

3.7.4 Surface Water Quality

Four major waterbodies are found within the expanded study area: the Millstone River, Little Bear Brook, the D&R Canal and Carnegie Lake. The expanded study area drains primarily to the Millstone River, Little Bear Brook, and the D&R Canal. A small, isolated depression, located in the northwest quadrant of the Route 1/Alexander Road intersection, accepts a small portion of expanded study area runoff. The high point elevation in the expanded study area is located approximately at the intersection of Washington Road and Route 1.

Millstone River

The Millstone River runs parallel to the northern expanded study area boundary. The river flows in a northwesterly direction and discharges to Carnegie Lake under an aqueduct that carries the D&R Canal over the river. Prior to discharging to Carnegie Lake, the following perennial stream channels are tributary to the Millstone River from east to west: Cranbury Brook, Big Bear Brook, Little Bear Brook and Devil's Brook. A small portion of Big Bear Brook is within the expanded study area, whereas Cranbury and Devils Brooks are adjacent to the expanded study area. Cranbury Brook and Devils Brook all enter the Millstone River from the north and are outside of the expanded study area. Cranbury Brook flows westerly and joins the Millstone just east of the NEC. Big Bear Brook flows in a northwesterly direction and discharges to the Millstone just west of the NEC. Devils Brook flows southwesterly and joins the Millstone River north of its junction with Little Bear Brook.

At a point approximately 125 feet northwest and downstream of the Route 1 crossing, the Millstone River is approximately 46 feet wide, 7.5 feet deep and the substrate is clay (NJDOT, 1985). In its entirety, the Millstone River is 38 miles long with a drainage area of approximately 271 square miles (NJDEP¹, 1993). The drainage area of the Millstone River at Carnegie Lake is 99 square miles (USDA, 1987). The drainage area of the river above its confluence with Little Bear Brook is 81.8 square miles. The Millstone River originates in Millstone Township in Monmouth County and extends north to the Raritan River near Manville and Bound Brook in Somerset County.

Approximately 23% of the study area currently drains to the Millstone River (Figure 3-28). This drainage area includes pervious and impervious surfaces north of Washington Road and east and west of Route 1, including the north and northwest portions of Sarnoff Corporation's complex. Runoff from pervious surfaces currently flows overland directly to the river. Runoff from impervious surfaces, including Route 1 (north and south of the river) and Harrison Street is discharged directly to the river either overland or via an underground piping system. No mechanisms are currently in place to control the rate of runoff or level of contaminant contribution.

Little Bear Brook

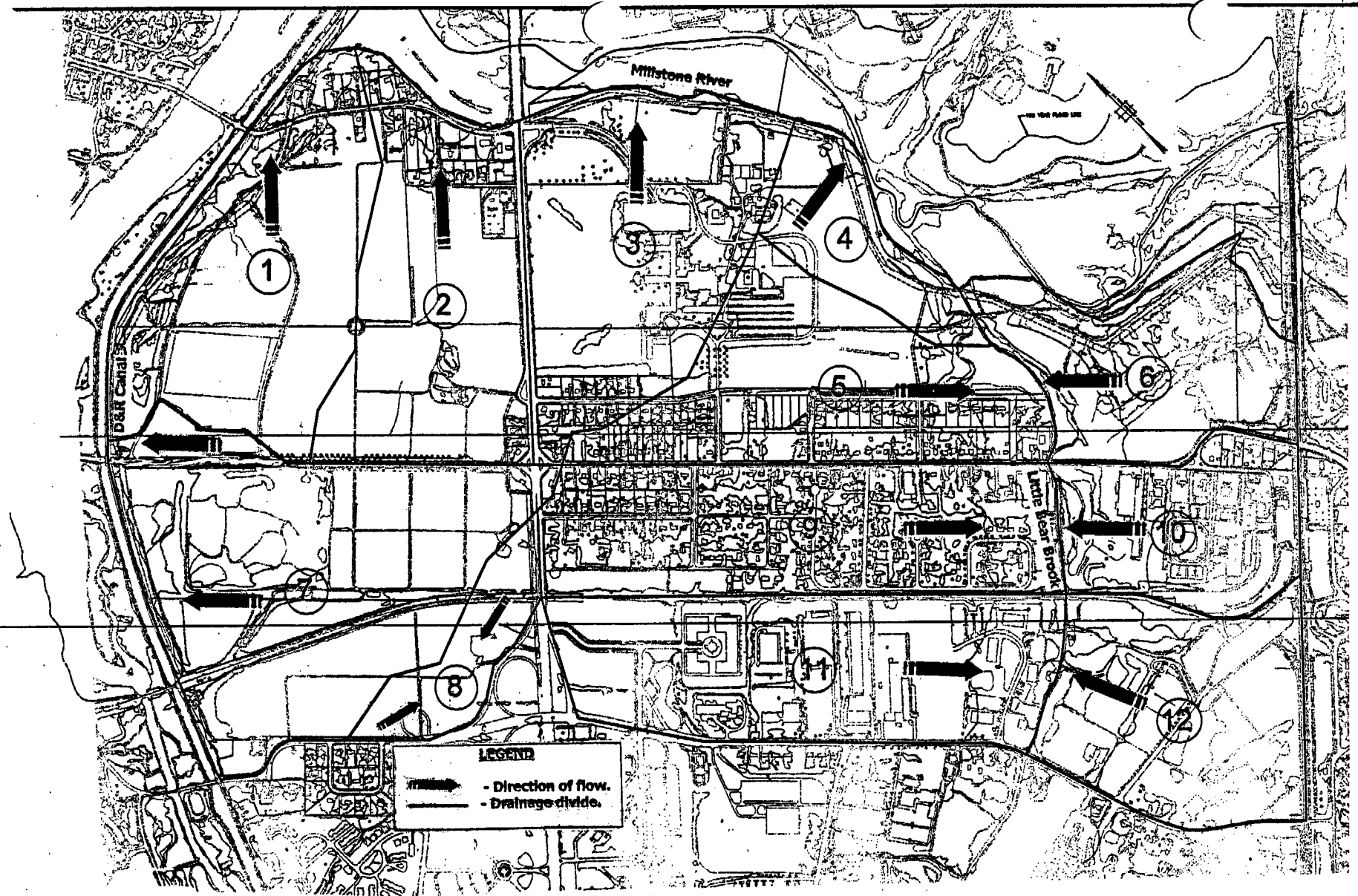
Little Bear Brook originates in Upper Bear Swamp in West Windsor Township, south of the study area. The brook flows in a northerly direction and joins the Millstone River north of Washington Road on the Sarnoff Corporation property. Little Bear Brook has a drainage area of 3.3 square miles at its confluence with the Millstone River. The substrate of the brook is comprised of a relatively thin layer of sand with underlying muck. According to FEMA (1983), the average velocity of Little Bear Brook within the study area is 2.3 feet per second.

Approximately 50% of the study area currently drains to Little Bear Brook (Figure 3-27). This drainage area includes pervious and impervious surfaces north and south of Washington and Alexander Roads east of Route 1, including the southeast portion of the Sarnoff building complex. Runoff from pervious surfaces currently flows overland directly to Little Bear Brook. Runoff from impervious surfaces, including Washington Road, Fisher Place and other neighborhood streets is discharged to the brook either overland or via an underground piping system. No mechanisms are currently in place to control the rate of runoff or level of contaminant contribution.

D&R Canal

The D&R Canal is located in the western portion of the expanded study area. The Canal is a 70-mile long, manmade water transportation system constructed in the mid-19th Century. According to the Delaware and Raritan Canal Commission (DRCC), the Canal is an average of 75 feet in width and 8.0 feet deep (www.dandrcanal.com/history.html). The configuration of the Canal is relatively straight. The Canal currently serves as a source of potable water and a recreational facility. The NJWSA operates and maintains the water transmission complex of the canal as a water supply resource, pumping out about 75 mgd (D&R Canal website, 2002; www.dandrcanal.com). Elizabethtown Water Company is a purveyor of the Canal water supply. Elizabethtown is a public utility providing New Jersey residents, businesses and industries with water supply resources.

Approximately 25% of the study area currently drains to the D&R Canal (Figure 3-27). This drainage area includes pervious and impervious surfaces on both sides of Washington and Alexander Roads west of Route 1. Runoff from pervious surfaces currently flows overland to culverts that discharge directly to the canal. Runoff from impervious surfaces, including portions of Washington and Alexander Roads, is discharged to the canal overland or via an underground piping system. No mechanisms or treatment facilities are currently in place to control the rate of runoff or level of contaminant contribution.



Summary of Sub-Watersheds in the Study Area

Number	Drainage Area	Discharges To	Number	Drainage Area	Discharges To
1	119.10	D&R Canal	7	167.50	D&R Canal
2	112.29	Millstone River	8	28.31	Isolated Pocket
3	123.93	Millstone River	9	118.93	Little Bear Brook
4	37.62	Millstone River	10	61.79	Little Bear Brook
5	105.95	Little Bear Brook	11	124.41	Little Bear Brook
6	78.53	Little Bear Brook	12	92.01	Little Bear Brook
Total Drainage Area				1,170.34	

Notes: Approximately 25% of the study area discharges to the D&R Canal.
 Approximately 23% of the study area discharges to the Millstone River.
 Approximately 50% of the study area discharges to Little Bear Brook.
 Approximately 2% of the study area is an isolated pocket.

NEW JERSEY DEPARTMENT OF TRANSPORTATION
 PENNS NECK AREA
 ENVIRONMENTAL IMPACT STATEMENT

EXISTING DRAINAGE AREA MAP

DATE: NOVEMBER 2002
 NOT TO SCALE

FIGURE 3-27

Carnegie Lake

Carnegie Lake is a man-made lake that was built in 1906 for use by Princeton University for sailing and specifically, rowing by the crew team. The lake is fed by Stony Brook south of the expanded study area, and impounded by a dam in Kingston, approximately 2.5 miles north of Princeton. Carnegie Lake is three and a half miles long and 800 feet wide at its widest point. The drainage area at the Kingston dam is 159 square miles (USGS, 2001). Carnegie Lake is classified as Freshwater 2, Non-Trout by the NJDEP Surface Water Quality Standards (1994).

Carnegie Lake forms the western study area boundary. Drainage to the lake is predominantly from the west, outside the study area. This drainage area includes pervious and impervious surfaces on both sides of the lake, but primarily on the west side. In the study area, the east side consists of a forested fringe and towpath between the lake and the D&R Canal. Runoff from pervious surfaces currently flows overland to storm drain inlets that discharge to the lake via an underground piping system. Runoff from impervious surfaces, including a portion of Faculty Road, upper Harrison Street, and Washington Road west of the lake is discharged to the lake either via overland flow or an underground piping system. No mechanisms or treatment facilities are currently in place to control the rate of runoff or level of contaminant contribution.

Isolated Depression

A low-lying area is found in the northwest quadrant of the Route 1 intersection with Alexander Road. This depression, created by construction of the interchange, collects stormwater runoff from the immediate surrounding area. Approximately 2% of the study area currently drains to this location (Figure 3-27).

Surface Water Standards and Criteria

All of the surface waterbodies in the study area are classified as Freshwater Class 2, Non-Trout Waters (FW2-NT) by the NJDEP, Surface Water Quality Standards (NJDEP³, 1994). FW2-NT waters have the following designated uses as defined in the New Jersey Surface Water Quality Standards:

- Maintenance, migration and propagation of the natural and established biota;
- Primary and secondary contact recreation;
- Industrial and agricultural water supply;
- Public potable water supply after such treatment as required by law or regulation; and,
- Any other reasonable uses.

Non-trout waters are "fresh waters that have not been designated as trout production or trout maintenance. Non-trout waters are generally not suitable for trout because of their physical, chemical, or biological characteristics, but are suitable for a wide variety of other fish species" (NJDEP³ 1994).

Discharges Affecting Waterbodies

According to the NJDEP, Division of Water Quality, there are fifteen permitted discharges in West Windsor Township. All but one of these are private and most of them discharge within the Raritan River Basin. All discharges to surface and groundwater are required to be in compliance with the specifications of the New Jersey Pollutant Discharge Elimination System (NJPDES) program. There are fifteen discharges located in Princeton Township and twelve in Plainsboro Township.

Surface Water Quality Data

Surface water sampling data was obtained from the NJDEP, *2000 New Jersey Water Quality Inventory Report* (NJDEP², 2001). The sampling data was obtained from 1995 to 1997. Three sampling stations were selected for inclusion in this document. These stations are situated within the Raritan River Basin and Watershed Management Area 10 (Millstone River watershed).⁹ Parameters sampled at these stations and documented in the *Inventory* include dissolved oxygen (DO), total phosphorus (TPO₄), un-ionized ammonia (NH₃), pH (i.e., acidity/alkalinity), total suspended solids (TSS) and fecal coliform (FC). A brief description of these parameters follows.

DO analysis measures the amount of gaseous oxygen (O₂) dissolved in an aqueous solution. Adequate DO is necessary for good water quality. As DO levels in water drop below 5.0 mg/l, aquatic life is put under stress. The lower the DO concentration, the greater the stress.

Phosphorus (TPO₄) is one of the key elements necessary for growth of plants and animals. If an excess of phosphate enters waterbodies, algae and aquatic plants can grow wild, choke the waterway and use up large amounts of oxygen, causing eutrophication.

Ammonia (NH₃) is present in aquatic systems mainly as the dissolved ion NH₄⁺, which is rapidly taken up by aquatic plants for growth. Despite its rapid uptake by algae, ammonia persists in small quantities because it is also a major excretory product of aquatic animals.

pH is a measure of the acidic or alkaline nature of a solution. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom-dwelling invertebrates.

Total Suspended Solids (TSS) is a measure of the turbidity in the water and can be visibly observed.

Total coliform bacteria is a collection of microorganisms that live in large numbers in the intestines of man and warm- and cold-blooded animals. Fecal

⁹ Twenty-one Water Management Areas (WMAs) have recently been delineated within New Jersey's five major drainage basins. Each basin constitutes a "Water Region". Within each WMA are several sub-basins, delineated by the USGS as "hydrologic units".

coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human or animal waste. Common sources of fecal coliforms in surface waters in New Jersey consist of waterfowl and specifically, Canada geese, due to a large and increasing resident population. The water may also be contaminated by pathogens or disease-producing bacteria or viruses which can exist in fecal material.

The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water.

The 2000 New Jersey Water Quality Inventory Report (NJDEP², 2001) sampling locations up and downstream of the study area and included herein are as follows:

- Millstone River near Manalapan (near the headwaters of the river southeast of the study area);
- Millstone River at Grovers Mill (just east and upstream of the study area);
- Stony Brook at Princeton (adjacent to the southern study area boundary; upstream of the study area); and,
- Millstone River at Blackwells Mills (north and downstream of the study area).

None of the samples from the four stations demonstrated impairment due to low DO or ammonia. However, all of the samples had exceedances for TPO_4 , and three were impaired due to unacceptable pH levels. The only station assessed for TSS, the Stony Brook station, was impaired due to unacceptable TSS, and two of the Millstone River stations were partially impaired due to fecal coliform exceedances. A summary of physical and chemical water quality characteristics at these locations is provided in Table 3-28.

Nutrient enrichment, as reflected in TPO_4 , varies in the Millstone from mild as observed near Manalapan, to severe downstream at Blackwells Mills. The pattern for inorganic nitrogen is moderate (but acceptable) near Manalapan, very high at Grovers Mill, and lower again at Blackwells Mills. Grovers Mill shows severely depressed DO in the summer and fall. Sanitary quality to some extent mirrors phosphorus upstream near Manalapan, where conditions show mildly elevated bacterial levels, rising a bit at Grovers Mill and becoming unacceptable at the downstream-most station at Blackwells Mills. Elevated lead appears to be a problem at all three monitoring locations. In addition, violations were recorded near Manalapan for zinc and at Grovers Mill for cadmium.

Compared to the previous assessment period, (1986 through 1990), the Manalapan site has not changed. Grovers Mill has improved with respect to BOD, DO, TPO_4 and sanitary quality. Lead and chromium violations appear to come and go through various assessment periods. Conditions at Blackwells Mills may have improved slightly with regard to TPO_4 and sanitary conditions.

The predominant nonpoint pollution sources in the Millstone watershed are those associated with suburban development, which had been reported to be on the increase throughout the watershed

Runoff from construction sites, suburban surfaces, storm sewers and roads are contributing to excessive sediment loading. Septic systems are also believed to be a potential pollution problem throughout the watershed.

No other parameters in this survey appear to exceed recommended maximum contaminant levels (MCLs). Additional water quality information for surface waters in the study area is included in the *Natural Ecosystems Technical Environmental Study, Penns Neck Area EIS*.

Penns Neck Area EIS Water Sampling Program

A water sampling study was conducted as part of the Penns Neck Area EIS to assess water quality within the study area. During the winter of 2002, water samples were taken at five locations within the study area along the D&R Canal, Millstone River and Little Bear Brook. Sampling locations are shown in Figure 3-28 and include:

- SW-1 - D&R Canal at Washington Road;
- SW-2 - D&R Canal at Harrison Street;
- SW-3 - Confluence of the Millstone River and Devil's Brook;
- SW-4 - Millstone River at D&R Canal/Carnegie Lake culvert; and,
- SW-5 - Little Bear Brook at Washington Road.

The samples were analyzed for several pollutants to assess water quality in the study area. The findings were compared with New Jersey State Surface Water Quality Standards (NJAC 7:9B, 1994). Some parameters do not have State drinking water standards and hence, no standards were provided. Table 3-28 presents the results of the sampling study and the water quality standards.

As shown in Table 3-28, several parameter concentrations were too low to be measured, as they were below the method detection limit (MDL). The MDL is the minimum concentration of a substance that can be measured and reported with 99% confidence that the concentration is greater than zero. In these instances, the pollutant may be present at some level below the MDL, or may not be present at all. The MDL can vary from substance to substance and from one measurement procedure to another. Results for parameters below the MDL are shown in the table with a less than (<) sign.

As shown in Table 3-28, none of the pollutant concentrations exceeded State Standards.

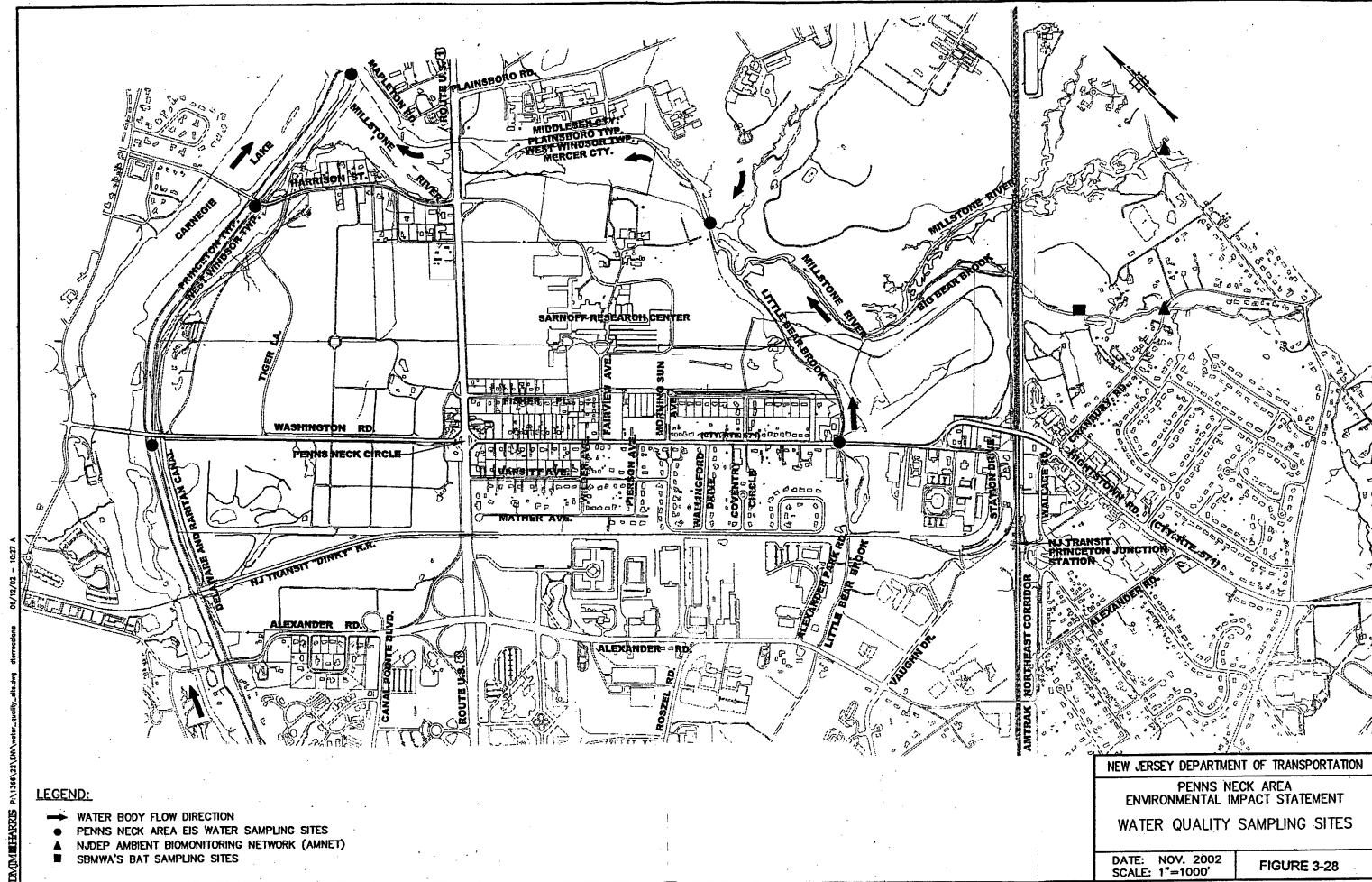


Table 3-28
Local Area Water Sampling Study Results

Parameter	Sample Site					
	State Standard Mg/l	SW-1 (mg/l)	SW-2 (mg/L)	SW-3 (mg/L)	SW-4 (mg/L)	SW-5 (mg/L)
Parameters With Water Quality Standards						
Total Suspended Solids (TSS)	40 (s)	2.8	7.4	7.0	6.3	23.9
Chloride (Cl)	250 (s)	23	23	20	40	190
Lead (Pb)	0.0005 (s)	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium (Cd)	0.01 (s)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium (Cr)	0.16 (s)	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	0.000144 (s)	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Zinc (Zn)	NA	0.04	0.085	0.163	0.039	0.079
Iron (Fe)	NA	0.167	0.152	0.630	0.528	2.095
Copper (Cu)	NA	<0.02	<0.02	0.034	0.02	<0.02
Parameters Without Water Quality Standards						
Volatile Suspended Solids (VSS)	NA	2.6	3.4	5.0	4.0	13.3
Total Volatile Solids (TVS)	NA	30	20	32	46	42
Total Kjeldahl Nitrogen (TKN)	NA	<1.0	<1.0	1.22	1.33	1.45
Biochemical Oxygen Demand (BOD)	NA	<10	<10	<10	<10	<10
Total Organic Carbon (TOC)	NA	3.01	2.78	5.13	3.82	6.03
Chemical Oxygen Demand (COD)	NA	<10	<10	<10	<10	12.0
Total Nitrate (TN)	NA	1.10	1.06	1.79	3.0	1.37
Total Phosphorus (TPO ₄)	NA	<0.05	<0.05	<0.05	<0.05	<0.05
Calcium (Ca)	NA	17.7	21.7	9.08	10.24	31.0
Sodium (Na)	NA	16.8	15.4	30.9	31.5	94.9

Source: Lan Associates, 2003.

The water quality sampling data was compared with the findings of the 1993 West Windsor Environmental Commission study. Common parameters to both studies included total suspended solids (TSS) and total phosphorus. Equivalent TSS and total phosphorus concentrations were found in samples from Little Bear Brook.

West Windsor Environmental Commission Sampling Program

The West Windsor Environmental Commission conducted a limited water quality sampling program during two sampling periods, 1983-1987 and 1990-1993. This sampling program included locations within the study area along Little Bear Brook and Big Bear Brook.

This data is consistent with sampling done by the NJDEP, SBMWA, and the sampling work conducted for the Penns Neck Area EIS, in that it indicates that water quality in study area waterbodies has been and continues to be degraded by certain

pollutants. Additional information about this study may be found in the *Natural Ecosystems Technical Environmental Study, Penns Neck Area EIS*.

Public and Recreational Uses

The NJDEP Surface Water Classifications established uses for waterways in accordance with NJAC 7:9B-1.2. These uses include but are not limited to swimming and fishing for primary and secondary activities, respectively. Waters that fully support these uses are those that are non-impaired and can safely provide for these designated uses. Partially support means that portions of these waterbodies can support the designated uses and no support means that these waters are severely impaired (e.g., due to unacceptable high fecal coliform levels, low pH, etc.) and cannot support the designated uses. The Millstone River at Blackwells Mills does not support the designated uses provided for FW2-NT waters. Stony Brook, which is outside and upstream of the study area, partially supports its designated uses. Stony Brook discharges directly to the head of Carnegie Lake, which is situated within the study area.

According to the NJDEP, Division of Fish, Game and Wildlife, the D&R Canal is stocked with trout by the NJDEP during the annual spring stocking period. In addition, angling opportunities are fair for smallmouth bass, very good for largemouth bass, good for pickerel and very good for catfish or eels (NJDEP website, 2002; www.state.nj.us/dep/fgw).

Angling opportunities in Carnegie Lake are very good for catfish, carp and crappie; good for largemouth bass, pickerel, and channel catfish; fair for yellow perch; and poor or none for striped bass hybrid, trout, smallmouth bass, musky, northern pike and walleye.

Other recreation opportunities within Carnegie Lake, the Millstone River and the D&R Canal include birding, fishing, canoeing and kayaking. The D&R Canal affords miles of trails for hiking, running or bike riding. Carnegie Lake and the Canal also provide opportunities for electric outboard motorized boats. Carnegie Lake is the practice and competition location for the Princeton University crew team.

3.7.5 Aquatic Ecology

Benthic macroinvertebrates are organisms found on or in the sediments of waterbodies. They are commonly used as indicators of water quality because they are relatively immobile and therefore, useful for identifying site specific pollutant impacts. Different macroinvertebrate species have varying degrees of tolerance to different environmental factors including sedimentation, temperature, and pollutants. Some macroinvertebrates are very tolerant while others are very sensitive and cannot tolerate even minimal amounts of pollution. Through the collection and identification of individual species, the relative health of a waterbody can be determined (i.e., the greater the diversity of pollution intolerant species present, the healthier the stream). Examples of macroinvertebrates include insects (mostly immature forms), annelids

(worms, leeches), mollusks (snails, clams) and crustaceans (scuds, shrimp, water fleas, etc.).

Biological impairment may be caused by several major facts such as organic enrichment, habitat degradation, or toxicological effects. Impairment may be manifested in several aspects of the benthic macroinvertebrate community, including absence of pollution-sensitive taxa. The NJDEP defines the various degrees of waterway impairment as follows:

Non-impaired – Benthic community is comparable to other undisturbed streams within the region.

Moderately impaired - Macroinvertebrate richness is reduced, particular pollutant intolerant taxa.

Severely impaired – A dramatic change in the benthic community has occurred. Macroinvertebrates are dominated by a few taxa which are very abundant. Pollutant-tolerant taxa are the only individuals present.

Studies Conducted

In 1992, the NJDEP established the Ambient Biomonitoring Network (AMNET). This program conducts and evaluates long term monitoring data to support environmental policy decisions in watershed management and permitting activities. The first round of AMNET monitoring for the Raritan River basin occurred in 1993-94 and the second occurred in 1999 (NJDEP¹ - website).

The SBMWA initiated its own sampling program in the Stony Brook-Millstone watershed, known as Stream Watch, to examine the overall quality of the waters in the Stony Brook-Millstone watershed region. The Stream Watch program is comprised of three components: Chemical Assessment Teams (CATs), Biological Assessment Teams (BATs), and River Action Teams (RATs). Biological sampling locations coincide with the current StreamWatch sites allowing for comparisons to be made between the chemical and biological monitoring (SBMWA, 2000).

These waters were reported as “fair” in the 1992 NJDEP AMNET study, meaning that pollution varies from moderate to severe. The Millstone River habitat rating was sub-optimal at all AMNET stations sampled. StreamWatch determined that the overall water quality within the Stony Brook-Millstone watershed is fair (i.e., between moderate and severe).

3.7.6 Floodplains

The study area contains portions of the National Flood Insurance Program (NFIP) and NJDEP mapped floodplains for the Millstone River, Little Bear Brook, Carnegie Lake and the D&R Canal. The NFIP defines the 100-year flood as a flood that has a one percent chance of being equaled or exceeded in any given year. A base flood

may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

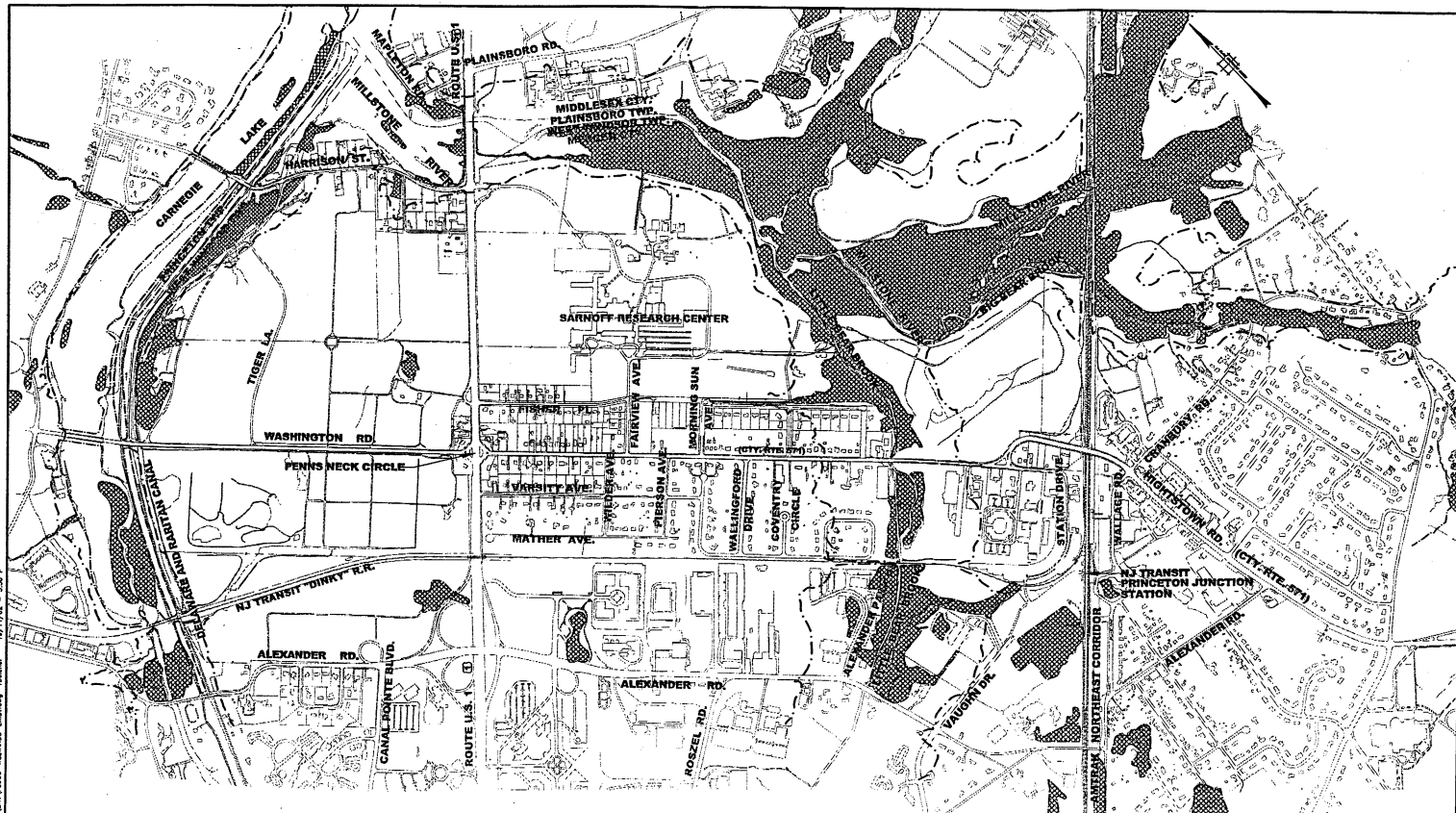
NJDEP regulates the flood hazard area design flood for delineated watercourses in New Jersey. The flood hazard area design flood is the flood resulting from the 100-year flood discharge increased by 25 percent. The Millstone River and Little Bear Brook flood hazard area design flood limits are shown on Figure 3-29. In some areas, such as along portions of Harrison Street, Fisher Place, Washington Road and Alexander Road, residential and commercial development has occurred within the Flood Hazard Area Design Flood and 100-Year Floodplain, apparently without regard to the inevitable consequences of such development and without compensating for the loss of flood storage area caused by the development. Elsewhere in the study area, such as along the east side of Little Bear Brook south of the Dinky, the floodplain has been preserved in a thoughtful planning effort to allow its intended flood management function to continue.

Unless otherwise noted, floodplain refers to the flood hazard area design flood limits for the Millstone River and Little Bear Brook, and to the 100-year floodplain limits for the D&R Canal and Carnegie Lake.

Within the study area, the floodplain of the Millstone River ranges in width from 1,000 to 1,500 feet. The 1,600-foot width of the Little Bear Brook floodplain is generally consistent within the study area. Floodplain characteristics feature broad, gradually sloping land forms in which the water channels wind and meander in response to sediment movements. In this environment, flooding is quick during storms. The Millstone River floodplain elevation varies from +67 feet at the NEC crossing to +58 feet downstream of the confluence with Stony Brook at Carnegie Lake. At the Route 1 crossing, the 100-year discharge of the Millstone River is 9,030 cubic feet per second (cfs) with a mean velocity of 1.3 feet per second (fps) (FEMA, 1983).

Approximately 23% percent of the study area currently drains to the Millstone River and approximately 50% percent of the study area currently drains to Little Bear Brook (Figure 3-27). No stormwater management facilities are currently in place to control the rate of runoff or the potential for flooding as a result of that runoff.

Carnegie Lake provides a large area for storage of flood flow. Consequently, the range from the normal low water level to the highest known water level has been relatively small (about 4 feet since records began). The lake is bordered by the D&R Canal along the east bank and by a comparatively high bank along the west side. The majority of the drainage to Carnegie Lake is from the west, outside the study area. No stormwater management facilities are currently in place to control the rate of runoff or the potential for flooding associated with this runoff.



LEGEND:

- EXISTING CONDITIONS
- WETLANDS
- NEW JERSEY FLOOD HAZARD AREA DESIGN FLOOD LINE

NEW JERSEY DEPARTMENT OF TRANSPORTATION

PENNS NECK AREA
 ENVIRONMENTAL IMPACT STATEMENT
 EXISTING CONDITIONS
 WETLANDS, WATERBODIES &
 FLOODPLAINS

DATE: NOV. 2002
 SCALE: 1"=1000'

FIGURE 3-29

Approximately 23% of the study area currently drains to the D&R Canal (Figure 3-27). The volume of water in the D&R Canal is regulated by opening and closing its weir systems. Flooding occurs when the weir systems are outpaced by the storm flows. Because the Millstone River flows under the D&R Canal aqueduct, the waters of the Millstone and the D&R Canal do not mix unless flooding conditions occur and the Millstone overtops the aqueduct, which is at an elevation of +55.9 feet. Normalized flows and water levels return when the weirs have been given sufficient time to discharge the excess water volume.

Approximately 2% of the study area drains to a small depression on the west side of Route 1 near the Alexander Road interchange. This depression was created during interchange construction and is intended to accommodate stormwater runoff.

3.7.7 Wetlands

Wetland Regulations

Freshwater wetlands and waters of the United States are regulated by Section 404 of the Clean Water Act, administered by the United States Army Corps of Engineers (USACE) and the NJDEP Freshwater Wetland Protection Act Rules (NJAC 7:7A, amended through 9/4/01). In 1993, the NJDEP assumed regulatory control over the Section 404 program in New Jersey for freshwater wetlands throughout the majority of the state although the USACE retains program oversight.

In accordance with the New Jersey Freshwater Wetlands Protection Act (FWPA) Rules, a freshwater wetland is defined as follows:

"An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; provided, however, that the Department, in designating a wetland, shall use the three-parameter approach (that is, hydrology, soils and vegetation) enumerated in the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands, and any subsequent amendments thereto incorporated herein by reference."

The Act defines state open waters (SOWs) as follows:

State open waters means all waters of the state including waters of the United States, but excluding groundwater and excluding freshwater wetlands.

Wetland and Waterbody Delineation Methodology

Wetlands and SOWs within the study area were delineated using the methodology outlined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Manual) (Federal Interagency Committee on Wetland Delineation, 1989). This document describes the three-parameter methodology for identifying and

delineating freshwater wetlands, whereby hydrophytic vegetation, hydric soils and sustaining wetland hydrology must be present in order for an area to be deemed a wetland. Existing published information was studied to determine the approximate extent of wetlands in the study area. All wetland delineations within the study area utilized the routine on-site delineation method as outlined in the Federal Manual.

Wetlands within Study Area

There are three main types of wetland habitats within the study area, consisting of forested, scrub-shrub and emergent. Forested wetlands are characterized by woody vegetation that is greater than twenty feet in height and typically consists of a canopy of trees, an understory of saplings or shrubs, and herbaceous ground cover. Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet in height and typically consist of shrubs and saplings and herbaceous ground cover. Within the study area, these wetlands are found adjacent to waterways and on sediment islands located in the stream channel. Emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. There are a total of approximately 245.13 acres of wetlands in the primary study area.

Study area wetlands and SOWs were delineated during the summer 1994, fall and winter 1995-1996 as part of a previous study area investigation by NJDOT. This information was then used to assess potential wetland impacts from each of the Action Alternatives. During the summer, 2002, field reconnaissance was conducted to confirm the previously delineated wetland boundaries. These areas were identified and mapped using available aerial photographs of the study area, New Jersey Freshwater Wetland quarter quadrangles, available base mapping, and previous wetland delineation boundary maps. During or prior to final design, study area wetlands will be re-flagged, surveyed and verified by the NJDEP. Applications for any required permits will be prepared and submitted to NJDEP for review and approval at that time.

The majority of the wetlands within the study area are palustrine, forested, broad-leaved deciduous wetlands (PFO1). All scrub-shrub wetlands in the study area are palustrine, broad-leaved deciduous (PSS1). Palustrine emergent wetlands (PEM) are present within the study area and the majority are located adjacent to or wholly within existing waterways.

Freshwater wetlands in New Jersey are given a resource value of exceptional, intermediate, or ordinary (NJAC 7:7A). In general, the majority of freshwater wetlands in New Jersey are classified as intermediate resource value with a regulated transition area of 50 feet. Exceptional resource value wetlands generally provide habitat for one or more threatened or endangered plant or wildlife species or contain trout-associated waters (i.e., trout production or trout maintenance). Exceptional resource value wetlands have a regulated transition area of 150 feet. Ordinary resource value wetlands are generally small in size, non-contiguous to other wetlands or waterbodies and surrounded largely by development. Ordinary resource value wetlands do not have a regulated transition area. The majority of wetlands within the

study area are likely considered intermediate resource value, as there are no known threatened or endangered species present in these wetlands (Section 3.7.9.6), and all waterbodies within the study area are classified as Non-Trout waters (NJDEP13, 1994).

Wetland and Waterbody Descriptions

As previously mentioned, there are four main waterbodies situated within the study area: the Millstone River, Little Bear Brook, the D&R Canal and Carnegie Lake. A detailed description of each of these waterbodies and associated wetlands is described below.

Millstone River

According to the NJDEP Freshwater Wetlands mapping, the Millstone River has several designations within the study area. Near Carnegie Lake, the river is classified as Palustrine Open Water, Permanent (POWH) with Seasonal PFO1 wetlands on its northern edge. This portion of the river also contains Seasonal PSS1 islands. Approaching the Route 1 corridor, the Millstone River is predominantly Seasonal PFO1 wetlands traversed by a Riverine, Lower Perennial, Open Water, Unknown Bottom (R2OW) channel. East of Route 1, the Millstone is Permanent POW adjacent to the Sarnoff Corporation, and then becomes Seasonal PFO1 in the eastern portion of the study area.

West of Route 1, the Millstone River is dominated by an abundance of arrow arum, water arum and arrowhead within the channel. The western portion of the Millstone River along Route 1 contains a forested fringe. Species along the perimeter include red maple (*Acer rubrum*), trident red maple (*Acer rubrum trilobum*), white mulberry (*Morus alba*), white willow (*Salix alba*) and silver maple in the canopy. The understory along the river's edge contains northern arrowwood (*Viburnum dentatum*) skunk cabbage (*Symplocarpus foetidus*), poison ivy and sensitive fern (*Onoclea sensibilis*).

The Millstone River on the eastern side of Route 1 is bordered by maintained lawn on both sides. Occasional shrub or herbaceous species include rugosa rose (*Rosa rugosa*), true forget-me-not (*Myosotis scorpioides*), and Virginia creeper. Portions of the Millstone River channel east of Route 1 contain an abundance of water arum (*Calla palustris*), arrow arum (*Peltandra virginica*).

Little Bear Brook

According to the NJDEP Freshwater Wetlands mapping, Little Bear Brook is classified as Seasonal PFO1 with a narrow R2OW channel. Little Bear Brook contains a forested wetland fringe, which is wider on the east than it is on the west. The narrow wetland fringe is bordered on the west by a steep embankment that slopes up to the Sarnoff Corporation property and an upland forested area. Little Bear Brook and its forested wetland fringe are dominated by trident red maple in the canopy, with associates of sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), pin oak (*Quercus palustris*) and white willow. The understory contains an

abundance of northern arrowwood, with spicebush (*Lindera benzoin*), silky dogwood (*Cornus amomum*), cinnamon fern (*Osmunda cinnamomea*), and sensitive fern.

D&R Canal

According to the NJDEP Freshwater Wetlands mapping, the D&R Canal is classified as R2OW. There are pockets of Saturated PFO1 wetlands along the D&R Canal within the study area. The towpaths themselves are generally bare or contain very sparse vegetation. Adjacent forested areas and the overhanging canopy, when present, include box elder maple (*Acer negundo*), American elm, trident red maple, red maple, pin oak, black locust (*Robinia pseudoacacia*), Norway maple (*Acer platanoides*), silver maple, black gum, and ailanthus (*Ailanthus altissima*). Commonly occurring shrub species include multiflora rose and raspberry species (*Rubus* spp.). Herbaceous species include grasses, poison ivy, Virginia creeper, Japanese honeysuckle (*Lonicera japonica*), garlic mustard (*Alliaria petiolata*) and crown vetch (*Coronilla varia*).

Carnegie Lake

According to the NJDEP Freshwater Wetlands mapping, Carnegie Lake is classified as a Lacustrine, Limnetic, Open Water, Unknown Bottom, Permanent, diked/impounded (L1OWHh) system. The eastern edge of the lake is forested and contains a variety of species, including trident red maple, red maple, white willow, sweetgum, and silver maple (*Acer saccharinum*). The understory of the lake's eastern forested edge contains multiflora rose along the edge of Harrison and Washington Roads, and northern arrowwood and silky dogwood further removed from the roadway. Arrow arum, water arum, and lizard's tail (*Saururus cernuus*) border the eastern lake edge within the water, forming an emergent fringe.

The western edge of the lake contains a forested fringe and portions of maintained lawn. Arrow arum and water arum are along much of the water's edge. The forested areas contain red maple, white willow, sweetgum and weeping willow (*Salix babylonica*). Swamp rose mallow, curly dock (*Rumex crispus*), white vervain (*Verbena urticifolia*), purple loosestrife (*Lythrum salicaria*), moth mullein (*Verbascum blattaria*), wild carrot (*Daucus carota*), wild cucumber (*Melothria pendula*), and Japanese honeysuckle are within the understory. Residential properties are along the majority of the western edge of the forested fringe.

Wetland Functions and Values

Hydrology. Wetland hydrology is defined as permanent or periodic inundation or soil saturation to the surface, at least seasonally, which are the driving forces behind wetland formation. All wetlands usually have at least a seasonal abundance of water, which may come from direct precipitation, overbank flooding, surface water runoff due to precipitation or snow melt, groundwater discharge, or tidal flooding. Based on their placement in the landscape, both the Millstone River and Little Bear Brook receive sustaining hydrology from direct precipitation, overland stormwater flow, and groundwater discharge. The low placement in the landscape in valleys and the

adjacent hydric soils with high groundwater tables indicate that the water table is close to the surface.

Flood Control. Any depression in the landscape has the potential to store water and, therefore, may play a role in flood control. The Millstone River and Little Bear Brook contain undeveloped, vegetated floodplains for a portion of their lengths within the Study area. These floodplains perform a flood protection and flood storage function, whereas developed areas adjacent to these stream channels provide minimal flood protection.

Groundwater Recharge and Discharge. Hydrologists seem to agree that while some wetlands recharge the groundwater, most do not. More wetlands function as important groundwater discharge areas than groundwater recharge areas (USDI, 1984). Wetlands associated with the Millstone River and Little Bear Brook predominantly contain hydric soils where the water table is at or close to the surface. Therefore, it is believed that groundwater discharge predominates in the study area wetlands.

Water Quality. Wetlands are important in maintaining water quality because they function as filters to remove pollutants and sediments from moving waters. This is true of wetlands in the study area.

Food Chain Support and Nutrient Cycling. The food chain support function of wetlands refers to the direct or indirect use of nutrient sources derived from wetlands by heterotrophic organisms. Wetlands, as with all ecosystems, have an inherent functional value in terms of food chain support. Wetlands in the study area have demonstrated at least moderate support of primary and secondary producers.

Habitat. Wetlands provide habitat for a variety of plants and animals. Some animals are completely dependent on wetlands for food, protection from weather and/or predators, resting areas, reproductive materials or sites, molting grounds, and other life requisites. Other animal species use wetlands for only part of their life functions. Upland habitats contained within the study area are described in more detail in Section 3.7.8, below.

Socioeconomic. The socioeconomic category involves wetland functions that, in many cases are the most obvious functions or values because individuals or groups are more likely to derive socioeconomic benefits directly. Socioeconomic functions can usually be separated into one of two categories, consumptive and non-consumptive. The consumptive category includes those products, usually food, fuel or fiber, whose production is dependent on wetlands and that are physically removed (i.e., harvested) for human utilization. The non-consumptive category includes the scenic, recreational, educational, aesthetic, archaeological, heritage, and historical values of wetlands, experienced directly or vicariously by individuals, while preserving the essential attributes of the wetland.

The study area does not contain any wetland resources for which consumptive use values are obtained. The Millstone River and Little Bear Brook provide non-consumptive use values for scenic and recreational activities within the study area.

3.7.8 Upland Vegetation

The study area has been largely developed. More specifically, the study area is divided among horticulture (sod, nursery), landscaped lawns, office/research complexes, and commercial and residential uses. The study area also contains undeveloped parcels consisting of forested uplands, forested wetlands and disturbed vacant land sites, such as composting yards. Existing upland vegetation types within the study area are illustrated on Figure 3-30. The existing terrestrial vegetation and wildlife habitat are presented in more detail in the sections to follow.

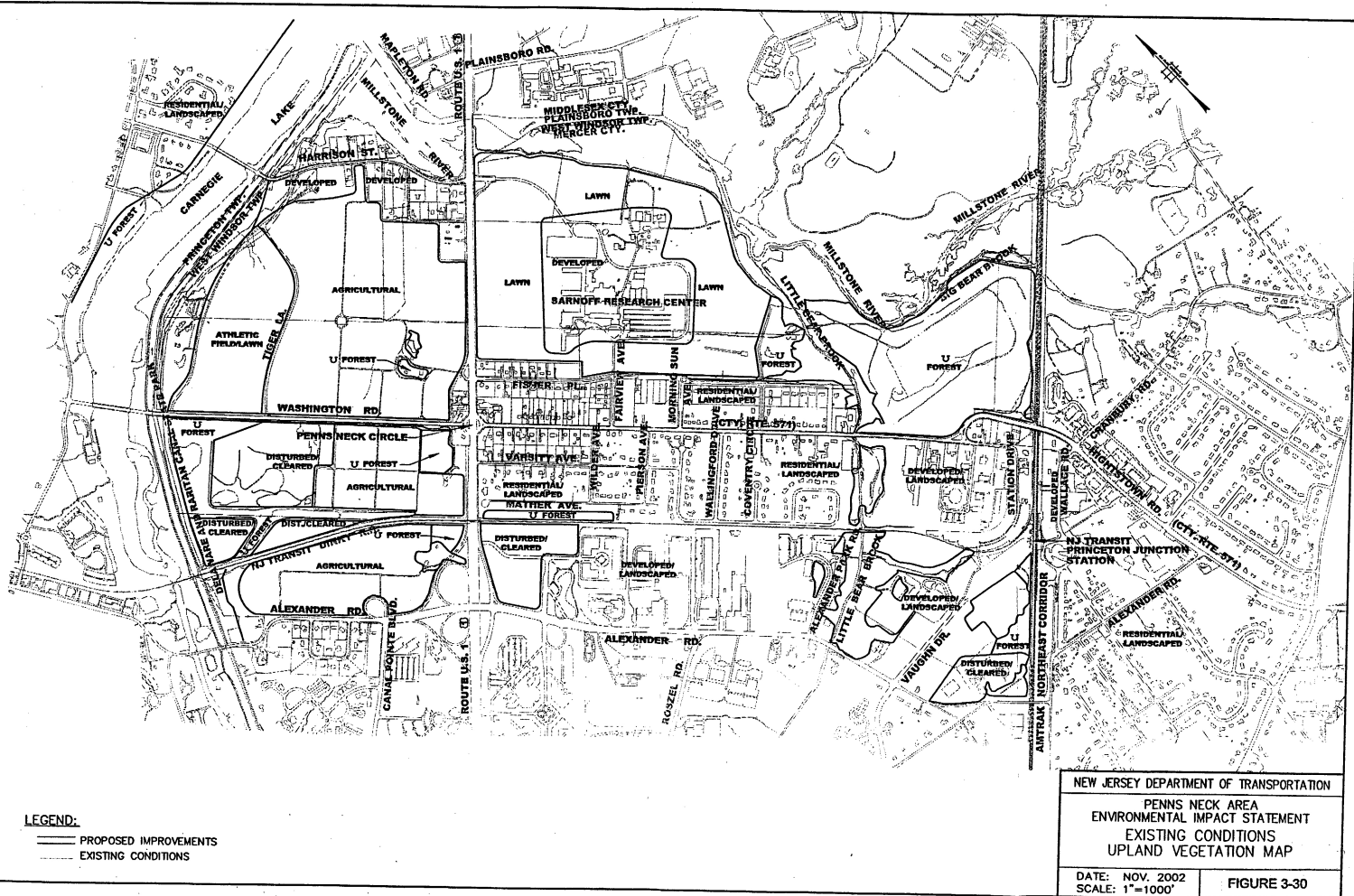
Large areas of undisturbed land, especially forested areas (wetlands or uplands) generally have a higher resource value than small vegetated patches, lawn areas or developed parcels. These larger areas provide better, more expansive wildlife habitat for migratory and resident birds, mammals, reptiles and amphibians. Long, unbroken corridors along rivers and streams also provide valuable habitat to these species.

Forest

Portions of the forested corridor along the D&R Canal and Carnegie Lake are upland. Specifically, forested areas along the western edge of Carnegie Lake are predominantly upland. In addition, there are forested upland patches at the western end of Washington Road adjacent to the D&R Canal. Portions of these two forested patches have been previously disturbed through clearing for composting areas. The active use of mechanized equipment and stockpiling of compost materials in these areas prevents the vegetation from being permanently established.

Vegetation species typically found in these upland forested areas include eastern white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), quaking aspen (*Populus tremuloides*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), and black cherry (*Prunus serotina*). Understory species include multiflora rose, climbing bittersweet (*Celastrus scandens*), common pokeweed (*Phytolacca americana*), and fox grape (*Vitis labrusca*).

According to the Township of Princeton Master Plan (as amended through 5/6/99), www.princetontwp.org, there are three specimen trees, consisting of two shagbark hickories (*Carya ovata*) and a beech species (*Fagus* sp.) located within the Rogers Wildlife Refuge. The Refuge is situated adjacent to the west side of Stony Brook, south of Alexander Road, outside but proximate to the study area.



There are numerous specimen trees in Mercer and Middlesex Counties, as listed in the NJDEP, Division of Parks and Forestry publication, *New Jersey's Big Trees* (1998). These trees include six that are located in Princeton, all of which are located outside of the study area. There are no other specimen trees documented in West Windsor or Plainsboro Township.

Maintained Lawn

The Sarnoff Corporation contains a large area of maintained lawn. Essentially, the existing buildings are surrounded by maintained lawn, inclusive of scattered tree lines and hedgerows. The maintained lawn consists of mowed turf grass species with occasional common dandelion (*Taraxacum officinale*) and white clover (*Trifolium repens*). Tree lines and hedgerows generally contain eastern white pine, eastern hemlock, quaking aspen, northern red oak, pin oak, and multiflora rose.

There are several agricultural fields located along the west side of Route 1. One large agricultural field is bordered by Harrison Street on the north, Tiger Lane on the west, Washington Road on the south and Route 1 on the east. A second large agricultural field is located between Route 1 and the D&R Canal, with Washington Road on the north and Alexander Road on the south.

Other Areas

The remaining upland habitat within the study area consists predominantly of a variety of developed land and landscaped lawns. Developed and landscaped properties have a mix of native and ornamental plant species that consist primarily of trees and shrubs. Maintained lawn areas also include athletic fields.

3.7.9 Wildlife

The study area contains a diversity of habitats mixed in with developed areas. These include a composite of horticultural and athletic fields, forested wetlands, forested uplands, open water, stream corridors and residential and office development. Edge, open field, upland forest and forested wetland habitat types are accessible to wildlife within and adjacent to the study area. These habitat types, in conjunction with one another, are capable of supporting complex and diverse wildlife communities. Unbroken wetland corridors also provide valuable habitat, particularly for terrestrial species that may migrate along these contiguous segments. Based on diversity of vegetation and availability of large vegetated parcels or uninterrupted corridors, the majority of the study area is assessed to have wildlife habitat of moderate value.

Wildlife diversity was assessed based on review of published literature and quality of habitat observed within the study area. This assessment was conducted to determine species which would most likely occupy those habitats at the geographical locale of the study area. Field observations of wildlife species were used to support this assessment of wildlife diversity within the study area.

3.7.9.1 Mammals

Upland Forest

Mammals likely to utilize the upland forest habitats include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), opossum (*Didelphis virginiana*), woodchuck (*Marmota monax*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), eastern cottontail (*Sylvilagus floridanus*), longtail weasel (*Mustela frenata*), deer mouse (*Peromyscus maniculatus*), big brown bat (*Eptesicus fuscus*) and various mice, rats, shrews and voles. Sightings during field investigations included white-tailed deer, gray squirrel, eastern chipmunk, and woodchuck.

Forested Wetland

Forested wetlands provide habitat for mammals such as white-tailed deer, raccoon, opossum, red fox, gray fox, striped skunk, longtail weasel, deer mouse, big brown bat, gray squirrel, coyote, star-nosed mole (*Condylura cristata*), and various mice, rats, shrews and voles. The only mammal species observed in the forested wetlands during field investigations was the white-tailed deer.

Agricultural Fields

Areas undergoing agricultural crop production are likely to harbor mammals such as eastern cottontail, red fox, woodchuck, and coyote (*Canis latrans*) as well as a variety of small rodents. Mammals observed during field investigations were red fox and woodchuck.

Athletic Fields

Mammals likely to utilize athletic fields include eastern cottontail, red fox, woodchuck, and various mice, rats, shrews and voles.

3.7.9.2 Birds

A large variety of bird species are expected to utilize the study area. The more common species or those observed during the field visits are discussed in this section. A more detailed composite species list is provided in the *Natural Ecosystems Technical Environmental Study, Penns Neck Area EIS*.

Upland Forest

Avian species expected to utilize the upland forest habitats are red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), great horned owl (*Bubo virginianus*), screech owl (*Otus asio*), rufous-sided towhee (*Pipilo erythrophthalmus*), blue jay (*Cyanocitta cristata*), northern cardinal (*Cardinalis cardinalis*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), common flicker (*Colaptes auratus*), tufted titmouse (*Parus bicolor*), ovenbird (*Seiurus aurocapillus*), woodthrush (*Hylocichla mustelina*), gray catbird (*Dumetella carolinensis*), northern oriole (*Icterus galbula*), tanagers (*Piranga spp.*), warblers

(*Dendroica spp.*), sparrows, northern junco (*Junco hyemalis*), and mourning dove (*Zenaida macroura*). The majority of these species were observed during site visits.

Agricultural Fields

Avian species that feed on insects and seeds are likely to forage in agricultural field habitat. Birds sighted include American crow (*Corvus brachyrhynchos*), common grackle (*Quiscalus quiscula*), European starling (*Sturnus vulgaris*), killdeer (*Charadrius vociferus*), eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), mourning dove, American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottis*), and song sparrow (*Melospiza melodia*). Numerous species of warblers, sparrows and finches as well as Canada geese (*Branta canadensis*) may use this area during migration to and from their wintering habitat. A red-tailed hawk and turkey vulture were seen flying over the agricultural fields during field visits while song sparrows, meadowlarks, starlings, and blackbirds were seen foraging in these fields.

Athletic Fields

Avian species likely to utilize the athletic field habitat include eastern kingbird (*Tyrannus tyrannus*), American crow, common grackle, European starling, northern mockingbird, killdeer, Canada geese, and barn swallow (*Hirundo rustica*). Numerous species of warblers, sparrows and finches may use this area during migration to and from their wintering habitat. Eastern kingbirds were observed in the athletic fields during field investigations.

Forested Wetland

Avian species likely to be found using the forested wetland habitat are red-bellied woodpecker (*Melanerpes carolinus*), common flicker, mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), green heron (*Butorides striatus*), wild turkey (*Meleagris gallopavo*), mourning dove, flycatchers (*Empidonax spp.*), veery (*Catharus fuscescens*), warblers, and sparrows. Bird species observed in the forested wetland habitat during field investigations were red-bellied woodpecker, common flicker, common grackle, gray catbird, and northern cardinal.

3.7.9.3 Reptiles/Amphibians

Upland Forest

Reptiles commonly found in the upland forested habitat include various species of snakes such as hognose snake (*Heterodon platyrhinos*), common garter snake (*Thamnophis sirtalis*), milk snake (*Lampropeltis triangulum*), racer (*Coluber constrictor*), common king snake (*Lampropeltis getulus*), rat snake (*Elaphe obsoleta*), and eastern ribbon snake (*Thamnophis sauritus*). Amphibians likely to be found in this habitat include the spring peeper (*Hyla cricifer*), eastern newt (*Notophthalmus viridescens*), various species of salamanders and skinks.

Agricultural and Athletic Fields

Reptile species commonly found in agricultural field habitats include hognose snake, eastern garter snake, and eastern ribbon snake. Amphibians likely to be found in this habitat include various species of salamanders and skinks, and the common toad (*Bufo woodhousei*).

Forested Wetland

Reptile species commonly found in the forested wetland habitats include northern water snake (*Nerodia sipedon*), painted turtle (*Chrysemys picta*), eastern box turtle (*Terrapene carolina*), brown snake (*Storeria dekayi*), and northern brown snake (*Storeria dekayi*). Amphibians include spring peeper, bullfrog (*Rana catesbeiana*) and northern leopard frog (*Rana pipiens*). The painted turtle (*Chrysemys picta*), slider (*Chrysemys scripta*), and snapping turtle (*Chelydra serpentina*) are other reptiles likely to be found near water. During one of the field visits a painted turtle was basking on an emerged rock in Little Bear Brook.

3.7.9.4 Aquatic Fauna

According to the NJDEP, Division of Fish, Game and Wildlife, the D&R Canal is stocked with trout by the NJDEP during the annual spring stocking period. In addition, angling opportunities are fair for smallmouth bass (*Micropterus dolomieu*), very good for largemouth bass (*Micropterus salmoides*), good for pickerel (*Esox niger*) and very good for catfish (*Ictalurus punctatus*) or eels (*Anguilla rostrata*) (NJDEP website, 2002; www.state.nj.us/dep/fgw).

Angling opportunities in Carnegie Lake are very good for catfish, carp and crappie; good for largemouth bass, pickerel, and channel catfish; fair for yellow perch (*Perca flavescens*); and poor or none for striped bass hybrid, trout, smallmouth bass, musky, northern pike (*Esox lucius*) and walleye (*Stizostedion vitreum*).

3.7.9.5 Insects

Insects that can be expected to be found in habitats throughout the project site include the gypsy moth (*Lymantria dispar*), spotted tiger moth (*Halisidota maculate*), tiger swallowtail (*Pterourus glaucus*), common black ground beetle (*Pterostichus* spp.), horned fungus beetle (*Bolitotherus cornutus*), bark beetles (*Scolytus* spp.), cylindrical hardwood borer (*Neoclytus acuminatus*), tree-hole mosquito (*Aedestri seriatus*), yellow jackets (*Vespula* spp.), cicada killer (*Sphecius speciosus*), and honey bee (*Apis mellifera*).

3.7.9.6 Threatened and Endangered Species

The Federal government, through the USFWS of the Department of Interior, and the State government, through the Natural Heritage Program in the Office of Land Management, Division of Parks and Forestry of the NJDEP, publish lists of threatened and/or endangered plant and animal species. It is from these sources that

the potential existence of any threatened and/or endangered species in or around the study area was determined. It is important to note that none of these data lists are definitive lists and that data acquisition is an ongoing, dynamic process. Information received from these agencies is included in Appendix A.

Mammals

No mammals classified as endangered or threatened by the NJDEP or the USFWS are known to occur within the study area. Likewise, there are no rare mammals listed by the Natural Heritage Program within the study area.

Birds

According to the USFWS (1995), "except for an occasional transient bald eagle (*Haliaeetus leucocephalus*) or peregrine falcon (*Falco peregrinus*), no other federally-listed or proposed threatened or endangered flora or fauna under Service jurisdiction are known to occur within the vicinity of the proposed project site." In addition, the Natural Heritage Program of the NJDEP does not list any rare birds in the study area.

Several bald eagle sightings were reported by residents and boaters during the fall 2002 in the vicinity of Lake Carnegie. The NJDEP Endangered and Non-Game Species Program (ENSP) and NJ Audubon Society, who are keepers of sightings records and strictly monitor nesting eagle pairs in New Jersey, were contacted. The responses from these agencies indicated that there are no known pairs of nesting eagles in Mercer County. The agencies advised that due to the populated nature of the Carnegie Lake area and Mercer County, it is extremely unlikely that a bald eagle nest could exist in the vicinity of Carnegie Lake without agency knowledge. Correspondence from these agencies is found in Appendix A of this EIS.

Information received from the NJ Natural Heritage Program indicated a historically documented barred owl (*Strix varia*) from 1985, within the Rogers Wildlife Preserve. This Preserve is adjacent to the south side of the study area. Field investigations conducted in this area confirmed that the forested wetlands adjacent to Stony Brook provides suitable barred owl habitat, however, no barred owls were observed.

The sighting of a State-threatened long-eared owl (*Asio otus*) on the Sarnoff property was reported to the NJDEP ENSP in December 2002. The agency has reviewed the report and accepted it as valid according to their April 21, 2003 letter, provided in Appendix A.

Invertebrates

According to the USFWS, there is a known occurrence of the brook floater freshwater mussel (*Alasmidonta varicose*) in the D&R Canal and the Millstone River within the study area. The brook floater is not a federally-listed species, but is considered critically imperiled in New Jersey. Contact with the NJDEP, Endangered and Nongame Species Program indicated that the information on the brook floater in the D&R Canal and Millstone River is an outdated record from 1909, and the brook

floaters no longer occurs in the Millstone River or the D&R Canal in the study area. Confirmation of this determination by the NJDEP is contained Appendix A. The Natural Heritage Database of the NJDEP has no recent records of rare invertebrates occurring within the study area.

Plants

The USFWS and the NJDEP Natural Heritage Program do not have any records of threatened or endangered plant species in the vicinity of the study area. In addition, no threatened or endangered plant species were observed during numerous field visits conducted by qualified wetland and environmental scientists.

3.7.10 Wild and Scenic Rivers

According to the National Park System, there are no designated wild or scenic rivers in the study area (National Park Service website; www.nps.gov/rivers/wildriverslist.html).

3.7.11 Coastal Zone and Coastal Barriers

There are no coastal barriers in the study area (Coastal Zone Management Rules, NJAC 7:7E).

3.8 Contaminated Sites

The potential for contaminated materials within the study area was examined in accordance with all applicable policies, rules, and regulations, including but not limited to, the New Jersey Department of Environmental Protection's (NJDEP) Tech Rule, NJAC 7:26E33 USC 1241 et seq., Resource Conservation and Recovery Act (RCRA); 42 USC 9601 et seq., Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); American Society for Testing and Materials (ASTM) Standard E 1527; the FHWA, 1998 Interim Guidance-Contaminated Materials Sites Affecting Highway Project Development; and the guidelines and regulations of the NJDEP's Office of Coastal Planning and Program Coordination (EO215). All reviews, reconnaissance, and inquiries were completed in accordance with ASTM Standard E 1527.

3.8.1 Regulatory Agency Records Review

A database records search was performed to identify known Underground Storage Tanks (USTs), Leaking Underground Storage Tanks (LUSTs), contaminated materials sites, and, in general, any potential areas of environmental concern that could impact the location or construction of the Action Alternatives (see Table 3-29).

The search was completed by screening specified federal and state databases in the study area and adjacent properties located within 1-mile and/or ½-mile of the study area to identify the presence of potential or existing liabilities. Additional

information is provided in the *Contaminated Materials Technical Environmental Study, Penns Neck Area EIS*.

In addition to the regulatory database search, federal and state publications were reviewed to confirm the information provided by the database search and to provide supplemental and updated data where applicable.

Inquiries were initiated through Freedom of Information Act (FOIA) requests, phone contact, or on-site interviews. Inquiries were made to state and local agencies during the course of this investigation to further identify contaminated sites or potential areas of concern.

3.8.2 Field Survey

Site reconnaissance and on-site inquiries involved a general visual overview of the study area to locate any obvious areas of concerns related to contaminated materials. Sites and areas identified as of potential concern through the computer database search, publications review, and agency coordination were reviewed to determine the accuracy of the information and whether or not any obvious, visible contaminated materials concerns were present. In addition, the locations and types of all commercial/industrial sites within the study area were searched and recorded to determine their Standard Industrial Classification (SIC) code. The SIC codes assisted in determining the Industrial Site Recovery Act (ISRA) applicability of these sites.

Field inspections of the study area focused on non-residential properties and on all the properties detailed in the database and publications. Such properties, in general, are likely, depending on the type of operations, to present a greater environmental concern than residential properties. Accessible areas were visually inspected for the presence of potential sources of environmental concern (storage tanks, drums, stained soil, stressed vegetation, waste piles, monitoring wells, etc.).

Figure 3-31 shows the location of known sites of concern in the study area. The dots on the figure are markers and are not intended to imply the presence or limits of contamination.

Route 1

Three gasoline service stations and one apparent former gasoline station are present at the intersection of Route 1 and Washington Road (the Penns Neck Circle) and one gasoline station is located at the intersection of Route 1 and Harrison Street.

The current Exxon and Gulf gasoline service stations are on the western portions of the Penns Neck Circle. They are long-time active gasoline stations that currently contain up to three active gasoline underground storage tanks (USTs) and each contains multiple gasoline dispenser islands. An active groundwater treatment and remediation system is present at the Exxon location, while no groundwater monitoring wells or treatment systems are located at the Gulf station.

At the southeast corner of the Penns Neck Circle is a Getty gasoline service station containing multiple active gasoline USTs and dispenser islands. No groundwater monitoring wells or treatment systems are present at this location. Located at the northeastern corner of the Circle is an apparent former gasoline service station currently used as a realtor's office. The presence of relic USTs and/or on-site contamination at this location is not known.

It is important to note that the absence of groundwater monitoring wells or active subsurface treatment systems at selected locations (e.g., the Gulf and Getty locations) does not preclude the presence or indicate the severity of impacts of contaminated materials. The potential for unknown or unreported USTs or releases exists at these and other properties where active or former gasoline storage facilities are located.

A Sunoco gasoline service station is currently located at the southwest corner of the intersection of Route 1 and Harrison Street. This long-time active gasoline station currently contains up to three active gasoline underground storage tanks (USTs) measuring 6,000 gallons or more and multiple gasoline dispenser islands. An active groundwater treatment and remediation system is present at the Sunoco location.

The Eden Institute is located immediately south of the Sunoco station. This property is reported to contain an underground heating oil tank. The presence of any spills or problems with the UST was not identified during site reconnaissance. In addition, asbestos-containing building materials may be present in this building.

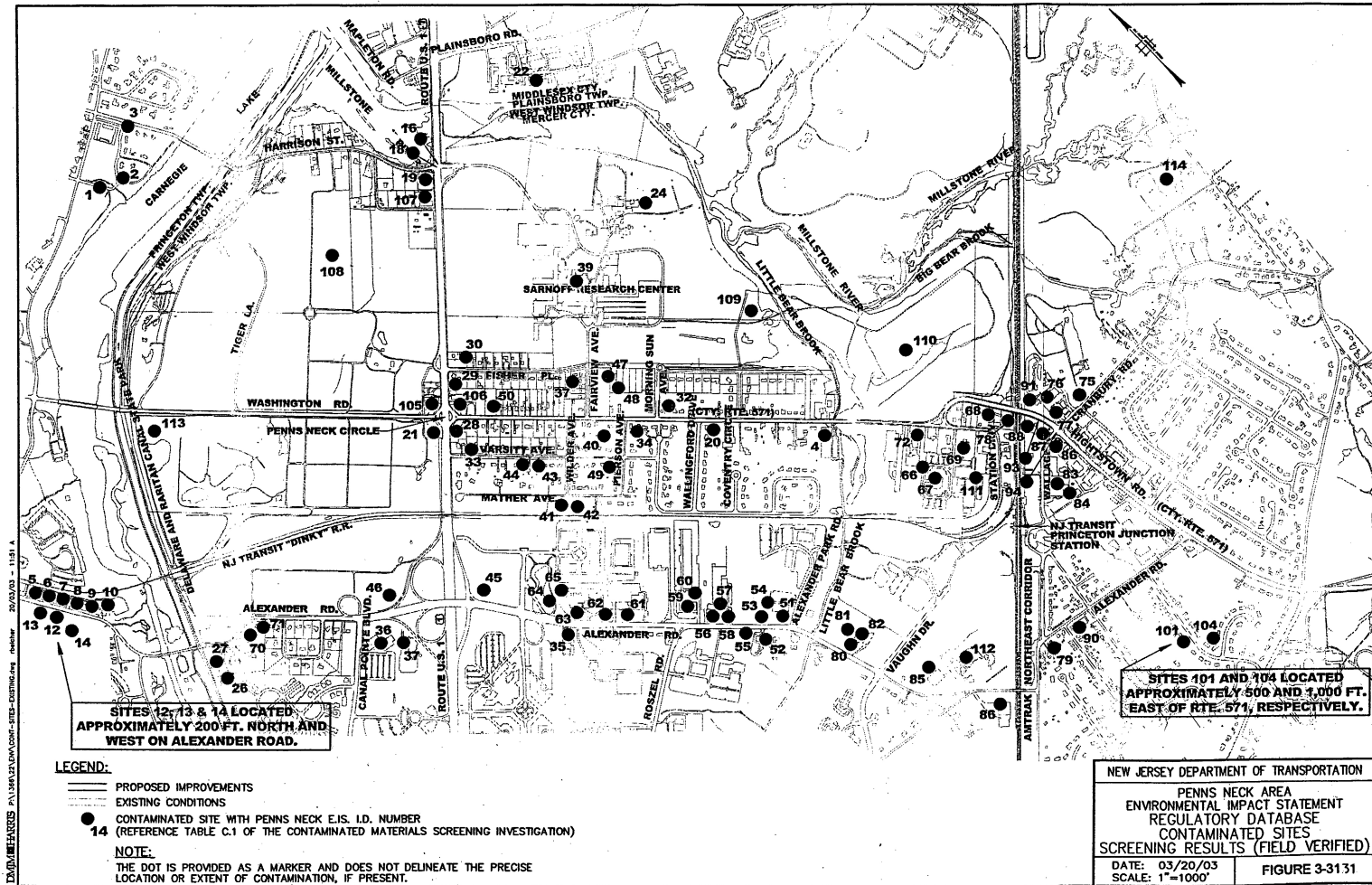


Table 3-29
Route 1 Contaminated Materials Database Search
and Field Reconnaissance Results

Property Name/ Map Reference	Address	Areas of Concern/Comments	Database/Source	Database Case No.
Sumoco 0001-5446/19	Rte 1 & Harrison St., West Windsor	1,000-gal. heating oil, 1,000-gal. waste oil, three 8,000-gal. gas USTs. Remedial treatment system and wells present on property.	UST UST Reg. # LUST	U1000328687 148719 S104388303
Roadway/16	Rte 1 & Harrison St., West Windsor	5-gal. of diesel fuel spill from disabled vehicle on 7/30/96. No evidence detected during site reconnaissance.	NJ SPILLS	S102228872
On the Roadway/18	Rte 1 & Harrison St., West Windsor	50 to 100 gal. of diesel fuel from motor vehicle accident on 4/3/96. No evidence detected during site reconnaissance.	NJ RELEASE	S102224965
Princeton Circle Exxon 3-2036/21	3713 Rte 1 & Washington Rd., West Windsor	Two 2,000 gal. gas, four 3,000 gal. gas, one 10,000 gal. gas, two 12,000 gal. gas, one 1,000 gal. Waste oil and a 550-gal waste oil UST. Remedial treatment system and wells present on property.	UST UST Reg. # RCRIS-SQG FINDS	U000359016 86961 1000542346 1000542346
Cumberland Gulf Station/105	Rte 1 & Washington Rd., West Windsor	Gasoline service station on NW corner of Circle. Multiple USTs and dispenser islands present. No wells or remedial action apparent.	UST Reg. #	67377
Getty Station/28	Rte 1 & Washington Rd., West Windsor	Gasoline service station on SE corner of Circle. Multiple USTs and dispenser islands present. No wells or remedial action apparent.	UST Reg. #	102890
Former Gas Station (Century 21 Realty Office)/106	Rte 1 & Washington Rd., West Windsor	Property located on NE corner of Circle. Site walk indicated location is an apparent former gasoline station. Presence of USTs is unknown.	Site Reconnaissance	Not Applicable
Eden Institute/107	Rte 1 S. near Harrison St., West Windsor	One registered fuel oil UST	UST	Not Provided
FINDS - The USEPA Facility Index System. NJ RELEASE - NJDEP database. NJ SPILLS - NJDEP database. RCRIS-SQG - USEPA's RCRA database for small quantity generators of hazardous waste.				

It should be noted that the FMC Corporation property located immediately north of the Millstone River has been indicated as a CERCLIS site as well as being identified on numerous databases. The site has been identified as a potential source for the Millstone Apartments/Holiday Inn and Harrison Street regional chlorinated compound groundwater contamination. In addition, the FMC property has had multiple RCRIS violations levied against it.

Information was received from West Windsor Township with regards to the University Square Site located at the intersection of Alexander Road and Route 1 in West Windsor Township. Information indicated the property was cited by the NJDEP for violations between 1989 and 1992 with regards to potential releases and

dumping activities of asbestos, volatile organics, hydrocarbons and chlorinated hydrocarbons.

The Federal and State database searches completed for this investigation indicated the site was a listed property. However, the databases now limit the Case/Department involvement to only the EPA's RCRIS-Large Quantity Generator and FINDS tracking activities. The dates and level of activity of the formerly cited releases compared to the dates and information reported in the databases indicate the levels of concern have decreased at the site.

West of Route 1

As indicated by the historical aerial photography, farmlands have existed at these locations as far back as 1940. Common farming practices could have introduced herbicides and pesticides to the properties (see Table 3-30). As a result, these compounds and their breakdown components (e.g., arsenic) may still be present in the soil.

Table 3-30
West of Route 1 Reconnaissance Results

Property Name/Map Reference	Address	Areas of Concern/Comments	Database/Source	Database Case No.
Farmlands west of Route 1/108	West of Route 1	Historic farming practices may have introduced herbicides and/or pesticides and their by-products	Field Reconnaissance Aerials	N/A

Disturbed areas were historically reported east of the Delaware and Raritan Canal and south of Washington Road. This area was determined to be a former disposal site for sediments dredged from the man-made Carnegie Lake. Dredge spoils from the lake are not likely to represent a hazardous waste concern.

It also should be noted that individual residences or commercial complexes located south of Harrison Street and west of Route 1 were not investigated via walkthrough inspections due to limited access to these properties. Underground or basement heating oil tanks and asbestos-containing building materials may be present at these locations.

East of Route 1

As previously indicated the Sarnoff facility has several potential areas of concern located on its property. These include a CERCLIS case as the result of regional chlorinated compound groundwater contamination, two former 10,000-gallon fuel oil USTs, the release of chlorinated compounds from a below-grade neutralization chamber, a potential former low-level radiation dump site, and a former lab equipment, construction debris, and soil disposal site. Table 3-31 details the results of the database search for the area east of Route 1.

**Table 3-31
East of Route 1 Reconnaissance Results**

Property Name/Location and Address/Map Reference	Areas of Concern/Comments	Database/Source	Database Case No.
Sarnoff Corporation/RCA Corp 201 Washington Rd., West Windsor/109, 110	Groundwater contamination with TCE has been documented since 1982.	CERCLIS RCRIS-LQG FINDS SHWS	1000247687 Not Provided Not Provided NJD009305772
	One 10,000 gal. Fuel oil and one 10,000 gal gas UST (inactive)	UST UST Reg. #	1000783889 85142
	Notification of release of 1,2 DCA, TCE and PCE as a result of below-grade neutralization chambers and the removal of 2 fuel oil USTs	NJ RELEASE NJ SPILLS NJDEP-BFO-S	S104663701 S102193243 9502108
	Former laboratory equipment, construction debris, and soils dump site located at northeastern portion of the property.	Site Reconnaissance	Not Applicable
	Former low-level radiation laboratory equipment dumpsite located at eastern portion of the property.	Site Reconnaissance	Not Applicable
Delsys Pharmaceutical Corp 201 Washington Rd – Bldg 2 West Windsor/109	No release reported. Facility indicated as a generator of hazardous waste.	RCRIS-LQG FINDS	1001460141 NJR000027771
Princeton Station Garage & Auto Detailing (Formerly Bower & Sons Automotive Maintenance) 10 Station Dr, (aka 29 Washington Rd.) Princeton Junction/78	Storage and disposal of hazardous and/or contaminated materials	RCRIS-SQG FINDS	1000261965 NJD982180010
	Violation for improper storage of contaminated materials in 1986. Violation was corrected and no fines levied.	Fire Dept.	N/A
	2,000-gallon gasoline UST removed in 1988. No contamination detected.	Fire Dept.	N/A
Princeton-Windsor News Service 19 Washington Road, Princeton Junction/68	Three wells are located on the property and a UST was formerly installed.	UST Reg. #	48107 (Inactive)
Office Complex Building Washington Road/66, 67, 69, 72, 111	Demolition of the building would require investigation and potential removal of asbestos building materials and/or a heating oil tank.	Site Reconnaissance	N/A
CERCLIS – USEPA's Comprehensive Environmental Response, Compensation and Liability Information System. FINDS – The USEPA Facility Index System. NJDEP-BFO-S – NJDEP database. NJ RELEASE – NJDEP database of reports to the Environmental Protection Action Line. NJ SPILLS – NJDEP database of reports to the Environmental Protection Action Line. RCRIS-LQG – USEPA's RCRA database for large quantity generators of hazardous waste. RCRIS-SQG – USEPA's RCRA database for small quantity generators of hazardous waste. SHWS – NJ State Hazardous Waste Sites database.			

The findings of this investigation indicate that Sarnoff's former low-level radiation site is centrally located between Little Bear Brook and the NEC. Material placed in this dumpsite was reportedly spent laboratory equipment such as cathode tubes. Sarnoff's former lab equipment, construction debris, and soil dumpsite is located immediately west of Little Bear Brook.

Sarnoff's current processing and storage systems and the former UST locations are centrally located on the Sarnoff property. These systems include the neutralization chamber where the chlorinated compounds were reportedly released. The central portion of the Sarnoff Corporation campus has the potential to contain contaminants and impacts associated with the CERCLIS listing detailed in the regulatory databases.

The Princeton Station Garage & Auto Detailing (formerly Bower & Sons Automotive Maintenance) is located at the eastern terminus of Washington Road immediately west of the NEC. The asphalt- and gravel-covered areas of this property were noticeably stained and stressed vegetation was observed along the perimeter of the property. Contaminated media at this location may include waste oil, gasoline, coolants, solvents, and degreasers typically associated with automobile service centers. Hydraulic fluids and small quantity USTs are also typically associated with the service lifts used for vehicle repairs. Additionally, a 2,000-gallon gasoline UST was removed from the property in 1988 and no contamination was reportedly detected.

The Princeton-Windsor News Service is located at 19 Washington Road immediately west of the automobile repair facility. The NJDEP's UST database indicates the former presence of a UST at this location and well records indicate that three monitoring wells were originally present on the property (although only one was verified during the field reconnaissance).

Within the office complexes located south of Washington Road in Penns Neck are a number of buildings that could include asbestos-containing building materials and/or heating oil tanks. Access to the interior of the office building was not acquired during this EIS investigation.

The West Windsor Landfill, located at Old Alexander Road and locally known as the transfer station site, is identified on the NJDEP's New Jersey Landfill Status Database Search Results. This landfill is indicated as being closed and has a new NJDEP Identification Number of #1113001228.