

# 2007 Monitoring Summary



## Valley Creek upstream of 18th Avenue Bridge (Jefferson County) (33.42002/-86.96305)

### BACKGROUND

Valley Creek, from 19th Street North (Bessemer) to Opossum Creek, was added to Alabama's Clean Water Act (CWA) §303(d) list of impaired waters in 2004 for only partially meeting its *Limited Warmwater Fishery (LWF)* use classification. It was listed due to mercury concerns from an unknown source. In 2010 it was determined atmospheric deposition was the cause of the increased mercury levels.

Valley Creek at VC-5 is one of a network of 94 ambient sites monitored annually by the Alabama Department of Environmental Management (ADEM) to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDL) and water quality criteria.

Valley Creek was also selected for biological and water quality monitoring as part of the 2007 Assessment of the Black Warrior and Cahaba River Basins (BWC). The objectives of the BWC Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the BWC basin group.



Figure 1. Valley Creek at VC-5.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. From its confluence with Blue Creek to its source, Valley Creek is classified as a *Limited Warmwater Fishery (LWF)*. Valley Creek at VC-5 is located within this reach and drains a large portion of the west Birmingham metropolitan area. The population density is relatively high, and according to 2000 National Land Cover Dataset, landuse within the watershed is primarily development (90%). As of February 23, 2011, ADEM has issued a total of 205 NPDES permits in this watershed.

### REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Valley Creek at VC-5 is characterized by a mostly open canopy and a mixture of gravel, cobble, boulder and sand substrates (Figure 1; Table 2). Overall habitat quality was categorized as *sub-optimal* for supporting macroinvertebrate communities.

Table 1. Summary of watershed characteristics.

| Watershed Characteristics             |                               |                     |
|---------------------------------------|-------------------------------|---------------------|
| <b>Basin</b>                          |                               | Black Warrior River |
| <b>Drainage Area (mi<sup>2</sup>)</b> |                               | 35                  |
| <b>Ecoregion<sup>a</sup></b>          |                               | 67f                 |
| <b>% Landuse</b>                      |                               |                     |
| Open water                            |                               | <1                  |
| Wetland                               | Woody                         | <1                  |
| Forest                                | Deciduous                     | 7                   |
|                                       | Evergreen                     | 1                   |
|                                       | Mixed                         | 1                   |
| Shrub/scrub                           |                               | 1                   |
| Grassland/herbaceous                  |                               | <1                  |
| Pasture/hay                           |                               | 1                   |
| Cultivated crops                      |                               | <1                  |
| Development                           | Open space                    | 22                  |
|                                       | Low intensity                 | 44                  |
|                                       | Moderate intensity            | 15                  |
|                                       | High intensity                | 9                   |
| <b>Population/km<sup>2b</sup></b>     |                               | 1260                |
| <b># NPDES Permits<sup>c</sup></b>    | <b>TOTAL</b>                  | 205                 |
|                                       | Construction Stormwater       | 125                 |
|                                       | Mining                        | 1                   |
|                                       | Industrial General            | 51                  |
|                                       | Industrial Individual         | 8                   |
|                                       | Municipal Individual          | 15                  |
|                                       | Underground Injection Control | 5                   |

a. Southern Limestone/Dolomite Valleys and Low Rolling Hills

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011.

Table 2. Physical characteristics of Valley Creek at VC-5, June 12, 2007.

| Physical Characteristics |                |             |
|--------------------------|----------------|-------------|
| <b>Width (ft)</b>        |                | 45          |
| <b>Canopy cover</b>      |                | Mostly Open |
| <b>Depth (ft)</b>        | Riffle         | 0.8         |
|                          | Run            | 1           |
|                          | Pool           | 2           |
| <b>% of Reach</b>        | Riffle         | 5           |
|                          | Run            | 85          |
|                          | Pool           | 10          |
| <b>% Substrate</b>       | Bedrock        | 3           |
|                          | Boulder        | 15          |
|                          | Clay           | 1           |
|                          | Cobble         | 25          |
|                          | Gravel         | 31          |
|                          | Sand           | 15          |
|                          | Silt           | 7           |
|                          | Organic Matter | 3           |

**Table 3.** Results of the habitat assessment conducted in Valley Creek at VC-5, June 12, 2007.

| Habitat Assessment              | % Maximum Score | Rating                     |
|---------------------------------|-----------------|----------------------------|
| Instream Habitat Quality        | 68              | Sub-optimal (59-70)        |
| Sediment Deposition             | 57              | Marginal (41-58)           |
| Sinuosity                       | 70              | Sub-optimal (65-84)        |
| Bank and Vegetative Stability   | 64              | Sub-optimal (60-74)        |
| Riparian Buffer                 | 56              | Marginal (50-69)           |
| <b>Habitat Assessment Score</b> | <b>151</b>      |                            |
| <b>% Maximum score</b>          | <b>63</b>       | <b>Sub-optimal (59-70)</b> |

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Valley Creek at VC-5, June 12, 2007.

| Macroinvertebrate Assessment Results  |            |                |                           |
|---------------------------------------|------------|----------------|---------------------------|
|                                       | Results    | Scores (0-100) | Rating                    |
| <b>Taxa richness measures</b>         |            |                |                           |
| # Ephemeroptera (mayfly) genera       | 5          | 42             | Poor (23-46)              |
| # Plecoptera (stonefly) genera        | 0          | 0              | Very Poor (<=15)          |
| # Trichoptera (caddisfly) genera      | 4          | 33             | Poor (22-44)              |
| <b>Taxonomic composition measures</b> |            |                |                           |
| % Non-insect taxa                     | 27         | 0              | Very Poor (<24.7)         |
| % Non-insect organisms                | 49         | 0              | Very Poor (<31.3)         |
| % Plecoptera                          | 0          | 0              | Very Poor (<6.5)          |
| <b>Tolerance measures</b>             |            |                |                           |
| Beck's community tolerance index      | 3          | 11             | Very Poor (<20.2)         |
| <b>WMB-I Assessment Score</b>         | <b>---</b> | <b>12</b>      | <b>Very Poor (&lt;23)</b> |

## BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community in Valley Creek at VC-5 to be in *very poor* condition due to low numbers of pollution intolerant organisms and high numbers of pollution tolerant organisms (Table 4).

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected in June, August and October of 2007 to help identify any stressors to the biological communities. Mercury and arsenic exceeded criteria applicable to this segment's *LWF* use classification. The median temperature and median concentration of total dissolved solids, specific conductance, hardness, alkalinity, nitrate + nitrite nitrogen, dissolved reactive phosphorus, chlorides, and fecal coliform were higher than expected when compared to verified data of reference reaches in the same ecoregion.

## SUMMARY

As part of the Assessment Process, ADEM will review the monitoring information presented in this report, along with all other available data.

A 0.9 mile segment of Valley Creek was placed on the CWA §303(d) list of impaired waters in 2004 for only partially meeting its *LWF* use classification due to mercury levels from atmospheric deposition. Habitat assessment results indicated the habitat to be in *sub-optimal* condition. Water quality results indicated elevated levels of arsenic, mercury, total dissolved solids, specific conductance, hardness, and alkalinity, which are potential causes of the *very poor* macroinvertebrate community condition. These results indicate the need for further monitoring to be conducted to identify the cause and sources.

**Table 5.** Summary of water quality data collected in June, August and October, 2007. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

| Parameter                                | N | Min     | Max   | Med                | Avg                 | SD    | E |
|--|---|---------|-------|--------------------|---------------------|-------|---|
| <b>Physical</b>                          |   |         |       |                    |                     |       |   |
| Temperature (°C)                         | 3 | 19.8    | 28.6  | 26.8 <sup>M</sup>  | 25.0                | 4.7   |   |
| Turbidity (NTU)                          | 3 | 2.1     | 2.8   | 2.5                | 2.5                 | 0.3   |   |
| Total Dissolved Solids (mg/L)            | 3 | 238.0   | 291.0 | 250.0 <sup>M</sup> | 259.7               | 27.8  |   |
| Total Suspended Solids (mg/L)            | 3 | < 1.0   | 3.0   | 2.0                | 1.8                 | 1.3   |   |
| Specific Conductance (µmhos)             | 3 | 344.0   | 411.0 | 373.0 <sup>G</sup> | 376.0               | 33.6  |   |
| Hardness (mg/L)                          | 3 | 173.0   | 181.0 | 177.0 <sup>G</sup> | 177.0               | 4.0   |   |
| Alkalinity (mg/L)                        | 3 | 140.5   | 151.0 | 145.0 <sup>M</sup> | 145.5               | 5.3   |   |
| Stream Flow (cfs)                        | 3 | 13.1    | 20.0  | 17.5               | 16.9                | 3.5   |   |
| <b>Chemical</b>                          |   |         |       |                    |                     |       |   |
| Dissolved Oxygen (mg/L)                  | 3 | 6.4     | 8.7   | 7.3                | 7.5                 | 1.2   |   |
| pH (su)                                  | 3 | 7.8     | 8.0   | 7.8                | 7.9                 | 0.1   |   |
| Ammonia Nitrogen (mg/L)                  | 3 | < 0.015 | 0.015 | 0.008              | 0.008               | 0.000 |   |
| Nitrate+Nitrite Nitrogen (mg/L)          | 3 | 0.416   | 0.531 | 0.423 <sup>M</sup> | 0.457               | 0.064 |   |
| Total Kjeldahl Nitrogen (mg/L)           | 3 | < 0.150 | 0.375 | 0.075              | 0.175               | 0.173 |   |
| Total Nitrogen (mg/L)                    | 3 | < 0.498 | 0.791 | 0.606              | 0.632               | 0.148 |   |
| Dissolved Reactive Phosphorus (mg/L)     | 3 | 0.017   | 0.028 | 0.026 <sup>M</sup> | 0.024               | 0.006 |   |
| Total Phosphorus (mg/L)                  | 3 | 0.018   | 0.053 | 0.044              | 0.038               | 0.018 |   |
| CBOD-5 (mg/L)                            | 3 | < 1.0   | 1.4   | 0.5                | 0.8                 | 0.5   |   |
| Chlorides (mg/L)                         | 3 | 8.1     | 11.0  | 10.3 <sup>M</sup>  | 9.8                 | 1.5   |   |
| <b>Total Metals</b>                      |   |         |       |                    |                     |       |   |
| Aluminum (mg/L)                          | 1 |         |       | <                  | 0.060               |       |   |
| Iron (mg/L)                              | 1 |         |       |                    | 0.083               |       |   |
| Manganese (mg/L)                         | 1 |         |       | <                  | 0.002               |       |   |
| <b>Dissolved Metals</b>                  |   |         |       |                    |                     |       |   |
| Aluminum (mg/L)                          | 1 |         |       | <                  | 0.050               |       |   |
| Antimony (µg/L)                          | 1 |         |       | <                  | 10.0                |       |   |
| Arsenic (µg/L)                           | 1 |         |       |                    | 1.7 <sup>H</sup>    |       | 1 |
| Cadmium (mg/L)                           | 1 |         |       | <                  | 0.015               |       |   |
| Chromium (mg/L)                          | 1 |         |       | <                  | 0.050               |       |   |
| Copper (mg/L)                            | 1 |         |       | <                  | 0.050               |       |   |
| Iron (mg/L)                              | 1 |         |       | <                  | 0.050               |       |   |
| Lead (µg/L)                              | 1 |         |       | <                  | 0.5                 |       |   |
| Manganese (mg/L)                         | 1 |         |       | <                  | 0.020               |       |   |
| Mercury (µg/L)                           | 1 |         |       |                    | 0.057 <sup>AH</sup> |       | 1 |
| Nickel (mg/L)                            | 1 |         |       | <                  | 0.050               |       |   |
| Selenium (µg/L)                          | 1 |         |       | <                  | 0.3                 |       |   |
| Silver (mg/L)                            | 1 |         |       | <                  | 0.005               |       |   |
| Thallium (µg/L)                          | 1 |         |       | <                  | 0.7                 |       |   |
| Zinc (mg/L)                              | 1 |         |       | <                  | 0.050               |       |   |
| <b>Biological</b>                        |   |         |       |                    |                     |       |   |
| Chlorophyll a (µg/L)                     | 3 | 1.00    | 1.00  | 0.50               | 0.50                | 0.00  |   |
| <sup>J</sup> Fecal Coliform (col/100 mL) | 3 | 40      | 168   | 152 <sup>M</sup>   | 120                 | 70    |   |

<sup>J</sup>=estimate; N= # samples; M=value>90% of all verified ecoregional reference reach data collected in the ecoregion 67f; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 67f; A=aquatic life user criterion exceeded; H=human health criterion exceeded.

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