Attachment 1

INTER-OFFICE COMMUNICATION

To: Al Rupp, Section Manager, DSW-NWDO
From: Dan Glomski, ES II through Tom Balduf, Unit Supervisor, DSW-WQ-NWDO
Date: December 8, 2000
Subject: Village of Waldo

Waldo is located in southern Marion County and has a population of approximately 345 residents. Since there are no municipal sewage collection and treatment facilities, most sanitary wastewater is treated by on-lot systems. These systems usually employ a settling tank followed by either a leaching field or sand filters. Commercial establishments with Ohio EPA approved on-lot systems include the American Legion, Dairy Bar, Post Office, and Municipal Pool. The Duchess Convenience Store operates a package sewage treatment plant and is regulated by an Ohio EPA permit to discharge to waters of the state. Initial reconnaissance of the study area indicated that many settling tanks are connected to the storm sewer system. This occurs either when tile fields fail or are absent and prevents sewage from backing up in yards. Replacement of failed leaching fields is not a good option here because of small lot sizes and in some instances poorly drained soil. Most storm tiles discharge to an unnamed stream that flows through the village. For purposes of this study, the stream will be referred to as Tomahawk Creek. It originates at the confluence of three ditches maintained by the Marion County Engineers, Tomahawk Ditch, Augenstine Ditch, and Wyatt Ditch. It then meanders through town in an easterly direction to its confluence with the Olentangy River at river mile (RM) 40.4. The river mile system is a useful means of relating distance between sites. Miles are calculated in an upstream direction starting from the stream mouth. The confluence is in the headwaters of Delaware Reservoir which is created by a dam at RM 32.3. A description of the study area, including the location of sampling points and major septic discharges, and sampling results are discussed below. Some minor septic discharges were also located but are not discussed in detail. A map of the study area is displayed in Figure 1.

This area was ranked as a priority for investigation by the Ohio EPA, Division of Surface Water at Northwest District Office for several reasons. Foremost, there is a significant concern for human health and pollution of the environment. The Marion County Sanitary Engineer has expressed interest in sewage treatment facilities and several complaints from local citizens regarding stream pollution have been received in the past, indicating local interest in a project. Finally, the village has a long history of negotiations regarding sanitation issues. Consulting engineers Tozzer and Associates, Ltd. were contracted and submitted a preliminary sanitary sewerage system report in 1970. The village applied for Farmers Home Administration (FHA) financing at this time. The consultant submitted detailed plans for sewerage collection and treatment facilities in 1972, recommending a gravity sewer collection system and treatment by a series of two wastewater lagoons. The village decided not to proceed with the project and declined the FHA financing offer in 1973. During this time the Federal Water Pollution Control Act of 1972 was passed by Congress (Public Law 92-500). This law was subsequently amended as the Clean Water Act of 1977 (Public

Law 95-217) and is contained in Title 33 of the U.S. Code of Federal Regulations, Part 1251 et seq (33 U.S.C. 1251). The primary objectives of these laws were to limit the discharge of pollutants into the nations waters and to restore them to fishable and swimmable levels. The National Pollutant Discharge Elimination System (NPDES) was established to attain these goals and is outlined in Title 40 of the Code of Federal Regulations, Part 122 (40 C.F.R. 122). This system regulates by permit the quality and quantity of effluent discharged by point sources of wastewater. The Duchess Convenience Store in Waldo is currently assigned Ohio EPA permit # 2PR00062. The Waldo mayor and council submitted a NPDES permit application as required to Ohio EPA for a proposed sewage treatment facility in 1974. The village became involved with the U.S. EPA Construction Grants program and several town meetings were held to discuss sewerage options. The village council voted to drop the project after the final meeting in April 1975. Although a NPDES permit was issued and renewed on several occasions by the village, limited negotiations have occurred since this time.

The primary human health concern is exposure to raw and poorly treated sewage. Potential routes of exposure include either ingestion of contaminated well water or contact with surface water. This is especially a problem if the sewage contains pathogenic (disease producing) bacteria and viruses. Although intestinal organisms eventually die off outside the body, some will remain virulent for a period and may be dangerous sources of infection. Reactions to exposure can range from an isolated illness such as skin rash, sore throat, or ear infection to a more serious wide spread epidemic. Some types of bacteria that may be a concern in contaminated water include Escherichia, which cause diarrhea and urinary tract infections, Salmonella, which cause typhoid fever and gastroenteritis ("food poisoning"), and Shigella, which cause severe gastroenteritis or bacterial dysentery. Some types of viruses that may be a concern include polio, hepatitis A, and encephalitis. The concern for human health extends beyond the Waldo municipal limits. The stream that flows through the village is a tributary of the Olentangy River. The confluence is located in the headwaters of Delaware Reservoir, which is a 1330 acre lake created by a dam approximately eight miles further downstream. This lake is heavily used for boating, swimming, and fishing and harbors Delaware State Park. Slightly further downstream from the dam is the is the City of Delaware water treatment plant intake.

The primary environmental concern is water pollution caused by excessive loading of organic compounds. Sewage is very high in organic content and acts as food for bacteria, which break down the carbohydrates, fats, and proteins into their inorganic constituents. This process consumes dissolved oxygen and the subsequent release of nutrients stimulates nuisance growths of algae. While algae release oxygen to the water during photosynthesis, the reverse process of respiration consumes oxygen during periods of darkness. This can cause extreme daily variations in dissolved oxygen concentration and result in stress and even mortality to aquatic life. If the process of oxygen consumption by bacteria is vigorous enough it can result in completely anaerobic zones. This is where specialized bacteria reduce sulfates and nitrates to obtain oxygen and in the process release hydrogen sulfide, methane, and ammonia gas. This is the source of the characteristic "rotten egg" odor. Elevated ammonia concentrations often cause a negative impact to aquatic life. At low levels, it can reduce growth and reproduction and at high levels can cause mortality.

Three sets of stream samples were collected during the study period. Physical measurements were performed in the field using a YSI Model 55 dissolved oxygen meter and a Fisher Scientific Model 1003 pH meter. The method used by Ohio EPA to determine the level of health risk is to measure fecal coliform counts. Samples collected for fecal coliform analysis were delivered same day to Jones and Henry Laboratories in Northwood, OH. Samples collected for inorganic compound analysis (nutrient compounds and oxygen demanding substances) were delivered overnight to the Ohio EPA, Division of Environmental Services in Columbus, OH. All samples were collected, preserved, shipped, and analyzed according to protocol contained in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices. Results of all analyses performed are presented in Table 1.

The Ohio EPA is the state agency responsible for oversight in regards to restoring and maintaining the chemical, physical, and biological integrity of waters of the state. These goals are obtained by administering Ohio Water Pollution Control Laws (Ohio Revised Code, Chapter 6111) and the Ohio Water Quality Standards (Ohio Administrative Code, Chapter 3745-1). Water quality criteria and stream use designations applicable to this study are contained in the standards. Some numerical criteria have tiered values depending on various aquatic life, recreation, and water supply uses defined in the standards. Tomahawk Creek is not named on any drainage or topographic maps and therefore is not listed in the use designation section for this watershed (Scioto River Basin, 3745-1-08). The only standards that are legally defendable for undesignated streams are aquatic life criteria established for limited resource water (OAC, 3745-1-07, Table 7-1). There are no recreation criteria for undesignated streams. More appropriate use designations (i.e. warmwater aquatic life and primary contact recreation) are likely for Tomahawk Creek because the stream has fairly well developed habitat and deep pools with potential for full body. Recommending appropriate use designations for this stream would first require intensive habitat and biological assessments. For the uses to be adopted in the standards a draft rule must then be approved by the Ohio General Assembly Joint Committee on Agency Rule Review. Stream aesthetics are protected by the "free from" rules that apply to all waters of the state (OAC, 3745-1-04). Criteria established to prevent public health nuisances are also contained in the free from rule. Parameters measured with criteria are summarized as follows; dissolved oxygen- a minimum of 2.0 mg/l and a daily average of 3.0 mg/l, pH- a range from 6.5-9.0 S.U., temperature- a maximum of 37.0 °C and an average of 34.0 °C, dissolved solids- an average of 1500 mg/l, and fecal coliform- a maximum of 5,000 colonies per 100 ml. Ammonia criteria are based on sample temperature and pH and are contained in OAC, 3745-1-07, Table 7-2. The ammonia criteria for most samples was 13.0 mg/l. Water quality standard violations (maximum criteria) and exceedences (average criteria) that were documented are displayed in Table 2.

Background water quality was evaluated at the stream origin, adjacent to the Norfolk Railroad and behind the American Electric Power sub-station at river mile (RM) 1.30. While any impact from urban sources should be minimal here, there may be some impact from the Landmark Agri-Center facility and runoff from crop land. Although water levels were usually low at this location there was always some noticeable flow present. Water quality was determined to be fairly good. There were no violations documented, but the average dissolved solids criteria was exceeded in one sample.

Several pollutant concentrations were elevated, especially nutrient type compounds such as nitrate and phosphorus. The proximity of the Landmark Agri-Center and presence of agricultural fertilizers make them a likely source, although it is possible that some septic drainage from several homes west of the railroad tracks may contribute.

The remaining samples were collected in known problem areas. The first was near the municipal pool at the western Main St. crossing at RM 1.15. This site was sampled to evaluate the impact from a grey colored effluent discharged by an 8 inch diameter corrugated steel tile. Water quality was determined to be very poor. There was one ammonia violation and three fecal coliform violations documented and the average dissolved solids criteria was exceeded in two samples. General conditions in the mixing area included a heavy sludge deposit, a strong septic or "rotten egg" odor, and grey to black colored water. A colony of *Sphaerotilus natans* was growing on the substrate. This is a filamentous bacteria common in sewage rich environments. There was also an abundance of Chironomid (bloodworm) larvae, which are a pollution tolerant organism common in low dissolved oxygen environments. About 300 feet downstream from here is the treatment plant serving the municipal pool. The sand filters from this facility are covered with vegetation and appear to be poorly maintained. No effluent was observed discharging from this facility. The next sample was collected from Tomahawk Creek where the stream passes back under Main St. at RM 0.85 (central creek crossing). This site was sampled to evaluate the impact from a grey colored effluent discharged by a 4 inch diameter PVC tile. Water quality here was also very poor. There were three fecal coliform violations documented, the average dissolved oxygen criteria was exceeded in two samples, and the average dissolved solids criteria was exceeded in one sample. General conditions were similar to the previous location, including a sludge deposit, a slight septic odor, grey to black colored water, presence of *Sphaerotilus natans*, and some floating clumps of algae and scum. Another sample was collected from Tomahawk Creek just below Center St. at RM 0.60. This site showed evidence of a nutrient enrichment impact with large floating mats of algae present. There was also dead and decaying algae on the bottom of the creek and gas bubbles were being released. There were three fecal coliform violations documented and the average dissolved oxygen criteria was exceeded in one sample. The last sampling location on Tomahawk Creek was near U.S. 23 (RM 0.35) just upstream from where the creek becomes culverted. This site was affected by septic effluent from a catch basin at the end of Main St. The catch basin is across from the Fire Station and has a tile exiting that flows through a residential lot before it opens in a small woodlot. There were two fecal coliform violations and the average dissolved oxygen criteria was exceeded in three samples.

All results for dissolved oxygen and ammonia concentrations obtained in Tomahawk Creek are graphically displayed in Figure 2. The dissolved oxygen graph portrays a significant sag that occurs downstream from the septic discharges. The lowest average concentrations were at the U.S. 23 site, downstream from all wastewater sources. This section of stream had the highest gradient, most warmwater habitat attributes such as riffle and pool development, rock substrate, and riparian corridor, and greatest potential to attain warmwater aquatic life criteria in the study area. The ammonia graph displays a spike in concentration downstream from the discharge near the municipal pool and the violation that was documented. An additional sample was collected from a small swale

that drains from the north and flows into Tomahawk Creek just upstream from Center St. The site was downstream from Casey St. where a 10 inch diameter black plastic tile discharges. Water quality here was extremely poor. There was one dissolved oxygen violation and three fecal coliform violations documented and the average dissolved solids criteria was exceeded in two samples. General conditions included a heavy sludge deposit, a very septic odor, and black-colored water.

Results of this study determined that water quality in Tomahawk Creek is very poor because of septic discharges originating in the Village of Waldo. Numerous violations and exceedences of Ohio water quality standards were documented. Many visual indications of sewage pollution were also present, including sludge, grey to black colored water, putrid odor, floating scum, and organisms such as bacteria colonies and tolerant insect larvae. These conditions not only violate water quality laws and regulations, but pose a significant threat to human health. One health risk is the potential for potable water supply contamination, including individual wells in Waldo and the public supply from the Olentangy River for the City of Delaware. Another health risk is exposure to water borne illness during recreational activities in Delaware Reservoir and even Tomahawk Creek itself, especially in the area around the community pool and municipal park.

Table 1. Results of physical, chemical, and microbiological sampling conducted in the Waldo study area during 2000. Values preceded by a < were below the reporting limit and those followed by a qualifier are defined as follows; J- result estimated, PT- result estimated because sample was analyzed past holding time, and R- result unusable because quality control criteria were not met.

Tomahawk Creek adjacent Norfolk Railroad

Parameter	071800	082900	090700
temperature (°C)	19.6	18.5	14.3
dissolved oxygen (mg/l)	4.0	5.3	4.8
pH (S.U.)	7.50	7.49	6.85
fecal coliform (#/100 ml)	1,500	4,400	4,600
BOD_5 (mg/l)	3.3	3.9 J	12
$cBOD_5$	<2	2.2	<2
COD (mg/l)	16	24	21
dissolved solids (mg/l)	820	1030	1650
suspended solids (mg/l)	5	5	13
nitrite (mg/l)	0.79	0.86	0.77
nitrate-nitrite (mg/l)	13.3	19.9	7.05
ammonia (mg/l)	1.16	2.11	4.06
kjeldahl nitrogen (mg/l)	1.8	2.9	5.4
phosphorus (mg/l)	1.15	1.77	2.06

Tomahawk Creek downstream Main St. (western crossing)

Parameter	071800	082900	090700
temperature (°C)	20.7	19.9	17.8
dissolved oxygen (mg/l)	3.4	3.1	5.2
pH (S.U.)	7.60	7.54	7.53
fecal coliform (#/100 ml)	86,000	52,000	26,000
BOD_5 (mg/l)	9.0	16	13
$cBOD_5$	4.9	11	9.3
COD (mg/l)	33	49	148
dissolved solids (mg/l)	1280	1600	4580
suspended solids (mg/l)	18	10	17
nitrite (mg/l)	0.80	1.12	0.28
nitrate-nitrite (mg/l)	7.56	14.5	0.25
ammonia (mg/l)	4.76	9.56	13.2
kjeldahl nitrogen (mg/l)	5.8	11	17
phosphorus (mg/l)	1.44	2.60	3.58

Table 1. continued

Tomahawk Creek downstream Main St. (central crossing)

Parameter	071800	082900	090700
temperature (°C)	20.8	19.6	16.7
dissolved oxygen (mg/l)	2.2	3.7	2.9
pH (S.U.)	7.51	7.46	7.74
fecal coliform (#/100 ml)	15,000	22,000	7,200
BOD_5 (mg/l)	<2	5.8	5.6
$cBOD_5$	<2	4.8	5
COD (mg/l)	19	32	30
dissolved solids (mg/l)	880	1050	4330
suspended solids (mg/l)	<5	<5	9
nitrite (mg/l)	0.52	1.60	0.10
nitrate-nitrite (mg/l)	7.63	31.7	0.22
ammonia (mg/l)	0.91	2.78	2.80
kjeldahl nitrogen (mg/l)	1.8	3.7	4.5
phosphorus (mg/l)	0.60	1.46	1.52

Tomahawk Creek at Center St.

Parameter	071800	082900	090700
temperature (°C)	22.1	19.4	16.6
dissolved oxygen (mg/l)	5.6	3.0	2.4
pH (S.U.)	7.90	7.40	7.63
fecal coliform (#/100 ml)	17,000	25,000	13,000
BOD_5 (mg/l)	6.7	3.3	5.0
$cBOD_5$	5.2	2.3	3.6
COD (mg/l)	31	27	24
dissolved solids (mg/l)	1010	1400	1360
suspended solids (mg/l)	<5	<5	5
nitrite (mg/l)	1.66	1.08	0.34
nitrate-nitrite (mg/l)	7.61	29.4	0.78
ammonia (mg/l)	2.51	3.31	2.74
kjeldahl nitrogen (mg/l)	3.7	4.7	3.8
phosphorus (mg/l)	1.15	1.08	2.04

Table 1. continued

Tomahawk Creek upstream U.S. 23

Parameter	071800	082900	090700
temperature (°C)	20.1	19.4	16.1
dissolved oxygen (mg/l)	2.7	2.8	2.2
pH (S.U.)	7.55	7.23	7.61
fecal coliform (#/100 ml)	>200,000	4,200	12,000
BOD_5 (mg/l)	12	8.4	17
$cBOD_5$	2.3	<2	2.1
COD (mg/l)	25	24	18
dissolved solids (mg/l)	1080	1190	1210
suspended solids (mg/l)	5	9	8
nitrite (mg/l)	1.20	0.80	0.34
nitrate-nitrite (mg/l)	7.20	15.0	1.12
ammonia (mg/l)	3.65	4.41	5.97
kjeldahl nitrogen (mg/l)	4.3	5.2	7.0
phosphorus (mg/l)	0.97	1.04	1.55

Tomahawk Creek Tributary downstream Casey St.

Parameter	071800	082900	090700
temperature (°C)	21.6	20.5	18.5
dissolved oxygen (mg/l)	3.5	4.9	1.4
pH (S.U.)	7.36	7.44	7.55
fecal coliform (#/100 ml)	100,000	69,000	150,000
BOD_5 (mg/l)	17	16	32
$cBOD_5$	13	14	19
COD (mg/l)	105	65 PT	<10 R
dissolved solids (mg/l)	5180	8890	1110
suspended solids (mg/l)	21	37	30
nitrite (mg/l)	0.27	0.27	0.76
nitrate-nitrite (mg/l)	3.08	0.74	2.32
ammonia (mg/l)	8.51	7.46	10.3
kjeldahl nitrogen (mg/l)	12	11	12
phosphorus (mg/l)	2.22	2.38	4.83

Table 2. Violations (maximum criteria) and exceedences (average criteria) of Ohio water quality standards (Ohio Administrative Code, Chapter 3745-1) documented in the Village of Waldo study area based on general water quality criteria applicable to all waters (Rule 3745-1-04) and statewide limited resource aquatic life criteria (Rule 3745-1-07, Table 7-1).

Site	Parameter (value)
Tomahawk Creek	
Penn. RR	dissolved solids (1650)
Main St. western	dissolved solids (1,600, 5,580); ammonia (13.2); fecal coliform (86,000, 52,000, 26,000)
Main St. central	dissolved oxygen (2.2, 2.9); dissolved solids (4330); fecal coliform (15,000, 22,000, 7,200)
Center St.	dissolved oxygen (2.4); fecal coliform (17,000, 25,000, 13,000)
U.S. 23	dissolved oxygen (2.7, 2.8, 2.2); fecal coliform (>200,000, 12,000)
Tomahawk Creek Tributary	
Casey St.	dissolved oxygen (1.4); dissolved solids (5180, 8890); fecal coliform (100,000, 69,000, 150,000)

Figure 1. Village of Waldo study area.

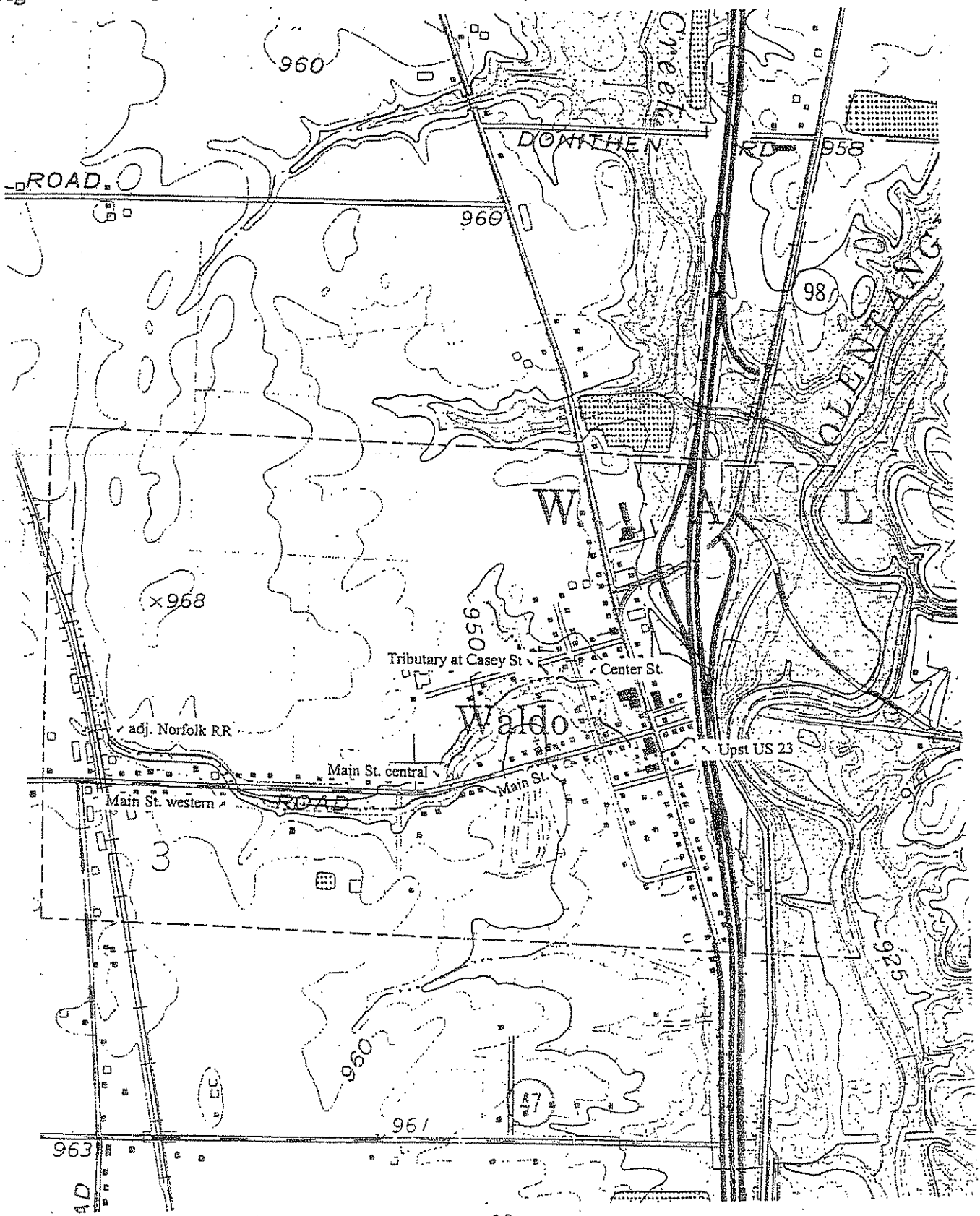

Table A-2. Continued

Tomahawk Ditch at U.S. Rt. 23- RM 0.38; V04G19						
date (mmddyy)	060403	061803	070903	072303	080603	082003
temperature (°C)	13.5	15.9	19.5	17.7	18.7	18.9
dissolved oxygen (mg/l)	8.4	8.6	6.3	7.5	6.1	4.1
pH (SU)	7.66	7.80	6.94	7.68	7.63	7.54
Fecal coliform (CFU/100 ml)	27000	12700 JL	5200	3900	5100	>10000
Escherichia coli (CFU/100ml)	1230 JL	700 JL	3600	3400	4800	>10000
BOD_5 (mg/l)	<2	<2	2.6	2.2	2.6	4.6
conductivity (μmhos/cm^3)	757	783	394	700	984	1620
dissolved solids (mg/l)	460	458	268	418	578	970
suspended solids (mg/l)	7	5	22	5	<5	18
alkalinity (mg/l)	166	230	109	211	263	305
chloride (mg/l)	71	53	16	59	110	283
COD (mg/l)	14	14	18	<10	11	11
nitrite (mg/l)	0.11	0.11	0.12	0.14	0.26	0.44
ammonia (mg/l)	0.37	0.35	0.29	0.33	0.46	0.72
nitrate-nitrite (mg/l)	13.9	11.5	9.85	6.30	5.15	3.14
kjeldahl nitrogen (mg/l)	1.4	1.0	1.6	1.2	1.2	2.1
sulfate (mg/l)	38	47	20	42	52	80
phosphorus (mg/l)	0.22	0.25	0.34	0.28	0.50	0.77

Table A-2. Continued

Tomahawk Ditch at U.S. Rt. 23- RM 0.38; V04G19						
date (mmddyy)	060403	061803	070903	072303	080603	082003
hardness (mg/l)	296	331	180	298	359	410
aluminum (µg/l)	537	<200	1780	<200	<200	<200
barium (µg/l)	58	56	49	56	58	72
calcium (mg/l)	79	88	49	80	96	108
chromium (µg/l)	<30	<30	<30	<30	<30	<30
copper (µg/l)	<10	<10	<10	<10	<10	<10
iron (µg/l)	880	218	2490	524	221	368
magnesium (mg/l)	24	27	14	24	29	34
manganese (µg/l)	29	34	41	30	28	68
nickel (µg/l)	<40	<40	<40	<40	<40	<40
potassium (mg/l)	4	4	6	5	5	6
sodium (mg/l)	30	29	30	28	59	141
strontium (µg/l)	577	706	162	472	897	2530
zinc (µg/l)	<10	<10	19	<10	<10	<10
mercury (µg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
arsenic (µg/l)	<2	<2	<2	<2	<2	3.0
cadmium (µg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
lead (µg/l)	<2	<2	2.3	<2	<2	2.3
selenium (µg/l)	<2	<2	<2	<2	<2	<2