7. STUDY DESIGN (ERAGS STEPS 4 AND 5)

As discussed in Chapter 1, major field investigations were conducted by Honeywell in 1992, 1999, and 2000 to provide information for the BERA. Additional fish data collected by NYSDEC from 1992 through 2000 and wetland data from 2002 were also used in this BERA. The major components of each investigation are described below, and are discussed in detail in Chapter 2 of the Onondaga Lake Remedial Investigation (RI) report (TAMS, 2002b).

7.1 1992 Investigation

The 1992 field investigation, conducted from April to December of 1992 by Honeywell/PTI, was subdivided into five smaller investigations corresponding to the major types of data targeted for collection. These smaller investigations are described below, along with information from each investigation that was used in the BERA:

- **Geophysical Investigation** – Information on the bathymetry of Onondaga Lake was used to stratify benthic macroinvertebrate sampling stations by water depth and to evaluate the potential for wind-induced sediment disturbance throughout the littoral zone of the lake.

- **Contaminant and Stressor Investigation** – Information on contaminants and stressor concentrations and distribution in surface sediments (0 to 2 cm) of Onondaga Lake was used to evaluate potential risks to biota in the lake.

- **Mercury and Calcite Mass Balance Investigation** – Information on mercury and calcite concentrations in the water of Onondaga Lake and its tributaries was collected. However, Honeywell did not develop acceptable mass balance models for use in the BERA (NYSDEC/TAMS, 1998b,c). Mass balance estimates for mercury prepared by NYSDEC/TAMS are included in the RI report (TAMS, 2002b).

- **Ecological Effects Investigation** – Quantitative information on sediment chemistry, toxicity, and benthic macroinvertebrate communities in Onondaga Lake, as compared to a nearby reference lake (i.e., Otisco Lake), was used to evaluate potential risks to sediment-dwelling organisms in Onondaga Lake. Semi-quantitative and qualitative information on macrophyte, phytoplankton, and zooplankton communities in Onondaga Lake was combined with more quantitative information collected by other parties to evaluate potential risks to those communities in the lake.

- **Bioaccumulation Investigation** – Information on chemical of concern (COC) concentrations in sediment, surface water, benthic macroinvertebrates, and fish in Onondaga Lake was used to evaluate exposure to COCs and potential risks to fish, semiaquatic, and terrestrial receptors (e.g., insectivorous, benthivorous, piscivorous, and carnivorous birds, and insectivorous, semi-piscivorous, and piscivorous mammals) that prey on lake biota.

A detailed summary of the 1992 information used in this BERA is presented in Table 7-1. Station locations are presented in Figures 7-1 to 7-5. Detailed descriptions of sampling and analytical methods are presented in PTI (1993b,c,d,e). All 1992 data used in this BERA are located in Appendix I.

7.2 1999 and 2000 Field Investigations

Following the submittal of the draft BERA in May 1998, a supplemental field investigation was conducted by Honeywell/Exponent during 1999 and 2000 (Exponent, 2000) to collect additional information needed for the BERA, the HHRA, and the RI, as requested by NYSDEC. A detailed summary of the investigations used in the BERA is presented in Table 7-2. Station locations are presented in Figures 7-6 to 7-10.

A limited amount of water column sampling was conducted in 1999 to evaluate conditions during fall turnover at stations in the centers of both basins of the lake and to evaluate water quality from a human health perspective at nine nearshore stations. In 2000, supplemental sampling of lake sediment, sediment porewater, wetlands sediment, dredge spoils area soil, and biota (benthic organisms, young-of-year [YOY] fish, and adult fish) was performed. All 1999 and 2000 data used in this BERA are included in Appendix I.

7.3 Other Sources of Information

In addition to information collected by Honeywell during the RI, relevant information collected by other parties was also used in the BERA. Major sources of such information include:

- Sediment/soil data collected from five locations (two depths per location, 0 to 15 cm, 15 to 30 cm) by NYSDEC/TAMS in May 2002 in Wetland SYW-6 adjacent to Station S375 sampled in 2000 (Figure 7-10) (TAMS, 2002b).

- Monitoring data on water chemistry, phytoplankton, and zooplankton collected by the Onondaga County Department of Water Environment Protection (OCDWEP) (Stearns & Wheler, 1994; OCDWEP, 2002).

- Data on aquatic macrophytes collected by the US Army Corps of Engineers (USACE) (Madsen et al., 1993, 1996, 1998; Auer et al., 1996a).

- Data on fish communities collected by researchers at State University of New York College of Environmental Science and Forestry (SUNY ESF) (Gandino, 1996; Ringler et al.,1995; Auer et al., 1996a; Tango and Ringler 1996).

- Fish tissue data collected by NYSDEC (1992 to 2000, unpublished).

- Data on amphibians and reptiles collected by researchers at SUNY Cortland (Ducey and Newman, 1995; Ducey, 1997; Ducey et al., 1998, 2000).

- Data on zooplankton conducted by researchers at Cornell University (Hairston et al. 1999; Duffy et al. 2000).

Analytical data used in this BERA are located in Appendix I.