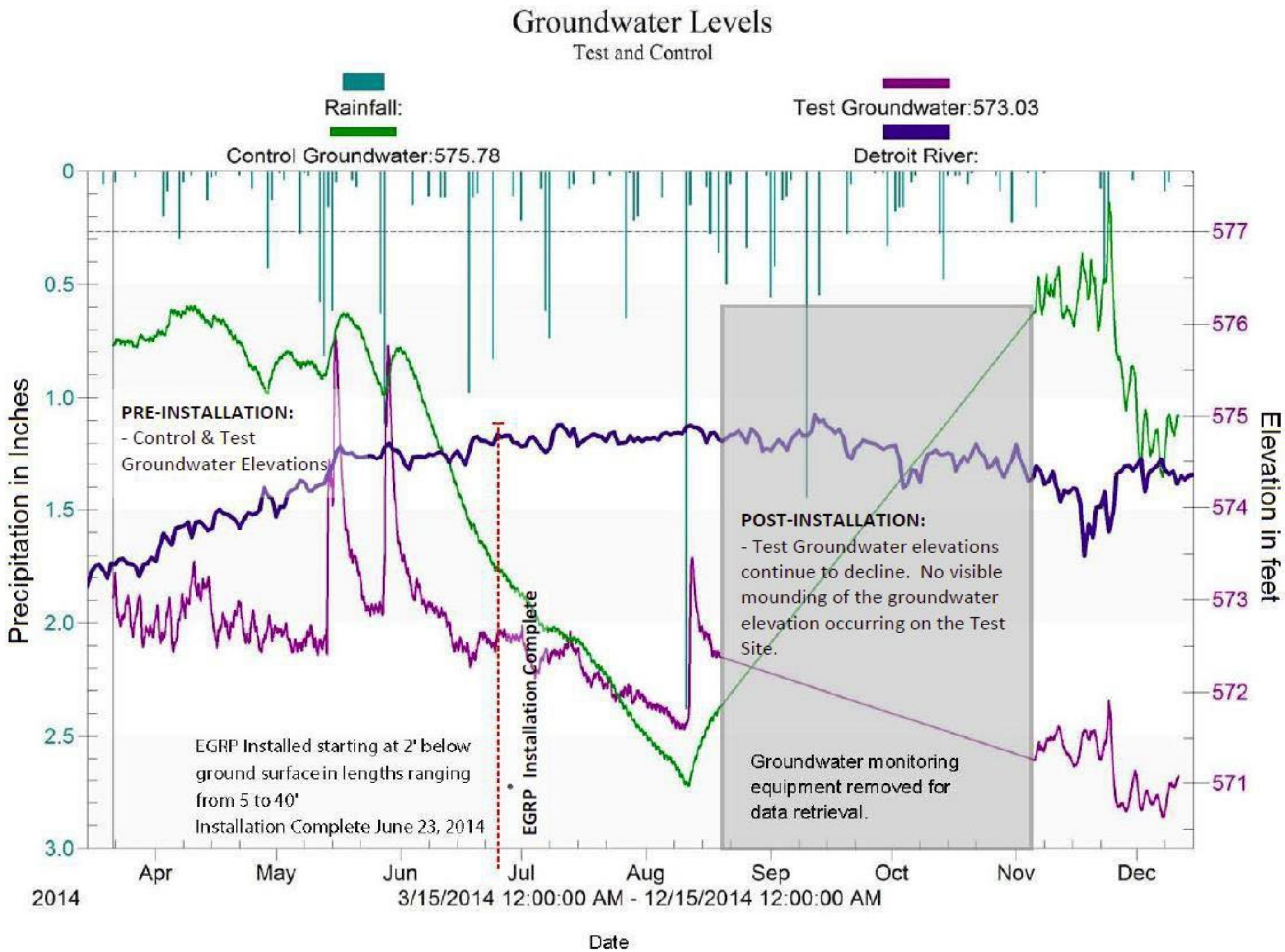


Figure 14: Groundwater and Detroit River water levels during investigation (ECT 2016)

Coleman A. Young International Airport, Detroit MI

This test site is located in the south west corner of the Coleman A. Young International Airport in Detroit, Michigan (Figure 15). This project was developed to address to the concerns of the Michigan Department of Environmental Quality (MDEQ) in regards to the EGRP® system's influence on the infiltration of surface water and its potential to accelerate surface water contaminates into the groundwater supply. The project was under the supervision of the MDEQ and conducted by Dr. David Lusch from Michigan State University (MSU) with consultation from Dr. Donald Carpenter from Lawrence Technological University (LTU). The testing involved the launching of a bromide slug into an infiltration pond where EGRP®s were installed. After the slug was launched a continuous water level of 6” was kept on the pond to simulate a “worst case” scenario of long-term ponding of storm water runoff.

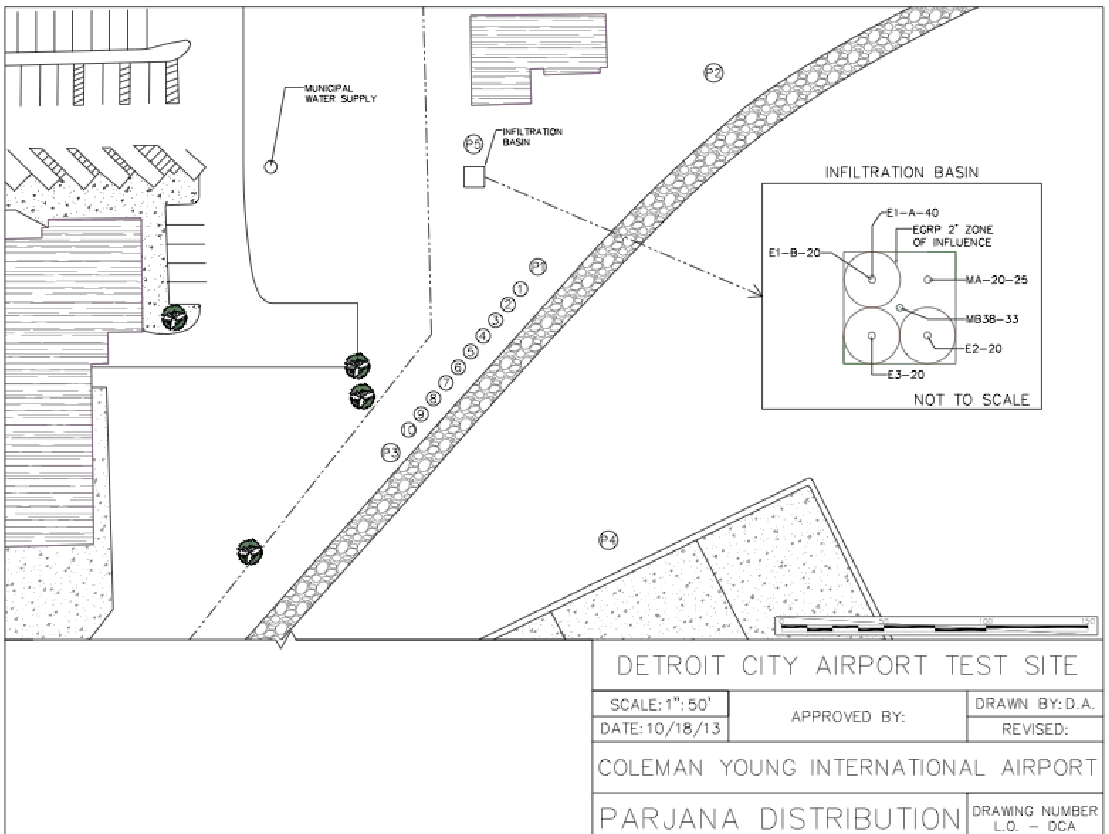


Figure 15: Site Layout for Coleman A. Young Infiltration Study

Coleman A. Young International Airport, Detroit MI

Table 4: Description of Monitoring Wells and EGRP®s show prior in Figure 15.

EGRP® AND MONITORING WELL DESCRIPTIONS

Sampling Well Name	Depth	Screen Interval	Description
MA-20-25	27.3'	25'-20'	1" Ground water monitoring well located in EGRP® infiltration basin
MB-38-33	38'	38'-33'	1" Monitoring well located in EGRP® infiltration basin
E1A-40	40'	40'	A 40' EGRP® device installed with a 40' ground water sampling tube
E1B-20	20'	20'	A sampling tube installed 20' below grade on the 40' EGRP® device
E2-20	20'	20'	20' triple EGRP® device installed with sampling tube 4" below grade
E3-20	22'	20'	20' triple EGRP® device installed with sampling tube 2' below grade
P1	22.55'	20'-15'	1" Ground water monitoring well located Southeast and downstream of infiltration basin
P2	40'	38'-33'	1" Ground water monitoring well located Northeast and upstream of infiltration basin
P3	27.5'	25'-20'	1" Ground water monitoring well located Southwest and downstream of infiltration basin
P4	40.8'	39'-34'	1" Ground water monitoring well located South and downstream of infiltration basin
P5	31.1'	29'-24'	1" Ground water monitoring well located North and upstream of infiltration basin

Coleman A. Young International Airport, Detroit MI

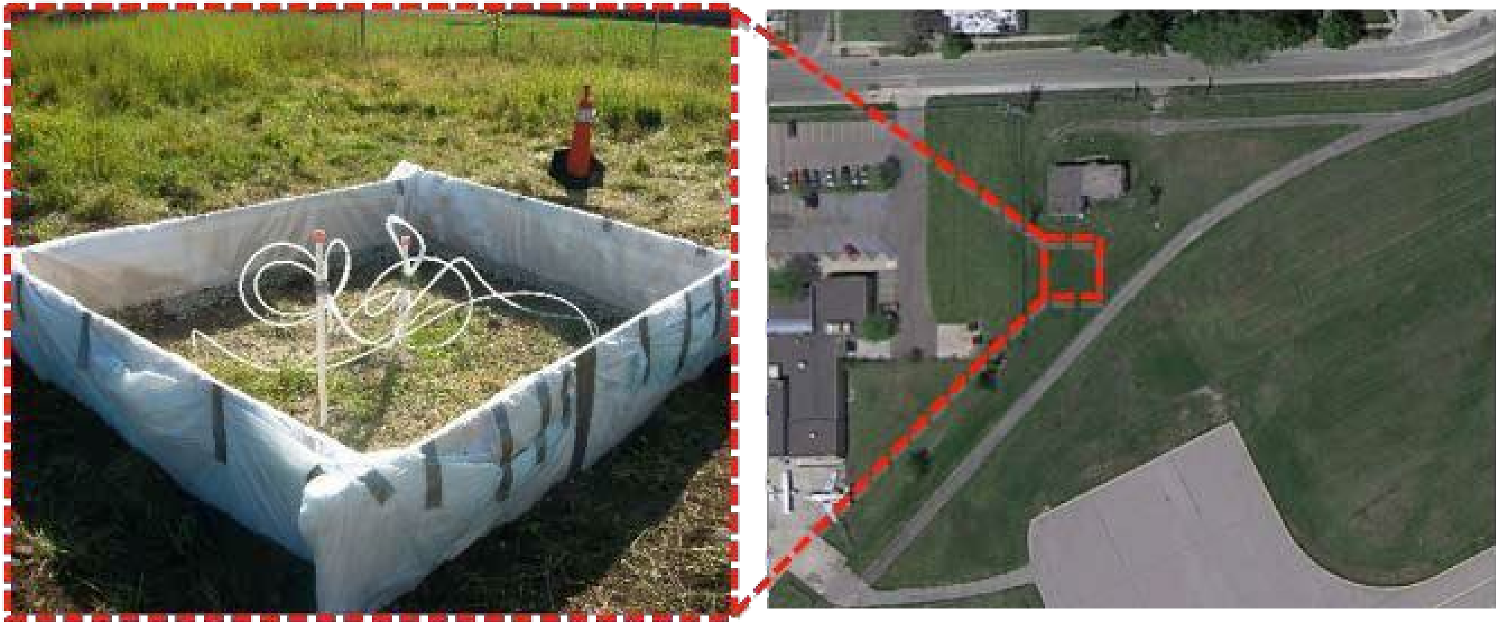


Figure 16: Aerial view of testing site at Coleman A. Young International Airport, Detroit, MI

Results:

Data showed that the EGRP® increased the infiltration rate of surface water 7 to 10 times the rate of native soil conditions (Lusch 2015). However, bromide concentrations were not detected at the bottom of the EGRP® installations until between 16 (E2-20) and 68 days (E3-20) after the slug test was administered. As such, the study also concluded that EGRP®s do not act as vertical drains or injection wells that allow water, along with its' constituents, to flow straight down to the bottom of the EGRP® systems (Lusch 2015).

Geneva International Airport, Switzerland

Parjana® EGRP® system was installed at Geneva International Airport (GIA) in late 2012 and was constantly monitored through piezometric testing for nearly two year (GADZ 2014). The goal for GIA was to reduce or eliminate water seepage into underground concrete chambers that are common at the airport; especially chambers that are remote from existing stormwater sewer systems. The research goal is to compare the effects of EGRP® device on shallow water tables and soil moisture distribution. Unlike other typical EGRP® installations, this location had no issues with standing surface water.

Geotechnique Appliquee Deriaz SA (GADZ) compared piezometric water levels between two different zones - one with and one without the EGRP® (Figure 17 and 18). The top soil layers were primarily silt and silty fine sands and were found to have low permeability. The deeper soil layer consisted of a well stratified preconsolidated sandy loam (glacial Moraine) with higher vertical permeability and significantly higher horizontal permeability (10 to 100 times greater) (PCS 2014). The 40 ft deep EGRP® installations on the four corners, and some of the shallower EGRP® installations, penetrate the deeper Moraine soils (Figure 10) (GADZ 2014).

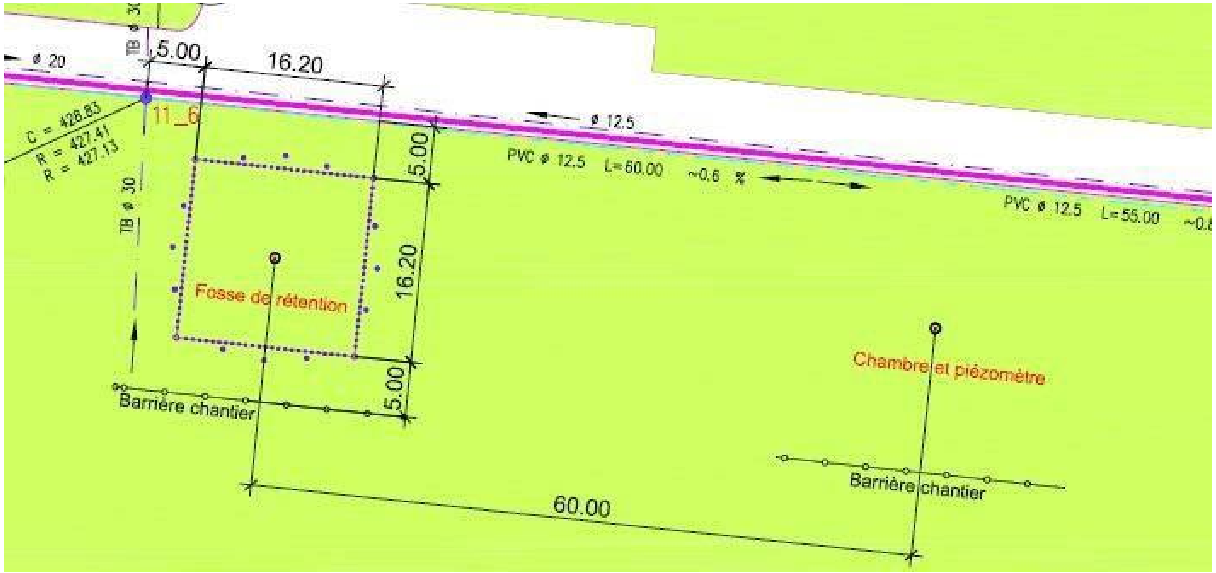


Figure 17: Test study layout adjacent to taxiway at GIA (GADZ 2014).

Geneva International Airport, Switzerland

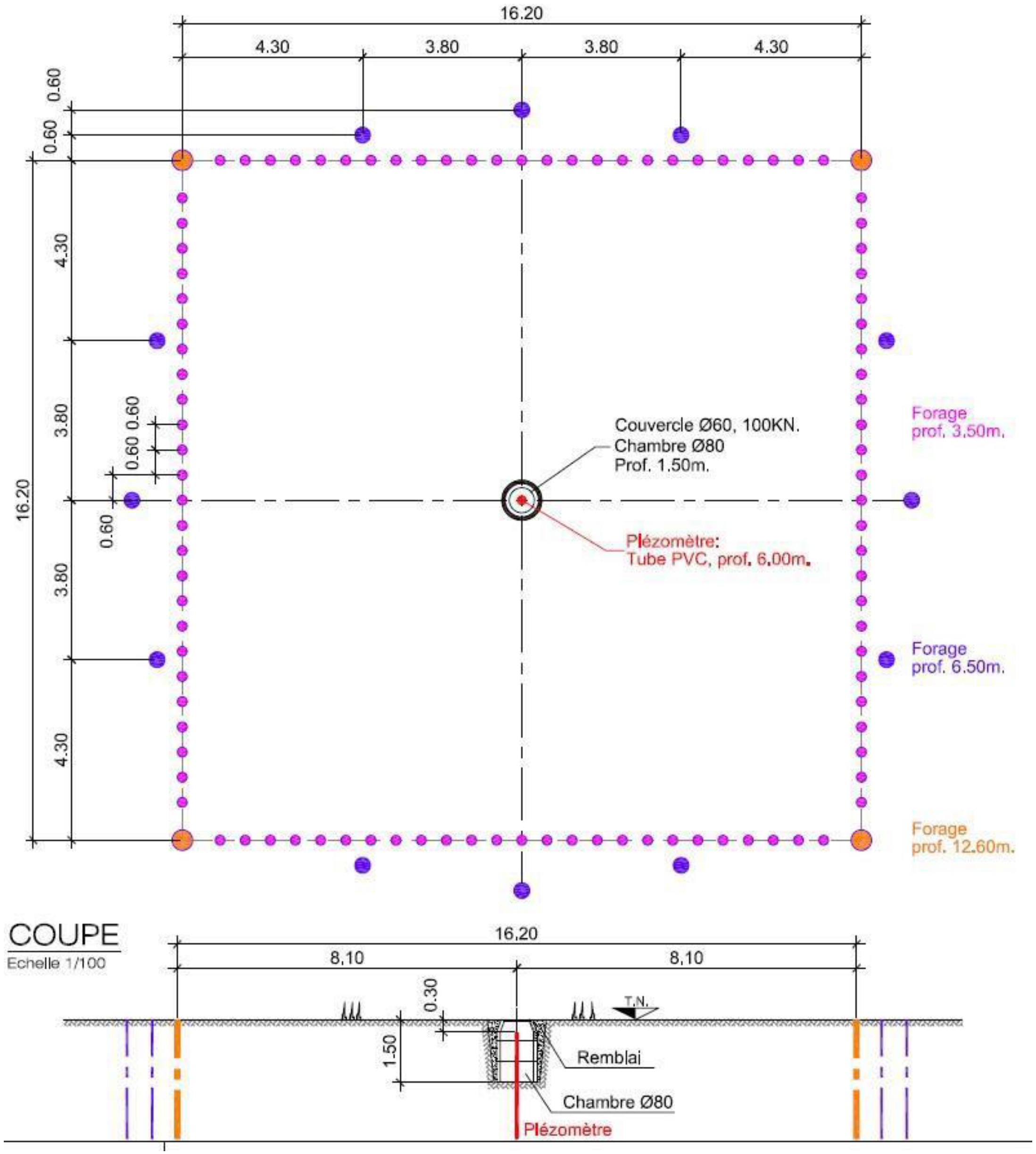


Figure 18: Layout of EGRP® system at GIA (GADZ 2014).

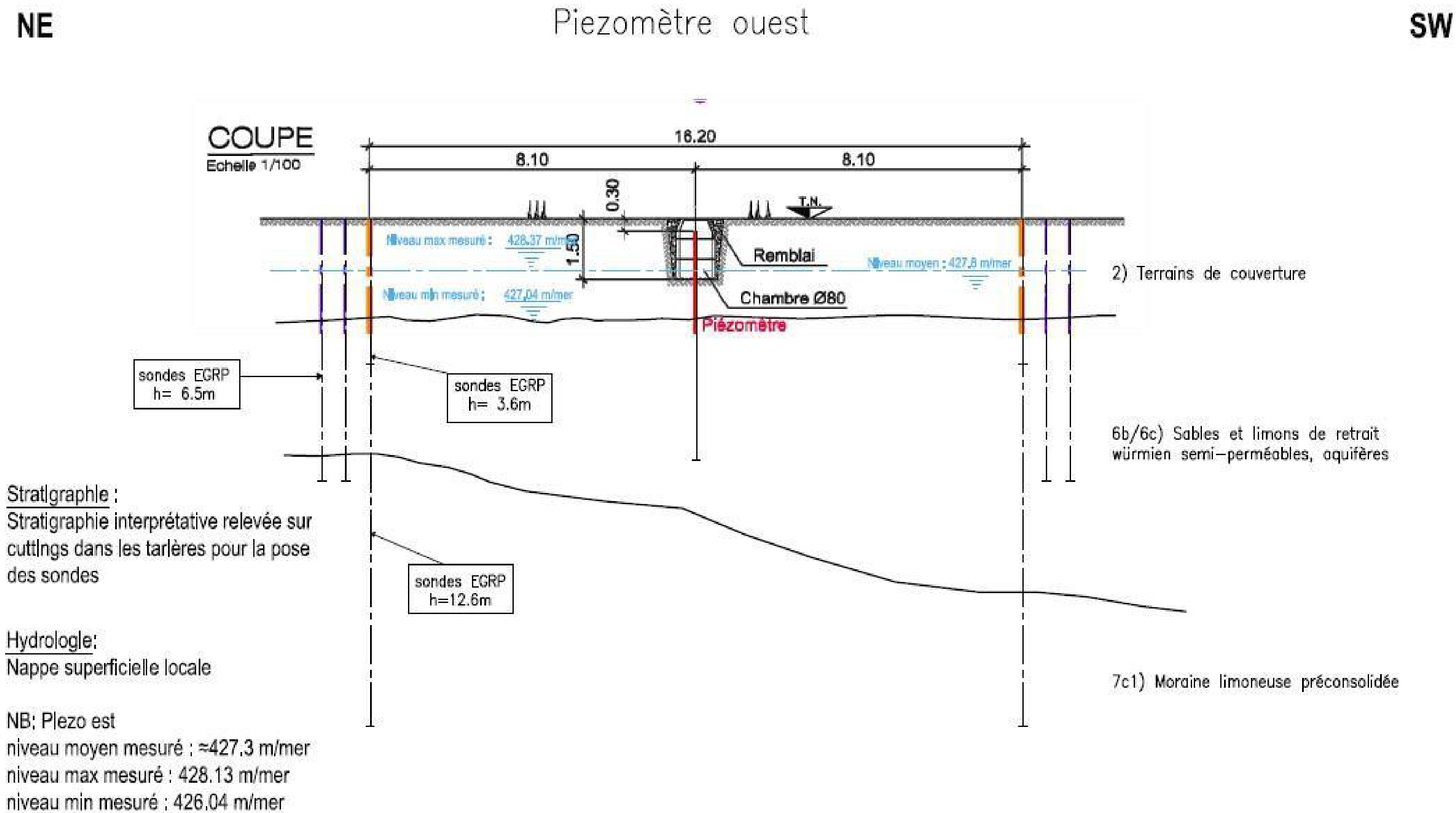


Figure 19: Cross-section of EGRP® installation through stratified soils (GADZ 2014).

Results:

Initial results (PCS 2014) concluded that the level of water table reacts immediately in both zones during "extended" (over 24 consecutive hours) and "intense" (over 0.4 inch) rainfall periods. However, the impact of those rainfall events on increasing the water table level is clearly less in the EGRP® zone (average of 73% less). Likewise the lowering of the water table level after a rainfall event is often clearly less in the EGRP® zone. An example of this is visible in Figure 20 which presents the results of three months of testing (January to March) (GADZ 2014). The report also indicated the water table was higher in the area of the EGRP® system during dry periods. GADZ attributed this to the fact the EGRP® "worked to maintain a degree of saturation as constant as possible in the soil" and the EGRP® system is moving water vertically in both directions thereby creating communication between the surficial layers of topsoil and the permeable to semi- permeable soils beneath (PCS 2014).

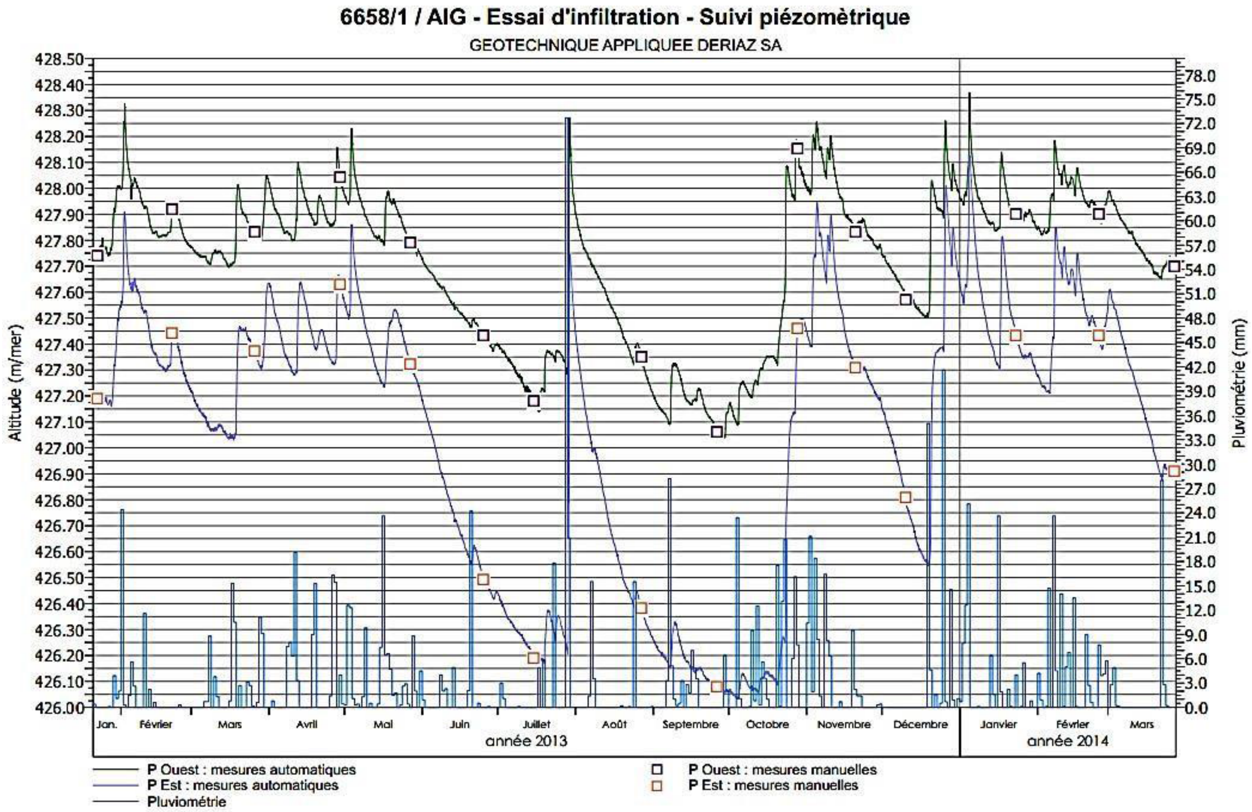


Figure 20: Comparison plot of variation of groundwater levels along with rainfall over period of time at the locations with and without EGRP®, installed at Geneva airport (GADZ 2014)[1].

[1] Original figure in French – groundwater elevation is on left axis and rainfall on right axis

Mettetal Airport, Canton MI

The site is located in the south-west corner of the Mettetal Airport in Canton, Michigan. Figure 21 shows the geographical location of the testing site in relation to the rest of the airport property and the layout of EGRP® installed around forebay. The test site consisted of an initial forebay where water flows and infiltrates into the larger detention pond. The forebay was originally designed for a 1–inch rain event. When there is a rain event above 1-inch or multiple rain events in a row, the water overflows and is released into the detention pond without filtration. Prior to the installation, the forebay did not adequately drain.

The testing was conducted by Mannik & Smith Group, Inc. (MSG 2015). The investigation included tracking water levels in the sediment forebay and four close proximity monitoring wells. The purpose of the investigation was to determine if the EGRP® system would reduce surface water in the forebay and eliminate water within 72 hours following a 1” rain event.

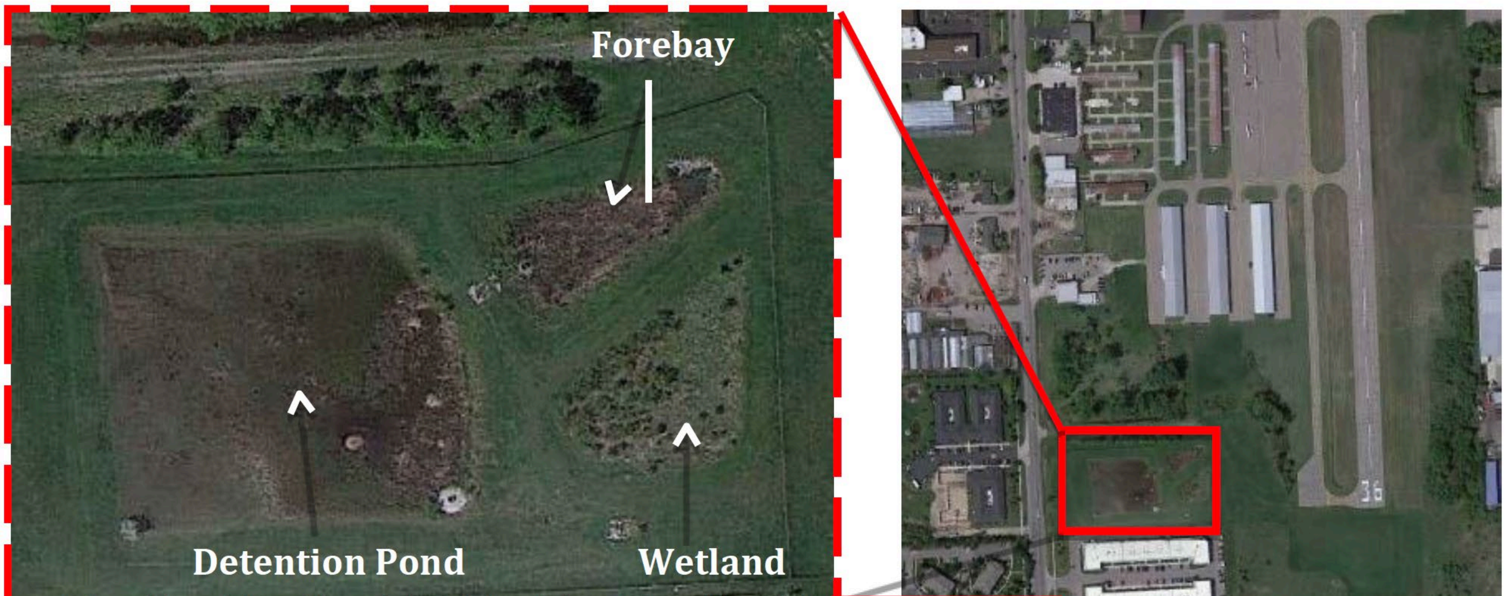


Figure 21: Geographical location and layout of Mettetal airport showing position of installed EGRP® System.

Mettetal Airport, Canton MI

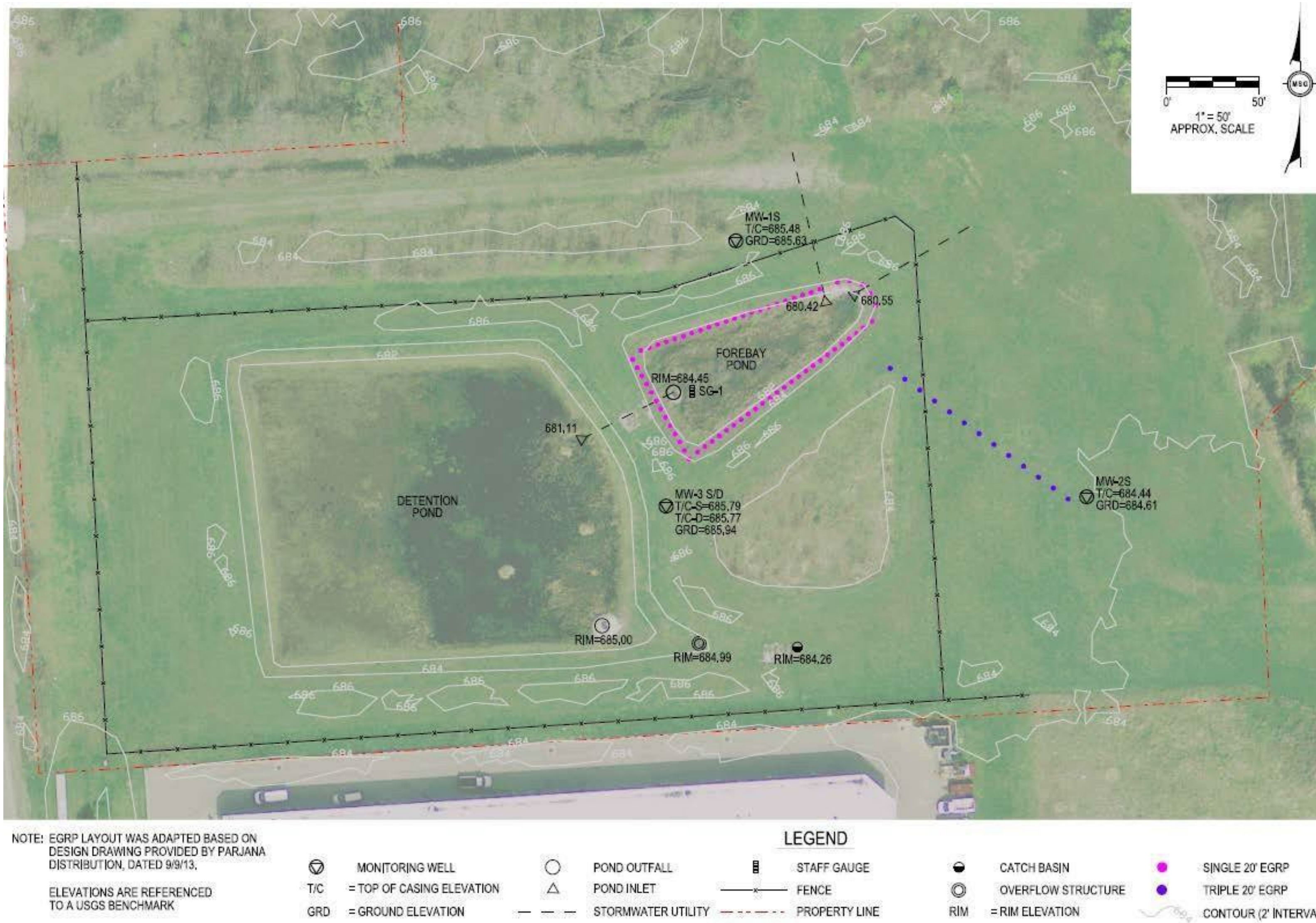


Figure 22: Layout of EGRP® system installed and location of monitoring wells (MSG 2015).

Mettetal Airport, Canton MI

Results:

Figure 23 shows the water level decreasing to previous levels less than 72 hours after a 1” rainfall, which was the goal of the EGRP® system for this project. However, lack of pre- installation data and inconsistencies in variables during the course of the investigation means that MSG is unable to confirm the influence of the EGRP® system on improving infiltration (MSG 2015). MSG did determine that water levels in the shallow monitoring wells mimic the water levels in the forebay closely and are shown to be influenced by rainfall events almost immediately. This indicates good hydrologic connection between the forebay and shallow monitoring wells. Water levels in the deep monitoring well (located in underlying class soils) do not exhibit the same fluctuations and there appears to be no significant hydrologic connection. (MSG 2015).

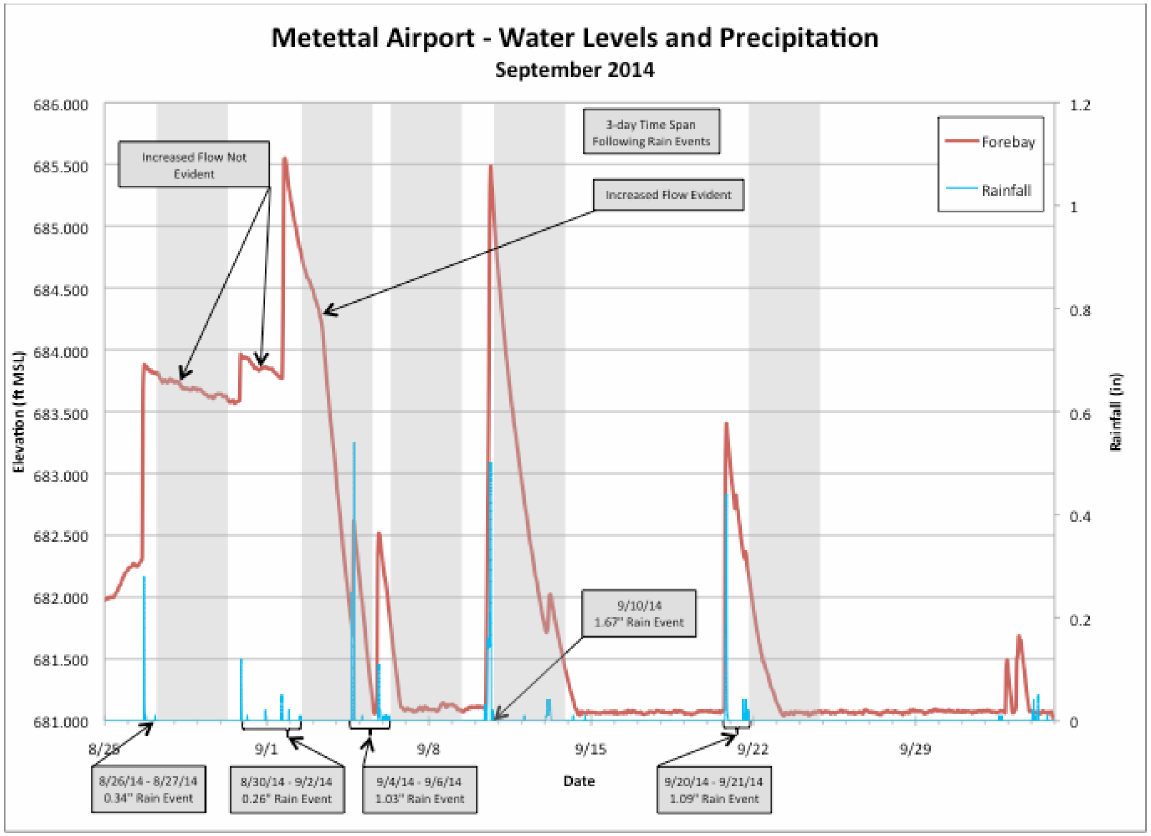


Figure 23: Metettal Airport water levels in response to precipitation (MSG 2015).

Edgbaston County Cricket Club Practice Area, Birmingham, UK

The Edgbaston County Cricket Club (Club) had an EGRP® system installed by Groundwater Dynamics in May of 2013 (GDL 2013) to improve drainage on a practice area that was known for standing water (Figure 24).

The overall soil profile was deemed of poor texture with high silt and clay content and compacted by use (Woodham 2014). STRI Ltd was commissioned by the Club to undertake an independent assessment of the practice area for infiltration, surface firmness, and soil moisture and how they might relate to the installation of the EGRP® system (Woodham 2014).

Results:

STRI Ltd found increased infiltration in areas that were previously deemed unusable for play by the Club (Woodham 2014) which is shown in Figure 25. They also reported that the turf health was in good health for the time of year (May) and that given recent inclement weather "the playing surface was relatively firm and dry (Woodham 2014)." They concluded that the drainage infiltration rates "are more promising and higher than could have been expected given the nature of the site" and were likely contributable to the EGRP® system (Woodham 2014). However, they are unable to confirm these results because there was no testing performed prior to installation. Finally, they conclude that surface firmness and moisture content do not appear to be correlated with the location of the EGRP® system and that excess moisture retention is more likely the result of "excess thatch and compaction" (Woodham 2014).

Edgbaston County Cricket Club Practice Area, Birmingham, UK

Figure 24: Edgbaston Cricket Ground practice field in Birmingham, England in March 13, 2014 at 5pm.

Figure 25 :Edgbaston Cricket Ground practice field in Birmingham, England on March, 14 2014 at 9 am.

References

Drummond Carpenter, PLLC. “Comparison of Groundwater Levels and Gradients: 2016 vs. 2017” April 17th, 2018.

Nikolai, Thomas A. “2017 Statistical Analysis Summary.” Michigan State University. January 10th, 2018.

Environmental Consulting and Technology, Inc. (ECT). “EGRP® Pilot Demonstration Project on Belle Isle, Detroit Michigan Technical Memorandum” February 10, 2016.

Geotechnique Appliquee Deriaz SA (GADZ), “Test de l'aéroport de Genève Infiltration,” August 25, 2014.

Greene, Jay. “Project to test storm water removal technology on Belle Isle” Crains Detroit Business Vol. 29 No. 41 October 7, 2013.

Groundwater Dynamics Ltd (GDL), “Edgbaston Cricket Stadium Installation,” Video by Groundwater Dynamics Ltd. https://www.youtube.com/watch?v=aTJSV7wdse4. January 15, 2015.

Litcherman, Joseph. “Detroit signs deal to lease Belle Isle to state” Reuters. Tue Oct 1, 2013 6:15pm.

Lusch, David. “EGRP® Infiltration Test at Coleman Young International Airport,” Final Report Submitted to MDEQ Groundwater Discharge Program, February 6, 2015, 43 pp.

Mannik Smith Group (MSG), “Forebay Infiltration Pilot Study: Mettetal Airport Application of Parjana®’s EGRP® System, Canton MI,” Final Report Submitted to Parjana® Distribution LLC, January 16, 2015.

Parjana® Cleantech SA (PCS), Translation of the French language GADZ Report on Geneva Airport Infiltration Test, October 26, 2014.

Soils and Materials Engineers, Inc. (SME), “Draft Supplemental Work Plan to Test Parjana® EGRP®s Coleman A. Young International Airport Detroit, MI” SME Proposal No. PO2442. 12, July 18, 2013

Woodham, Paul. “Assessment of Edgbaston County Cricket Club Practice Area,” A Report by STRI Ltd, April 1, 2014.