APPENDIX L.1

NATURAL RESOURCES

A. INTRODUCTION AND METHODOLOGY

As described in detail in Chapter 2, "Project Alternatives," the project has been refined since issuance of the SDEIS. Of particular importance to this chapter are the withdrawal of any activities at Coney Island (Coney Island Yard expansion site), and withdrawal of the 129th Street barge site. Therefore, text previously including those two sites has been eliminated from this FEIS.

This appendix provides more detailed information on the ecosystems of the East River to support the discussion in Chapter 15, "Natural Resources." (See Chapter 15 for a description of mitigation measures.)

Because terrestrial resources are limited to some parkland sites and because the project area consists almost entirely of a developed urban area, the analyses conducted for the project present a general description of existing terrestrial resources, focusing largely on vegetation in parklands and wetlands that could be affected. Furthermore, most of the analysis is devoted to considering the project's potential impacts on surface water resources and aquatic life in the East River at Pier 6. This is the only location where the Second Avenue Subway would require construction in or adjacent to water bodies (see Figure L.1-1).

To facilitate the analysis, field surveys were conducted between December 2001 and June 2002 at the Pier 6 site. In addition, letters were sent to federal and state agencies that regulate natural resources inquiring whether these agencies know of any endangered, threatened, or special concern species along the project corridor. Correspondence from the agencies is attached as part of this appendix. A literature search and review of published data concerning the various project sites was also conducted.

B. REGULATIONS AND PERMITS

A number of federal and state agencies have jurisdiction over elements of the aquatic and terrestrial environment. The regulations that pertain to the natural resources analyses for the Second Avenue Subway, including those covering surface water, wetlands, and ecologically sensitive areas, are discussed below, as well as in Chapter 4, "Public Outreach and Review Process."

FLOODPLAINS

Storm water is conveyed to a receiving body of water via the land's drainage system. An important component of this system is the floodplain, or the area low enough to hold flood waters during large storms. When the banks of rivers or streams overflow during a storm, the wide, flat floodplain spreads the water, reducing its velocity and force. The floodplain permits the water to flow more slowly and in some cases, its vegetation removes pollutants. Thus, it is a very important element in protecting water resources.

Regulated floodplain areas have been defined by the Federal Emergency Management Agency (FEMA) and include areas that flood during storms that have a 1 percent chance of occurring in any given year, which is equivalent to a likelihood of occurring once every 100 years (100-year storm). FEMA also maps the 500-year floodplains, but these are not regulated. Federal regulations require an analysis of impacts and options to avoid floodplain encroachment. FEMA has responsibility for mapping and regulating floodplain areas. Federal regulations stipulate that in the case of a "significant encroachment" on the floodplain by a proposed project, a finding of an "only practicable alternative" is required. While a project may encroach on the 100-year floodplain, this encroachment may not be significant. In addition to federal requirements, New York State Department of Environmental Conservation (NYSDEC) Environmental Conservation Law regulations (6 NYCRR Part 502) require state agencies contemplating projects in the floodplain to consider the effect of these actions individually as well as cumulatively with other projects in the vicinity. In New York City, Local Law 33 of 1988 regulates building in the 100-year floodplain. In all cases, habitable structures must be flood-proofed or raised above the 100-year floodplain. Finally, all federal agencies must comply with Executive Order No. 11988 of May 24, 1977 concerning Floodplain Management, which requires that each agency has, among other things, "a responsibility to evaluate the potential effects of any action it may take on the floodplain; to ensure that its planning programs and budget reflect consideration of flood hazards and floodplain management; and to prescribe procedures to implement the policies and requirements of this Order."

WETLANDS

Wetlands are transitional lands between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is covered by shallow water. While there are many types of wetlands distinguished by specific ecological characteristics, there are two fundamental wetland types: tidal and freshwater. Freshwater wetlands have no saline inputs, whereas tidal wetlands can either be saline or fresh, but are found in areas influenced by tides. Wetlands are a valuable resource since they can be essential breeding, rearing, and feeding grounds for many species of fish and wildlife. They may also perform flood protection and pollution control functions. Wetlands in the study area are tidal wetlands.

Tidal wetlands are regulated by both NYSDEC and U.S. Army Corps of Engineers (ACOE). In addition to tidal wetland resources within New York City limits, NYSDEC regulates a protective adjacent area, which extends 150 feet from the regulated wetland boundary. However, as defined by NYSDEC regulation, the seawall edge of existing "functional and substantial fabricated" structures (such as bulkheads, seawalls, rip-rap walls, etc.) that are greater than 100 feet in length may be considered as the limit of the regulated adjacent area.

Except for very minor disturbances, activities within wetlands and buffer areas cannot be undertaken without a permit from the ACOE and/or NYSDEC, as relevant. Among other regulations, the ACOE must comply with Executive Order No. 11990 concerning the protection of wetlands. This order requires that federal agencies shall avoid undertaking or providing assistance for new construction located in wetlands "unless the head of the agency finds (1) that there is no practicable alternative to such construction and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use." The Order also provides that "in making this finding, the agency may take into account economic, environmental and other pertinent factors." In practice, permission to disturb, fill, or otherwise remove a wetland itself can only be granted if there is no feasible alternative to avoid such action and if appropriate mitigation, such as replacement wetlands in another location, can be agreed

upon. Activities in the wetland buffer areas are limited to those types of development that would not change natural drainage systems or require removal of vegetative cover.

The Second Avenue Subway could affect one type of wetland littoral zone, at Pier 6. The littoral zone includes all lands under tidal waters where water depths are shallower than 6 feet at MLW.

SURFACE WATER REGULATIONS

Activities in and discharges to surface waters are controlled by federal, state, and local agencies through a number of permits and approvals, reflecting legislation and regulations promulgated at all levels of government. At the federal level, a number of programs address activities in navigable waters and protect the environment of these waters, such as the Federal Clean Water Act of 1987. New York State classifies water quality for its surface water resources; issues permits for discharge to surface waters; identifies and protects wild, scenic, and recreational rivers; and oversees the state's coastal zone management program. New York City regulates discharges to its sewer system, which then discharges to surface water bodies under the auspices of New York State.

GROUNDWATER

In addition to the surface waters that could be affected by the Second Avenue Subway, certain project components would be located above groundwater sources. Groundwater beneath Manhattan and the Bronx is not used for drinking or non-potable purposes. It is contained in igneous and metamorphic rocks, and is geologically isolated from the groundwater layers under Queens and Brooklyn. Overall, the groundwater under Manhattan and the Bronx is not an issue with this project.

However, all of Long Island (including the 36th-38th Street area of Brooklyn where a subway yard could be located) is located above Environmental Protection Agency (EPA)-designated sole source aquifers that supply all of the drinking water for Long Island. In 1978, EPA designated the Long Island aquifer as a sole source aquifer, concluding that the system is the "principal source of drinking water" to the people of Long Island, and "if contaminated, would create a significant hazard to public health." As a result, federally funded projects must be reviewed by EPA to ensure that they do not adversely impact groundwater at this aquifer. This designation is made pursuant to the Safe Drinking Water Act (SDWA), Section 14-24(e).

The EPA, under the SDWA, has also defined the outside boundaries of Kings County (Borough of Brooklyn) and Queens County (Borough of Queens) in the City of New York and parts of Nassau County as a recharge zone and streamflow source zone for the aquifers underlying southeastern Queens County. While the Kings and Queens County aquifers are neither the sole nor principal sources of drinking water for these counties, the geographic boundaries of Kings and Queens Counties are within the recharge zone for the aquifers underlying the southeastern portion of Queens County.

ECOLOGICALLY SENSITIVE AREAS

Significant or unique habitats and landforms are regulated by NYSDEC, NYSDOS, and local authorities. Areas such as wetlands and habitats critical to spawning of fish and animal populations must be given close examination. The quality, rarity, human use, and wildlife of such areas dictate how impacts are measured, as well as the level of any required mitigation.

Several laws have been established to protect ecologically sensitive areas. For example, the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act established Essential Fish Habitat (EFH) provisions to protect and enhance important habitats of federally managed marine and anadromous (fish that migrate up rivers from the sea to breed in freshwater) fish species. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Fish may change habitats with changes in seasons, life history stages, migration and geographic distribution, abundance, and interactions with other species. Federal agencies that fund, permit, or undertake activities that may adversely affect EFH must consult with the National Marine Fisheries Service (NMFS) about the potential impacts of their actions on EFH, and respond in writing to NMFS's recommendations.

As part of the 1973 Endangered Species Act, several categories of federal status for plants and animals were created by the Department of the Interior (DOI), U.S. Fish and Wildlife Service (USFWS). The regulations for the designations are contained in 50 CFR 17. While the USFWS has jurisdiction over terrestrial and freshwater species, NMFS would be responsible for any endangered or threatened marine species found in the study area. Plants and animals can be listed as endangered or threatened, thereby receiving protection under federal law. Picking, damaging, or destroying any protected plants on property not owned by the individual is illegal. Likewise, hunting, importing, exporting, or possessing protected animals is illegal. Under Section 7 of the Endangered Species Act, any federal agency that is sponsoring or assisting a project must coordinate with DOI for a determination of impacts on protected plants and animals. Similarly, under New York State Environmental Conservation Law, NYSDEC maintains a list of plant and animal species that are considered rare, endangered, threatened, or of special concern.

PERMITTING

Project construction for the proposed barge site would be a regulated activity and would require permits from various agencies, including the ACOE and NYSDEC. A brief overview of the regulatory oversight and permitting processes that may be applicable for the Second Avenue Subway's proposed in-water construction activities is discussed in Chapter 4. No permits could be issued until completion of the Final Environmental Impact Statement (FEIS) and issuance of the Record of Decision.

C. EXISTING CONDITIONS

As described in Chapter 2, "Project Alternatives," the Second Avenue Subway project would extend generally from 129th Street to approximately State Street in Lower Manhattan. Along this area, the vast majority of construction and operations activity would occur on inland sites located on Second Avenue, Chrystie Street, St. James Place, Pearl Street and Water Street, but some construction activity would also take place along the water's edge at Pier 6 on the East River in Lower Manhattan. In addition, some construction and operations for the subway could also take place at several storage and maintenance yards, including existing facilities in Brooklyn, the Bronx, and northern Manhattan. The vast majority of the area that would be directly or indirectly affected by the Second Avenue Subway consists of paved property, much of which is occupied by buildings of various types and where natural resources would not be affected. Consequently, the text below concentrates on those sites where impacts to natural

resources could potentially occur—chiefly, unpaved areas (parklands) and sites along the water's edge at the East River.

The following section first describes geology and groundwater, as well as terrestrial vegetation and wildlife at upland sites on the East River. Next is an overview of surface water characteristics (water and sediment quality). This section generally describes the water body and specific issues, such as water's edge conditions, channel width and depth, and NYSDEC wetland jurisdiction. Finally, the section describes aquatic biota (phytoplankton, zooplankton, benthic invertebrates, and fish) in the East River.

GEOLOGY

Manhattan is situated at the extreme southern terminus of the Manhattan Prong, part of the New England Upland Physiographic Province. The Manhattan Prong is a northeast-trending, deeply eroded sequence of metamorphic rocks. According to the Geologic Map of New York-Lower Hudson produced by the New York State Education Department (1995), Manhattan consists of three prominent geologic formations: Manhattan Schist, Inwood Marble, and Fordham Gneiss, all of which are highly folded, faulted, and metamorphosed rocks.

- Manhattan Schist occurs throughout Manhattan and is the most prevalent bedrock formation. The Manhattan Schist consists of foliated pelitic schists that may be of the Middle Ordovician age (460 to 470 millions years ago). Sillimanite, garnet, muscovite, biotite, plagioclase, quartz, and kyanite comprise the schist. Layers of gneiss composed of similar materials are also present in this formation.
- Fordham Gneiss is a coarsely banded hornblende-biotite-quartz plagioclase formation primarily from the Upper Precambrian age (1.2 billion to 544 million years ago). It exists primarily in the northeastern portions of Manhattan north of Central Park.
- Inwood Marble is commonly associated with valleys and lower-lying areas and is primarily a white to gray, medium- to-coarse-grained rock that ranges in composition from calcite to nearly pure dolomite. Inwood Marble can be of either Lower Ordovician or Upper Cambrian ages (470 to 510 million years ago). Inwood Marble is found primarily along the shores of the East River in lower Manhattan and in some areas near the Harlem River.

Manhattan has been affected by glaciation beginning nearly 300,000 years ago. Glacial reformation of topography smoothed out the ground surface and often deepened valleys that were oriented in the direction of glacial advance. Glacial till, deposited as ground moraine directly from the bottom of glacial ice, is the dominant overburden material in Manhattan.

GROUNDWATER

Groundwater is typically found at approximately 10 to 60 feet below grade along the project alignment in Manhattan. However, potable groundwater is not a major resource in Manhattan or the Bronx. Very little is found either above the rock or within fractures in the rock, and it is insufficient as a source of water supply. All potable water in Manhattan and the Bronx comes from a system of upstate reservoirs. Groundwater quality is variable, but frequently poor, as it has been altered by more than a century of contamination from industrial uses. Manhattan and the Bronx's groundwater is not used for potable supply and non-potable use is limited.

Manhattan Island is criss-crossed by many subsurface streams and some surface streams (mostly in the north). The surface or subsurface ridges, such as rock structures, control the flow of these

streams. The majority of the underground streams flow eastward from higher elevations in the west. Canal Street and Spring Street form the longest subsurface stream channels in Lower Manhattan. These streams flow from Washington Street in the west to the vicinity of the Brooklyn Bridge in the east.

TERRESTRIAL VEGETATION AND WILDLIFE

MANHATTAN ALIGNMENT

Most of the sites that could be used for storing and transporting spoils and construction materials, or for future subway operations, are located within densely developed areas of Manhattan. From a natural resources perspective, the entire Second Avenue Subway corridor would be located within disturbed, urban areas where either no vegetation or highly invasive species exist. Similarly, it is likely that terrestrial and avian wildlife within these areas is generally limited to urban species tolerant of such conditions, such as the gray squirrel, rock dove, or Norway or black rats.

Some of the upland sites that may be affected by Second Avenue Subway construction or operations are within parklands. Neither these nor any of the other open spaces along the alignment near proposed construction activities have a high terrestrial habitat value. Avian species noted throughout the parks along the Second Avenue Subway corridor included such common urban species as rock dove, European starling, and house and song sparrows.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

As part of the analysis, written requests were sent to NYSDEC Natural Heritage Program and the USFWS on December 11, 2001 (see correspondence in the Natural Resources Appendix L.3), inquiring whether these agencies' databases recorded any known reported endangered, threatened, or special concern species within the study area. The NYSDEC Natural Heritage Databases indicated various sites within the area along Second Avenue where the endangered peregrine falcon and its nests have been observed, including a nest at a building on Water Street; however, none of these sites are currently being considered as project sites. Therefore, no further surveys for this species are required.

FLOODPLAINS

MANHATTAN ALIGNMENT

As shown in Figure L.1-2, the designated 100-year floodplain is mapped along much of Manhattan's East Side shoreline. The floodplain extends inland several blocks in low-lying areas, such as in East Harlem (particularly between 103rd and 110th Streets), the East Village (close to 14th Street), and Lower Manhattan. As shown in the graphic, the proposed subway alignment and some storage tracks pass through the 100-year floodplain in East Harlem and Lower Manhattan. In addition, the potential staging and barge site at Pier 6 falls within the 100-year floodplain.

STORAGE YARDS

One of the potential storage yard or maintenance sites under consideration as part of this project—the southern and eastern portions of the 207th Street Yard, which is the area closest to the Harlem River shoreline—is also located within the 100-year floodplain (see Figure L.1-3).

The 36th-38th Street Yard and Concourse Yard, neither of which is close to a shoreline, are not within the mapped 100-year floodplain.

WETLANDS

The Second Avenue Subway could affect wetlands at Pier 6.

MANHATTAN ALIGNMENT

As described above, the littoral zone includes all areas where water depths are shallower than 6 feet at MLW. At the Pier 6 site, there is a continuous functional bulkhead along the entire potential construction site, limiting the presence of tidal marsh plants and submerged aquatic vegetation. However, even though the East River is designated as littoral zone, NYSDEC regulations state that actual water depths determine whether or not an area is actually a littoral zone. Therefore, the fact that the area was recently dredged to depths greater than 6 feet at MLW likely removes the littoral zone (i.e., anything shallower than 6 feet) at this location.

SURFACE WATER

Barging facilities are proposed for storing and transporting spoils and construction materials needed to build the new subway along the East River at Pier 6. This waterway and its associated natural resources are described below, along with site-specific descriptions of the water's edge, channel dimensions, and NYSDEC tidal wetland or ACOE jurisdictional issues pursuant to the proposed project activities. NYSDEC has determined that the East River has a best use classification of Class I suitable for secondary contact recreation and other usage except for primary contact recreation and shell fishing for market purposes.

EAST RIVER

The East River is a tidal strait connecting New York Harbor with the western end of Long Island Sound. The river is approximately 16 miles long and generally ranges from 600 to 4,000 feet wide. Water depth is maintained to a depth of 40 feet below MLW from the Battery to the former Brooklyn Navy Yard, and 35 feet at MLW from that point to the Throgs Neck Bridge. In reality, the channel is much deeper in places than the maintained depth, reaching up to 100 feet deep in areas just north of Hell Gate.

Circulation and salinity structure is largely determined by conditions in the Harbor and Sound, and this river's fish, benthic, and plankton communities are strongly influenced by the composition and abundance of these communities in adjacent water bodies. The reach of the East River between Roosevelt Island and Wards Island, known as Hell Gate, is noted for its strong tidal currents. The flood current sets eastward and the ebb sets westward, and direction and velocity of the currents are affected by strong winds, which may increase or diminish the periods of flood and ebb. Current velocities are rapid in the East River—maximum velocities in the lower River reach 5 knots. Current speeds in the upper East River are not as great since it is wider and since more of its tidal prism is exchanged with the Harbor than with the Sound.

The mean tidal range is considerable—approximately 4.26 feet at the Battery and increasing to 7.2 feet at Willets Point. The phase of the tide at Willets Point lags the Battery by about 3 hours. This phase difference (and the difference in resulting water elevations between the Battery and Willets Point) is chiefly responsible for the rapid tidal currents in this water body. Tidal excursion distances vary between 16 and 21 kilometers (9.9 to 13 miles) in the upper East River.

Water Quality Overview

The New York City Department of Environmental Protection (NYCDEP) currently collects water quality monitoring data from 14 sites in the Inner Harbor area, which encompasses the proposed Pier 6 barge site in the lower East River as well as the Hudson River, the Narrows, and the Kill van Kull-Arthur Kill system. The closest sampling site to the proposed Pier 6 barge site is located on the west side of the river off of East 23rd Street. According to the 2001 NYCDEP New York Harbor Water Quality Survey summer temperatures in the East River near the project site at the East 23rd Street sampling station ranged from 20 to 24°C (68°F to 75.2°F), and salinity ranged from 23 to 26.5 ppt. Differences in water quality measurements between surface waters (3 to 6 feet) and bottom waters (39 to 52 ft) were slight.

The East River is classified as a Class I water by NYSDEC. The dissolved oxygen (DO) standard for Class I waters is 4.0 mg/L. Although water quality conditions in the estuary have improved considerably over the past two decades, violations of the "never less than" DO standard are still recorded. Summer DO values recorded at the East 23rd Street sampling station ranged from 2.5 to 5.3 mg/L for surface waters and 2.2 to 5.0 for bottom waters. DO concentrations were below the 4.0 mg/L standard in 3 of 15 surface water samples and 5 of 15 bottom water samples in 2001.

Fecal coliform concentrations for the lower East River ranged from 8 to 1,020 MF/L in 2001 and complied with the standard for best-use classifications for fishing (2,000 MF/L). Past data show that the Inner Harbor area is prone to short-term fluctuations in water quality, particularly episodic increases in fecal coliform following rainstorms. The Inner Harbor shows the least year-to-year chlorophyll *a* variation and lowest summertime average (5 µg/L average in 2001), although trends have shown a slight increase in chlorophyll *a* concentration in the 1990's relative to the value concentrations measured in the 1980's. In 2001 chlorophyll *a* concentrations at the East 23rd Street sampling station ranged from 1.2 to 9.6 µg/L, with 13 of 15 samples below 5 µg/L.

Sediments Overview

The lower East River primarily has a hard, rock bottom consisting of gravel, cobble, rocks, and boulders covered with a shallow layer of sediment, usually ranging from less than 2 inches and occasionally up to 12 inches thick in the channel area. Studies indicate that the lack of soft sediments is most likely attributable to the high current velocities that maintain particulate matter in suspension. However, sediment samples collected in July 2002 at the Pier 6 barge site, as part of the natural resources assessment for this project, were mostly silt and clay with some sand. Concentrations of several heavy metals and methylene chloride in East River sediments were measured over the period between 1980 and 1982 as part of the Newtown Creek 301 (n) application. Sampling at the Pier 6 barge site in July 2002 indicates that sediment concentrations of contaminants exceed NYSDEC guidance levels (TAGM #4046) for some semi-volatile organic compounds (SVOCs) and heavy metals. However, no pesticides were detected in any of the samples collected in July 2002, and only four VOCs and one PCB mixture (Aroclor® 1248) were detected in these samples. The VOC and Aroclor® did not exceed NYSDEC guidance levels.

Pier 6 Barge Site at East River

The project site at Pier 6 on the East River was used as part of the World Trade Center recovery effort. To accommodate this effort, including its barge-based debris removal operation, the area surrounding Pier 6 was dredged under emergency conditions in fall 2001, and approximately

60,000 cubic yards of sediment were removed. Before this recovery operation, the pier was used as a heliport owned by the Port Authority of New York and New Jersey. The East River in this area has a cement bulkhead edge, generally in good condition.

AQUATIC BIOTA

The hydrodynamic and estuarine characters of the East River, coupled with the numerous municipal and industrial discharges that have occurred over many years, make this river a physically harsh environment; therefore, many of the species using the area are tolerant of highly variable conditions. The following sections provide a brief description of the aquatic biota found in this water body. The descriptions that follow are drawn primarily from studies conducted along the East River. The East River is the tidal strait that connects the western Long Island Sound with the Harbor and Hudson River. In general, a decrease in nutrients and increase in DO have resulted in a more favorable habitat for aquatic biota, according to NYCDEP.

PRIMARY PRODUCERS

Phytoplankton

Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Several species can obtain larger sizes as chains or in colonial forms. Light penetration, turbidity and nutrient concentrations are important factors in determining phytoplankton productivity and biomass. While nutrient concentrations in most areas of New York Harbor are very high, low light penetration has often precluded the occurrence of phytoplankton blooms. Because of the rapid currents and large tidal excursion distances, planktonic organisms found in western Long Island Sound, the lower Hudson River, and Upper New York Harbor would also be expected to occur in the East River.

In several studies focusing on the East River, investigators have collected 77 phytoplankton genera, several of which were represented by a number of different species. Diatoms are generally the most widely represented class of phytoplankton, accounting for over 90 percent of the different taxa collected in one 1983 survey; the green algae, *Nannochloris,* was the most abundant single taxa identified in this area. In a 1993 survey of New York Harbor, 29 taxa of phytoplankton were identified, with the diatom *Skeletonema costatum* and the green algae *Nannochlorus atomus* determined to be the most abundant species at the monitored sites. Resident times of phytoplankton species within New York Harbor are short and species move quickly through the system. Therefore, studies conducted at locations throughout the Harbor showing various species indicate that these same species would also likely be present within the project areas. The average summer cell counts in that year ranged from 6,300 to 97,000 cells/mL. Investigators have suggested that the overall composition and relative abundance of phytoplankton taxa in the East River is more heavily influenced by the influx from waters of the Sound and New York Harbor than by localized water quality conditions.

Submerged Aquatic Vegetation and Benthic Algae

Submerged aquatic vegetation (SAV) are rooted aquatic plants that are often found in shallow areas of estuaries; these organisms are important because they provide nursery and refuge habitat for fish. Benthic algae can be large multicellular algae that are important primary producers in the aquatic environment. They are often seen on rocks, jetties, pilings, and sandy or muddy bottoms. Since these organisms require sunlight as their primary source of energy, the limited light penetration of New York Harbor limits their distribution to shallow areas. Light

penetration, turbidity and nutrient concentrations are all important factors in determining SAV and benthic algae productivity and biomass.

None of the studies reviewed as part of this assessment reported the presence of SAVs in the lower East River. The extensively developed shoreline, swift currents, and steeply sloped riverbanks make inhabitation by SAVs unlikely. However, in the upper East River, there are a number of areas that provide suitable habitat for SAVs and benthic algae. One study reported common algal species including *Fucus*, *Ulva*, and *Enteromorpha*.

ZOOPLANKTON

Zooplankton are an integral component of aquatic food webs—they are primary grazers on phytoplankton and detritus material, and are themselves used by organisms of higher trophic levels as food. The higher-level consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species, such as striped bass and white perch during their early life stages. Predacious zooplankton species can consume eggs and larvae, and can have a detrimental effect on striped bass and white perch.

Zooplankton studies conducted in New York Harbor found crustacean taxa to be the most prevalent form of zooplankton in collected samples. The most dominant species include the copepods *Acartia tonsa, Acartia hudsonica, Eurytemora affinis*, and *Temora longicornis*, with each species being prevalent in certain seasons. The data suggest that the copepods collected in the East River may be extensions of populations established in Long Island Sound and New York Harbor.

BENTHIC INVERTEBRATES

Invertebrate organisms that inhabit river bottom sediments as well as surfaces of submerged objects (such as rocks, pilings, or debris) are commonly referred to as benthic invertebrates. These organisms are important to an ecosystem's energy flow because they convert detrital and suspended organic material into carbon (or living material); moreover, they are also integral components of the diets of ecologically and commercially important fish and waterfowl species. In addition, benthic invertebrates are also essential in promoting the exchange of nutrients between the sediment and water column. Benthic invertebrates include those that can be retained on a 0.5 mm screen (macroinvertebrates) as well as smaller forms, such as nematodes (a class of roundworm) and harpacticoid copepods (order of copepods found in fresh and saltwater that are primarily benthic) called meiofauna. Some of these animals live on top of the substratum (epifauna) and some within the substratum (infauna). Substrate type (rocks, pilings, sediment grain size, etc.), salinity, and dissolved oxygen levels are the primary factors influencing benthic invertebrate communities; secondary factors include currents, wave action, predation, succession, and disturbance.

A number of studies regarding the distribution and abundance of benthic invertebrates have been conducted in New York Harbor. A compilation of these studies (Coastal Environmental Services, 1987) indicated that over 100 taxa had been identified in the East River, most of which were either crustaceans or polychaete worms. A more recent literature review identified over 180 benthic taxa in the Hudson River, East River, and upper New York Harbor (PBS&J, 1998). Common infaunal macroinvertebrates collected within the New York Harbor system include aquatic earthworms, segmented worms, snails, bivalves and soft shell clam, barnacles, cumaceans, amphipods, isopods, crabs and shrimp. Epifauna include hydrozoans, sea anemones, flatworms, oligochaete worms, polychaetes, bivalve, barnacles, gammaridean and caprellid

amphipods, isopods, sea squirts, hermit crabs, rock crabs, grass shrimp, sand shrimp, blue crabs, mud dog whelks, mud crabs, horseshoe crabs, blue mussels, softshell clams, and a sea slug.

Two separate but intermingled benthic invertebrate subcommunities have also been identified based on sediment hardness in the East River. The hard substrate community was characterized by organisms that were either firmly attached to rocks and other hard objects (e.g., mussels or barnacles), or that built or lived in tubes. Other species of polychaetes and amphipods also occur on the hard bottom surfaces, and several species have adapted to the East River's hard bottoms and rapid currents by living within the abandoned tubes of other species. The soft substrate community, which is characteristic of the more protected areas within the upper East River, has permitted detritus, clay, silt, and sand to accumulate in shallow, low velocity areas near piers and pilings. Common soft substrate organisms observed included oligochaete worms, the soft shelled clam *Mya arenaria*, and a variety of flatworms, nemerteans, polychaetes, and crustaceans.

A benthic macroinvertebrate sampling program was conducted in July 2002 as part of the natural resources assessment for this project. Vibratory core and benthic grab sediment samples were collected in the vicinity of the Pier 6 barge site between Piers 6 and 9 on the East River. Six locations were sampled at the barge site. Benthic grab samples were sorted and invertebrates were identified and counted.

In the 2002 survey, large numbers of pollution-tolerant benthic invertebrate (primarily polychaetes in the families Capitellidae and Spionidae) were collected. However, pollution-sensitive benthic invertebrate species (e.g., *Ampelisca* sp.) were also collected. Five pollution-sensitive species were collected at Pier 6; a snail, an amphipod, two polychaetes, and a clam. Other invertebrates collected at Pier 6 were mussels, crabs, shrimp, isopods, nematodes, and several species of polychaete. Sensitive species were found at all but one of the six sampling locations at Pier 6.

FISH

New York City is located at the convergence of several major river systems, all of which connect to the New York Bight portion of the Atlantic Ocean. This convergence has resulted in a mixture of habitats in the East River that supports marine fish, estuarine fish, anadromous fish (fish that migrate up rivers from the sea to breed in freshwater), and catadromous fish (fish that live in freshwater but migrate to marine waters to breed).

Despite the relatively low value of the East River as residential fish habitat, the waterway serves as a major migratory route from the Hudson River to the Long Island Sound. Harsh conditions within the East River, including its swift current, lack of shoal and protected habitat, reduced water quality, and possibly a lack of prey, probably explain why the East River experiences only limited utilization by fish at various times of the year. The swift currents act to scour the river bottom and prevent accumulation of sediment. Consequently, the benthic community is characterized by attached rather than infaunal species. During the summer months, poor water quality—particularly low levels of dissolved oxygen—can also limit fish presence. The Essential Fish Habitat assessment prepared for the Second Avenue Subway and attached as Natural Resources Appendix L.2 provides a more detailed description of managed fish species found in the East River.

Marine Species

Winter flounder, scup, and bluefish are marine species present in the East River. Winter flounder is an important commercial and recreational fish species that prefers cold water. Adults have a

short migration pattern, moving offshore a short distance in spring and returning to shallow inshore or estuarine waters in late fall. Winter flounder spawn in the lower estuary during winter and early spring and prefer sandy bottoms in shallow water where freshwater from the estuary reduces salinities to slightly below full strength. Capture of adult-size winter flounder during the winter months in the lower East River indicates possible spawning activity. Flounder are most likely utilizing the lower East River as residents during the winter months. Winter flounder have a varied diet of small invertebrates and fish fry, and the relatively small size of their mouths may limit the size of their prey.

Scup, or porgy, is a marine species that migrates inshore during late spring. It tends to stay close to the coast during the summer months before moving offshore during the fall to deeper waters. The scup is a bottom feeder that spawns from May through August.

Bluefish were reported as an abundant species captured in the East River (excluding bait fish). Bluefish is a pelagic fish whose young migrate into estuaries and harbors along the coast during late spring or early summer. The major spawning grounds of the bluefish are located in the outer half of the continental shelf, and the resulting young move inshore in the late summer to feed. Incidence of young bluefish in the East River is probably related to this migration pattern.

Estuarine Species

Species that have been found in adequate numbers within the East River are the resident fish Atlantic silverside and striped killifish and common killifish. These species are important as forage species for larger predator fish and are commonly used as bait by fishermen. They are primarily resident estuarine fish although considered euryhaline.

Atlantic silversides are small fish that school in shallow water and are permanent residents of the estuary. They spawn in May through early July and mature in 1 year. Atlantic silversides are omnivorous and feed chiefly on copepods, mysids, shrimp, amphipods, cladocerans, fish eggs, young squid, annelid worms, and mollusk larvae.

Common killifish spawn primarily in fresh or brackish water, usually from spring to late summer or early autumn. Adults generally mature during their second year. Striped killifish spawn in shallow water close to shore from June through August, and again mature in their second year. Both species feed primarily on crustaceans and polychaetes.

White perch is an additional estuarine species that has been found in the East River. Adult white perch migrate to shallow fresh and slightly brackish water in the spring and early summer to spawn, after which they return to the lower estuary. The demersal eggs hatch in 3 to 5 days, and after approximately 1 month they begin to look like small adults. The juveniles inhabit creeks and inshore areas until they are about a year old. Small white perch primarily eat invertebrates. Larger white perch in salt and brackish water eat small fish fry, crabs, shrimp, and other invertebrates. White perch of more than 200 mm in length eat mostly fish.

Anadromous Species

Anadromous species that use the East River include striped bass and tomcod, and members of the herring family. Striped bass use the East River for migration from fall through spring. Striped bass return from marine waters to fresh water to spawn before migrating back to salt waters. The young then use the brackish waters as nursery and wintering area. Juvenile striped bass migrate to marine waters when nearing maturity. The majority of adults then spend much of their time in coastal, bay, and river mouth waters before returning to spawn in the spring each year. Juvenile striped bass eat a variety of invertebrates, and adults eat a variety of fish and may

also east shrimp. Young-of-the-year striped bass feed primarily on invertebrates; as they grow and become adults, striped bass feed primarily on fish.

Tomcod is an inshore species of cod that is distributed from southern Labrador to Virginia along the Atlantic Coast. Adults may spawn in marine waters but are typically anadromous and migrate into rivers and estuaries during late fall and winter to spawn. In New York water, the adult tomcod move out from shore to cooler waters in the spring. These fish feed mainly on small crustaceans.

Two of the common anadromous species are members of the herring family-alewife and American shad. These species live in the sea as adults and move into estuaries in spring on their spawning migrations. Both spawn in freshwater. Juveniles migrate from the estuaries in their first year primarily in the fall. These species primarily eat crustaceans and other invertebrates.

Catadromous Species

The single catadromous species common to the East River is American eel. Eels spawn at sea and the young move into the estuary as elvers in the spring, typically in February and March. American eels are opportunistic feeders and juveniles eat crustaceans, polychaetes, bivalves and fish. They grow slowly and at sexual maturity move down the estuary in the fall and out to sea.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

Additional requests were sent to NYSDEC Natural Heritage Program, USFWS, and NMFS in April 2002 for review of their databases concerning aquatic endangered, threatened, or special concern species that could potentially be present at the waterfront sites. According to the NMFS, the following species would be of concern within the project area because they may be present as occasional, seasonal transients: leatherback turtle, loggerhead, Kemp's ridley, and green turtle (see agency correspondence in Appendix L.3). Some marine mammals, such as harbor seal, grey seal, and harbor porpoise, may also be present in these water bodies.

ESSENTIAL FISH HABITAT

The NMFS has identified the East River as EFH for 15 species of fish pursuant to the Magnuson-Stevens Fishery Conservation and Management Act of 1996. Please see the Essential Fish Habitat assessment in Appendix L.2.

D. CONSTRUCTION IMPACTS OF THE PROJECT ALTERNATIVES

Construction impacts on natural resources from the Second Avenue Subway are described in Chapter 15. Following are some additional details on certain topics.

GEOLOGY

In total, the subway would require the removal of over 6 million cubic yards (CY) of rock and soil. Although the amount of bedrock and soil removal would be substantial, the underlying geology of Manhattan would not be altered. Additionally, since Manhattan's geology is not considered an ecologically sensitive habitat, and since no substantial outcropping would be disturbed as a result of the proposed project, no adverse impacts would occur.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

The NYSDEC Natural Heritage Databases only indicate the presence of one endangered, threatened, and special concern species—the peregrine falcon—within the vicinity of the Second Avenue Subway alignment, including the yard sites. As described in the chapter, no adverse impacts on peregrine falcons would occur.

FLOODPLAINS

With respect to the requirements of 6 NYCRR, Part 502, which requires that State projects demonstrate why they need to be located in the 100-year floodplain, there is no practicable alternative to constructing the Second Avenue Subway where it is currently proposed in East Harlem and Lower Manhattan and still meet the project's goals. Moving the subway further inland, for example, would not provide service along the Second Avenue corridor, and would not provide the required relief of congestion on the existing Lexington Avenue Line. The 207th Street Yard (which is also within the floodplain) already exists, and new tracks would be constructed within the confines of the existing yard. Therefore, use of the 207th Street Yard would not create any floodplain impacts.

WETLANDS

Use of a barging site would have environmental benefits and would not substantially affect wetlands, as this area is currently bordered by a hard bulkhead wall and does not currently support wetland plant communities. The Second Avenue Subway project would comply with Executive Order No. 11990, which concerns the protection of wetlands, and with all other appropriate regulations.

GROUNDWATER AND SURFACE WATER

Groundwater resources in Manhattan are not used as potable water, and would not be adversely affected by construction of the new subway tunnels or stations. During construction, design requirements would limit the amount of dewatering allowed as one aspect of such protection measures. Construction work proposed at the various above-ground yard and maintenance sites would also not adversely affect groundwater.

In terms of surface water, the operation of barges at the waterfront sites is not likely to create significant adverse impacts on the East River waterway or on the species present within it. Although barging operations on the East River would increase as a result of the Second Avenue Subway, construction of the subway would not introduce a new use to the river channel. While final plans for barge operations have not yet been determined, the following detailed analyses for the proposed construction site represent a conservative view of how the construction site might operate.

PIER 6 AT THE EAST RIVER

A barge facility is proposed at or near Pier 6 to reduce the number of trucks that would be required to transport construction spoils and materials during the Second Avenue Subway construction period. The current concept design of the barging facility involves the placement of three fixed barges, each supporting a crane, in the water for the duration of construction at this site, which could last for up to 7 years. In addition, up to four hopper barges would be temporarily moored near the barge cranes and used to transport construction spoils. A further

discussion of construction of the barge facilities at Pier 6 is provided in Chapter 3. No bulkhead repairs would be required, and only a small amount of dredging (approximately 3,500 cubic yards) may be required.

Effects on Water Quality

Some water quality degradation would be expected to occur while the spud barges are anchored to the river bottom; this could last for approximately 3 to 6 months. It is likely that in-water placement of spud barges would require the use of pile driving equipment from the landside, which would cause resuspension of particulates and fine matter within the water column. However, as noted previously, the current velocities within the East River would disperse suspended material quickly. Additionally, the decrease in water quality would only be temporary and could be minimized using mitigation measures, described below. In total, spud barge construction would disturb approximately 30,000 square feet of river area. Barge facility operations are not likely to result in any significant long-term impacts to water quality within the East River. In addition, the potential above-ground conveyer system, which would transport material to the site, would be completely covered, and would minimize the release of materials or fines into the water or air. A storm water pollution prevention plan (SPPP) and other protection measures to be developed within the Construction Environmental Protection Program (CEPP) and related plans would also be developed to reduce effects of stormwater runoff or other contamination at this barge site.

Effects from Dredging

Because the area around Pier 6 was recently dredged to accommodate transport of World Trade Center debris by barge, it is not anticipated that dredging would be required at the site, with the possible exception of a small amount of channel deepening at the southern edge of Pier 9 (if needed for safe barge operations). It may be necessary to conduct maintenance dredging if the area were to become resedimented. Maintenance dredging is expected to be minimal, approximately 3,500 cubic yards. If dredging were to occur at this site, the dispersion capabilities of current velocities within the East River are expected to effectively remove any suspended contaminants quickly, resulting in only minimal impacts to the East River in a limited time. All applicable state and federal permit requirements associated with dredging operations also would need to be secured before undertaking any dredging.

Effects on Hydrodynamics

No major effects to East River hydrodynamics are expected to occur with the Pier 6 barge operation. The proposed barge facility does not extend beyond the existing pierhead line, and the channel within this area of the East River is very wide.

AQUATIC BIOTA

PRIMARY PRODUCERS

Construction and operation of the barge facility are not expected to result in any long-term adverse impacts to phytoplankton, SAV, or macro algae present in the East River. Construction of the barge facility would result in temporary and localized increases in turbidity that may affect light penetration in the water column. Because light is necessary for the photosynthetic process, construction may result in some degree of temporary impairment to photosynthesis and

primary production, the creation of new organic matter from inorganic substances, in the project area.

Fixed platform coverage would increase by approximately 30,000 square feet in the East River due to the barges. This increase in platform coverage would increase shading in the waterway. Since primary productivity is light-limited, tidal currents, which carry phytoplankton under shaded areas, would experience a decrease in light intensity with some resulting decrease in primary production. However, residence time under the fixed barge coverage by primary producers would likely be limited within the East River where currents are swift. Therefore, duration of decreased production would continue to be very short and there would be no consequential decrease in production. Barges moving to and from the facility would likely create similar but temporary shading effects, and residence times would again not result in any significant decrease in production.

ZOOPLANKTON

The proposed barging facility is not expected to result in adverse effects to zooplankton communities in the East River. Many zooplankton are primary grazers on phytoplankton as well as detritus, and a steady supply of suspended detritus within these waterways provides an adequate food source at all times. While the increase in shaded area from barge coverage may decrease visual feeders' ability to locate prey, resident time in such areas is expected to be short; thus no significant adverse impacts would result.

BENTHIC INVERTEBRATES

The activities associated with the establishment of the barge facilities and yard expansion would not be expected to result in long-term impacts to the benthic invertebrate community. The addition of piles would temporarily alter the benthic habitat to some degree. However, the extent of habitat disturbance would be highly localized. Bottom disturbing activities would be confined to very limited areas of construction, and benthic recolonization would be expected to occur relatively quickly, starting within weeks and taking approximately 1 to 2 years to complete.

Impacts to the benthos would also be expected from the proposed dredging activities including potential maintenance dredging. The Second Avenue Subway would remove approximately 3,500 cubic yards of sediments from the East River. This would result in a temporary loss of benthic invertebrates from this area. However, these species would again be expected to quickly recolonize the new sediment and pile substrate.

Barging operations are not expected to cause any significant adverse impacts to the benthic invertebrate community in the East River. Barge structures would provide additional substrate for the species present, and with the exception of a few piles for spud barge placement, barges would not disturb river bottom habitat.

FISH

Installation of piles for the spud barges and dredging would disturb substrate habitat and the water column. These activities could result in a temporary increase in turbidity, and a temporary adverse impact on the habitat for certain fish species (such as winter flounder and bluefish), because of these species' dependence on sight and light. However, these species have adapted to relatively harsh estuarine conditions and can avoid highly turbid conditions that are temporary in nature. Since the proposed action would occur over a maximum of approximately 6 months,

water quality is expected to return to existing levels following the construction of the barge facility. In addition, the intensity of construction during this period would vary, with periods of turbidity alternating with periods of limited activity. Also, as mentioned previously, due to current velocities within the East River dispersion of re-suspended sediments would likely occur quickly.

Because winter flounder and other species are known to be light-dependent feeders, the potential impacts resulting from increased platform coverage from the proposed barges over the waterways was also considered. During its construction phase, the Second Avenue Subway project would cover approximately 30,000 square feet at Pier 6 in the East River; all other barges would be moving in and out of the waterway and would not create permanent coverage. The increased shading could cause adverse impacts to certain fish, because recent studies have suggested that the habitat quality for juvenile stages of benthic fish, such as winter flounder and others, is diminished beneath large pile-supported platforms. Pier coverage limits light penetration, which may, along with increased turbidity, affect the ability of fish to feed. In winter flounder studies, weight loss, shrinkage, or minimal increases in length were observed in the winter flounders that were caged in underpier areas. Since growth in the open-water and pile field areas was greater, research suggests that these open-water habitats are better nursery areas than the underpier areas.

Despite these studies, no significant adverse impacts are expected to occur from the limited amount of platform addition that would result from the barge operations at Pier 6. The above-referenced study was conducted under concrete piers with larger widths (approximately 698 feet by 328 feet) and limited side-light penetration to the underpier area, whereas the proposed fixed barges would be far smaller (generally approximately 200 feet by 50 feet). Consequently, for the Second Avenue Subway, the limited size of the fixed barges, coupled with the limited amount of vertical intrusion into the river bottom (no more than 20 piles are expected to be needed at the site, according to current concept design), would allow fish to move through the underpier areas at the barge location. In addition, the narrow dimensions of the proposed spud barges (approximately 80 feet by 50 feet) would still allow for some light penetration from the sides, and the proposed construction activities would produce very minimal changes from current conditions to the physical habitat utilized by the fish. These activities would not substantially alter the existing habitat at the in-water construction site, so adverse impacts would not be expected. Moreover, the extent of the area that would be affected at any one time would likely be too small to interfere with any directed coastal, seasonal, or daily movement patterns of the fish community. Also, as part of the permitting process, coordination with NMFS and other agencies would occur to determine the most appropriate seasons and timeframes for in-water construction; based on other projects within the New York Harbor area, some limitations on certain construction activities could occur during the winter months.

For all of these reasons, the proposed project is not expected to have a significant adverse impact on these fishery resources. A potential benefit of the fixed barges is that they would provide additional substrate for the invertebrate communities in the East River, increasing food sources for fish species, and providing additional habitat for those species commonly associated with man-made structures, such as black sea bass.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

As described previously, according to NMFS the following species may occur as occasional seasonal transients within the East River: leatherback turtle, loggerhead, Kemp's ridley, and green turtle (see agency correspondence in Appendix L.3).

The barge site would not result in any adverse impacts to shortnose sturgeon, as shortnose sturgeon spawn, develop, and overwinter well upriver in the Hudson River, and prefer colder, deeper waters. Fish that may pass through the upper East River would be expected to use the deeper channel areas as opposed to the shallow near-shore areas that would be used for the barge operations. Out of the 1,000-plus trawls taken in one study in both the Hudson and East River, only one shortnose sturgeon was collected, in the deep water habitat, near the Peekskill-Haverstraw section of the Hudson River. Long-term Hudson River monitoring data, collected by the New York utilities companies and others since the 1970s, have also indicated that shortnose sturgeon inhabit deep-water habitats, and occur in greatest abundance north of the Tappan Zee Bridge.

The project is also unlikely to have significant adverse impacts on any of the four species of turtles listed above. New York turtles mostly inhabit Long Island Sound and Peconic and Southern Bays. They neither nest in the New York area nor reside there year-round. With the exception of the leatherback, all turtles in New York waters are juveniles or subadults. They generally arrive in June and July and leave in October, when colder temperatures force them to migrate south. Turtles that occur past November often become victims of cold stunning, which occurs on a regular basis. Turtles leaving Long Island Sound for the winter usually do so by heading east to the Atlantic Ocean before turning south. It is extremely unlikely that they would head west into East River and travel past Manhattan Island and through New York Harbor to emigrate south. While it is possible that the loggerhead and even Kemp's ridley may occasionally reach the potential barging area via New York Harbor, the leatherback and green turtle are not expected to do so, given the general lack of habitat for them in the East River. Given the paucity of sea turtles in the project area and vicinity, the project would have no adverse impact on these species.

Any potential impacts to marine mammals, such as harbor seals, gray seals, and the harbor porpoise, are also not expected to be significant, as these species are only rarely observed near the East River.

EROSION, STORMWATER MANAGEMENT, AND DEWATERING

During construction activities, there would be increased potential for on-site erosion and sedimentation at construction sites where soils would be disturbed. Beginning in 2003, a detailed storm water management plan would have to be prepared under NYSDEC State Pollutant Discharge Elimination System (SPDES) permitting requirements for any construction sites between 1 and 5 acres proposed to be covered with greater than 30 percent impervious surface or if impervious surfaces are connected on the site. An impervious area is considered connected if runoff from it flows directly into the drainage system, or if runoff from it occurs as concentrated shallow flow that runs over a pervious area and then into a drainage system. The SPDES permitting requirements would be implemented during construction. Storm Water Pollution Prevention Plans would be developed as part of the design process, with implementation to be carried out by the contractors under supervision of the owner, construction manager, and the SPDES permitting and enforcement program administered by NYSDEC.

The storm water management program would contain appropriate requirements for erosion and sedimentation controls to be used during construction. Such controls may include structural and vegetative measures such as hay bales, silt fencing, vegetative covers, and slope and soil stabilization methods. A series of temporary sediment traps would be strategically located within the project sites, where runoff within the construction zones would be collected and settled. Straw bales would be used to protect all proposed catch basins and other drainage structure inlets. Trapped sediment would be stored, sampled, and characterized (as prescribed by the CEPP), as would other excavated soil, and either disposed of or reused. Implementation of the storm water management plan would be the responsibility of the construction contractor with oversight and enforcement provided by the construction manager/owner and regulatory authorities.

Anti-tracking devices/equipment would be installed at the project exits. In addition, silt fencing would be installed along contours directly below construction zones and used where sheet flow is likely to occur. This fencing would be installed prior to construction activity to delineate areas predetermined as construction zones. Temporary and permanent vegetative measures are proposed to stabilize soils on the site. With these measures in place, erosion and stormwater pollution would be minimized and no significant adverse impacts would occur.

Dewatering will also be needed during certain tunneling activities. Permits from NYCDEP would be required in order to discharge into the sewer system and permits from NYSDEC would be required to discharge to area waterways. With use of proper pre-treatment measures, no impacts to the East River would occur as a result.

E. PERMANENT IMPACTS OF THE PROJECT ALTERNATIVES

Once the Second Avenue Subway has been fully constructed, barge facilities and operations would be discontinued along the East River, and the related facilities would be removed. Permanent impacts on natural resources from the Second Avenue Subway are described in Chapter 15. Following are some additional details on certain topics.

WETLANDS

The Second Avenue Subway would not alter existing wetlands conditions at the East River at Pier 6 (if this were determined to be a littoral zone), as conditions at this location would not experience substantial changes from existing conditions. Accordingly, the operation of the barge site would not be expected to significantly adversely affect public health, safety, or welfare; the environment; or natural resources—a provision for receiving a NYSDEC variance, as described above.

SURFACE WATER

As previously noted, water quality in the New York Harbor has improved in recent years and is expected to continue improving to some degree due to continued implementation of the City's water pollution abatement programs. With completion of the proposed Second Avenue Subway, construction activities within the water would cease, and surface water characteristics at the East River are likely to return to existing conditions. Some water quality degradation might occur during removal of the piles for the spud barges; this activity would again be limited in duration and area, and mitigation could be developed to address any disturbances, as described below. Platform coverage from fixed barges would decrease at Pier 6, and surface water would revert to existing levels.

Any effects caused by dredging at Pier 6 would be limited in scope and of a short duration, and would have ceased prior to subway operation. Therefore, no permanent impacts from dredging would occur.

Therefore, with operation of the subway, impacts to the water quality within the aquatic environs of the East River would be minimal.

AQUATIC BIOTA

PRIMARY PRODUCERS AND ZOOPLANKTON

Operation of the Second Avenue Subway is not expected to result in any long-term adverse impacts to phytoplankton, zooplankton, SAV, or macro algae present in the East River. With the removal of the construction barge operations, light penetration into the water column would return to original conditions.

BENTHIC INVERTEBRATES

The activities associated with the operation of the Second Avenue Subway would not be expected to result in long-term impacts to the benthic invertebrate community. However, by removing spud barges, temporary substrates inhabited by benthic invertebrates would be lost. This loss would be expected to be limited since only a small number (between 10 and 20) of piles would be needed to secure the spud barges at the barge site. Alternatively, spud barge piles could be left in the waterway as substrate after spud barge removal, creating preferred habitat for both invertebrate and some fish species.

Benthic community recolonization in areas disturbed during construction, including removal of the barges, would occur quickly, with replacement of the community completed within 1 to 2 years. Recolonization might occur through the survival of individuals (e.g., below a barge), lateral migration into the disturbed area, vertical migration of buried organisms, and settling. A succession of benthic communities might occur before complete recolonization is achieved. The time required for recolonization depends on many factors, including the size of the area. Because the extent of the affected area would be small and tidal exchange large, introduction of fauna from adjacent areas would be rapid.

FISH

No adverse impacts to fish in the East River would be anticipated from the proposed project. Fish would continue to use this water body as they have in the past and present. The surrounding aquatic environments would continue to be characterized by bulkheads, piles, and open water areas that provide suitable habitat for numerous fish species. The Second Avenue Subway would produce very minimal changes from current conditions to the physical habitat utilized by the fish. These activities would not substantially alter the areas used by the fish community, and adverse impacts would not be expected.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

The proposed Second Avenue Subway would have no impact on any rare, threatened, or endangered species in the study area. Sea turtles are the only endangered aquatic species that might occur in the areas where train operations would occur; however, studies have demonstrated that it is highly unlikely that the operation of the Second Avenue Subway would

affect these species based on the fact that they are seldom found within the waters that would be affected by the operation of the Second Avenue Subway.

F. MITIGATION MEASURES

Mitigation measures are described in Chapter 15. ✷