
Valley Creek, Alabama UAA

Abstract

Complexity: Simple
Region: 4

Type of Action: Assign limited warmwater fishery use
131.10(g) Factors: 3, 5

In this 2001 use attainability analysis (UAA), the Alabama Department of Environmental Management (ADEM) provided evidence to support the proposed change for the upper segment of Valley Creek from Agricultural and Industrial Water Supply (A&I) to Limited Warmwater Fishery (LWF). The corresponding water quality criteria are more stringent for waters classified as LWF than for A&I waters. The key element of the LWF classification establishes seasonal uses and water quality criteria for waters that otherwise cannot maintain the more protective Fish & Wildlife (F&W) classification year-round. The LWF classification does not fully meet the water quality uses and criteria associated with the “fishable/swimmable” goal, and therefore a UAA was necessary. In the UAA, ADEM provided information on the physical, biological, and chemical characteristics of Valley Creek; water quality data from sampling stations; discharge monitoring reports from the point source dischargers; and water quality modeling results. EPA approved the revision to Alabama’s water quality standards to reclassify Upper Valley Creek for LWF and Lower Valley Creek for F&W.

Background

The Valley Creek watershed is in north-central Alabama. Valley Creek originates in Birmingham and flows west to Bankhead Lake, an impoundment of the Black Warrior River. Valley Creek is 46 miles long and has a total drainage area of 257 square miles. Its tributaries include Blue Creek, Fivemile Creek, and Opossum Creek; all of which are designated for Fish and Wildlife (F&W) use with the exception of Opossum Creek, which is designated for Agricultural and Industrial Water Supply (A&I) use.

In August 2000 the Alabama Department of Environmental Management’s (ADEM’s) Environmental Management Commission adopted new water quality standards regulations that eliminated the Industrial Operations use classification. At that time the use designation of Valley Creek was changed to A&I. In 2001 ADEM conducted a use attainability analysis (UAA) to provide evidence to support a proposed use classification change for Upper Valley Creek from A&I to limited warmwater fishery (LWF). Because LWF is not a “fishable/swimmable” use as defined in Clean Water Act (CWA) section 101(a)(2), the proposed change requires a UAA. At that time ADEM also proposed that Lower Valley Creek be classified for the F&W use, which meets the goals of CWA section 101(a)(2).

The best uses of LWF waters include: agricultural irrigation, livestock watering, industrial cooling, and process water supply, and any other use except fishing, bathing, recreational activities, or as a source of water supply for drinking or food-processing purposes.
The best uses of F&W waters include: fishing, propagation of fish, aquatic life, and wildlife, and any other use except swimming and water-contact sports or as a source of water supply for drinking or food-processing.

Attainment of the F&W use in Upper Valley Creek is precluded by two of the 40 CFR 131.10(g) factors:

Factor 3: Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.

Factor 5: Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude the attainment of aquatic life protection.

Limited Warmwater Fishery Classification

ADEM developed the LWF use classification in 2000 to establish seasonal uses and water quality criteria for waters that otherwise could not maintain the F&W criteria year-round. All provisions of the F&W use apply to the LWF use, with the exception of the criteria for dissolved oxygen (DO), bacteria, and chronic aquatic life. Table 1 provides the key differences between the F&W and LWF uses.

Table 1. Differences between F&W and LWF Uses

Classification	Criteria		
	Dissolved oxygen	Bacteria (fecal)	Chronic aquatic life
F&W	≥5.0 mg/L	For freshwater Geometric mean: ≤1000/100 mL For freshwater Geometric mean: ≤200/100 mL (Incidental water contact and recreation, June through September)	7-day, 10-year (7Q ₁₀) low flow used to establish the chronic aquatic life criteria for point source discharges
LWF	≥3.0 mg/L ^a	For Freshwater Geometric mean: ≤1000/100 mL ^b	7-day, 2-year (7Q ₂) low flow used to establish the chronic aquatic life criteria for point source discharges

^a Criterion applies May–November. Dissolved oxygen criterion associated with F&W classification is used December–April.

^b Bacteriological criteria for incidental water contact and recreation during June–September are not required.

Water Quality Impairment and Pollutant Sources in the Upper Valley Creek

The Opossum Creek watershed is one of the most highly industrialized areas of Birmingham, and it contributes point source and nonpoint source pollutants to Valley Creek. In addition, a number of land uses in the Valley Creek watershed have the potential to degrade water quality. In Upper Valley Creek, industrial and commercial activities and residential land uses adversely affect water quality. The upper segment exhibits characteristics typical of an urban stream, including poor habitat, degraded water quality, and stressed biological communities due to the large amounts of impervious landscape. In addition, much of the stream has been concrete-lined, adding to algae production and fluctuations in DO.

Key Characteristics of Upper Valley Creek

- Poor DO levels
- High pathogen levels
- Elevated BOD
- Elevated nutrient concentrations

This segment has poor DO levels, high pathogen levels, and elevated biochemical oxygen demand (BOD) and nutrient concentrations.

Three point sources operating under National Pollutant Discharge Elimination System (NPDES) permits are located in the Valley Creek watershed. The Valley Creek wastewater treatment plant (WWTP) is on Valley Creek, and two other point sources are on Opossum Creek.

Conditions in Lower Valley Creek

In the lower segment, the area is primarily rural, with silvicultural, agricultural, and mining land uses. The lower segment has improved chemical, physical, and biological conditions suitable for classification as F&W use.

Data Collection and Analysis

ADEM, the U.S. Geological Survey (USGS), and EPA conducted water quality monitoring. In a 1989 study, EPA examined biological conditions in Village, Valley, Opossum, and Fivemile creeks. Opossum Creek was cited as having poor habitat and deposits of tar-like substances, with growth impairment to the fathead minnow. In addition, the study showed mortality to daphnia at two sampling points on Valley Creek. A biological survey conducted by EPA in 1997 documented degraded habitat at two of three sampling stations in Upper Valley Creek (habitat scores of 66 and 64 versus 118 in the reference F&W stream), and fewer fish species were reported than in the lower segment. On the basis of this information, EPA suggested that Upper Valley Creek would need significant enhancements to improve stream habitat and removal of excess nutrients to be able to achieve the F&W designated use.

USGS data from the Birmingham Watershed Project confirmed the water quality impacts that EPA and ADEM had found. Sampling at several locations from 1998 to 2001 showed that sewer overflows, leaking sewer lines, and other regulated and nonregulated stormwater runoff were contributing the high pathogen loads. EPA, USGS, and ADEM data showed that conditions improved downstream such that F&W uses could be met in Lower Valley Creek. USGS benthic macroinvertebrate data from 1999–2000 showed poor taxa richness in Upper Valley Creek, consistent with the degraded physical and chemical characteristics. These data exhibited:

- Poor Ephemeroptera, Plecoptera, or Trichoptera (EPT) family richness and poor total taxa richness at both sampling sites
- Low benthic invertebrate diversity and low fish community diversity (Shannon's index of diversity)
- Absence of sculpin (intolerant of contaminated waters) and spotted sucker (intolerant of turbid or silty waters)

In a review of these data, EPA concluded that the aquatic community structure showed degraded water quality, negatively affected by anthropogenic impacts in the watershed over an extended period.

In another study, USGS monitored DO at three stations on Valley Creek. One station was monitored continuously, and DO concentrations at that site ranged from 3.8 to 19.6 mg/L. The daily minimum concentrations at the site were between 4 and 5 mg/L for 39 days between June 25, 2000 and February 22, 2001, with concentrations less than 4 mg/L on one day. Dissolved oxygen measurements at two other sampling sites reached as low as 3.3 and 4.3 mg/L. In a 1998 survey, EPA and ADEM found DO concentrations less than 5 mg/L at a sampling gauge 5 miles upstream from the Valley Creek WWTP. This station was downstream of a channelized stream segment, which provides an ideal surface for periphytic and other microbial growths that produce a large diurnal swing in DO through photosynthesis and respiration.

ADEM conducted water quality modeling for the three point sources to predict the effluent limits needed to meet the various use classifications (A&I, LWF, and F&W). Modeling showed that LWF would be achievable in Upper Valley Creek through effluent limits on the three point sources (with the most stringent limits on the Valley Creek WWTP). ADEM also considered discharge monitoring report data from the facilities and found that at the time of the UAA, the Valley Creek WWTP was operating at very efficient levels and providing a high degree of treatment. ADEM concluded that the Valley Creek WWTP would be able to achieve effluent limits for the LWF, and that the F&W designation would require much more stringent limits for the summer months. With the LWF classification, each facility would be required to conduct chronic toxicity biomonitoring.

ADEM also provided an analysis that showed highly elevated bacteria levels and demonstrated correspondence of bacteria levels with the patterns of precipitation in the Valley Creek watershed. This pattern indicates a strong relationship to nonpoint sources.

Conclusion

The biological health of Valley Creek is dependant on good physical and hydrological characteristics, including proper flow, adequate zones, and diverse substrate. The urbanization of the watershed has fostered habitat destruction through erosion, channelization, concrete substrate, and excessive light and heat penetration.

In their UAA document, ADEM concluded, in part:

Leaking sewer lines, domestic animals and wildlife populations, and leaking septic tanks are nonpoint sources of both nutrients and bacteria to Valley Creek. Sewer overflows are also a source of both nutrients and bacteria to Village Creek that is driven by precipitation. The Valley Creek WWTP currently achieves an extremely high level of treatment. Jefferson County is estimated to expend \$800 million to resolve sewer overflows and replace leaking sewer lines. It is anticipated that this substantial capital investment will improve water quality.

It is not currently possible to determine the percent contribution from the known categories of nonpoint sources, nor is it possible to project the degree of success in terms of measurable water quality improvements that will result from ongoing efforts to resolve sewer overflows and replace leaking sewer lines. The available information suggests that the magnitude of nutrient and bacteria levels, the variety of sources, and the physical characteristics of the waterbody indicate that the F&W use classification is not attainable, and the highest attainable use is LWF. Therefore, F&W is not designated at this time as a result of a combination of human-caused conditions (that may not be feasible to fully remedy) and natural physical conditions of the watershed unrelated to water quality (e.g., high water table). However, as new information becomes available that pertains to attainability of the F&W use classification, it will be considered and water quality standards revised accordingly.

EPA approved the revision of Alabama's water quality standards to include the new classification of LWF for Upper Valley Creek and F&W for Lower Valley Creek. This is an example of a UAA for both aquatic life and recreational uses for an urbanized stream, where significant investment is being made to improve water quality, and the results are anticipated to reach certain goals but may still fall short of a full "fishable/swimmable" designated use.

References

ADEM. 2001. *Use Attainability Analysis: Valley Creek*. Alabama Department of Environmental Management.

USEPA. 2002. Section 303(c) Review of State-adopted Use Classifications. Memorandum from Gail Mitchell to James Giatanna. U.S. Environmental Protection Agency, Region 4, Atlanta, GA.