

3.4 Delaware River and Bay Surface Water Quality Assessment for Years 2000-2002

The following section of the report presents the results of assessing the Delaware River and the tidal portions of its tributaries.

3.4.1 Assessment of Designated Uses for Surface Waters

Aquatic Life Designated Use

The water quality parameters used in this assessment of the Aquatic Life Designated Use are pH, Temperature, Dissolved Oxygen, Alkalinity, Total Dissolved Solids or TDS (Ambient water quality should not exceed 133% of background levels for this use), Turbidity, and toxic parameter data (along with Chronic Toxicity) that were collected in Water Quality Zones 2-5. DRBC standards include temperature criteria for all portions of the River; however only in Zones 2, 3 and 4 do ambient criteria exist. In other portions of the River, criteria are based upon the regulation of temperature increases, caused by effluent discharges, above background conditions. Those background conditions are not defined in Zones 1, 5 and 6. However, DRBC, through its Water Quality Advisory Committee, is working to establish temperature criteria for all portions of the River and Bay.

The Aquatic Life designated use was assessed along the length of the Delaware River from Hancock, NY to the bottom of Zone 1 (202 miles), in Zones 2-5 of the Delaware Estuary (97 square miles), and in the Delaware Bay (693 square miles). Figure 3.7 depicts the level of Aquatic Life Use support in the Delaware River and Bay.

Non-Tidal River

The use was supported in 33 miles of the non-tidal river, or 16.3 %. The remaining 169 miles either had insufficient data or did not support the Use. The following table explains the rationale behind the assessment decisions in those assessment units.

Table 3.12: Use Support Level Explained for Non-Tidal River AUs Not Supporting Aquatic Life Use

| AU | Use Support Level | Explanation |
|-----------|--------------------------|---|
| 1A1 | Not Supported | High pH (greater than 8.5) in 12.5% of samples |
| 1A2 | Not Supported | High pH (greater than 8.5) in 11.4% of samples |
| 1A3 | Insufficient Data | No readily available data |
| 1B1 | Not Supported | High pH (greater than 8.5) in 16.7% of samples |
| 1B2 | Not Supported | Turbidity criterion exceeded in 11% of samples with one 30-day average of 18.25 |
| 1C1 | Insufficient Data | No readily available data |
| 1C2 | Probably Supported | All criteria met except insufficient TDS data. TDS criteria are likely being met. |
| 1C3 | Insufficient Data | No readily available data |
| 1C4 | Insufficient Data | No readily available TDS data |
| 1D1 | Insufficient Data | No readily available TDS data |
| 1D2 | Not Supported | TDS criterion exceeded in 13.2% of samples |
| 1D3 | Not Supported | TDS criterion exceeded in 18.5% of samples |
| 1D4 | Not Supported | TDS criterion exceeded in 18.2% of samples |
| 1D5 | Probably Not Supported | No readily available data, but TDS criterion not met in 1D4 and 1D6 |
| 1D6 | Not Supported | TDS criterion exceeded in 67% of samples |
| 1E1 | Insufficient Data | No readily available data |
| 1E3 | Insufficient Data | No readily available data |
| 1E4 | Not Supported | High pH (greater than 8.5) in 10.2% of samples |

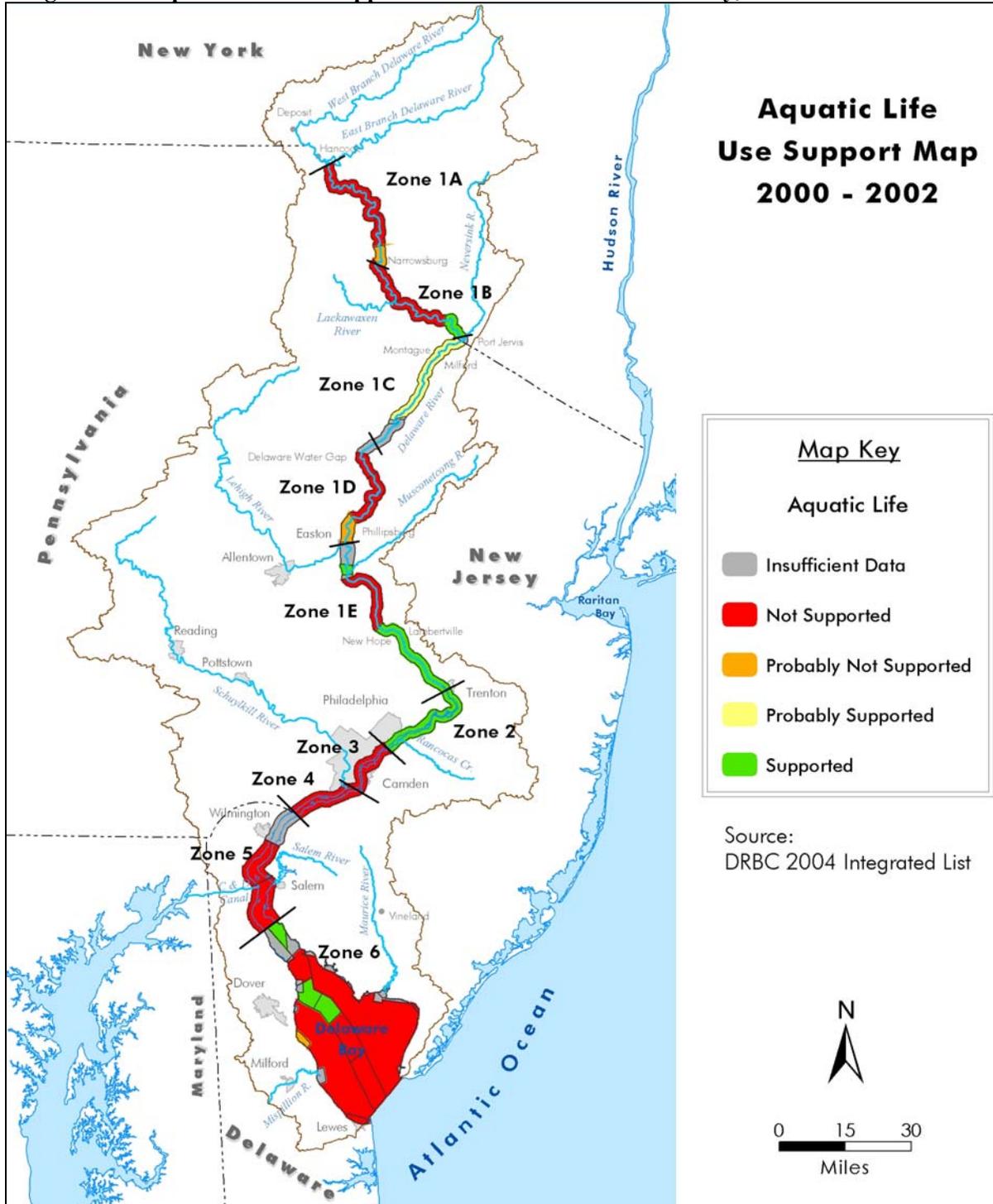
Estuary

The use was supported in Zone 2 of the Estuary (8 square miles) and in 56 square miles of the Bay. The remaining 726 square miles either had insufficient data or did not support the use. The following table explains the rationale behind the assessment decisions in those assessment units.

Table 3.13: Use Support Level Explained for Estuary and Bay AUs Not Supporting Aquatic Life Use

| AU | Use Support Level | Explanation |
|-----------|--------------------------|--|
| 3 | Not Supported | Seasonal DO criterion not met in one season (6.4 mg/L average) Temperature criterion not met in 11.8% of 24-hour averages |
| 4 | Not Supported | Temperature criterion not met in 12.5% of 24-hour averages Copper exceedances |
| 5a | Insufficient Data | Insufficient DO data for 24-hour averages and seasons not well-represented |
| 5b | Not Supported | Insufficient DO data for 24-hour averages and seasons not well-represented Copper exceedances |
| 5c | Not Supported | DO criterion not met in 14.1% of 24-hour averages |
| 6br1a | Insufficient Data | No readily available data |
| 6br2a | Insufficient Data | No readily available data |
| 6br2b | Not Supported | DO criterion not met |
| 6br2c | Insufficient Data | No readily available data |
| 6br3a | Insufficient Data | No readily available data |
| 6br3c | Insufficient Data | No readily available data |
| 6brA | Not Supported | DO criterion not met |
| 6brB | Not Supported | Temperature criterion not met |
| 6de1 | Not Supported | DO criterion not met |
| 6de3 | Probably Not Supported | Turbidity data show a “high likelihood” of impairment |
| 6de4 | Insufficient Data | No readily available data |
| 6de5 | Not Supported | DO criterion not met |
| 6nj1 | Not Supported | Temperature criterion not met DO criterion not met |
| 6nj2-6nj8 | Insufficient Data | No readily available pH, Alkalinity or Turbidity data |
| 6nj9 | Not Supported | DO criterion not met |
| 6nj10 | Insufficient Data | No readily available data |

Figure 3.7: Aquatic Life Use Support in the Delaware River and Bay, 2000-2002



Fish Consumption Designated Use

The assessment of Fish Consumption is not based on zones, but rather is based upon the presence of fish consumption advisories for the main stem Delaware River and the tidal portions of its tributaries. Tables 3.14 – 3.16 below indicate the portions of the River for which such advisories exist. Figure 3.8 shows how those advisories translate into use support for fish consumption in the Delaware River. All portions of the Delaware River and Bay were found to have fish consumption advisories in place and so were assessed as not supporting the Fish Consumption use.

Where no advisories are in effect, the water body is supporting the Fish Consumption use. Where restrictions exist on the amount of fish consumed in a given time period, or consumption advisories exist for susceptible populations, the water body is not supporting the use. Since the 2002 report, New Jersey has developed a new methodology for making these advisories that has resulted in a two-tiered approach based upon risk level. For the purposes of this assessment, however, any advisory, regardless of risk level utilized, was used to indicate non-support of the use.

In total, all 202 miles of the mainstem Delaware River, all 97 square miles of the Estuary and 686 square miles of the Bay were assessed for fish consumption. As described in the Assessment Methodology (see Section 3.3), only water-body specific advisories for particular contaminants are used for determining use support. Statewide advisories require more information.

Table 3.14: Fish Consumption Advisories for the Delaware River : Delaware, New York and Pennsylvania (Main Stem and Tidal Portions)

| Issuing State | From RM | To RM | Locations | Species | Advisory | High Risk Advisory | Contaminant |
|-----------------|---------|--------|---|---|---------------------------------|-------------------------|--|
| NY ^a | 330.71 | 253.6 | Statewide (i.e., NY portion of mainstem Delaware River) | All Species | no more than 1/2 lb/week | do not eat ^b | Various |
| PA ^c | 330.71 | 137.60 | Source to Yardley | American Eel | 2 meals/month | | Mercury |
| PA | 137.60 | 78.74 | Yardley to PA/DE line | American Eel | Do Not Eat | | PCBs |
| | | | | White Perch, Striped Bass, Carp, Flathead Catfish | 1 meal/month | | PCBs |
| | | | | Channel Catfish | 6 meals/year | | PCBs |
| | | | | Smallmouth Bass | 2 meals/month | | Mercury |
| DE ^d | 78.74 | 58.90 | Delaware State Line to C&D Canal | All Finfish | do not eat | | PCBs, Arsenic, Dioxin, Mercury, Chlorinated Pesticides |
| DE | 58.90 | 0.00 | C&D Canal to mouth of Delaware Bay | Striped Bass, Channel Catfish, White Catfish, American Eel, White Perch | no more than 1 8-oz. meal/year | | PCBs, Mercury, Dioxin |
| DE | | | Red Lion Creek, Rt. 13 to Delaware R. | All Finfish | no more than 3 8-oz. meals/year | | PCBs, Dioxin |
| DE | | | Tidal Brandywine R., mouth to Baynard Blvd. | All Finfish | do not eat | | PCBs |
| DE | | | Tidal Christina R., mouth to Smalley's Dam | All Finfish | do not eat | | PCBs, Dieldrin |
| DE | | | Tidal White Clay Creek, mouth to Route 4 | All Finfish | do not eat | | PCBs |
| DE | | | C&D Canal, entire Canal in DE | All Finfish | do not eat | | PCBs |
| DE | | | Shellpot Creek, Rt. 13 to Delaware River | All Finfish | do not eat | | PCBs, Chlordane |
| DE | | | Appoquinimink River, Tidal Portions | All Finfish | no more than 1 8-oz. meal/year | | PCBs, Dioxin |
| DE | | | Drawyers Creek, Tidal Portions | All Finfish | no more than 1 8-oz. meal/year | | PCBs, DDT |

^a NYS DEC 2003-2004 Health Advisories - Chemicals in Sportfish and Game

^b in NY, high risk individuals are women of childbearing age, infants and children under 15

^c Commonwealth of Pennsylvania Fish Consumption Advisories-2003

^d Delaware Division of Fish and Wildlife, Fish Health Advisories as of February, 2002

Table 3.15: Fish Consumption Advisories for the Delaware River : New Jersey (For PCBs and Dioxins, Main Stem and Tidal Portions) ^a

| From RM | To RM | Locations | Species | Advisory for 1 in 10,000 Lifetime Cancer Risk Level | Advisory for 1 in 100,000 Lifetime Cancer Risk Level | High Risk Advisory ^b |
|---------|-------|--|---|---|--|--------------------------------------|
| 253.60 | 0.00 | Statewide | American Eel | 4 meals/year | Do Not Eat | Do Not Eat |
| | | | Striped Bass | 1 meal/month | 1 meal/year | Do Not Eat |
| 137.60 | 78.74 | Delaware River, Easton/Phillipsburg to PA/DE border, including tributaries to head of tide | American Eel | 4 meals/year | Do Not Eat | Do not eat |
| | | | Striped Bass | 4 meals/year | Do Not Eat | Do Not Eat |
| | | | Channel Catfish | 1 meal every 2 months | 1 meal every 2 months | Do Not Eat |
| 78.74 | 58.90 | Delaware River, DE/PA line to C&D Canal | All Finfish | Do Not Eat | Do Not Eat | Do Not Eat |
| 58.90 | 0.00 | Delaware River, C&D Canal to mouth of Delaware Bay | Striped Bass, Channel Catfish, White Catfish, American Eel, White Perch | no more than one 8-oz. meal per year | no more than one 8-oz. meal per year | no more than one 8-oz. meal per year |
| 48.20 | 0.00 | Delaware Bay Tributaries | American Eel | 1 meal/month | 4 meals/year | 4 meals/year |

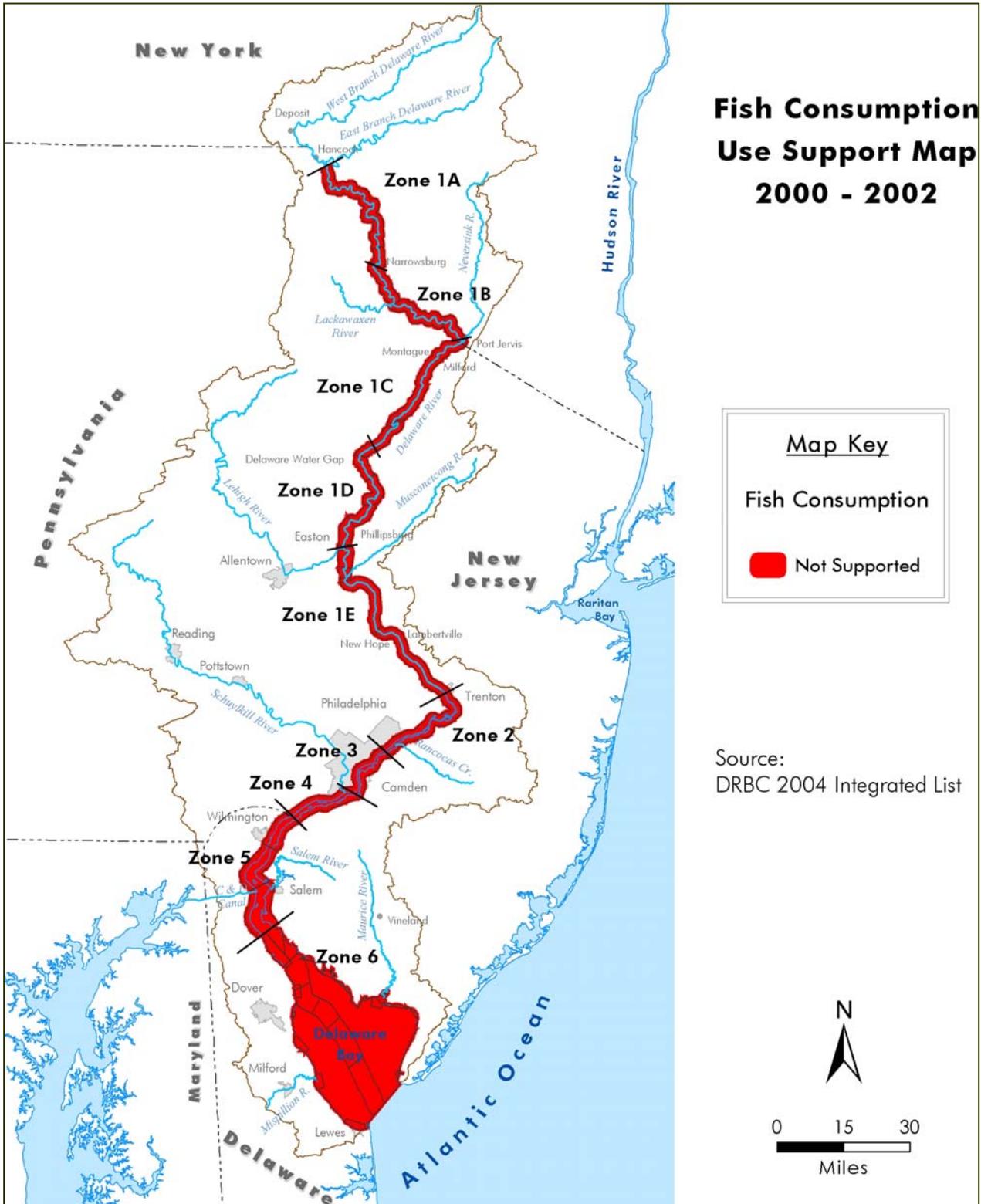
^a Public Health Advisories And Guidance on Fish Consumption for Recreational Fishing - 2003 PCBs and Dioxin
^b in NJ, high risk individuals include infants, children under 15, pregnant women, nursing mothers and women of childbearing age.

Table 3.16: Fish Consumption Advisories for the Delaware River: New Jersey (for Mercury) ^a

| From RM | To RM | Locations | Species | General Advisory | High Risk Advisory ^b |
|---------|--------|---|--|------------------|---------------------------------|
| 253.60 | 0.00 | Statewide | Largemouth & Smallmouth Bass, Chain Pickerel | 1 meal/week | 1 meal/month |
| | | | Brown Bullhead | No Restrictions | 1 meal/month |
| | | | Yellow Bullhead & Sunfish | No Restrictions | 1 meal/month |
| 253.60 | 209.50 | Delaware River upstream of Water Gap | Smallmouth Bass | 1 meal/week | 1 meal/month |
| | | | Channel Catfish Muskellunge | No Restrictions | 1 meal/month |
| 209.50 | 184.60 | Delaware River from Water Gap to Phillipsburg | White Catfish | 1 meal/week | Do Not Eat |
| | | | Channel Catfish | No Restrictions | 1 meal/month |
| | | | Smallmouth Bass | | |
| | | | Walleye | No Restrictions | 1 meal/week |
| 184.60 | 131.96 | Delaware River, Phillipsburg to Trenton | Channel Catfish | 1 meal/week | 1 meal/month |
| | | | Largemouth Bass | No Restrictions | 1 meal/month |
| | | | Smallmouth Bass | No Restrictions | 1 meal/week |
| 131.96 | 100.12 | Delaware River Trenton to Camden | Largemouth Bass & White Catfish | No Restrictions | 1 meal/week |
| 100.12 | 78.74 | Delaware River Camden to Delaware State Line | Hybrid Striped Bass | No Restrictions | 1 meal/week |

^a Guide to Mercury Health Advisories for Eating Fish from New Jersey Freshwaters - 2002 Update
^b High-risk individuals are pregnant women, women planning pregnancy within one year, nursing mothers and children under five years old

Figure 3.8: Fish Consumption Use Support in the Delaware River and Bay, 2000-2002



Shellfish Consumption Designated Use

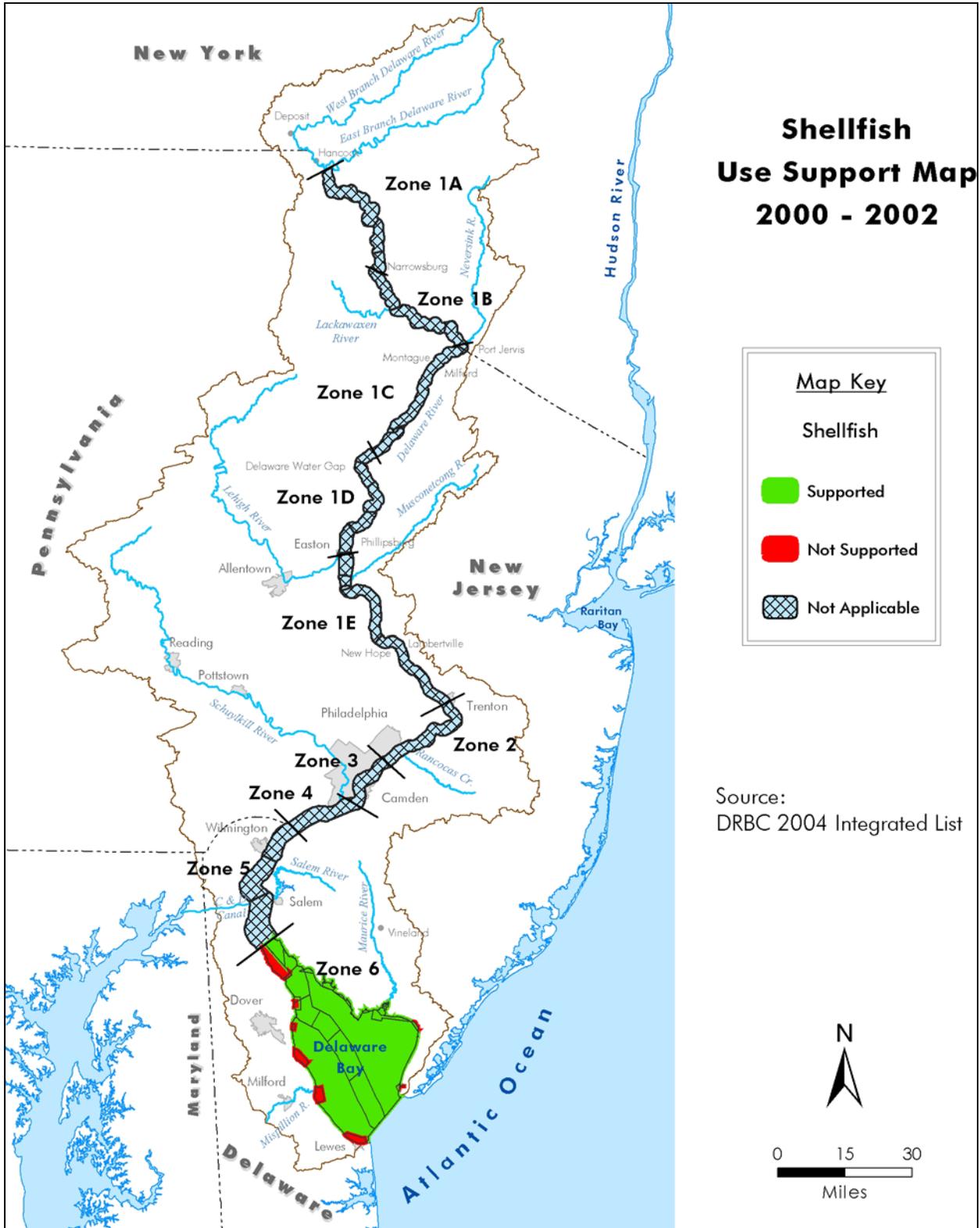
DRBC classifies only Zone 6 for the shellfish consumption use. In Zone 6, a criterion is set such that Total Coliform (Most Probable Number, or MPN) is not to exceed federal shellfish standards in designated shellfish areas. Because both the states of Delaware and New Jersey monitor and assess water quality for suitability for shell fishing based upon the same set of federal guidelines, the reader is referred to the most recent water quality assessment reports of those states for an assessment of the shellfish consumption use.

The State of Delaware classifies its designated shellfish waters as falling into the following categories; Approved, Seasonally Approved, Prohibited Shellfish Harvesting and Resource Protection Area, or Prohibited. New Jersey classifies shellfish waters as falling into the following categories; Unrestricted, Special Restricted, Seasonal, and Prohibited (either due to water quality or to administrative closures).

For this assessment, Prohibited waters were considered to be Not Supporting the use, while all other harvesting areas were considered to be Supporting the use. Figure 3.9 indicates the use support for shellfishing in Zone 6. In total, 652 square miles (94% of Zone 6) were in Full Support and 41 square miles (6% of Zone 6) were Not Supporting the use. For Shellfish Consumption, the entirety of Zone 6 (693 square miles) was assessed.

It is important to note that both the States of Delaware and New Jersey do not list all prohibited or provisionally approved waters as impaired waters, as not all restrictions on shellfish harvesting are due to water quality issues. According to DNREC, there were no closures of shellfishing waters during the 2000-2002 seasons due to water quality concerns. Please see Delaware's and New Jersey's 2004 Integrated List Reports for more information.

Figure 3.9: Shellfish Consumption Use Support in Delaware Bay, 2000-2002



Recreational Designated Use

The determination of Recreational Use support in this assessment is based upon bacterial data. DRBC standards for bacteria are based upon a geometric mean such that, for areas where Fecal Coliform bacteria are used as indicators, a maximum geometric mean of 200 colonies per 100 ml is permitted. Some exceptions to this criterion are present in the standards, however. In Zone 3 and Zone 4 (above RM 81.8) the limit is 770 colonies per 100 ml and secondary contact recreation is the designated use. In sections of the River where Enterococcus is another indicator (Zones 2-6), a maximum geometric mean of 33 colonies per 100 ml is the criterion for primary contact recreation in fresh waters. In marine waters (Zones 5 and 6), the Enterococcus criterion is 35 colonies per 100 ml for primary contact recreation. Secondary contact recreation in fresh waters requires no more than 88 colonies per 100ml.

Fecal Coliform samples should be taken at such a frequency and location as to permit valid interpretation. In a review of the available data used for this report, it is uncommon for there to be at least five samples (sampling dates) represented in any 30-day period. The one exception in the data was in AU 1E5, where it was possible to calculate two 30-day geometric means with at least five samples in a 30-day period each.

Since spikes in Fecal Coliform concentrations are likely to be event-driven (high flow events would tend to increase levels of these bacteria in the streams), it seems inappropriate to analyze the data based on 30-day periods, when only one or two days may be represented. Therefore, for this analysis, single-sample criteria were used. EPA recommends, in their 1997 *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates*, 400 colonies per 100 milliliters be used for fecal coliform. For enterococci, the most stringent EPA guidelines were used. These were 61 colonies/100mL for freshwater and 104 colonies/100mL for marine water (Zones 5 and 6). Those allowable densities are based upon EPA's *Consolidated Assessment and Listing Methodology – Toward a Compendium of Best Practices* (July, 2002).

Figure 3.10 shows the level of use support for Recreation, which was assessed along the length of the Delaware River from Hancock, NY to the bottom of Zone 1 (202 miles), in Zones 2-5 of the Delaware Estuary (97 square miles), and in Delaware Bay (686 square miles). It should be noted that this assessment does not account for tributary use support. Bacteria data collected in tributaries may indicate a level of use support that is not consistent with that of the main stem and Bay.

Non-Tidal River

The use was supported in all non-tidal Assessment Units except those in Table 3.17.

Table 3.17: Non-Tidal Assessment Units Not Supporting the Recreation Designated Use

| AU | Use Support Level | Rationale |
|------|---------------------|--|
| 1A3 | Probably Supporting | insufficient data but the use is supported in the upstream and downstream AUs. |
| 1D4 | Probably Supporting | only 16 samples available for analysis, but maximum density was 100 colonies/100mL |
| 1D5 | Insufficient Data | no readily available data |
| 1D6 | Not Supporting | 17% of samples exceed 400 colonies/ 100mL |
| 1E1 | Insufficient Data | no readily available data |
| 1E2 | Not Supported | 12% of samples exceed 400 colonies/ 100mL |
| 1E3 | Insufficient Data | no readily available data |
| 1E5* | Not Supported | two 30-day geometric means did not meet 200 colonies/ 100mL criterion. |

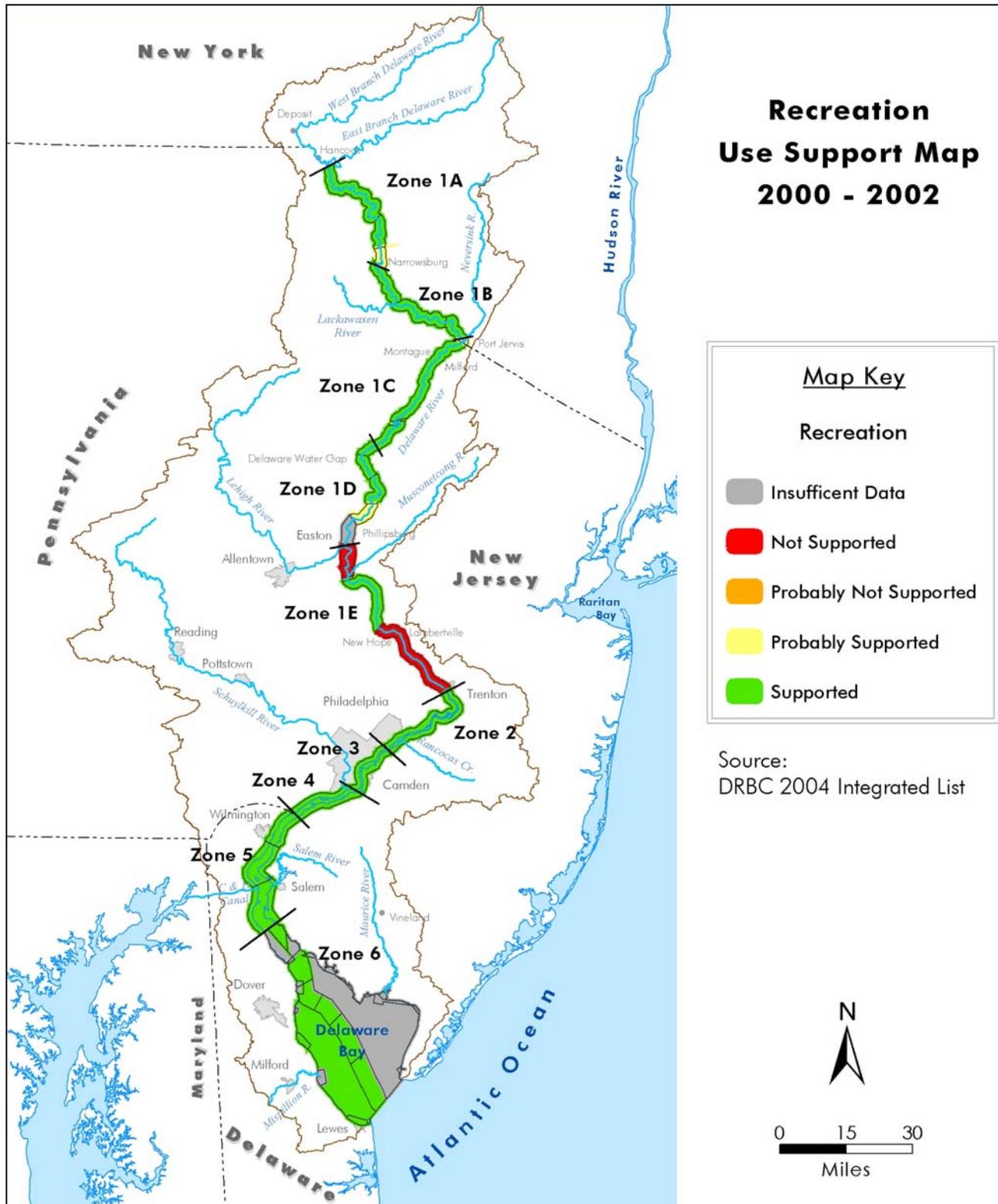
* sufficient data exist for calculating 30-day geometric means

Estuary

The use was supported in Estuary zones 2-5 (97 square miles, or 100% of the Estuary, excluding the Bay) and in the assessable portion of the Bay (368 square miles, or 53% of the Bay). All other Bay assessment units could not be assessed for recreation, according to DRBC water quality standards, because of a lack of readily available enterococcus data.

The assessment process could be improved with more frequent bacteriological sampling overall, as well as a more comprehensive coverage of enterococcus sampling.

Figure 3.10: Recreation Use Support in Delaware River and Bay, 2000-2002



Drinking Water Designated Use

The assessment of the Drinking Water designated use, in this assessment, is based upon levels of toxic substances, Total Dissolved Solids or TDS (secondary drinking water standards, or maximum of 500 mg/L applies for this use), Turbidity, Hardness and Chlorides. Zones 1A-E, 2 and 3 are designated for drinking water use, or a total of 197 main stem river miles and 14 square miles of Estuary.

Historical monitoring data show that levels of PCBs, 1,2 Dichloroethane (DCE) and Tetrachloroethene (PCE) exceed drinking water criteria in Zones 2 and 3 of the Delaware River. There is currently a TMDL in place for PCBs. Further, a 2000 DRBC resolution was passed by the Commissioners that noted that wasteload allocations were necessary in Zones 2 and 3, for DCE and PCE, in order to maintain the stream quality objectives. Discharge monitoring for these substances has occurred. Monitoring is underway to determine if the assimilative capacity of the Delaware River has in fact been exceeded for DCE and PCE. Modeling of the River has indicated that this is the case.

Figure 3.11 shows the level of drinking water use attainment for the various segments of the main stem Delaware River based upon an analysis of the parameters mentioned above. Note that Alkalinity, Chlorides, and Hardness criteria are not set for Zones 1A-E in the River. Note also that for Turbidity, which carries a “30-day average” criterion as well as a maximum value criterion, averages were calculated for the entire dataset. This was because the temporal nature of the data was not sufficient to calculate 30-day averages that would be useful for this analysis. It is recommended that, in the future, turbidity be measured with a greater frequency to improve assessment of the Drinking Water designated use.

The Drinking Water designated use was assessed along the length of the Delaware River from Hancock, NY (RM 335.5) down to the bottom of Zone 1 (202 miles) and in Zones 2 and 3 (14 square miles). This is equal to 100% of the main stem River and Estuary that are designated for that use.

Non-Tidal River

In Zones 1A-E, use support was based upon Turbidity and Total Dissolved Solids data. The use was supported in all Zones except those in Table 3.18.

Table 3.18: Non-Tidal Assessment Units Not Supporting the Drinking Water Designated Use

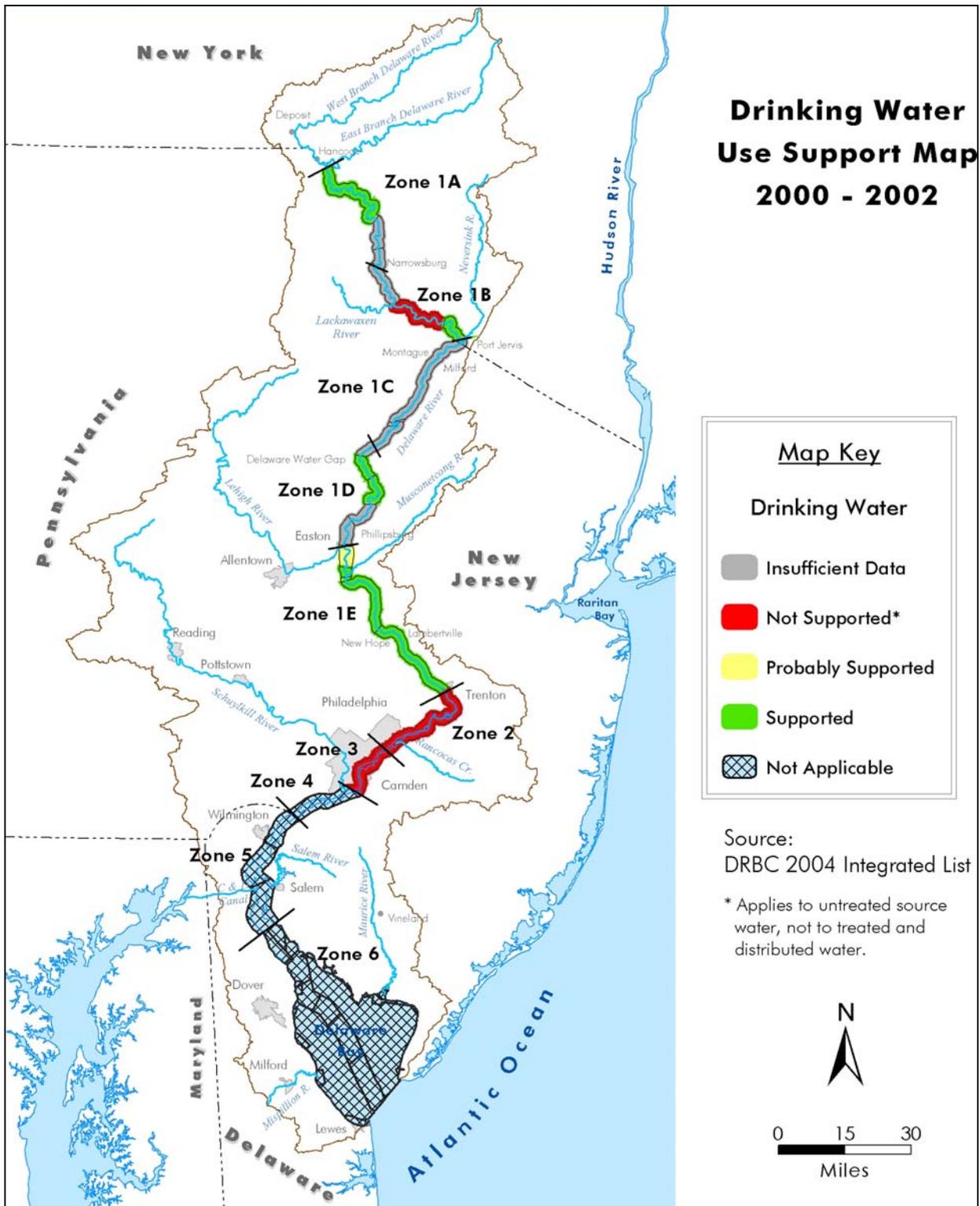
| AU | Use Support Level | Rationale |
|-----------|--------------------------|--|
| 1A2-1A3 | Insufficient Data | No readily available Total Dissolved Solids data |
| 1B1 | Insufficient Data | No readily available Total Dissolved Solids data |
| 1B2 | Not Supported | Turbidity does not meet criteria |
| 1C1-1C4 | Insufficient Data | No readily available Total Dissolved Solids data, no readily available data in 1C1 and 1C3 |
| 1D1 | Insufficient Data | No readily available Total Dissolved Solids data |
| 1D4 | Probably Supported | No readily available Turbidity data |
| 1D5 | Insufficient Data | No readily available data |
| 1E1 | Probably Supported | No readily available data but upstream and downstream AUs support the use |
| 1E3 | Probably Supported | No readily available data but upstream and downstream AUs support the use |

Estuary

In Zones 2 and 3 (15 square miles, or 100% of the designated area in the Estuary) the drinking water use was assessed as Not Supported. The ambient quality of the water in those zones does not meet the water quality criteria for fish and water ingestion. According to Section 3.10.3.D of DRBC's Water Quality Regulations (1996), "It is the policy of the Commission to designate numerical stream quality objectives for the protection of human health for the Delaware River Estuary (Zones 2 through 5) which correspond to the designated uses of each zone." It is those stream quality objectives, corresponding to the drinking water and fish consumption uses in Zones 2 and 3, that are not being attained and therefore those uses are considered not to be supported in this assessment. This does not, however, indicate that the quality of water treated and distributed for public use is not meeting the applicable drinking water criteria. Only ambient (in-stream) criteria were considered in this assessment.

Monitoring is underway to determine if the assimilative capacity of Zones 2 and 3 has been exceeded for DCE and PCE, as modeling of the system indicates. A TMDL for PCBs is in place for this portion of the River. Both the 2000 305(b) report (1998-1999 assessed) and 2002 305(b) report (2000-2001 assessed) indicated non-support in these zones. This assessment continues that characterization, until further data are collected and analyzed.

Figure 3.11: Drinking Water Use Support in Delaware River and Estuary, 2000-2002



Final Categorization of Assessment Units

Figure 3.12 represents the Integrated List categories into which each of the AUs belongs. The results of this assessment indicate that the vast majority of the Delaware River and Bay is in Category 5, not supporting one or more uses and requiring a TMDL. In some cases, non-support of the Fish Consumption designated use was the only cause of a water body being placed in Category 5. All parts of the River and Bay are affected by fish consumption advisories.

Figure 3.12: Categorization of AUs of the Delaware River and Bay, 2000-2002

