

**Water Quality Sampling
October 9, 2013**

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On October 9, 2013, the University of Iowa Hygienic Laboratory performed the third and final round of scheduled water quality monitoring for the City of Johnston for the 2013 calendar year. This report will discuss the results of this monitoring event and also review the results for all three monitoring events. All photos in this summary were taken by UHL staff.

Notes and Comments

While overall, the dry weather trend from the summer continued into the fall, several precipitation events did occur in the week prior to the monitoring. The Schoolnet 8 weather station at Grimes Elementary recorded 0.05 inches of rain on October 3rd, 1.24 inches on October 4th, and 0.12 inches on October 6th.

Three locations had no flowing water to sample. Sites Ta#9 and Tb#9, the upstream and downstream sites adjacent to the Storm-ceptor at NW Beaver Drive, comprised two of these sites. This site has not had flow present during any of the three monitoring events, even in the April sampling which occurred a few hours after a rain event. The third dry site was S#7, which is the concrete flume located east of NW 59th Court and west of Maurice's. This flume constitutes the upstream site of the 72" storm sewer that drains southeastward through Johnston and discharges just north of Johnston Drive.

The summary of the results for each analyte for all three monitoring events in 2013 are provided below. The results of the April 9th and July 15th sampling are both provided for comparison. A rain event had occurred the evening prior to the April sample collection. A result of "NF" refers to the fact that no flow was present at the time of sampling.

Analytes

E.coli Bacteria

Location	Site Description	Analyte	04/09/13	07/15/13	10/09/13
Site BC#1	Beaver Creek @ Merle Hay Rd	E.coli	330	380	570
Site C#2	Green Meadows West @ Foxboro Rd	E.coli	3300	1400	480
Site F#3	"Waterford Creek" @ NW 86 th St	E.coli	210	<10	180
Site G#4	Beaver Creek Elementary @ NW 86 th St	E.coli	460	1500	130
Site I#5	NW 86 th Street south of NW 70 th Ave	E.coli	530	570	31
Site LB#6	Little Beaver Creek @ NW 86 th Street	E.coli	420	250	400
Site S#7	NW 59 th St near Maurice's	E.coli	1600	220	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	E.coli	2500	610	340
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	E.coli	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	E.coli	NF	NF	NF

Four out of the seven sites that were sampled had bacteria levels that would be higher than the 235 MPN/100 ml standard applied to A1 and A3 streams. This standard only applies to the site on Beaver Creek (these standards apply from March 15 through November 15th, no standards are applicable from November 16 to March 14th).

Nitrate + Nitrite Nitrogen as N

Location	Site Description	Analyte	4/9/13	7/15/13	10/9/13
Site BC#1	Beaver Creek @ Merle Hay Rd	Nitrate + Nitrite nitrogen as N	0.48	15	1.9
Site C#2	Green Meadows West @ Foxboro Rd	Nitrate + Nitrite nitrogen as N	0.86	1.8	1.1
Site F#3	"Waterford Creek" @ NW 86th St	Nitrate + Nitrite nitrogen as N	0.21	8.7	0.84
Site G#4	Beaver Creek Elementary @ NW 86th	Nitrate + Nitrite nitrogen as N	1.6	2.8	2.9
Site I#5	NW 86th Street south of NW 70th Ave	Nitrate + Nitrite nitrogen as N	<0.10	5.6	1.9
Site LB#6	Little Beaver Creek @ NW 86th Street	Nitrate + Nitrite nitrogen as N	3.4	9.6	12
Site S#7	NW 59th St near Maurice's	Nitrate + Nitrite nitrogen as N	0.62	0.26	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	Nitrate + Nitrite nitrogen as N	1.9	5.2	6.0
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	Nitrate + Nitrite nitrogen as N	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	Nitrate + Nitrite nitrogen as N	NF	NF	NF

This analyte is the total amount of nitrogen present as nitrate and nitrite in the sample. Since nitrite relatively quickly converts into nitrate, this is for practical purposes a measurement of the amount of nitrate in the sample.

Nitrate levels typically fall rapidly in the mid- to late-summer timeframe, and this was certainly the case with Beaver Creek, which dropped from 15 mg/l to 1.9 mg/l between the July and November monitoring events. The Waterford Creek, and NW 86th Street sites likewise saw significant decreases in nitrate. The Green Meadows West site has shown lower nitrate levels in all three samples this year, peaking at 1.8 mg/l in July but dropping to 1.1 mg/l in October.

In contrast, the site at Johnston Drive increased across the year. In April the reading was 1.9 mg/l, which may have been diluted due to the rainfall preceding sampling. In July, the nitrate level at the site was 5.2 mg/l and in November the level had increased to 6.0 mg/l. It is not readily apparent from the other data as to why this site would appear to have an elevated nitrate level. This location is at the downstream end of the 72" storm sewer that runs diagonal through the city, beginning with the open flume next to the High School property where site S#7 is located near NW 59th Street. As previously noted, that site was dry in October and in July the nitrate levels at S#7 were very low (0.26 mg/l). However, there is no substantially elevated bacteria or phosphorus as might be expected if there was an illegal septic system connection to the storm sewer. One possibility may be the number of septic systems in the watershed of this stream and that the nitrate is travelling into groundwater via percolation in septic laterals.

Little Beaver Creek showed high levels of nitrate (12 mg/l), however this consistent with the influence of the Grimes Wastewater Treatment plant, and in the past as the natural water levels decrease, the amount of dilution also decreases and a corresponding increase in nitrate occurs.

pH

Location	Site Description	Analyte	4/9/13 Value	7/15/13 Value	10/9/13 Value
Site BC#1	Beaver Creek @ Merle Hay Rd	pH	8.1	8.1	8.0
Site C#2	Green Meadows West @ Foxboro Rd	pH	7.8	7.7	7.8
Site F#3	"Waterford Creek" @ NW 86th St	pH	7.7	7.6	7.4
Site G#4	Beaver Creek Elementary @ NW 86th St	pH	8.0	8.0	8.1
Site I#5	NW 86th Street south of NW 70th Ave	pH	8.0	7.0	6.9
Site LB#6	Little Beaver Creek @ NW 86th Street	pH	8.3	8.2	8.2
Site S#7	NW 59th St near Maurice's	pH	7.6	7.7	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	pH	7.6	7.6	7.8
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	E.coli	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	E.coli	NF	NF	NF

pH is a measure of how acid or alkaline a substance is, with 7 being neutral and lower levels than that indicating increasing acidity and higher numbers indicating how alkaline something is.

Typically most Iowa surface waters have a pH of in the range of 8.0 to 8.5, however based on the monitoring done thus far it appears that many of the smaller stream s being monitored in Johnston tend to be slightly less alkali than typical. While the larger streams of Beaver Creek and Little Beaver Creek have both fallen within the typical range, as has the Beaver Creek Elementary stream, the other sites have generally yielded results between 7 and 8, with one result actually being very slightly acidic at 6.9. Establishing baseline data such as this is very important, as it will help future monitoring determine whether a result is within the typical range for a given stream or whether it is an outlier that may require further investigation.

Total Phosphorus as P

Location	Site Description	Analyte	4/9/13	7/15/13	10/9/13
Site BC#1	Beaver Creek @ Merle Hay Rd	Total Phosphorus as P	0.18	0.12	0.25
Site C#2	Green Meadows West @ Foxboro Rd	Total Phosphorus as P	0.15	0.03	0.05
Site F#3	"Waterford Creek" @ NW 86th St	Total Phosphorus as P	0.07	0.10	0.07
Site G#4	Beaver Creek Elementary @ NW 86th St	Total Phosphorus as P	0.09	0.04	0.04
Site I#5	NW 86th Street south of NW 70th Ave	Total Phosphorus as P	0.06	0.02	<0.02
Site LB#6	Little Beaver Creek @ NW 86th Street	Total Phosphorus as P	0.54	0.37	1.0
Site S#7	NW 59th St near Maurice's	Total Phosphorus as P	0.13	0.11	ND
Site S#8	Johnston Dr @ Prairie Point Crossing	Total Phosphorus as P	0.17	0.05	0.06
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	Total Phosphorus as P	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	Total Phosphorus as P	NF	NF	NF

Phosphorus is an unregulated nutrient that is present in animal waste, decomposing organic matter and many commercial fertilizers. High levels can lead to algae blooms and undesirable levels of plant growth, especially in standing water such as ponds and lakes. Phosphorus attaches to soil particles, meaning that high levels of phosphorus can also be an indirect indicator of possible soil erosion.

Total P in the October samples ranged from below the detectable limit of 0.02 mg/l to as high as 1.0 mg/l. As in the previous sampling events of April and July, the highest level was present at Little Beaver Creek at NW 86th Street. As with the high nitrate levels at that site, this is most likely due to the influence of the discharge from the Grimes Wastewater Treatment Plant upstream.

There are currently no regulatory levels of phosphorus in Iowa, although the EPA recommended maximum levels for total phosphorus is approximately 0.08 mg/l for flowing streams and 0.04 mg/l for standing waters and reservoirs in this ecoregion.

Total Residual Chlorine

Location	Site Description	Analyte	4/9/13 Value	7/15/13 Value	Quant Limit
Site BC#1	Beaver Creek @ Merle Hay Rd	Total Residual Chlorine	<0.1	<0.1	<0.1
Site C#2	Green Meadows West @ Foxboro Rd	Total Residual Chlorine	<0.1	<0.1	<0.1
Site F#3	"Waterford Creek" @ NW 86th St	Total Residual Chlorine	<0.1	0.36	<0.1
Site G#4	Beaver Creek Elementary @ NW 86th St	Total Residual Chlorine	<0.1	<0.1	<0.1
Site I#5	NW 86th Street south of NW 70th Ave	Total Residual Chlorine	<0.1	<0.1	<0.1
Site LB#6	Little Beaver Creek @ NW 86th Street	Total Residual Chlorine	<0.1	<0.1	<0.1
Site S#7	NW 59th St near Maurice's	Total Residual Chlorine	<0.1	<0.1	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	Total Residual Chlorine	<0.1	<0.1	<0.1
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	Total Residual Chlorine	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	Total Residual Chlorine	NF	NF	NF

This analyte was chosen to provide information on the presence of fresh treated water in the water sample. Chlorinated water in a stream or drainage area during a time when little or no lawn irrigation is occurring could be an indicator of a water line leak. During times when lawn irrigation is occurring, it can provide a measure of how much of a stream's flow is coming from irrigation compared to natural groundwater sources.

No Total Residual Chlorine was detected in any of the samples in October. In total, of all the sites where samples were collected in April, July and October, only one instance of detectable chlorine levels occurred, and that was located at the Waterford Creek location. The most likely cause of this was low natural flow conditions coupled with runoff from lawn irrigation in the area discharging to the stream.

Total Suspended Solids

Location	Site Description	Analyte	4/9/13	7/15/13	10/9/13
Site BC#1	Beaver Creek @ Merle Hay Rd	Total Suspended Solids	50	14	20
Site C#2	Green Meadows West @ Foxboro Rd	Total Suspended Solids	88	1	1
Site F#3	"Waterford Creek" @ NW 86th St	Total Suspended Solids	10	<1	2
Site G#4	Beaver Creek Elementary @ NW 86th St	Total Suspended Solids	35	<1	<1
Site I#5	NW 86th Street south of NW 70th Ave	Total Suspended Solids	7	1	3
Site LB#6	Little Beaver Creek @ NW 86th Street	Total Suspended Solids	18	3	5
Site S#7	NW 59th St near Maurice's	Total Suspended Solids	10	5	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	Total Suspended Solids	26	<1	<1
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	Total Suspended Solids	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	Total Suspended Solids	NF	NF	NF

Total Suspended Solids (TSS) is a measure of the amount of solid particles present in water samples. High TSS levels are usually an indicator of active soil erosion upstream.

As in the July monitoring data, TSS levels were very low, as would be expected given the lack of recent precipitation. Beaver Creek had the highest Total Suspended Solids level, at 20 mg/l, while the remaining sites ranged from 5 mg/l down to two locations having non-detectable levels.

Turbidity

Location	Site Description	Analyte	4/9/13	7/15/13	10/9/13
Site BC#1	Beaver Creek @ Merle Hay Rd	Turbidity	25	7.1	12
Site C#2	Green Meadows West @ Foxboro Rd	Turbidity	38	1.4	1.2
Site F#3	"Waterford Creek" @ NW 86th St	Turbidity	10	<1.0	2.5
Site G#4	Beaver Creek Elementary @ NW 86th St	Turbidity	19	<1.0	<1.0
Site I#5	NW 86th Street south of NW 70th Ave	Turbidity	5.2	<1.0	<1.0
Site LB#6	Little Beaver Creek @ NW 86th Street	Turbidity	7.8	1.5	3.5
Site S#7	NW 59th St near Maurice's	Turbidity	11	1.5	NF
Site S#8	Johnston Dr @ Prairie Point Crossing	Turbidity	20	<1.0	<1.0
Ta#9	Upstream of Storm-ceptor, NW Beaver Dr.	Total Suspended Solids	NF	NF	NF
Tb#9	Downstream of Storm-ceptor, NW Beaver Dr.	Total Suspended Solids	NF	NF	NF

Turbidity is a measure of water clarity and is measured in NTU's (Nephelometric Turbidity Units). In this measurement of clarity, lower numbers indicate higher water clarity (as a reference, treated drinking water is low as required to meet a turbidity standard of 0.3 NTU's in at least 95% of samples, and no single sample can exceed 1 NTU). Turbidity, like TSS, is often an indicator of active erosion but can indicate the presence of other pollutants as well.

As in July, and consistent with the low TSS levels, turbidity was low, with three sites below the detectable limit of 1.0 NTU. The highest turbidity was at the Beaver Creek site at Merle Hay Road, measuring 12 NTU's.

October 9, 2013 IOWATER Polk County Snapshot

The Polk County water quality snapshot occurred on October 9th, and city staff requested that UHL perform their sampling on the same day. This allows comparison of the data, and the two events complement each other. The lab data for sites monitored on Beaver Creek are shown below, and the analytes not also covered by the Johnston monitoring program are also explained below:

	Total Coliforms	E. coli	Chloride	Nitrate as N	Sulfate	Phosphorus-O as P	Nitrite as N
BC1 (at NW 128 th St)	16070	740	39.97	ND	39.91	0.45	ND
BC2 (at NW 70 th Ave)	8550	520	60.93	5.36	68.14	0.52	ND
BC3 (at Merle Hay Rd)	11870	200	44.29	1.76	51.46	0.47	ND
LBC1 (at 121 st St)	13540	200	37.01	2.11	49.67	ND	ND
LBC3 (at NW 86 th St)	10760	1100	98.07	10.94	87.31	1.06	ND

Total Coliforms refers to the total number of coliform bacteria in each sample. E.coli is the standard bacteria test used for state monitoring purposes, but Total Coliforms can be another way to gauge bacteria levels in a water body. Coliform bacteria are a less precise analyte to use than E.coli because while E.coli only thrive in the gut of warm blooded animals, coliform bacteria can also be found in soil and many other places.

Chloride is a measure of the level of salts in the sample. High chloride levels can be an indicator of human or animal waste inputs, some types of pollution, or contamination by road salts. Typically Beaver Creek shows chloride levels in the 30-50 mg/l range, in this case due to the influence of the Grimes Wastewater plant elevated levels were found in Beaver Creek below its confluence with Little Beaver Creek.

Sulfate is a naturally occurring substance that can add a bitter taste to drinking water and at higher levels can have a laxative effect. Levels above 400 mg/l are not recommended for infants. The EPA recommended maximum level of sulfate for drinking water is 250 mg/l, though this is primarily for the impact on the taste of the water and is not a regulatory limit.

Nitrite is a substance that quickly degraded into nitrate and is often an intermediary between ammonia and nitrate (the less stable ammonia breaks down into nitrite, which in turn then breaks down into nitrate, which is a stable compound). High nitrite levels are often an indicator of animal or human waste inputs, and because it quickly converts to nitrate any detectable levels of nitrite indicates that the source is either close by the sampling location or that the inputs are very large.

Phosphorus – O as P refers to orthophosphate, a phosphorus compound that is readily available for uptake by plants. This will usually provide a lower amount than Total Phosphorus, but both are a useful analyte as many of the compounds in Total Phosphorus will eventually convert to orthophosphate.

The snapshot results highlight the influence the Grimes Wastewater Plant can have on Beaver Creek during periods of low flow. The site on NW 128th Street, for example, showed non-detectable levels of nitrate, but at NW 70th Avenue below the confluence with Little Beaver Creek the nitrate levels in Beaver Creek increased to 5.36 mg/l. Chloride also increased about 50%, from 39.97 mg/l to 60.93 mg/l.

Summary

The data collected in 2013 begins to establish baseline data for the targeted streams which will allow for better detection of anomalies in future results. Generally results collected so far do not appear to be atypical when compared to data collected during other monitoring in the area (IOWATER, USGS, DMWW), but many of the sites being monitored may have on average a lower pH than is typical in most Iowa streams and this should be considered in reviewing additional monitoring results.

The Johnston Drive location showed increasing nitrate results through the year, though there is no clear indication of why this may be the case. While the nitrate levels are not extremely high, they were elevated at a time nitrate levels at other sites were decreasing and so future results from this location should be of particular interest.

Before continuing with monitoring in 2014, results of the 2013 monitoring should be reviewed to determine if any changes in analytes or monitoring locations should be made. For example, two sites, the location upstream and downstream of the Storm-ceptor on NW Beaver Drive, had no flow present at

any of the three sampling events, even with a rain event occurring the evening before sampling in April. Consideration should be made on whether keeping this site or selecting another site is a better use of resources.