

# **ROUGE RIVER MONITORING FOR *E. coli* TMDL IMPLEMENTATION**

## **FINAL REPORT**

**GRANT# 2011-0504**

**FUNDED BY:  
MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
CLEAN MICHIGAN INITIATIVE – CLEAN WATER FUND  
LANSING, MI**

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## EXECUTIVE SUMMARY

The Alliance of Rouge Communities conducted routine and investigational sampling in order to determine the sources of *Escherichia coli* (*E. coli*) impacting Pebble and Pernick creeks which are tributary to the Main Branch of the Rouge River. Human sources of *E. coli* were previously found in both creeks as indicated by the presence of the Bacteroides and/or the Enterococcus human biomarkers. The likely sources of the *E. coli* as identified during this investigation are failing septic systems, illegal dumping of wastewater from a recreational vehicle, and/or leaky sanitary sewer infrastructure. In addition, runoff impacted by dog feces may also be impacting Pebble Creek. Specific source areas were identified as listed in the Conclusions and Recommendations Section.

In order to confirm and address these sources, it is recommended that the local communities 1) have the identified homes dye tested or otherwise inspected for signs of failing septic systems, 2) distribute public education materials regarding the proper disposal of wastewater from recreational vehicles and the importance of pet waste clean-up in riparian areas; and 3) inspect the sanitary sewer infrastructure in the identified area to determine if it could be impacting the creek.

## INTRODUCTION

The objective of this project was to identify sanitary wastewater sources that may be impacting two tributaries of the Rouge River. This was accomplished by conducting routine sampling of the tributaries to identify sites with high *E. coli* and surveying the water bodies upstream of the most impacted sites to locate potential illicit discharges.

The Rouge River encompasses 467 square miles in southeast Michigan and is tributary to the Detroit River. Various segments of the Rouge River are included on the current 303(d) list for the State of Michigan due to a variety of sources of impairment. As a result, three total maximum daily load (TMDL) assessments have been completed by the Michigan Department of Environmental Quality (MDEQ), including one for *E. coli* for the entire Rouge River watershed.

Water quality monitoring conducted in 2005 and 2006 by Wayne County's Rouge River National Wet Weather Demonstration Project (Rouge Project) and the MDEQ found that several areas of the river do not meet water quality standards for full or partial body contact during dry and wet weather conditions (MDEQ, 2007). Furthermore, *E. coli* originating from the human intestinal track (based on the presence of the Bacteroides and/or Enterococcus human biomarkers) was found at various locations during dry and wet weather conditions. This data indicates that sanitary wastewater is impacting the river.

The ARC has identified the areas tributary to the locations with high *E. coli* and human *E. coli* biomarkers during dry weather as high priority for further investigations. These locations include U15 - Bell Branch, D62 - Tonquish Creek, and G97 - Lower Branch in Wayne County and G39 - Franklin Branch, G61 - Pebble Creek, and U01 - Upper Branch in Oakland County.

This project addressed a portion of Pebble Creek between 11 Mile and Farmington roads and Pernick Creek which is tributary to Pebble Creek. The drainage areas associated with these water

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bodies include the communities of Farmington Hills, Franklin, Southfield and West Bloomfield Township (See Figure 1).

The two study areas are served by both onsite sewage disposal systems (septic systems), which are owned and operated by private property owners, and sanitary sewers which are maintained by the local municipality or Oakland County. Failing septic systems, exfiltration from sanitary sewers, and illicit connections to the storm sewer system are all possible sources of human *E. coli* in surface waters.

## **WATER QUALITY INVESTIGATIONS**

Routine water sampling was conducted at select locations throughout the study areas during dry weather conditions in an effort to pinpoint areas with elevated *E. coli* concentrations. Samples with elevated concentrations<sup>1</sup> were then subject to bacterial source tracking (BST) analysis to determine if the sample's *E. coli* was from the human intestinal tract.

For the initial sampling events, predetermined sites were sampled. Additional sites were added during subsequent sampling events based on the results from the previous events. This process of data collection, interpretation, and sampling site modification continued throughout the project in order to narrow down the creek segments with elevated *E. coli* counts. The sampling sites are depicted in Figure 1 and the site descriptions can be found in Appendix A.

Two samples were collected at each location. One sample was sent to Paragon Laboratories to undergo *E. coli* analysis, while the other was shipped to Michigan State University (MSU) to await BST analysis. Once the *E. coli* results were received, MSU was directed to analyze the samples with *E. coli* counts above 1,000 MPN<sup>2</sup>/100 ml.

Select samples were analyzed using two BST methods: Human *Bacteroidetes* ID™ and Human *Enterococcus* ID™. These analyses were selected in order to be consistent with those used by the MDEQ and ARC in previous water quality assessments. Both analyses provide results as either “positive” or “negative” for the presence of biomarkers found only in human fecal matter. A positive result indicates that the sample likely has human fecal matter in it, while a negative result indicates the absence of human fecal matter<sup>3</sup>.

To further locate the sources contributing to the elevated *E. coli* counts detected by the routine samples, illicit discharge surveys were conducted. These surveys consisted of walking the stream and inspecting the banks for signs of failing septic systems, illicit connections, animal sources, or other factors which may be contributing the elevated *E. coli* found during the routine sampling. In stream and outfall samples were collected, as necessary, to further narrow down potential source areas.

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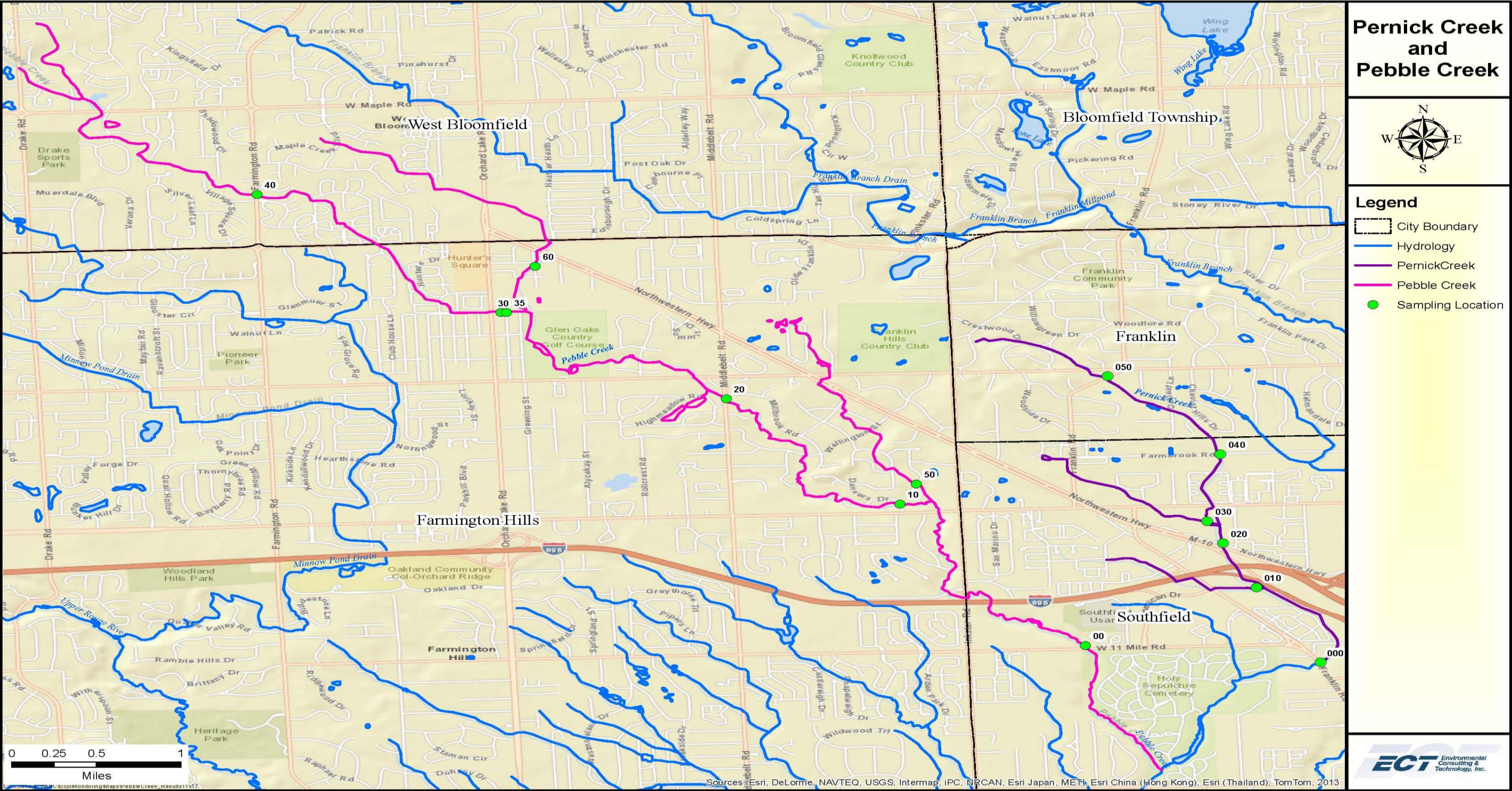
<sup>1</sup> For this report, “elevated” *E. coli* concentrations are those exceeded 1,000 MPN/100 ml.

<sup>2</sup> MPN = most probable number of *E. coli* colonies

<sup>3</sup> It should be noted that a negative result for either method does not definitively indicate an absence of human fecal contamination when the Enterococci count is less than 100 colonies per 100 ml.



Figure 1. Project Area and Routine Sampling Locations





## ROUTINE DRY WEATHER RESULTS

Dry weather samples were collected between April 13, 2012 and September 4, 2013. Five sampling events were completed on Pernick Creek and seven sampling events were conducted on Pebble Creek. Of the 122 samples that were collected, fourteen samples yielded *E. coli* counts greater than 1,000 MPN/100 ml. These select *E. coli* results and the associated BST results are listed in Table 1. The complete set of analytical results from the routine sampling can be found on Figure 2 and in Appendix B.

**Table 1. Elevated *E. coli* Results and BST Results from Routine Sampling**

Area	Sample ID	Date	<i>E. coli</i> (MPN/100 ml)	BST Results	
				Bacteroidetes Biomarker	Enterococcus Biomarker
Pernick Creek	000	6/7/2012	1,793	Negative	Negative
	010	6/7/2012	1,354	Negative	Negative
	020	4/13/2012	1,198	Negative	Negative
	030	4/13/2012	1,296	Negative	Negative
	040	4/13/2012	2,014	Negative	Positive
		5/16/2012	1,274	N/A	N/A
		5/25/2012	1,616	Negative	Negative
		7/12/2012	1,664	Negative	Positive
Pebble Creek	30	9/12/2012	1,169	Negative	Negative
		11/20/2012	1,439	Positive	Negative
		7/15/2013	1,187	Negative	Negative
	50	6/3/2013	5,794	Negative	Positive
		7/15/2013	12,033	Negative	Negative
		9/4/2013	8,164	N/A	N/A

Notes: N/A = not analyzed

Based on this data, the sites that were targeted for additional surveys were as follows:

- Pernick Creek: the area upstream of site 040 (Pernick Creek at Farmbrook Road),
- Pebble Creek: the area upstream of site 30 (Pebble Creek near Orchard Lake Road), and
- Pebble Creek: the area upstream of site 50 (tributary to Pebble Creek at Bradmoor Court).

## QA/QC RESULTS

Field blanks and duplicates were collected and analyzed to assess the precision of the sample collection techniques. Lab blanks and duplicates were also analyzed to assess the precision of laboratory analysis. All lab blanks results were < 10 MPN/100 ml indicating

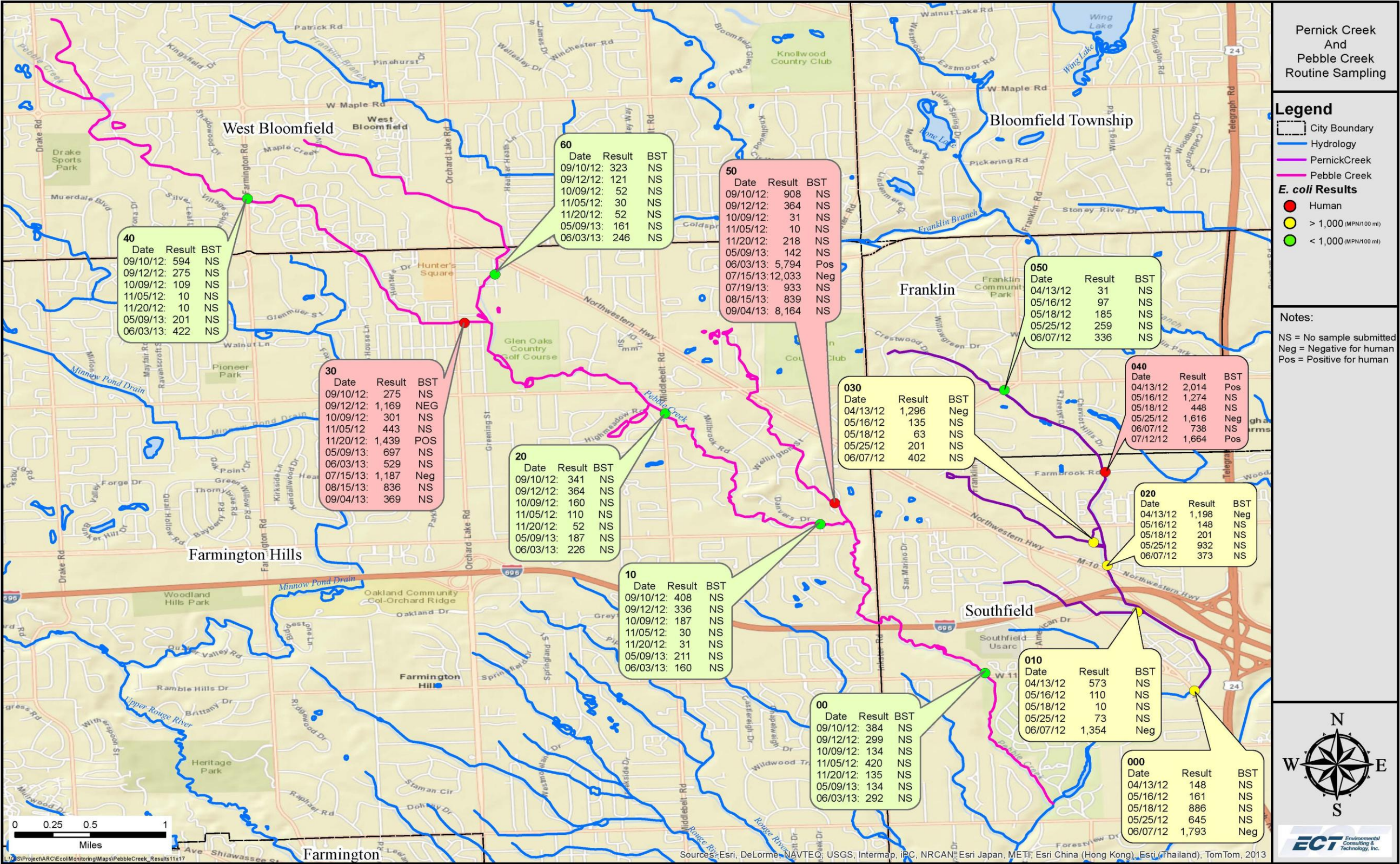
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the accuracy of sampling procedures and no cross contamination within samples collected.

Duplicate sample collection techniques were reviewed with the sampling team several times during the project. Nonetheless, six of thirteen field duplicates exceeded the relative percent difference (RPD) goal of +/- 20% during sample collection. This is likely a sample specific phenomenon and not reflective of the entire sample batch. Since this project was using sampling for investigative purposes and not stream assessment, all results were deemed acceptable (no results were flagged) despite the exceedences of the RPD goal. The complete set of quality control data can be found in Appendix C.



Figure 2. Pernick and Pebble Creek: Routine Dry Weather Sampling Data





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## INVESTIGATION FINDINGS

### **Pernick Creek**

To address the elevated *E. coli* readings and positive BST results found in Pernick Creek at site 040, additional sampling and investigations were conducted upstream of this site. An investigative stream walk was conducted on July 12, 2012 during dry weather conditions to document outfalls draining to the stream and to assess factors that may contribute to the elevated *E. coli* values. Outfalls were sampled for *E. coli* if flowing at the time of inspection. Only two outfalls were identified during this survey: a 4" PVC (outfall 043) and 12" concrete pipe. The 12" pipe was submerged in the stream, not flowing, and the field crew was unable to locate any upstream manhole or catch basin. The 4" PVC pipe was flowing and sampled, but the *E. coli* result was 10 MPN/100 ml which indicated it was likely not the source of the elevated *E. coli* at site 040 (See Figure 3).

When performing an investigation for wastewater sources, field crews rely on laboratory data and stream conditions including excessive algal or plant growth in an area which can be an indication of a consistent source of water and nutrients. During the survey, purple loosestrife (which grows in wet soils) was present in the ditch just east of the creek along the north side of Farmbrook Road. This plant wasn't noted in other sections of the ditch. During the investigation, a resident also complained to field staff that someone dumped something from a camper into the stream.

Given that some of the homes on Farmbrook Road are served by septic systems, it is suspected that the elevated *E. coli* found in the creek at site 040 is from a failing septic system located in close proximity to the creek and/or from the illegal dumping of sanitary waste from a recreational vehicle.

### **Pebble Creek**

To address the elevated *E. coli* and positive BST results found in Pebble Creek, additional investigations were conducted upstream of sites 30 and 50. An investigative stream walk was conducted between site 30 and the next upstream site (site 40) on June 16, 2013 and July 15, 2013 during dry weather conditions. Thirty seven outfalls varying in size and pipe material (PVC, concrete, and metal corrugated pipes) were identified during this survey. Ten outfalls were sampled for *E. coli*, but the results were all below 300 MPN/100 ml (See Figure 4 and Appendix B).

However during the stream walk, a sanitary odor and black seepage was noticed along the south stream bank at site RB1 (See Figure 5). Several homes in this area are served by septic systems. A stream sample was collected from site RB1 and it had an *E. coli* concentration of 10,462 MPN/100 ml. The BST results for this sample were negative for human *E. coli*. During the survey, a resident complained about smelling a sewage odor near this location throughout the year. RB1 was sampled a second time after a large rain event. At this time, the black seepage was not present and the *E. coli* value was much lower at 512 MPN/100 ml.



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An investigative stream walk was also conducted upstream of site 50 on June 19, 2013 and August 15, 2013 during dry weather conditions. A 1.5 mile stretch of Pebble Creek was surveyed and 28 outfalls varying in size and pipe material were identified during the survey. Three locations had elevated *E. coli* results as follows (See Figure 6):

- Site B24 which was collected from an open ditch that drains an area serviced by septic systems; and
- Sites B06 and B05 which were collected from the creek upstream and downstream of the sanitary pump station located at Harwich Drive north of New Bedford Drive.

Additionally, while surveying Pebble Creek upstream of B05, dogs were found within backyards and dog feces were noticed near the stream banks.

Based on this information, it is suspected that the sources of the elevated *E. coli* found at sites 30 and 50 could be a failing septic system, dog feces, and/or leaky sanitary sewer infrastructure.



Figure 3. Pernick Creek Investigation Results (The location of sanitary sewers and septic systems in the figure were provided by the Village of Franklin and City of Southfield, respectively.)

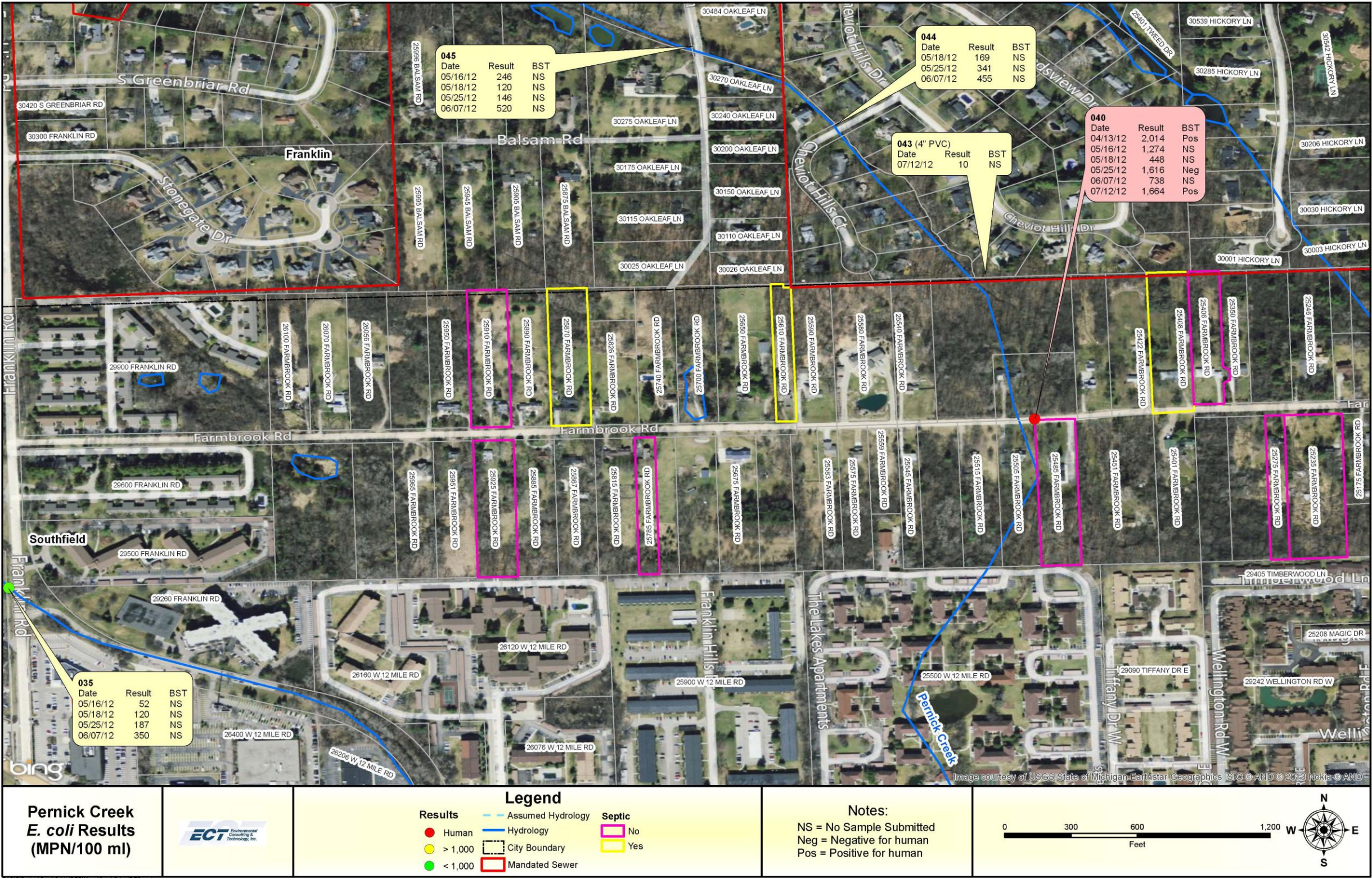




Figure 4. Pebble Creek Investigation Results upstream of Site 30 (The septic system areas in the figure were provided by the City of Farmington Hills)

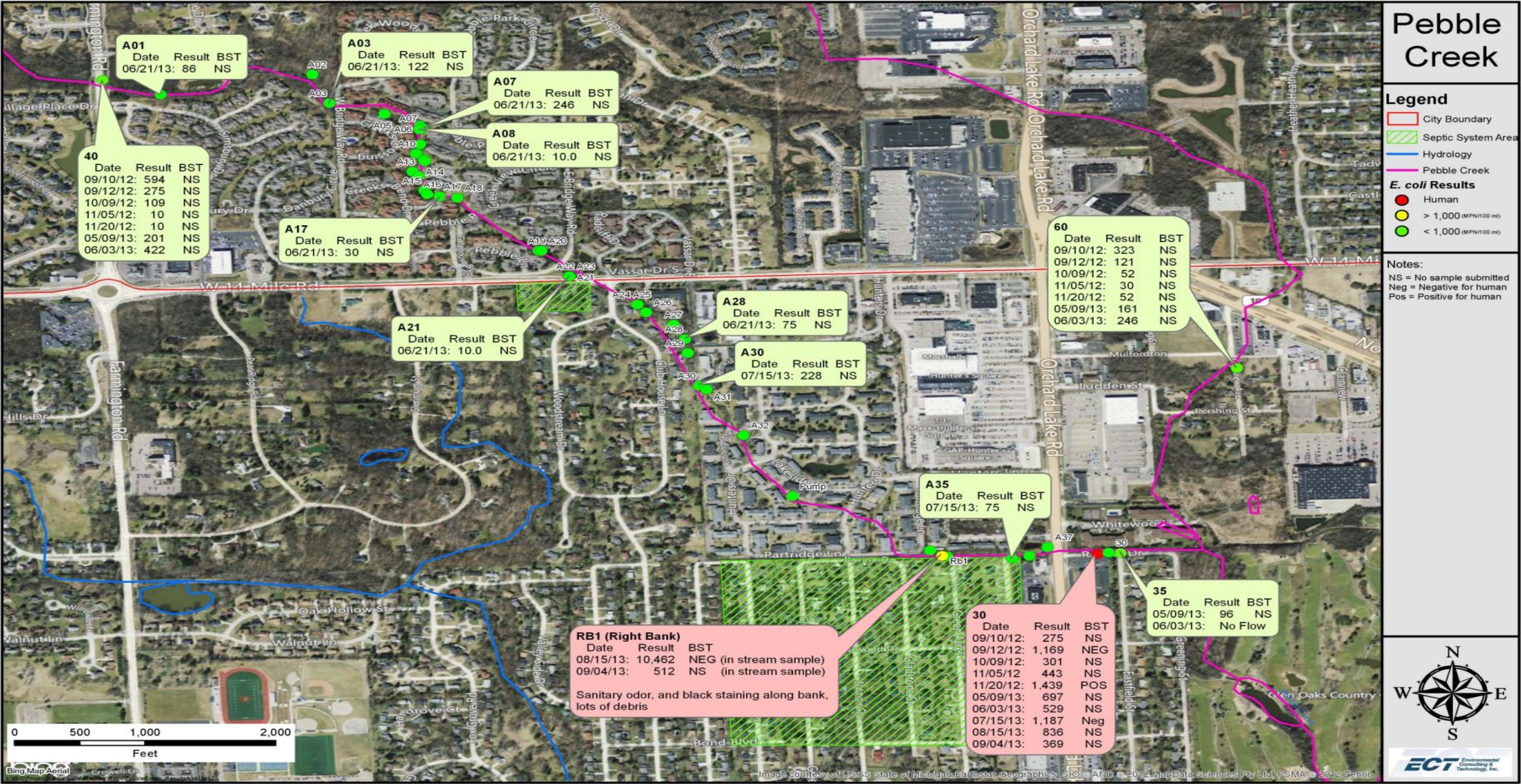




Figure 5. Pebble Creek Investigation Results at RB1 near Green Acres Street (The septic system area in the figure was provided by the City of Farmington Hills)

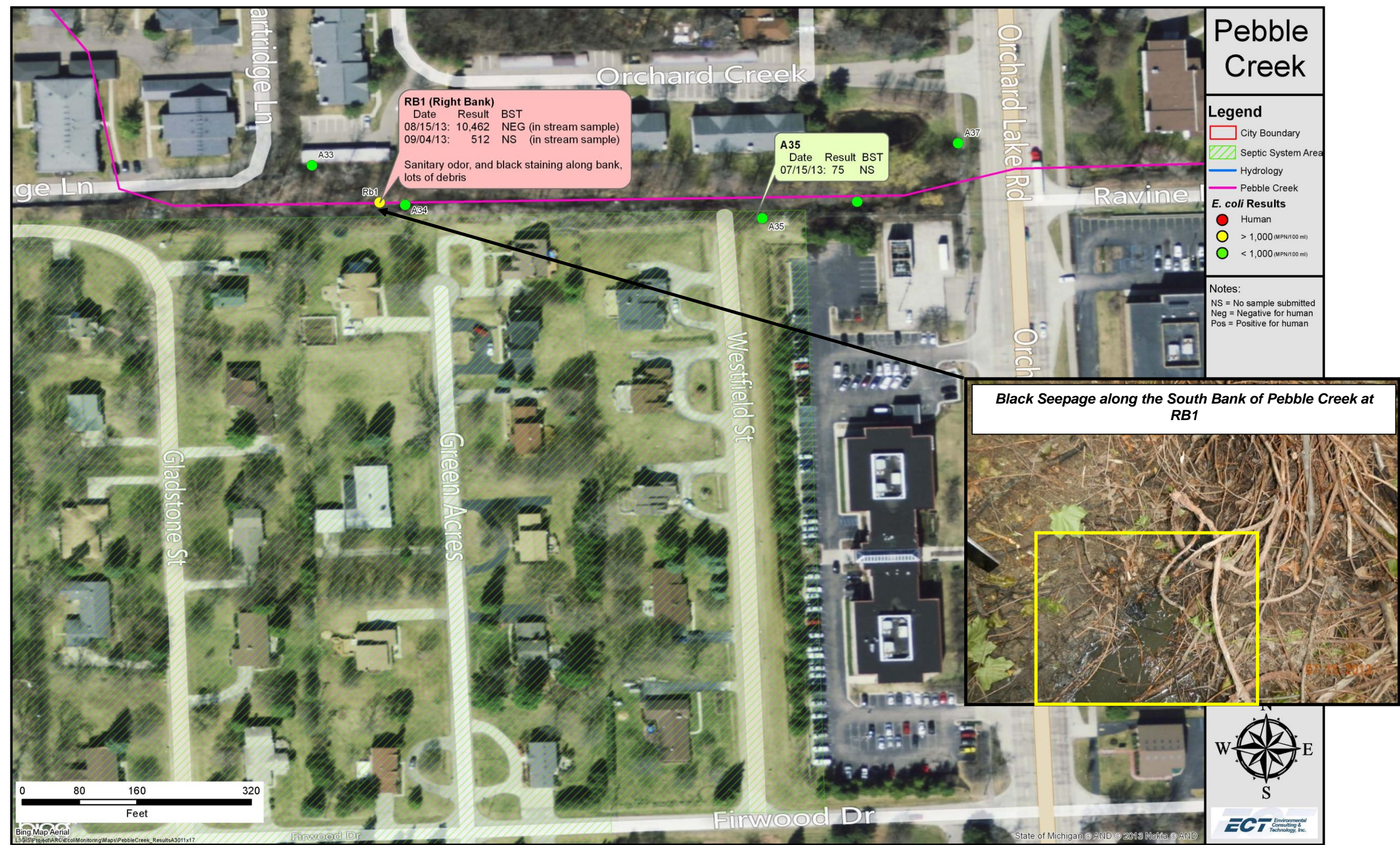
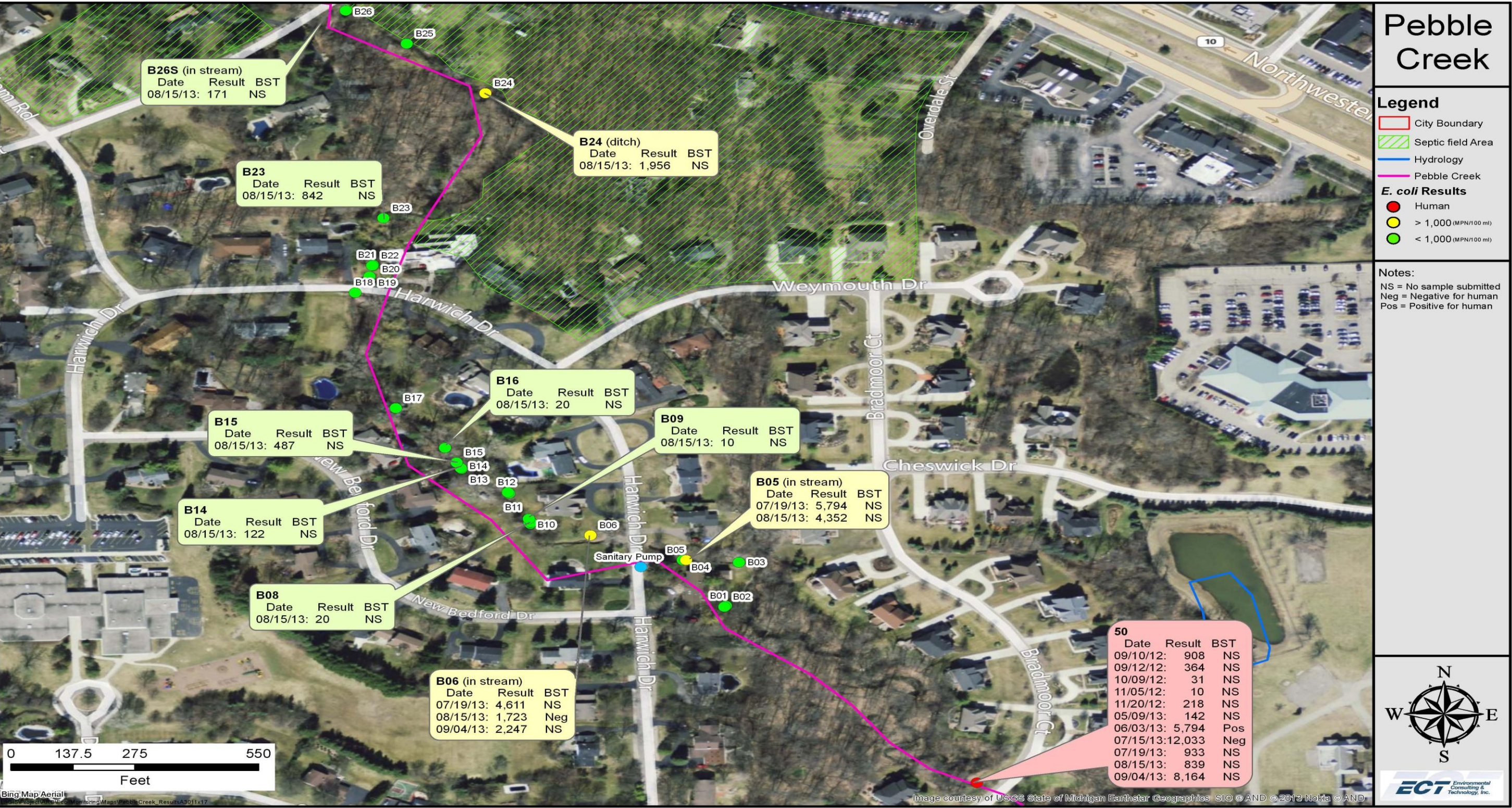




Figure 6. Pebble Creek Investigation Results upstream of Site 50 (The septic system area in the figure was provided by the City of Farmington Hills)





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## CONCLUSIONS AND RECOMMENDATIONS

This investigation indicates that human *E. coli* sources are likely impacting the waterways of Pernick Creek and Pebble Creek.

In the Pernick Creek subbasin, the suspected *E. coli* sources are as follows:

- One or more failing septic systems that serve homes on Farmbrook Road near the creek, and/or
- Illegal dumping of wastewater from a recreational vehicle.

In the Pebble Creek subbasin, the suspected *E. coli* sources are as follows:

- One or more failing septic systems that serve homes at the north end of Green Acre Street;
- One or more failing septic systems that serve homes located between Northwestern Hwy, Wellington Street, Salem Street, Harwich Drive, and Weymouth Court;
- Exfiltration from the sanitary pump station located at Harwich Drive north of New Bedford Drive.; and/or
- Runoff impacted by dog feces.

To address the *E. coli* sources in the target areas, the following actions are recommended:

- The local communities should request that the Oakland County Health Division (OCHD) dye test and inspect the septic systems serving the homes listed below and work with the homeowners and OCHD to correct any failing system:
  - 25500 Farmbrook Road, Southfield,
  - 25456 Farmbrook Road, Southfield, and
  - 30261 Green Acres Street, Farmington Hills;
- The local community should distribute public education information on the proper disposal of recreational vehicle waste including the location of nearby disposal facilities. A statewide list of disposal facilities is available at [http://www.sanidumps.com/sanidumps\\_usa.php?id=36](http://www.sanidumps.com/sanidumps_usa.php?id=36);
- The local community should distribute public education materials that encourage residents to routinely pick-up pet waste especially on riparian land;
- The ditch located between Northwestern Hwy, Wellington Street, Salem Street, Harwich Drive and Weymouth Court should be further investigated to narrow down the location of any potential failing septic system. If field investigations indicate potential septic system problems, the associated homes should be dye tested/inspected for system failures; and
- The sanitary pump station on Harwich Drive and the nearby sanitary sewers should be dye tested/inspected to determine if sewage may be exfiltrating.

## REFERENCES

Michigan Department of Environmental Quality. *Total Maximum Daily Load for E. coli for the Rouge River* Wayne and Oakland Counties, MI. August 2007.



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## APPENDIX A – SITE DESCRIPTION

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### **Pernick Creek Monitoring Locations**

<b>Site ID</b>	<b>Site Description</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Community</b>
000	350 ft South of Coral Gables St and on the east side of Franklin Rd.	42.484403	-83.288704	Southfield
010	Outfall east of the south bend of Clara Lane	42.492230	-83.294209	Southfield
020	320 ft northwest of Northwestern Service Dr and Case Ave.	42.496851	-83.297092	Southfield
030	Tributary at 600 ft south of 12 Mile Rd and 600 ft west of Case Ave	42.499145	-83.298425	Southfield
040	0.65 miles east of Franklin and Farmbrook Roads (north side of Farmbrook Rd)	42.506173	-83.297297	Southfield
050	420 ft southwest of 13 Mile and Franklin Roads (north side of Franklin Rd).	42.514324	-83.306980	Franklin

### **Pebble Creek Monitoring Locations**

<b>Site ID</b>	<b>Site Description</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Community</b>
00	500 ft West of Carnegie Park Dr on 11 Mile Rd	42.486160	-83.308846	Southfield
50	Between 29202-29358 Bradmoor Ct Farmington Hills, MI 48334	42.503070	-83.323320	Farmington Hills
10	350 ft North of 12 Mile Rd, East Danvers Dr	42.500954	-83.324720	Farmington Hills
20	150 ft South of Millbrook Rd on Middlebelt Rd	42.511993	-83.339620	Farmington Hills
30	North East of Orchard Lake Rd and Ravine Dr	42.520992	-83.358930	Farmington Hills
60	150 ft South of Mulfordton on East side of Highview Ave	42.525840	-83.356000	Farmington Hills
40	250 ft South of Daventry Woods Dr, West side on Farmington Rd	42.533340	-83.379814	West Bloomfield Township



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## APPENDIX B – ANALYTICAL DATA

Pernick Creek *E. coli* and BST Raw Data (*E. coli* in MPN/100 ml)

	4/13/2012			5/16/2012	5/18/2012	5/25/2012			6/7/2012			7/12/2012		
Sample ID	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker
000	148			161	886	645			1,793	Negative	Negative			
010	573			110	10	73			1,354	Negative	Negative			
020	1,198	Negative	Negative	148	201	932			373					
030	1,296	Negative	Negative	135	63	201			402					
035				52	120	187			350					
040	2,014	Negative	Positive	1,274	448	1,616	Negative	Negative	738			1,664	Negative	Positive
044					169	341			455					
045				246	120	146			520					
050	31			97	185	259			336					
043												10		



Pebble Creek *E. coli* and BST Raw Data (*E. coli* in MPN/100 ml)

	9/10/2012	9/12/2012			10/9/2012	11/5/2012	11/20/2012			5/9/2013	6/3/2013			6/21/2013	7/15/2013			7/19/2013	8/15/2013			9/4/2013
Sample ID	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>	<i>E. coli</i>	Bacteroidetes Biomarker	Enterococcus Biomarker	<i>E. coli</i>
00	384	299			134	420	135			134	292											
10	408	336			187	30	31			211	160											
20	341	364			160	110	52			187	226											
30	275	1169	Negative	Negative	301	443	1439	Positive	Negative	697	529				1187	Negative	Negative		836			369
40	594	275			109	10	10			201	422											
50	908	364			31	10	218			142	5794	Negative	Positive		12033	Negative	Negative	933	839			8164
60	323	121			52	30	52			161	246											
35										96	No Flow											
A01														86								
A03														122								
A07														246								
A08														10								
A17														30								
A21														10								
A28														75								
A30															228							
A35															75							
RB1																			10462	Negative	Negative	512
B05																		5794	4352			
B06																		4611	1723	Negative	Negative	
B08																			20			
B09																			10			
B14																			122			
B15																			487			
B16																			20			
B23																			842			
B24																			1956			
B26S																			171			
M10-Valley																			317			

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## APPENDIX C – QUALITY CONTROL DATA



## Field Quality Control Results

Pernick Creek									
Date	Sample ID	Parameter	Sample result	Duplicate Result	Reporting Limit	Type	RPD (%)	Field Blank Result	Comment
4/13/2012	040.1	<i>E. coli</i>	2014	2310	10	Field Dup	-14%	< 10	
5/16/2012	030.2	<i>E. coli</i>	135	145	10	Field Dup	-7%	<10	
5/18/2012	040.3	<i>E. coli</i>	448	417	10	Field Dup	7%	<10	
5/25/2012	040.4	<i>E. coli</i>	1616	1553	10	Field Dup	4%	<10	
6/7/2012	035.5	<i>E. coli</i>	350	206	10	Field Dup	52%	< 10	exceeds +/- 20%
7/12/2012	040.6	<i>E. coli</i>	1664	1935	10	Field Dup	-15%	< 10	

Pebble Creek									
Date	Sample ID	Parameter	Sample result	Duplicate Result	Reporting Limit	Type	RPD (%)	Field Blank Result	Comment
9/10/2012	10.1	<i>E. coli</i>	408	480	10	Field Dup	-16%	< 10	
9/12/2012	50.2	<i>E. coli</i>	364	414	10	Field Dup	-13%	< 10	
10/9/2012	20.3	<i>E. coli</i>	160	73	10	Field Dup	75%	< 10	exceeds +/- 20%
11/20/2012	10.05	<i>E. coli</i>	31	20	10	Field Dup	43%	< 10	exceeds +/- 20%
6/3/2013	40.07	<i>E. coli</i>	422	691	10	Field Dup	-48%	< 10	exceeds +/- 20%
8/15/2013	B05	<i>E. coli</i>	4352	3076	10	Field Dup	34%	< 10	exceeds +/- 20%
9/4/2013	B05	<i>E. coli</i>	2247	3255	10	Field Dup	-37%	< 10	exceeds +/- 20%