3.0 PHYSICAL CHARACTERISTICS

3.1 SURFACE FEATURES

Gaston County, North Carolina lies in the central portion of the Piedmont Physiographic Province between the Appalachian Mountains to the west and the Atlantic Coastal Plain to the east. The Piedmont is primarily characterized as rolling uplands although the county's western area contains some northeast trending ridges. The elevation of the Source Area A is approximately 760 feet above mean sea level (msl), and the elevation of Source Area B is approximately 730 feet msl. The elevations within a one-mile radius of the Site range from 600 to 800 feet above msl. The topography of the site is composed of low ridges accentuated by numerous small stream valleys. In general, the topographic changes are gradual, except for occasional steep-sided stream valleys. Specifically, the site topography is dominated by a ridgeline on the western half of the Site. The former Untz Dry Cleaning facility, located within the present Roper Shopping Center, was located along the center of the ridgeline. East of this ridgeline, the topography is dominated by slopes trending from the southwest to the northeast towards a small tributary of Fites Creek (unnamed tributary “A”) that has headwaters adjacent to the Roper location. The unnamed tributary lies along the northern edge of the Site and flows to the east. Site topography along the eastern perimeter is also affected by the presence of another small stream along the extreme eastern edge of the Site. This stream, which is also an unnamed tributary of Fites Creek (unnamed tributary “B”), flows northeast and into the aforementioned stream. West of the ridgeline the topography slopes to the west and eventually towards another stream further to the west. The general topographic relief over the Site is presented in **Figure 3-1**.

Source Area A. Source Area A consists of the former Untz’s dry cleaning operation located in Roper’s Shopping Center. In 1991, the “Site” also included 25 single family homes, a church, and an elementary school whose wells have been contaminated with PCE. The shopping center includes Roper's Furniture Store, Jericho Baptist Church and a cabinet manufacturing shop. The former Untz Dry Cleaners is believed to be the source of the groundwater contamination. The former Untz Dry Cleaner facility is approximately 0.75 acres in size and is bounded to the east and west by residential neighborhoods; to the north by a cemetary and an undeveloped wooded tract; and to the south by North Belmont Elementary School.

Two mobile homes are located on the property in the back of the shopping center, each occupied by one tenant. There is a buried septic tank behind the shopping center building, near the mobile homes. A flea market is held on the lawn between the shopping center and the elementary school five days per week. The shopping center is fenced along the southern boundary. The eastern portion of the shopping center is covered with an asphalt parking lot, and the western portion is covered with soil and grass. The terrain is relatively flat with a

Figure 3-1

gentle slope toward the northeast to an unnamed tributary of Fites Creek. An interview with a local resident revealed that drainage from the reclaimation operations at the dry cleaners drained from the northeast corner of the dry cleaning facility along the northern property boundary in a northeasterly direction.

Source Area B. Source Area B consists of a previous dry cleaning facility located at the northeastern corner of Acme Street and Suggs Road. This parcel has been converted to residential property. The majority of the area surrounding Source Area B is residential with a few small businesses. A cabinet shop is located to the North. Source Area B has been graded level with a slight drainage feature sloping from the southwest to the northeast. This feature eventually slopes towards the unnamed tributary to Fites Creek.

In addition, a previous refrigerator repair shop and a machine shop were also suspected to be potential sources of contamination. The refrigerator repair shop is located at the intersection of Julia Street and Acme Road in land lot 15-18A parcel #32. This is a small commercial strip area with residential property surrounding the Site, except for a cabinet shop and a well drilling company located to the east. The machine shop is located at the corner of Acme and Centerview Roads and is encompassed by residential neighborhoods.

3.2 METEOROLOGY

The climatological data shown in **Table 3-1** for Charlotte, North Carolina is representative of the climate in Belmont and at the Site. The climate is moderate with approximately one half of the winter days falling below freezing. Little snow falls and the occasional heavy snow usually melts within one or two days. The average freeze-free period is 216 days. The summers are warm with temperatures into the 90°F range.

TABLE 3-1. CLIMATOLOGICAL DATA FOR CHARLOTTE, NORTH CAROLINA.[a]

	Jan	*Feb*	*Mar*	*Apr*	*May*	*June*	*July*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*	*Year*	
Daily Max (°F)	50.3	53.6	61.6	72.1	79.1	85.2	88.3	87.6	81.7	71.7	61.7	52.6	70.5	Avg
Daily Min (°F)	30.7	32.1	39.1	48.4	57.2	64.7	68.7	68.2	62.3	49.6	39.7	32.6	49.4	Avg
Total Precipitation (in)	3.80	3.81	4.83	3.27	3.64	3.57	3.92	3.75	3.59	2.72	2.86	3.40	3.6	Avg mon
Max 24hr Precipitation (in)	3.57	2.92	3.83	3.2	3.67	3.77	3.00	4.52	4.74	5.34	3.27	2.87	5.34	Max
Wind Speed (mph)[b]	25	32	29	29	25	30	23	37	29	37	30	35	37	Max
Prevailing Wind Direction[c]	SW	NE	SW	S	SW	SW	SW	S	NE	NNE	SSW	SW	SW	Avg

[a]National Climatic Data Center, 1987. "Local Climatological Data Annual Summary with Comparative Data Charlotte North Carolina" National Environmental Satellite Data and Information Service, National Oceanic and Atmospheric Administration, Department of Commerce. Normals, Means and Extremes 1951-1980.
[b]8 year record
[c]Prevailing direction through 1951-1963.

3.3 SURFACE-WATER HYDROLOGY

The Site is located between the Catawba River and the South Fork of the Catawba River. Gaston County is drained by the Catawba River, which flows north to south and forms the east boundary of Gaston County. Surface water drainage from the Site is to an intermittent creek (unnamed tributary "A") located approximately 1000 feet to the north. The intermittent creek flows 0.5 miles east and joins another intermittent creek (unnamed tributary "B") to form an unnamed perennial stream. The unnamed stream continues approximately 0.75 miles to the confluence with Fites Creek. The surface water pathway continues along Fites Creek approximately 1.5 miles where it merges with the Catawba River (See **Figure 3-2**). The Catawba River is classified as WS-III by the North Carolina Water Quality Standards. These standards are established under the North Carolina Administrative Code (Title 15, Chapter 2, Subchapter 2B). The code establishes classes of freshwaters based on discharges to the water body and its quality. Chemical quality standards for surface waters are also established under the Code (Section 2B.0211). Flow rates in Fites Creek near Catawba Heights were calculated to be 4.6 cubic feet per second (cfs). The average flow rate along the Catawba River at US 85 near Belmont is 2,109 cfs.

3.4 GEOLOGY

The Site is located within the central portion of the Charlotte Belt of North Carolina. The rock types that underlie this terrain are dominated by granitic type rocks, metavolcanics, and gneisses and schists of varying types. The rock types are of varying metamorphic grade and all rock units trend parallel with the strike of the Appalachian Mountains, which is typically northeast to southwest. These same units typically dip to the southeast along with the regional topographic trend. Structurally, the area is complex with rock units displaying one or two types of metamorphism or structural changes, such as faulting or folding. A large, unnamed fault is located approximately six miles to the west of the Site.

According to the Geologic Map of North Carolina (1985), the Site is underlain by foliated to massive metamorphosed quartz diorite and massive to weakly foliated, hornblende rich granitic type rock. These rock units have undergone periods of deformation that have produced folding and fracture planes in the rock, as well as brittle zones where the rock is actually crushed, sheared, or faulted in some manner. As these rock types become weathered, soil profiles develop that are characteristic of the original rock (also referred to as saprolite). For example, the granite rock tends to weather to a clay rich loam or a dry rich sand, especially with depth. The sand originates from quartz content within the original parent rock; in some cases, larger grains of quartz sand can be found in the saprolite. As described above, the bedrock types have been fractured during metamorphic phases and, in some cases, the fracture places have been "resealed" by quartz. As the rock weathers, these quartz fillings are retained in the soil indicating that fractures existed in the rock. In addition, remnant fractures can be seen in the soil profile without quartz infilling as indicated by the presence of iron staining along the fracture plane. The iron staining, which is also referred to as the mineral

figure 3-2

limonite, is a result of groundwater leaching iron from the surrounding material, and as the groundwater travels along a fracture plane, the iron is being redeposited along the plane. Fracture planes were also detected during drilling as zones of weak to incompetent rock that were not resistant to the cutting action of the drill bit. These fracture zones, or secondary porosity features, were typically saturated.

During the field activities, the soil profile varied with each location; however, a common pattern was observed. From top to bottom, the materials consist of a saprolite layer, a partially weathered rock zone, and the underlying fractured crystalline bedrock. The saprolite is clay-rich, residual material derived from in-place weathering of bedrock. Typically, the saprolite is silty clay near the surface. With increasing depth, the amount of mica, silt, and fine-grained sand and gravel tend to increase. Remnant fracture planes with quartz infilling appear in this layer. The saprolite zone is thickest (approximately 125 feet) along the ridgeline on the western edge of the Site, thinning towards the lower elevations or stream valleys to approximately 30 feet in thickness. **Figures 3-3** thru **Figures 3-6** present geologic cross-sections along various locations around the Site. Underlying the saprolite is a partially weathered rock layer derived from the weathering of bedrock that ranges in thickness from approximately 10 to 50 feet. This layer is composed of saprolite and fragments of weathered bedrock. Particle sizes range from silts and clays to large boulders of unweathered bedrock. The weathering occurs in bedrock zones less resistant to physical and chemical degradation (i.e., fault zones, stress relief fractures, and mineralogic zones).

The predominant rock types, based on rock cores obtained during bedrock monitoring well drilling, appear to be metamorphosed quartz diorite and metamorphosed granite or granitic gneiss. The bedrock is fractured and these fractures contain quartz deposits that remain unweathered in the saprolite. The rock quality designation (RQD) which is the measure of the quality of a rock mass ranged from 0 to 45 percent; RQD values less than 50 percent indicate very poor to poor rock and generally high in fractures. **Figure 3-7** depicts the top of bedrock contours developed from the information contained in **Table 3-2**.

3.5 HYDROGEOLOGY

Regionally, the water bearing units that underlie the Site and surrounding areas represent an aquifer system consisting of metamorphosed and fractured quartz diorite and granitic type rocks in varying proportions and thicknesses. Geologic structures that produce high-yielding wells include contact zones of multilayered rock units, zones of fracture concentration, and stress-relief fracture zones. According to LeGrand and Mundorff (1952), wells in Gaston County that are set within granite have an average depth of 165 feet and an average yield of 18 gallons per minute. Within this area, LeGrand and Mundorff indicate that well depths range from 85 to over 1,000 feet and that well yields range from 2.5 to 116 gallons per minute. The aquifer system underlying the Site generally consists of the saprolite/partially weathered rock aquifer and the underlying bedrock aquifer; however, interconnection between these units is likely which would influence contaminant transport.

FIGURES 3-3 thru 3-7

TABLE 3-2. TOP OF BEDROCK ELEVATIONS FOR THE NORTH BELMONT PCE SITE.

STATION	EASTING	NORTHING	TOC ELEV, ft msl	TOTAL DEPTH, ft	TOP OF ROCK, ft	ROCK ELEV, ft
MW-1	1387833.98	560966.36	739.88	112	112	627.88
MW-2	1387895.55	561140.41	734.18	89	89	645.18
MW-3	1387895.55	561150.41	734.18	150	89	645.18
MW-4	1387530.12	560938.87	743.74	82	82	661.74
MW-5	1388416.24	560690.37	727.22	113	113	614.22
MW-6	1387857.53	560897.83	745.65	128.96	128.96	616.69
MW-7	1389374.2	560964.95	717.95	115	115	602.95
MW-8	1388158.44	561530.6	711.6	46.3	46.3	665.3
MW-9	1389506.65	561364.34	704.24	74	74	630.24
MW-10	1389197.43	560407.79	732.1	67.3	67.3	664.8
MW-11	1387760.65	560529.34	743.03	74.9	74.9	668.13
MW-12	1387700.56	561435.07	727.15	70.4	70.4	656.75
MW-13	1388892.9	561831.5	689.33	44.4	44.4	644.93
MW-14	1387840.6	560842.27	743.71	145.8	128	615.71
MW-15	1389425.53	560996.1	717.32	140	118	599.32
MW-16	1388139.8	561495.27	714.36	72.5	69	645.36
MW-17	1389834.91	561810.48	666.87	50	28.4	638.47
MW-18	1389063.46	560547.08	728.7	161	139	589.7
MW-19	1387790.53	560525.08	740.44	179.7	77	663.44
MW-20	1387545.37	560921.31	743.63	122.5	105.5	638.13
MW-21	1388874.67	561938.07	693.04	82.96	46	647.04
MW-22	1389520.01	561336.78	703.06	102.6	75	628.06
CW-1	1388108.99	560871.66	735.72	105	120	615.72
CW-2	1388120.87	560871.37	735.79	177.6	120	615.79
CW-3	1388183.2	560877.47	734.26	184	120	614.26
CW-4	1388301.12	560865.57	732.43	148	120	612.43
CW-5	1387966.65	561270.94	729.15	53.4	40	689.15
CW-6	1388127.45	561184.75	725.78	84.4	64	661.78
CW-7	1388605.84	561315.12	714.31	105.2	60	654.31
CW-8	1388785.96	561233.49	706.05	71.7	65	641.05
CW-9	1389185.86	560925.95	721.16	130.4	65	656.16

In the Site area, the top of the water table is typically found in the saprolite aquifer and will generally mimic the overlying land surface. **Figures 3-3** through **3-6** present cross-sectional views of the saprolite and bedrock aquifer. The depth to water across the area ranges from approximately 3 to 35 feet below ground surface. **Table 3-3** presents groundwater elevations collected from March through November 1996. The relatively shallow depths to water occur within the basin of the stream located along the northern edge of the Site. The greatest depth to water is found along the ridgeline on the western portion of the Site, which is also the location of the Roper's Shopping Center and North Belmont Elementary School.

TABLE 3-3. 1996 GROUNDWATER ELEVATIONS AT THE NORTH BELMONT PCE SITE.

STATION	EASTING	NORTHING	TOC ELEV ft msl	1-3 QTR GW LEVEL ft	1-3 QTR GW ELEV ft msl	4TH QTR GW LEVEL ft	4TH QTR GW ELEV ft msl
MW-1	1387833.98	560966.36	739.88	26.5	713.38	30.4	709.48
MW-2	1387895.55	561140.41	734.18	22.1	712.08	25.7	708.48
MW-3	1387895.55	561150.41	734.18	23	711.18	27.1	707.08
MW-4	1387530.12	560938.87	743.74	31.3	712.44	33.2	710.54
MW-5	1388416.24	560690.37	727.22	14.9	712.32	20.5	706.72
MW-6	1387857.53	560897.83	745.65	34.6	711.05	34.5	711.15
MW-7	1389374.2	560964.95	717.95	27.3	690.65	27.6	690.35
MW-8	1388158.44	561530.6	711.6	25.3	686.3	22.5	689.1
MW-9	1389506.65	561364.34	704.24	32	672.24	32	672.24
MW-10	1389197.43	560407.79	732.1	32.6	699.5	32.9	699.2
MW-11	1387760.65	560529.34	743.03	33.8	709.23	32.4	710.63
MW-12	1387700.56	561435.07	727.15	23.5	703.65	23.4	703.75
MW-13	1388892.9	561831.5	689.33	3.1	686.23	7.2	682.13
MW-14	1387840.6	560842.27	743.71	31.6	712.11	31.7	712.01
MW-15	1389425.53	560996.1	717.32	27.2	690.12	28.58	688.74
MW-16	1388139.8	561495.27	714.36	21.4	692.96	21.6	692.76
MW-17	1389834.91	561810.48	666.87	7.4	659.47	7.22	659.65
MW-18	1389063.46	560547.08	728.7	27.5	701.2	28	700.7
MW-19	1387790.53	560525.08	740.44	34.7	705.74	30.5	709.94
MW-20	1387545.37	560921.31	743.63	34.4	709.23	33.2	710.43
MW-21	1388874.67	561938.07	693.04	2.6	690.44	3.4	689.64
MW-22	1389520.01	561336.78	703.06	30.8	672.26	30.8	672.26
CW-1	1388108.99	560871.66	735.72	24.2	711.52	27.8	707.92
CW-2	1388120.87	560871.37	735.79	24.1	711.69	27.8	707.99
CW-3	1388183.2	560877.47	734.26	25.7	708.56	30.8	703.46
CW-4	1388301.12	560865.57	732.43	20.4	712.03	28.9	703.53
CW-5	1387966.65	561270.94	729.15	19.6	709.55	25.4	703.75
CW-6	1388127.45	561184.75	725.78	21.1	704.68	25.2	700.58
CW-7	1388605.84	561315.12	714.31	21.4	692.91	26.4	687.91
CW-8	1388785.96	561233.49	706.05	13.9	692.15	17.6	688.45
CW-9	1389185.86	560925.95	721.16	26.8	694.36	24.9	696.26

Using groundwater elevations collected in November 1996 and potentiometric maps drawn from these groundwater elevations, groundwater within the saprolite and bedrock aquifer generally flows to the northeast to east across the site. **Figures 3-8** and **3-9** depict the saprolite and bedrock aquifer potentiometric maps, respectively. Based upon the potentiometric contours, Roper's Shopping Center appears to be positioned within the top of a localized groundwater mound with potentiometric contours emanating in a semi-circular pattern from this point. Insufficient data of groundwater elevations along the western edge of the Site prevent completion of the potentiometric contours.

Based on depth-to-water measurements for monitor wells MW-13 and MW-21, groundwater discharges from the saprolite and bedrock aquifers into the small stream along the northern edge of the Site; however, fractures present in the partially weathered rock and bedrock will affect the direction of groundwater flow and relict fractures present in the saprolite

Figures 3-8 and 3-9

may also control groundwater flow directions. According to Harned (1989), while working in the Piedmont Province of Guilford and Mecklenburg Counties of North Carolina, most of the natural flow in the bedrock system is probably confined to the upper 30 feet of bedrock where fractures are concentrated, and the overlying transition zone which apparently has the highest hydraulic conductivity of any part of the hydrogeologic system.

3.5.1 Geophysical Borehole Logging

Five monitor wells, MW-14, MW-15, MW-18, MW-20, and MW-21, were examined as a part of the geophysical logging portion of the field investigation. Within each well, specific zones have been identified that appear to have fractures with indications of hydrologic activity at the time of logging or fractures that appear to have characteristics of possible hydrologic activity. Hydrologically active fractures are those that appear to be contributing water to the water column under static well conditions, and these hydrologically active fractures may potentially act as contaminant transport pathways.

As typical of bedrock aquifers in this region, the groundwater transport mechanism is characterized by fracture sets having high dip angles intersecting fracture sets with medium to low dip angles. Dip angle refers to the angle that the fracture plane makes to the horizontal plane or, in this case, the assumed local ground surface. Those fractures with higher dip angle provide gravity induced drainage from the overlying surface and surface soil cover. As fractures with high dip angle intersect lower angle fractures, lateral transport occurs. A summarization of the location or depth to fractures, the angles associated with these fractures, and zones of interest are found in **Table 3-4.**

The location of high dip angle fractures varied within each borehole, although each contained at least one zone of high dip angle fractures. Based on the data summarized in **Table 3-4**, the average dip angle of high dip angle fractures beneath the site is approximately 60 degrees. The average dip direction of the high dip angle fractures is N74.37 degrees, and the average dip direction of all features logged is N66.51 degrees. However, there appears to be fractures or other features that dip toward numerous directions across the Site. At the time of logging, not every fracture was found to be hydrologically active, although many fractures appear to have characteristics of active flow. Those zones determined to have hydrologic activity at the time of logging are as follows:

Well Number	Depth of Active Zone
MW-14	129 to 137 feet
MW-15	Not clearly defined
MW-18	138.5 to 144.8 feet
MW-20	101 to 112 feet
MW-21	Not clearly defined

TABLE 3-4. GEOPHYSICAL BOREHOLE LOGGING ZONES OF INTEREST IN MONITOR WELLS

Well	Zone of Interest (ft. btoc)	Bands within Interest Zone (ft. btoc)	Band Strike[1] and Dip[2]	Depth to High Dip Angle Features (ft. btoc)	Average Strike and Dip of High Angle Features	Potential Hydrologic Activity	Comments
MW-14	129-137	1) 129.5 to 132 2) 134.7 to 135	N338,32° N83,13°	130 to 136	N342,61°	Definite	1. Broken weathered rock found along borehole wall. Erosion of softer rock has occurred. 2. Slight temperature change to water within well. 3. Intersection of low dip angle fracture sets with high dip angle sets prominent.
MW-15	116 to 124	1) 119 to 119.2 2) 123	N229,43°	120 to 126	N116,60°	Probable; fractures appear to have characteristics necessary for providing flow into the well.	1. Broken, weathered rock in zone of interest. Erosion of softer rock has occurred. 2. Minor temperature response at 123 feet.
MW-18	139 to 150	1) 138.5 to 144.8 2) 146 to 148.7	N182,31° N036,18°	139 to 160	N026,67° N167,62°	Definite	1. Weathered and broken rock prominent, with erosion of soft materials. 2. Presence of water-filled fractures and erosion cavities.
MW-20	101 to 112	1) 103.2 to 104.5 2) 105.7 to 106 3) 110.3 to 110.4 4) 111.4 to 111.5 5) 111.8 to 112	N158,19° N205,27° N176,56° N191,55° N118,28°	103 to 112	N182,56° N177,25°	Definite	1. Broken and weathered rock prominent, with erosion of softer zones and open fractures. 2. Presence of water-filled fractures and erosion cavities. 1. No strong temperature response.
	117 to 122	1) 119.8 to 120.1	N119,17°	None		Hydrologic activity not indicated	1. No temperature response. 2. Sound and competent rock in this well. 3. Possible water-filled fractures.
MW-21	48 to 81	1) 80.1 to 81.4	N352,20°	48 to 81	N335,52°	Probable	1. No temperature response. 2. Sound and competent rock in this well. 3. Possible water-filled fractures.

Notes: "Strike" is interpreted as the direction in which a horizontal line can be drawn on a plane using true north as the starting point. In general terms, strick is also used in the sense of the general trend or run of the beds.
"Dip" is interpreted as the angle that a plane makes with a horizontal plane, typically the surface of the earth - the angle being measured in a direction perpendicular to the strike of the plane.
ft. btoc = feet below top of casing.

Since the borehole logging techniques use temperature response as an indicator of potential hydrologic activity, those zones within boreholes where no response is detected are typically regarded as not hydrologically active. However, because the saprolite, partially weathered bedrock, and bedrock aquifer zones are interconnected through gradational contacts, the possibility exists that groundwater moving downward or through these zones does not change temperature. As a result, a temperature response log may classify a fracture or other feature as not hydrologically active.

The lateral and vertical extent of hydrologically active or potentially active fractures was not determined via this borehole logging investigation. The interconnectivity of the fractures was also not defined. However, based upon the detection of contaminants during groundwater sampling activities, the spread of contamination within the bedrock aquifer may likely be attributed to the interconnection of fractures.

3.6 RESIDENTIAL WELL INVENTORY AND WATER USE

A residential well survey was conducted by Weston in October, 1995 and the results of this survey are shown on **Figure 3-10**, and the associated database is included in Appendix A. Groundwater is considered as a Class IIA Aquifer since it is currently used as a drinking water source (USEPA, 1988, Guidance on Remedial Actions for Contaminated Groundwater on Superfund Sites). The State of North Carolina classifies the aquifer as a GA aquifer since it is a present drinking water source and contains naturally occurring chloride concentrations less than 250 milligrams per liter (North Carolina Administrative Code, Title 15, Subchapter 2B.0201).

3.7 ECOLOGY

3.7.1 Wildlife and Natural Resources

According to the Gaston County Division of Planning, there are no endangered species within a one mile radius of the Site. There is one sensitive environment named Rankin Forest located within the three- to four-mile radius of the Site (See **Figure 3-11)**. The Bigleaf Magnolia (Magnolia macrophylla) grows within the Rankin Forest and is characterized as significantly rare by the State. The nearest wetlands are found along Fites Creek within 3 miles of the Site (See **Figure 3-2)**.

3.7.2 Bioassessment

Benthic Macroinvertebrates. A complete list of the benthic macroinvertebrates collected, the EPT Index, total taxa and total individuals, and the habitat score for all stations is included in Appendix A. The EPT Index represents the total number of EPT species (Ephemeroptera - mayflies, Plecoptera - stoneflies, and Trichoptera - caddisflies) collected at a site. These three

FIGURES 3-10 AND 3-11

orders of benthic macroinvertebrates are generally considered the most pollution-sensitive and their presence or absence is an indication of water quality conditions. The unnamed tributary - "A" is a first order stream. Low diversity and abundance characterized the benthic macroinvertebrate collections from the unnamed tributary due to its origin in and drainage through an urbanized area.

Station UT-1, near the headwaters and upstream of the Site (**Figure 2-5**), had the lowest number of species collected (7) and the lowest total organisms collected (35). Only one EPT species, the caddisfly Diplectrona, was collected at UT-1. Two-thirds of the organisms collected at UT-1 were crayfish (Astacidae). UT-1A, the station most proximal to the Site and downstream of UT-1 (**Figure 2-5**), had almost four times the species (24) collected at UT-1. However, the EPT Index was still only 1 (mayfly=Baetis) at UT-1A. The total number of benthic macroinvertebrates collected at UT-1A was 75. Over half of that number were pollution tolerant flies and midges (Diptera).

Station UT-2, downstream of the Site and less than a 1000 foot upstream of the confluence with the unnamed tributary to Fites Creek, was similar in the total species (28)and total number (96) collected at UT-1A. However, the benthic macroinvertebrate community at UT-2 was different in species composition from that at UT-1A. Pollution tolerant flies and midges (Diptera) comprised 78% of the benthic macroinvertebrate collections at UT-2. UT-2 had an EPT Index of only 2 (Ephemeroptera= Stenonema; Trichoptera= Diplectrona).

The reference stream, Dutchmans Creek at State Route 1918 (DC-1), is a larger stream than the unnamed tributary studied during this investigation (**Figure 2-6**). Benthic macroinvertebrate collections at DC-1 were diverse with a total of 258 organisms collected representing 35 total species. The EPT Index at DC-1 was 17. Almost half (49%) of the total benthic macroinvertebrates collected were from the pollution-sensitive Ephemeroptera, Plecoptera, and Trichoptera.

Habitat Evaluations. Habitat evaluation scores were low at the unnamed tributary - "A" stations. Habitat evaluation scores for the unnamed tributary were in the "fair" category and ranged from 56-67. Sedimentation, lack of stable habitats (rubble, gravel, logs, or undercut banks), and the lack of riffles and runs all contributed to low habitat evaluation scores. The reference station (DC-1), although experiencing some effects from sedimentation, had a habitat evaluation score of 100 which falls in the "good" category. Streams with degraded habitats are characterized by a benthic macroinvertebrate fauna composed of pollution-tolerant and opportunistic species. This seems to be the case for the unnamed tributary.

In-situ Physicochemical Measurements. **Table 3-5** presents results of the in-situ physicochemical measurements taken at each sampling station. Dissolved oxygen, pH, and water temperature measurements at all stations revealed no striking differences. Dissolved oxygen ranged between 7.0 - 8.0 mg/L, pH ranged from 6.6 to 7.4, and the water temperature ranged from 19 to 22° Centigrade. Conductivity at the unnamed tributary was higher (range:

TABLE 3-5. RESULTS OF IN-SITU PHYSICOCHEMICAL MEASUREMENTS; UNNAMED TRIBUTARY - "A" (UT) ADJACENT TO THE SITE AND DUTCHMANS CREEK (DC) REFERENCE STREAM; JULY 1996.

STATION	DATE	TIME	DISSOLVED OXYGEN (mg/L)	CONDUCTIVITY (umhos/cm)	pH	WATERTEMP. (°C)
UT-1	7/10/96	1205	7.4	119.9	6.9	20.4
UT-1A	7/10/96	1615	7.2	114.0	6.6	21.8
UT-2	7/10/96	1305	7.9	203.0	7.2	20.3
DC-1	7/11/96	0830	7.9	75.1	7.0	20.4

114 - 203 umhos/cm) than DC-1, the reference station (75 umhos/cm) possibly due to urban influences in the drainage area of the unnamed tributary. In-situ physicochemical measurements revealed no violations of state water quality standards.

The Rapid Bioassessment III of the unnamed tributary adjacent to the Site (stations UT-1, UT-1A, and UT-2) and Dutchmans Creek (reference station DC-1) resulted in these findings:

> Benthic macroinvertebrate collections from the unnamed tributary (UT) indicate that the creek is impaired. Pollution-tolerant species of benthic macroinvertebrates, primarily midges and flies (Diptera) were predominant numerically in both taxa (species) and individuals (density).
>
> Benthic macroinvertebrate collections from the reference station, Dutchmans Creek (DC-1), were diverse with a total of 35 species classified. Pollution-sensitive species of benthic macroinvertebrates (Ephemeroptera, Plecoptera, and Trichoptera = EPT) were more prevalent at DC-1 from both a numerical density and taxa richness perspective. No impairment is indicated for DC-1.
>
> Habitat degradation was evident at all the unnamed tributary stations. Lack of habitat diversity, siltation/sedimentation, and the absence of riffle/runs all contributed to low habitat evaluation scores. This was an obvious factor affecting the benthic macroinvertebrates at the unnamed tributary since the biological potential of a site is largely determined by the quality of the habitat at that site. Quality of the habitat at all the unnamed tributary sites could only be classified as fair. Habitat evaluation scores ranged from 56-67.
>
> The reference station, DC-1, had a habitat evaluation score of 100 which falls into the classification of "good" based on the habitat assessment form. Some sedimentation effects prohibited DC-1 from having a habitat evaluation score in the "excellent" range (104-135). Habitat diversity, coupled with no serious habitat degradation, led to a diverse benthic macroinvertebrate fauna at DC-1.

In-situ physicochemical measurements at the unnamed tributary (UT) and Dutchmans Creek (DC-1) revealed no violations of state water quality standards. Dissolved oxygen, pH, and water temperature were similar in range at both creek systems. Conductivity values were higher at the unnamed tributary possibly due to the effects of urban drainage.

Due to the unnamed tributary's location in a highly urbanized area, it is difficult, without extensive and intensive study efforts, to ascertain what effect the Site has on impairment of the benthic macroinvertebrate community. For example, both urban and Site effects could be impacting the biology of the unnamed tributary.