



Optical Brighteners and Source Tracking Duck Creek – Scott County, Iowa

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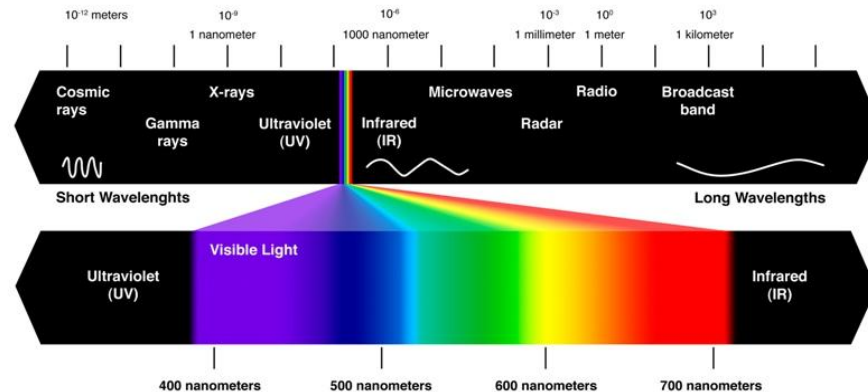
Iowa Department of Natural Resources

Source Tracking

- Used to determine sources of fecal bacteria contamination.
 - Human
 - Livestock, wildlife
 - Specific animal source
- Methods often expensive, complex and time-consuming.
- Testing for optical brighteners is a relatively cheap, simple, and fast alternative.

Optical Brighteners

- Fluorescent agents added to laundry detergents.
 - Create a whitening effect on fabrics and paper
 - “Make your whites whiter and brights brighter”
- Absorb light from the ultraviolet and violet region of the EMS and re-emit light in the blue region.



Sample Collection

- Collect samples in acid-washed bottles and store in a cool, dark place.
- Low-flow conditions for stream sampling.
- Collect in tandem with indicator bacteria samples.



Sample Analysis

- Turner Designs 10-AU fluorometer
- First analysis
- UV treatment
- Second analysis
- Difference in OBU, converted to $\mu\text{g/L}$ using standard curve
- Bacteria results

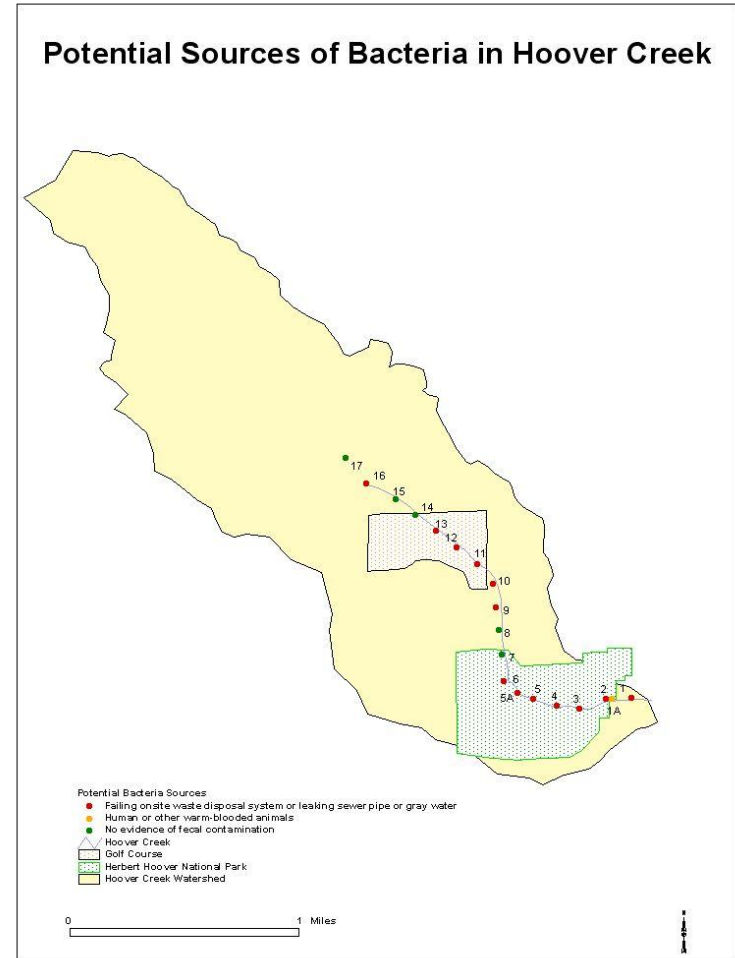


Relationship between levels of bacteria, levels of optical brighteners, and sources of bacteria in waterways

Indicator Bacteria Concentration	Optical Brightener Concentration	Potential Source(s) of Bacteria
High	High	Failing septic system or leaking sewer pipe
High	Low	Non-human warm-blooded animals (e.g. wildlife, livestock)
Low	High	Gray water in storm water system
Low	Low	No evidence of fecal contamination at time of sample collection

Herbert Hoover National Historic Site

- Hoover Creek
- Began to identify several potential sources of human bacterial contamination
- Urban sites vs. golf course sites
- No info on steps taken towards remediation



Duck Creek - Results

Site	E. coli (MPN/100 mL)	Optical Brighteners (µg/L)	E. coli (MPN/100 mL)*	Optical Brighteners (µg/L)†	Potential Source(s) of Bacteria
CLC1	770	18.32	High	High	Failing septic system or leaking sewer pipe.
CLC2	160	12.16	Low	Low	No evidence of human contamination.
DC3	130	12.56	Low	Low	No evidence of human contamination.
DC4	1400	15.74	High	High	Failing septic system or leaking sewer pipe.
DC5	780	13.95	High	Low	Non-human warm-blooded animals.
DC6	230	11.96	Low	Low	No evidence of human contamination.
DC7	330	9.98	High	Low	Non-human warm-blooded animals.
DC8	52	10.57	Low	Low	No evidence of human contamination.
DC9	84	10.97	Low	Low	No evidence of human contamination.
DC10	75	10.37	Low	Low	No evidence of human contamination.
DC11	31	12.16	Low	Low	No evidence of human contamination.
DC12	96	12.36	Low	Low	No evidence of human contamination.
DC14	210	11.76	Low	Low	No evidence of human contamination.
DC16	280	7.99	High	Low	Non-human warm-blooded animals.
GC2	5500	10.37	High	Low	Non-human warm-blooded animals.
GC3	520	11.37	High	Low	Non-human warm-blooded animals.
GC4	120	9.98	Low	Low	No evidence of human contamination.
GWC1	280	13.16	High	Low	Non-human warm-blooded animals.
HC1	41	17.93	Low	High	Gray water in storm water system.
PC2	2400	8.98	High	Low	Non-human warm-blooded animals.
RC1A	220	14.94	Low	Low	No evidence of human contamination.
SC1A	330	15.34	High	High	Failing septic system or leaking sewer pipe.
SFC2	440	13.35	High	Low	Non-human warm-blooded animals.

* High = >235 MPN/100 mL water; † High = >15.00 µg/L

Duck Creek - Conclusions

- Not a “silver bullet.”
- Tool to locate potential sources of human fecal contamination and trigger further investigations/actions.
- Results from initial sampling indicate evidence of potential human contamination at some sites.
- Further monitoring is recommended.