



Study Plan for the Brandywine Creek-Broken Sword Creek (Sandusky River) Study Area 2013

**Hydrologic Unit Code (HUC)
04100011 03 01**

Crawford County, Ohio



Division of Surface Water
June 3, 2013

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In support of:
U.S. Department of Agriculture
Natural Resource Conservation Service
National Water Quality Initiative

EA³ Project Name
Broken Sword Creek (Sandusky Basin)
NWQI Project, 2013

Ohio Environmental Protection Agency
Division of Surface Water
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Division of Surface Water
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June 3, 2013

CONTACTS

Ohio EPA Field Staff

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- Macroinvertebrates: Chuck McKnight/Jeff DeShon
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- Crawford County – 419-562-7906

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INTRODUCTION

Through the National Water Quality Initiative (NWQI) in 2013, the Natural Resources Conservation Service (NRCS) will work with farmers and ranchers in 165 small watersheds throughout the Nation to improve water quality where this is a critical concern. In 2013, NRCS will provide nearly \$35 million in financial assistance to help farmers and ranchers implement conservation systems to reduce nitrogen, phosphorous, sediment and pathogen contributions from agricultural land. This is the second year of the initiative, and NRCS provided \$34 million in 2012 to farmers and ranchers in the first year for the implementation of conservation systems. NRCS worked closely with partners, including federal and state agencies, and Soil and Water Conservation Districts, to refine the eligible priority watersheds for 2013. These partners assisted in selecting one to 12 priority watersheds in every state where on-farm conservation investments will deliver the greatest water quality improvement benefits. Eligible producers will receive assistance under the Environmental Quality Incentives Program for installing conservation systems that may include practices such as nutrient management, cover crops, conservation cropping systems, filter strips, terraces, and in some cases, edge-of-field water quality monitoring. In Ohio, three priority watersheds were selected including the headwaters of Broken Sword Creek, the focus of this study.

During the 2013 field season (July through October) chemical, physical, and biological sampling will be conducted in the Brandywine Creek-Broken Sword Creek watershed (HUC12- 04100011 01 03) to assess and characterize baseline water quality conditions prior to full implementation of NWQI on-farm conservation investments. The watershed lies within the Sandusky River basin, a direct tributary to the western basin of Lake Erie. The Brandywine Creek-Broken Sword Creek watershed encompasses the headwaters of Broken Sword Creek downstream to and including Brandywine Creek. The watershed is located in north central Ohio in Crawford County and is comprised of approximately 35,392 acres (55 mi²) - of which 82.6% is in agricultural row crop production. Other land uses within the watershed include developed land (6.2%), forest (8.1%) and grass/pasture (2.5%) (Source: National Land Data Set, 2001).

The current aquatic life use designation of Broken Sword Creek and its primary tributaries in this HUC12, Brandywine Creek and Red Run, is Warmwater Habitat (WWH). Based on sampling in 2001, portions of Broken Sword Creek and Brandywine Creek were recommended for the Modified Warmwater Habitat (MWH) use due to extensive channel modifications; the headwaters of Brandywine Creek and Red Run were recommended for the Limited Resource Water (LRW) designation (Table 1). However, these recommended designations have not yet been promulgated in the Ohio Water Quality Standards via a rulemaking. Based on the 2001 sampling survey results, principal causes of impairment in the Brandywine Creek-Broken Sword Creek watershed were identified as nutrients, direct habitat alterations, flow alterations, and excessive sedimentation/siltation. Primary impairment sources identified were nonirrigated crop production, channelization, flow regulation/modification, and spills.

Specific objectives of the survey are:

- Establish the present biological conditions in the Brandywine Creek-Broken Sword Creek watershed by evaluating fish and macroinvertebrate communities;
- Identify the relative concentrations and loadings of nutrients and other selected parameters in surface water;
- Assess physical habitat influences on stream biotic integrity;
- Determine beneficial use attainment status and recommend changes if appropriate; and

- Confirm or revise causes and sources of beneficial use impairment as determined by earlier studies.

The entire watershed is located within the Eastern Corn Belt Plains (ECBP) ecoregion and there are no permitted point source dischargers present. Stream samples, including sample type, drainage area and location information are listed in Table 2 and represented graphically in Figure 1.

SAMPLING ACTIVITIES

Macroinvertebrate and Fish Assemblages

Macroinvertebrate assemblages using artificial substrates (quantitative sampling) and/or natural substrates (qualitative sampling) will be collected as listed in Table 2. Fish assemblages will be sampled using pulsed DC electrofishing protocols as listed in Table 2. Habitat will be scored using the Qualitative Habitat Evaluation Index (QHEI) at all fish sampling locations.

Chemical/Physical Water Sampling

Chemical sampling locations within the study area are listed in Table 2. Conventional chemical/physical water quality grab samples will be collected at least 5 times at each designated location during the survey. Samples will be collected between April and October. DataSondes® will be deployed at several locations for two 48-hour periods as detailed in Table 2. Chemical/physical parameters to be tested are listed in Table 3. An attempt will be made to sample surface waters on a seasonal basis (*i.e.*, early spring thru late fall) and across a variety of flow conditions, from lower flows to moderate and higher flows.

Chlorophyll Sampling

Benthic chlorophyll-a samples are to be collected at designated wadeable and headwater sites noted in Table 2. Benthic chlorophyll samples are to be collected at least once, and should be timed to coincide with deployment of DataSonde® automated data loggers during stable, baseflow conditions (*i.e.*, typically the second sonde deployment).

QUALITY ASSURANCE/SAMPLING METHODS

Ohio EPA Manuals

All biological, chemical, data processing, and data analysis methods and procedures adhere to those specified in the Surface Water Field Sampling Manual for water column chemistry, bacteria and flows (Ohio EPA 2013a), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio EPA 1987, 1989a, 1989b, 2013b, 2013c), and The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Ohio EPA 1989c, 2006) for habitat assessment.

Use Attainment

Attainment/non-attainment of aquatic life uses will be determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-17. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community.

Performance expectations for the tiered aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH]) were developed using the regional reference site approach (Hughes et al. 1986; Omernik 1987). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of an aquatic life use is FULL if all three indices (or those available) meet the

applicable criteria, PARTIAL if at least one of the indices did not attain and performance did not fall below the fair category, and NON if all indices either fail to attain or any index indicates poor or very poor performance. The Broken Sword Creek watershed results will be compared to biocriteria for the Eastern Corn Belt Plains ecoregion.

Stream Habitat Evaluation

Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Ohio EPA 1989c, Ohio EPA 2006). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values higher than 60 were generally conducive to the establishment of warmwater faunas while those which scored in excess of 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

Biological Community Assessment

Macroinvertebrates will be collected from artificial substrates and/or natural stream habitats. Artificial substrate collections will be collected at all sites with greater than 20 mi² drainage areas or at reference site locations. This sample provides quantitative data and consists of a composite sample of five modified Hester-Dendy multiple-plate artificial substrate samplers colonized for six weeks. Qualitative sampling will be conducted at all sampling locations. This sampling effort consists of an inventory of all observed macroinvertebrate taxa from the natural stream habitats at each site with no attempt to quantify populations other than notations on the predominance of specific taxa or taxa groups within major macrohabitat types (e.g., riffle, run, pool, margin). Detailed macroinvertebrate assemblage sampling protocols are documented in Biological Criteria for the Protection of Aquatic Life, Volume III (1989b, 2013c).

Fish will be sampled at each sampling location using pulsed DC headwater, wading, or boat electrofishing methods depending on watershed size at each sampling zone. Sites with drainage areas greater than 20 mi² or at reference site locations will be sampled twice during the sampling index period. Fish are processed in the field which includes identifying each individual to species, counting individuals at all sites, weighing individuals at wading and boat sites, and recording any external abnormalities. Detailed fish assemblage sampling protocols are documented in Biological Criteria for the Protection of Aquatic Life, Volume III (1989b, 2013c).

Surface Water

Surface water grab samples will be collected and preserved using appropriate methods, as outlined in Surface Water Field Sampling Manual for water column chemistry, bacteria and flows (Ohio EPA 2013a) and delivered to the Ohio EPA Division of Environmental Services lab for analyses. DataSonde[®] automated data loggers will be deployed at select locations to evaluate diel measurements of dissolved oxygen, pH, temperature, and conductivity.

Chlorophyll

Benthic chlorophyll-a samples will be collected and preserved using appropriate methods, as outlined in Appendix II of Surface Water Field Sampling Manual for water column chemistry, bacteria and flows

(Ohio EPA 2013a) and delivered to the Ohio EPA Division of Environmental Services lab for analyses. Alkalinity must be requested as a routine water quality parameter at all study sites along with the routine field parameters, especially temperature and pH.

Field Quality Control Samples

Ten percent of the water samples will be submitted to the lab as field duplicates. Field blanks will occur at a minimum of 5 percent of the water samples. Field instruments will be calibrated daily using manufacturer guidelines and requirements as noted in Surface Water Field Sampling Manual for water column chemistry, bacteria and flows (Ohio EPA 2013a).

Figure 1. Sampling locations (biological, physical habitat, and stream chemistry) and current land uses in the Brandywine Creek-Broken Sword Creek watershed study area, 2013.

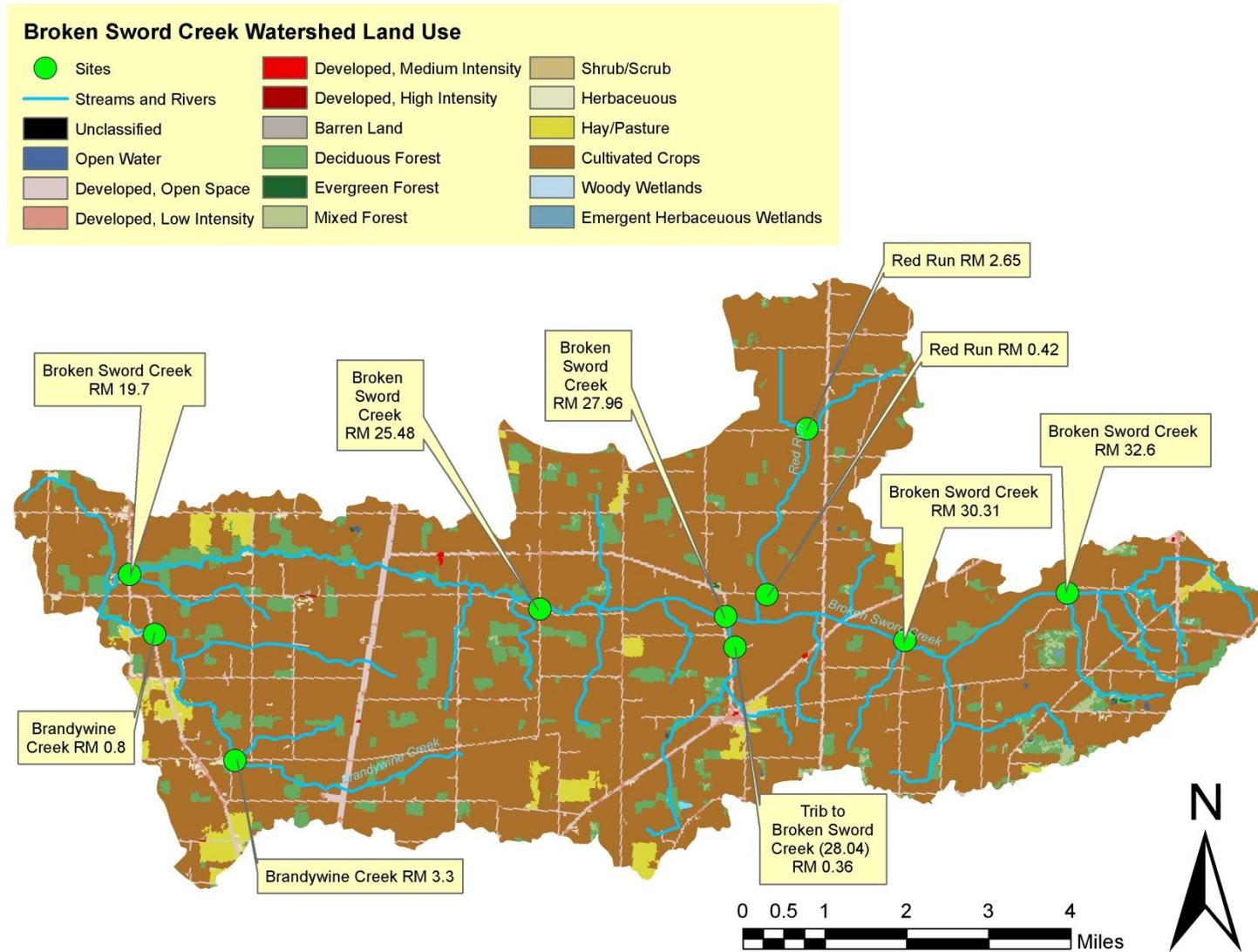


Table 1. Biological/habitat sampling in the Brandywine Creek-Broken Sword Creek (Sandusky River) study area, 2001.

RM	Stream Name	Station ID	Eco-Region	Drainage Area	Current Aquatic Life Use	Rec.	IBI	MIwb	ICI	Macro Narrative	QHEI	Attainment Status
Basin & Stream Code:		05-035-000										
32.60	Broken Sword Creek	201367	ECBP	4.1	WWH+	MWH-C			G	Good		
30.30	Broken Sword Creek	U02G09	ECBP	9.4	WWH+	MWH-C	36		G	Good	30.50	Full
27.90	Broken Sword Creek	U02G08	ECBP	26.0	WWH+	MWH-C	30		G	Good	31.50	Full
25.50	Broken Sword Creek	U02G07	ECBP	32.0	WWH+	MWH-C	26	6.83	54		20.00	Full
19.70	Broken Sword Creek	201366	ECBP	43.0	WWH+		28*	7.37*			52.50	Non
Basin & Stream Code:		05-037-000										
3.30	Brandywine Creek	201371	ECBP	4.1	WWH*	LRW	12*		P	Poor	37.50	Non
1.60	Brandywine Creek	U02G11	ECBP	8.7	WWH*	MWH-C	24		P*	Poor	31.50	Non
Basin & Stream Code:		05-038-000										
0.50	Red Run	201372	ECBP	4.7	WWH*	LRW			F	Fair		

Verified (+)
Not Verified (*)

HUC12 Assessment - 04100011 03 01										
Headwater Site Assessment (<20 mi^2)			Wading Site Assessment (>=20 and < 50 mi^2)			Intermediate Score	Principle Site Assessment (>= 50 and < 500 mi^2)			HUC 12 Assessment Unit Score
Total Sites	# Site Full	Score	Total Sites	#Sites Full	Score		Total Sites	#Sites Full	Score	
3	1	33.3	3	2	66.7	50.0				50.0

Causes*

- nutrients
- direct habitat alterations
- flow alterations
- sedimentation/siltation

Sources*

- nonirrigated crop production
- channelization - agriculture
- flow regulation/modification - agriculture
- spills

* From current 2012 Integrated Report 303(d) list.

Table 2. Sampling locations in the Brandywine Creek-Broken Sword Creek (Sandusky River) watershed study area, 2013.

HUC12									
04100011 03 01 Brandywine Creek-Broken Sword Creek									
	<u>Stream Code</u>	<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Sample Type</u>	<u>River Mile</u>	<u>Drainage Area</u>	<u>Location</u>	
Broken Sword Creek	05-035-000	201367	40.893357	-82.798203	F1x, Mql	32.60	4.4	Dickson Rd.	
		U02G09	40.884857	-82.836005	F1x, Mql, C	30.31	9.4	Beck Rd.	
		U02G08	40.888957	-82.877706	F2x, Mqt, C	27.96	26.6	Ridgeton-Annapolis Rd. (Co. Rd. 78)	
		U02G07	40.890157	-82.921008	F2x, Mqt, C, Cl, D	25.48	32.6	Schwemley Rd.	
		201366	40.895857	-83.016611	F2x, Mqt, C, Cl, D	19.70	42.0	St. Rts. 19/100	
Brandywine Creek	05-037-000	201371	40.863157	-82.991810	F1x, Mql	3.30	5.3	Spore Brandywine Rd.	
		302323	40.887180	-83.016760	F1x, Mql, C, Cl, D	0.45	11.1	Holmes Center Rd. (sample dst.)	
Red Run	05-038-000	302280	40.922138	-82.858995	F1x, Mql	2.65	4.3	upst. Heetrich Rd.	
		201372	40.892857	-82.868206	F1x, Mql, C	0.42	8.0	Henry Cooper Rd.	
Trib. to Broken Sword Creek @ RM 28.04	05-035-003 (05-095)	U02G10	40.883585	-82.875514	F1x, Mql, C	0.36	4.8	Drive off Ridgeton-Annapolis Rd.	

F1x - Fish one-pass site; F2x – Fish two-pass site.
 Mqt - Macroinvertebrate quantitative site; Mql – Macroinvertebrate qualitative site.
 C - Chemical water quality site.
 Cl - Chlorophyll analysis site.
 D - DataSonde[®] automated data logger monitoring site.

Table 3. List of chemical/physical water quality parameters to be analyzed/ measured in surface water from the Brandywine Creek-Broken Sword Creek watershed study area, 2013. Water samples will be collected at least 5 times. Select sampling locations will be monitored for dissolved oxygen, pH, temperature, and conductivity using DataSonde® automated data loggers (Table 1).

Parameter	Units	Method	MDL
Temperature	°C	YSI 556 or Pro Plus Meter	
Dissolved Oxygen	mg/L	YSI 556 or Pro Plus Meter	
Dissolved Oxygen	%	YSI 556 or Pro Plus Meter	
pH	SU	YSI 556 or Pro Plus Meter	
Conductivity	µS/cm	YSI 556 or Pro Plus Meter	
Specific Conductivity	µS/cm	YSI 556 or Pro Plus Meter	
Dissolved Solids	mg/L	SM 2540 C	10
Suspended Solids	mg/L	SM 2540 D	5
Alkalinity	mg/L	USEPA 310.1	5
Ammonia	mg/L	USEPA 350.1	0.05
Chemical Oxygen Demand	mg/L	SM 5220 D	20
Chloride	mg/L	USEPA 325.1	5
Specific Conductivity (lab)	µS/cm	SM 2510 B	2
Nitrate-Nitrite	mg/L	USEPA 350.1	0.5
Nitrite	mg/L	USEPA 353.2	0.02
Sulfate	mg/L	USEPA 375.2	10
Kjeldahl Nitrogen	mg/L	USEPA 351.2	0.2
Orthophosphate	mg/L	USEPA 365.1	0.01
Phosphorus	mg/L	USEPA 365.4	0.01
Chlorophyll a	µg/L	USEPA 445.0	

REFERENCES

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Bucyrus Community Hospital

419-562-4677

Print - Maps

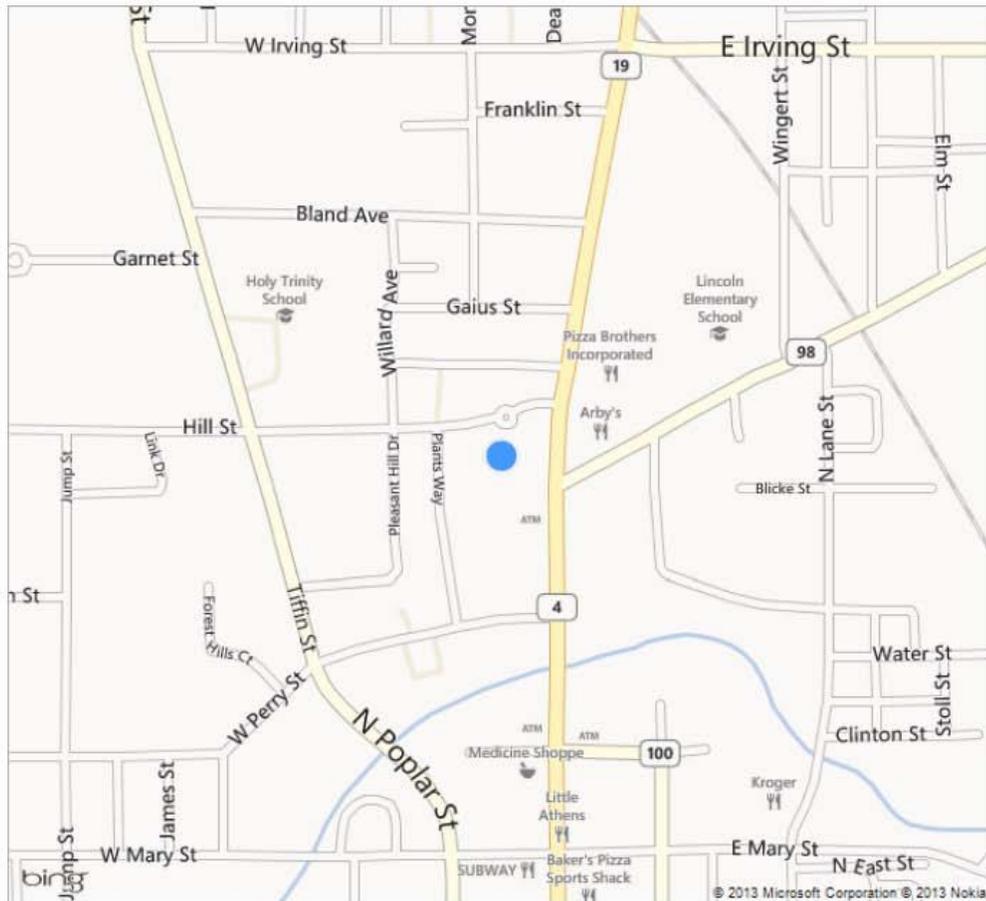
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