Section VII: Development of Problem Statements and Threat Identification

Concerns and Problem Statements

The Subwatershed Assessment and ongoing watershed research and monitoring has allowed the Eagle Creek Watershed Alliance to determine the scope of each water quality concern and from those concerns develop problem statements to summarize the primary watershed concerns.

Concerns

Based on the results of the Subwatershed Assessment, five areas of primary concern have been identified. They are:

1. *E. coli* loading within the watershed exceeds acceptable levels in many areas of the watershed for considerable amounts of time. Given that *E. coli* is an indicator organism, concerns exist that other pathogens may also be present at elevated levels in the watershed. All watersheds in Eagle Creek Watershed are listed for *E. coli* impairment with the exception of School Branch (IDEM 2004 303 d List). Data is now available showing that School Branch is also impaired and will be listed in the upcoming 303d listing (J. Arthur, IDEM, personal communication). Both *Giardia lamblia* and *Cryptosporidium* are present in area streams as evidenced by measurements in Eagle Creek Reservoir (Veolia Water Indianapolis 2003 data).
2. Atrazine loading (measured as triazine) within the watershed has been shown to exceed USEPA and IAC drinking water standards in several areas of the watershed. Although drinking water standards are based on an annual average of atrazine in treated water, high atrazine loads in the watershed can pose a problem and are a concern. Given the source of triazines is agricultural applications, other herbicides, pesticides and metals may also exceed acceptable standards.
3. Sedimentation/Turbidity, low dissolved oxygen, and elevated nutrients may be causing degradation of aquatic habitats. Riparian habitats in many portions of the watershed have been degraded by stream erosion and/or loss of riparian buffer. These combinations of factors are resulting in poor habitat quality in some portions of the watershed.
4. Nutrient (nitrogen and phosphorous) loading within the watershed is frequently at or above levels that promote algal blooms in Eagle Creek Reservoir, taste and odor problems in finished drinking water and potential health risks associated with elevated nitrate in source waters and the toxins from algal blooms in both Eagle Creek Reservoir and in the drinking water supply.
5. The public's level of understanding about and stewardship of the watershed, drinking water resources, and the value as a natural resource need to be increased.

Problem Statements

Problem:
Streams in the Eagle Creek watershed exceed the Indiana single sample daily maximum of 235 colonies per 100 milliliters for *Escherichia coli* (*E. coli*) bacteria.

Discussion:
All Eagle Creek subwatersheds, with the exception of Eagle Creek Reservoir - School Branch, are listed as impaired for *E. coli* (IDEM 2004 303d list); however, data is now available that show this subwatershed to also be impaired. Sampling of Eagle Creek subwatersheds by CEES between January 2003 and March 2005 indicated concentrations of *E. coli* exceed the Indiana single sample daily maximum of 235 colonies per 100mL at least 65% of the time based on 107 samples collected throughout the Eagle Creek watershed. A benchmark analysis prepared by CEES using 1995-2004 data from the Marion County Health Department, Eagle Creek Watershed Task Force, and the Central Indiana Water Resources Partnership showed an exceedence of the 235 CFU daily maximum between 52-100% of the times sampled. Land-use/Land-cover data assessments show that streams with high *E. coli* loads such as Dixon Branch, Little Eagle Branch – Headwaters have subwatersheds with CAFOs and unsewered communities, respectively. Additionally, windshield surveys completed in the spring of 2005 revealed that there are still areas where livestock have access to the streams. *E. coli* in water is indicative of fecal contamination by warm-blooded animals, and may also be an indicator that other pathogens are present in the water. Both *Giardia lamblia* and *Cryptosporidium* are present in area streams as evidenced by measurements in Eagle Creek Reservoir (Veolia Water Indianapolis 2003 data).

Poorly functioning septic systems and package plant operations are additional sources of *E. coli* to Eagle Creek Watershed streams. Other potential sources of *E. coli* and pathogens in the watershed include: runoff of manure applications to cropland, regulated confined feeding operations and smaller non-regulated private livestock farms.

Problem:
Concentrations of Atrazine in Eagle Creek watershed streams are resulting in elevated Atrazine levels in Eagle Creek Reservoir that exceed the USEPA standard of 3.0 ug/L (.003 mg/L) for drinking water supplies.

Discussion:
Eagle Creek Reservoir frequently exceeds the Atrazine maximum contaminant level of 3.0 ug/L for a drinking water supply (USEPA, National Primary Drinking Water Regulations; http://www.epa.gov/safewater/mcl.html#2). Although the maximum contaminant level (MCL) of 3.0 µg/L for atrazine is based on an annual average of atrazine in treated water, the importance of keeping atrazine levels low in the watershed and reservoir is recognized. Water collected from Eagle Creek Reservoir by the Indianapolis Water Company in 1996, 1998 and 2002 indicated peak levels of atrazine

typically occur between April and September. In 2002, 75% of the 111 samples collected from Eagle Creek Reservoir exceeded the drinking water standard. Calculations based on USDA 2002 chemical usage reports for corn and soybean, indicate approximately 448,100 pounds of pesticide were applied in Eagle Creek Watershed, of which 40,140 pounds and 88,250 pounds were atrazine and metolachlor, respectively (USDA, 2002). Furthermore, the windshield survey in Spring 2005 revealed that there are numerous agricultural drainage pipes discharging into the watershed streams and ditches. Adequate riparian buffer was noted to be missing in the subwatersheds, which is crucial to prevent runoff of agricultural and lawn chemicals applied to the adjacent lands from entering the streams. Grassy buffers were observed in many parts of the watershed but still lacked the acceptable width of 150' (Kovacic, 1994) needed to remove 80% of nitrate. In 1991, the U.S. Geological Survey began the National Water Quality Assessment (NAWQA) Program to describe the status and trends in the quality of the Nation's water resources. The USGS noted that there was a significantly greater frequency of detections and much higher concentrations of atrazine and metolachlor observed in samples of river water than groundwater (Crawford and others, 1995). Low pesticide concentrations in ground water and high concentrations in nearby stream waters suggests that pesticides may move quickly from agricultural fields to streams via tile drain discharge and surface runoff. An estimated 52% of Eagle Creek Watershed is tiled, but the number is likely higher from farmlands that were developed but still have functioning tile systems.

Problem:
Sediment loads in the subwatersheds of Eagle Creek are high during event flows, eventually transporting large pulses of sediment to the reservoir and potentially degrading aquatic health.

Discussion:
Although base flow does not contribute excessive amounts of suspended sediment in the watershed, storm events have high suspended sediment loads, particularly in the spring. Samples collected by CEES during a spring runoff event in 2003 indicate all subwatersheds exceeded the TSS benchmark criteria of 263 mg/L for protection of aquatic life, with the exception of School Branch which had 235 mg/L TSS during spring event flow. Many areas of moderate stream bank erosion in Eagle Creek Watershed were noted during the windshield survey, an indicator that these areas are sensitive to high flowing water removing the stream's bank. Lack of adequate buffer was observed and can also influence stream bank erosion, making the banks less stable and more vulnerable. Steep slopes are another stressor and lead to higher rates of sedimentation as well as runoff. Although much of Eagle Creek Watershed has a low percent slope (mean slopes range from 0.85% in Dixon Branch to 2.43% in School Branch), some of the areas had as high as 44.12% slope (Fishback Creek). Areas of highest slope are located near the reservoir where development is rapidly occurring. More impervious surfaces are associated with development, increasing runoff and therefore, increasing discharge of the streams. Much of the suspended sediment transport occurs during pulses of higher discharge in Eagle Creek and its tributaries.

Chemicals, nutrients and other pollutants are carried with the sediment during these pulses which also threaten the stream's health. CEES studies have shown phosphorus may be bound to the suspended sediment particles. These phosphorous-laden particles are transported to the reservoir where anoxic conditions can release the bound phosphorus and become a phosphorous source for reservoir algal blooms (Pascual *et al*., 2004; Raftis *et al*., 2004).

Problem:
Nutrient concentrations in all streams in Eagle Creek watershed frequently exceed the national average for watersheds with 50-75% agricultural use.

Discussion:
Despite that Eagle Creek Watershed's land-use is 52% agricultural use, Eagle Creek Watershed streams frequently exceed nutrient concentrations that are found in US watersheds with 50-75% agriculture. Using the Total P concentration of 0.125 mg P/L, the Total N concentration of 2.75 mg N/L, and nitrate concentration of 1.0 mg N/L from the EPA's 1977 nationwide study on non-point source stream nutrients (Omernik, 1977), the streams in Eagle Creek Watershed exceed these concentrations at least 60% of the time sampled, with stations in School Branch and Irishman Run & Long Branch subwatersheds exceeding nitrate threshold more than 75% of the time sampled. Excess amounts of phosphorous and nitrogen, plant growth limiting nutrients, have detrimental affects down stream in Eagle Creek Reservoir. 2004 estimated total P and total N load entering the reservoir showed that total P load exceeds 40 metric tons/year and total N load exceeds 550 metric tons/year. These high nutrient loads spur algal blooms that adversely affect the water quality of the reservoir, a designated public water supply for over 80,000 Indianapolis residents. Nutrient concentrations in water are generally related to landuse in the upstream watershed or the area overlying an aquifer (USGS, 1996). This was demonstrated in the USGS White River Basin study that showed nitrate concentrations were low in ground water, but high is streams, indicating that the tile drains were rapidly directing nitrate into nearby streams. The 2004 detailed stream reach sampling study on School Branch and Fishback Creek Watersheds showed that portions of watersheds with intense agriculture (90 to 100 percent agriculture landcover) contribute high total P and total N loadings relative to water contribution during both eventflow and baseflow conditions, whereas stream reaches with less intense agriculture landuse showed total N and total P loading typically equals or is less than water contribution (Jackson *et al*., 2004). The study demonstrates that intense agricultural areas are loading extraneous amounts of total N and total P to streams. Additionally, all CEES studies completed from 2003 to 2004 find increased loads of phosphorous and nitrogen with increasing streamflow is consistent with nonpoint sources (Tedesco *et al*., 2003; Shrake *et al*., 2003; Shrake *et al*., 2004).

Problem:
An adequate educational outreach program is not in place to inform the residents in the Eagle Creek Watershed about their role in maintaining the overall quality of the watershed.

Discussion:
While difficult to quantify, many of the observed water quality problems in the Eagle Creek Watershed suggest that the residents do not fully understand how their actions can impact water quality. Personal contact with Boone County Health Department and the County NRCS District Conservationists confirm that no formal educational outreach programs are currently in place for the Eagle Creek Watershed community. Residents encountered during the 2003-2005 stream sampling, however, often expressed interest in knowing more about the overall state of their watershed. As development continues in the watershed, a considerable outreach effort will be required to integrate newer watershed scale practices into these areas.