Results/Discussion

To assess water quality, macroinvertebrate, and habitat conditions, SRBC sampled a total of 101 sites in the Juniata River Subbasin in 2010. The results of the 101 sites are depicted in Figures 4-6.

Ninety-six of those sites included a benthic macroinvertebrate collection. Twenty-nine sites (29 percent) had nonimpaired macroinvertebrate communities, 37 sites (36 percent) had slightly impaired communities, 29 sites (29 percent) had moderately impaired communities, and only one site had a severely impaired community (Figure 4).

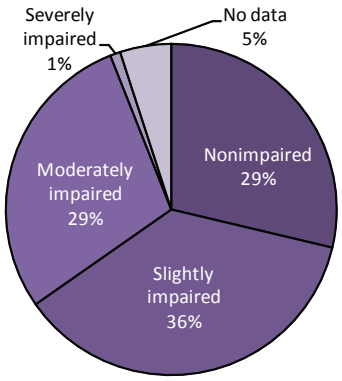

Figure 4. 2010 Biological Condition Categories for 101 Juniata Subbasin Sites

A total of 99 sites were evaluated for habitat conditions, which on the whole were rated highly. Fifty-eight sites (57 percent) had excellent habitat, 39 sites (39 percent) had supporting habitat, and two sites (2 percent) had partially supporting habitat (Figure 5).

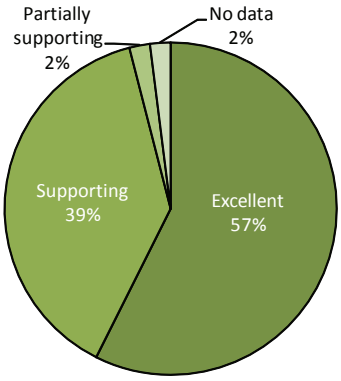

Figure 5. 2010 Habitat Condition Categories for 101 Juniata Subbasin Sites

Water chemistry was evaluated at all 101 sites. Thirty sites (30 percent) did not exceed any water quality levels of concern and received a higher water quality designation. A total of 71 sites (70 percent) had at least one parameter exceed levels of concern, with 66 sites (65 percent) receiving a middle water quality designation and five sites (5 percent) receiving a lower water quality designation (Figure 6). Fifty-three sites (52 percent) had at least two parameters exceed levels of concern, and 12 sites (12 percent) had four or more parameters exceed levels of concern.

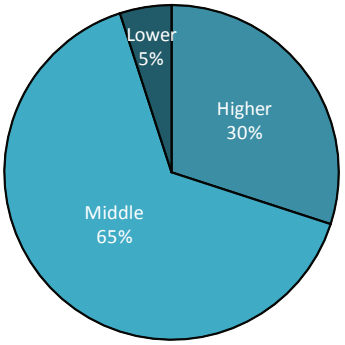

Figure 6. 2010 Water Quality Condition Categories for 101 Juniata Subbasin Sites

Eleven sites (11 percent) had the ideal combination of nonimpaired macroinvertebrate communities, excellent habitat, and higher water quality designations. An additional eighteen sites (19 percent) had nonimpaired communities and either higher or middle water quality designations.

The most widespread parameters of concern within the subbasin were total nitrogen and nitrate, at 56 percent and 47 percent of sites, respectively. The values set for total nitrogen and nitrate (1.0 mg/l) are based on natural background concentrations, which means values higher than 1.0 mg/l indicate the potential presence of nitrogen sources such as agriculture in the watershed. This level is not based on aquatic life tolerances or levels of concern, as standards have not yet been developed for nutrients in Pennsylvania. The highest levels of nitrate and total nitrogen were 11.9 mg/l and 12.27 mg/l, respectively, both of which occurred on Yellow Creek in Woodbury (YELL 12.0).

"The most widespread parameters of concern within the subbasin were total nitrogen and nitrate."

Orthophosphate and total phosphorus exceeded background concentrations at 16 percent and 10 percent of sites, respectively. The Frankstown Branch Juniata River near Hollidaysburg (FRNK 32.5) had the highest levels of both orthophosphate (0.355 mg/l) and total phosphorus (0.418 mg/l). High phosphorus levels can be indicators of wastewater and septic systems, detergents, chemical fertilizers, animal waste, some industrial discharges, and soil erosion.

Other parameters that exceeded levels of concern at multiple sites included alkalinity (11 percent of sites), sodium (7 percent), and aluminum (5 percent).

Section 303(d) of the Clean Water Act requires a Total Maximum Daily Load (TMDL) to be developed for any waterbody designated as impaired or not meeting the state water quality standards or its designated use. Streams in Pennsylvania are being assessed as part of the State Surface Waters Assessment Program, and if they are found to be impaired, a TMDL is calculated for the watershed (PADEP, 2010). Some of the watersheds in the Juniata River Subbasin have been rated impaired, and subsequently will require a TMDL. Since the Subbasin report in 2005, six TMDLs have been established for streams that are part of the Year-1 study. TMDLs were established for Sixmile Run (SIXM 0.3) and Burgoon Run (BURG 0.5) for abandoned mine drainage (AMD) and for Beaverdam Branch (BVDB 0.1 and 5.0) and Frankstown Branch (FRNK 32.5) for AMD, combined sewer overflow, and urban runoff. TMDLs were also established for Yellow Creek (YELL 9.1 and 12.0) for siltation and nutrients and Little Juniata River (LJUN 29.6) for municipal point source and urban runoff.

Major sources of impairment within the Juniata River Subbasin include agriculture (general, crop-related, grazing-related, and animal feeding-related), AMD, combined sewer overflows, urban runoff, small residential runoff, industrial point source, municipal point source, road runoff, and construction activities. Pollutants from these sources are listed as mercury, siltation, nutrients, organic enrichment, low dissolved oxygen, metals, low pH, nonpriority organics, priority organics, suspended solids, PCBs, and thermal modifications.

Confluence of Plum and Halter creeks, near Roaring Spring, Blair County, Pa.

Frankstown Branch & Raystown Branch of the Juniata River

Frankstown Branch Juniata River

Site conditions for the Frankstown Branch and Raystown Branch of the Juniata River are depicted in Figure 7. The Frankstown Branch drains the urban area of Altoona, Pa., some AML, agricultural lands, and forested areas with sections of state game lands. Of the 11 sites in the Frankstown Branch, nine sites (82 percent) had parameters above levels of concern. Nitrogen and phosphorus were the most common parameters to exceed background levels in the Frankstown Branch at 73 percent and 55 percent, respectively.

Two of the 11 sites had higher water quality (BLRG 2.5 (Blair Gap Run) and BVDB 0.1 (Beaverdam Branch)), and three sites had lower quality. Two of these three lower water quality sites (FRNK 32.5 and 38.1) had elevated nitrate, total nitrogen, orthophosphorus, phosphorus, and sodium levels, but the one benthic macroinvertebrate sample that was taken indicated only slight impairment. The third lower water quality site (BURG 0.5) experienced the highest levels of magnesium, acidity, and metals, as well as the lowest values of alkalinity and pH, and had the only severely impaired benthic community in the entire Juniata River Subbasin. This site is heavily impacted from AMD and the substrate of the stream is covered in iron precipitate.

Only one site within the Frankstown Branch had a nonimpaired benthic community (FRNK 1.6), which also had middle water quality influenced by elevated nutrients and sodium. Four sites were slightly impaired, and four sites were moderately impaired. The moderately impaired sites largely correlated with middle water quality resulting from higher nitrate, nitrogen, orthophosphate, and phosphate levels. Both FRNK 18.9 and BVDB 5.0 had elevated sodium, while BVDB 5.0 also had higher aluminum and magnesium levels. Both BVDB 5.0 and BURG 0.5 receive AMD and display iron precipitate on the substrate. The moderately impaired community at BVDB 0.1 is not as easily explained as it had higher water quality and supporting habitat, and further investigation would be required.

As previously mentioned, the Frankstown Branch Juniata River near Hollidaysburg (FRNK 32.5) had the highest levels of both orthophosphate (0.355 mg/l) and total phosphorus (0.418 mg/l). There are numerous sewage treatment plants and other industrial discharges that may account for this.

"Of the 11 sites in the Frankstown Branch, nine sites (82 percent) had parameters above levels of concern."

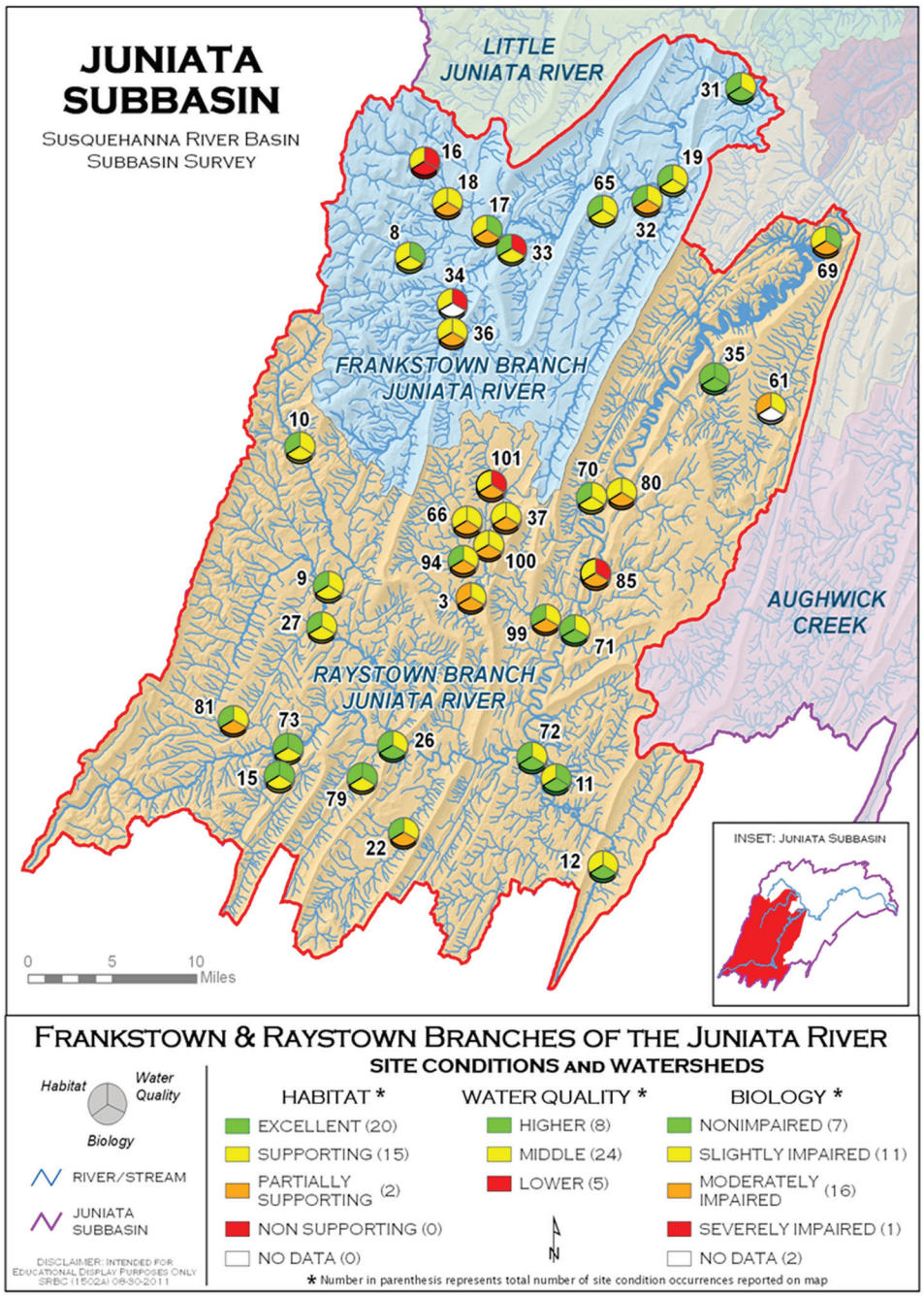

Figure 7. Frankstown and Raystown Site Conditions and Watersheds

Raystown Branch near Breezewood, Bedford County, Pa.

Raystown Branch Juniata River

The Raystown Branch Juniata River drains the area west of Bedford to near Huntington, Pa., the lower section of which is dammed for approximately 28 miles, forming Raystown Lake. The land use in the Raystown Branch Subwatershed is similar to that of the Frankstown Branch, but less urbanized. The most agricultural area within this watershed is Yellow Creek, located in the Morrison Cove area.

A total of 26 sites were located throughout the Raystown Branch Watershed. Seventy-seven percent of those sites had water quality parameters above the levels of concern. The vast majority of these parameters included nitrate and nitrogen (58 percent of all sites), indicating the presence of agricultural land use, as well as typical AMD indicators such as excessive hardness and metals and depressed pH and alkalinity. Total aluminum was problematic at 12 percent of sites.

Two of the seven ecoregion-specific reference sites (GTRC 2.9 and RAYS 54.1) are located within the Raystown Branch Watershed. Both of these sites had nonimpaired benthic macroinvertebrate communities and excellent habitat, but GTRC 2.9 had higher water quality while RAYS 54.1 had middle water quality. Six sites had nonimpaired benthic communities.

Six sites had higher water quality: BRUS 0.1 (Brush Creek), BUFR 0.4 (Buffalo Run), GTRC 2.9 (Great Trough Creek), RAYS 4.6 and 103 (Raystown Branch), and SHOB 0.4 (Shobers Run). The vast majority of sites had middle water quality. Two sites had lower water quality and moderately impaired benthic communities. One of these sites is SIXM 0.3 on Sixmile Run, which is affected by AMD. The other site, YELL 12.0, suffered from lower water quality stemming from the highest levels of nitrate, nitrogen, hardness, and magnesium levels seen in the entire study. Most sites within the Yellow Creek Watershed (including BEAV 0.1 (Beaver Creek), HKBC 0.1 (Hickory Bottom Creek), PTRC 0.1 (Potter Creek), TSPR 0.1 (Three Springs Run), and YELL 3.5 and 9.1 (Yellow Creek)) had moderately impaired benthic communities, middle water quality, and moderately higher levels of nitrate and nitrogen, indicating surrounding agricultural land use.

Based on water quality results, AMD appears to be affecting three streams in addition to Sixmile Run—Cove Creek (COVE 7.7), Shawnee Branch (SHWN 4.2), and Shoups Run (SHUP 0.1)—resulting in moderately impaired benthic communities and middle water quality. Raystown Branch at RAYS 4.6 also had a moderately impaired benthic community, but had higher water quality and supporting habitat.

Upper Juniata River

Site conditions for the Upper Juniata River section are illustrated in Figure 8. The Upper Juniata River section includes Little Juniata River, Shavers Creek, Crooked Creek, Standing Stone Creek, Mill Creek, and Aughwick Creek Watersheds. A total of 30 sites were located within this section. Sixty percent of those sites had water quality parameters above levels of concern. Forty percent of sites had elevated levels of nitrate and nitrogen, with 13 percent having elevated orthophosphate or phosphorus levels. Twelve of the sites had higher water quality, with the vast majority of the sites (18) having middle water quality.

The Upper Juniata River section contains four of the seven ecoregion-specific reference sites: BIGF 1.0 (Big Fill Run), NBLA 1.4 (North Branch Little Aughwick Creek), and STST 1.0 and 26.8 (Standing Stone Creek). These sites have nonimpaired benthic communities and either higher or middle water quality.

Twelve sites had slightly impaired benthic communities, while six sites had moderately impaired benthic communities. Five of these six moderately impaired sites occur in the Little Juniata River Watershed, with two sites, SINK 0.3 (Sinking Run) and SPRU 10.6 (Spruce Creek), draining agricultural lands and having nitrogen and nitrate issues. Two more moderately impaired sites were on the Little Juniata River itself (LJUN 19.4 and 29.6) and had orthophosphorus, phosphorus, and sodium issues in addition to elevated nitrogen and nitrate. These two sites, as well as LJUN 15.0 (no biological sample taken), drain urban centers Altoona, Bellwood, and Tyrone. The fifth site, SBEC 1.4 (South Bald Eagle Creek), had higher water quality, despite draining the town of Tyrone. The sixth moderately impaired site was located in the upstream reaches of South Branch Little Aughwick Creek (SBLA 8.3) and had issues with low alkalinity. All six moderately impaired sites had either excellent or supporting habitat quality.

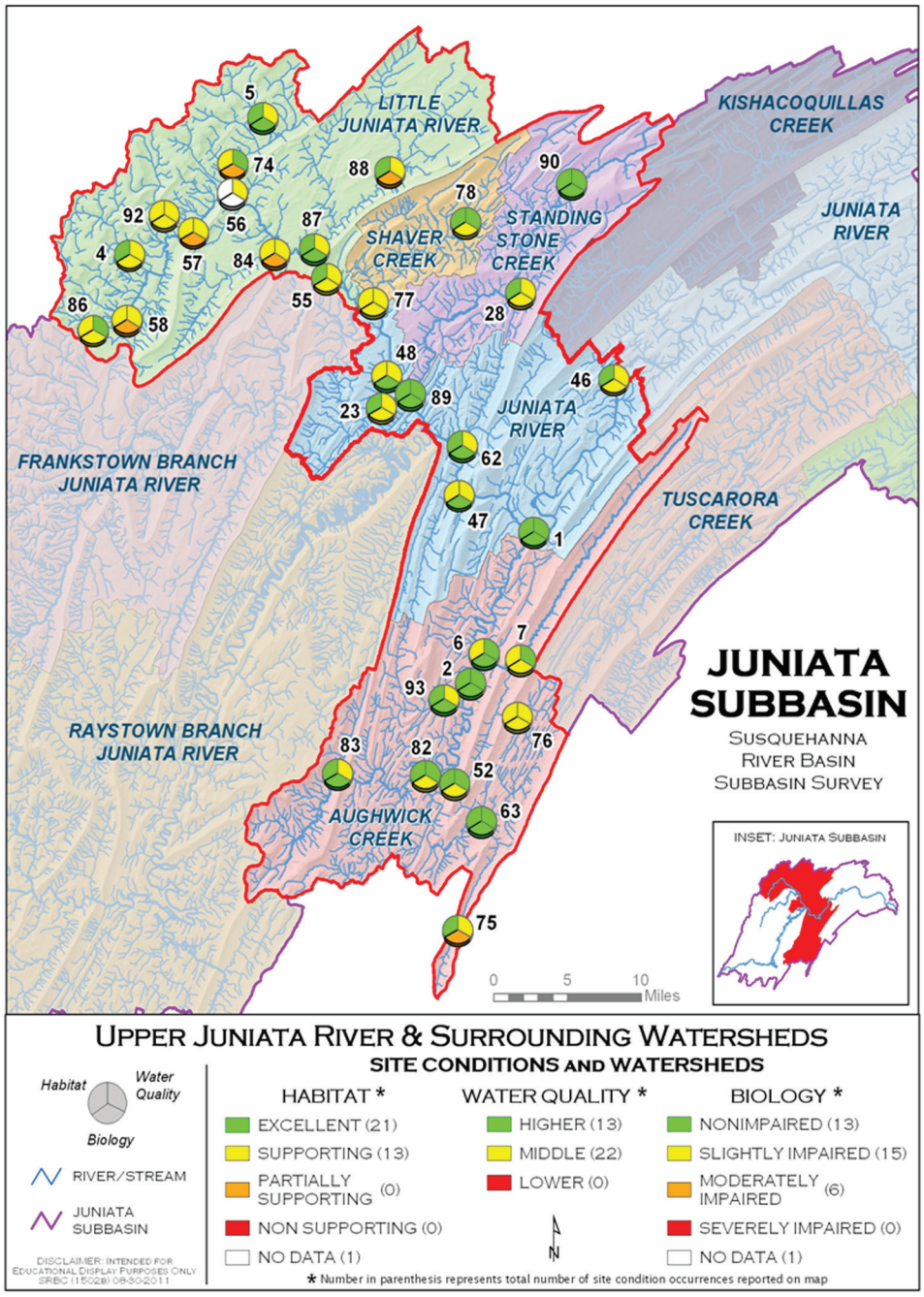

Figure 8. Upper Juniata Site Conditions and Watersheds

Crooked Creek in Huntingdon, Huntingdon County, Pa. — Upper Juniata River Subbasin.

Lower Juniata River

Site conditions for the Lower Juniata River section are shown in Figure 9. The Lower Juniata River section consists of Kishacoquillas Creek, Jacks Creek, Lost Creek, Doe Run, Tuscarora Creek, Delaware Creek, Raccoon Creek, Cocolamus Creek, Buffalo Creek, and Little Buffalo Creek. A total of 27 sites were evaluated within this section. Seventy-four percent of these sites had parameters above levels of concern. Seventy percent of the sites had elevated levels of nitrogen and/or nitrate. Eleven percent had orthophosphate and/or phosphorus above background levels. Seven percent had issues with total suspended solids.

The Lower Juniata River section contains one ecoregion-reference site, ELKC 9.8 (East Licking Creek), which had higher water quality and a nonimpaired benthic community. A total of seven sites had higher water quality, with three of those sites also having nonimpaired communities. The 20 remaining sites had middle water quality. Most of the sites had slightly impaired benthic communities, but eight sites had nonimpaired communities, including BUFF 0.4 and 14.6 (Buffalo Creek), DELA 0.2 (Delaware Creek), ELKC 9.8, HONY 0.2 (Honey Creek), JACK 2.9 (Jacks Creek), and TUSC 0.6 and 22.5 (Tuscarora Creek).

Six sites had moderately impaired benthic communities, and all had middle water quality. Both TEAC 0.1 (Tea Creek) and JACK 11.7 (Jacks Creek) have nitrate and/or nitrogen problems. These watersheds drain croplands, pasture, and varying degrees of urbanization. In addition to nitrate and/or nitrogen, both LBUF 2.1 (Little Buffalo Creek) and DOER 0.3 (Doe Run) also have elevated levels of total suspended solids and aluminum. Their drainage areas include roads, crops, pastures, and industrialized and urbanized areas. Sites KISH 0.4 and 15.6 (Kishacoquillas Creek) are in the urbanized areas of Burnham, Highland Park, Lewistown, and part of Belleville and experience issues with elevated nitrogen/nitrate, total suspended solids (TSS), and orthophosphate. All sites had either excellent or supporting habitat.

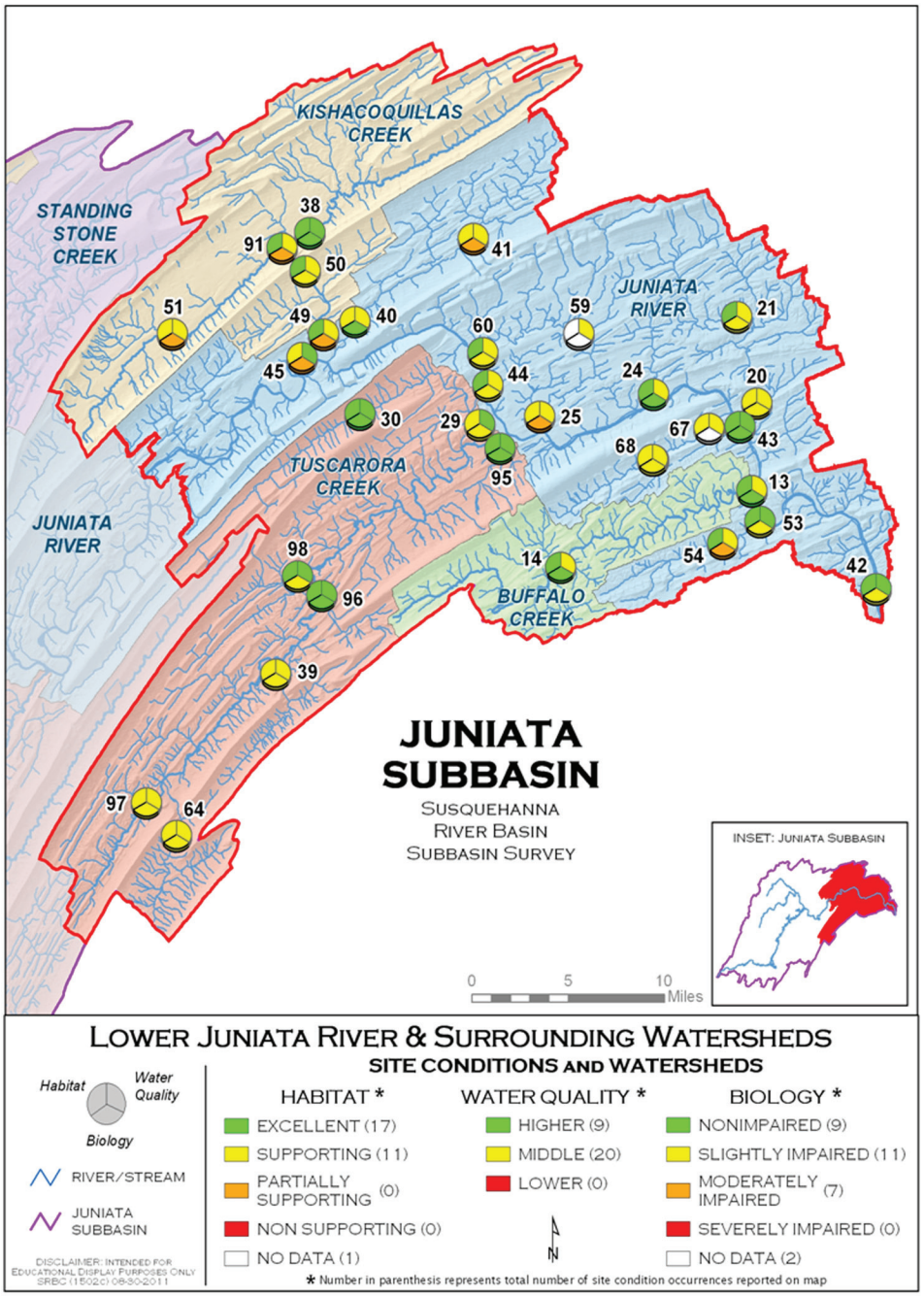

Figure 9. Lower Juniata Site Conditions and Watersheds

Kishacoquillas Creek, near Belleville, Mifflin County, Pa. — Lower Juniata River Subbasin.