

Setting Goals and Indicator Selection for Performance Assessment

Potential watershed improvements shall be evaluated for construction feasibility, level of expected improvement, and cost effectiveness. The basis for goals and performance assessment will vary depending on the type of improvement.

Hydrologic – Flood Related Improvements

Hydrologic and flood related improvements shall be implemented to attenuate the severe flooding that is common to the watershed, as much as possible. Measures such as improved conveyance and additional storage shall be proposed at locations of maximum effectiveness without impact to existing structures. Performance will be measured based on reduction in flood elevations and damages, as well as implementation cost.

Sediment Removal Improvements

Sediment removal improvements shall be implemented to alleviate the deposit of sediment that occurs when channels and drainage ways enter larger, slower moving water bodies. Measures shall include the removal of existing sediment by dredging, as well as the construction of sediment basins upstream of the problem areas to reduce the probability of future sedimentation problems. Annual maintenance shall consist of removal and proper disposal of the sediment contained by the proposed basins. Performance will be measured based on the actual reduction of sediment deposits in the subject water bodies.

Land Treatment and Other Ecological Improvements

Land treatment and other ecological improvements shall be provided to improve the water quality within the watershed. Measures shall include burying or drilling of animal waste, implementation of filter strips, wetland development, and removal of illicit sanitary connections to drain tiles. Performance will be measured based on the visible reduction of sediment and debris in the lake system, the measured reduction of bacteria and other contaminants in the watershed, and improved lake trophic readings.

Goals for the Pigeon Creek Watershed are listed in Table 22 by present concern, present status, target status, and anticipated timeline to reach target status.

Goal	Current Problem	Current Status	Target Goal	Target Date
Improved Water Quality	Bacteria, Waste interaction with runoff	Variable Concentrations See Table 16	235 Human Colonies / 100 mL (Dry Weather – excludes 48-72 hours after rain)	2010
	Nitrates	0-39 mg/L	10 mg/L	2010
	Phosphates	Avg. 0.2-3 mg/L	0.025 mg/L	2010
	Lawn fertilizer in ponds – algae blooms	Homeowners apply fertilizer on slopes before rain events	Less algae blooms, decreased levels of nitrates	2006
	Sedimentation	Long Lake filled with sediment	Minimal sediment in Long Lake	Upon sediment basin implementation
	Angola Combined Sewage Overflows	Overflows During Extreme Rain Events	No Overflows	Per Angola NPDES Permit
	Illicit Connection	Likely connections to Pigeon Creek	100 Voluntary Tests	2010
Improved Drainage	Lake Chain Flooding	Hogback Lake Bounce: 2yr rain – 6ft 10yr rain – 7ft 100yr rain – 8.5ft	Reduced flooding in Upper Watershed and Lake Chain	Upon project implementation
	West Otter Lake Flooding	West Otter Lake outlet is limited during flood events	Provide additional flood storage upstream of lake	2010
	Road Drainage	Roads are flooded for extended periods after rain events	Develop Access Plan	2010
Regulated Development	None (Ongoing Guideline)	Development is regulated by Angola and Steuben County	Continued or Improved Regulation	2005

Table 22: Goals for Pigeon Creek Watershed Improvements.

Target Load Reduction for E.Coli, Nitrates, Phosphates, and Sedimentation

As shown in Table 20, measured concentrations for *E. Coli* vary throughout the watershed, with the highest concentrations measured at the inlet to Long Lake and on Hammond Ditch upstream of the CR 100S culvert. As concentrations will vary due to the weather conditions at the time of measurement, calculating a specific load reduction for the entire watershed does not appear practical. However, measures should be undertaken upstream of Long Lake and the CR100S culvert on Hammond Ditch to reduce or eliminate *E. Coli* sources as much as possible.

As with *E. Coli*, nitrate and phosphate levels vary across the watershed, with the highest concentrations measured at the Long Lake inlet. Nitrate measurements at the Long Lake inlet average near the state standard of 10 mg/L; therefore, minimal improvement is required. The weighted average for nitrates in the remainder of the watershed is 5.1 mg/L (using data from Table 20). To meet the average concentration for the remainder of the watershed, the target concentration reduction for nitrates upstream of the Long Lake inlet is $10 \text{ mg/L} - 5.1 \text{ mg/L} = 4.9 \text{ mg/L}$. Using the average streamflow for Pigeon Creek as determined by the trend analysis in Figure 16, the target load reduction for nitrates is $4.9 \text{ mg/L} * 100 \text{ cfs} * 0.03531 \text{ L/cft} * 31536000 \text{ s/yr} = 19.3 \text{ ton/yr}$.

Phosphate measurements vary across the watershed from 0.2 mg/L to 3.33 mg/L, with the weighted average measurement of 0.35 mg/L (using data from Table 20). To obtain compliance with State Standards, the target concentration reduction for phosphates is $0.35 \text{ mg/L} - 0.025 \text{ mg/L} = 0.325 \text{ mg/L}$. Using the average streamflow for Pigeon Creek as determined by the trend analysis in Figure 16, the target load reduction for phosphates is $0.325 \text{ mg/L} * 100 \text{ cfs} * 0.03531 \text{ L/cft} * 31536000 \text{ s/yr} = 1.28 \text{ ton/yr}$.

The “Watershed Protection Plan – Environmental Assessment for Pigeon Creek Watershed” of November 1987 produced an evaluation of erosion on 16,800 acres of problem cropland within the watershed. The report concluded that 128,000 tons of sediment erodes from upland areas annually to fill ditches and channels. Improvement measures should be considered to control erosion from upland areas to reduce the sediment load entering the waterways, as well as sediment basins to collect the sediment at strategic points to prevent aggradation in the main Pigeon Creek channel and lake chain.