

# SUMMARY OF DUCK CREEK WATERSHED ASSESSMENT IONIA, MICHIGAN

BY: MELANIE HAVEMAN, STUDENT ASSISTANT  
AND JANICE TOMPKINS, SENIOR WATER QUALITY ANALYST  
FIELD OPERATION SECTION  
WATER DIVISION

## INTRODUCTION

The Duck Creek watershed is located in the southwestern portion of Ionia County and southeastern Kent County.

**DESCRIPTION:** It originates in the agricultural fields east of Clarksville and north of Lake Odessa. Duck Creek flows southwest to its convergence with the Coldwater River (part of the Thornapple River Watershed) in the southeastern portion of Bowne Township, Kent County just northwest of Freeport. The majority of the watershed drains a predominantly agricultural area with low density residential use. Department of Environmental Quality (DEQ) field staff surveyed road/stream crossings within the watershed to quickly assess the health of the watershed. The survey combined both qualitative and quantitative assessment of Duck Creek and its tributaries and provided a basis upon which to identify any potential sources of non point source pollution negatively affecting the watershed. In total, 17 road/stream crossing locations were surveyed during the assessment of the Duck Creek Watershed. Refer to Attachment A, Road Stream Crossings Inventory for a summary of the survey locations conducted during September of 2004, as well as survey location maps. Site identification codes were developed using four letter identifiers for the subwatershed followed by the two digit site location number. Sites were numbered successively from the headwaters to the mouth.

## METHODS

The DEQ's stream crossing watershed survey procedure was developed as a quick screening tool to assess general water quality and possible pollutant sources, causes and problems within the watershed. The survey procedure provides standardized visual assessments that can be conducted by DEQ staff or trained volunteers. Only observations that can be made from the road stream crossings are recorded; recording "educated guesses" or suspicions is prohibited. Because this assessment is based on visual observations, designed to be conducted quickly and by many different types of people and knowledge backgrounds, the survey results are only qualitative in nature.

A minimum of 30% of the road stream crossings within a watershed are to be surveyed with attention given to balanced geographical coverage and assessment across major land use changes and possible pollutant sources. Surveys are always conducted in one general direction (either upstream to downstream OR downstream to upstream), and the attempt is made to keep the surveyors and weather conditions consistent to limit bias and subjectivity between surveyors. This survey was conducted from the upstream to downstream direction and was completed in one day by two DEQ field staff. The right and left bank designations are always assigned based on looking downstream at each road stream crossing location.

**At each survey location the following stream conditions are visually assessed:**

- Weather and any event conditions
- Culvert/bridge conditions
- Channel conditions (width, depth, high water mark, riffles, pools, natural, maintained, recovering)
- Stream appearance (color, turbidity, algae, aquatic plants, trash, oil sheen, bacteria, foam)
- Substrate composition (boulder, gravel, silt, sand, unknown)
- In-stream Cover (undercut banks, overhanging vegetation, woody debris, pools, boulders, plants)
- Stream corridor (riparian vegetation type and width, bank erosion, canopy cover, adjacent land use)
- Potential Pollutant Sources (source and pathway identification)

**At each survey location the following stream conditions are directly measured:**

- Water temperature
- Dissolved oxygen content
- pH
- flow velocity
- latitude and longitude coordinates (GPS)

In addition each site was photo-documented with a digital picture taken in the downstream direction, upstream direction and of the road crossing. Refer to the DEQ's *Stream Crossing Watershed Survey Procedure* for further information and a complete description of the above conditions.

**OBSERVATIONS**

**Water Temperature, pH, and Dissolved Oxygen**

Survey locations were assessed in the order of upstream sites (in the headwaters) to downstream sites (towards the mouth). 17 locations, including 12 along the main stem of Duck Creek, were measured for temperature and pH. pH values ranged from 7.31 to 8.38, which were not outside of the normal range for streams within Michigan. Overall the average temperature was 64.1°F, with most stations between 60°F and 65° F. One location, at Elm Road north of Bippley Road, was 72°F, which was the highest recorded temperature. This comparatively high reading was due to unknown sources. Normal stream temperatures capable of supporting a coldwater fishery with few diseases are below 57°F. Walleye, northern pike and some trout are adapted to temperatures between 57° to 68°F while temperatures over 68°F are characteristic of fish communities characterized by bass, crappie, bluegill, carp and sucker with occurrence of fish disease high. While temperatures recorded here seem low it is important to note that this survey was not conducted during the hottest summer months when temperature becomes a limiting factor to some species. Temperatures will appear cool because the survey was conducted during the early fall. The average dissolved oxygen content is 8.68 ppm; it varies from 17.82 ppm at station DUCK-10 (which is an abnormally high DO measure and is suspect) to a measurement of 3.85 ppm in a low flowing tributary with agricultural ditch features. Most of the sites along the main stem have a DO between 6 and 10 ppm. The dissolved oxygen requirement for native bass and crappie growth and well-being is 5

ppm and for trout it is at least 6 ppm. Given the dissolved oxygen content moderate flow of the main stem, Duck Creek could be a comfortable environment for abundant aquatic life. Refer to Figure 1 in Attachment B, which depicts the temperature, pH, and DO levels at all main stem locations surveyed.

### **Substrate**

Substrate was observed and quantified for both the upstream and downstream stretch at each survey location. In all, 34 substrate observations were recorded at 17 locations. Substrate type is important when considering habitat suitability for desired species within the system (i.e. trout and other fish species). Cobble and gravel substrates with a low degree of embeddedness are the most suitable for reproduction in many fish species and are important for macro invertebrates as well. Evidence of silt and sand dominated substrate could indicate problems within the watershed such as erosion and sedimentation. Among the survey locations within the Duck Creek Watershed approximately 41% were dominated (50 to 100% covered) by sand and 16 % were dominated silt, detritus or muck. 20% of the observations were unable to be categorized due to turbidity or other factors, and in a few sites the substrate was equally distributed. No sites observed appeared to be dominated by cobble or gravel however 47% of the sites had some amount of gravel present although it was always less than 50%. Refer to Figure 2 for substrate data for each of the main stem Duck Creek sites.

### **In-Stream Cover**

The presence of in-stream cover was assessed at each location for both the upstream and downstream stretches. In-stream cover, such as overhanging vegetation, undercut banks, deep pools, boulders, plant cover and large woody debris provide habitat for macro invertebrates and aquatic organisms such as amphibians and fish. Of the 34 observations made, 100% of the sites had overhanging vegetation, and 41% of the sites had boulders. Deep pools, woody debris, and undercut banks were each found in approximately 38%, 35%, and 6% of the sites respectively. No aquatic plant cover was observed at these sites. Refer to Table 1, in Attachment B for a summary of the in-stream cover observations made at each survey location.

### **Physical Appearance**

The physical appearance of the stream at each survey location was assessed based on the presence or absence of aquatic plants, floating algae, filamentous algae, bacterial slimes, turbidity, oil sheen, foam and/or trash. In all, 34 sites were assessed for physical appearance; observations were recorded and rated as either present or abundant. No oil sheens or bacterial slimes were observed at any of the sites. In general trash, foam, floating algae were the least common. 41% of the sites exhibited turbidity. Approximately 32% of the sites exhibited aquatic plants (including duckweed), and 32% had filamentous algae. Refer to Table 2, in Attachment B for a summary of the physical appearance observations made for each survey location.

## **Stream Corridor**

The width of riparian vegetation was assessed at each survey location for the both the right and left banks of the upstream and downstream stretches. The presence of riparian vegetation reduces the amount of surface water runoff to streams, provides a filter strip for nutrients within runoff waters, provides overhanging vegetation for stream habitat, provides a source of woody debris, stabilizes stream banks against erosion and determines the availability of sufficient stream canopy cover for temperature regulation. 17 survey locations were assessed, resulting in 68 observations of riparian vegetation width recorded. Most of the observations fell almost evenly into the three width categories: 38% had less than 10 feet, 27% had between 10 and 30 feet and 30% had over 100 feet of riparian vegetation. The riparian width class of 30 to 100 feet was the least common and was observed at only 5% of the sites.

The streamside land cover, estimated bank erosion and percent stream canopy were evaluated at each of the 17 survey locations for both the upstream and downstream stretches. In all, 34 observations were made for each of the above listed characteristics. Of the survey observations, 62% were recorded as having streamside land cover predominantly grasses, 15% predominantly shrubs, 18% dominated by trees. Two sites were not identified. In general, vegetation such as grasses and shrubs and residential and agricultural land uses, are associated with narrow riparian widths. More extensive riparian vegetation is usually associated with forests and old fields. Overall erosion of the banks was not a major problem in the Duck Creek Watershed with approximately 97% of the sites described as having no or low bank erosion. Refer to Table 3, in Attachment B for the distribution of riparian width and vegetation observations made for both the right and left bank at each survey location.

Stream canopy cover is important for providing shade and maintaining cool temperatures within the stream. Cooler temperatures also helps keep dissolved oxygen levels from depleting, an important habitat requirement for many fish species and other aquatic organisms. Of the 34 upstream and downstream observations assessed, 65% had less than 25% cover, 26% had between 25 and 50% cover and only 9% had over 50% cover, which coincides with the agricultural landscape of the watershed.

## **Adjacent Land Uses**

Adjacent land uses were recorded at each survey location for both the upstream and downstream stretches as well as both the right and left banks. Because the entire section of stream that can be seen from the road crossing is evaluated, multiple land uses can be recorded for each site. Land uses within the watershed play an important role in nutrient input, erosion, and in-stream conditions that affect water quality, quantity and habitat. The most common adjacent land uses was crop land. Forest, shrub/old field, and maintained lawn also appeared at many of the sites. There were also a few observations for pasture, impervious surfaces, and disturbed ground. Refer to Attachment B, Table 4 and Figure 3 for a summary of all the adjacent land uses recorded within the watershed.

## **Potential pathways of non-point source pollution**

During the completion of the road stream crossing surveys, field staff also evaluated the *potential* for non point source pollution. This assessment focuses on the severity of potential pollutant *inputs*, not pollutant *impacts*. As part of this evaluation process field staff look for 1.) a possible pollutant source, 2.) a potential pathway to the water body and 3.) potential severity of the input. Because each potential source was given a ranking of slight, moderate and high for severity, the values recorded were weighted before they were summed for each category (Refer to Figure 4, Attachment B). Observations recorded as slight were considered to be the basis for comparison, therefore observations recorded as moderate were multiplied by 1.5 and observations recorded as high were multiplied by 2. Potential non point source pollution from crop related sources and transportation were the most serious while urban/residential runoff related sources were also considered common sources of non-point source pollution. Refer to Table 5 in Attachment B for a summary of the non point source pollution observations identified for each survey location.

## **RESULTS**

### **Duck Creek Watershed:**

Duck Creek originates in the agricultural fields east of Clarksville and north of Lake Odessa and flows southwest to its convergence with the Coldwater River (part of the Thornapple River Watershed) in the southeastern portion of Bowne Township, Kent County just northwest of Freeport. The majority of the watershed drains a predominantly agricultural area with low density residential use. Stations in the Duck Creek sub watershed are denoted by the DUCK prefixes. Refer to Attachment C for site photos and to Attachment D for site survey forms. The following conditions and comments were recorded on the survey forms:

#### **DUCK-01: Clarksville Road east of Ainsworth Road**

Water temperature was ~61°F, pH was measured at 7.64, and the DO was 8.02 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of Silt, detritus and muck. Gravel was also present downstream. Only overhanging vegetation was available for in-stream cover. Some aquatic plants, floating algae (upstream only) and filamentous algae (downstream), were observed. Little riparian vegetation (less than 10 feet) was observed which consisted of grasses. Adjacent land uses included cropland and impervious surfaces (upstream). Potential non point source pollution (NPS) was categorized as moderate for crop related activities and slight for transportation. Comments were: *Agricultural drains emptying into ditches; recently dug channel added to the upstream side. Second culvert on the downstream side is perched.*

**DUCK-02:** Jordan Lake Road south of Clark Road

Water temperature was ~66°F, pH was measured at 7.91, and the DO was 10.04 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of Silt, detritus and muck and gravel downstream. Upstream, silt, detritus, and muck predominated with less sand and gravel. Only overhanging vegetation was available for in-stream cover. Some aquatic plants and abundant filamentous algae were observed. Little riparian vegetation (less than 10 feet) was observed which consisted of grasses with (10-30 feet) on the downstream right side of the stream. Adjacent land uses included cropland and maintained lawn. Potential non point source pollution (NPS) was categorized as moderate for crop related activities and slight for transportation and urban/residential runoff. Comments were: *Larger agricultural drain; more significant flow than upstream.*

**DUCK-03:** Clark Road west of Jordan Lake Road

Water temperature was ~60°F, pH was measured at 7.31, and the DO was 3.85 ppm. The stream was less than ten feet wide and less than one foot deep. Substrate observations were prohibited at this site. Only overhanging vegetation was available for in-stream cover. Some aquatic plants and turbidity were observed. Little riparian vegetation (less than 10 feet) was observed which consisted of grasses. Adjacent land uses included cropland and maintained lawn (upstream only). Potential non point source pollution (NPS) was categorized as moderate for crop related activities and slight for transportation. Comments were: *Agricultural ditch with low flow.*

**DUCK-04:** Clarksville Road west of Tasker Road

Water temperature was ~60°F, pH was measured at 7.51, and the DO was 5.06 ppm. The stream was less than ten feet wide and less than one foot deep. Substrate observations were prohibited at this site. Only overhanging vegetation was available for in-stream cover. Some aquatic plants were observed on the downstream side only. Little riparian vegetation (less than 10 feet) was available for the stream corridor, which consisted of grasses. Adjacent land uses included cropland for both stream directions and shrub/old field and pasture on the downstream side only. Potential non point source pollution (NPS) was categorized as moderate for crop related activities and slight for transportation and downstream grazing related sources. Comments were: *Extremely low flow; agricultural drain discharging into drainage ditch.*

**DUCK-05:** Tasker Road north of Clinton Trail

Water temperature was ~70°F, pH was measured at 7.99, and the DO was 10.90 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of gravel and a small amount of hardpan downstream. Some overhanging vegetation and deep pools (downstream only) were available for in-stream cover. Some turbidity was observed on the downstream side only. Little riparian vegetation (less than 10 feet) was available for the stream corridor, which consisted of grasses. Adjacent land uses included cropland for both stream directions. Potential non point source pollution (NPS) was categorized as moderate for crop related activities and slight for streambank erosion on the downstream side. Comments were: *Unusual erosion patterns on downstream side into stream; somewhat of a clay/cobble mixture showing the erosion patterns.*

**DUCK-06:** Clinton Trail west of Tasker Road

Water temperature was ~68°F, pH was measured at 8.17, and the DO was 12.34 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of silt, detritus, and muck, and boulders. Gravel was also present downstream. Some overhanging vegetation and boulders were available for in-stream cover. Some filamentous algae were observed. A moderate amount of riparian vegetation (10-30 feet) was available for the stream corridor with more (>100) feet on the upstream right side; all of the stream sides consisted of grasses. Adjacent land uses included shrub/ old fields for both stream directions and forest upstream. No potential non point sources were identified for this site. Comments were: *Crossing has an older concrete bridge; stream picks up flow and width at this crossing but still maintains agricultural ditch characteristics. DO readings seem unusually high.*

**DUCK-07:** Ralph Road north of Bippley Road

Water temperature was ~70°F, pH was measured at 8.38, and the DO was 15.44 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of gravel. Boulders were also present downstream. Some overhanging vegetation as well as deep pools and boulders on the downstream side were available for in-stream cover. Abundant filamentous algae were observed on both stream sides, and there was some foam downstream. A moderate amount of riparian vegetation (10-30 feet) was available for the stream corridor downstream with little (<10 feet) on the upstream right side; all of the stream sides consisted of grasses. Adjacent land uses included crops for both stream directions and pasture and maintained lawns downstream. Potential non point source pollution (NPS) was categorized as moderate for crop related

activities, slight for grazing on the downstream side, and slight for streambank erosion upstream. Comments were: *Maintaining agricultural drain characteristics; agricultural drains pouring into stream. An abundance of filamentous algae are present. DO ready is extremely high (meter trouble?)*

**DUCK-08:** Jackson Road north of Peddler Lake Road

Water temperature was ~65°F, pH was measured at 7.98, and the DO was 8.64 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate downstream with lesser amounts of silt, detritus, and muck. Upstream, substrate observations were prohibited. Some overhanging vegetation was available for in-stream cover. Aquatic plants were also observed on the downstream side only. A moderate amount of riparian vegetation (10-30 feet) was available for the stream corridor downstream that consisted of grasses with abundant riparian vegetation (>100 feet) on the upstream side that consisted of shrubs. Adjacent land uses included crops and pasture downstream and shrub/old field on both stream sides. Potential non point source pollution (NPS) was categorized as slight for grazing on the downstream side. Comments were: *Thick vegetative cover upstream.*

**DUCK-09:** Peddler Lake Road west of Jackson Road

Water temperature was ~63°F, pH was measured at 7.43, and the DO was 7.61 ppm. The stream was less than ten feet wide and less than one foot deep. Sand appeared to dominate the substrate downstream with lesser amounts of gravel. Upstream, substrate observations were prohibited. Only overhanging vegetation was available for in-stream cover. Aquatic plants and floating algae were also observed on the downstream side only. With the exception of downstream left streamside, which has little riparian vegetation (<10 feet) consisting of grasses, there was an abundance (>100 feet) of riparian vegetation consisting primarily of shrubs. Adjacent land uses included crops and forest downstream and shrub/old field upstream. Potential non point source pollution (NPS) was categorized as moderate for crop related sources on the downstream side. Comments were: *Thick vegetative cover upstream at this crossing as well as at the previous.*

**DUCK-10:** Elm Road north of Bippley Road

Water temperature was ~72°F, pH was measured at 8.43, and the DO was 17.82 ppm (DO and pH readings at this site are abnormally high suggesting a possible meter error). The stream was 10-25 feet wide and less than one foot deep. Sand appeared to dominate the substrate with lesser amounts of silt, detritus, and muck. Overhanging vegetation as well as deep pools and

boulders on the downstream side only were available for instream cover. Aquatic plants and filamentous algae were also observed. With the exception of downstream left streamside, which has little riparian vegetation (<10 feet), there was a moderate amount (10-30 feet) of riparian vegetation consisting primarily of grasses. Adjacent land uses upstream included crops and forest, and downstream there were shrubs/old field, maintained lawns, and disturbed ground. Potential non point source pollution (NPS) was categorized as slight for crop related sources and transportation on the upstream side and for streambank erosion and urban/residential runoff downstream. Comments were: *An abundance of filamentous algae is present; DO is extremely high (meter problem?)*

**DUCK-11:** Campbell Road west of Mote Road

Water temperature was ~62°F, pH was measured at 7.75, and the DO was 5.59 ppm. The stream was less than 10 feet wide and 1-3 feet deep. Sand appeared to dominate the substrate with lesser amounts of gravel on both stream sides and silt, detritus, and muck upstream. Overhanging vegetation and deep pools were available for instream cover. Floating and filamentous algae were also observed. With the exception of downstream right streamside, which had abundant riparian vegetation (>100 feet), there was a moderate amount (10-30 feet) of riparian vegetation consisting primarily of grasses upstream and trees downstream. Adjacent land uses upstream included shrubs/old fields, cropland, and forest, and downstream there were shrubs/old field, maintained lawns, and forest. Potential non point source pollution (NPS) was categorized as moderate for crop related sources upstream and slight for urban/residential runoff downstream. Comments were: *Maintains agricultural ditch features.*

**DUCK-12:** Nash Highway @ M-50

Water temperature was ~62°F, pH was measured at 7.83, and the DO was 6.95 ppm. The stream was less than ten feet wide and 1-3 feet deep. Silt, detritus, and muck appeared to dominate the substrate with lesser amounts of sand and gravel upstream. Downstream, substrate observations were prohibited. Some overhanging vegetation, deep pools, boulders, and woody debris were available for in-stream cover. Abundant turbidity and some foam were observed on both stream sides. There was a moderate amount (10-30 feet) of riparian vegetation consisting primarily of grasses upstream and abundant (>100 feet) riparian vegetation downstream consisting of shrubs. Adjacent land uses included forest and maintained lawn (upstream only). Potential non point source pollution (NPS) was categorized as slight for transportation on both stream sides and slight for urban/residential runoff on the upstream side only. Comments were: *High turbidity/silt content. Stream has gotten away from agricultural ditch features.*

**DUCK-13:** Bell Road south of Stahl Road

Water temperature was ~62°F, pH was measured at 8.02, and the DO was 7.55 ppm. The stream was 10-25 feet wide and 1-3 feet deep. Silt, detritus, and muck appeared to dominate the substrate with lesser amounts of gravel and boulders. Some overhanging vegetation, deep pools (downstream only), undercut banks, boulders, and woody debris were available for in-stream cover. Some turbidity was observed on both stream sides. There was a moderate amount (10-30 feet) of riparian vegetation consisting primarily of shrubs downstream and abundant (>100 feet) riparian vegetation upstream consisting of trees. Adjacent land uses included forest upstream and shrub/old field and maintained lawn downstream. Potential non point source pollution (NPS) was categorized as moderate for transportation on both stream sides, slight for urban/residential runoff downstream, and slight for streambank erosion upstream. Comments were: *Some erosion problems from roadside ditches; silt fence has been used ineffectively. Some turbidity with high silt content exists.*

**DUCK-14:** Hastings Road south of Furlong Road

Water temperature was ~63°F, pH was measured at 7.04, and the DO was 8.17 ppm. The stream was 10-25 feet wide and 1-3 feet deep. Silt, detritus, and muck appeared to dominate the substrate with lesser amounts of sand and gravel (downstream only). Some overhanging vegetation, deep pools (downstream only), boulders, and woody debris were available for in-stream cover. Some turbidity was observed on both stream sides. There was little (< 10 feet) riparian vegetation on the upstream left side and abundant (>100 feet) riparian vegetation on the upstream right side. The vegetation upstream consists primarily of trees, and downstream it consists of grasses. Adjacent land uses included forest and maintained lawn. Potential non point source pollution (NPS) was categorized as slight for transportation on both stream sides, slight upstream and moderate downstream for urban/residential runoff, and slight for riparian vegetation removal downstream. Comments were: *High silt content. Bridge is a State Remand Bridge.*

**DUCK-15:** Furlong Road west of Hastings Road

Water temperature was ~59°F, pH was measured at 7.57, and the DO was 4.41 ppm. The stream was less than 10 feet wide and less than one foot deep. Silt, detritus, and muck appeared to dominate the substrate with lesser amounts of sand upstream. Substrate observations downstream were prohibited by turbidity levels. Some overhanging vegetation, deep pools, and woody debris were available for in-stream cover. Some turbidity downstream and trash upstream were observed. There was a moderate amount (10-100 feet) of riparian vegetation upstream and abundant (>100 feet) riparian vegetation downstream consisting of trees. Adjacent land uses included

forest on both stream sides and cropland upstream only. Potential non point source pollution (NPS) was categorized as slight for transportation on both stream sides and moderate for crop related sources upstream. Comments were: *Stream appears to only be flowing due to recent rainfall although it has no turbidity upstream, but turbidity is abundant downstream.*

**DUCK-16:** Montcalm Ave. south of Furlong Road

Water temperature was ~63°F, pH was measured at 8.13, and the DO was 6.42 ppm. The stream was 10-25 feet wide and 1-3 feet deep. Silt, detritus, and muck appeared to dominate the substrate downstream with lesser amounts of gravel and boulders. Substrate observations upstream were prohibited by turbidity levels. Some overhanging vegetation, deep pools, boulders, and woody debris were available for in-stream cover. Some turbidity was observed on both stream sides, and trash was present on the downstream side. With the exception of upstream left streamside, which had a moderate amount of riparian vegetation (10-30 feet), there was an abundance (>100 feet) of riparian vegetation consisting primarily of shrubs upstream and trees downstream. Adjacent land uses included forest on both stream sides and an impervious surface upstream. Potential non point source pollution (NPS) was categorized as slight for transportation on both stream sides. Comments were: *Abundance of dead bullhead/catfish both upstream and downstream.*

**DUCK-17:** Freeport Ave. south of 100<sup>th</sup> Street

Water temperature was ~64°F, pH was measured at 8.18, and the DO was 8.35 ppm. The stream was 10-25 feet wide and 1-3 feet deep. Substrate observations were prohibited by abundant turbidity levels. Some overhanging vegetation, deep pools, and woody debris were available for in-stream cover. There was an abundance (>100 feet) of riparian vegetation consisting primarily of shrubs upstream. Downstream riparian vegetation was not recorded at this site. Adjacent land uses included cropland and shrub/old field. Potential non point source pollution (NPS) was categorized as slight for transportation upstream only. Comments were: *High turbidity. Dead animal was floating in stream on the upstream side.*

The majority of the impacts to the stream in this area seem to result from possible nutrient runoff from adjoining crops and transportation erosion or erosion due to the road stream crossing (sand/gravel roads, road washout). In a few areas grazing, streambank erosion, and urban/residential runoff could also potentially impact the stream.