Appendix F

Exceedances of Onondaga Lake Sediment Effect Concentrations and Probable Effect Concentrations

APPENDIX F. EXCEEDANCES OF ONONDAGA LAKE SEDIMENT EFFECT CONCENTRATIONS and PROBABLE EFFECT CONCENTRATIONS

This appendix provides figures comparing concentrations of contaminants detected in surface sediments collected in 1992 and 2000 with site-specific sediment effect concentrations (SECs) and probable effect concentrations (PECs). The 1992 sampling event examined samples taken from the upper 0 to 2 cm of the sediments throughout the lake. The 2000 sampling event concentrated on the more heavily contaminated areas (i.e., in the south basin and the Ninemile Creek delta area) within the lake, and examined samples from the upper 0 to 15 cm of the lake surface, which is considered to be the biologically active zone. Two sets of site-specific SECs were used in this comparison, based on:

- The effects range-low (ER-L) and effects range-median (ER-M) methodology developed by Long and Morgan (1990).
- The threshold effects levels (TEL) and probable effects levels (PEL) methodology developed by MacDonald et al. (1996).

The calculation of the SECs is based on the separation of the data into stations at which effects were observed and stations at which no effects were observed. The effects and no-effects stations were determined using Washington State's SEDQUAL program, as discussed in Chapter 9 of this BERA.

There are sets of effect and no-effect stations for each of the four toxicity test parameters from the 1992 survey (i.e., amphipod biomass and survival and chironomid biomass and survival). SECs were calculated for each of these sets of stations, but the results for the chironomid survival were selected for use in this appendix, because these values were the most conservative overall.

SECs from the 2000 data set were calculated for each of the six toxicity test parameters from the 2000 survey (i.e., amphipod biomass, survival, and reproduction and chironomid biomass, survival, and emergence) for comparison to the 1992 results (see Chapter 9), but were not used here because the number of data points and the spatial extent of the stations were far more limited. Figures F-1 through F-45 present the comparisons of the 1992 and 2000 data to the site-specific ER-Ls and ER-Ms. The ER-L is the 10^{th} percentile of the concentration distribution of the effects data. The ER-M is the median of the concentration distribution for the effects data. Figures F-46 through F-91 present the comparisons of the data to the TELs and PELs. The TEL is the geometric mean of the 15^{th} percentile of the concentration distribution for the effects data and the median of the distribution for the no-effects data. The PEL is the geometric mean of the ER-M and the 85^{th} percentile of the concentration distribution for the no-effects data.

Consensus-based probable effect concentrations (PECs) for select contaminants in Onondaga Lake were developed following the methodology described in MacDonald et al. (2000) and Ingersoll et al. (2000) as the geometric mean of the site-specific SECs. Figures F-92 through F-137 present the comparisons of the data to the PECs.

The SECs and PECs shown in these figures for both organics and inorganics are presented on a dry-weight basis. More information about these SECs and PECs can be found in Chapters 9 and 10 of the BERA.

References

Ingersoll, C. D. MacDonald, N. Wang, J. Crane, L. J. Field, P. Haverland, N. Kemble, R. Lindskoog, C. Severn, and D. Smorong. 2000. Prediction of Sediment Toxicity Using Consensus-based Freshwater Sediment Quality Guidelines. EPA 906/R-00/007. June 2000.

Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum, NOS OMA 64. National Oceanic and Atmospheric Administration, Seattle, WA.

MacDonald D, C. Ingersoll, and T. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch.Environ Contam Toxicol 39:20-31

MacDonald, D.D., R.S. Carr, F.D. Calder, E.R. Long and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. Ecotoxicology 5:253-278.

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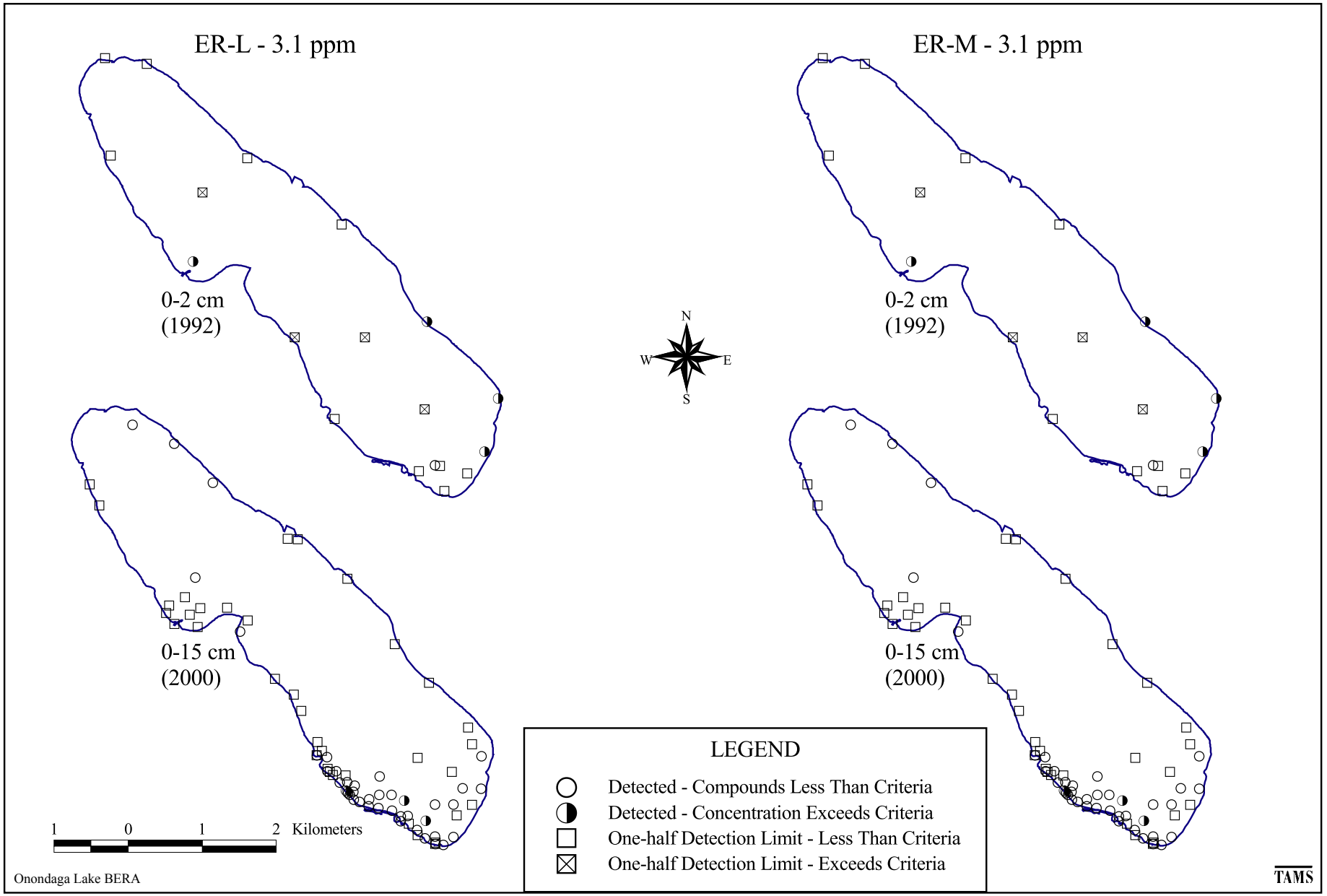

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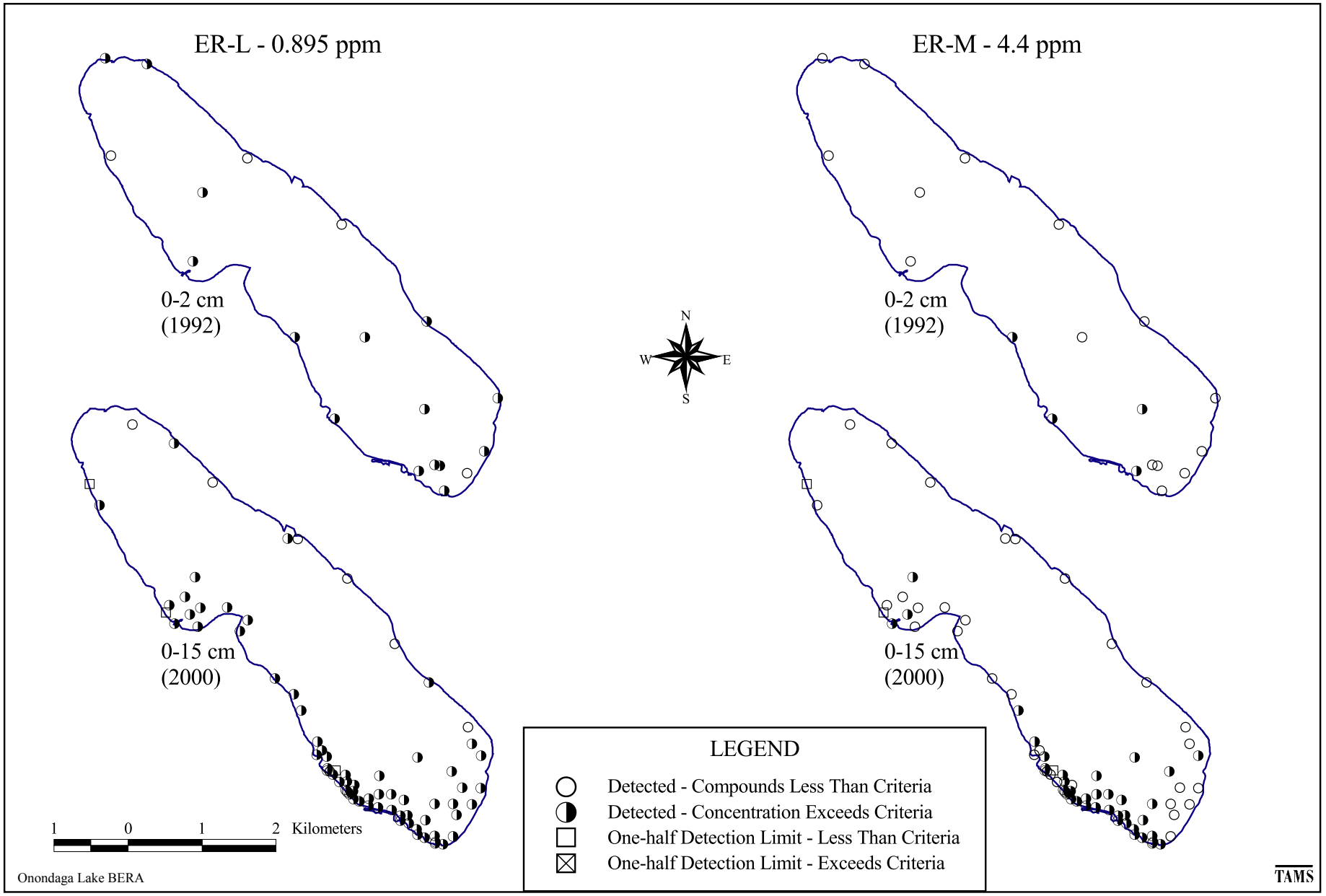

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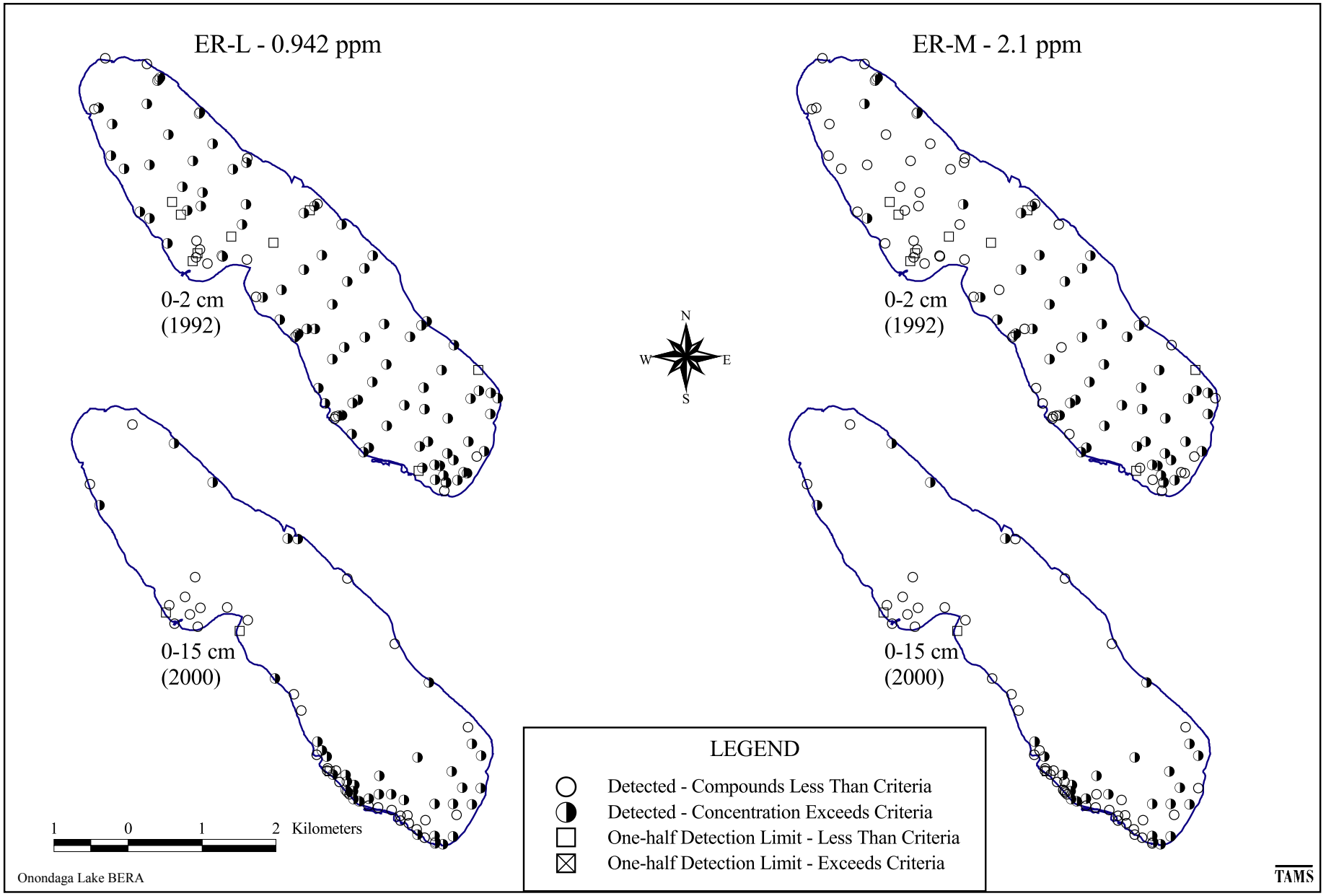

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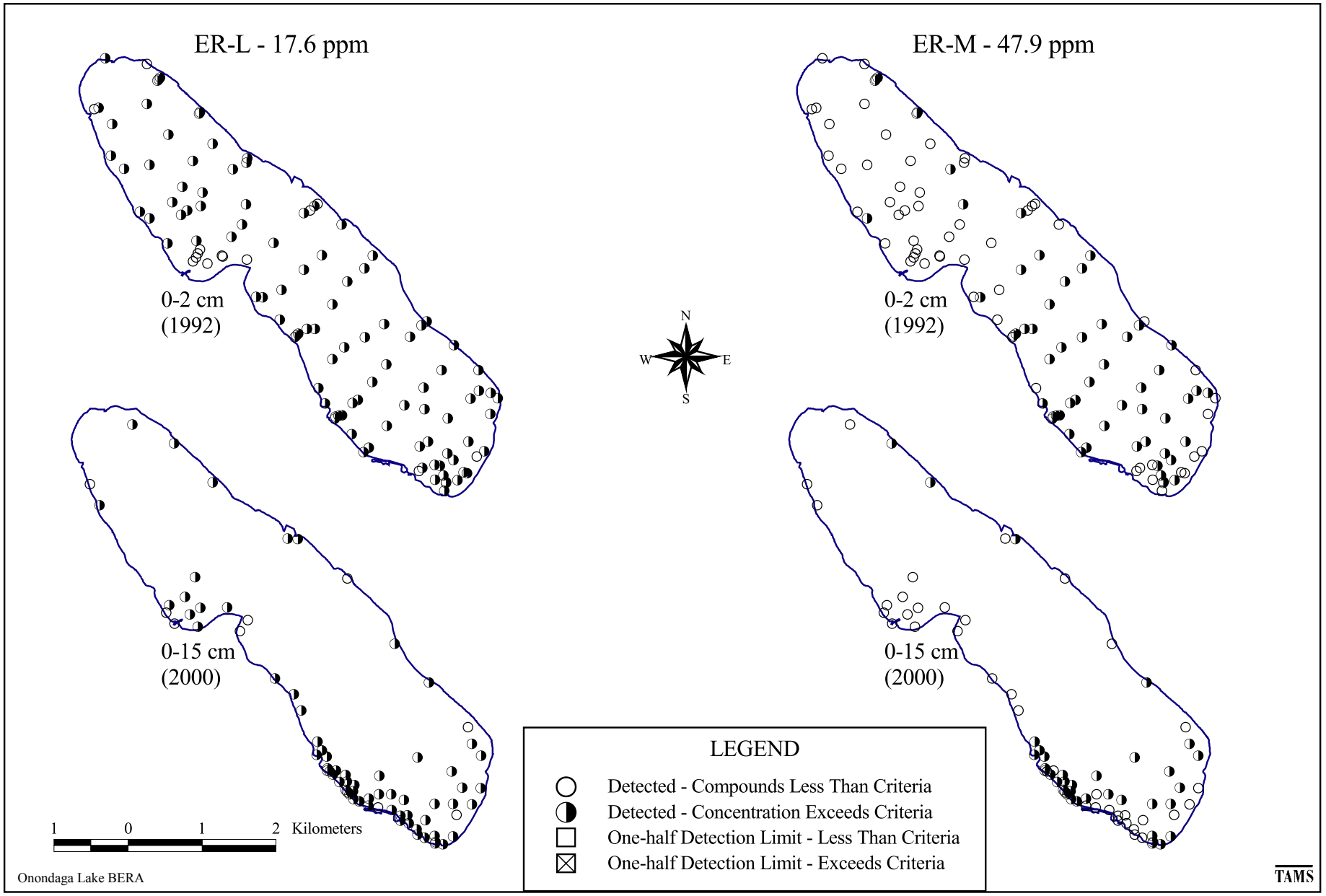

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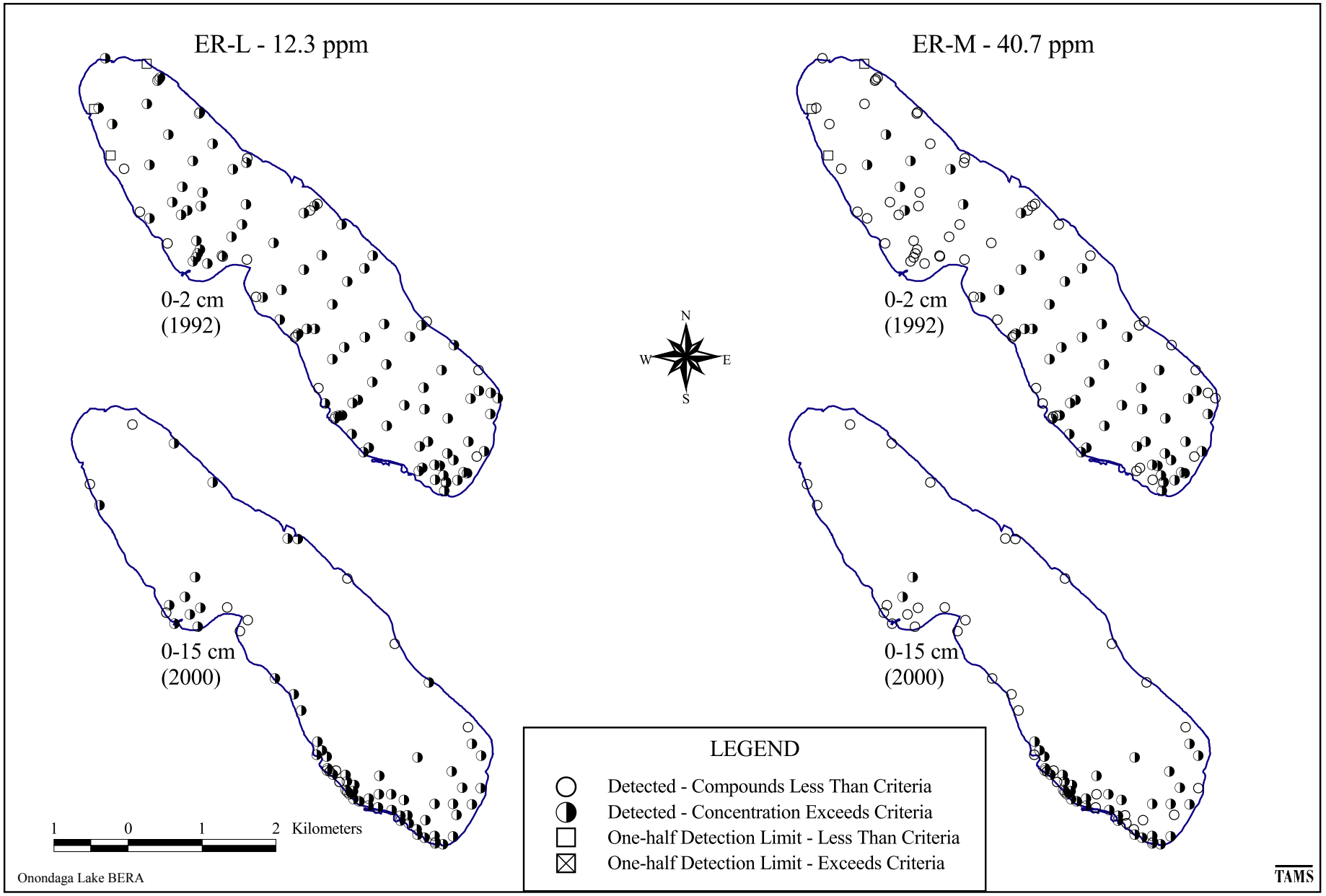

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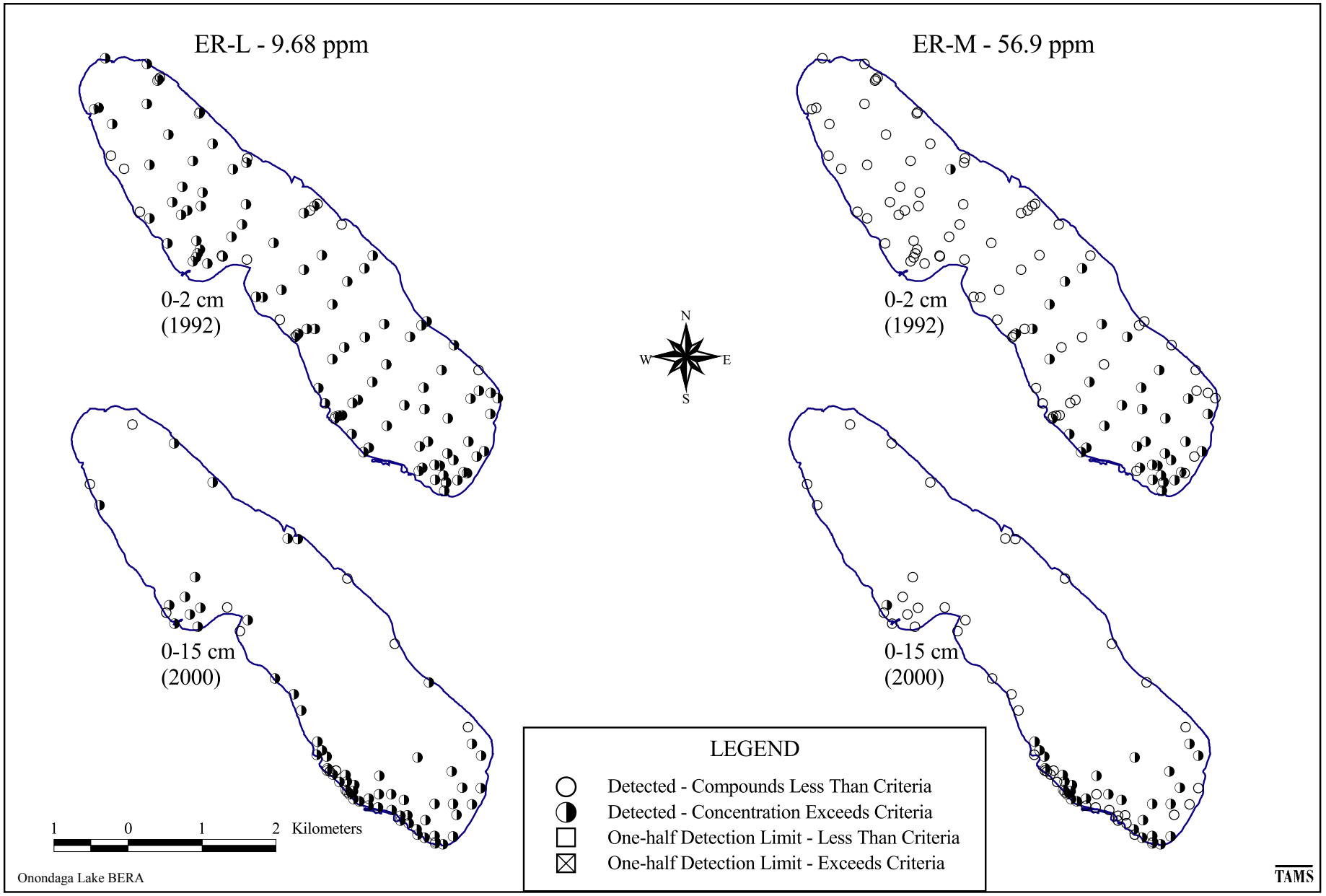

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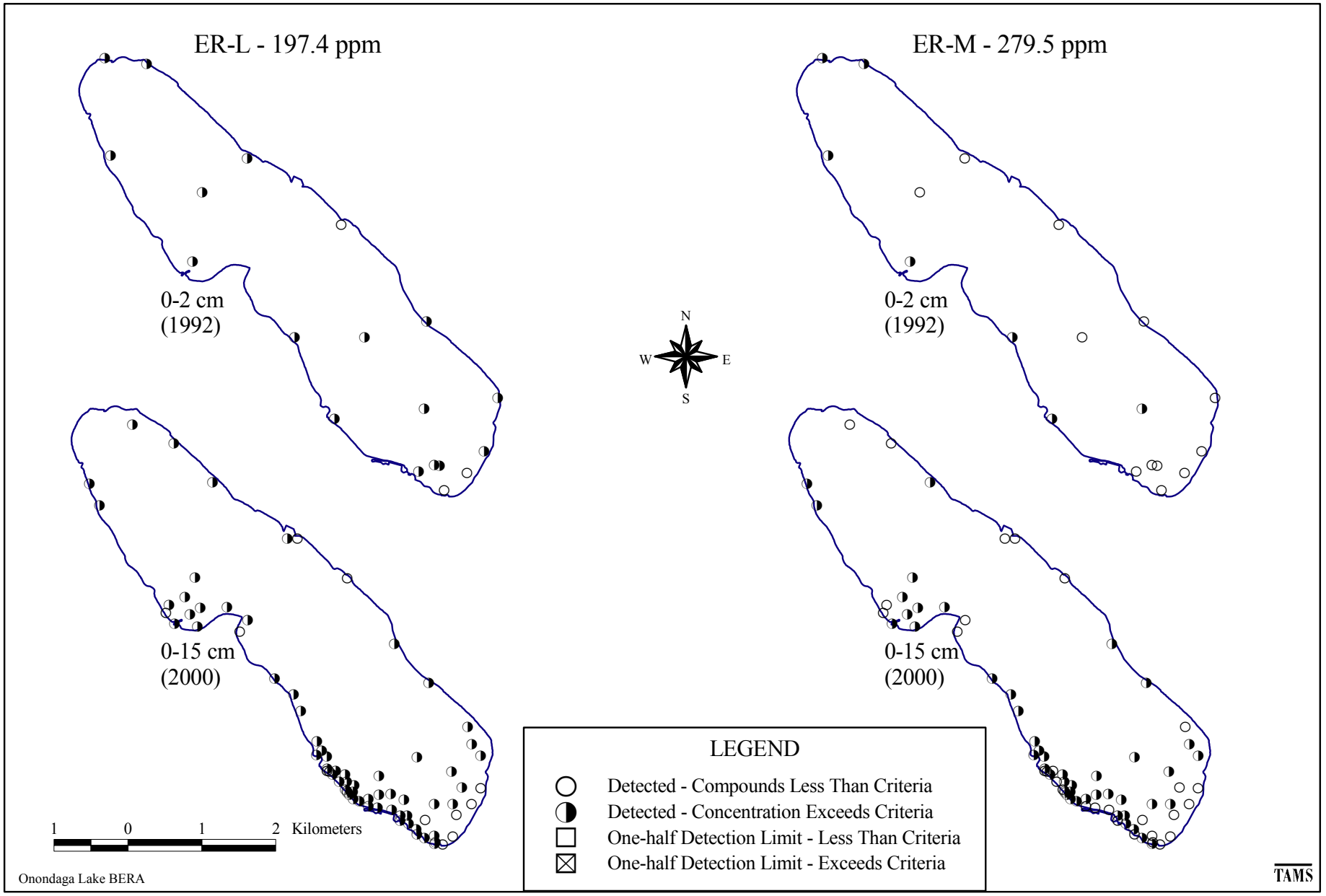

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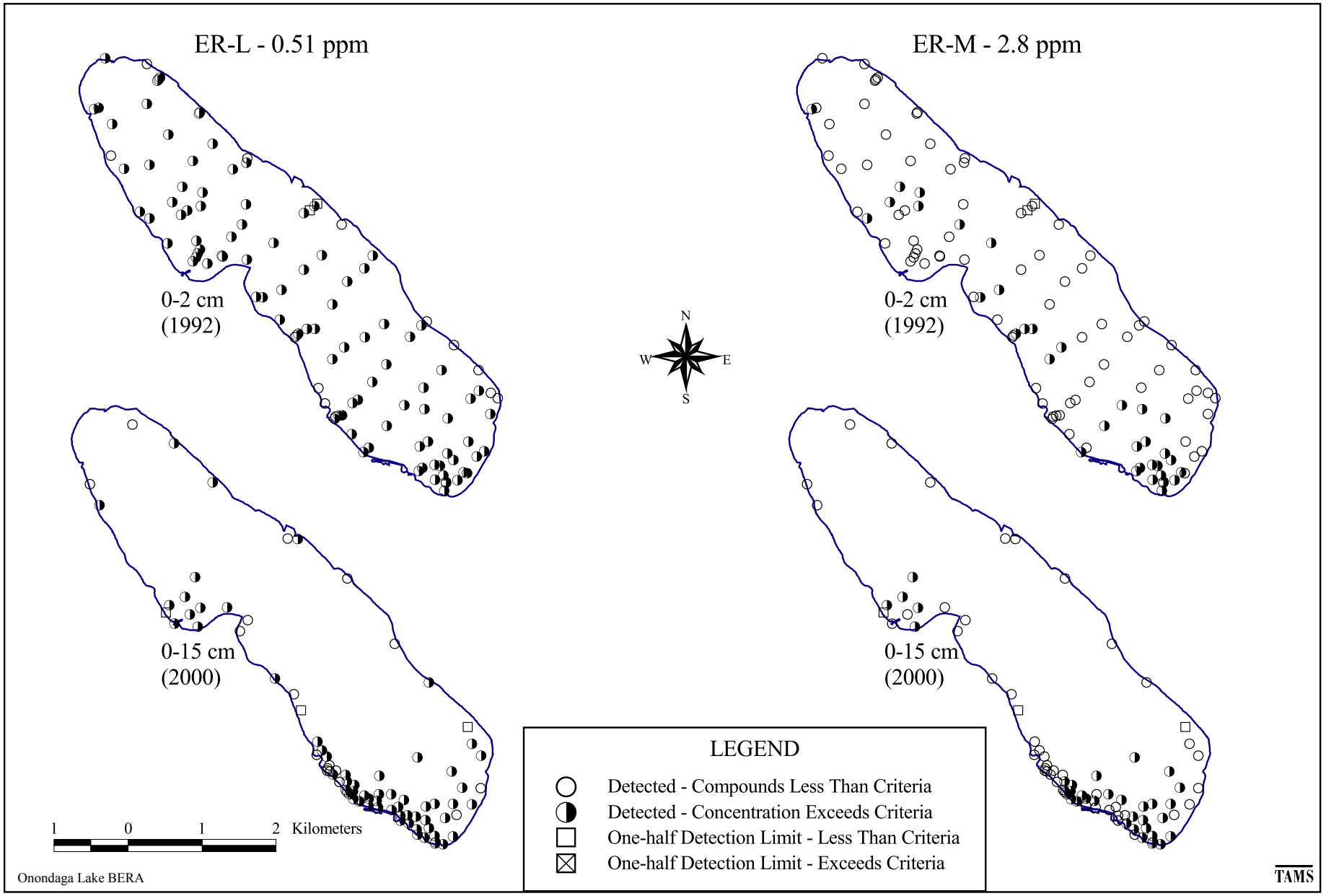

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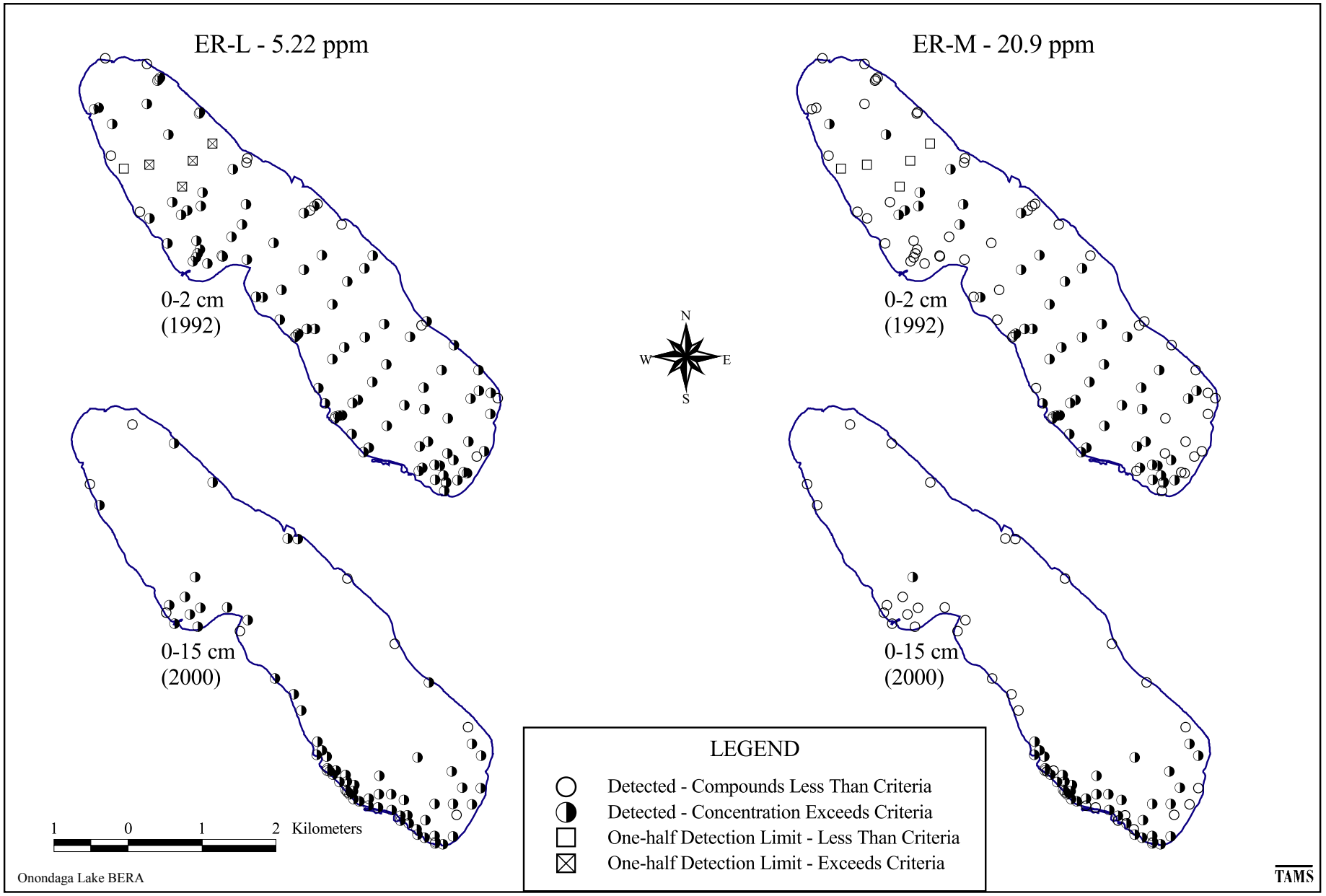

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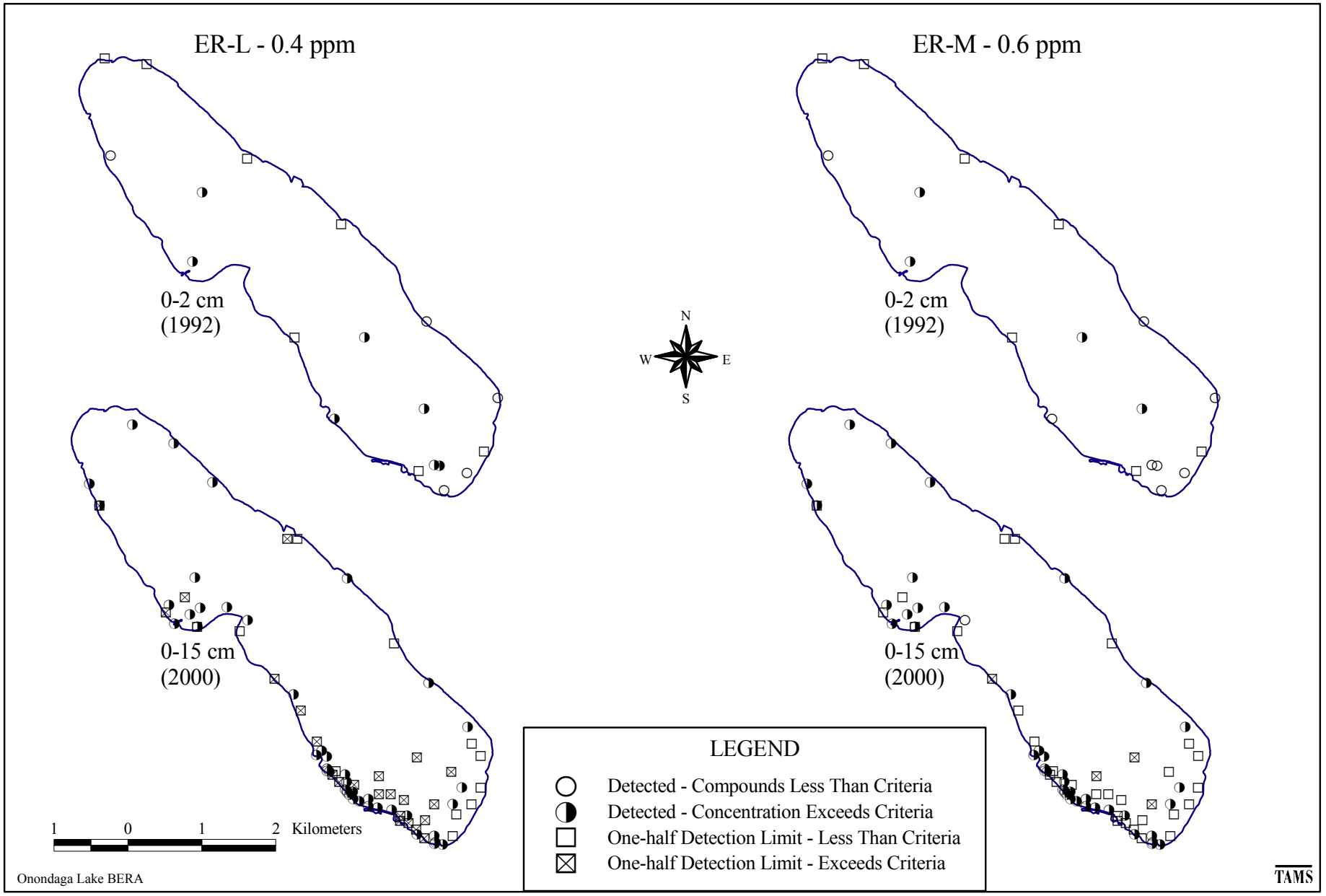

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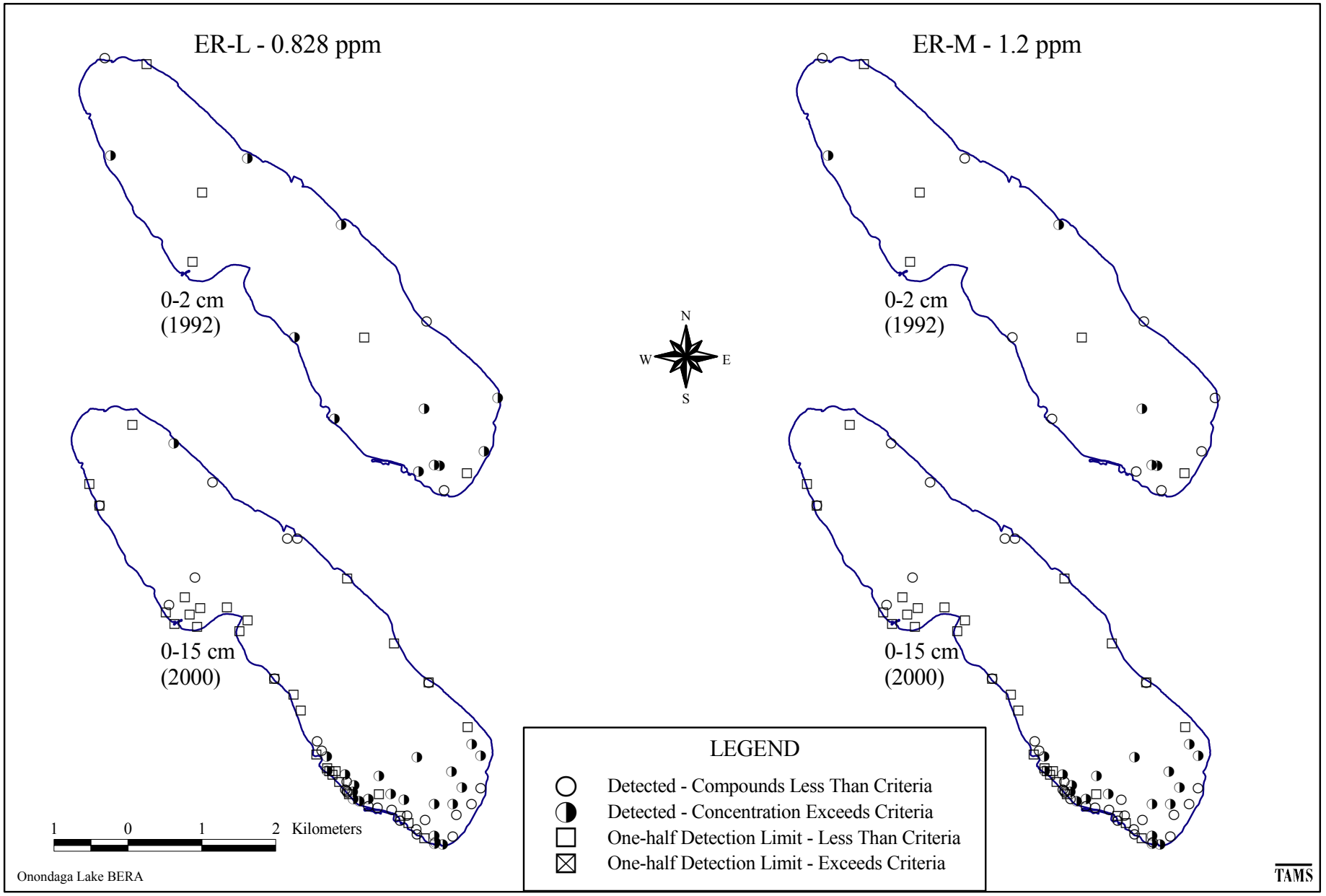

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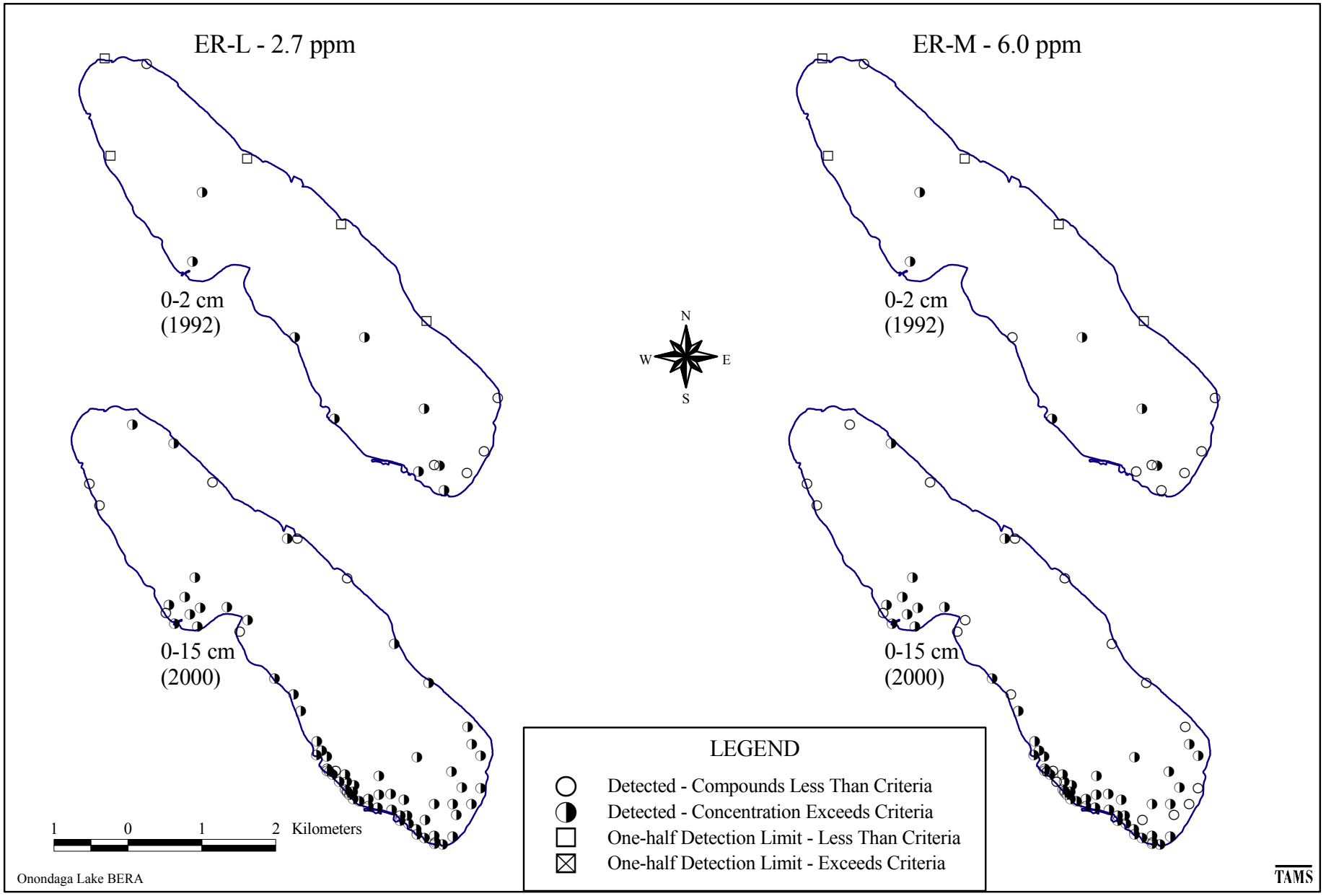

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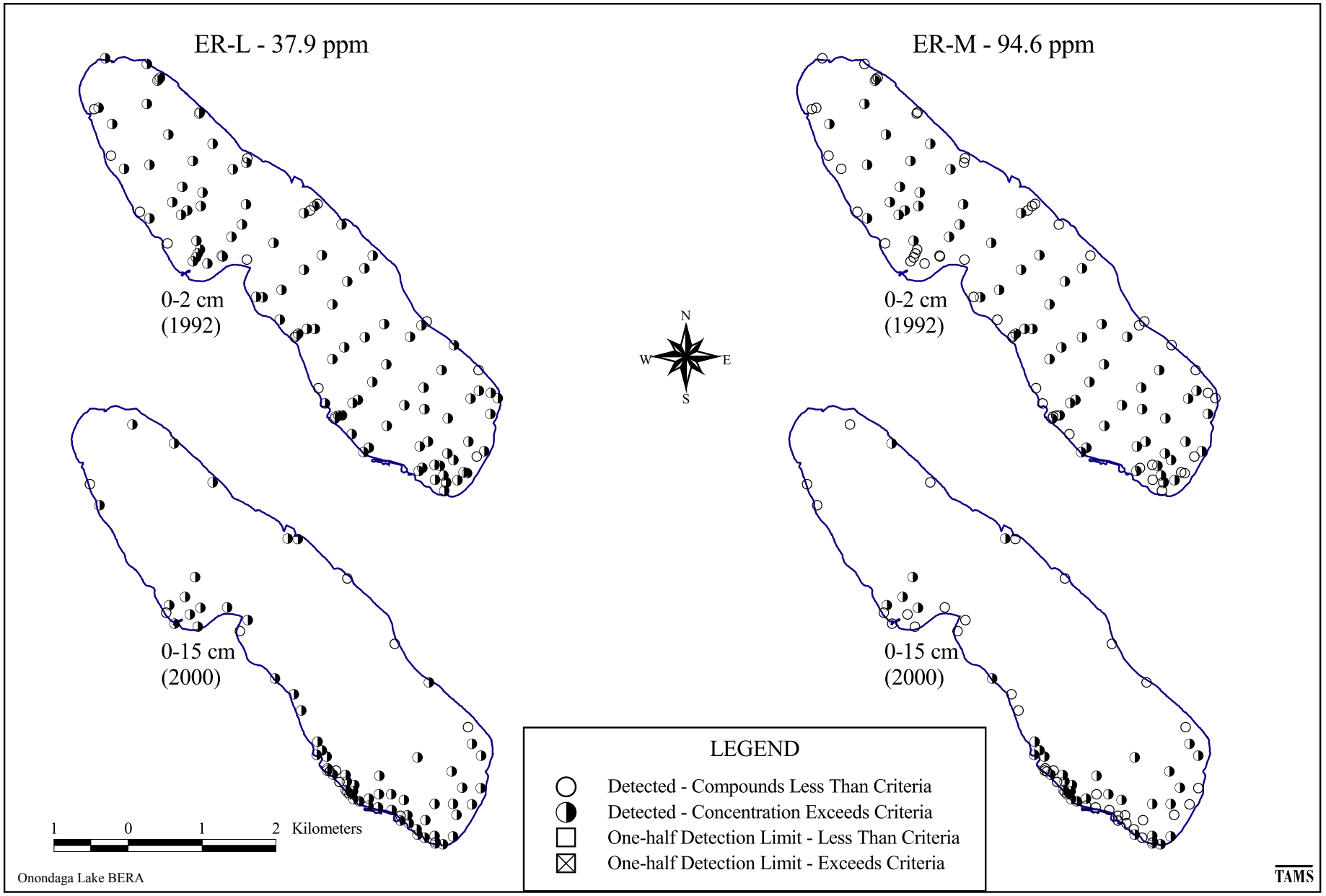

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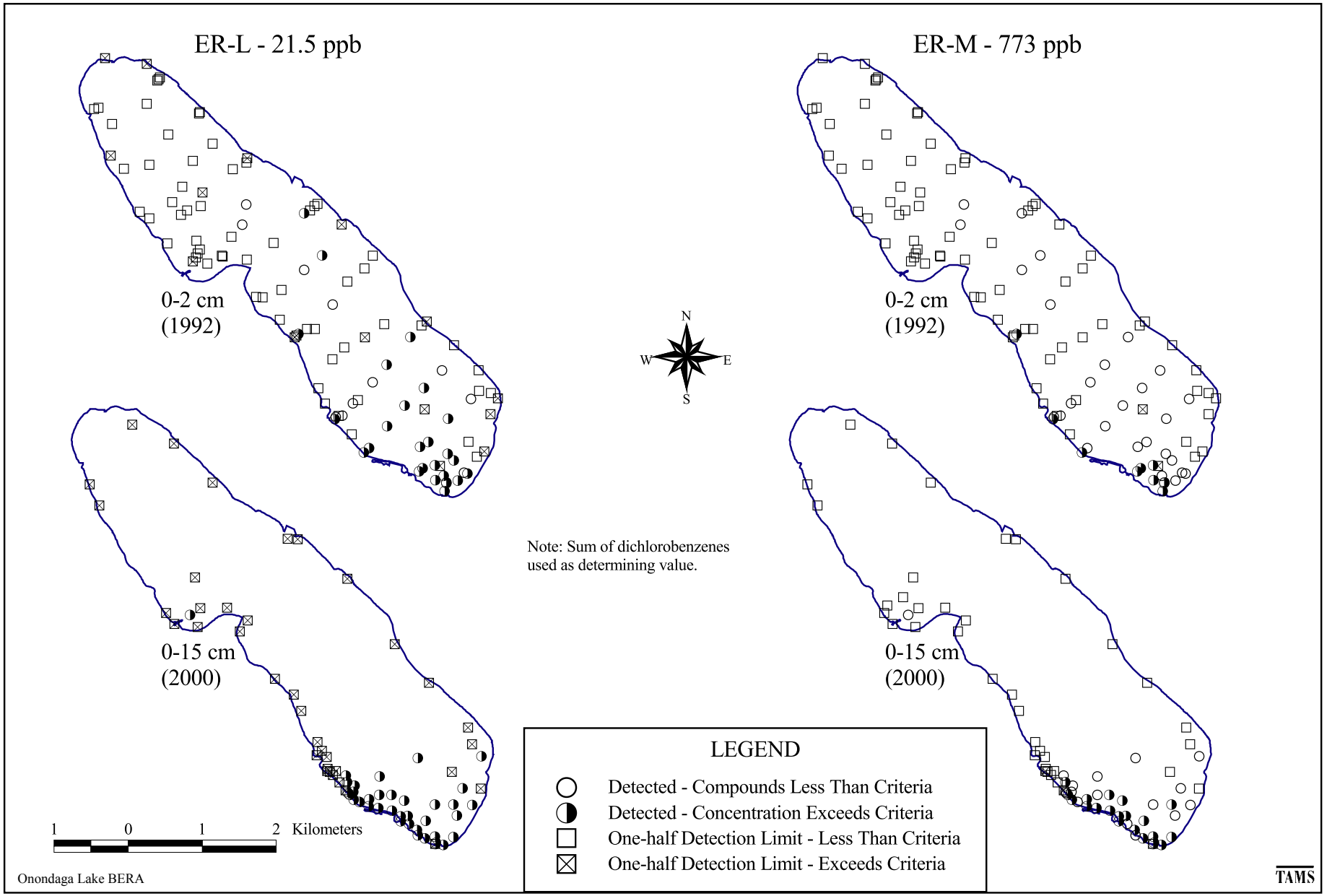

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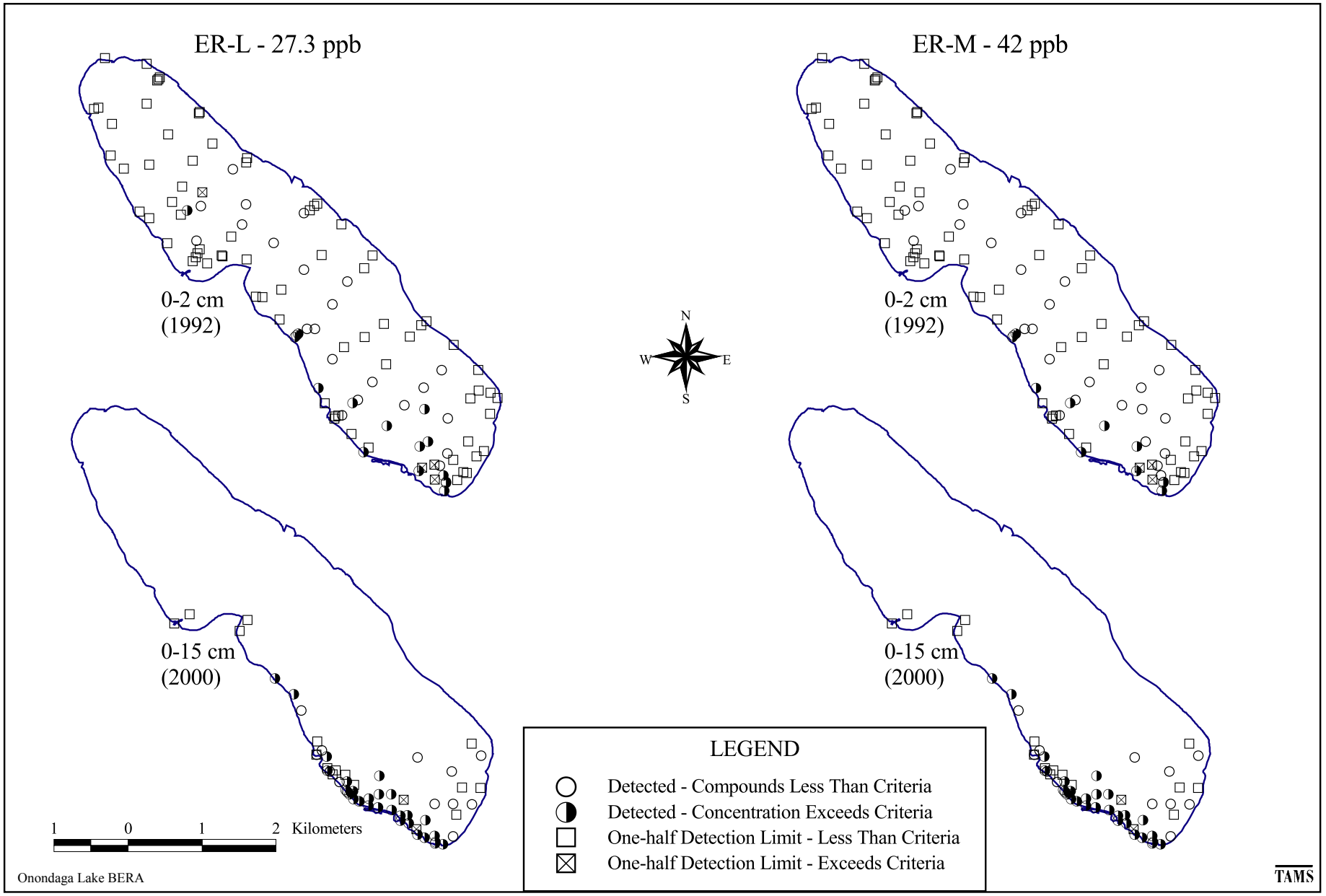

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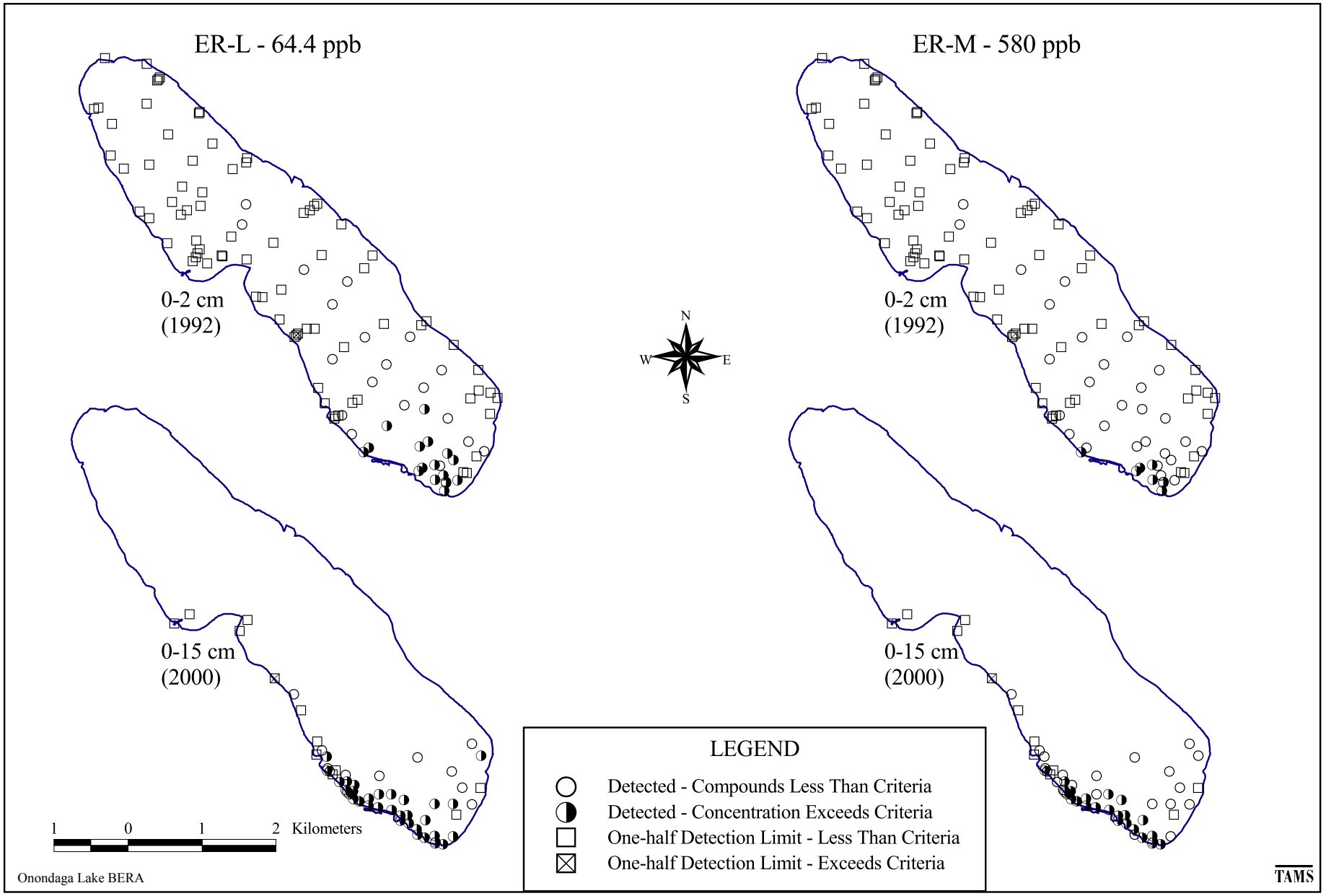

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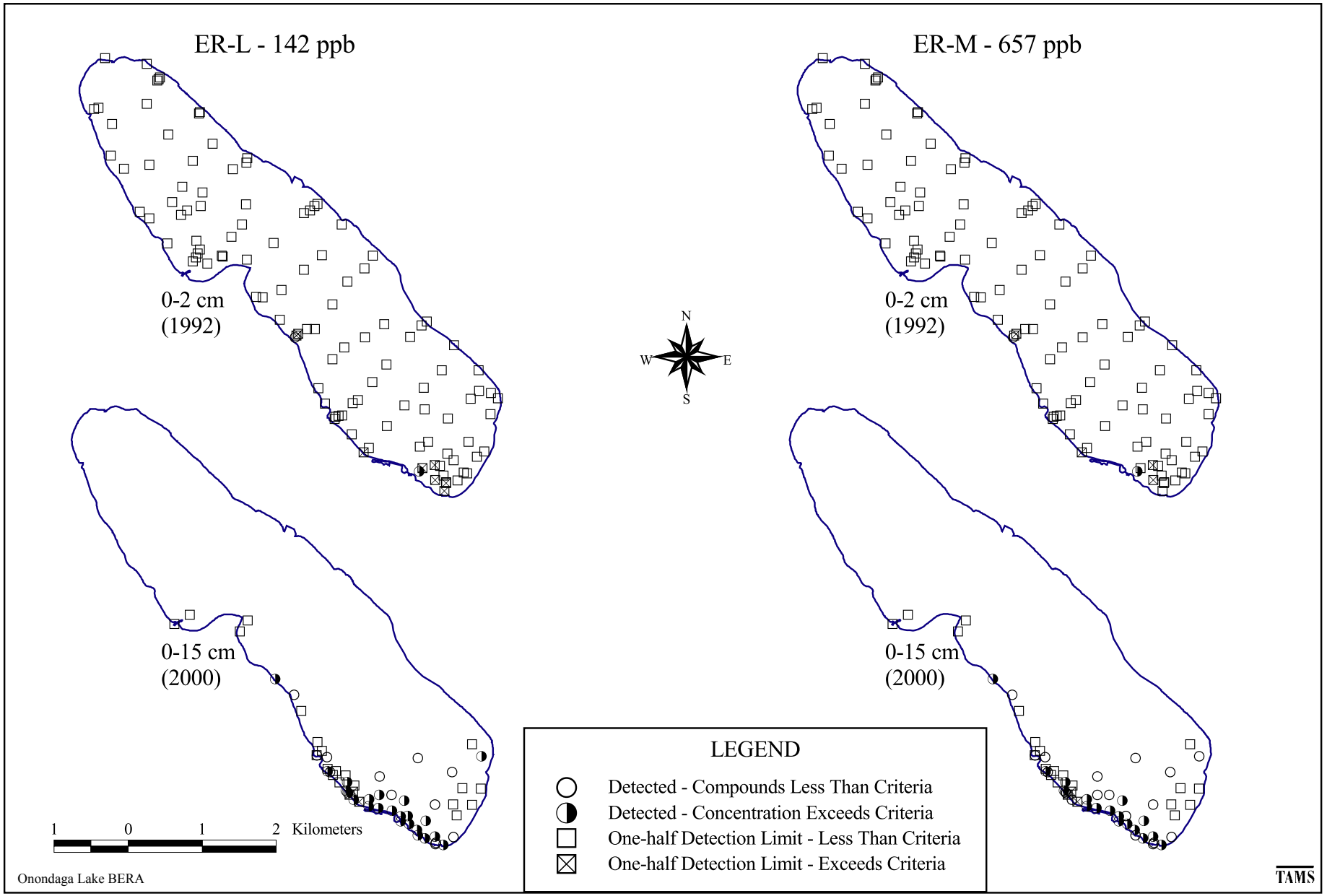

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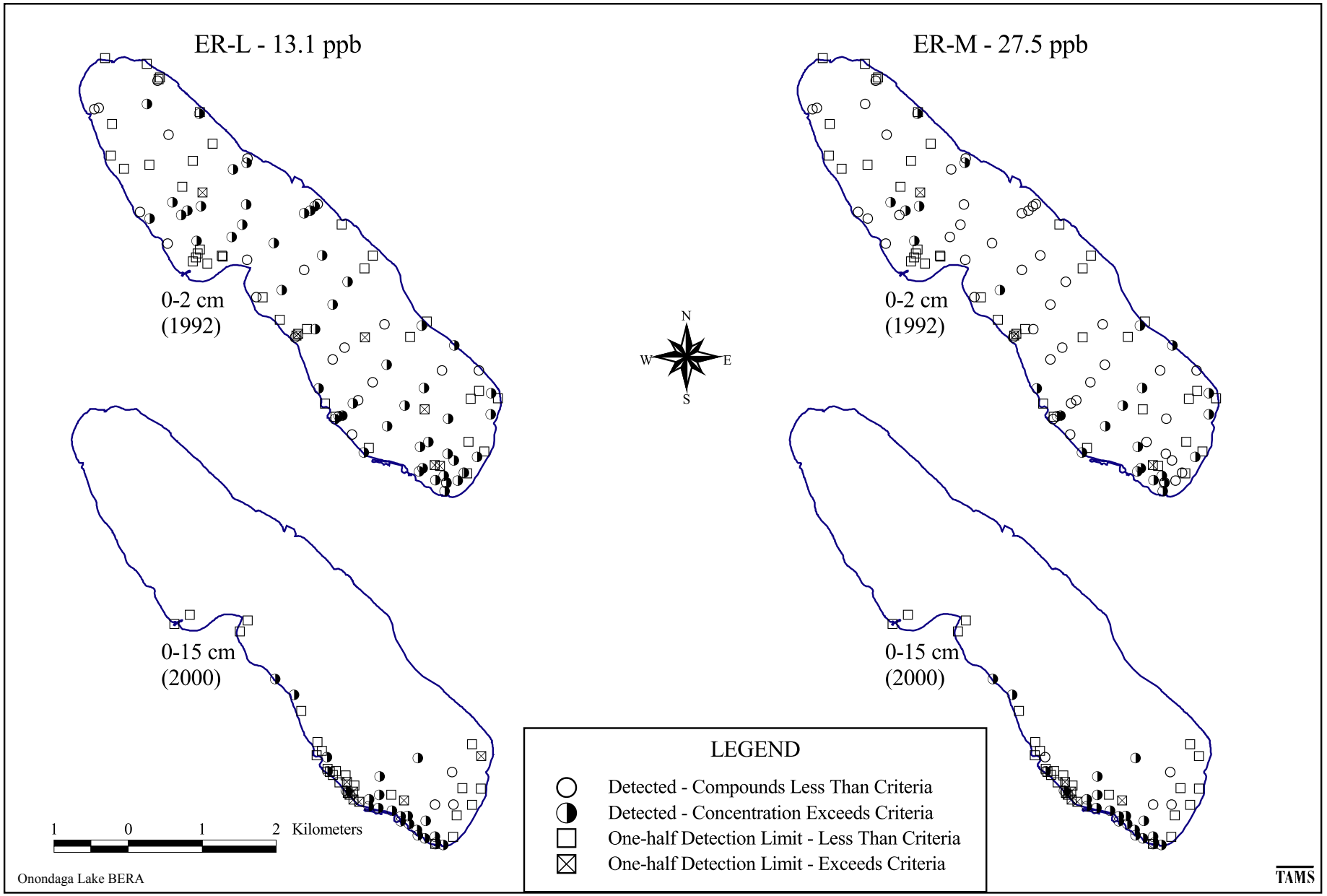

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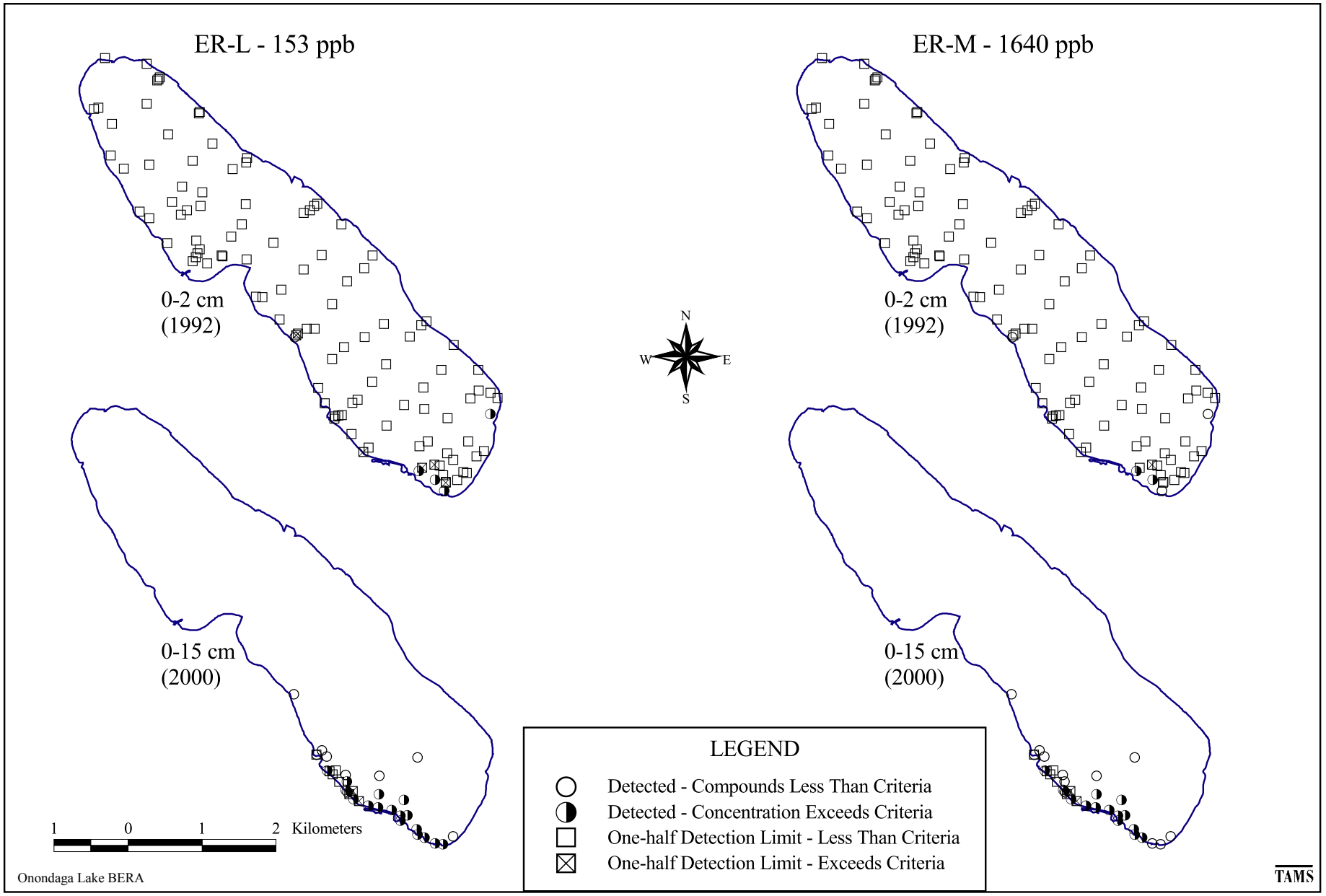

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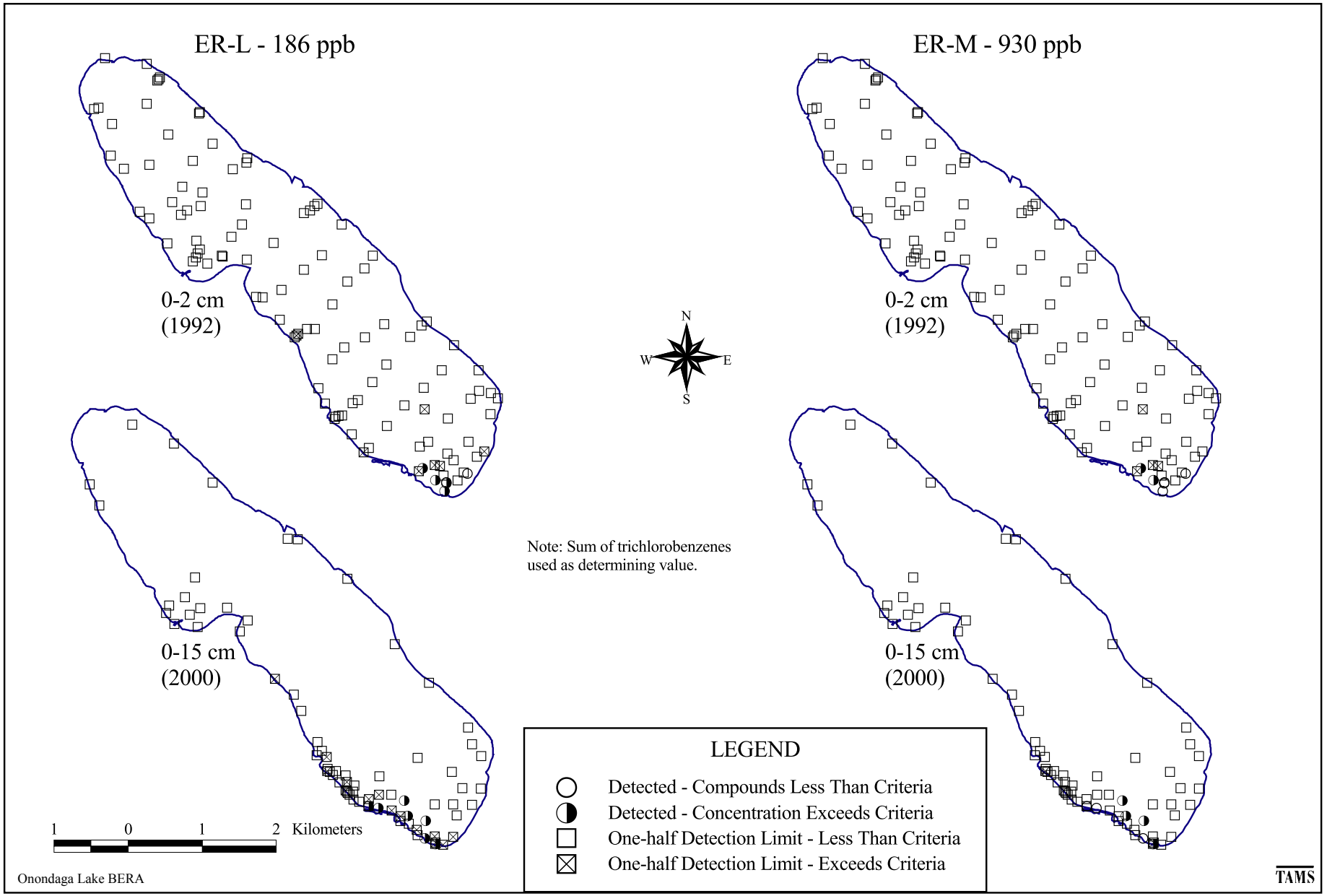

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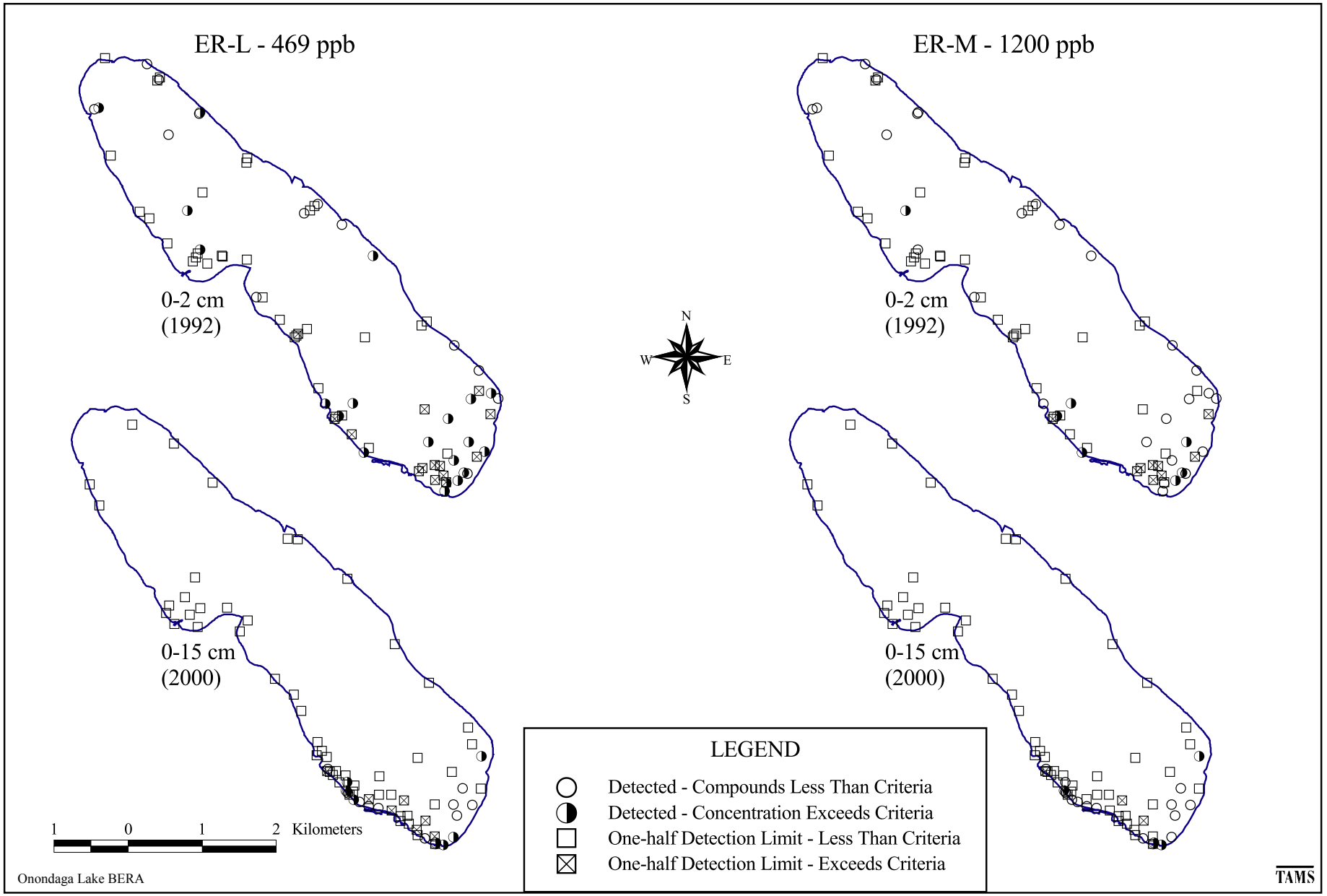

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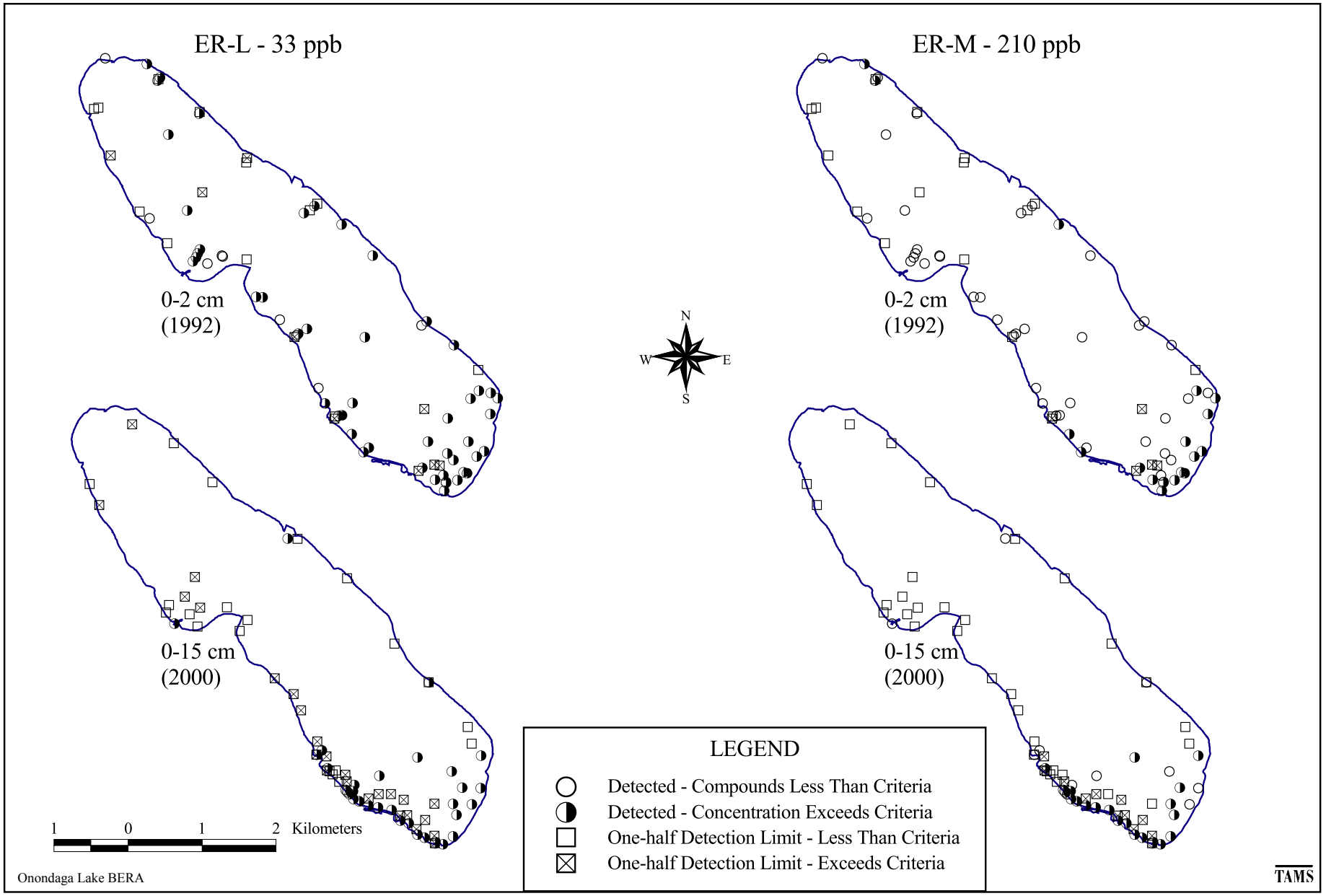

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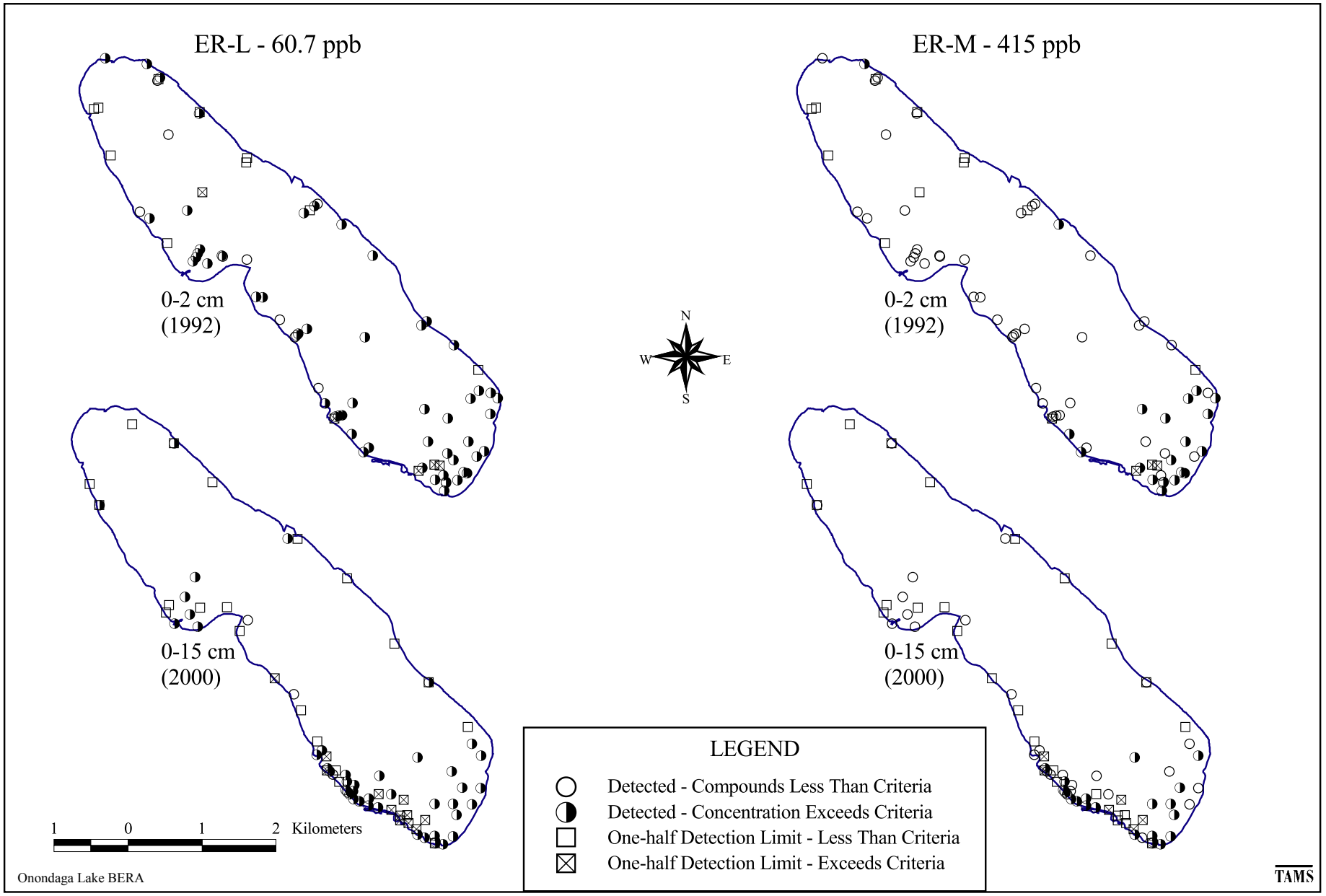

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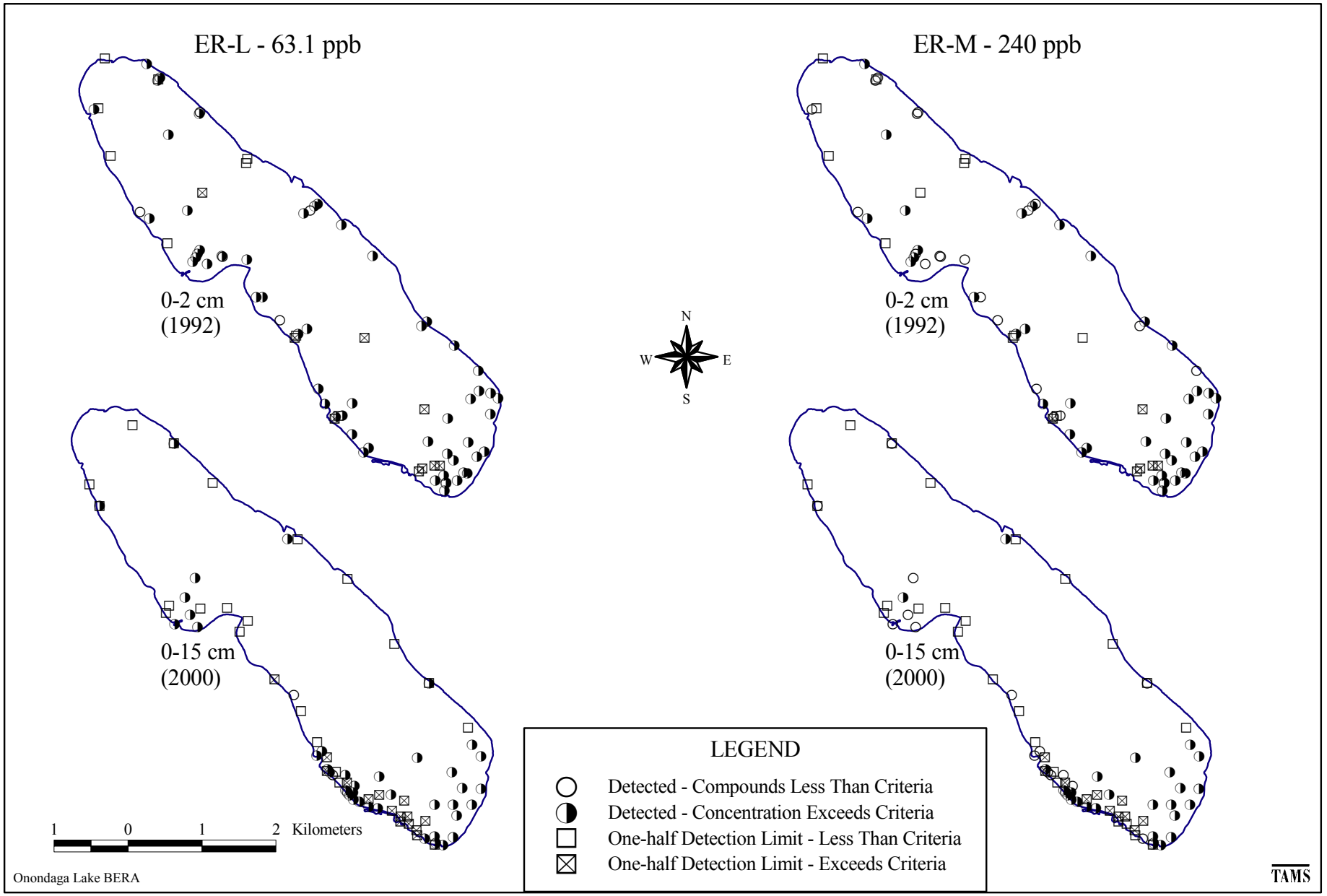

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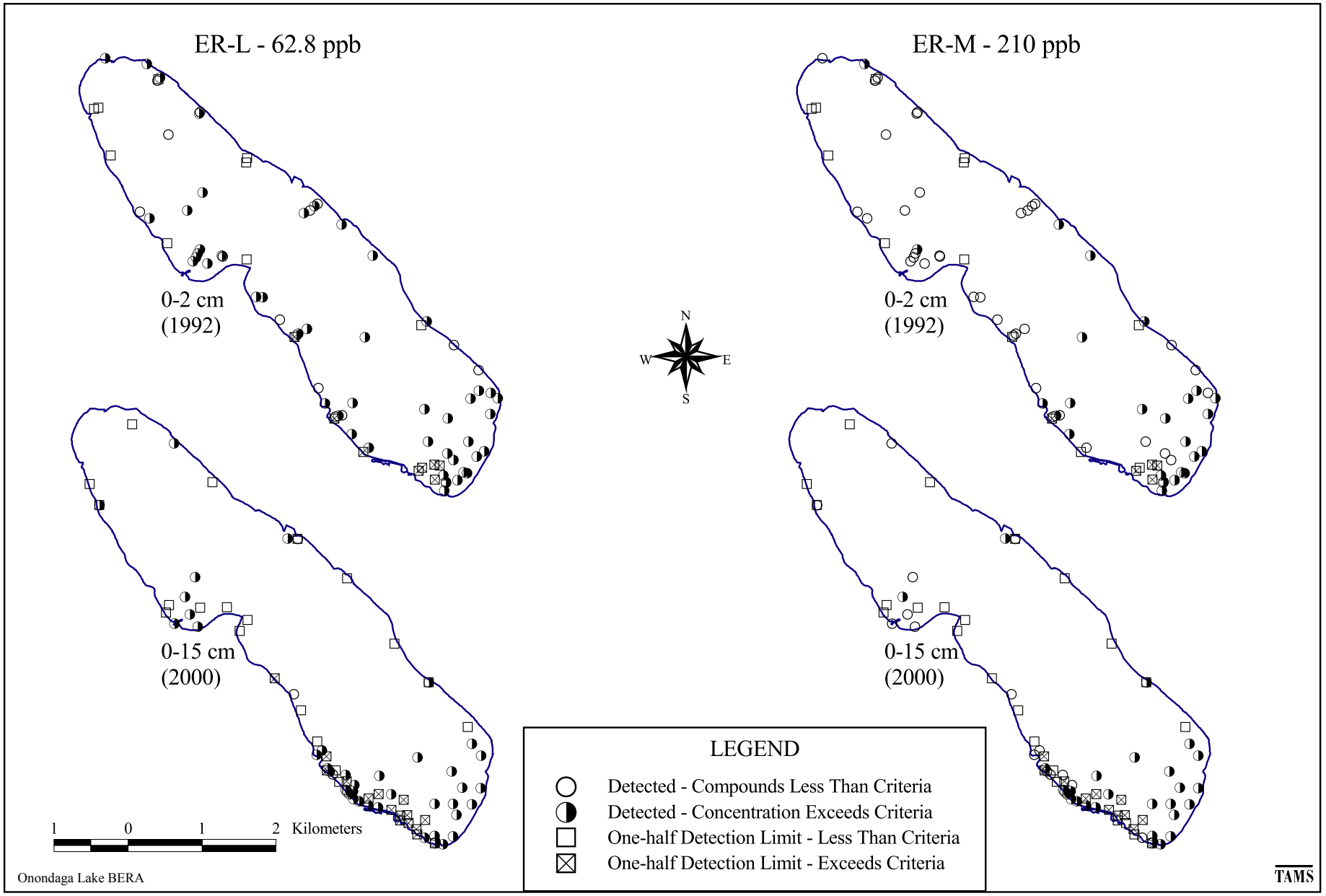

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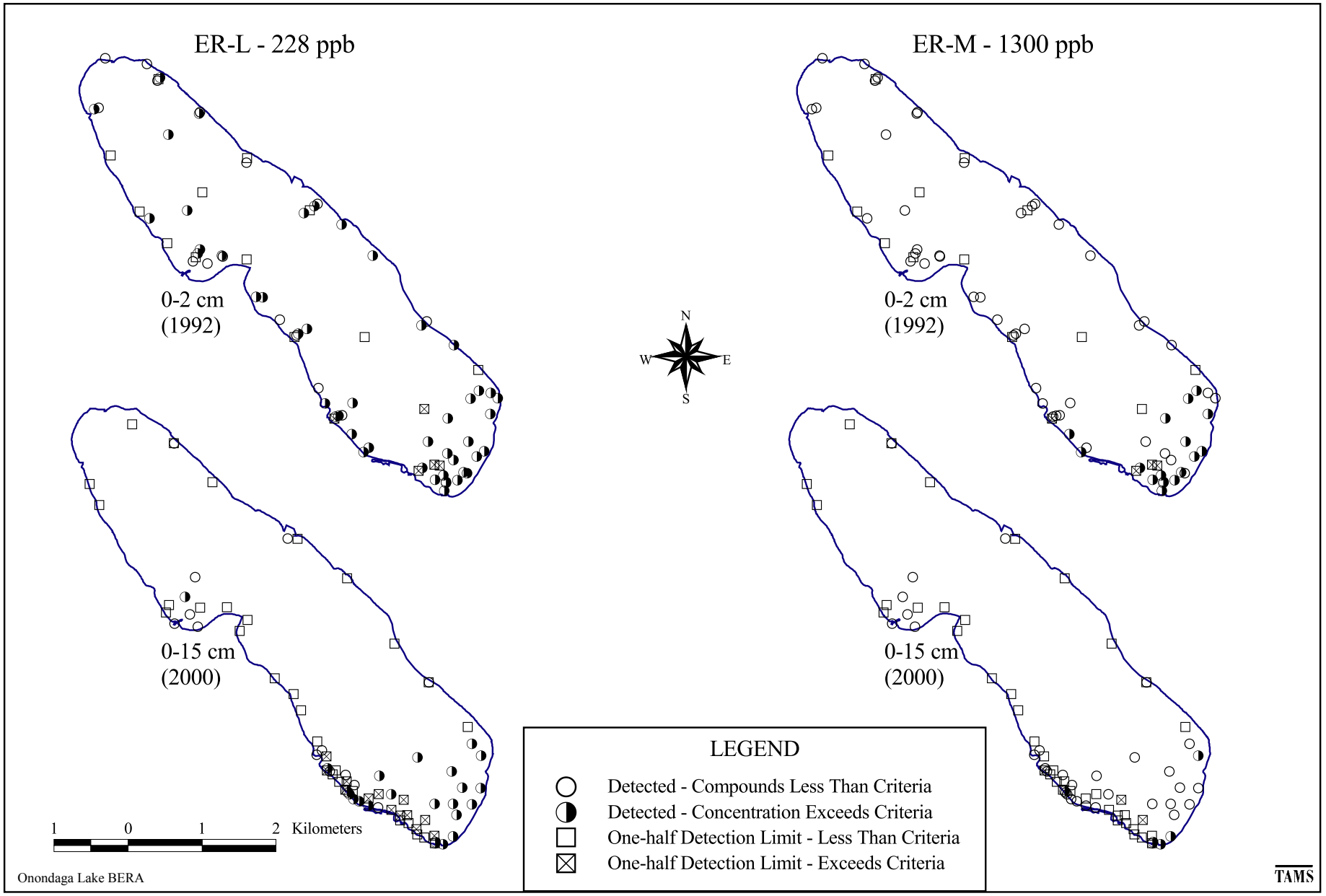

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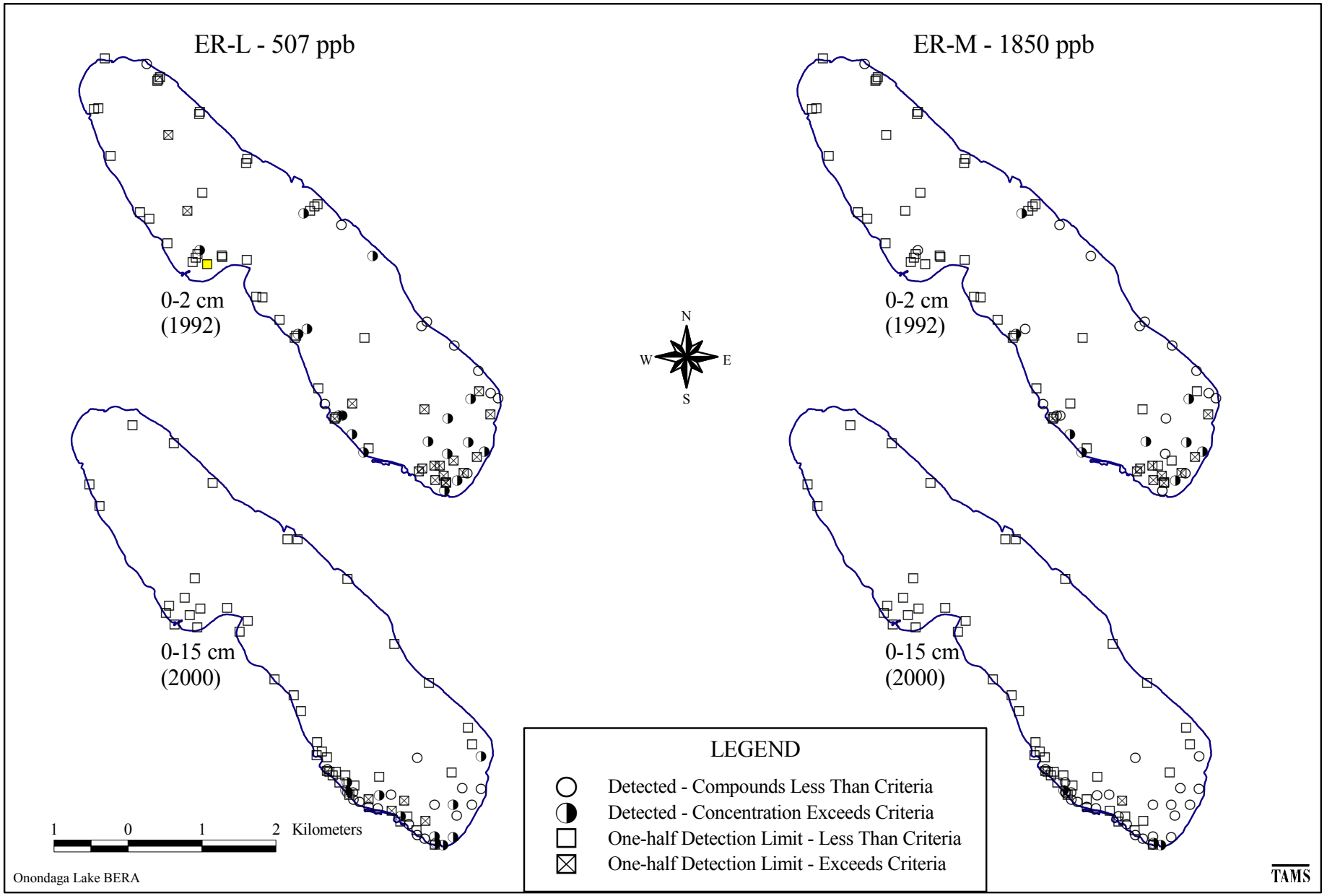

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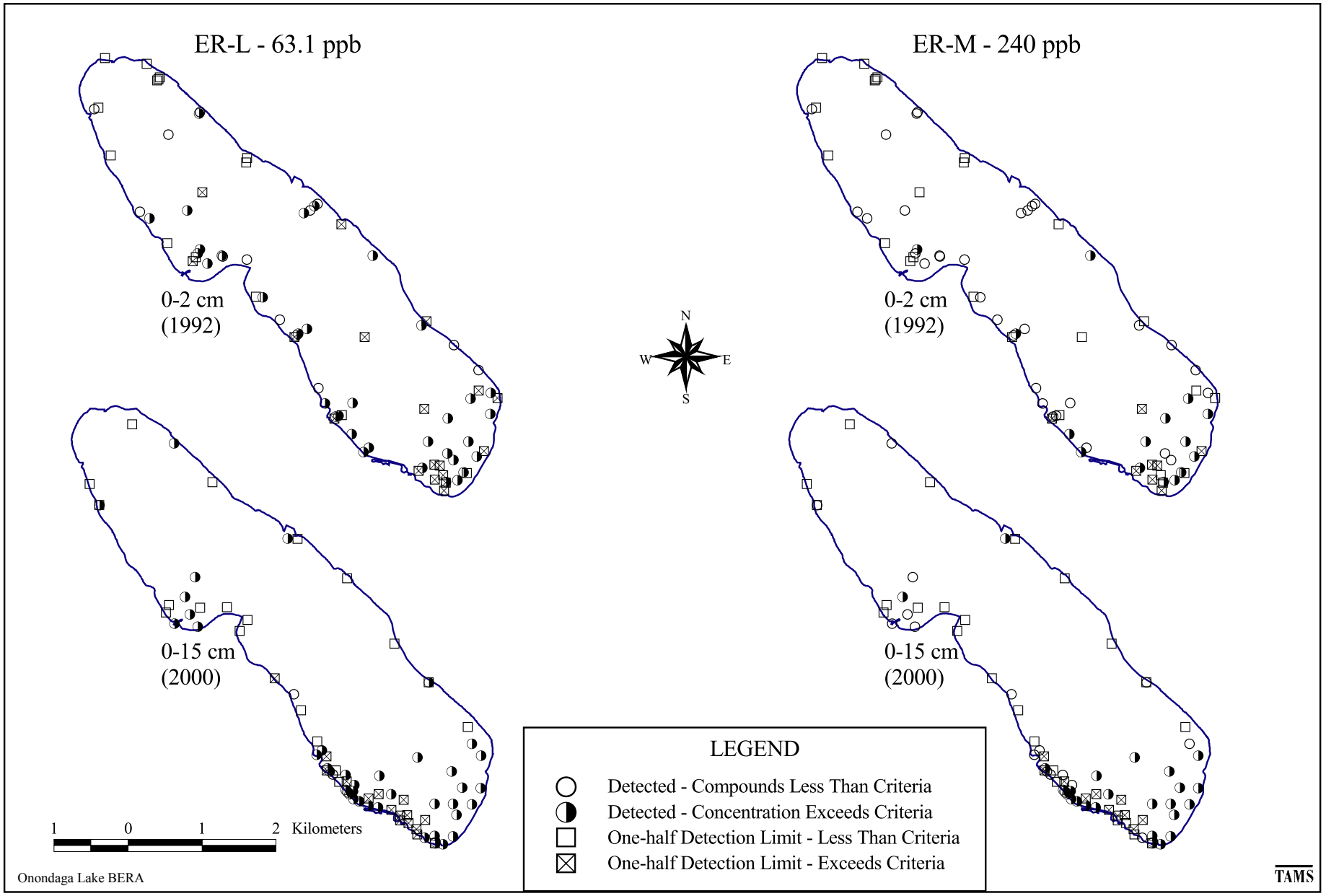

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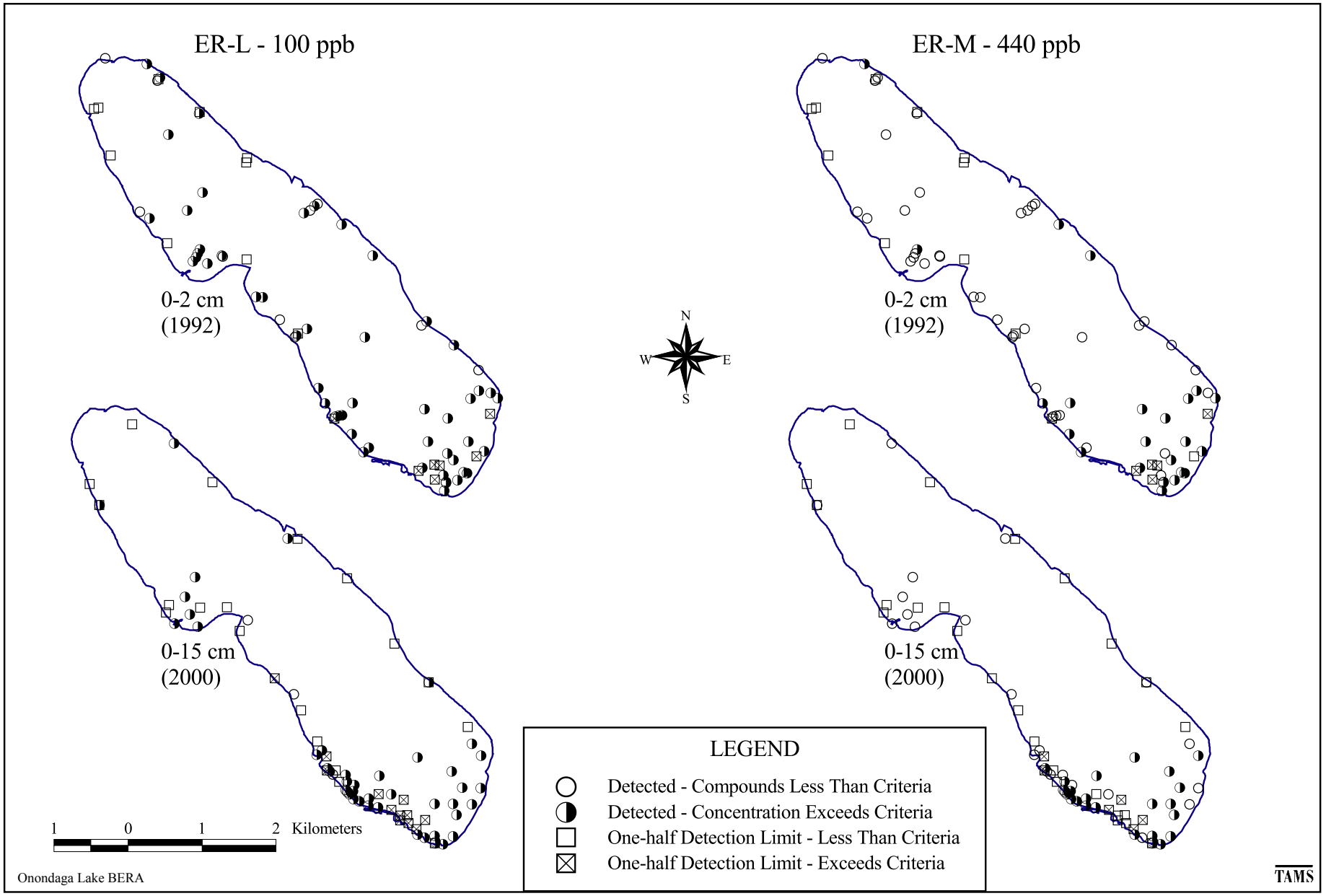

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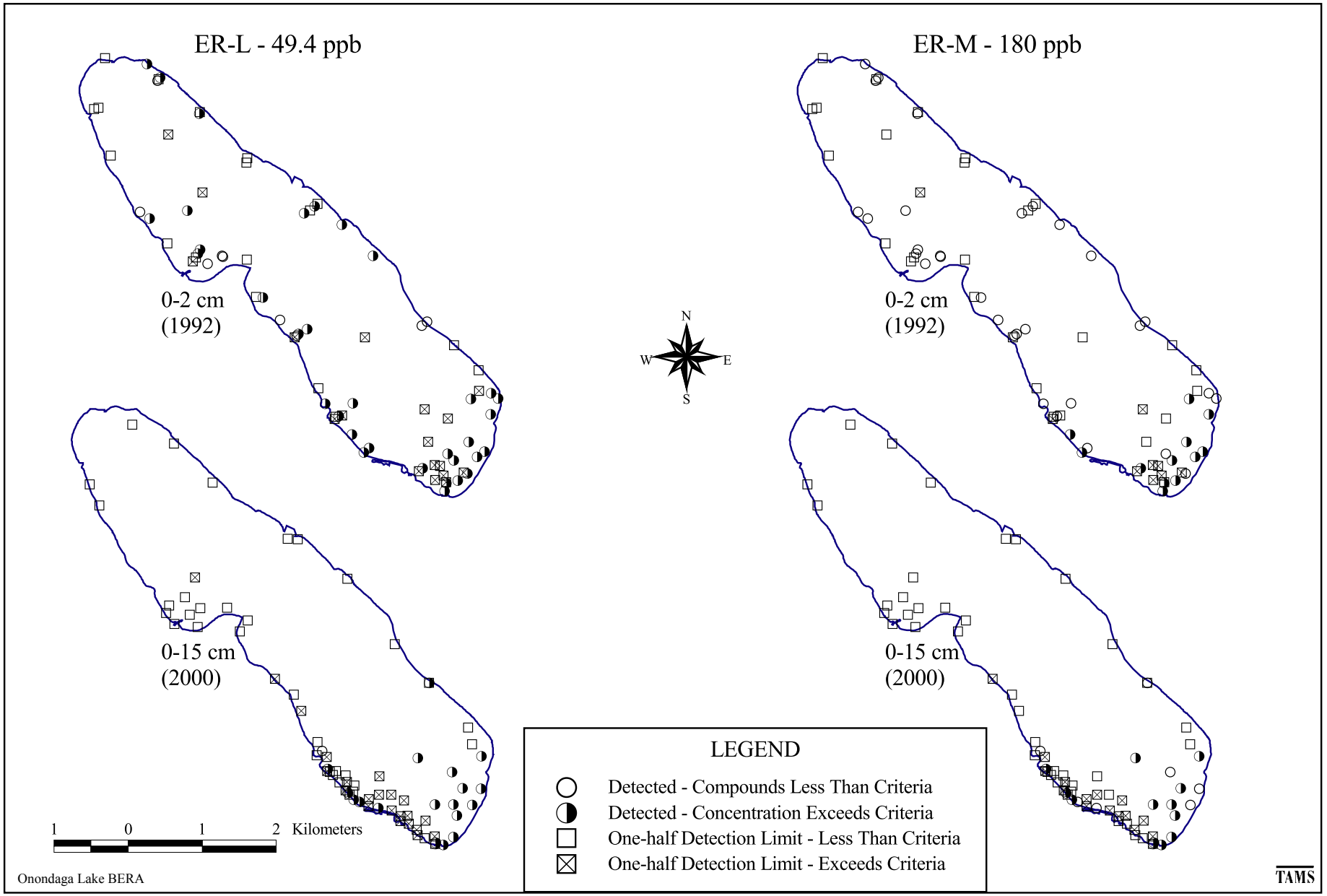

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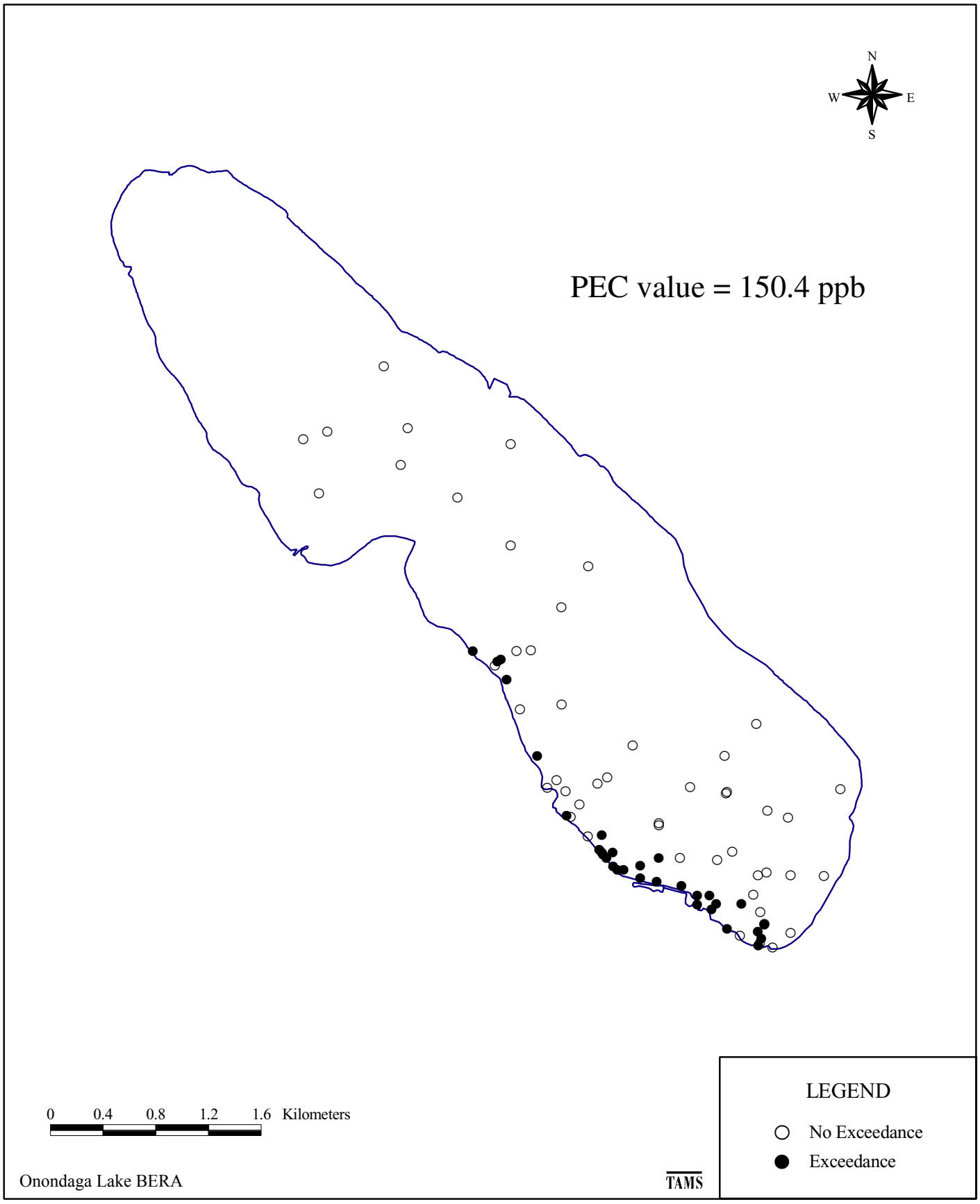

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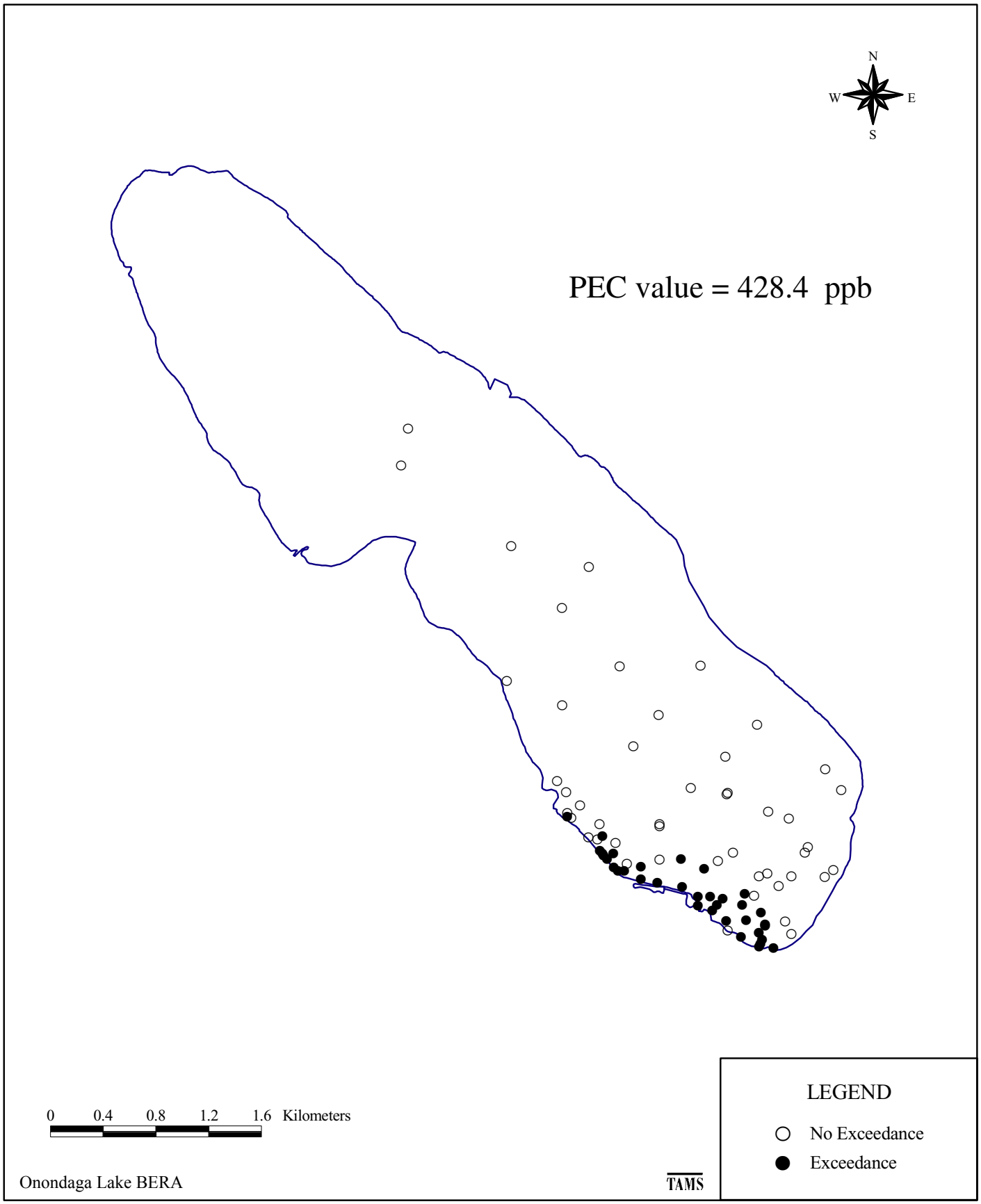

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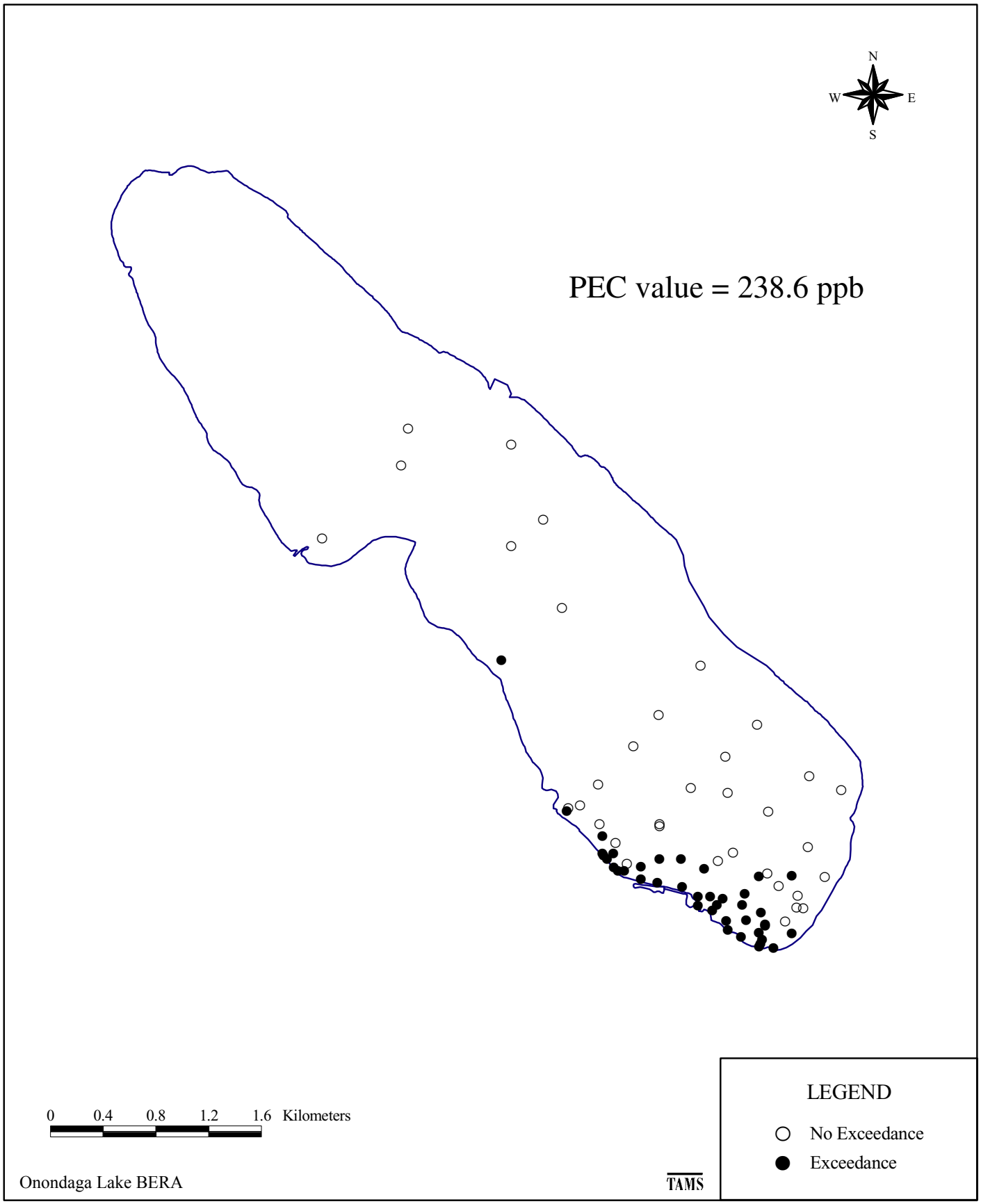

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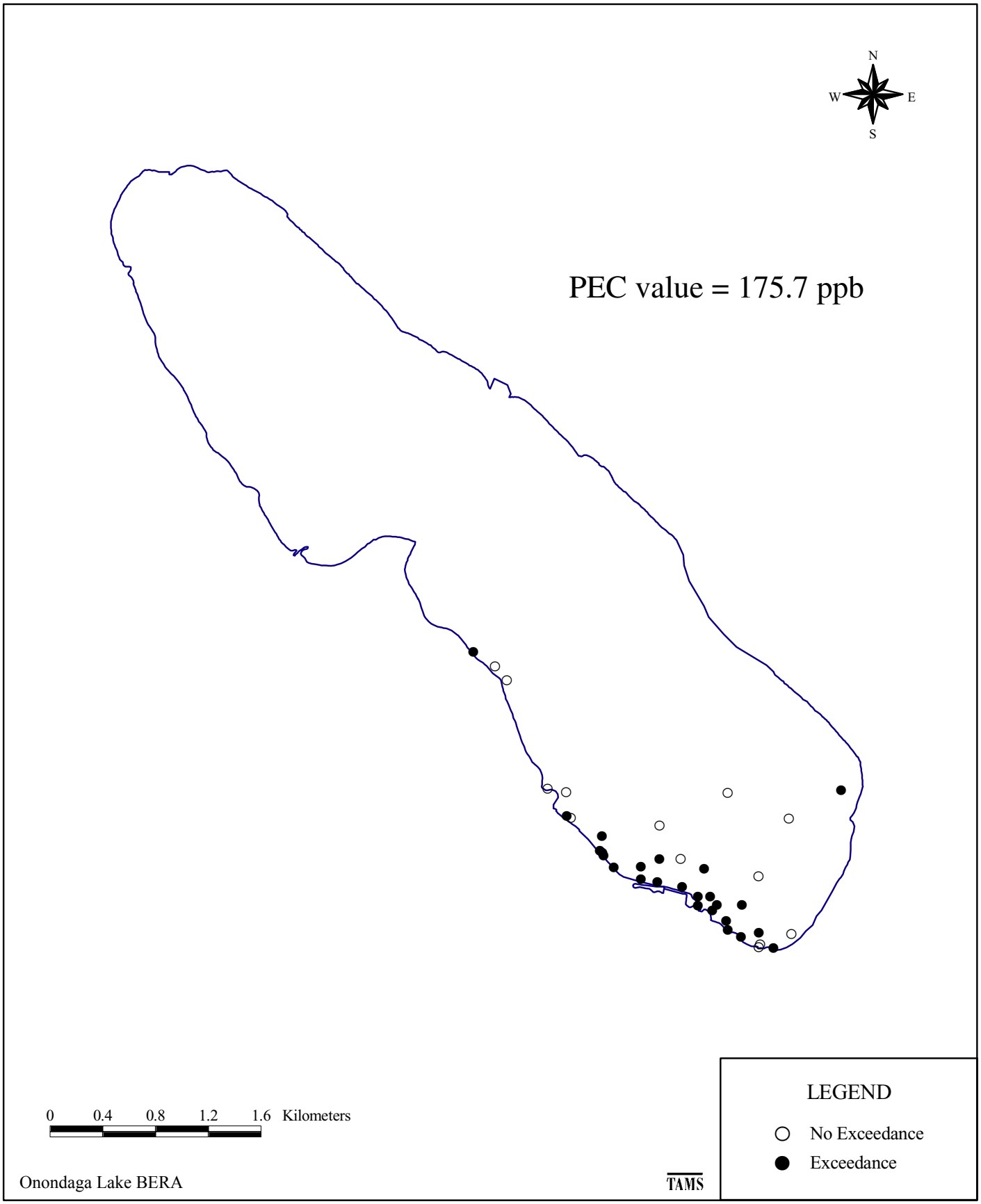

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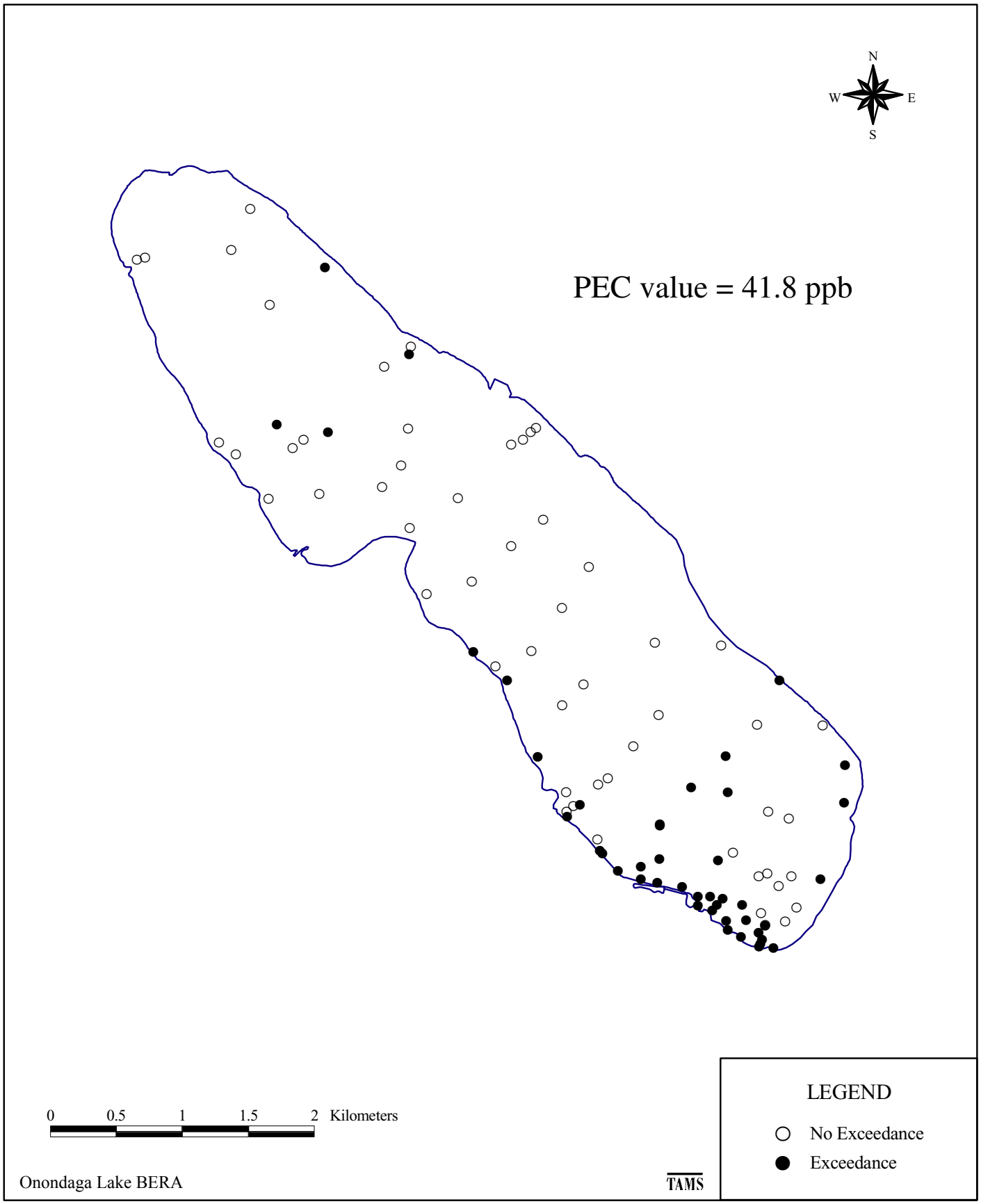

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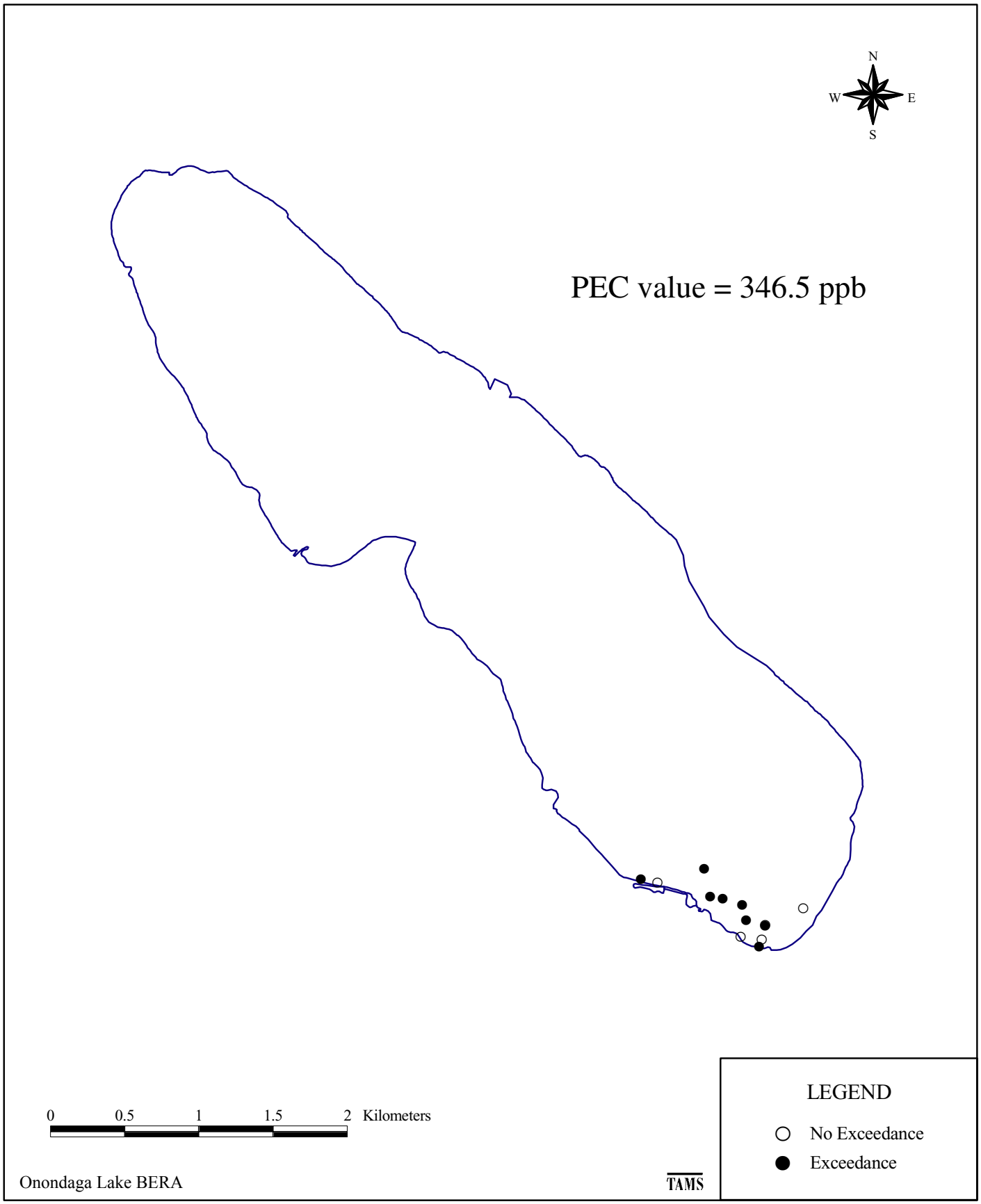

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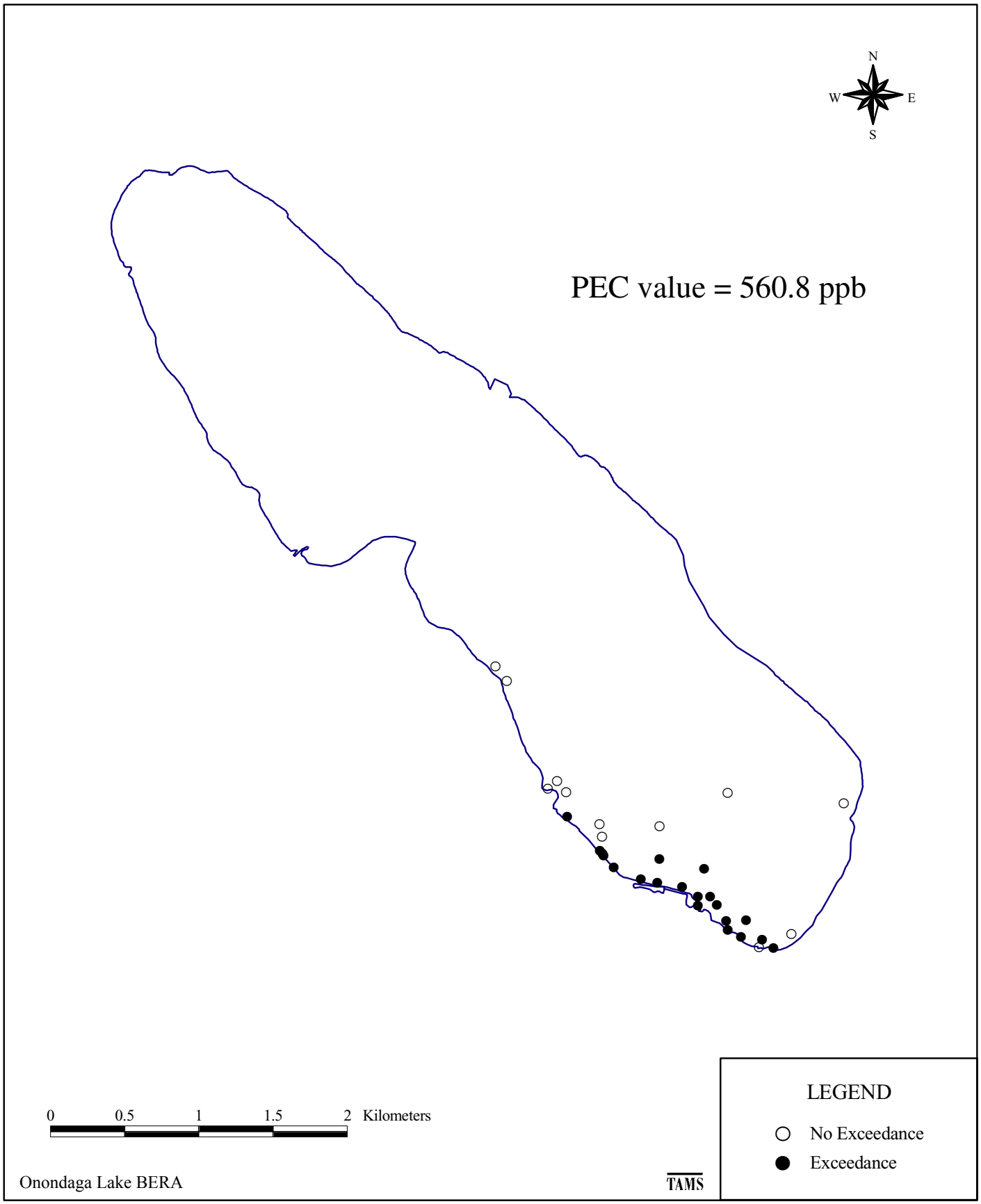

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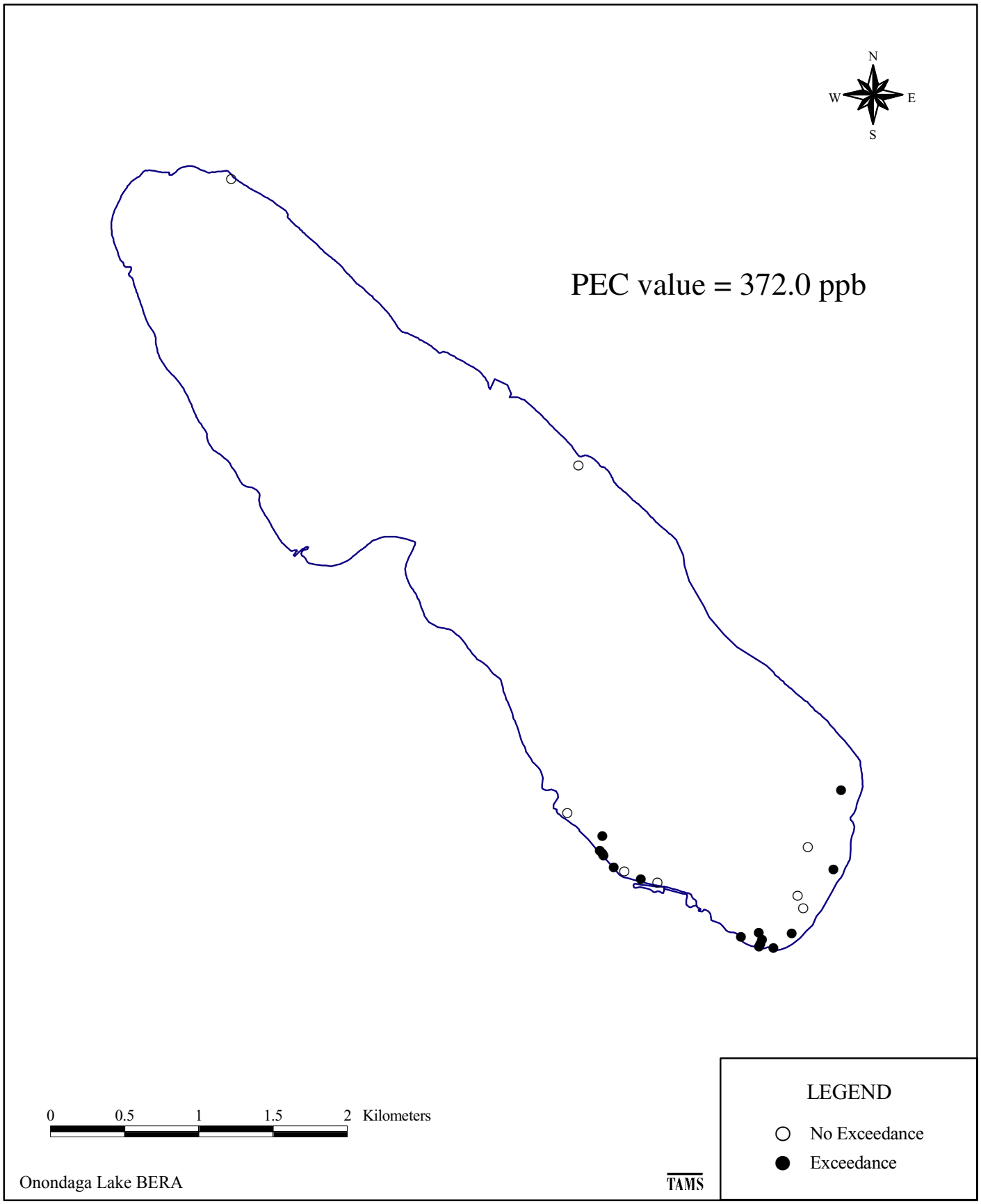

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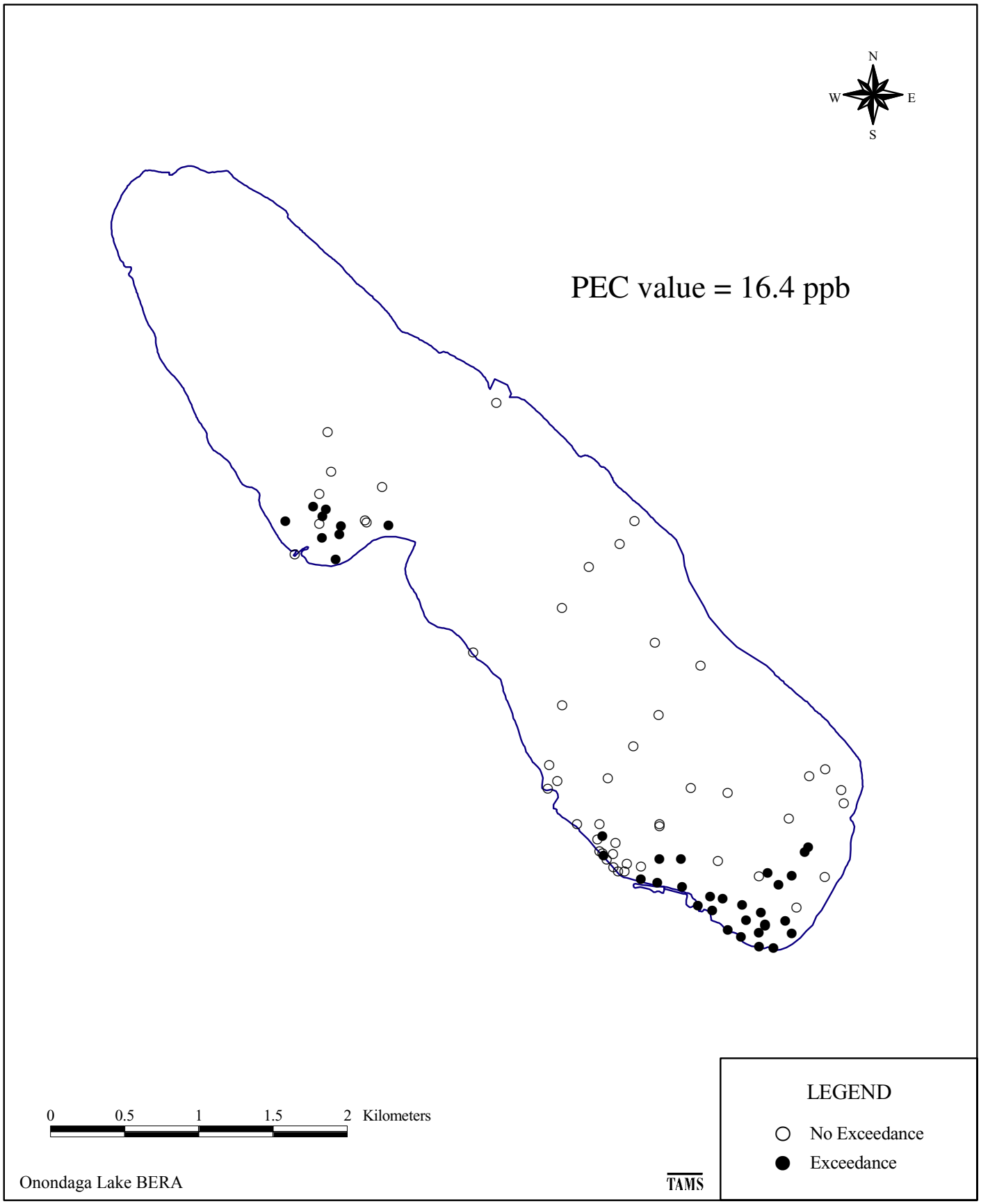

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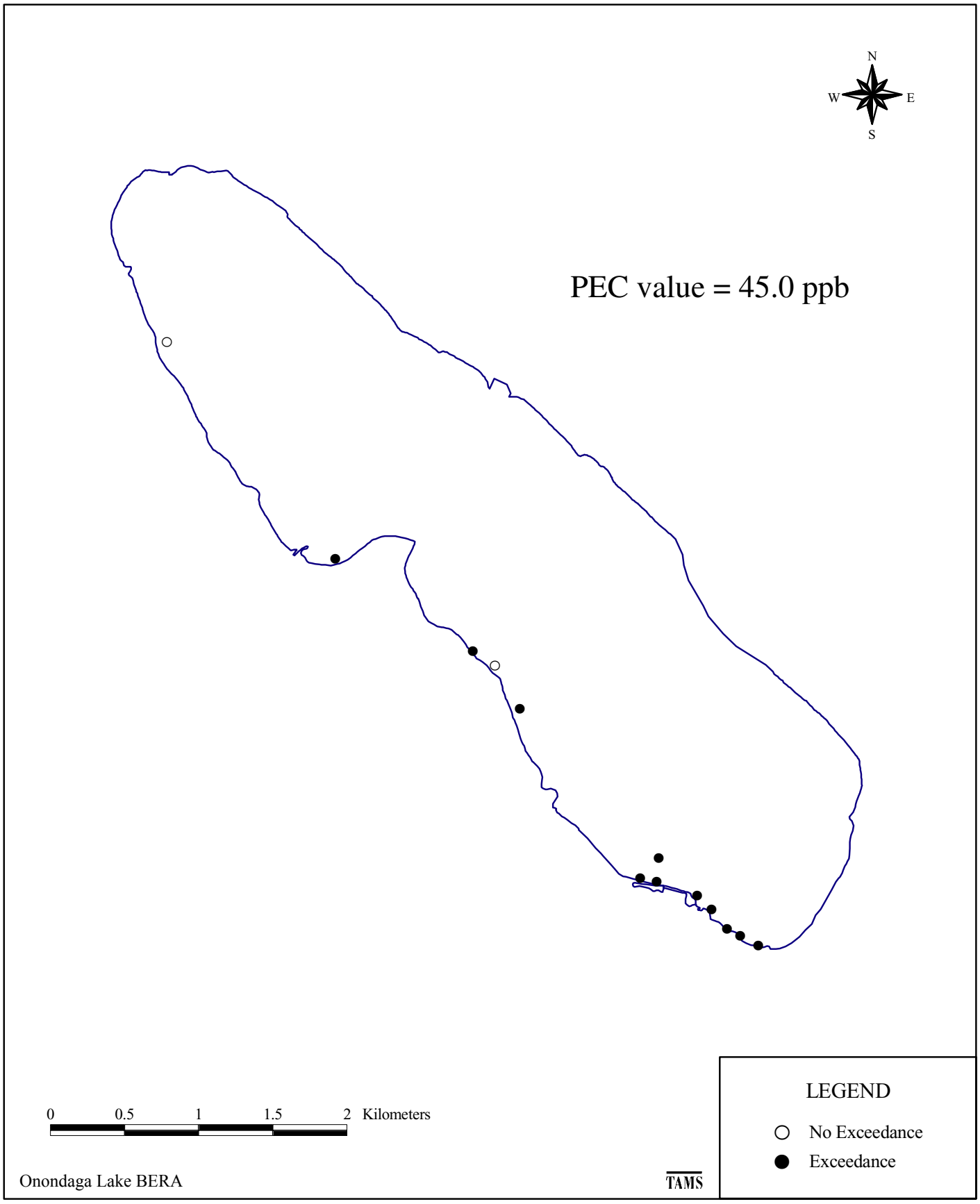

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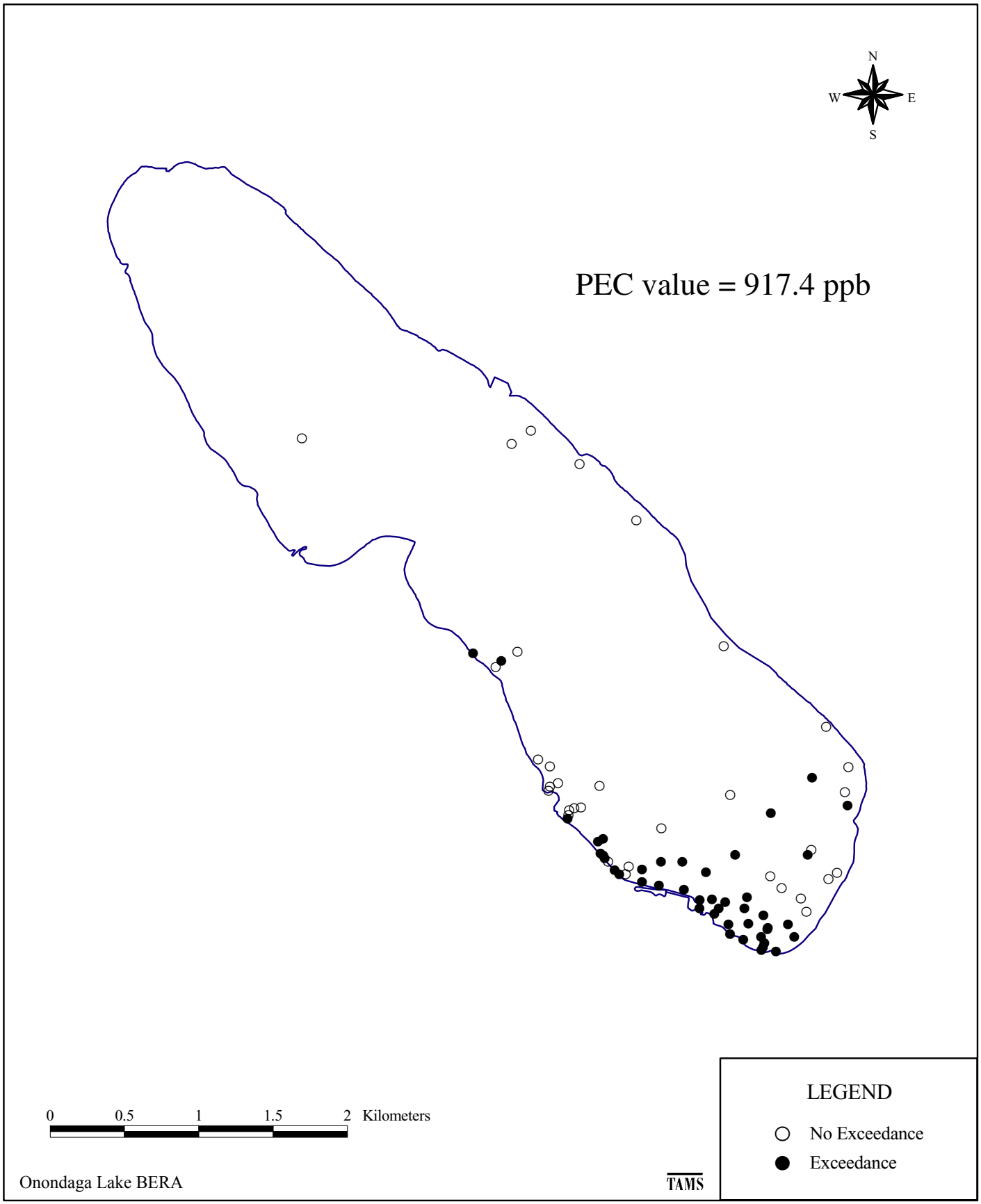

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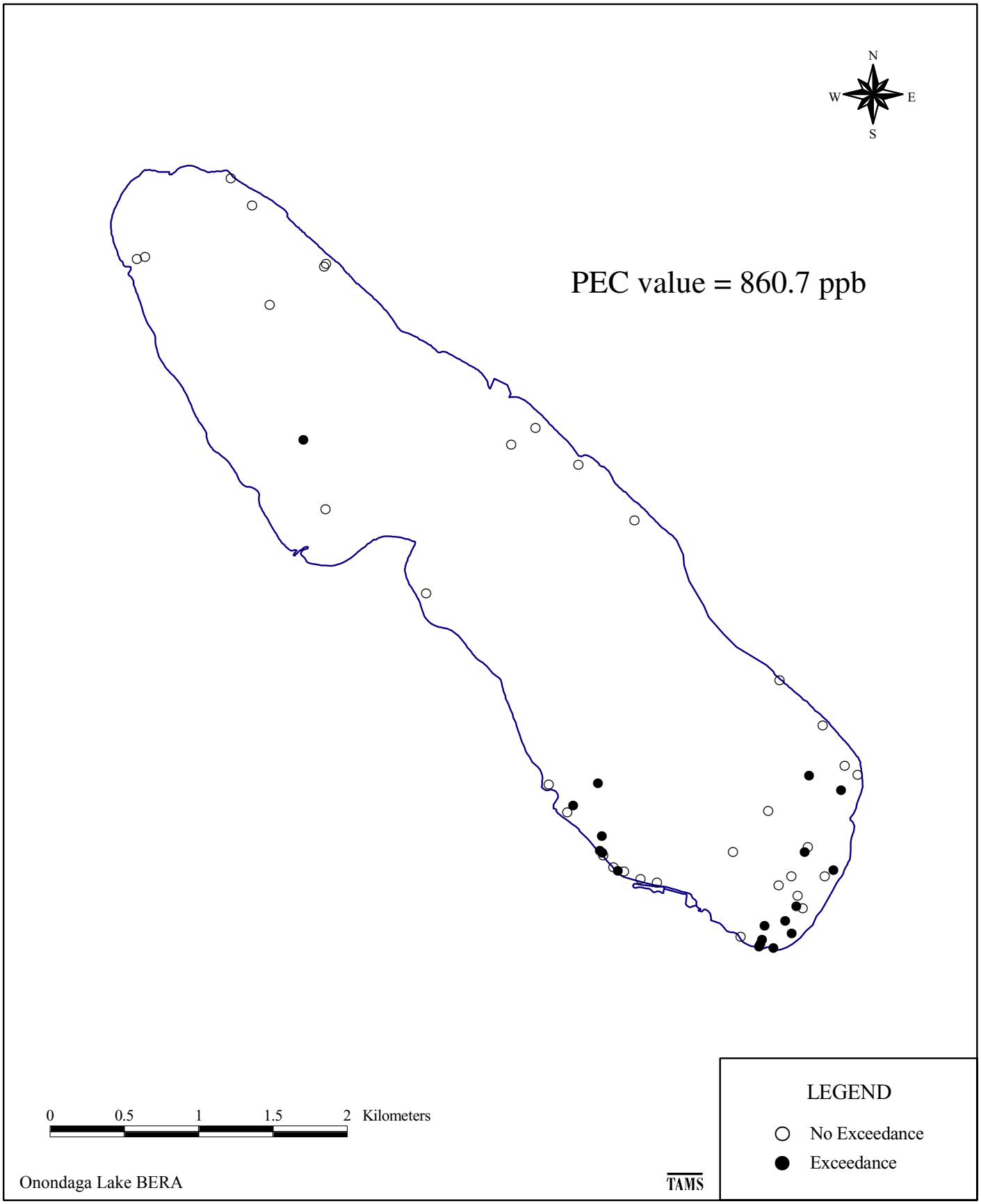

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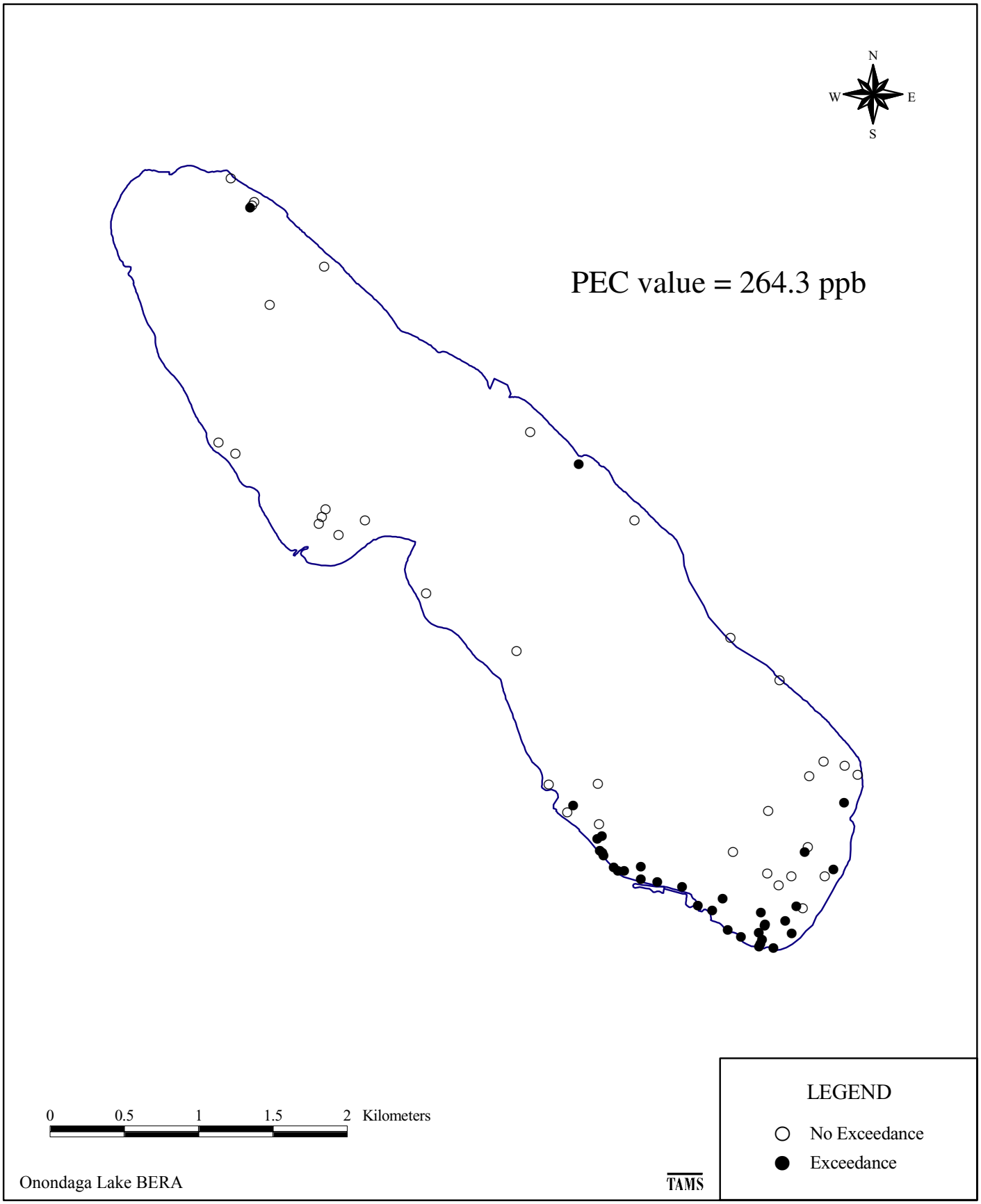

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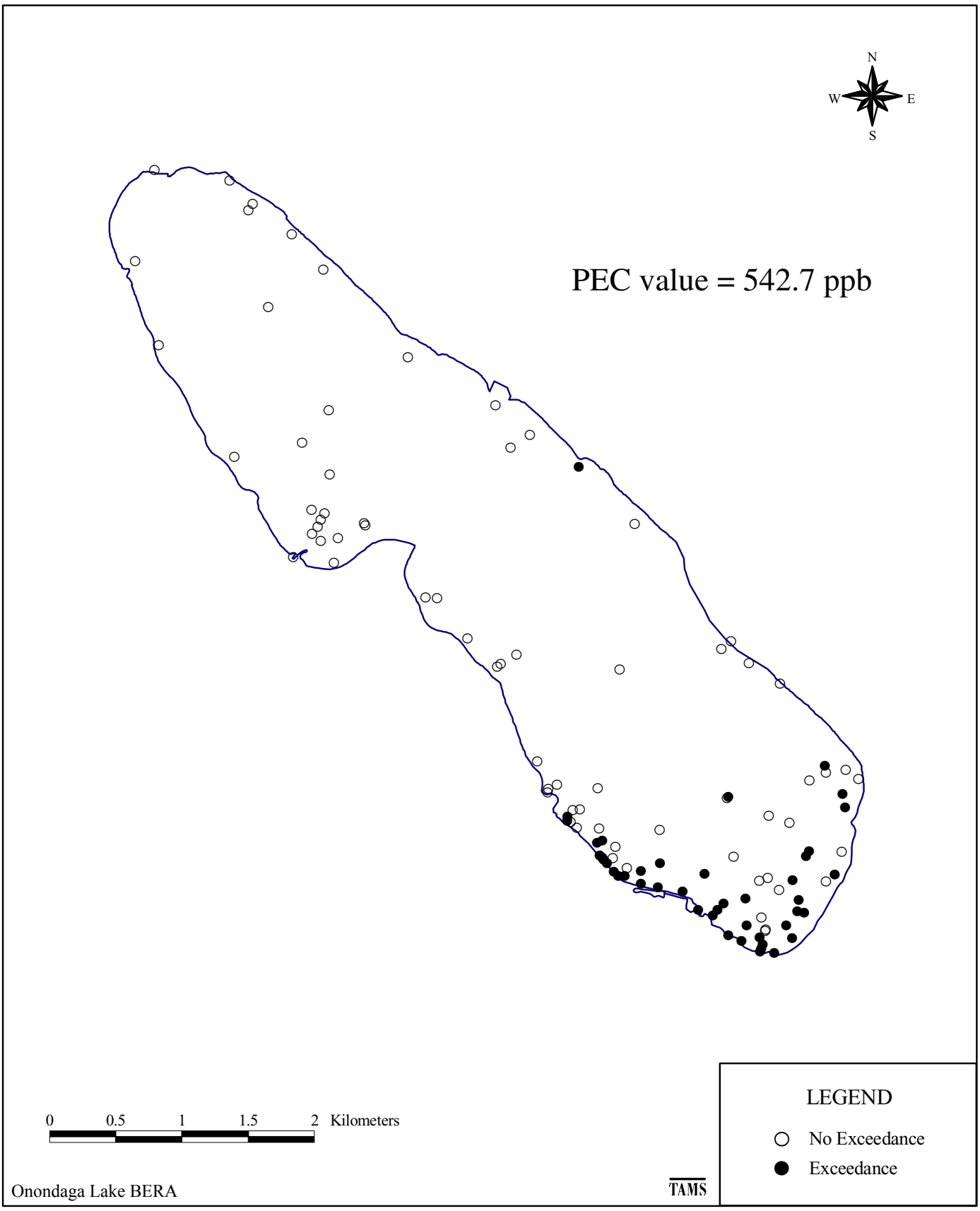

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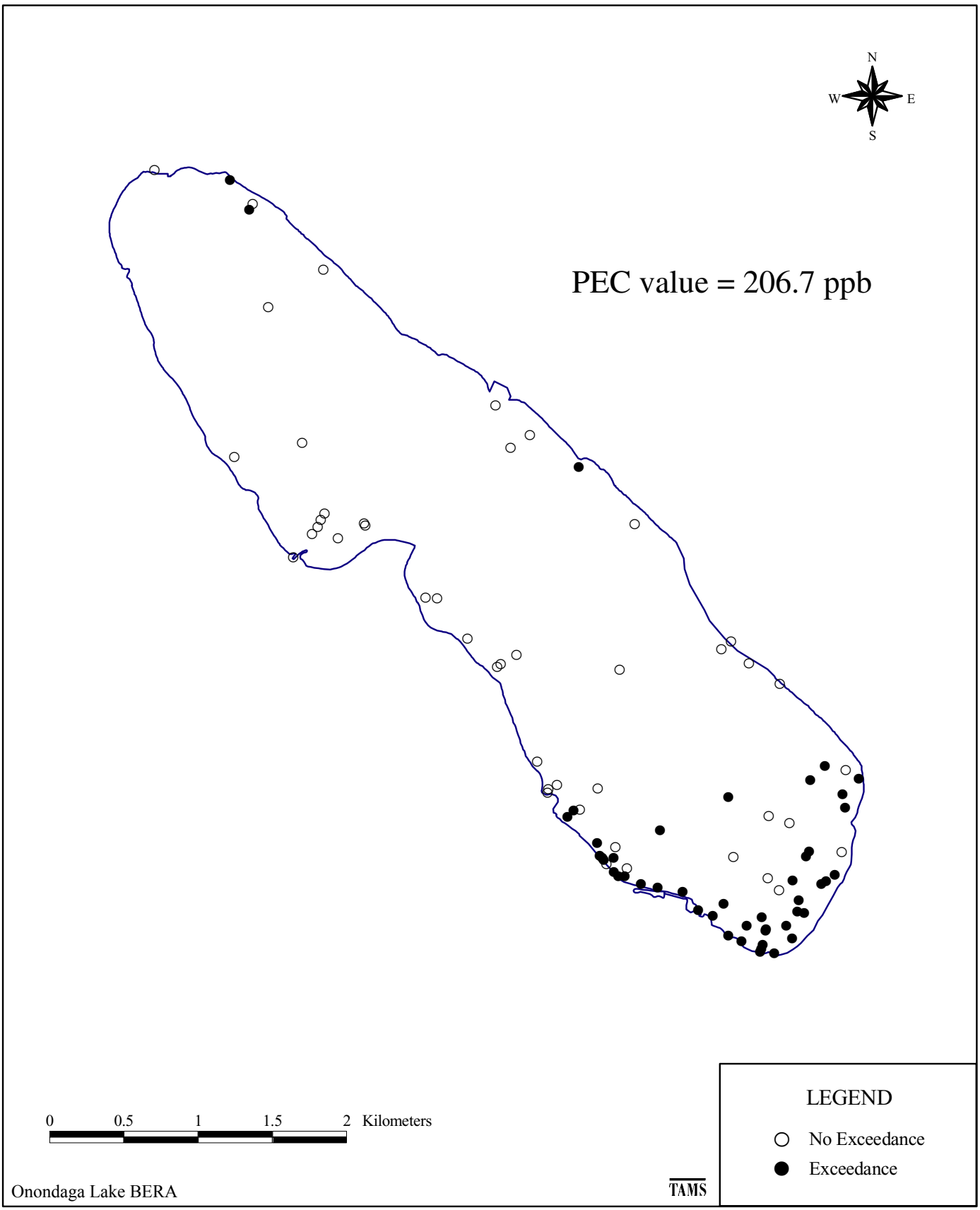

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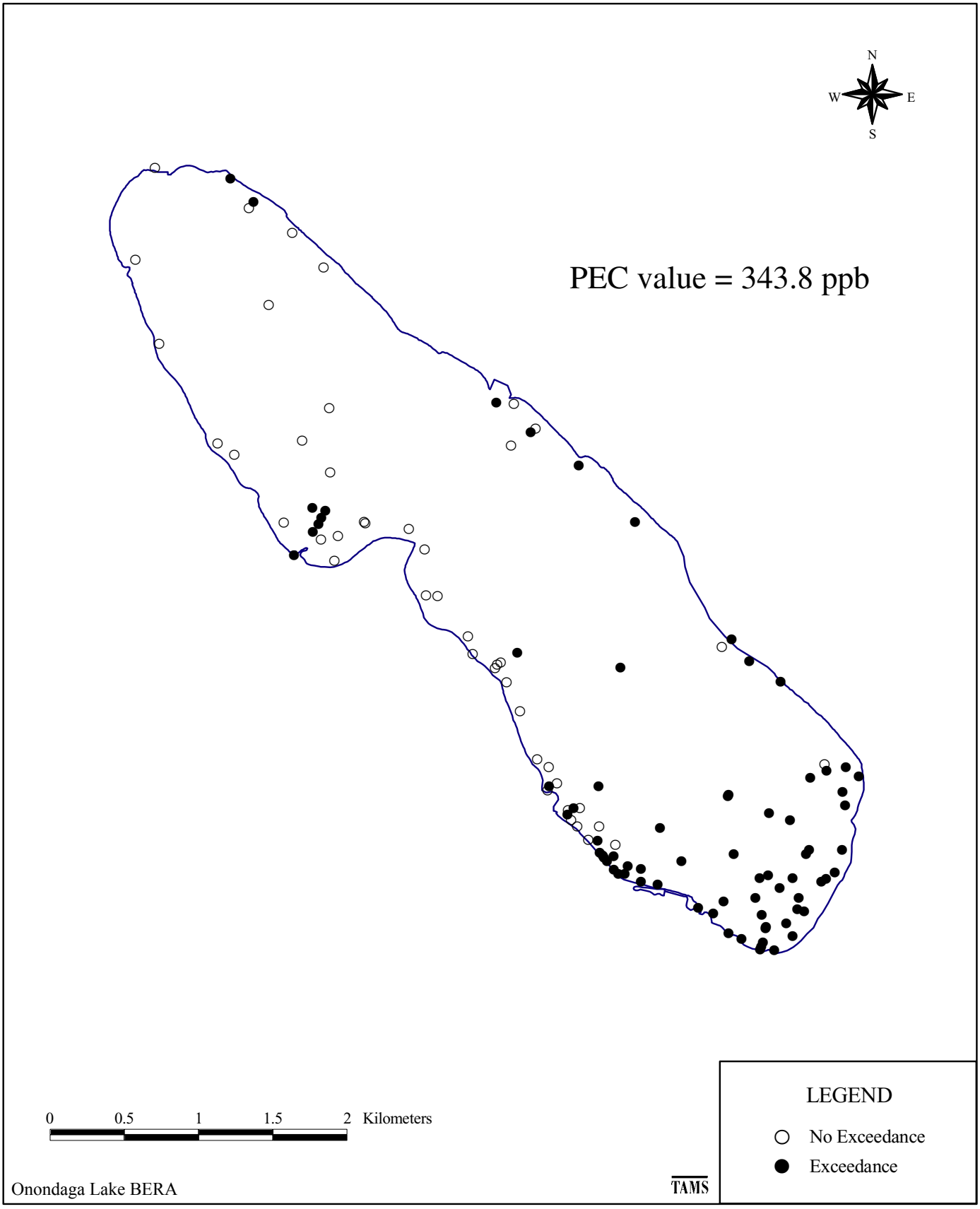

Figure F-120 Locations of Pyrene Exceedances of Consensus Based Probable Effect Concentrations

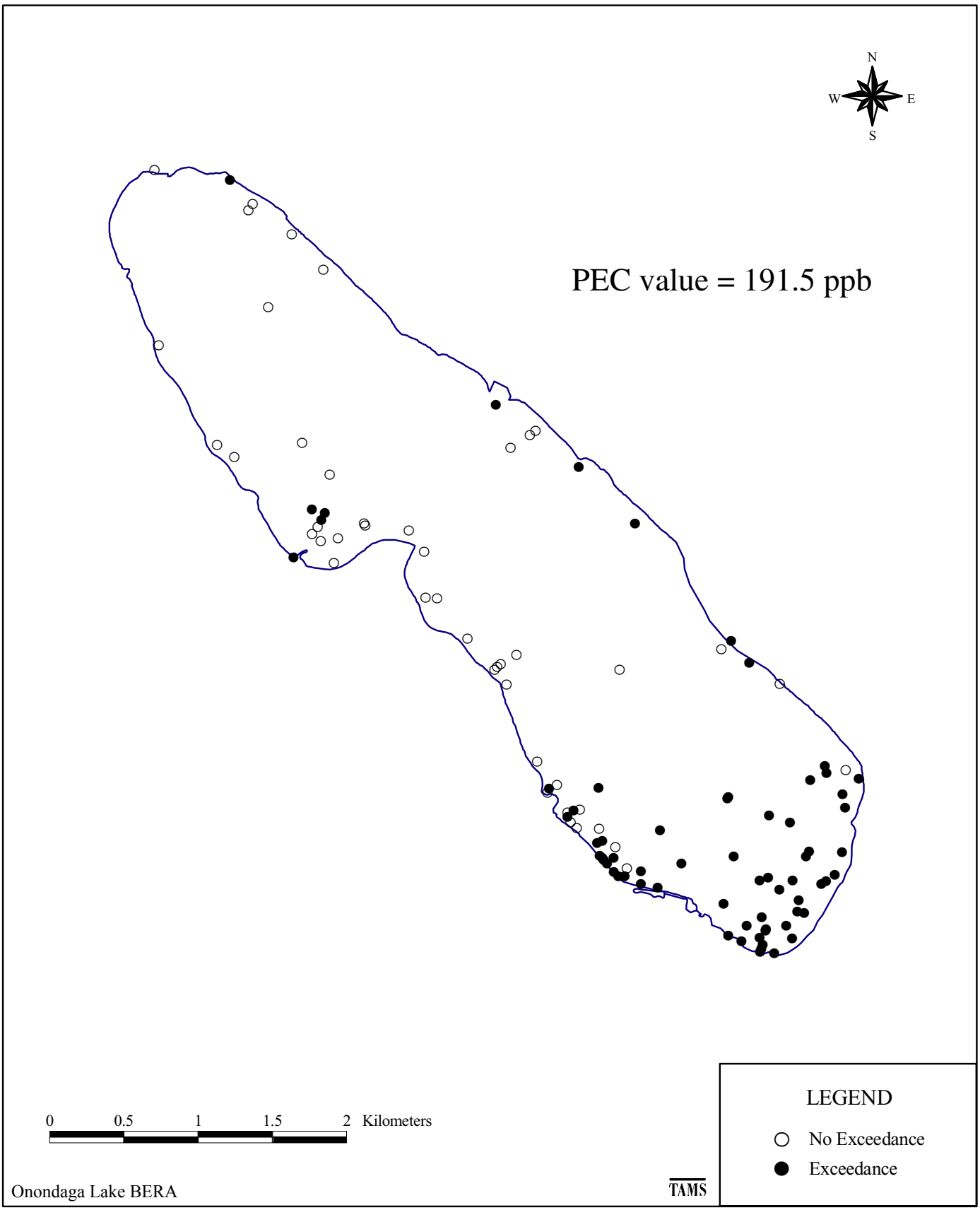

Figure F-121 Locations of Benz(a)anthracene Exceedances of Consensus Based Probable Effect Concentrations

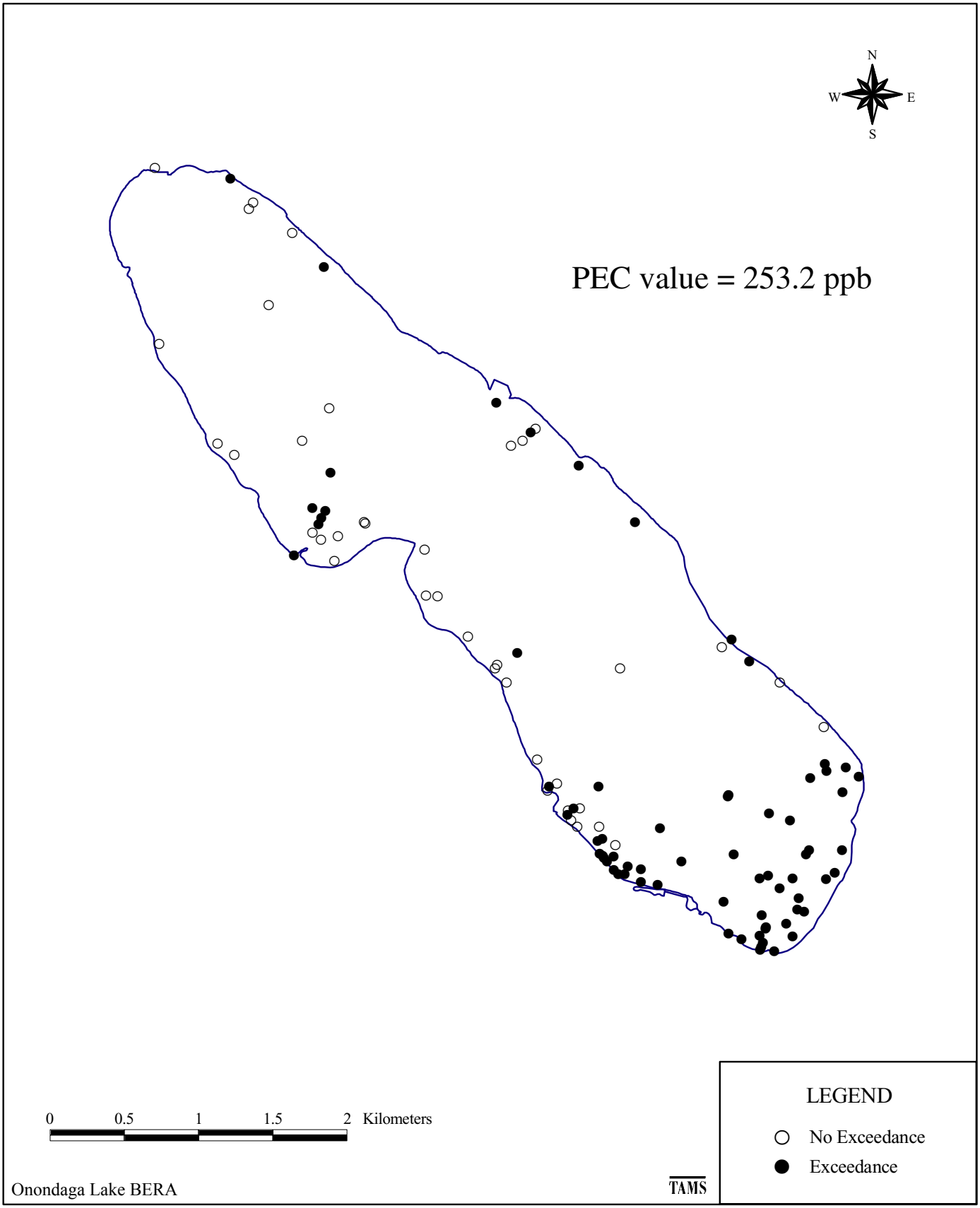

Figure F-122 Locations of Chrysene Exceedances of Consensus Based Probable Effect Concentrations

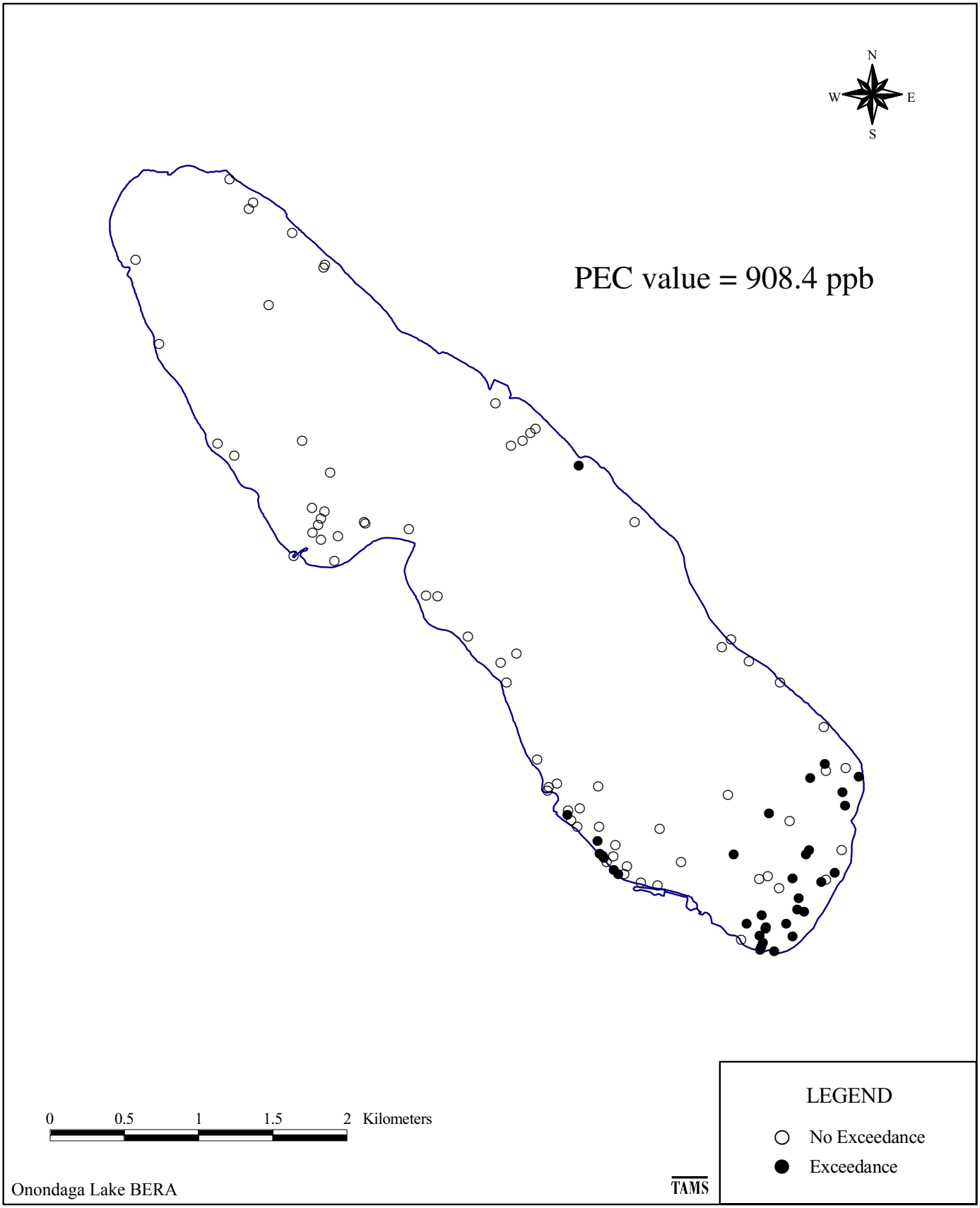

Figure F-123 Locations of Benzo(b)fluoranthene Exceedances of Consensus Based Probable Effect Concentrations

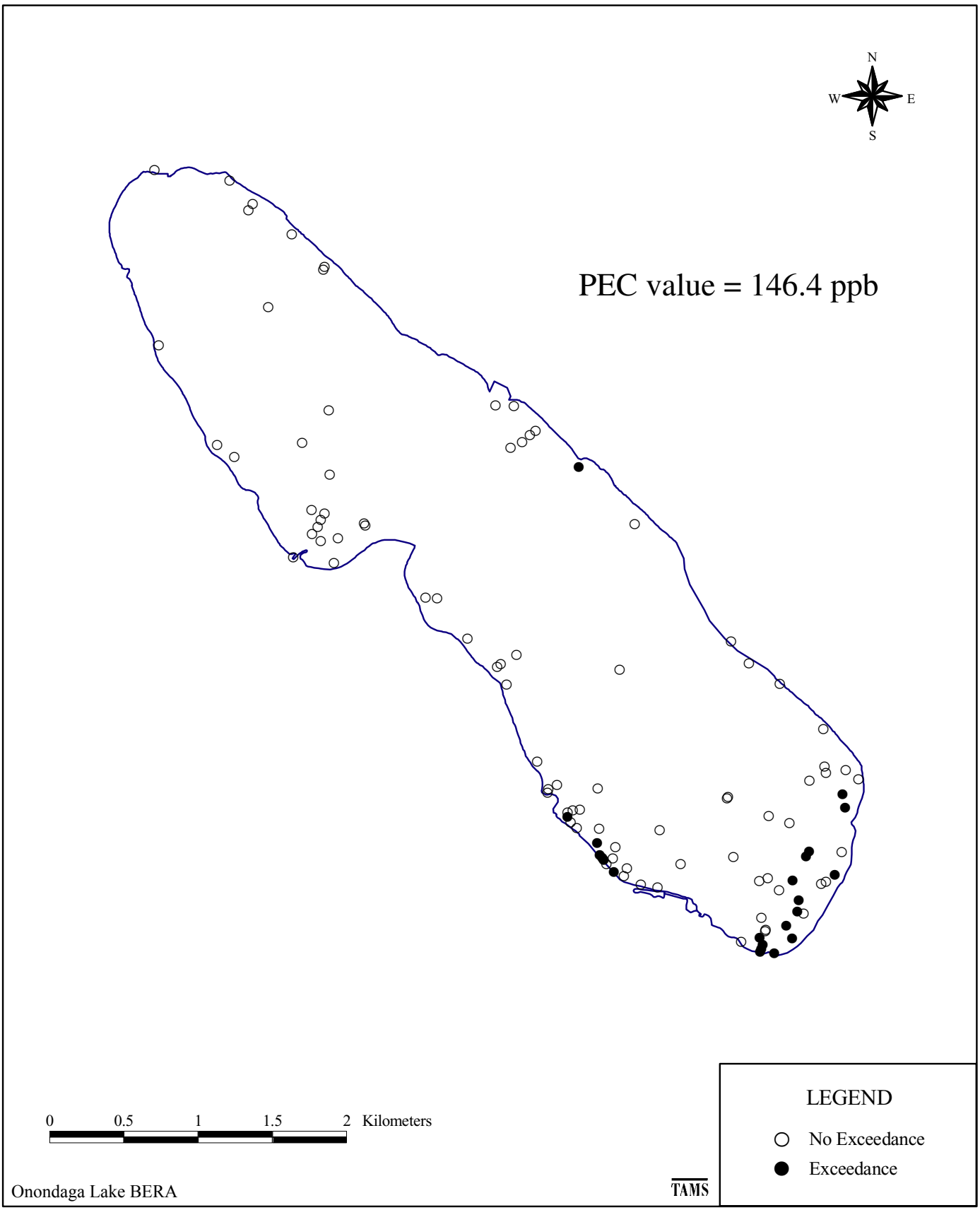

Figure F-124 Locations of Benzo(a)pyrene Exceedances of Consensus Based Probable Effect Concentrations

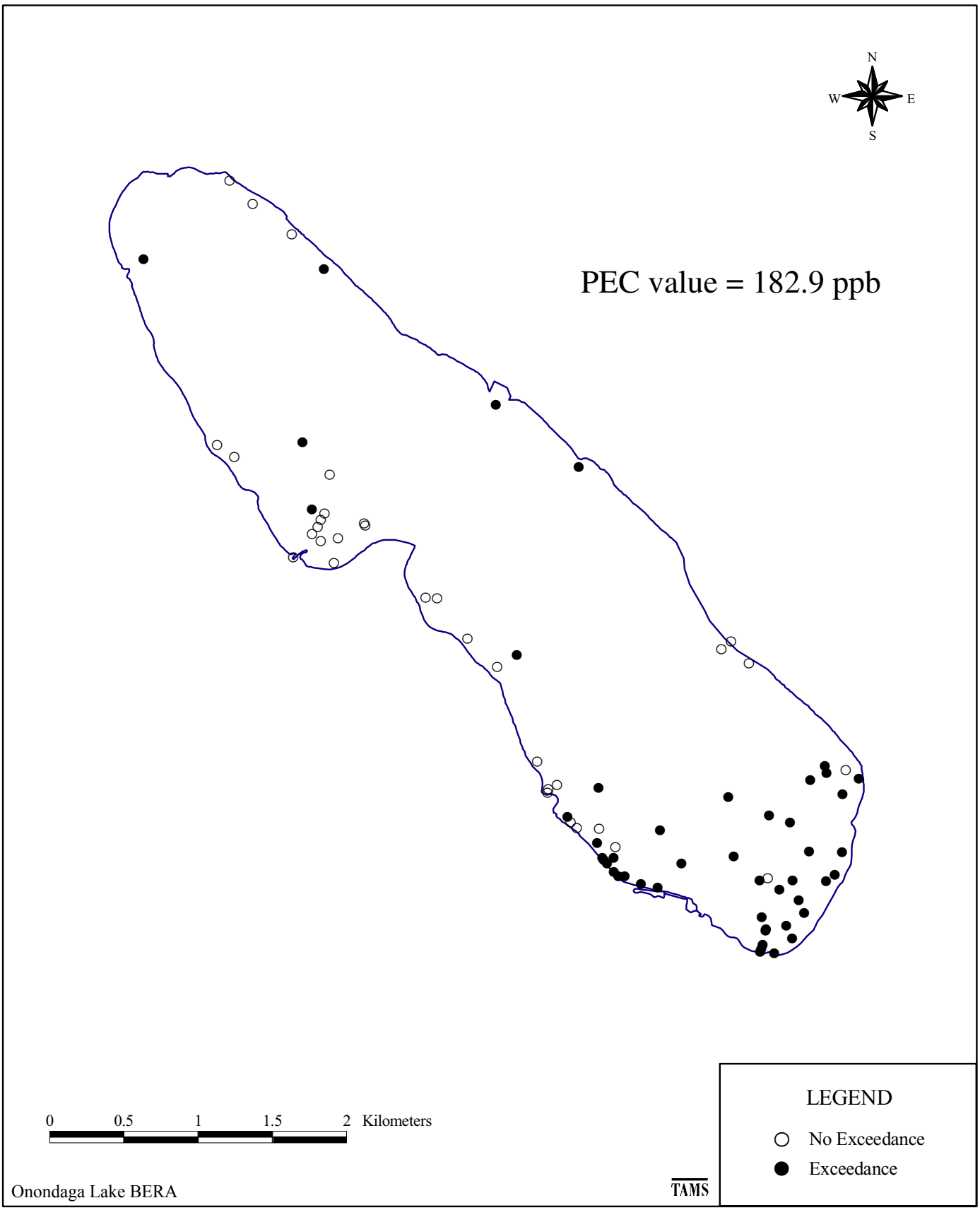

Figure F-125 Locations of Indeno(1,2,3-cd)pyrene Exceedances of Consensus Based Probable Effect Concentrations

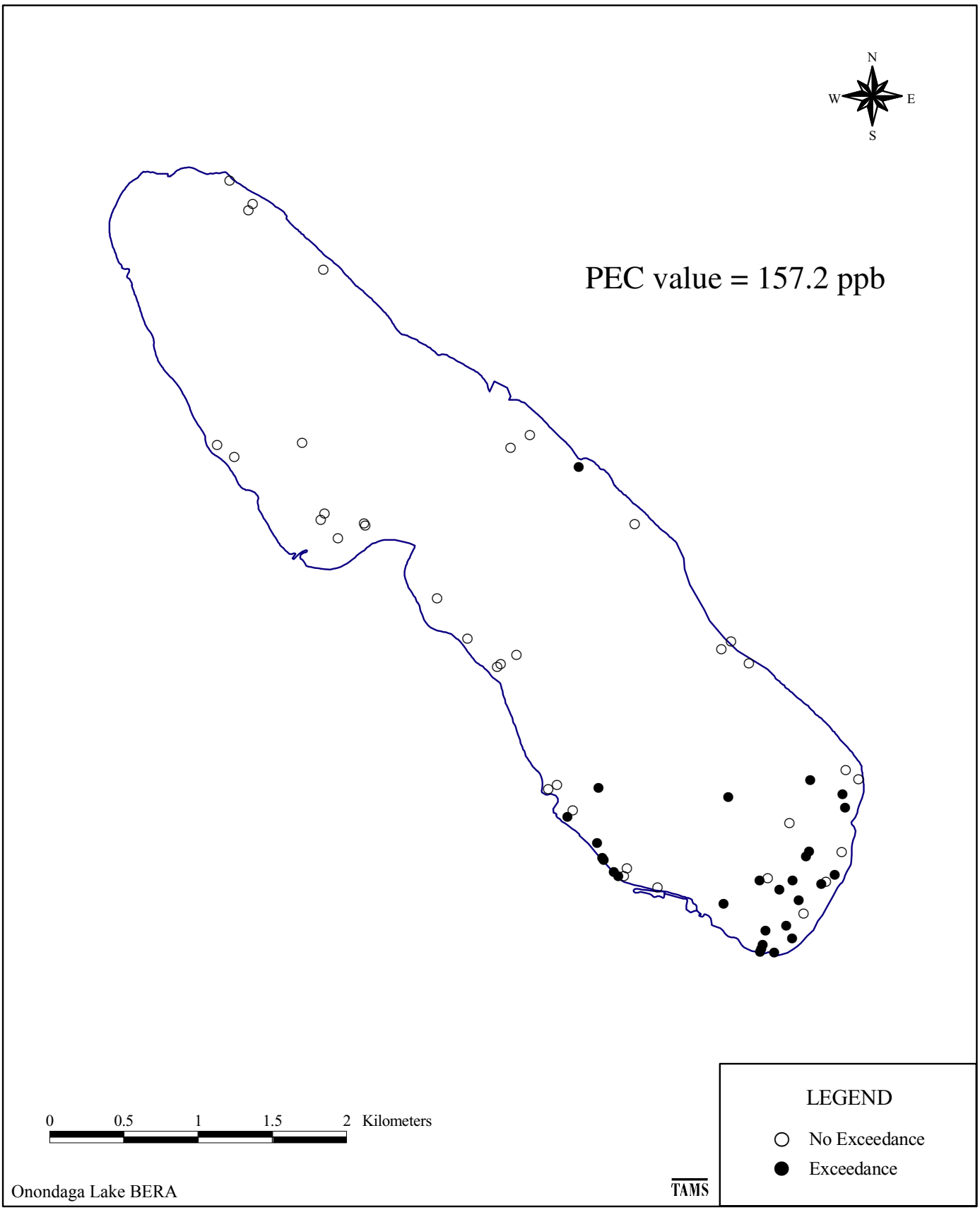

Figure F-126 Locations of Dibenz(a,h)anthracene Exceedances of Consensus Based Probable Effect Concentrations

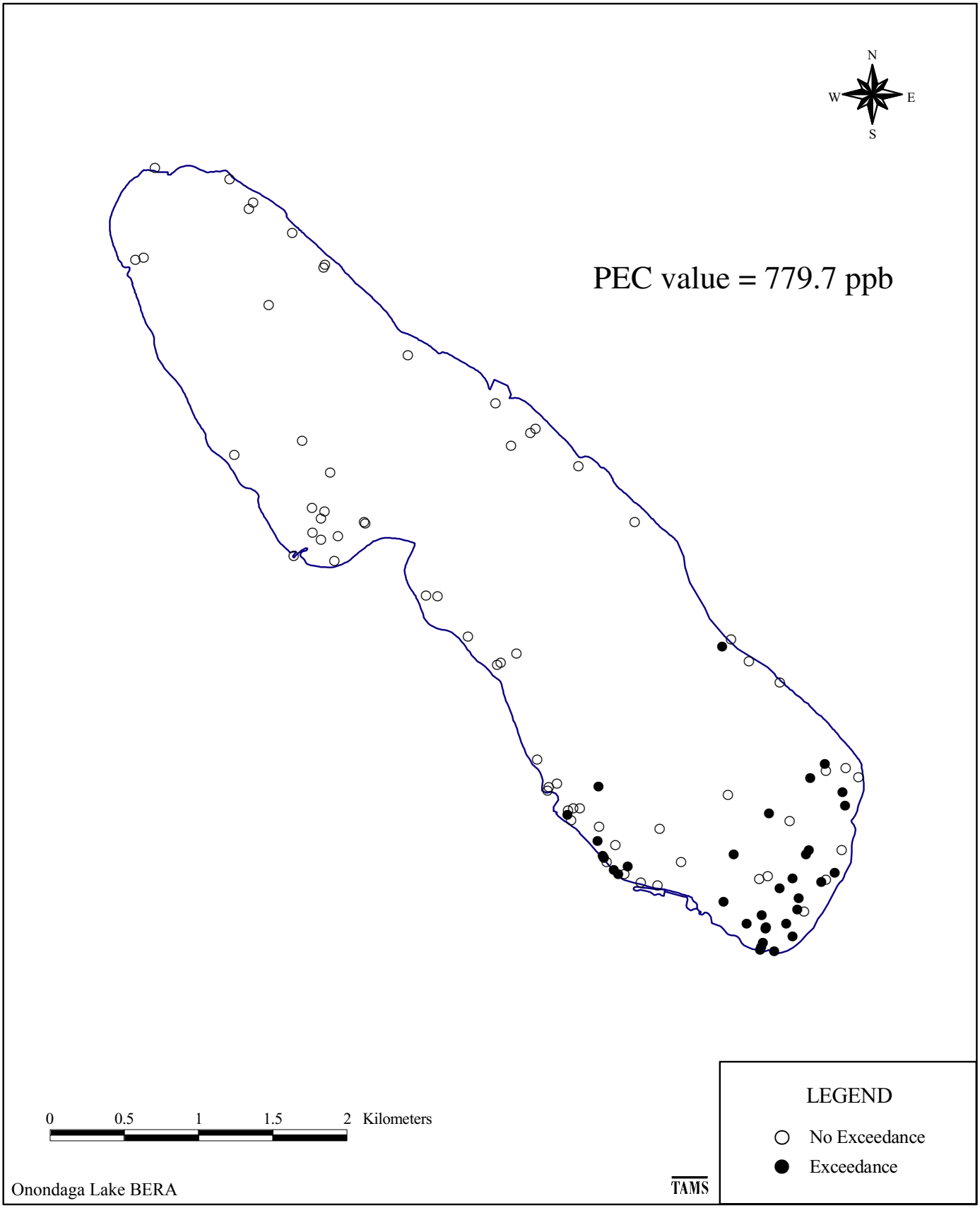

Figure F-127 Locations of Benzo(g,h,i)perylene Exceedances of Consensus Based Probable Effect Concentrations

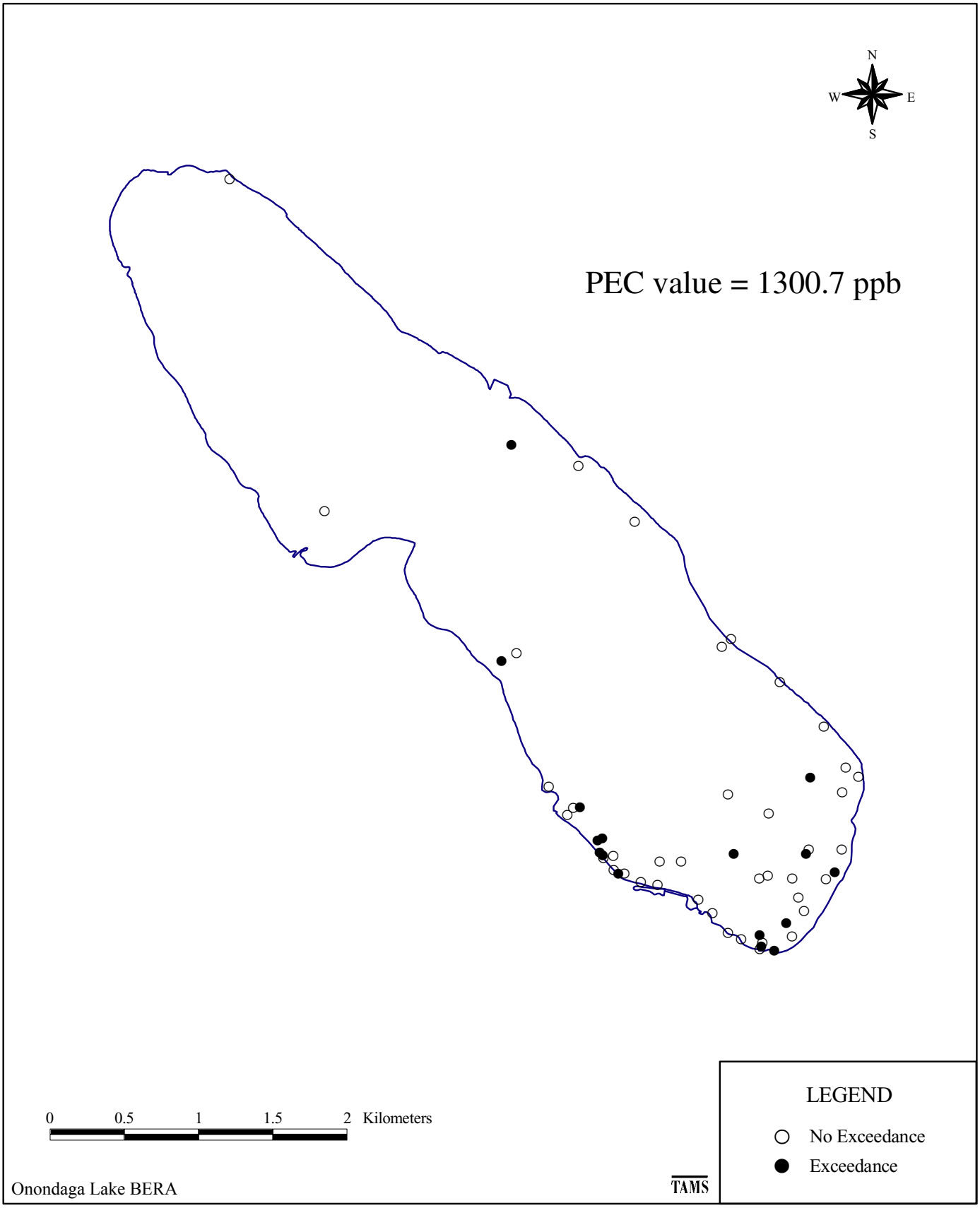

Figure F-128 Locations of Acenaphthylene Exceedances of Consensus Based Probable Effect Concentrations

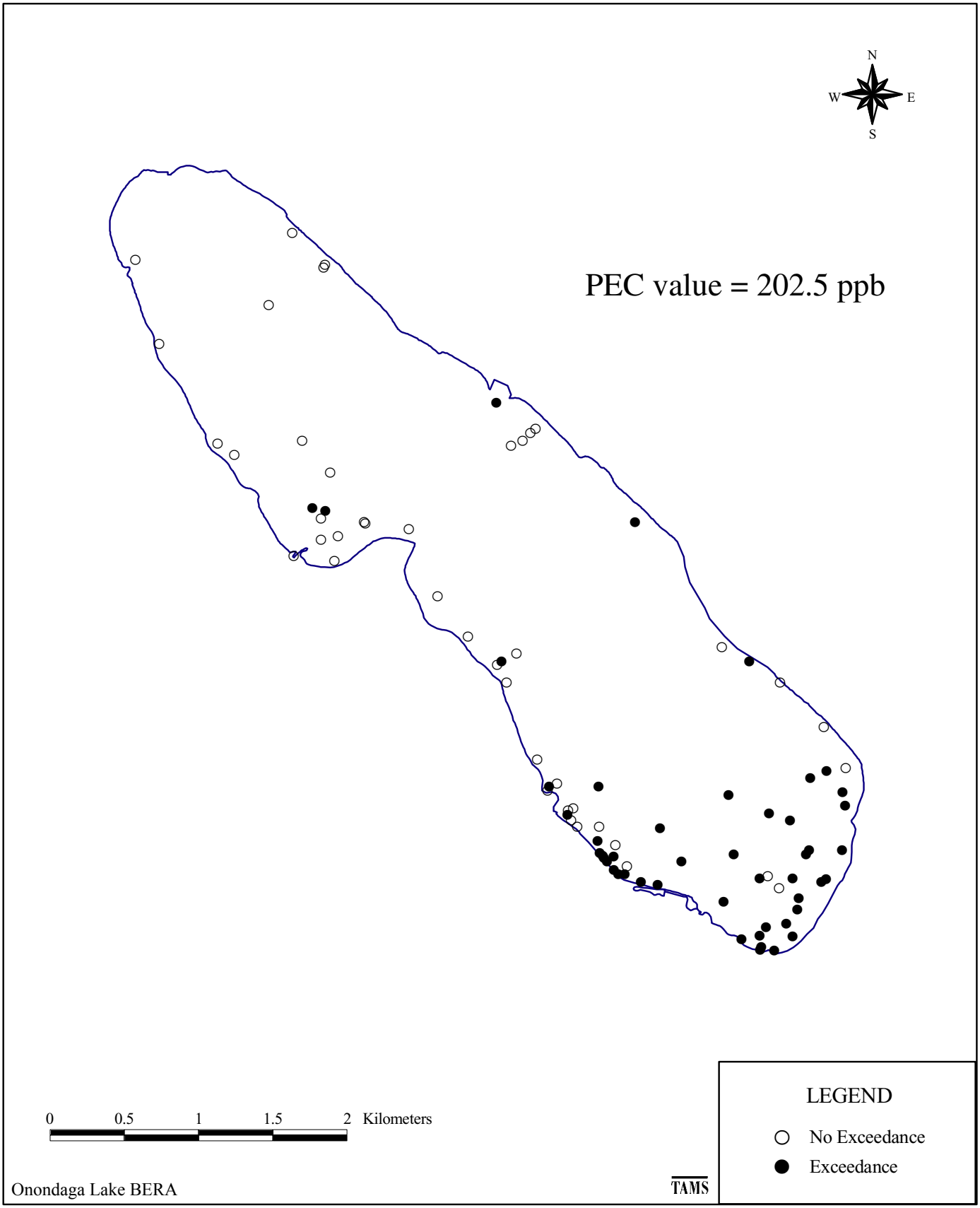

Figure F-129 Locations of Benzo(k)fluoranthene Exceedances of Consensus Based Probable Effect Concentrations

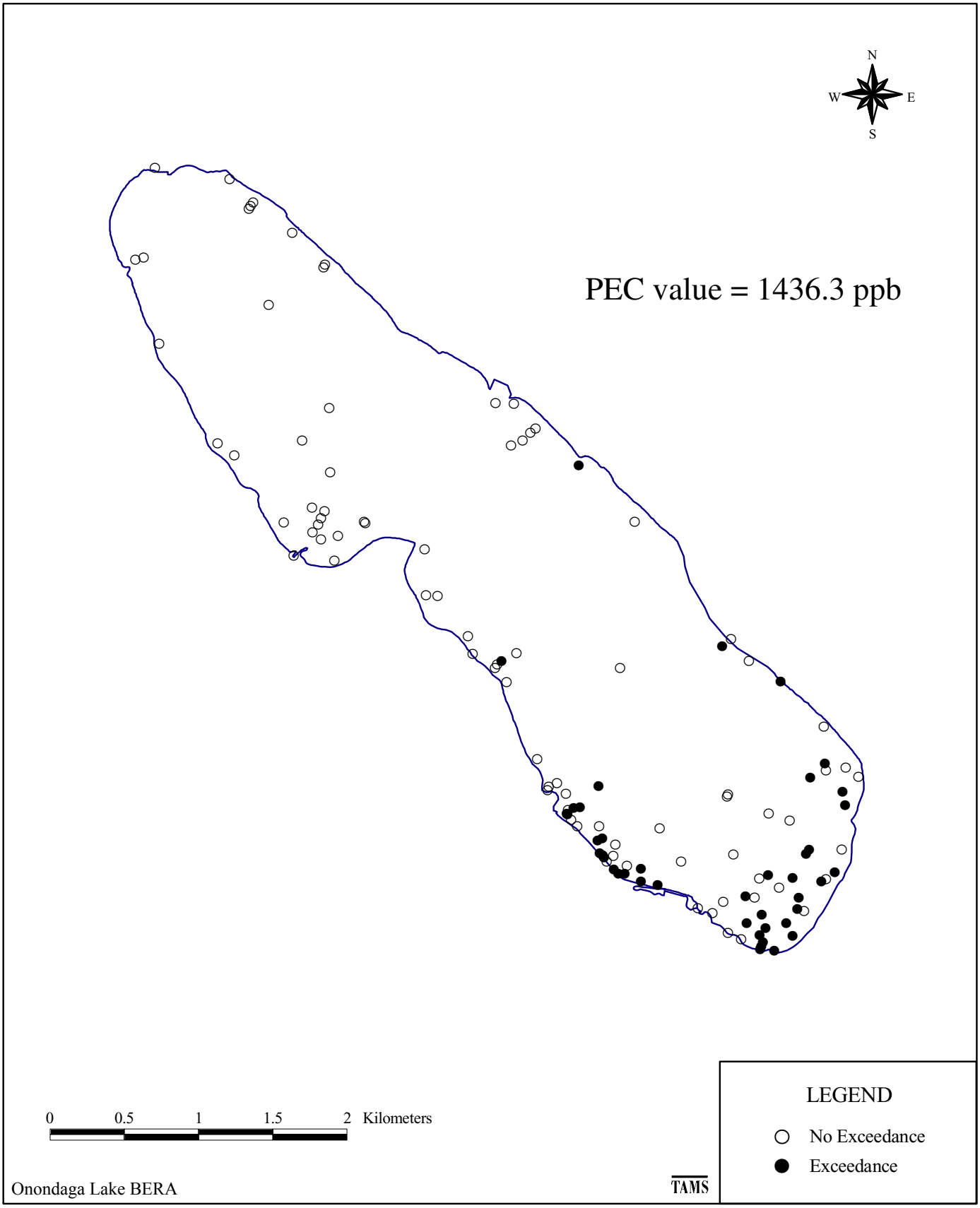

Figure F-130 Locations of Fluoranthene Exceedances of Consensus Based Probable Effect Concentrations

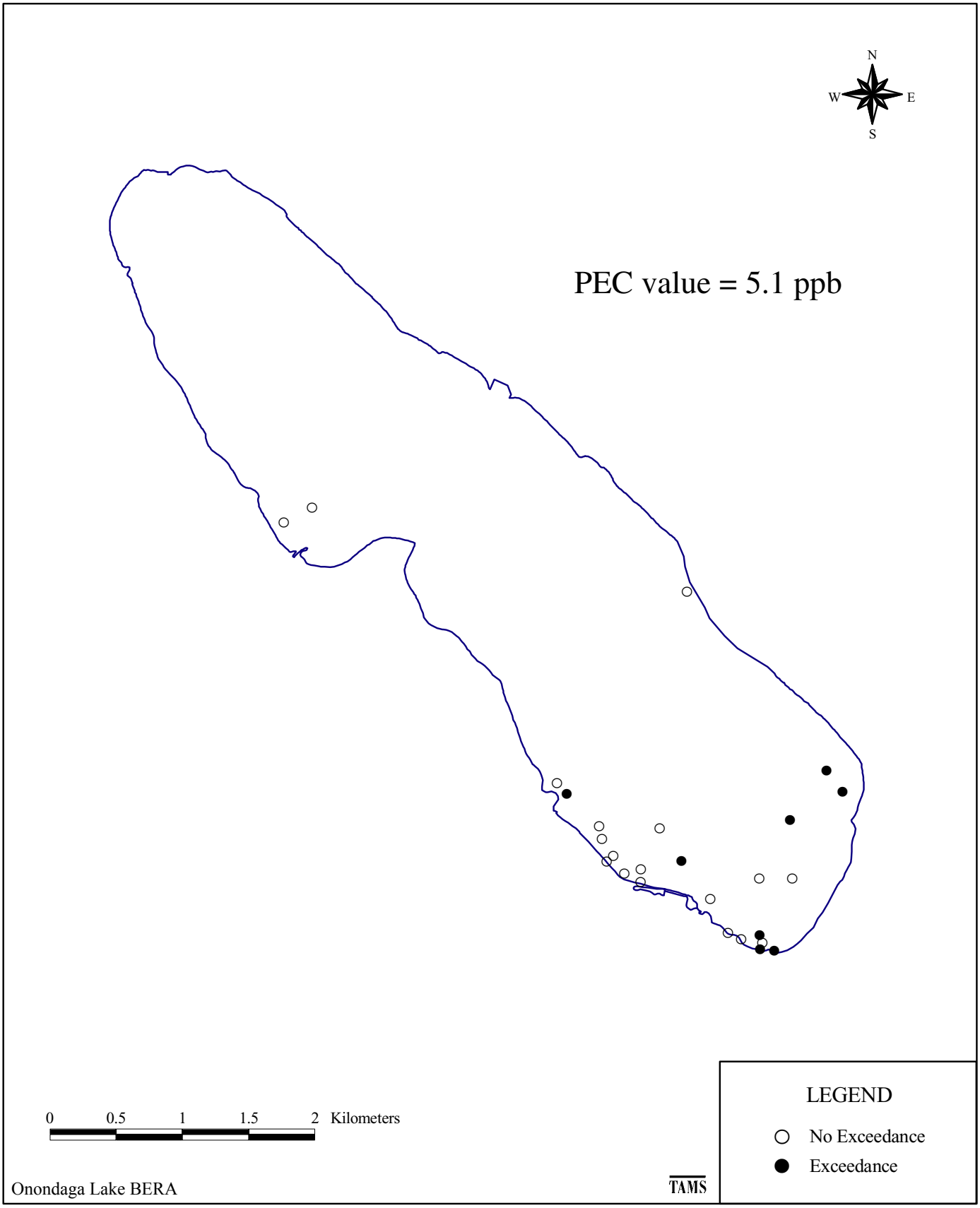

Figure F-131 Locations of Chlordane (Sum) Exceedances of Consensus Based Probable Effect Concentrations

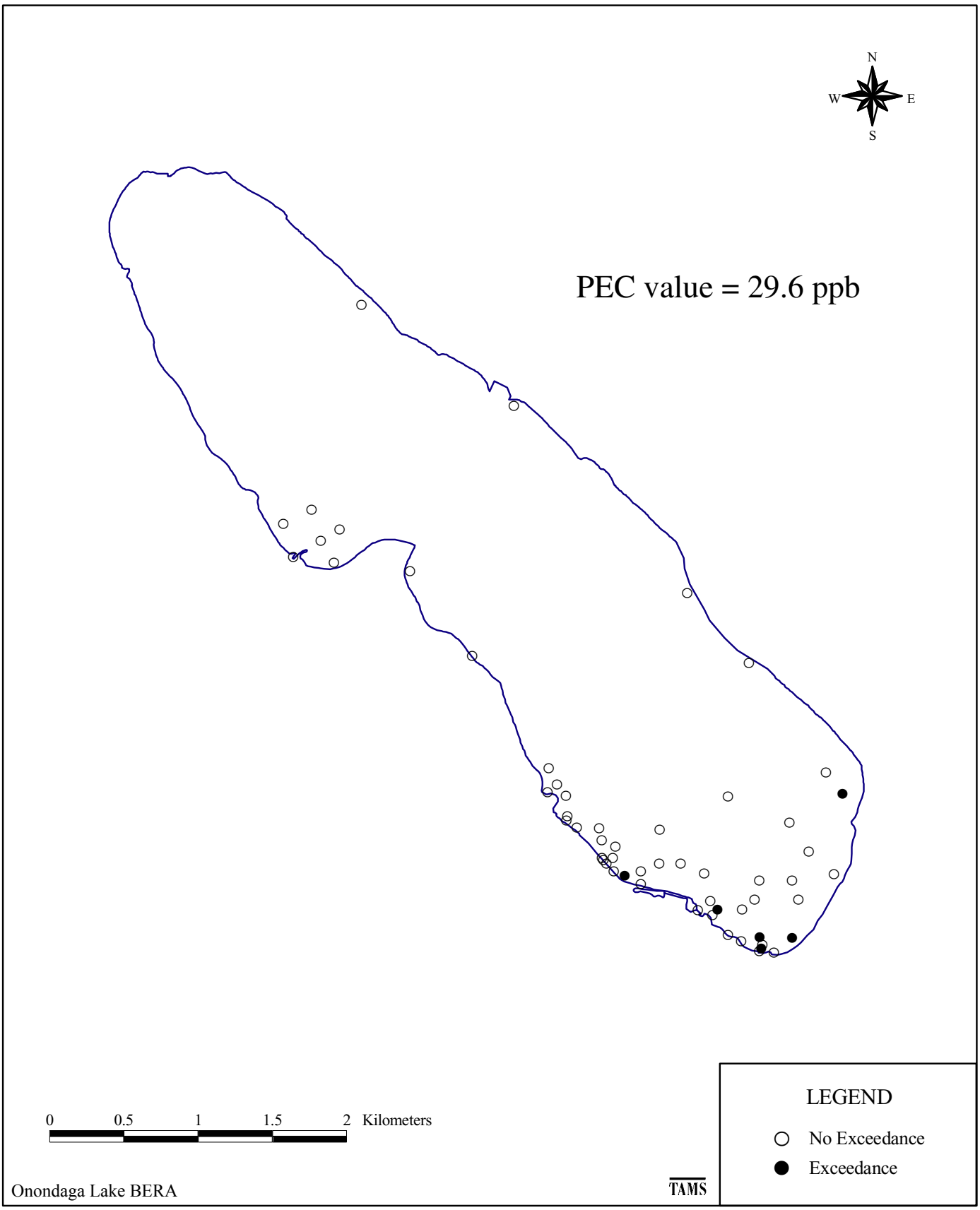

Figure F-132 Locations of DDT and Metabolites Exceedances of Consensus Based Probable Effect Concentrations

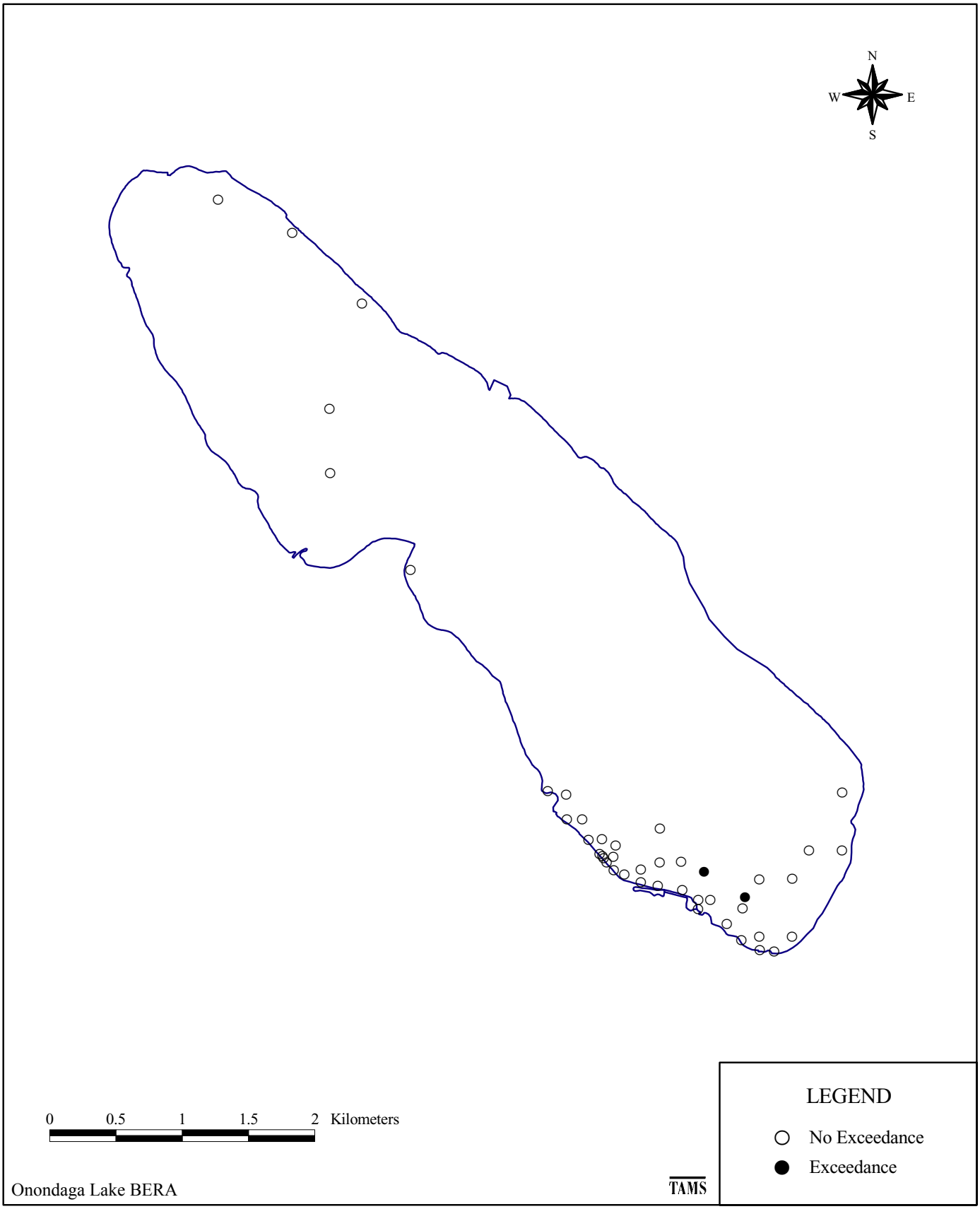

Figure F-133 Locations of Aroclor 1016 Exceedances of Consensus Based Probable Effect Concentrations

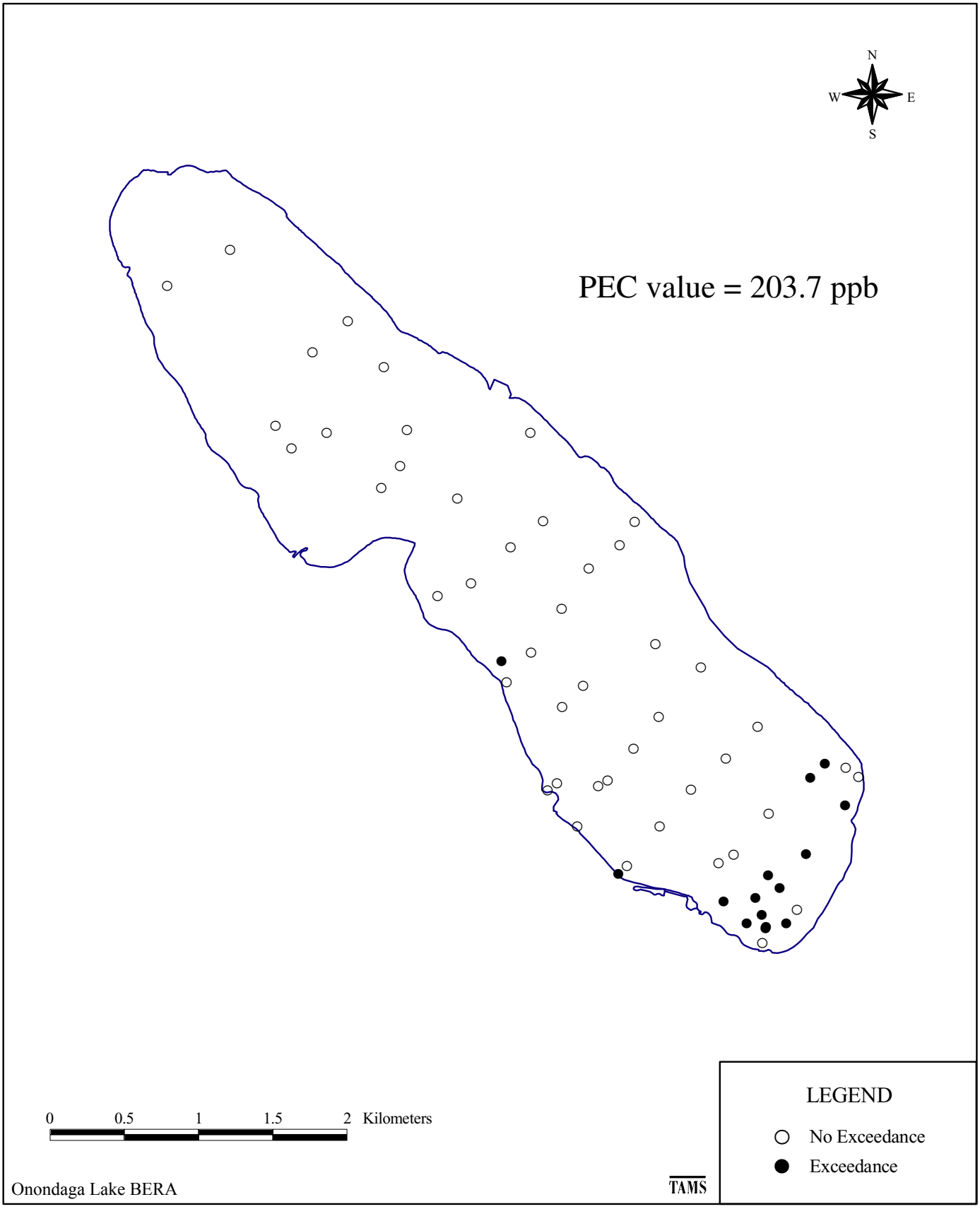

Figure F-134 Locations of Aroclor 1248 Exceedances of Consensus Based Probable Effect Concentrations

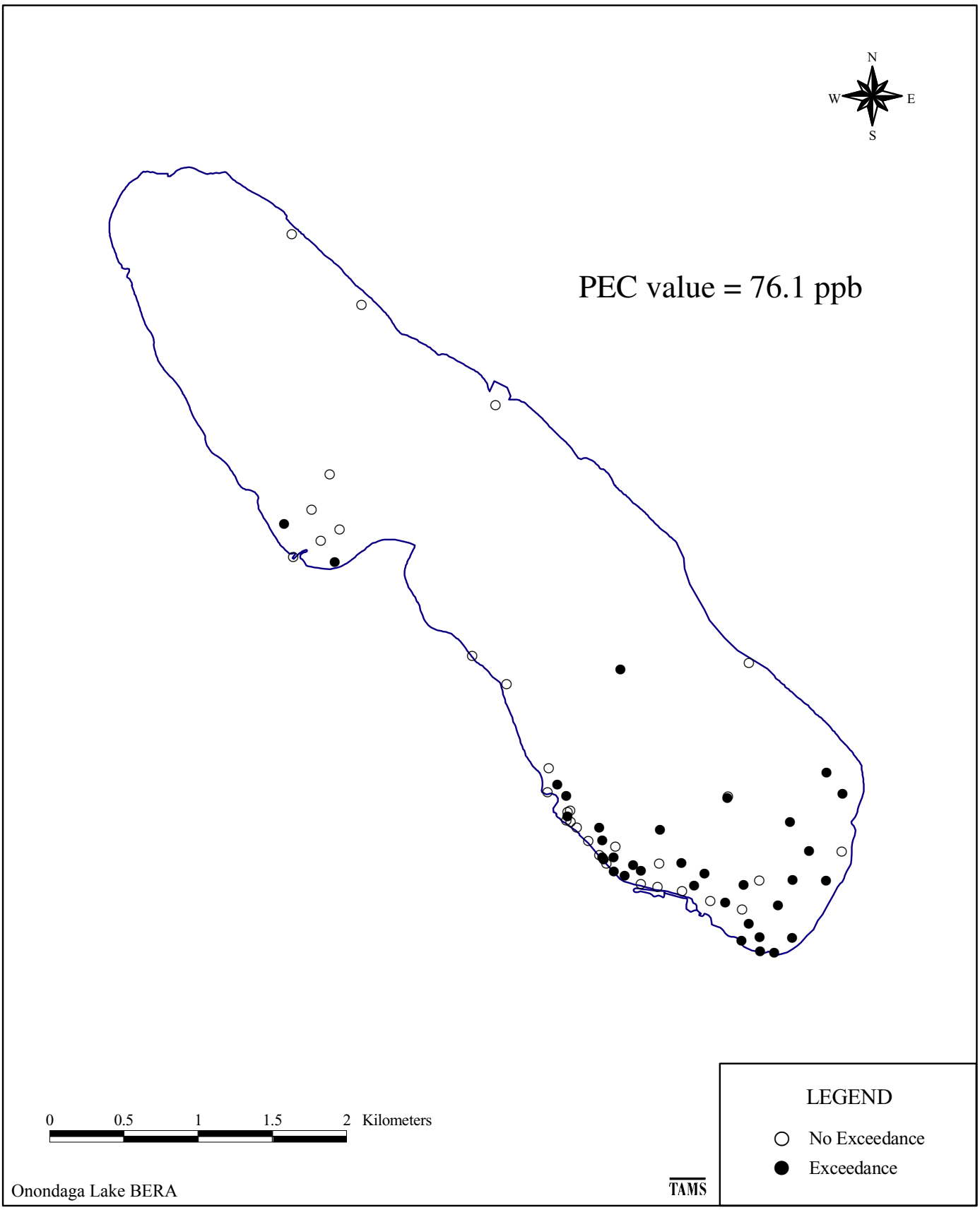

Figure F-135 Locations of Aroclor 1254 Exceedances of Consensus Based Probable Effect Concentrations

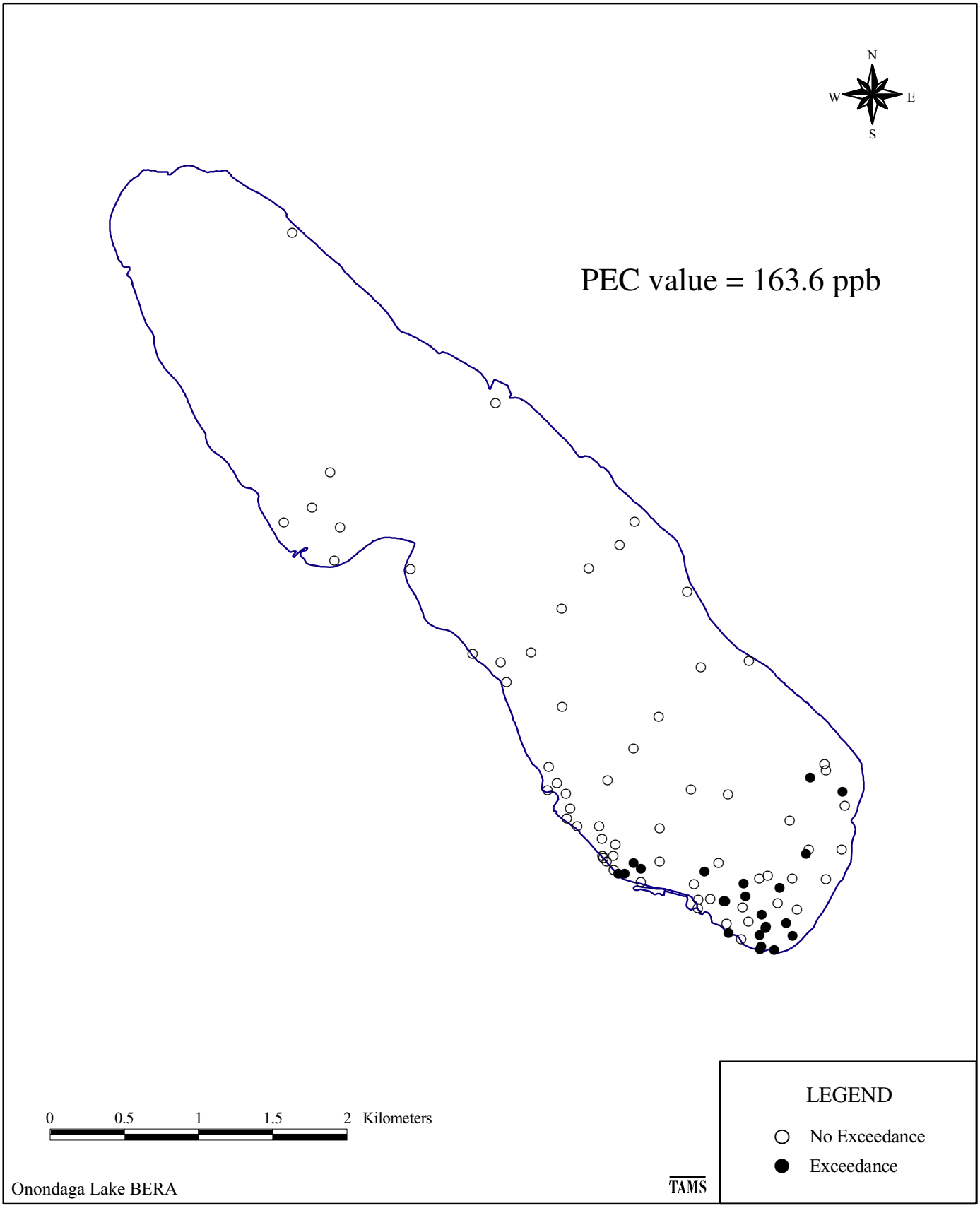

Figure F-136 Locations of Aroclor 1260 Exceedances of Consensus Based Probable Effect Concentrations

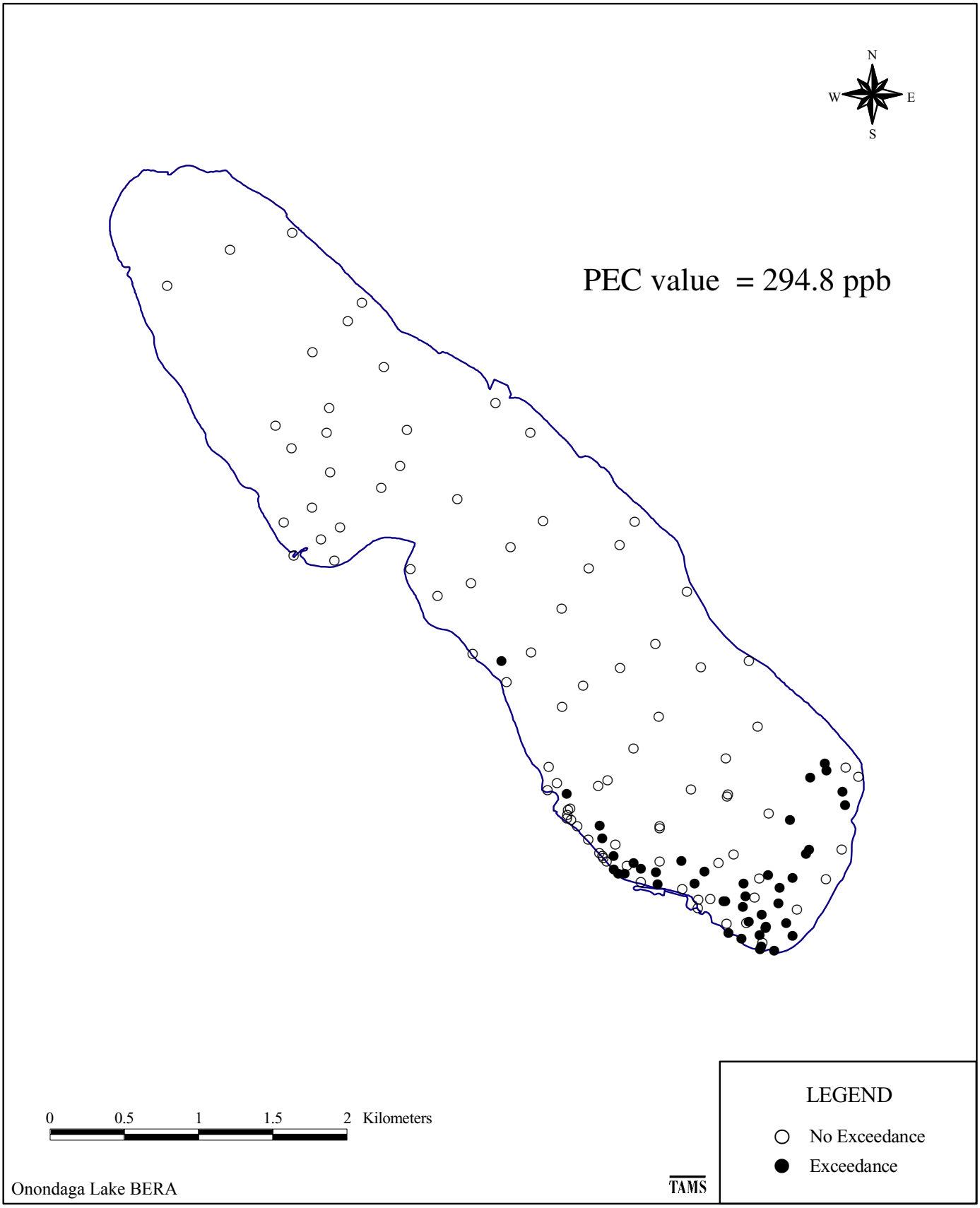

Figure F-137 Locations of PCBs (Sum) Exceedances of Consensus Based Probable Effect Concentrations

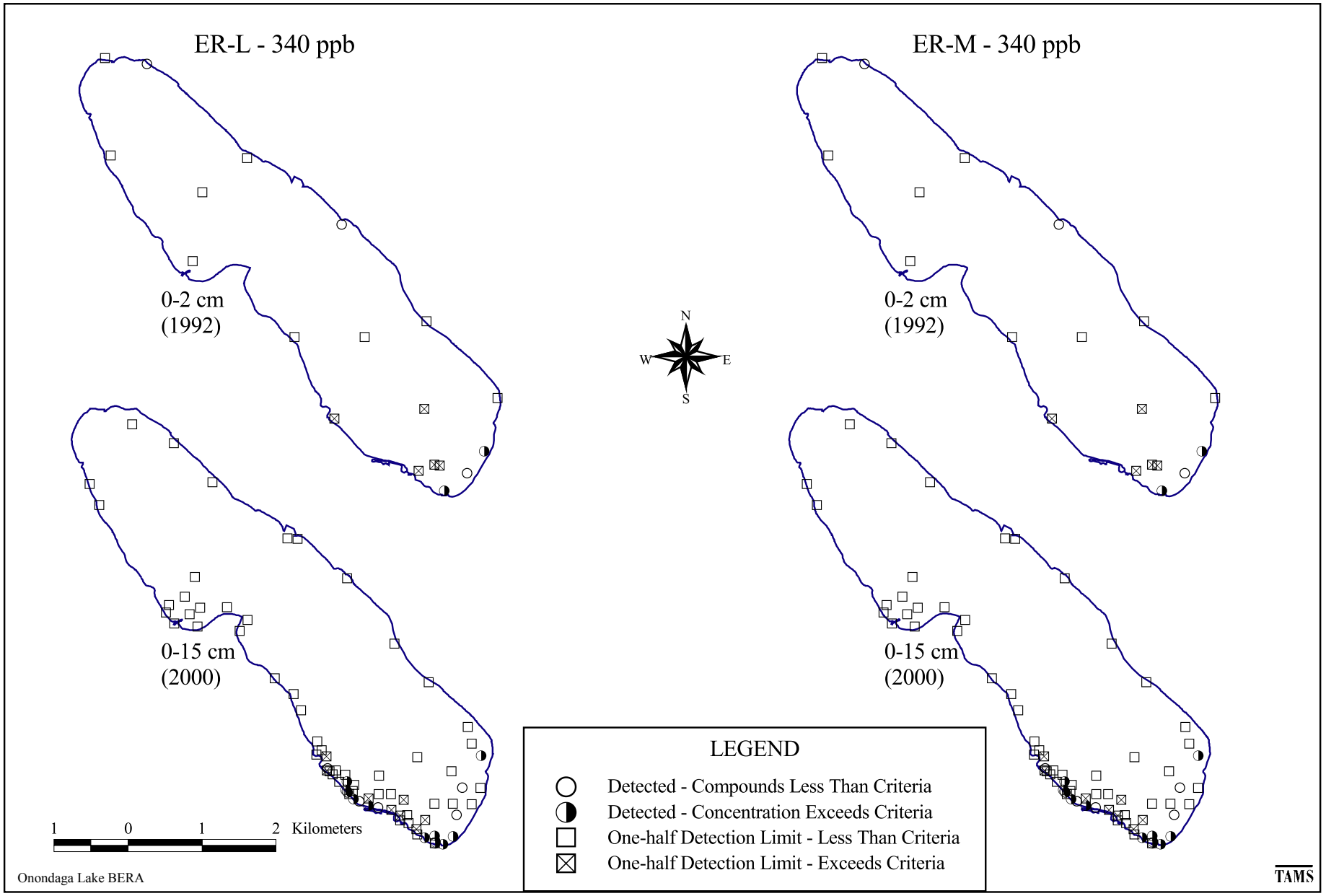

Figure F-31

Comparison of Dibenzofuran Sediment Concentrations with the ER-L and ER-M

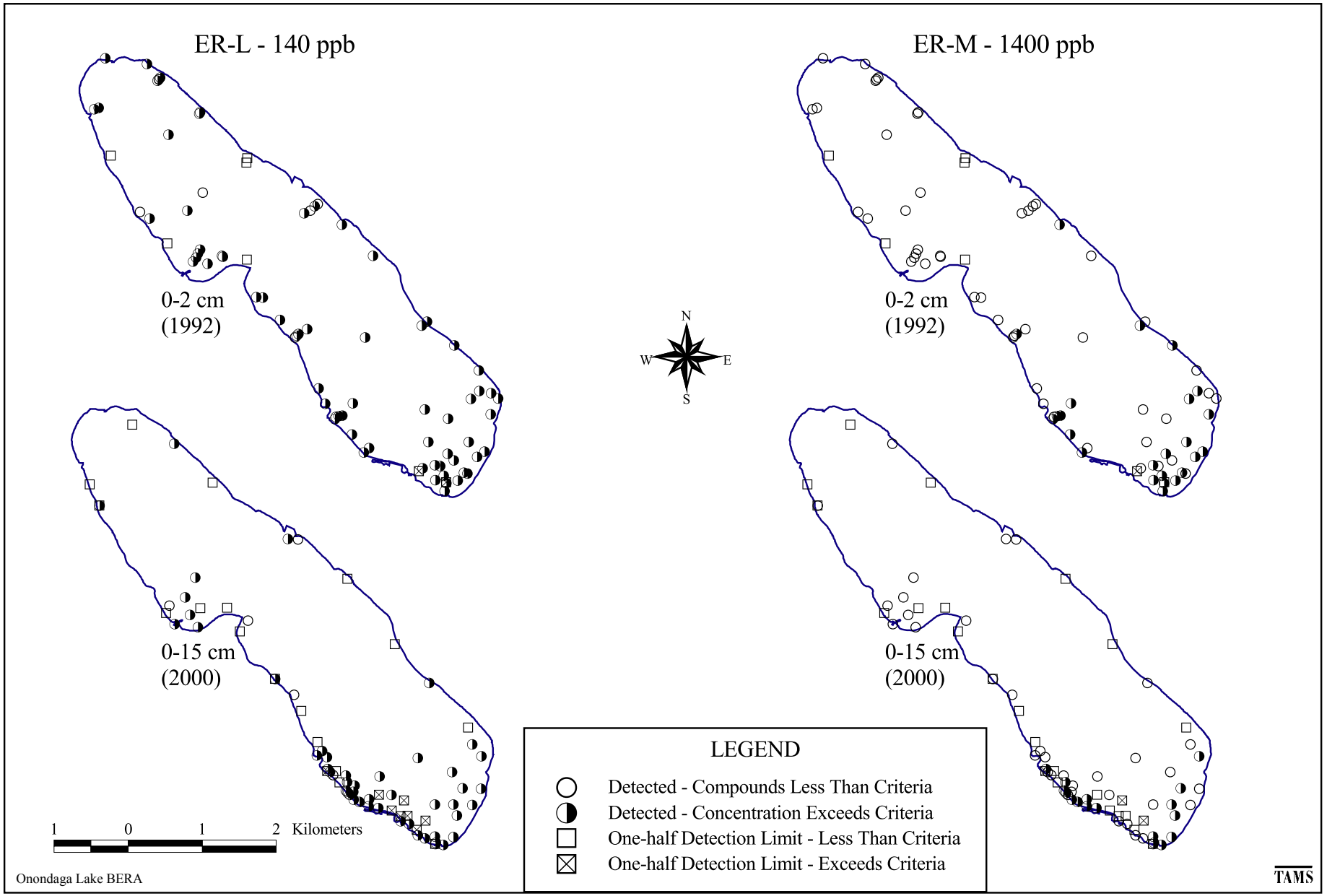

Figure F-32

Comparison of Fluoranthene Sediment Concentrations with the ER-L and ER-M

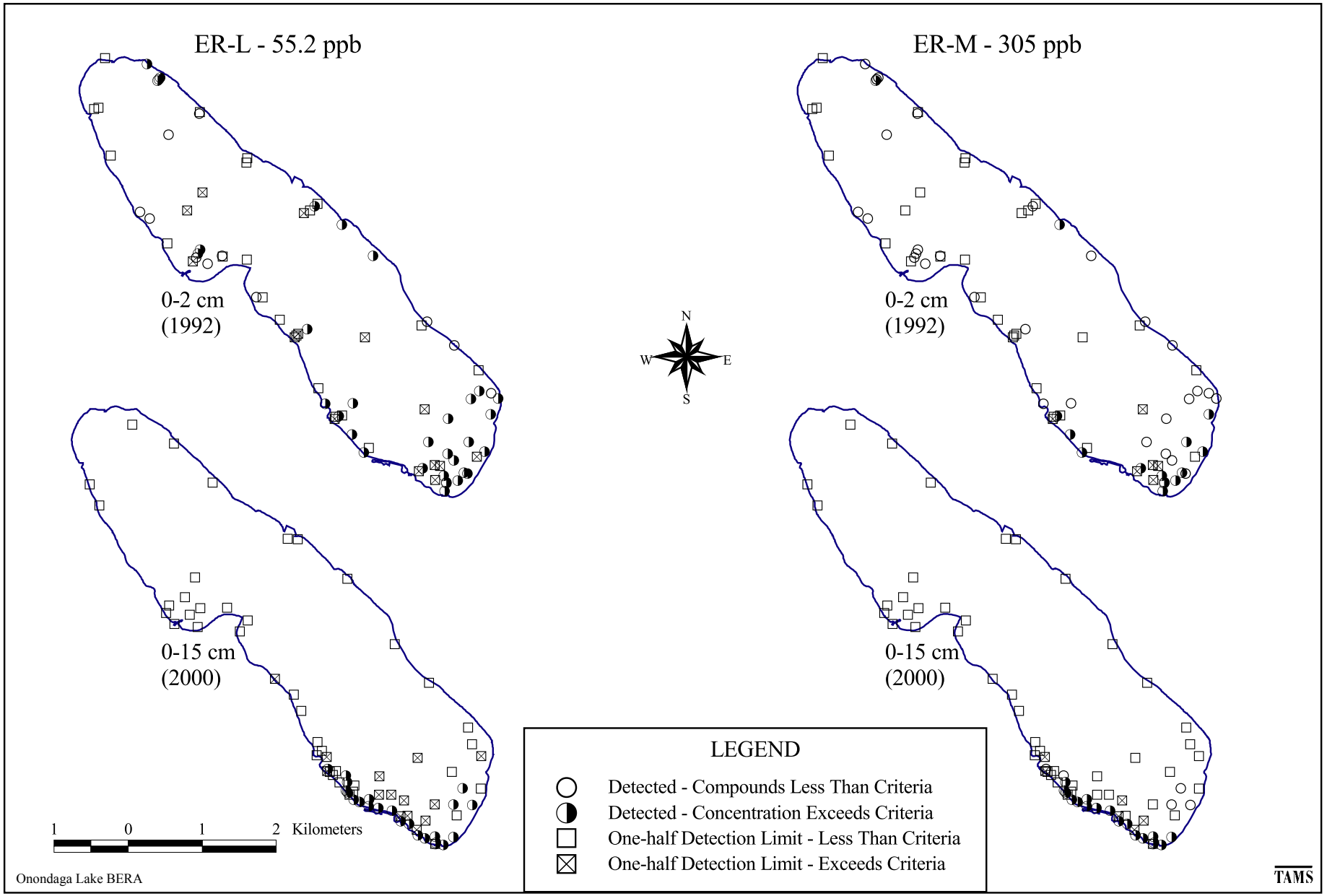

Figure F-33

Comparison of Fluorene Sediment Concentrations with the ER-L and ER-M

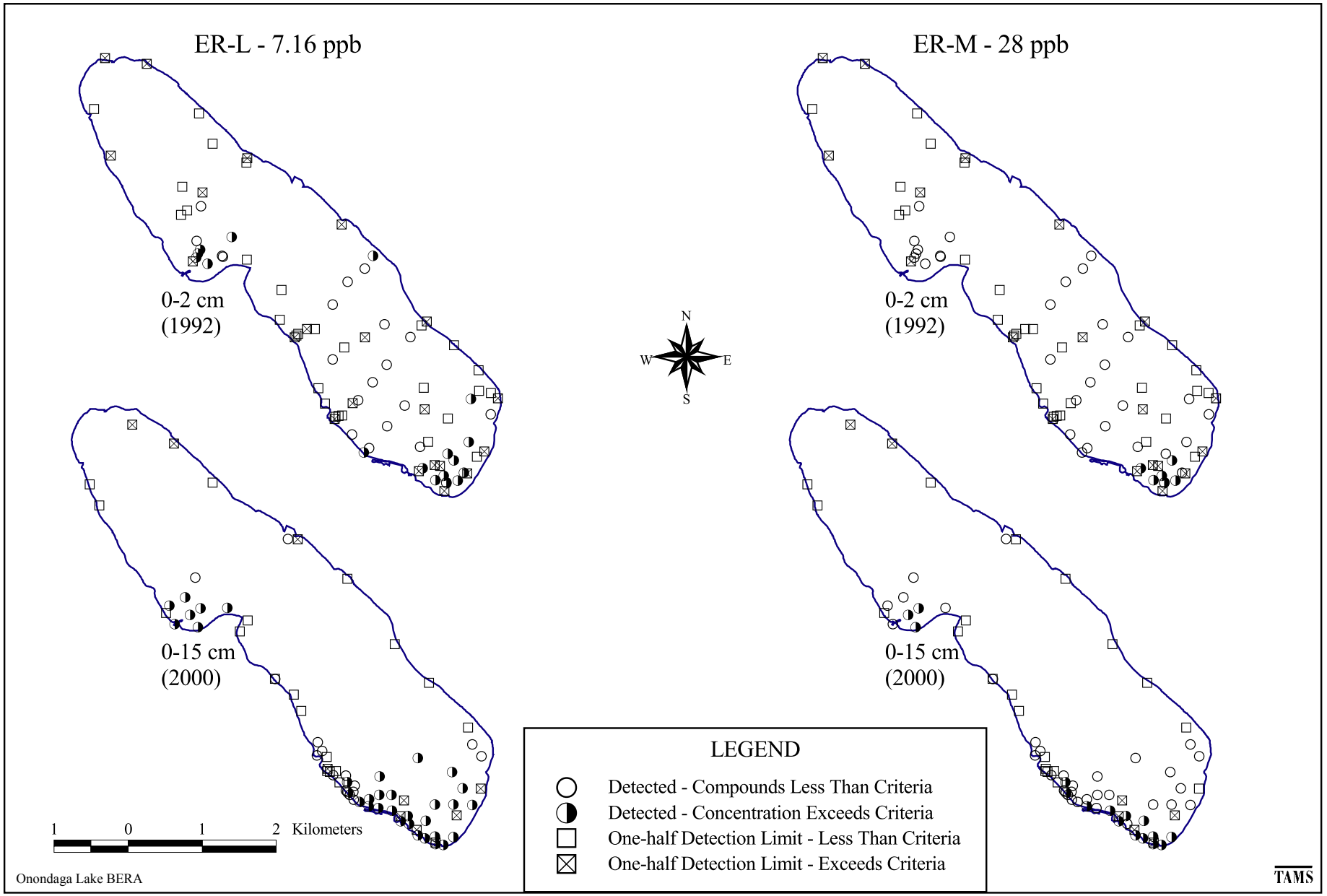

Figure F-34

Comparison of Hexachlorobenzene Sediment Concentrations with the ER-L and ER-M

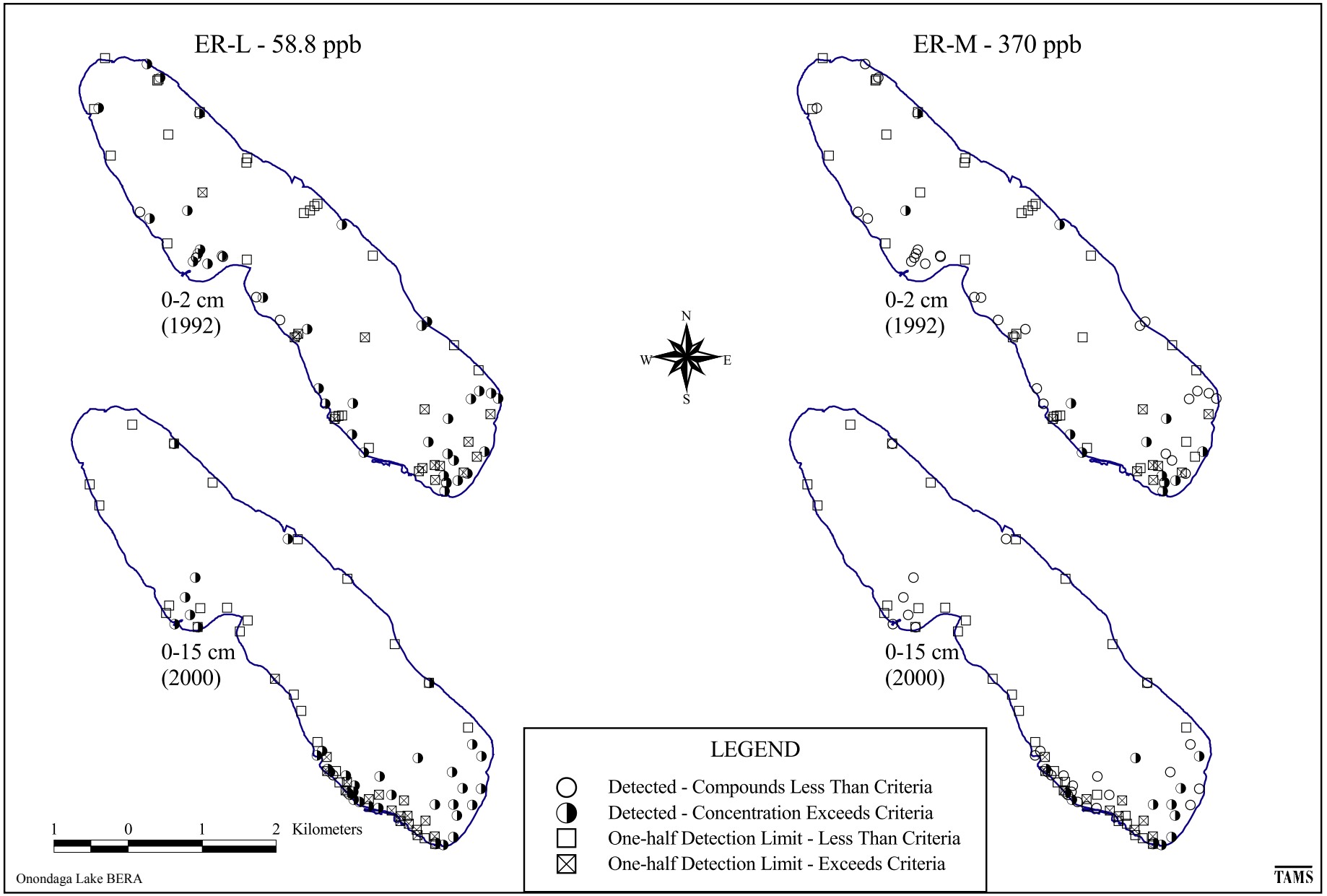

Figure F-35

Comparison of Indeno(1,2,3-cd)pyrene Sediment Concentrations with the ER-L and ER-M

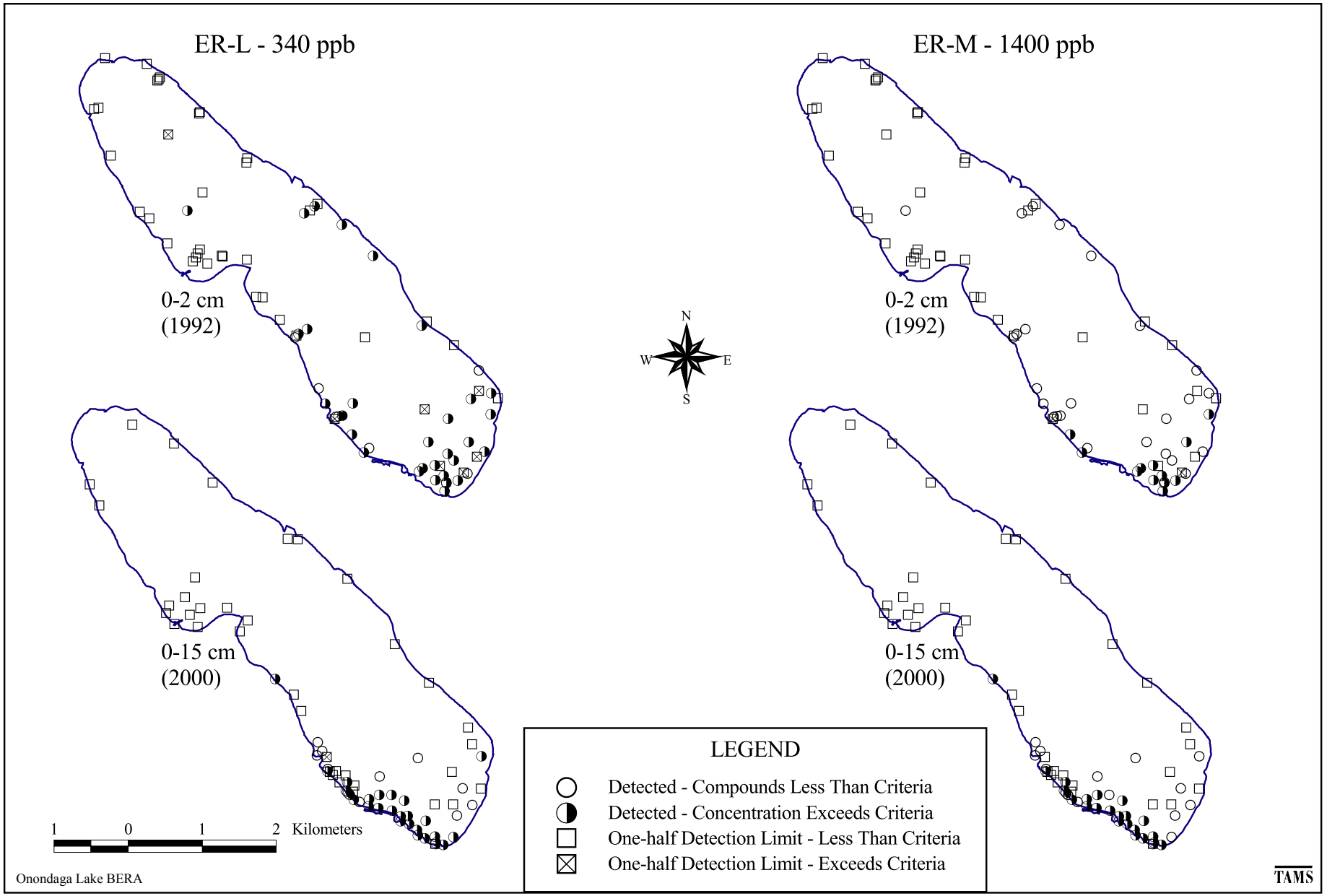

Figure F-36

Comparison of Naphthalene Sediment Concentrations with the ER-L and ER-M

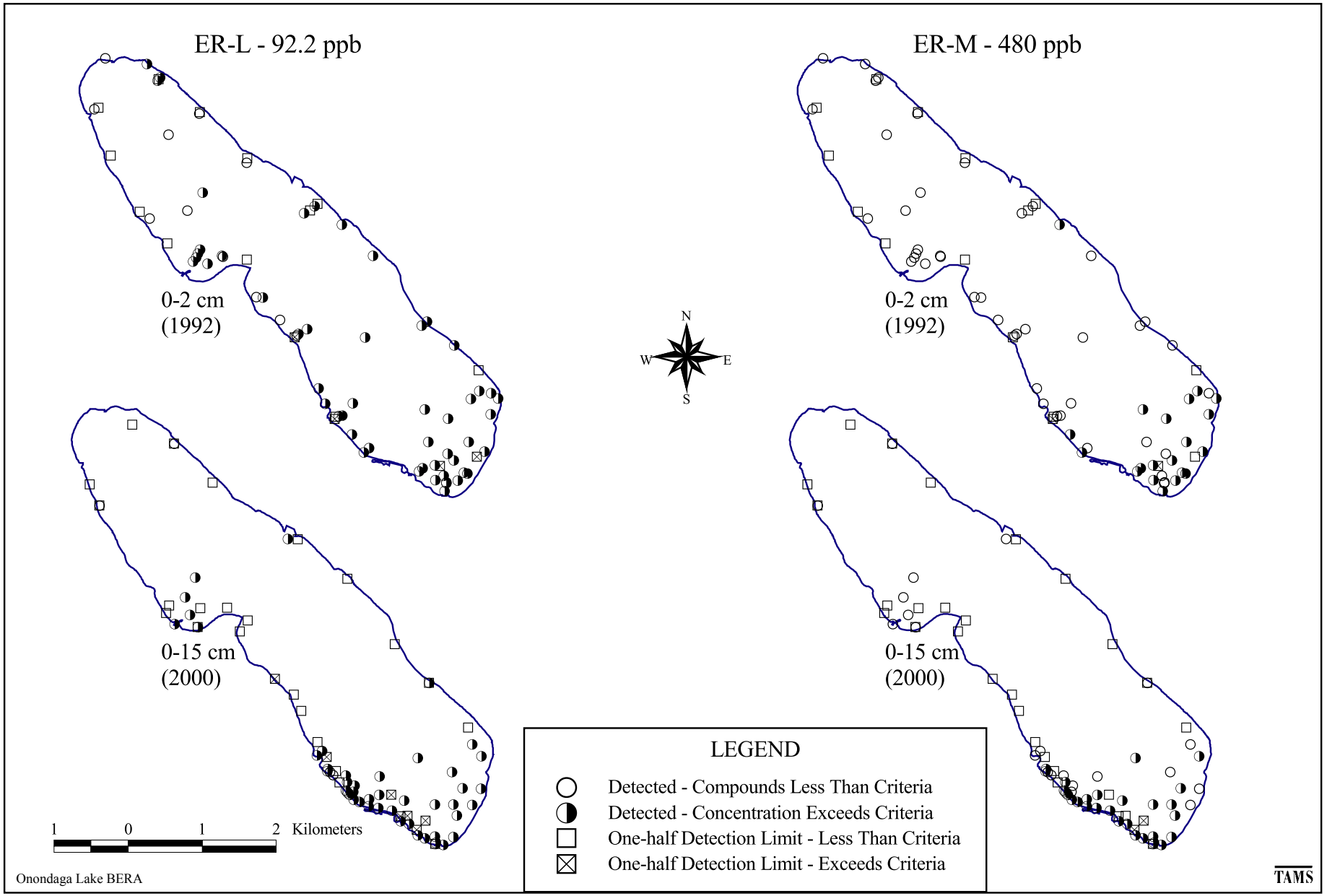

Figure F-37

Comparison of Phenanthrene Sediment Concentrations with the ER-L and ER-M

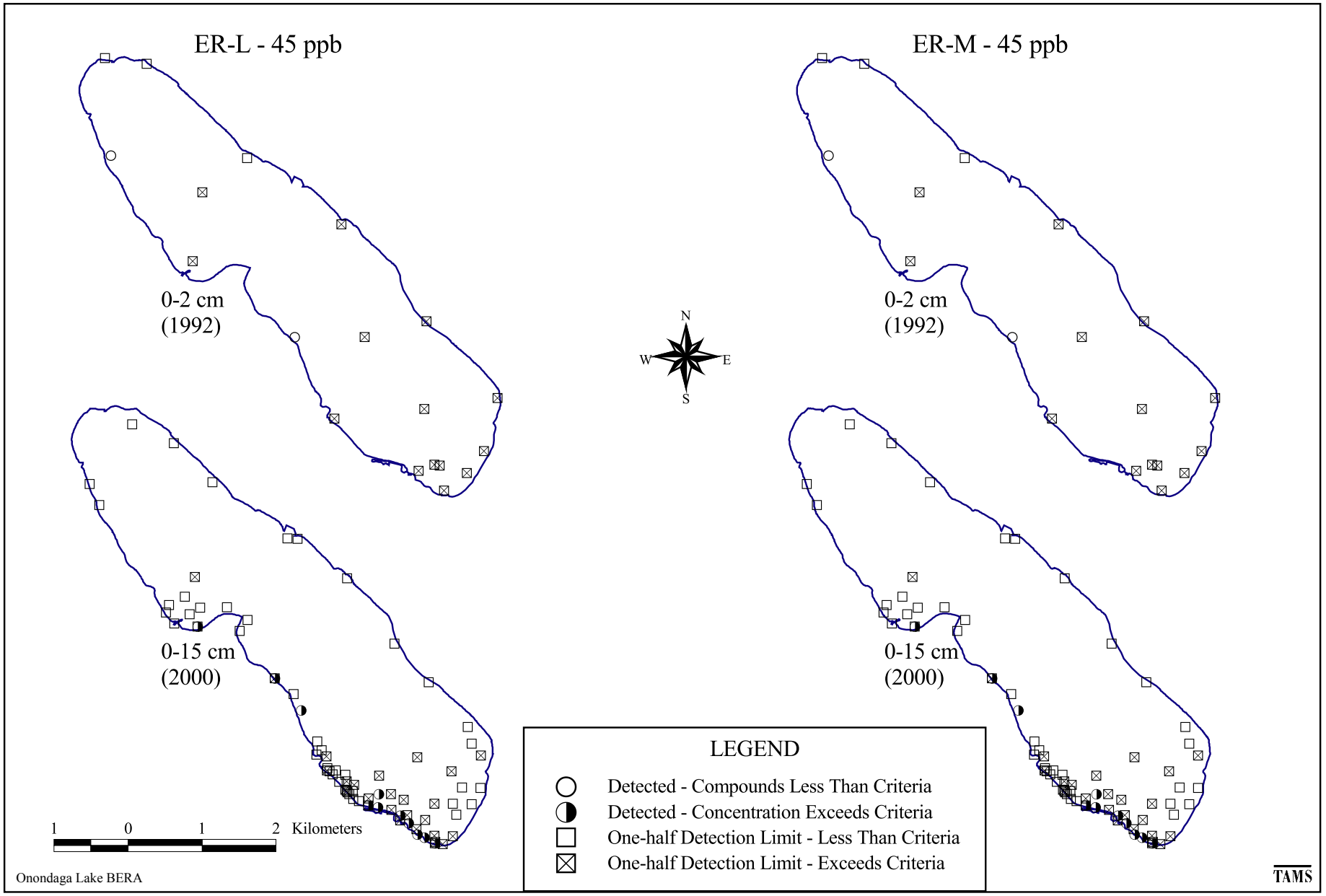

Figure F-38

Comparison of Phenol Sediment Concentrations with the ER-L and ER-M

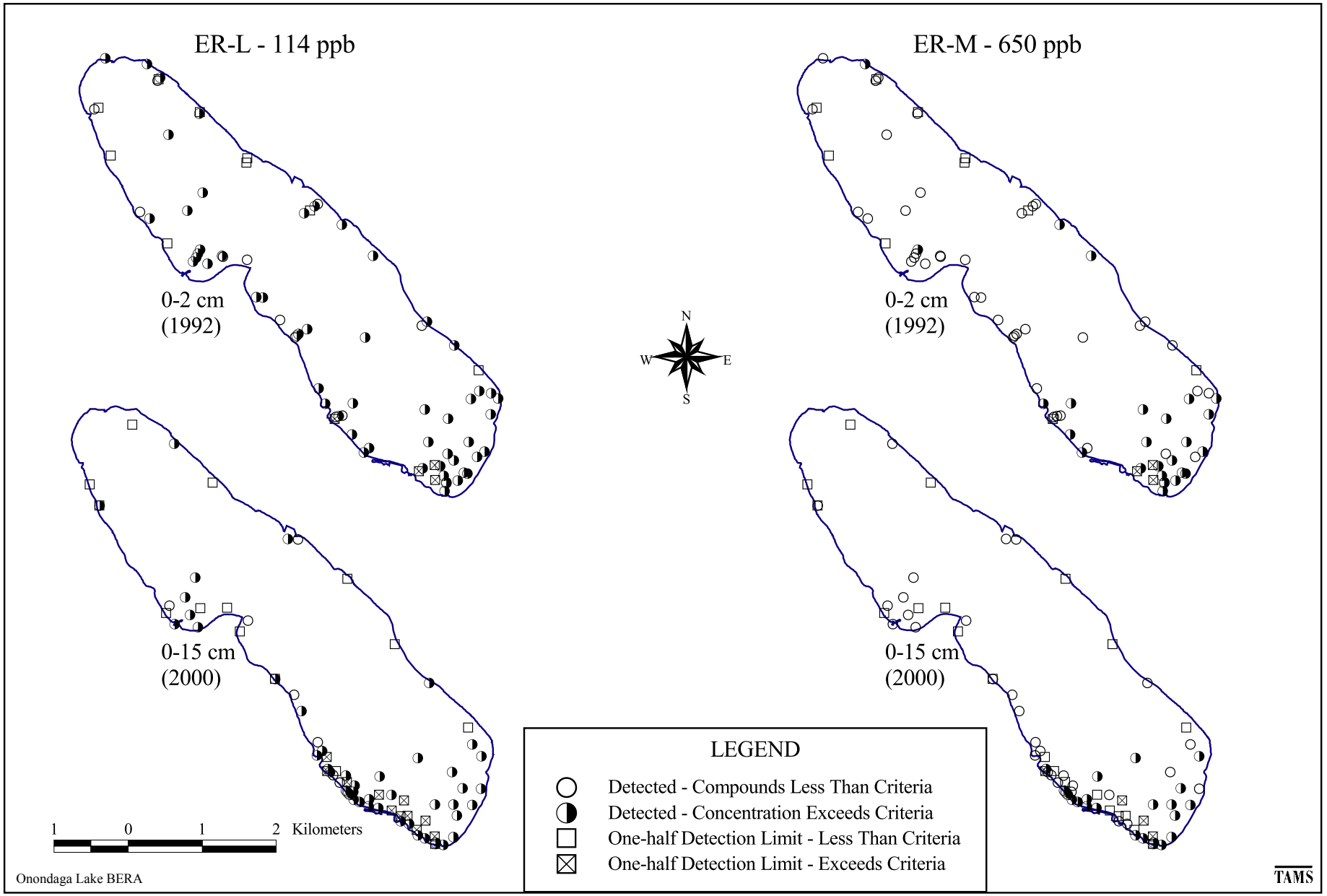

Figure F-39

Comparison of Pyrene Sediment Concentrations with the ER-L and ER-M

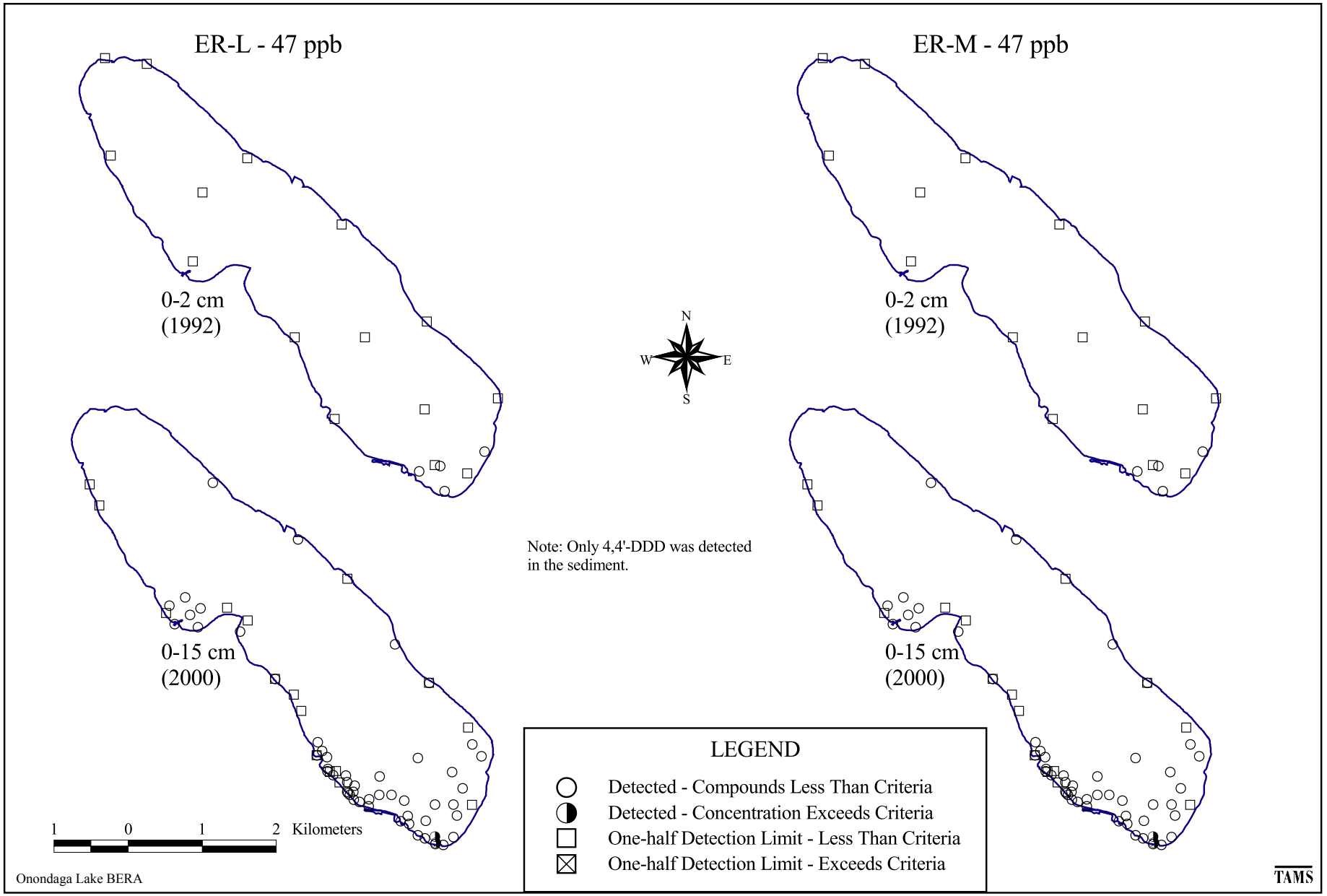

Figure F-40

Comparison of DDT and metabolites Sediment Concentrations with the ER-L and ER-M

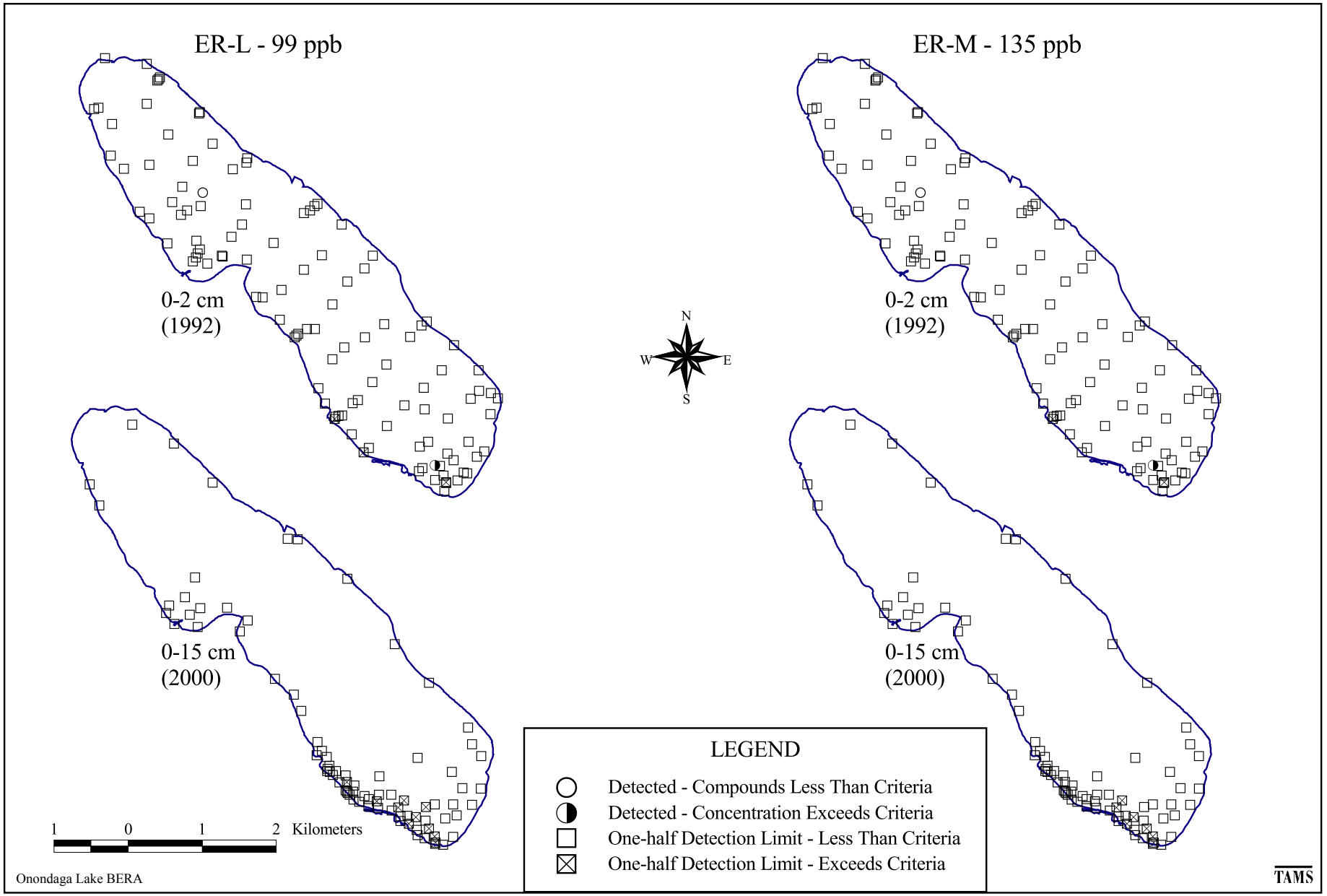

Figure F-41

Comparison of Aroclor-1016 Sediment Concentrations with the ER-L and ER-M

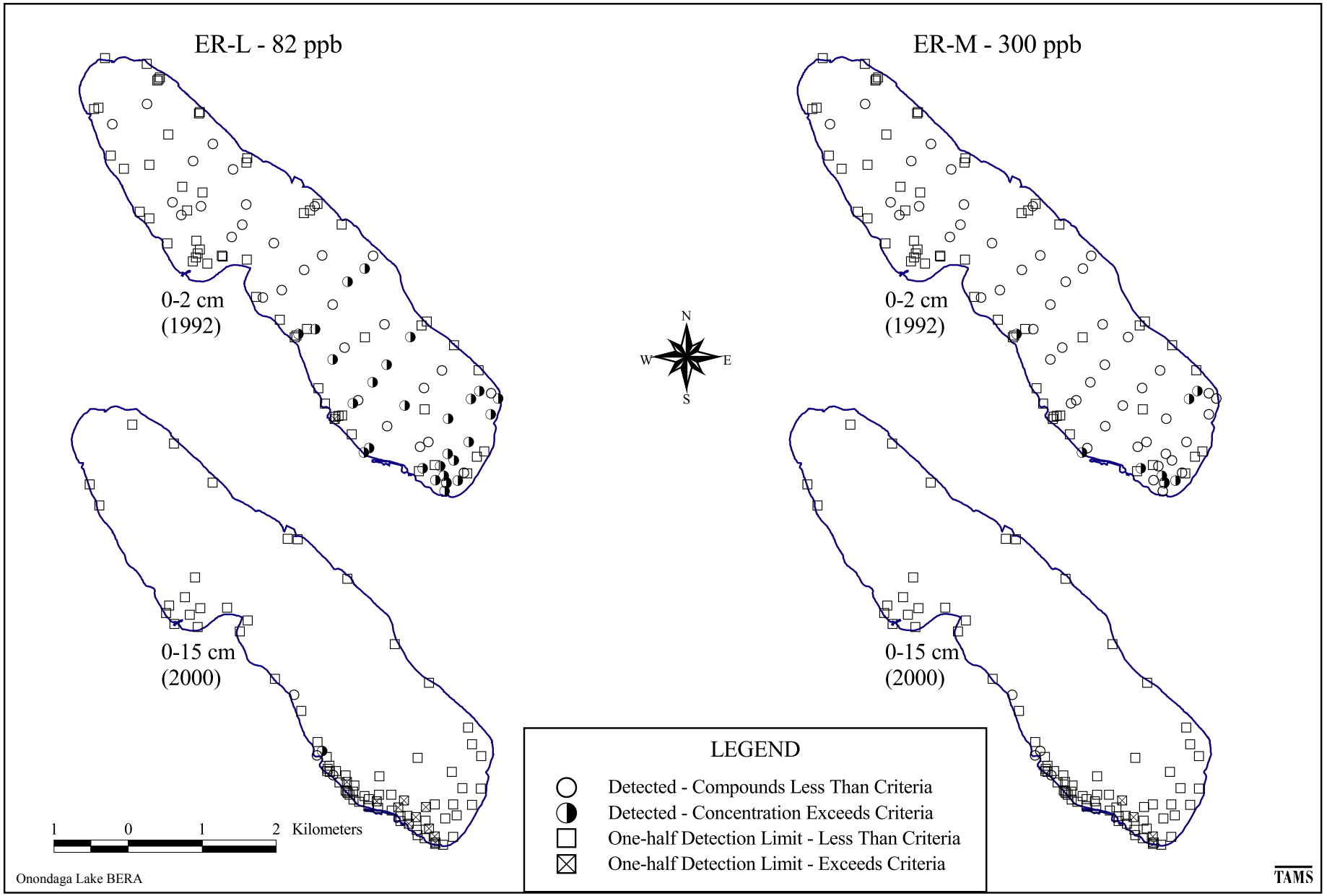

Figure F-42

Comparison of Aroclor-1248 Sediment Concentrations with the ER-L and ER-M

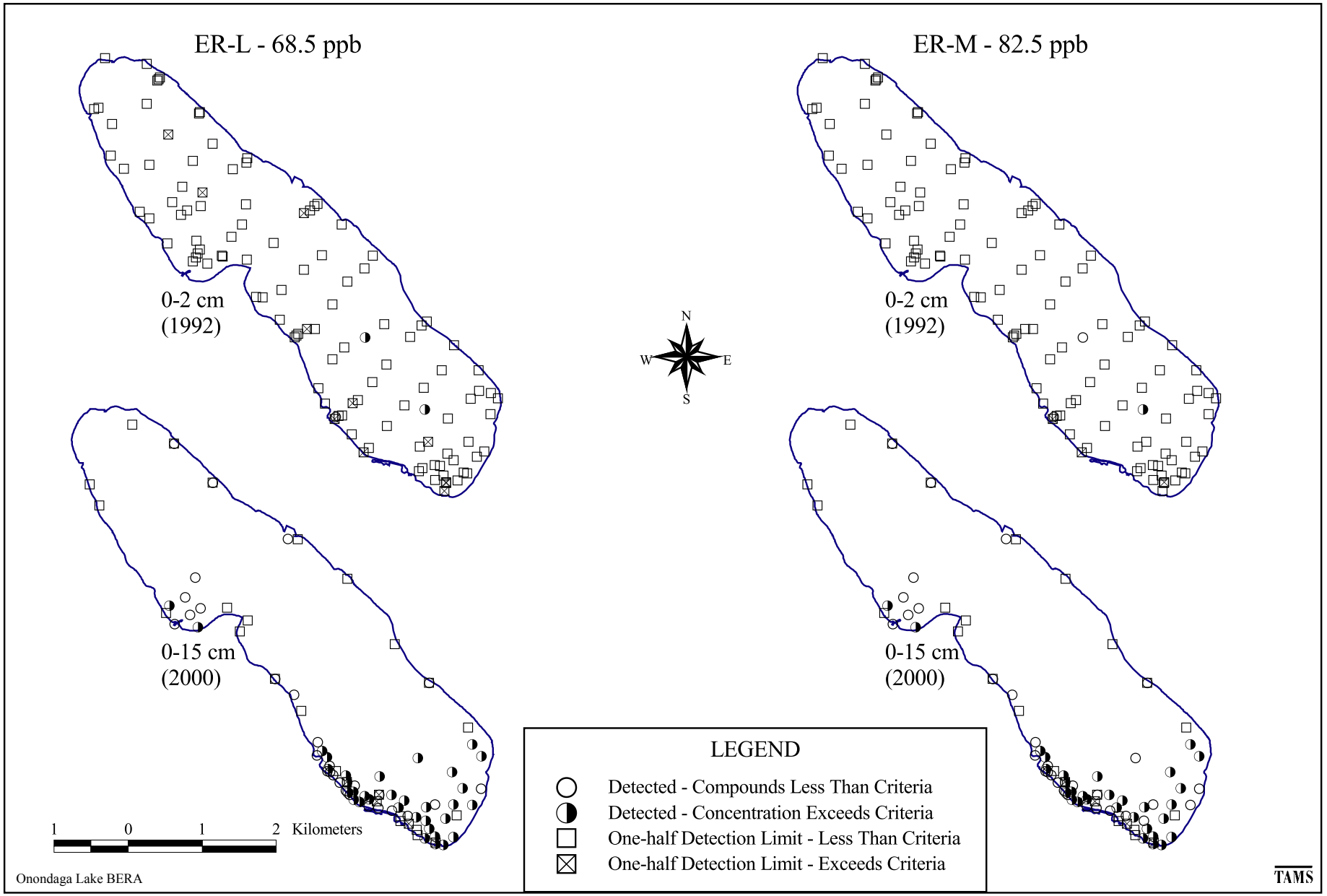

Figure F-43

Comparison of Aroclor-1254 Sediment Concentrations with the ER-L and ER-M

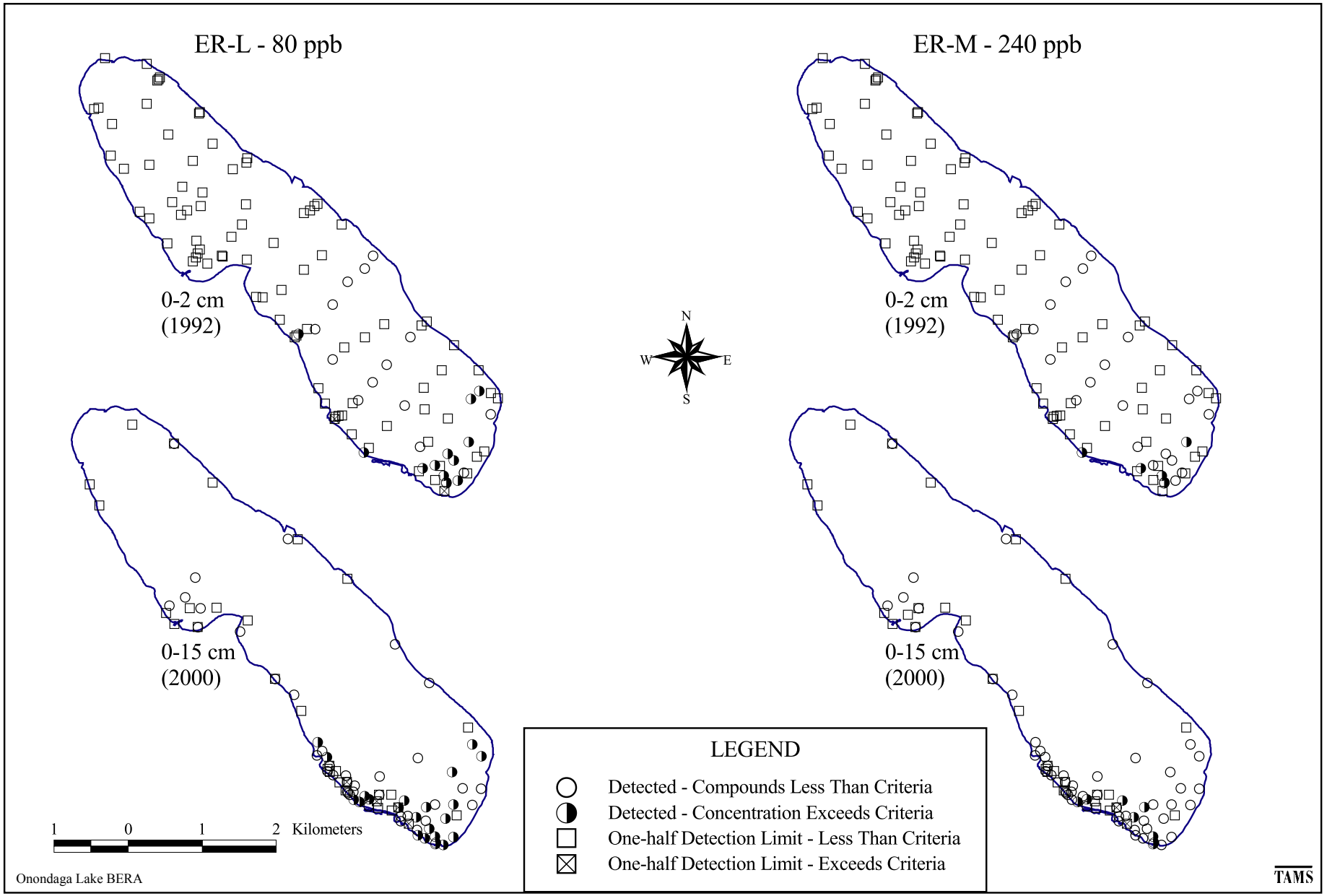

Figure F-44

Comparison of Aroclor-1260 Sediment Concentrations with the ER-L and ER-M

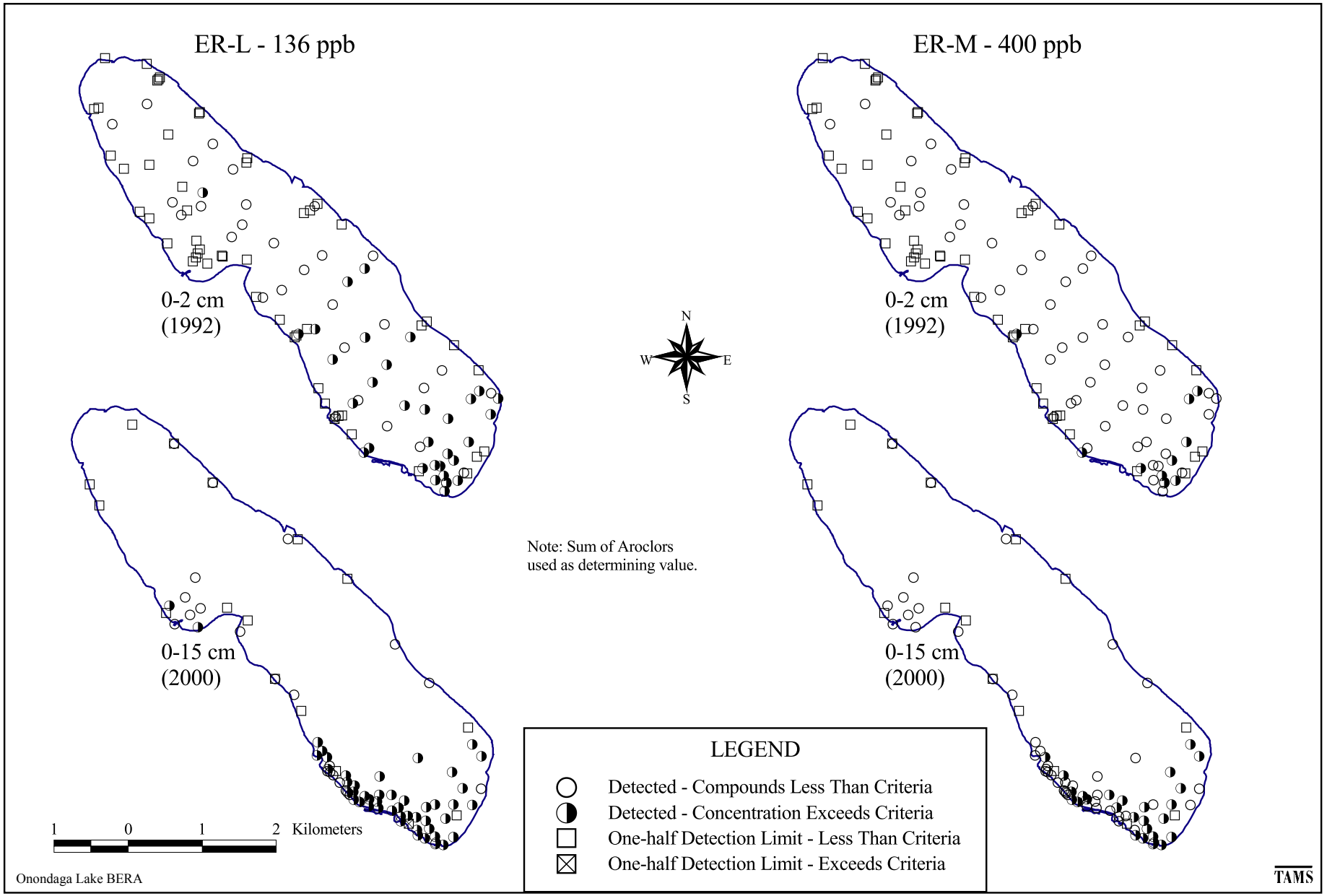

Figure F-45

Comparison of PCBs (Sum) Sediment Concentrations with the ER-L and ER-M

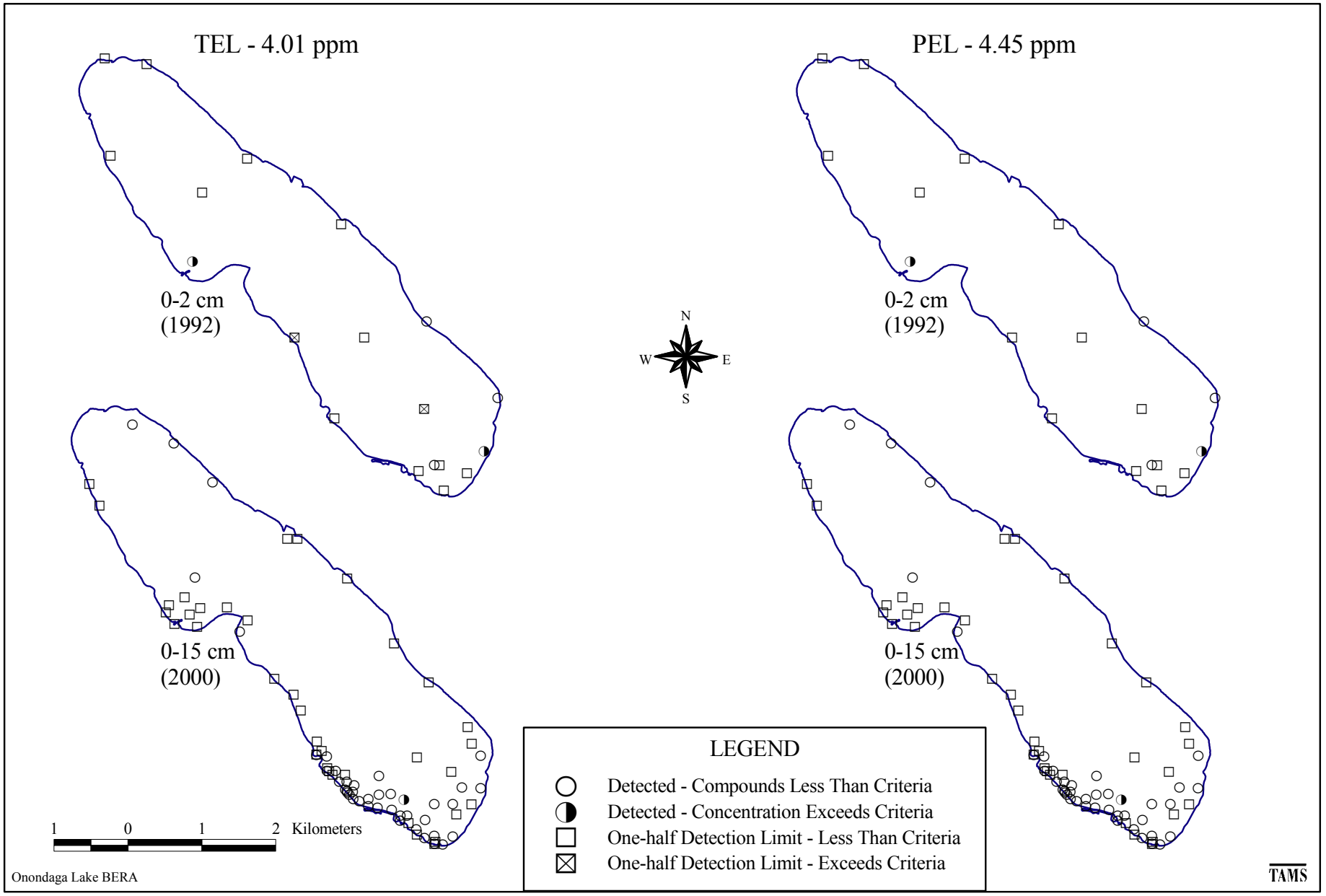

Figure F-46
Comparison of Antimony Sediment Concentrations with the TEL and PEL

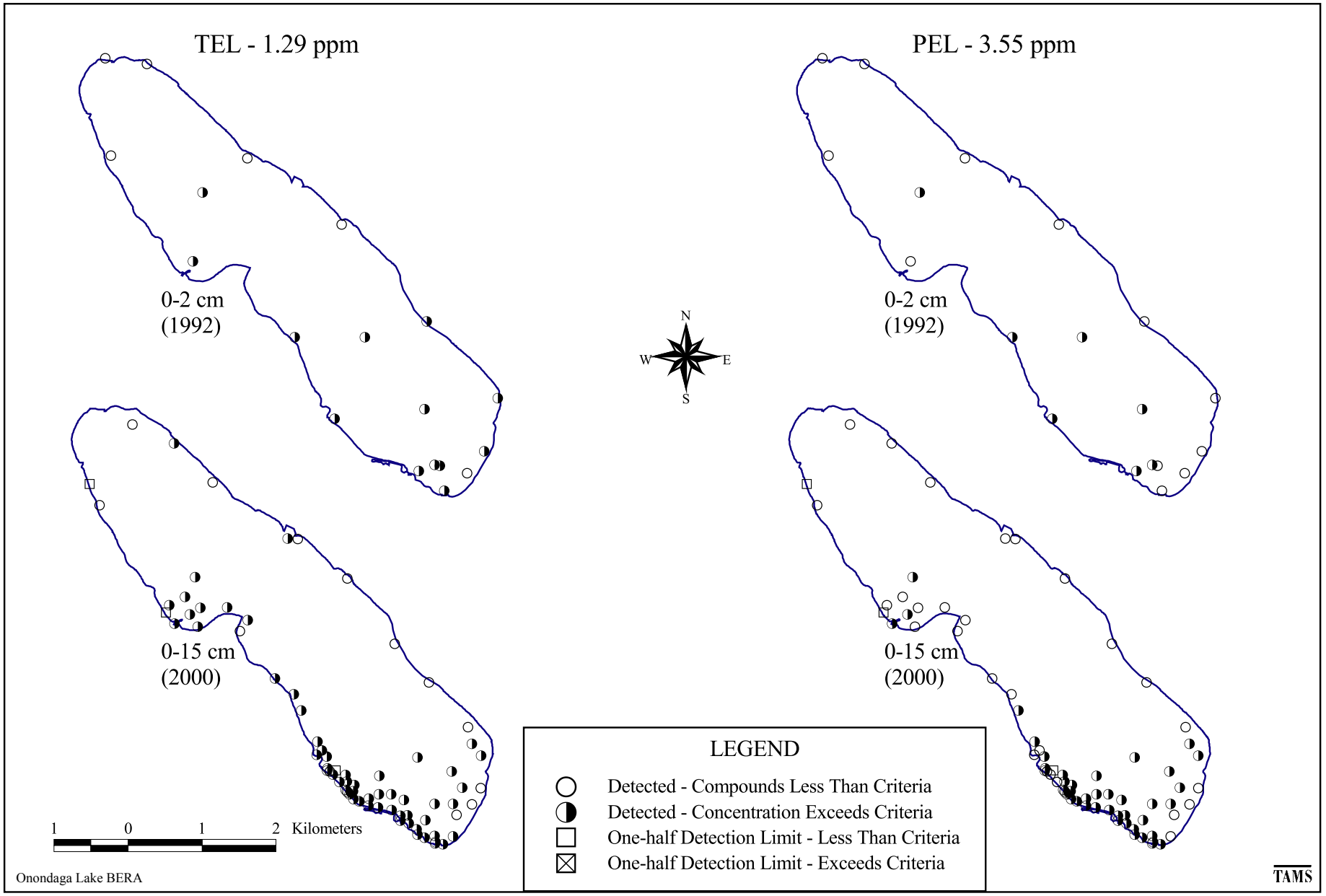

Figure F-47

Comparison of Arsenic Sediment Concentrations with the TEL and PEL

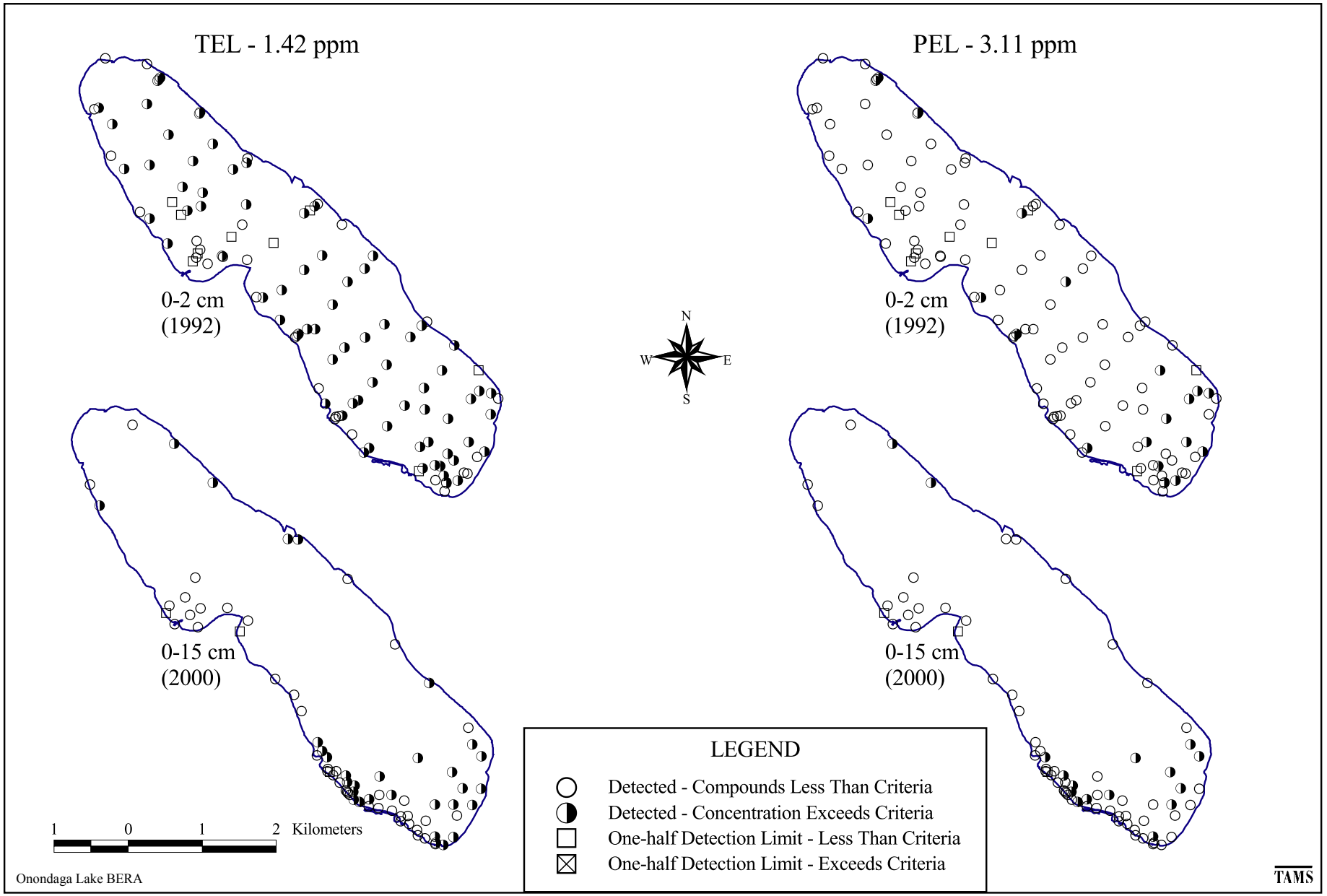

Figure F-48

Comparison of Cadmium Sediment Concentrations with the TEL and PEL

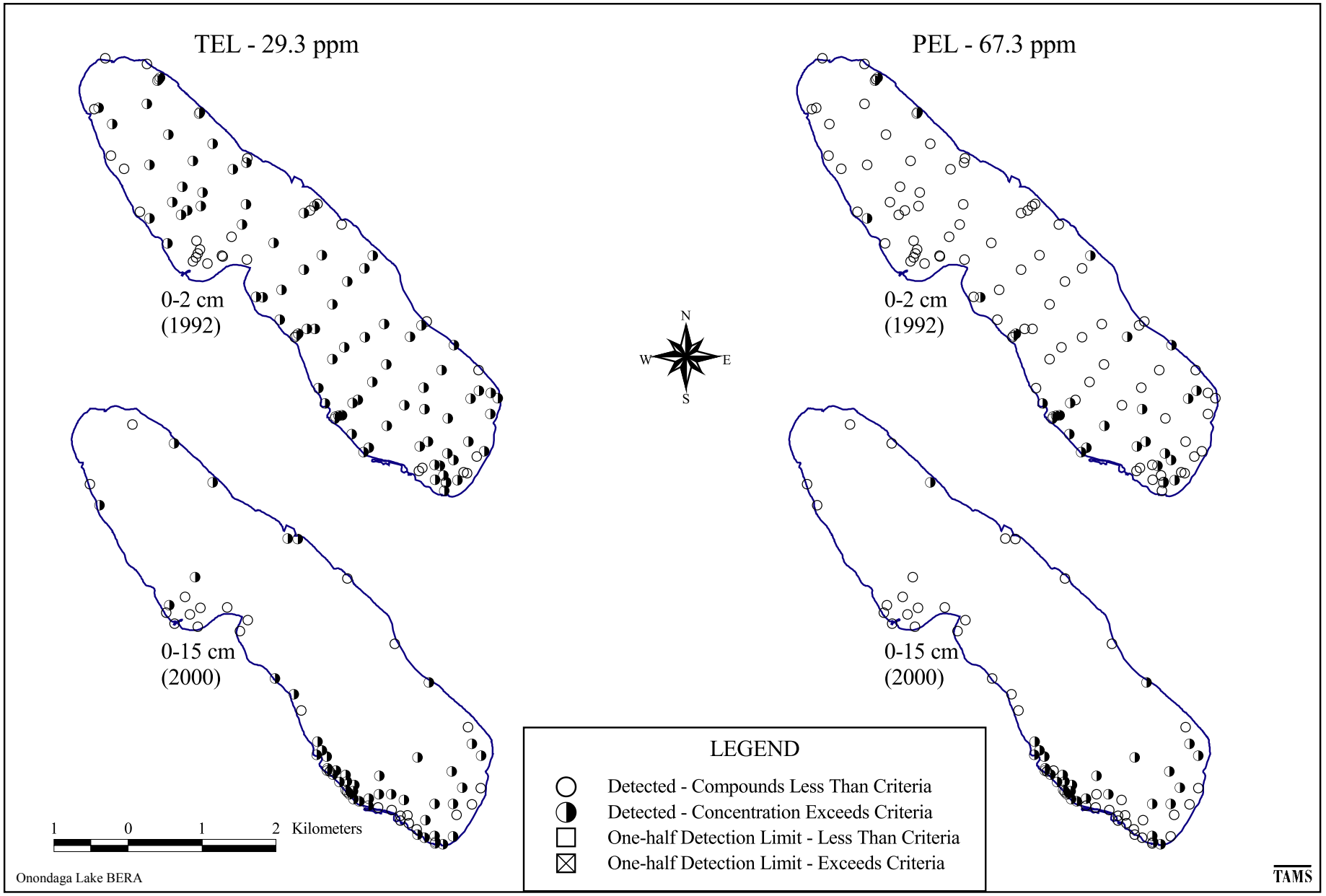

Figure F-49

Comparison of Chromium Sediment Concentrations with the TEL and PEL

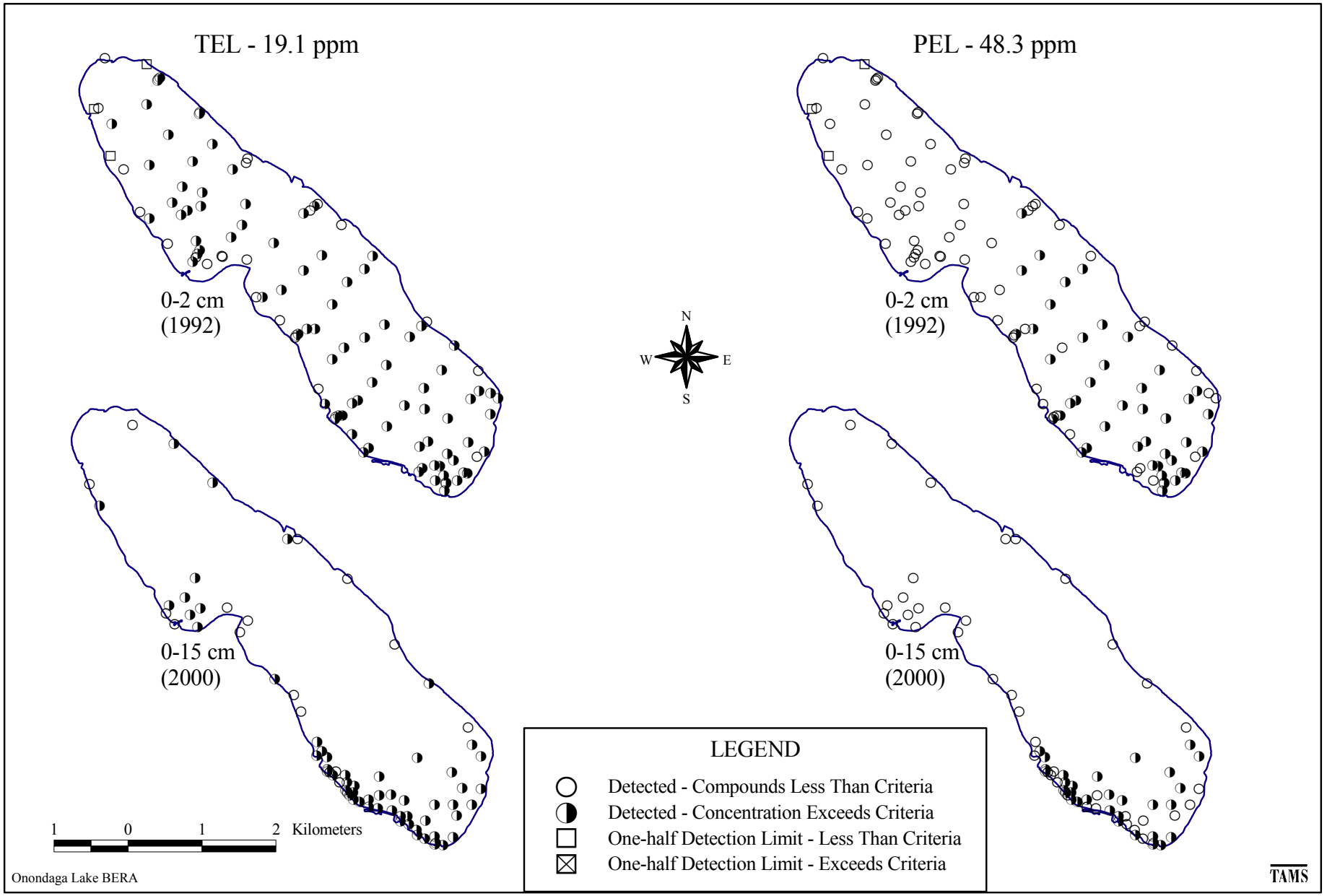

Figure F-50
Comparison of Copper Sediment Concentrations with the TEL and PEL

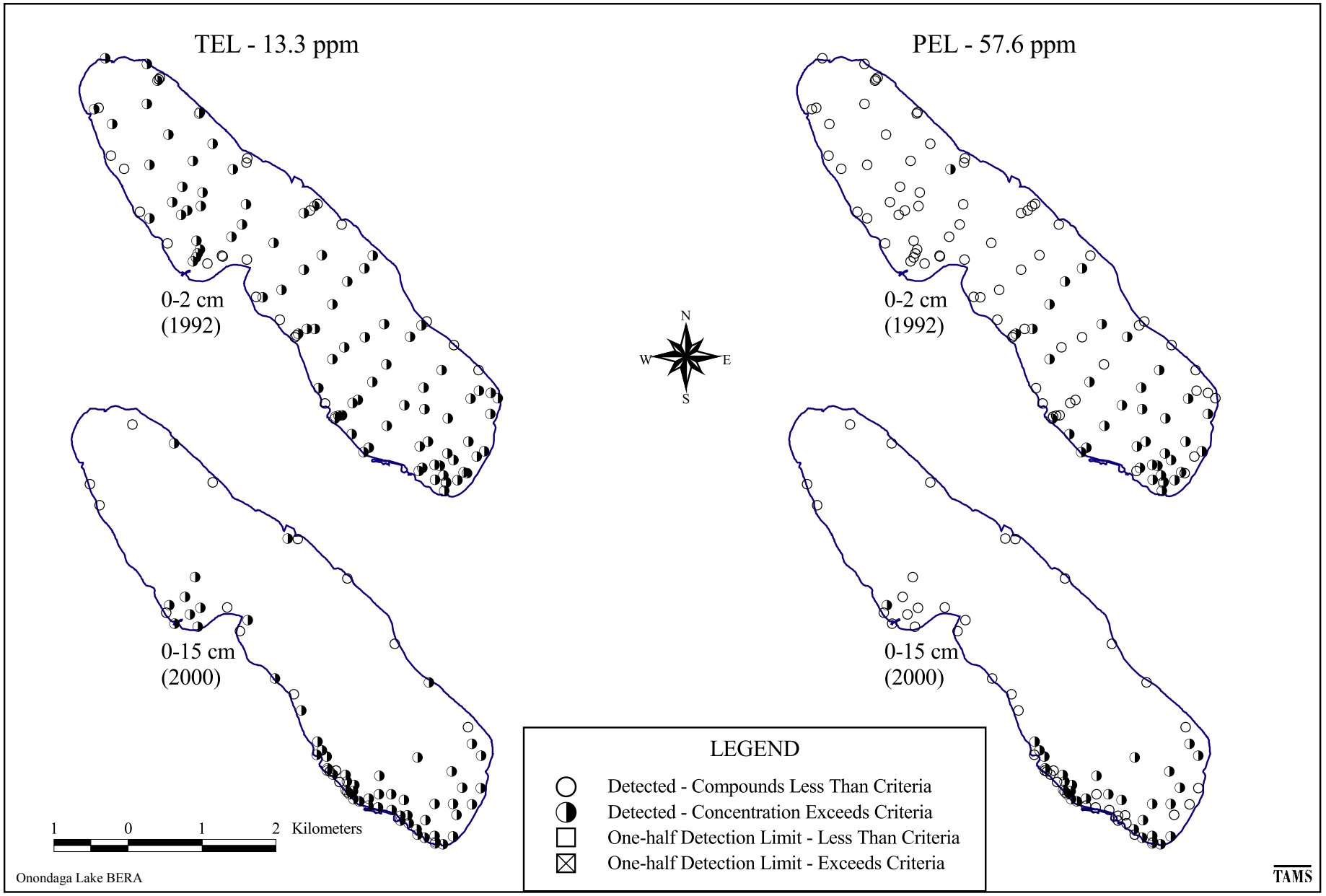

Figure F-51

Comparison of Lead Sediment Concentrations with the TEL and PEL

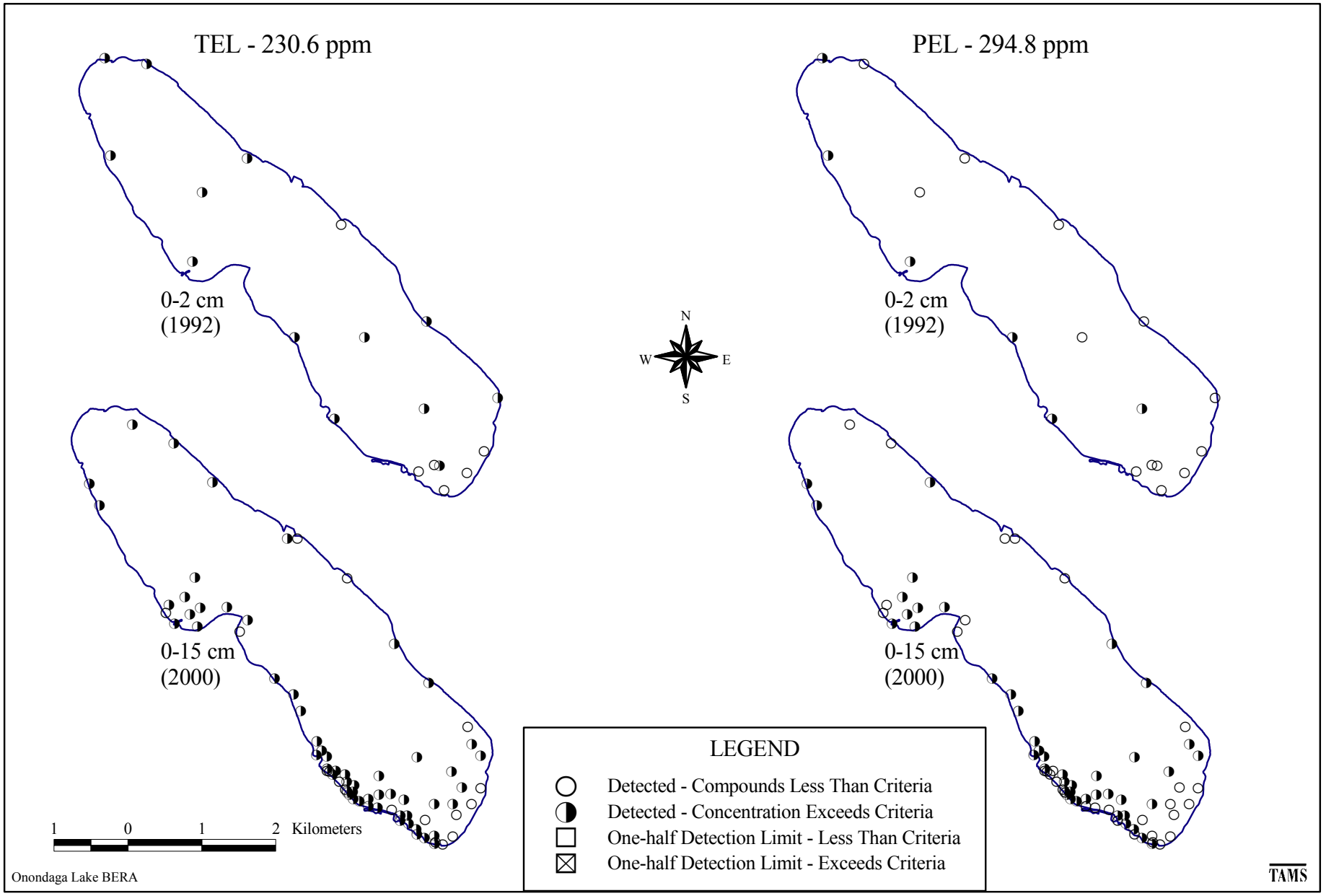

Figure F-52
Comparison of Manganese Sediment Concentrations with the TEL and PEL

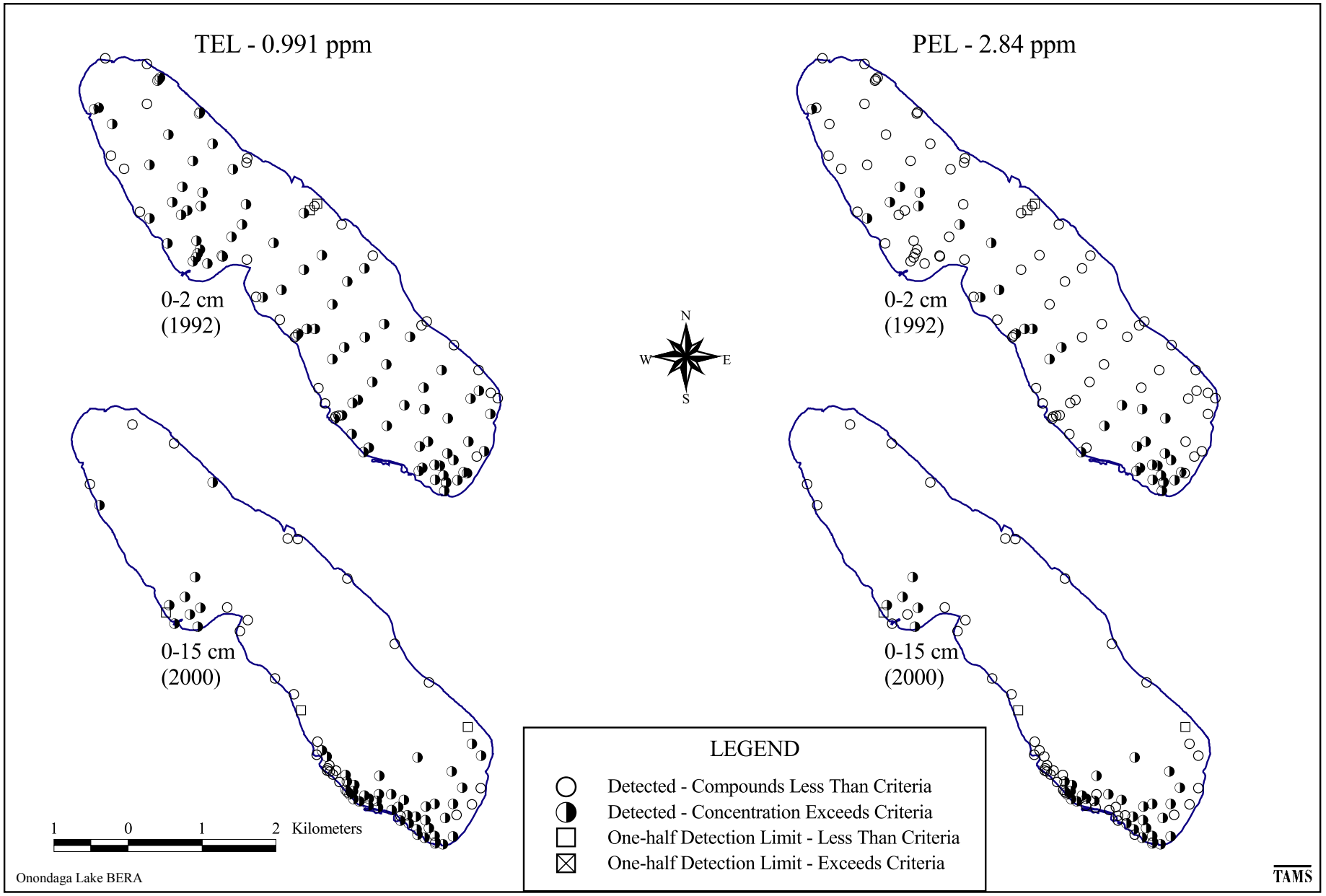

Figure F-53

Comparison of Mercury Sediment Concentrations with the TEL and PEL

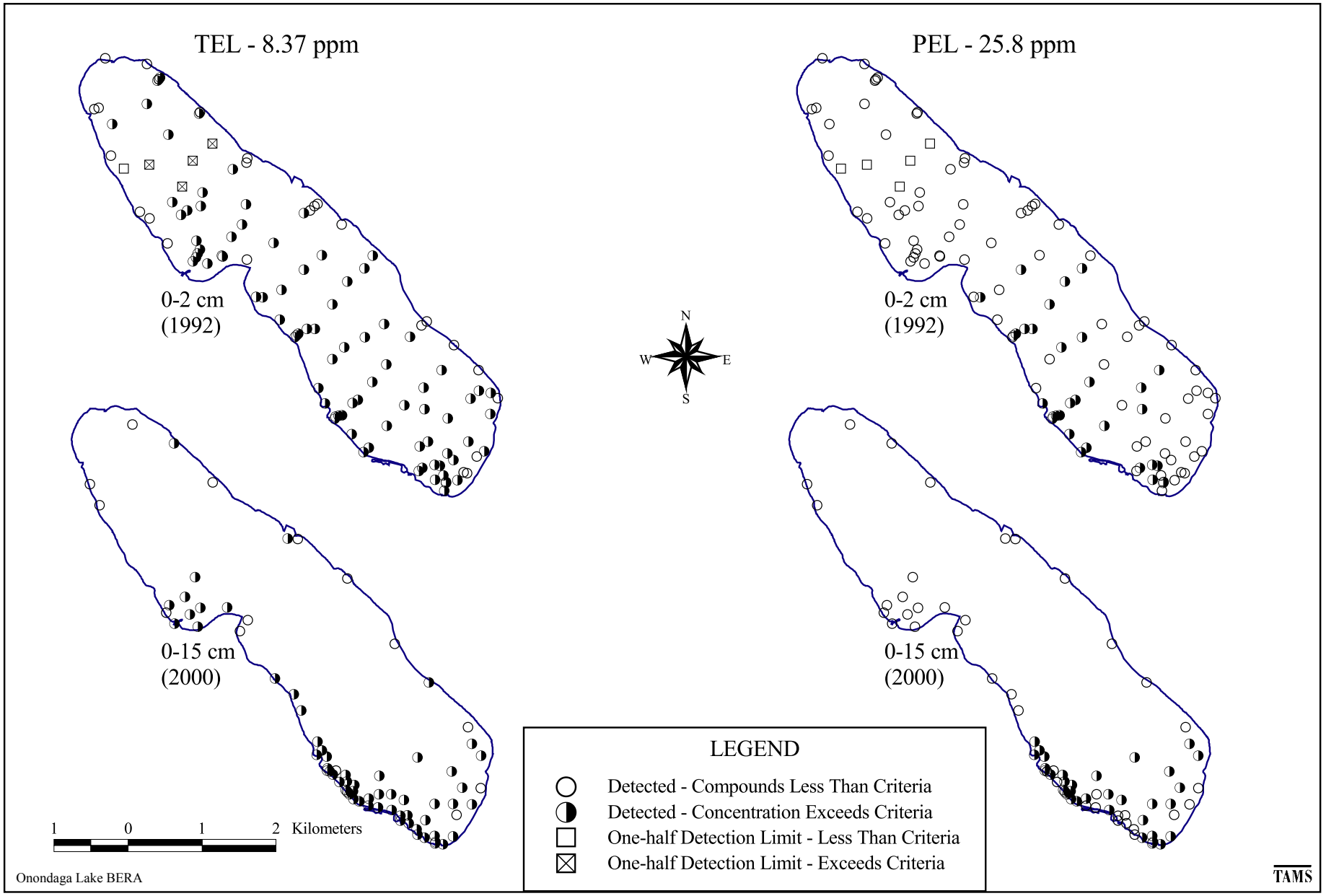

Figure F-54

Comparison of Nickel Sediment Concentrations with the TEL and PEL

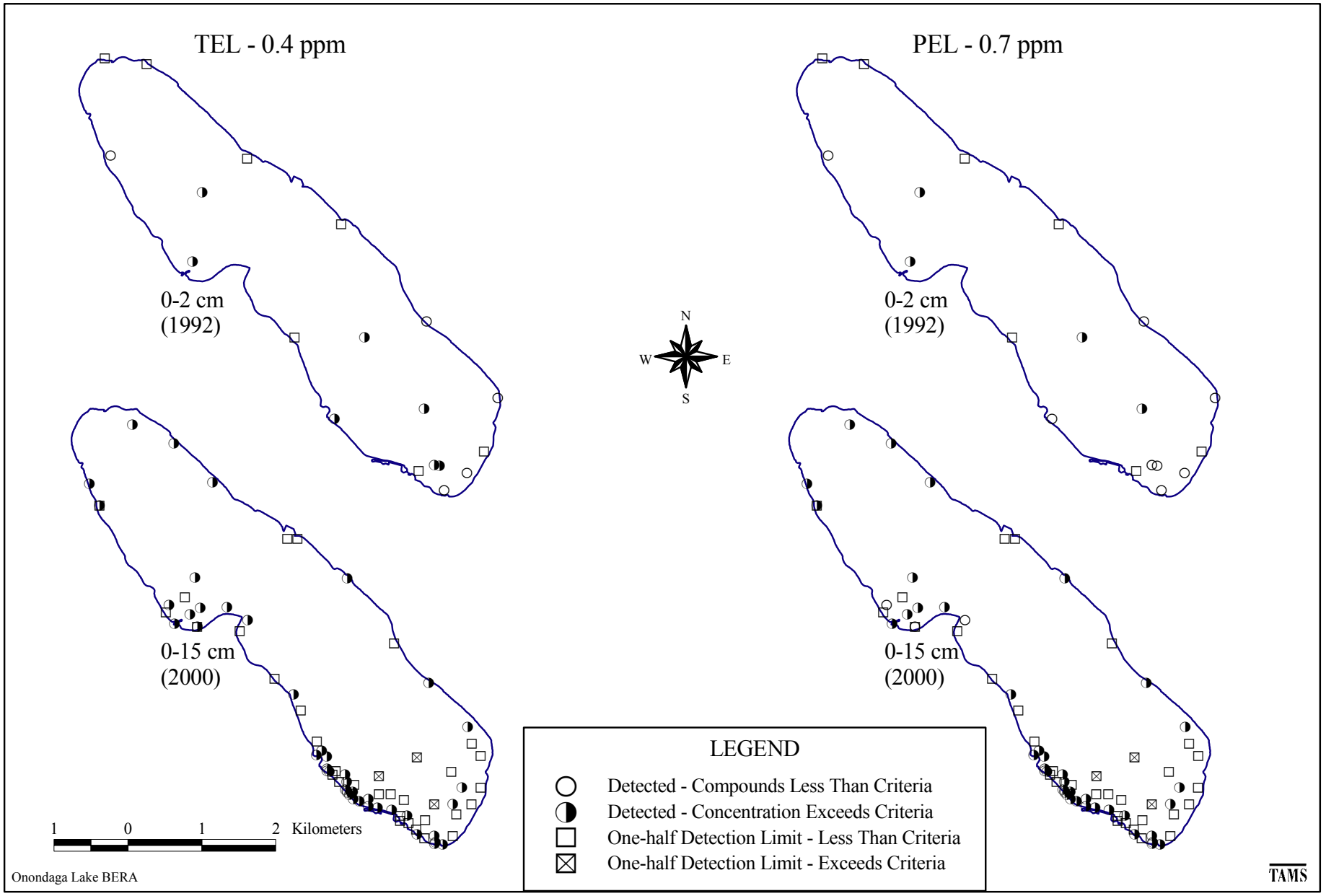

Figure F-55
Comparison of Selenium Sediment Concentrations with the TEL and PEL

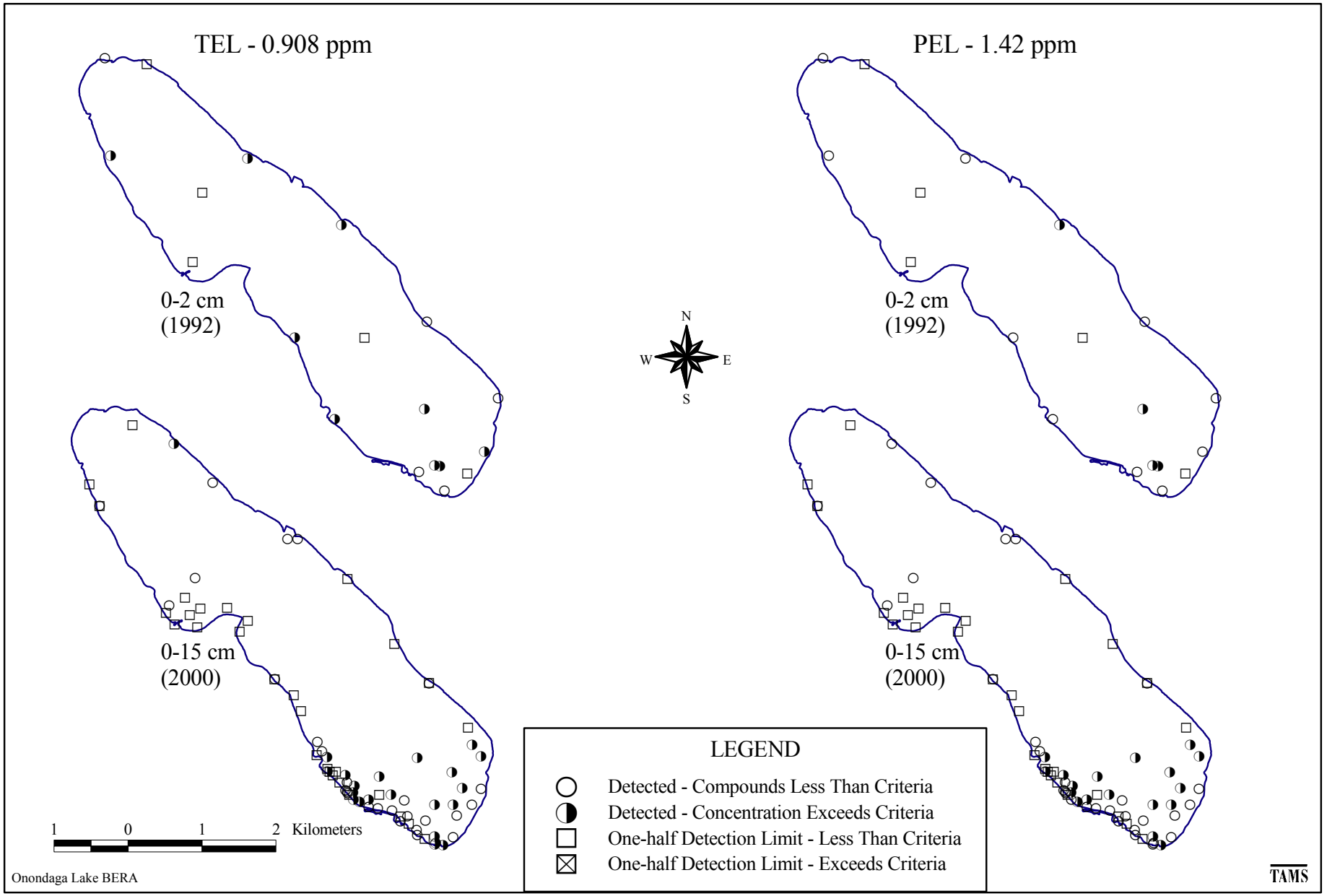

Figure F-56
Comparison of Silver Sediment Concentrations with the TELs and PELs

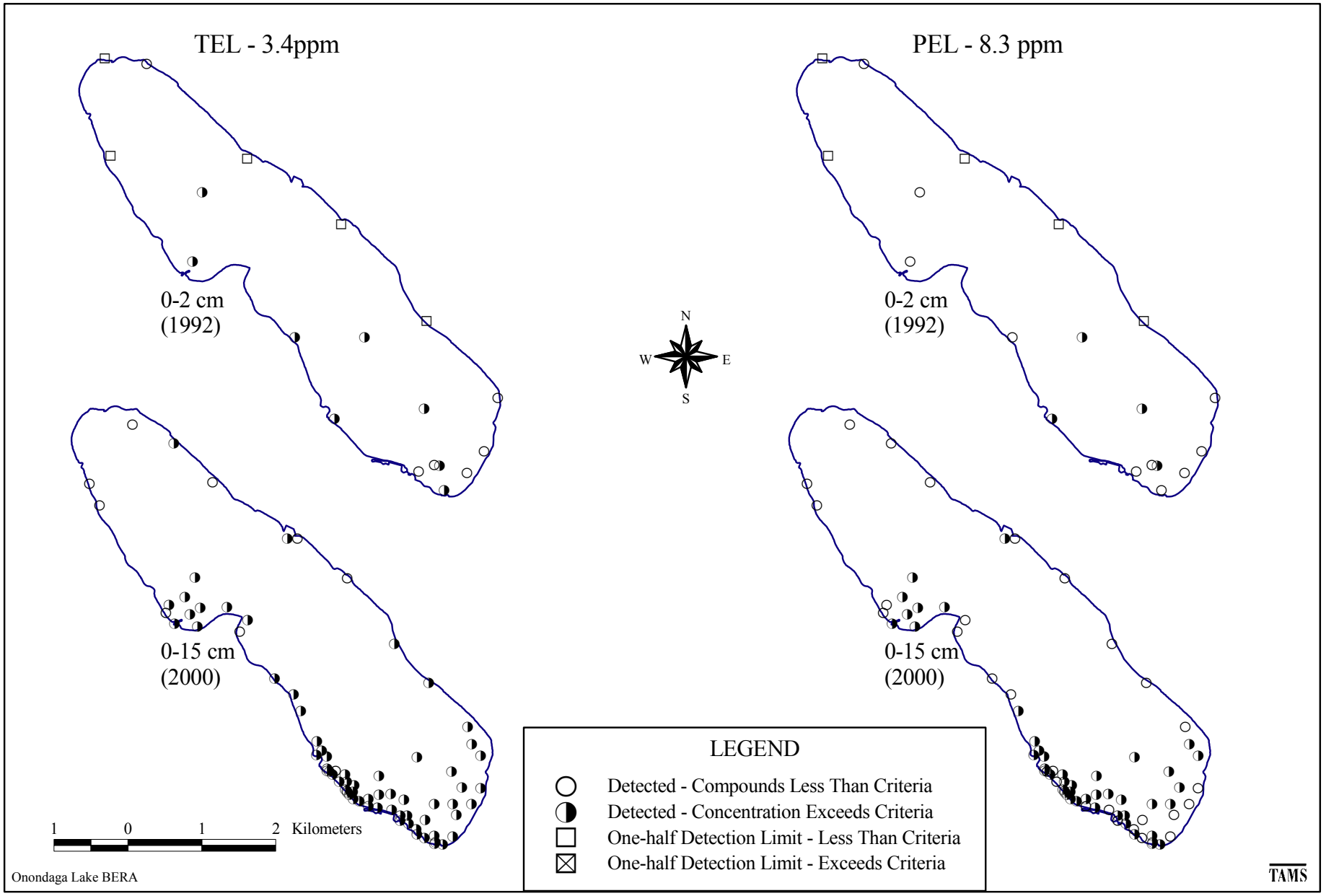

Figure F-57
Comparison of Vanadium Sediment Concentrations with the TELs and PELs

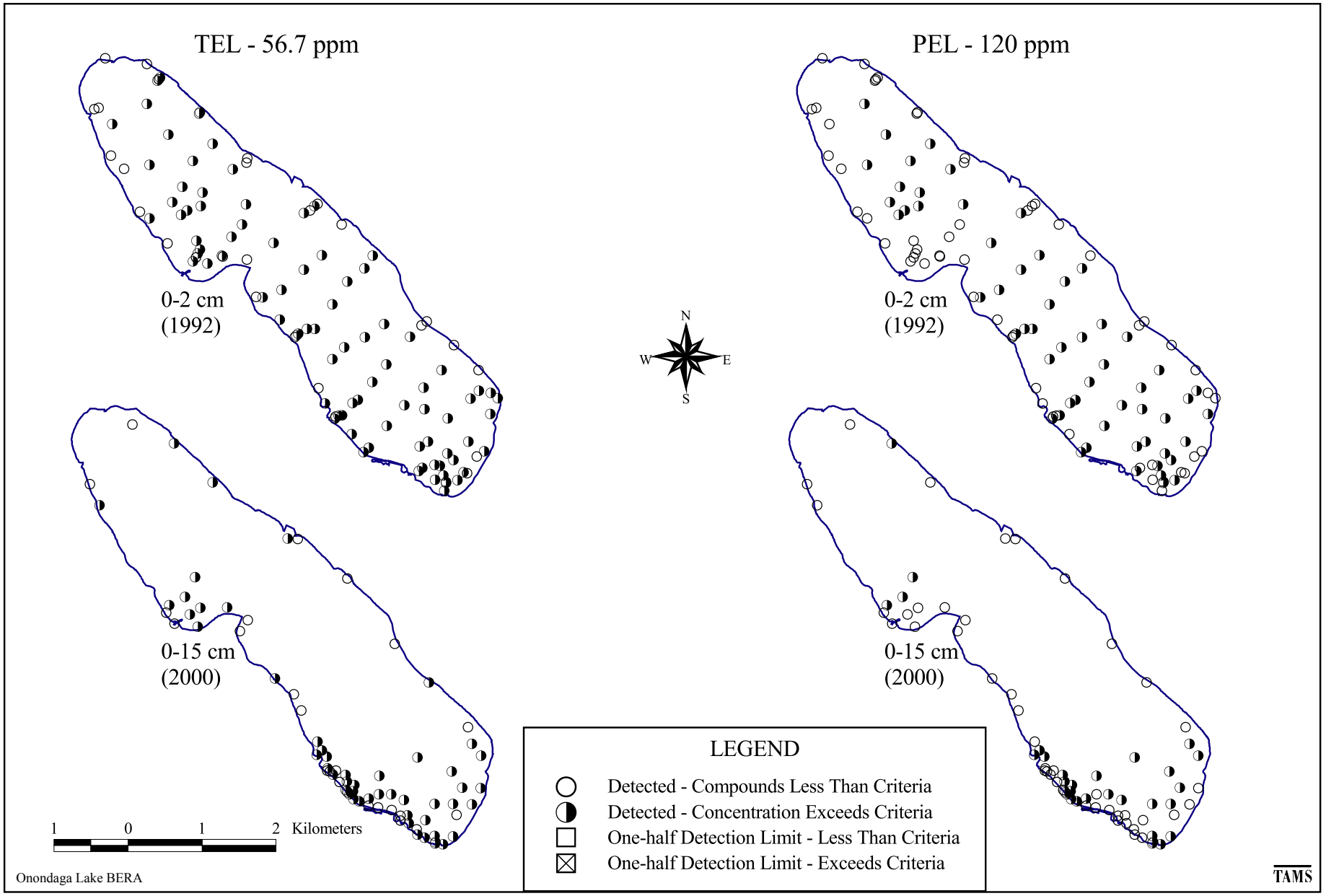

Figure F-58

Comparison of Zinc Sediment Concentrations with the TEL and PEL

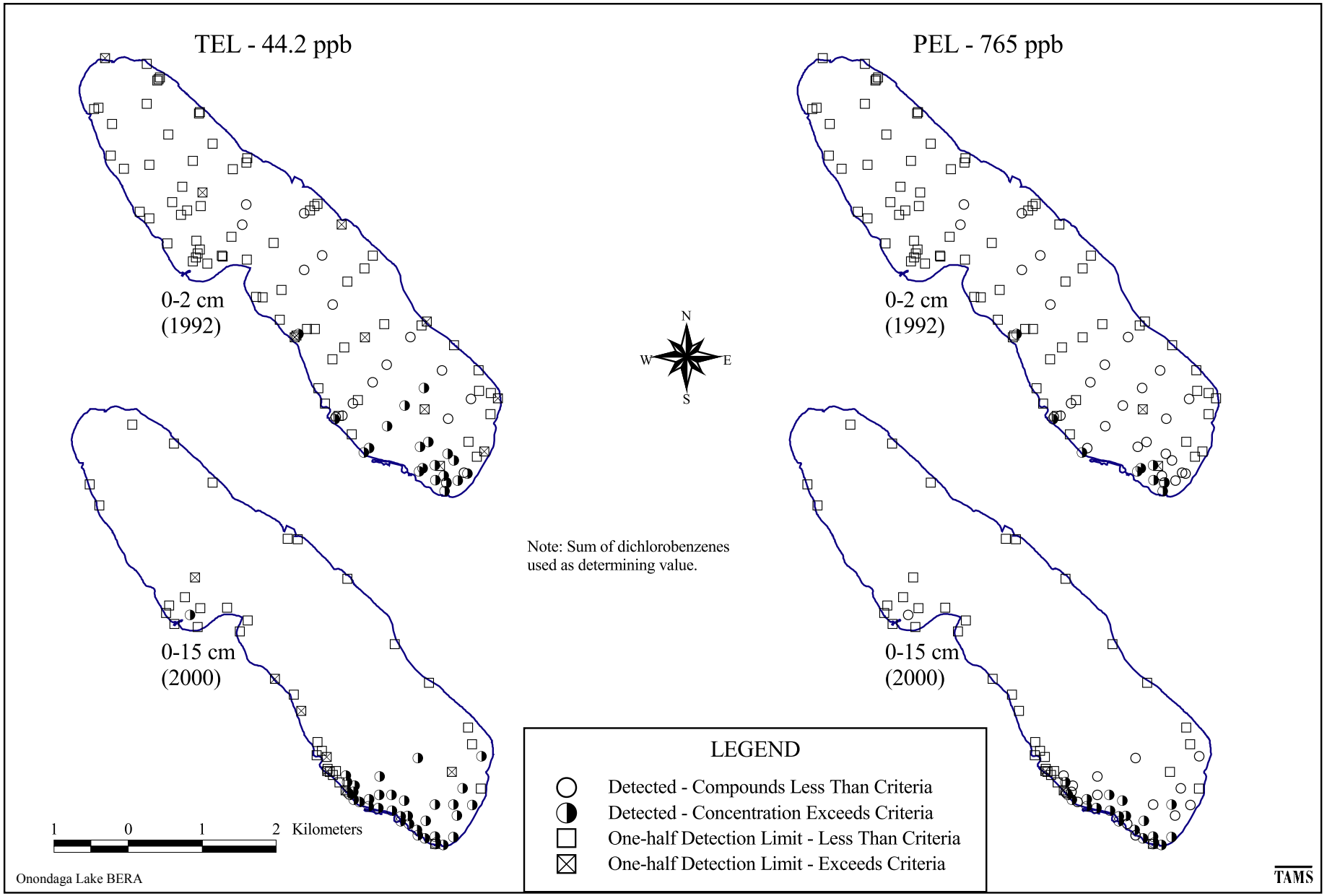

Figure F-59

Comparison of Dichlorobenzenes (Sum) Sediment Concentrations with the TEL and PEL

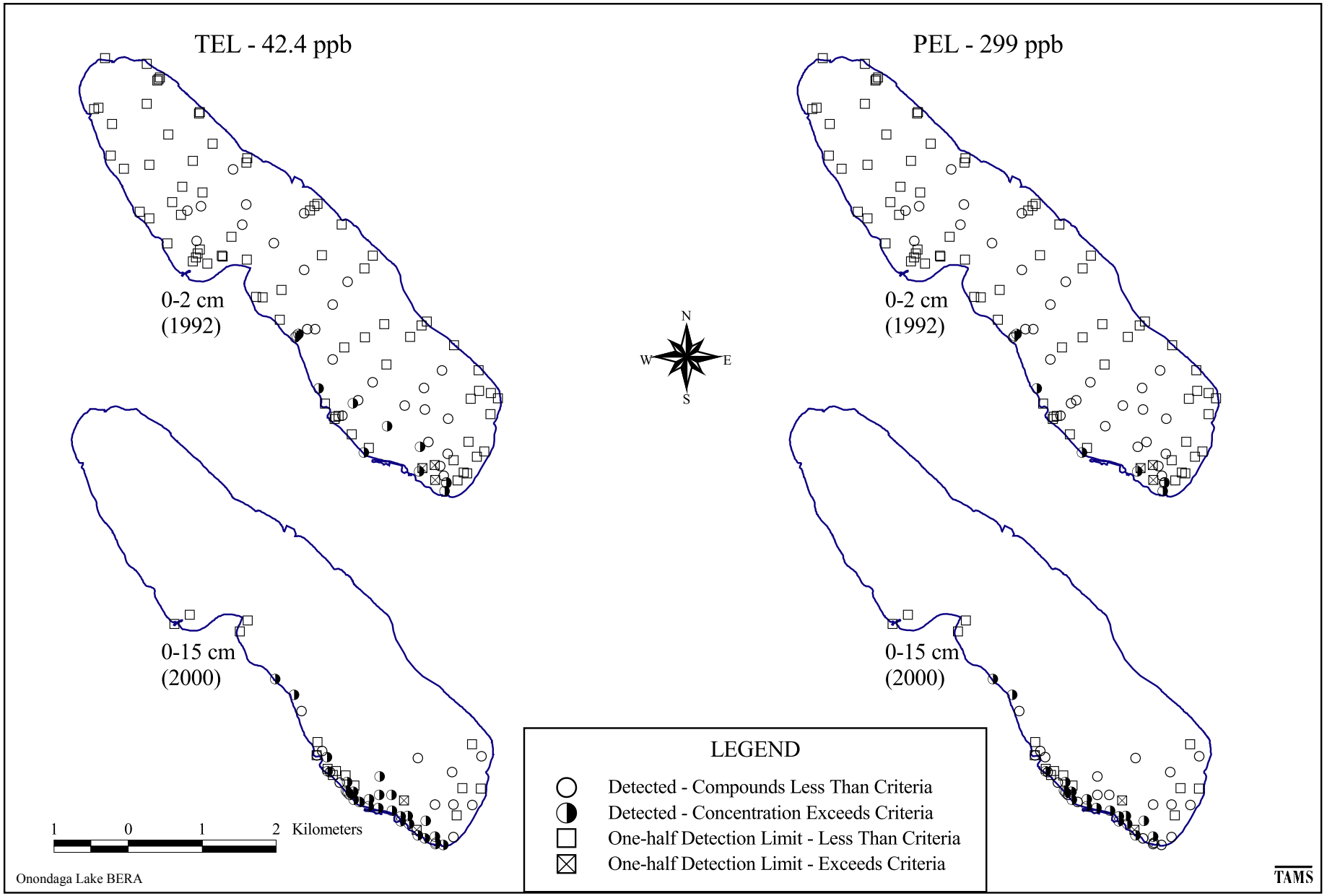

Figure F-60

Comparison of Benzene Sediment Concentrations with the TEL and PEL

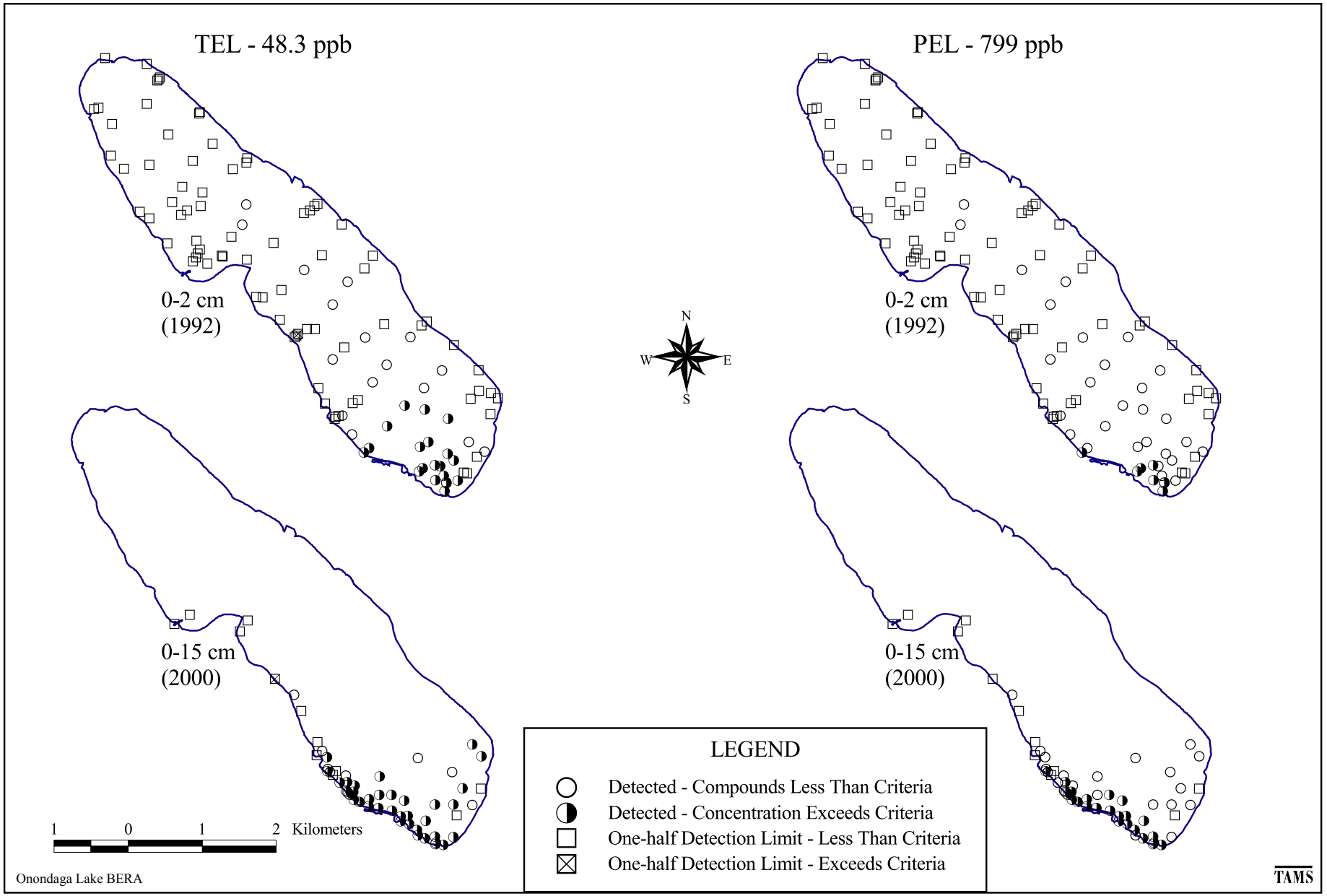

Figure F-61

Comparison of Chlorobenzene Sediment Concentrations with the TEL and PEL

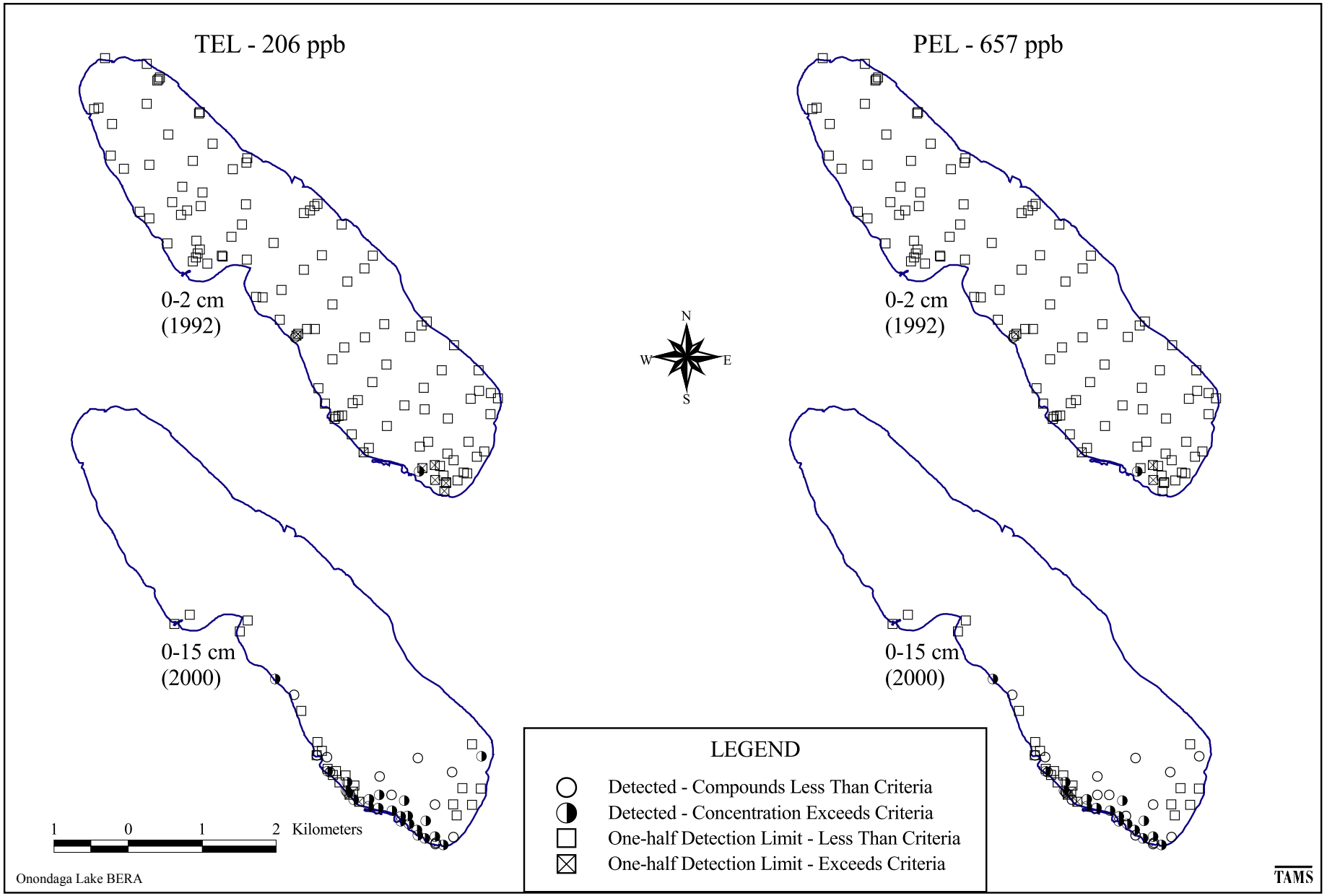

Figure F-62

Comparison of Ethylbenzene Sediment Concentrations with the TEL and PEL

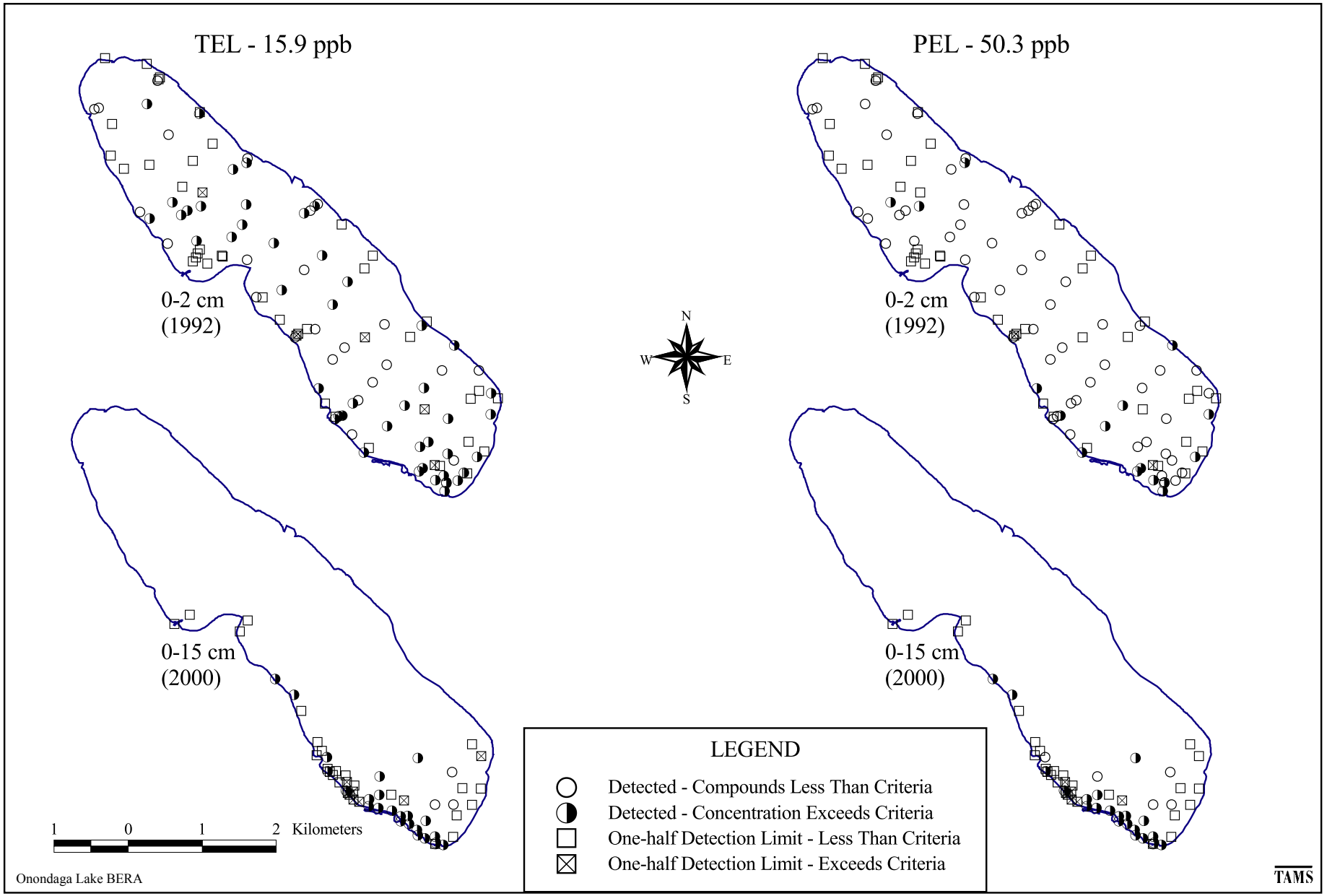

Figure F-63

Comparison of Toluene Sediment Concentrations with the TEL and PEL

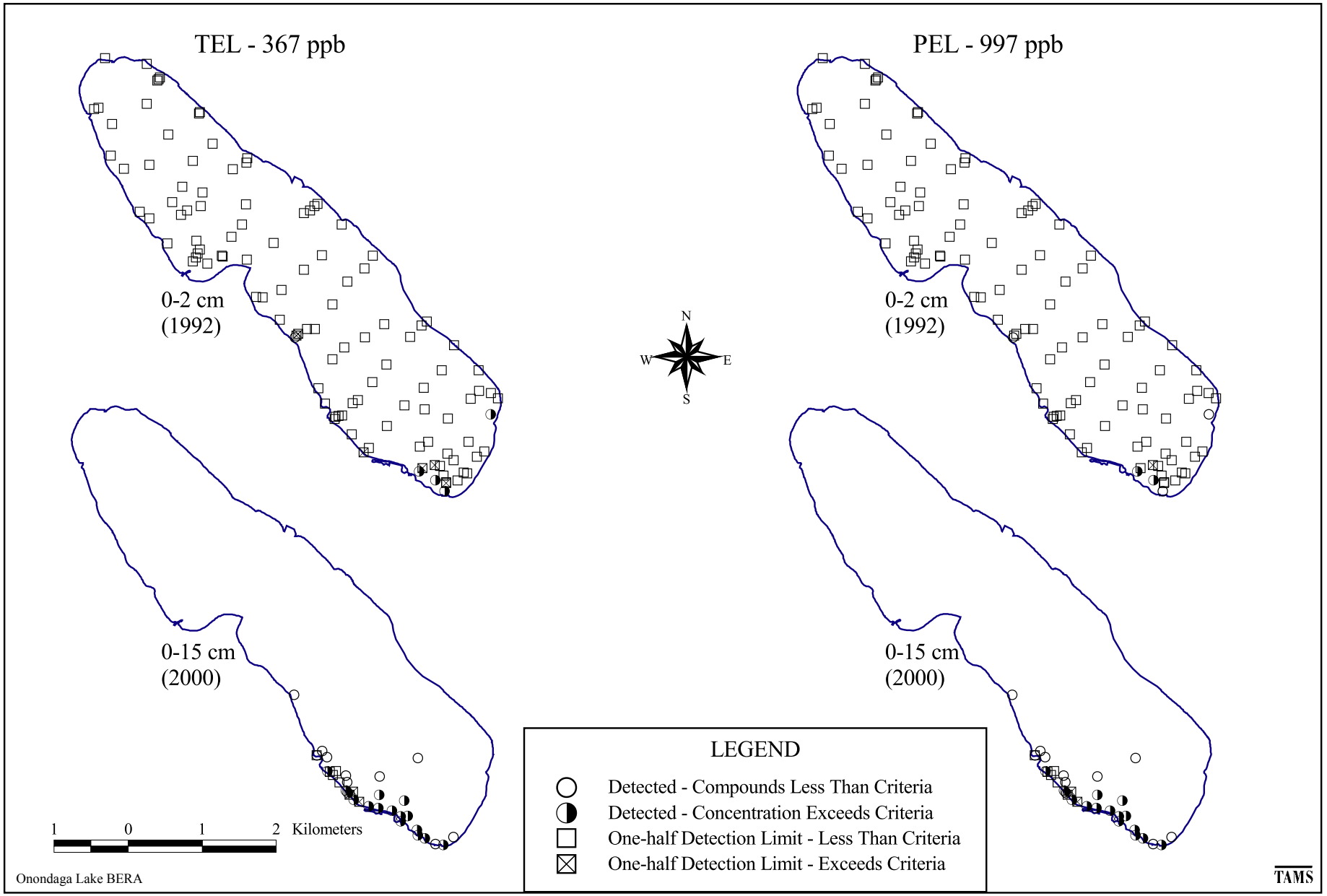

Figure F-64

Comparison of Xylene (Total) Sediment Concentrations with the TEL and PEL

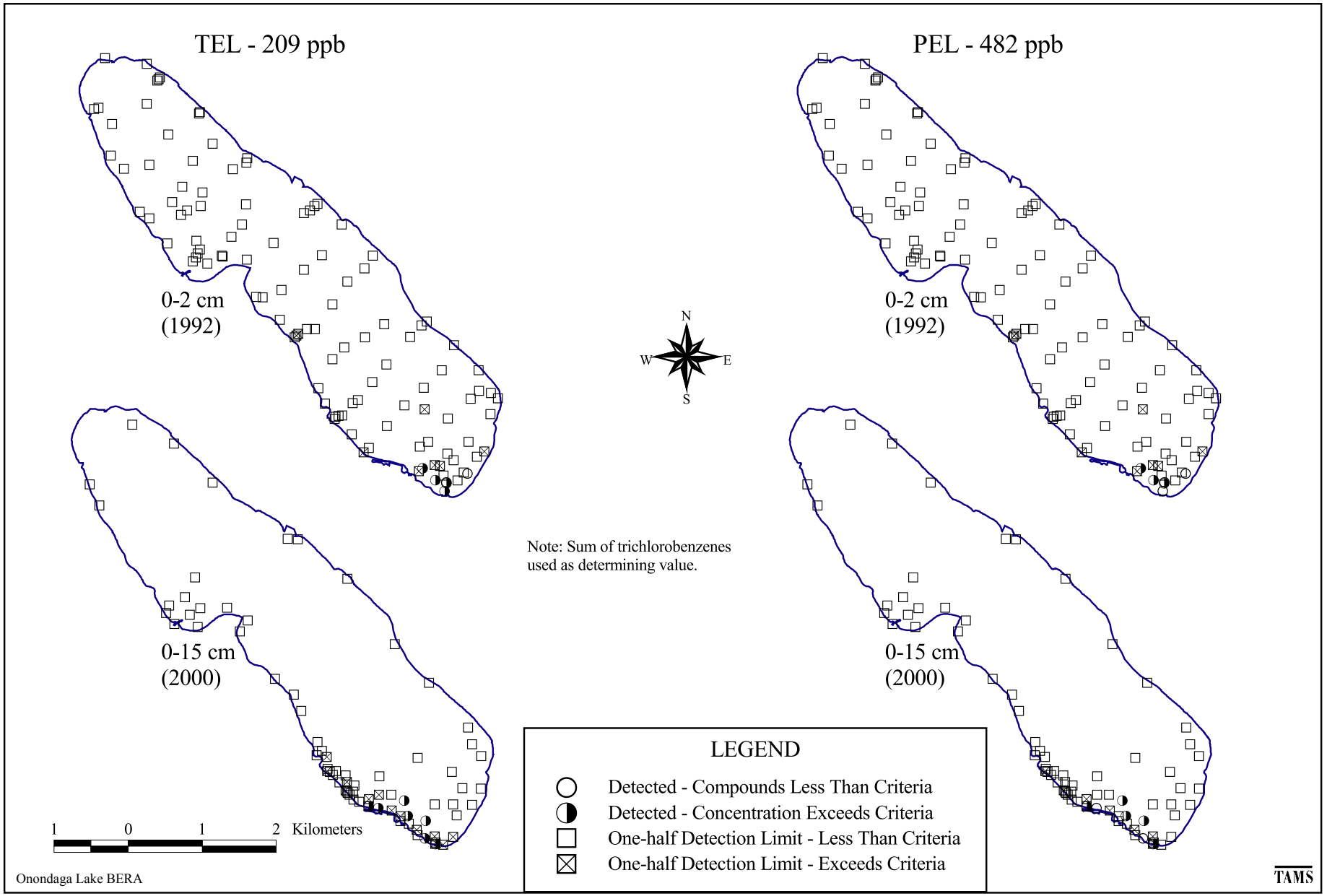

Figure F-65

Comparison of Trichlorobenzenes (Sum) Sediment Concentrations with the TEL and PEL

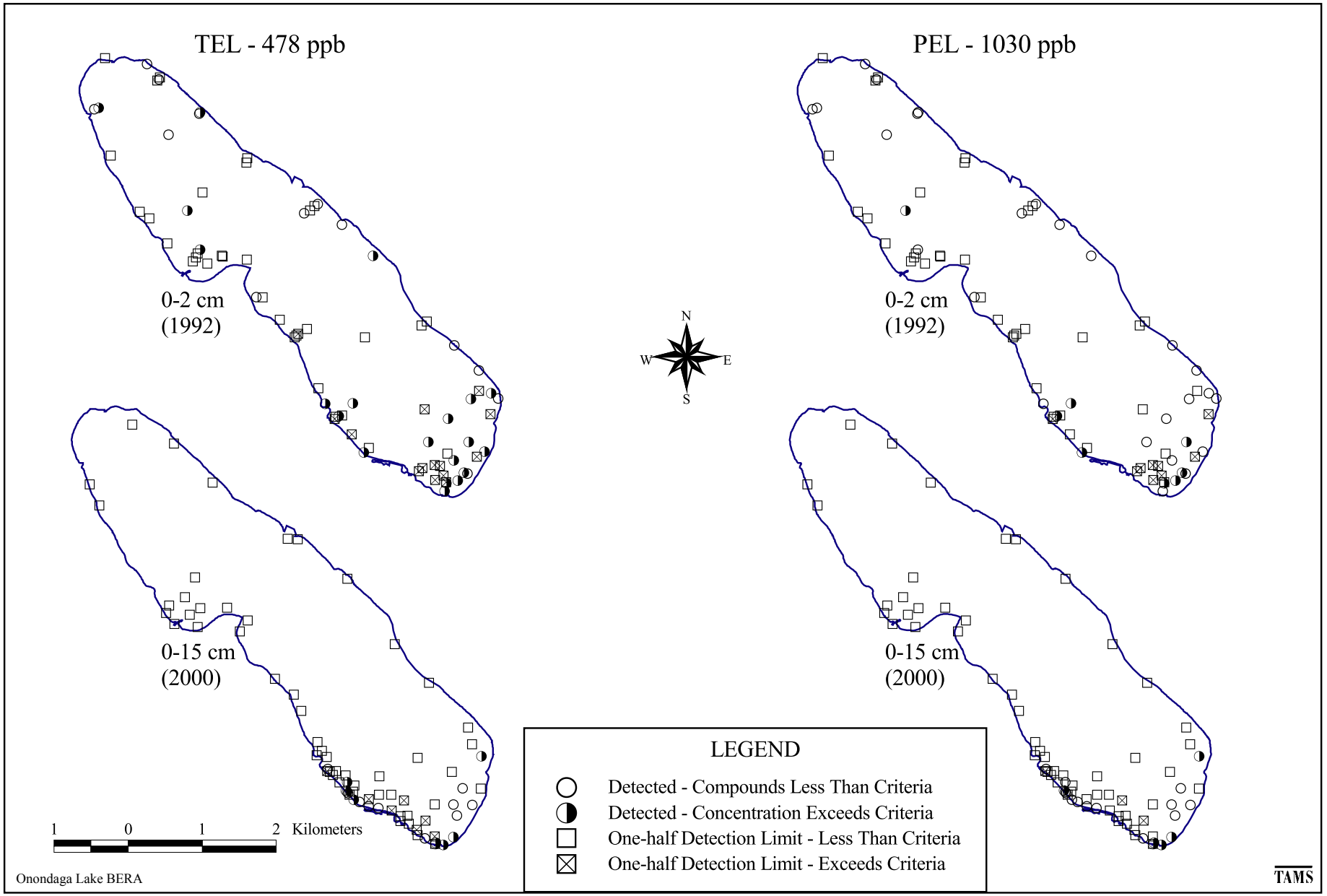

Figure F-66

Comparison of Acenaphthene Sediment Concentrations with the TEL and PEL

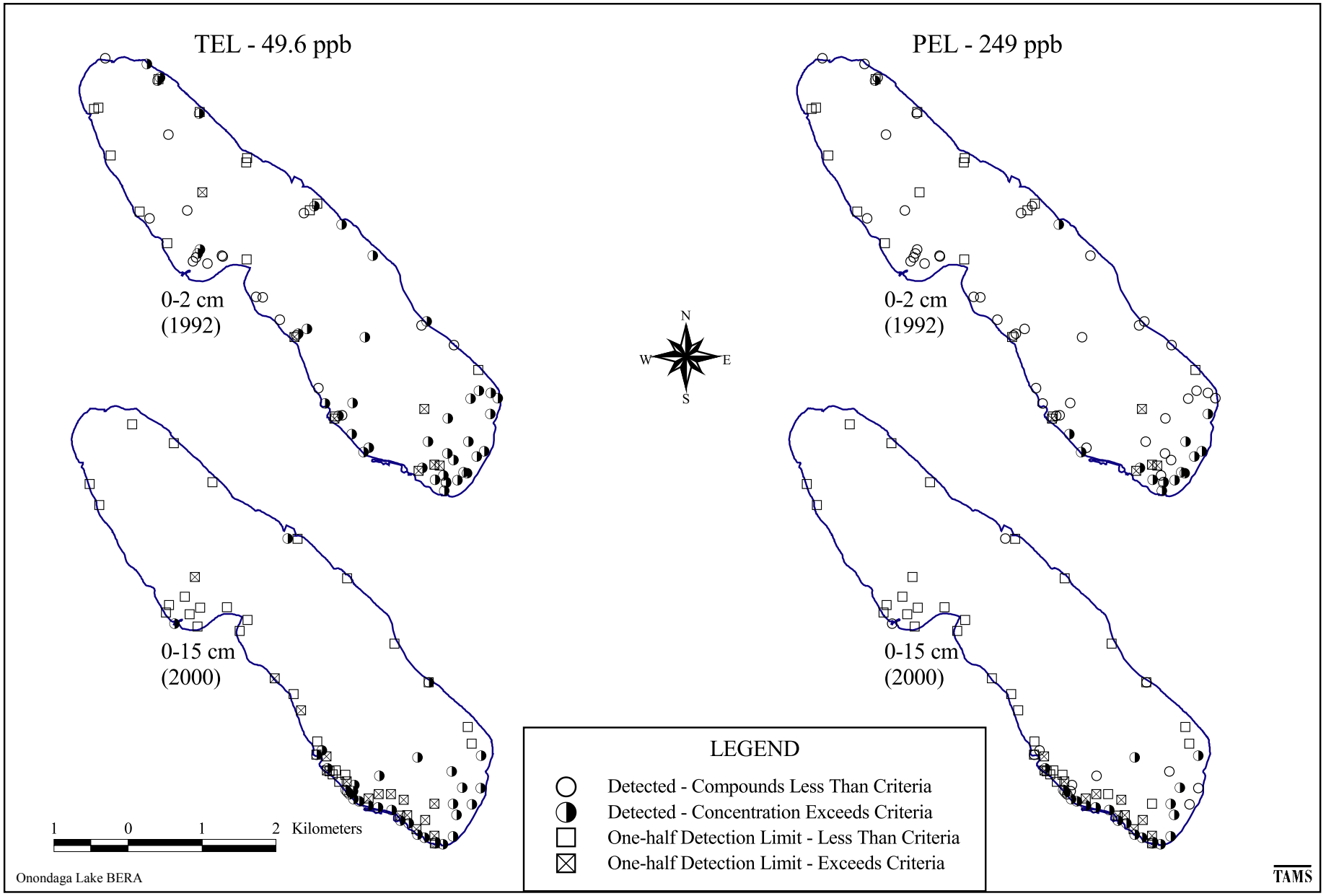

Figure F-67

Comparison of Anthracene Sediment Concentrations with the TEL and PEL

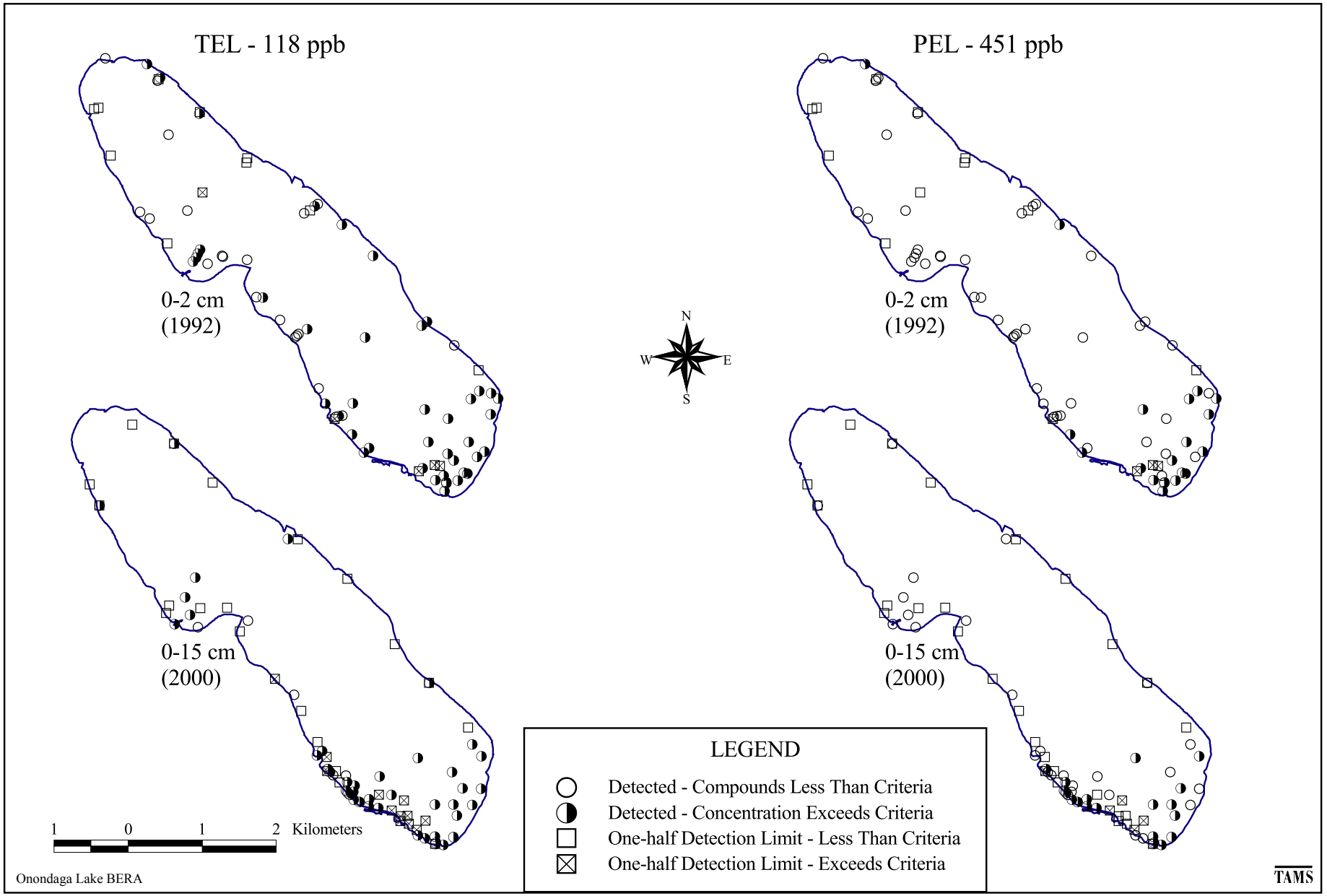

Figure F-68

Comparison of Benz(a)anthracene Sediment Concentrations with the TEL and PEL

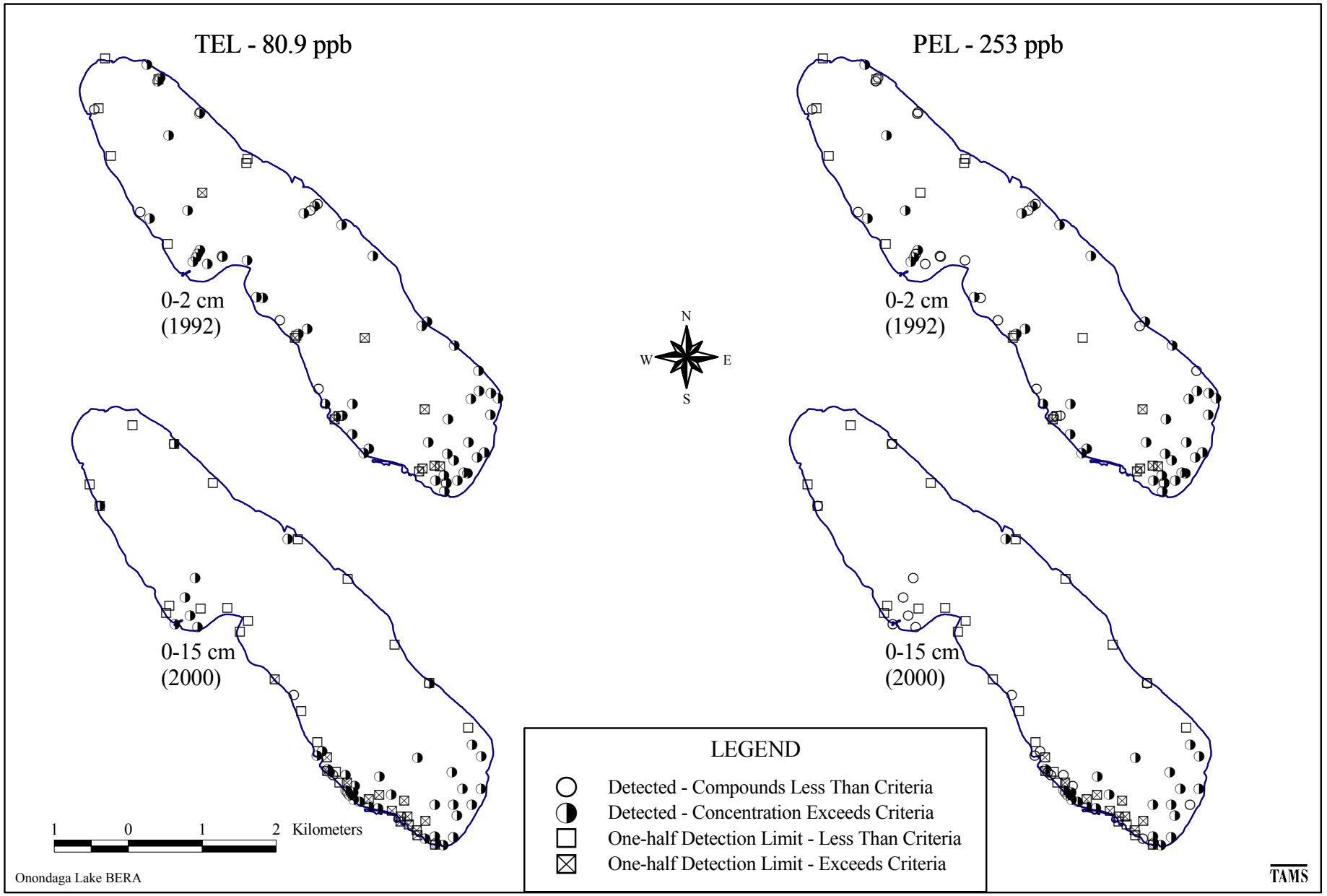

Figure F-69
Comparison of Benzo(b)fluoranthene Sediment Concentrations with the TEL and PEL

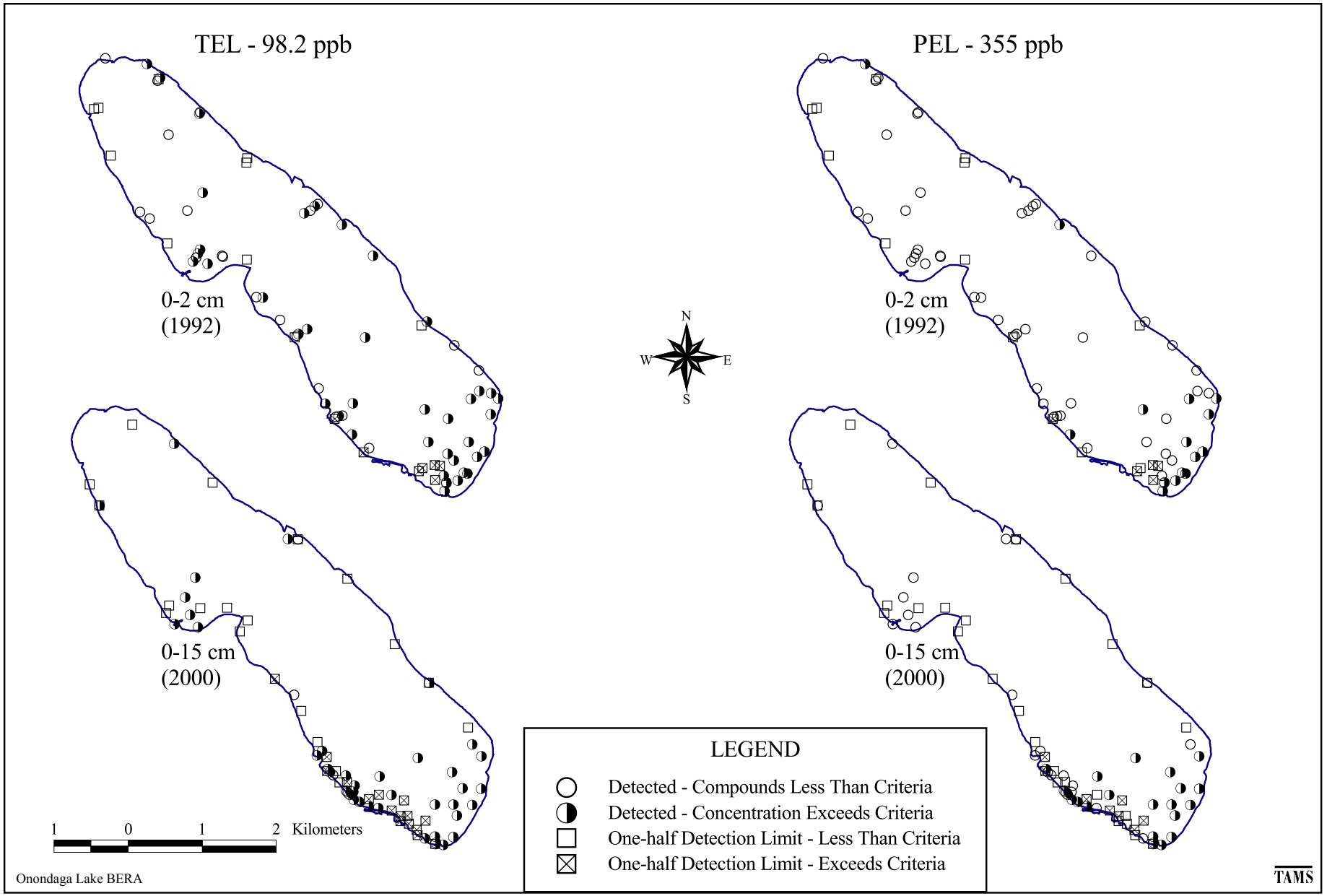

Figure F-70

Comparison of Benzo(a)pyrene Sediment Concentrations with the TEL and PEL

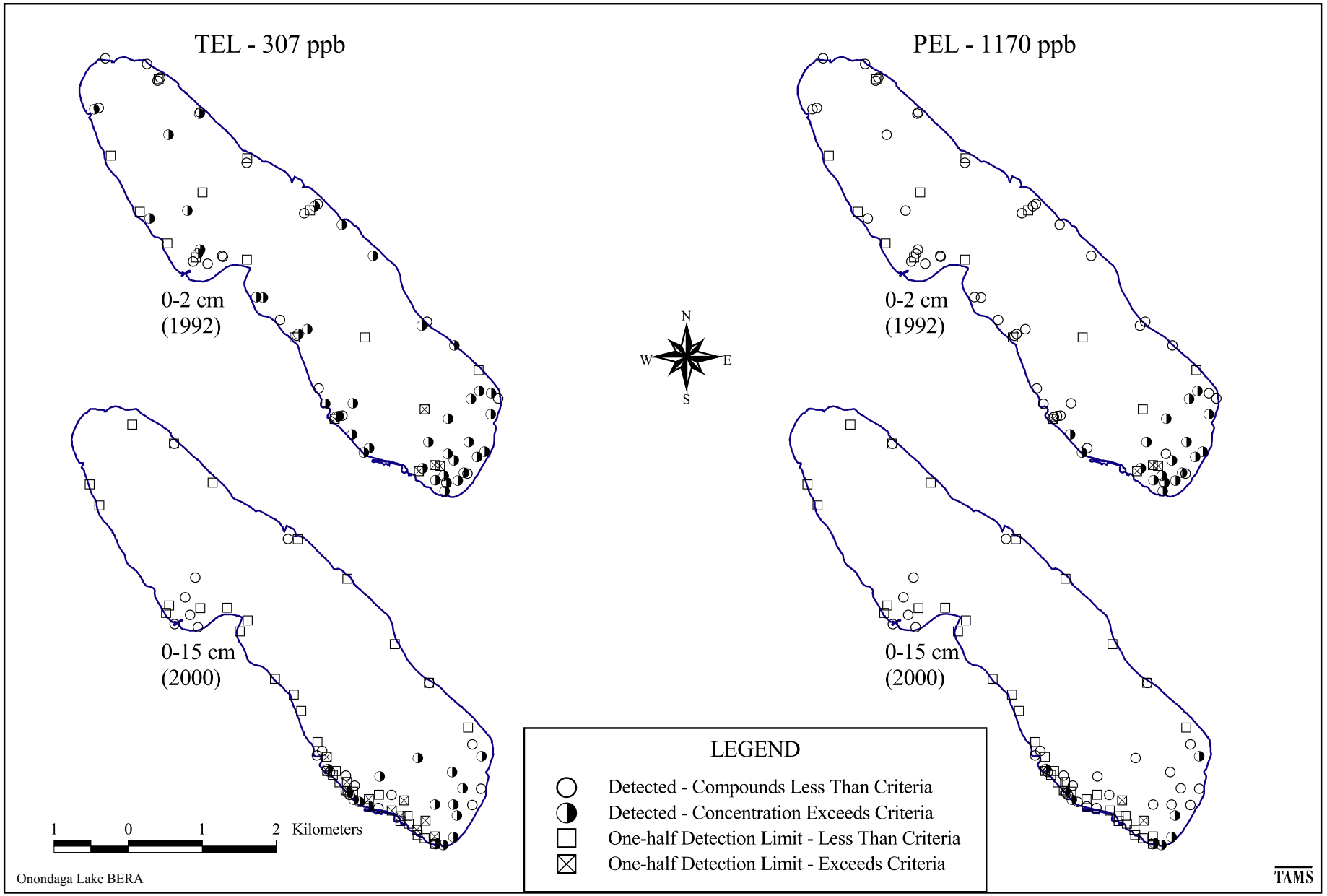

Figure F-71

Comparison of Benzo(g,h,i)perylene Sediment Concentrations with the TEL and PEL

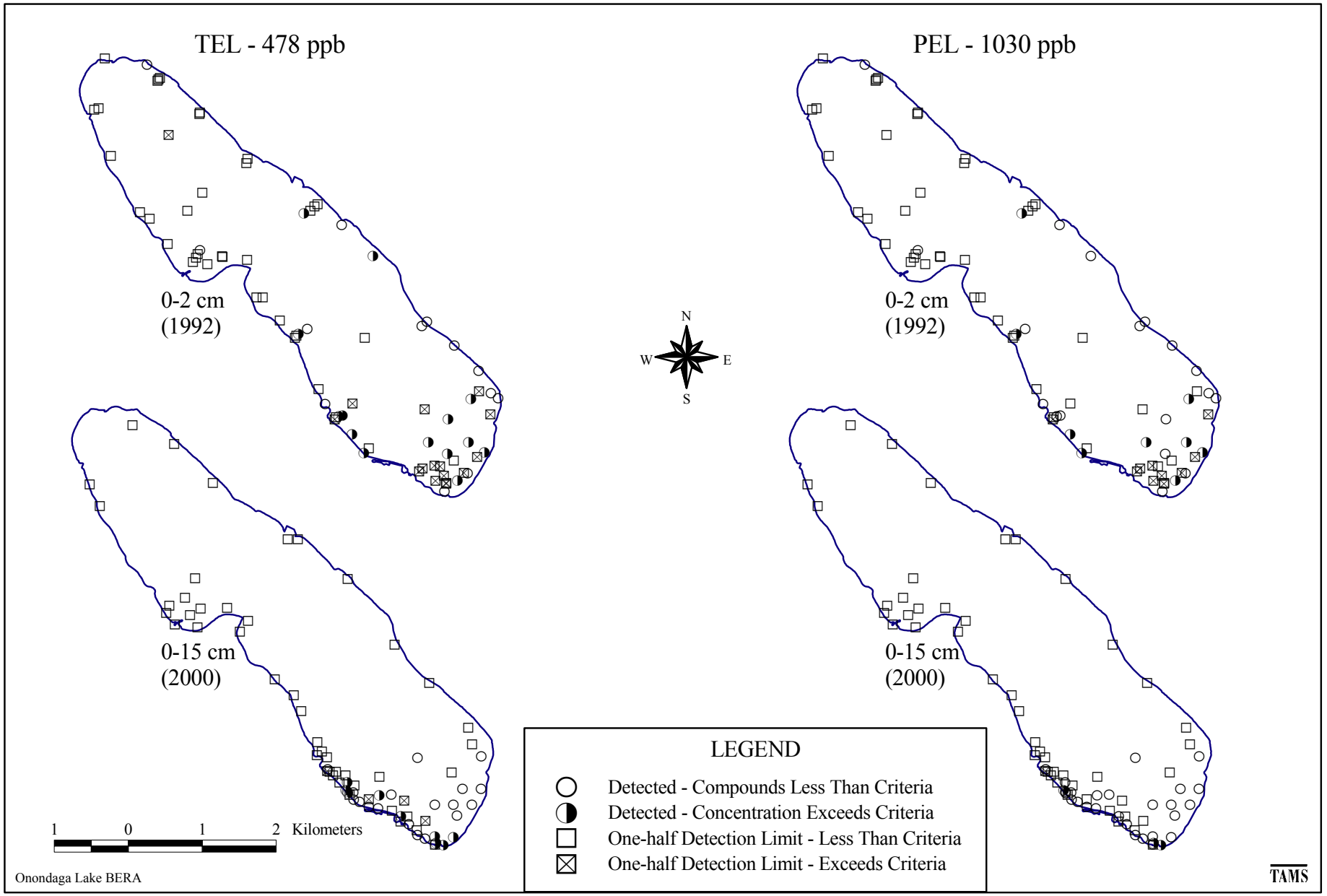

Figure F-72
Comparison of Acenaphthylene Sediment Concentrations with the TEL and PEL

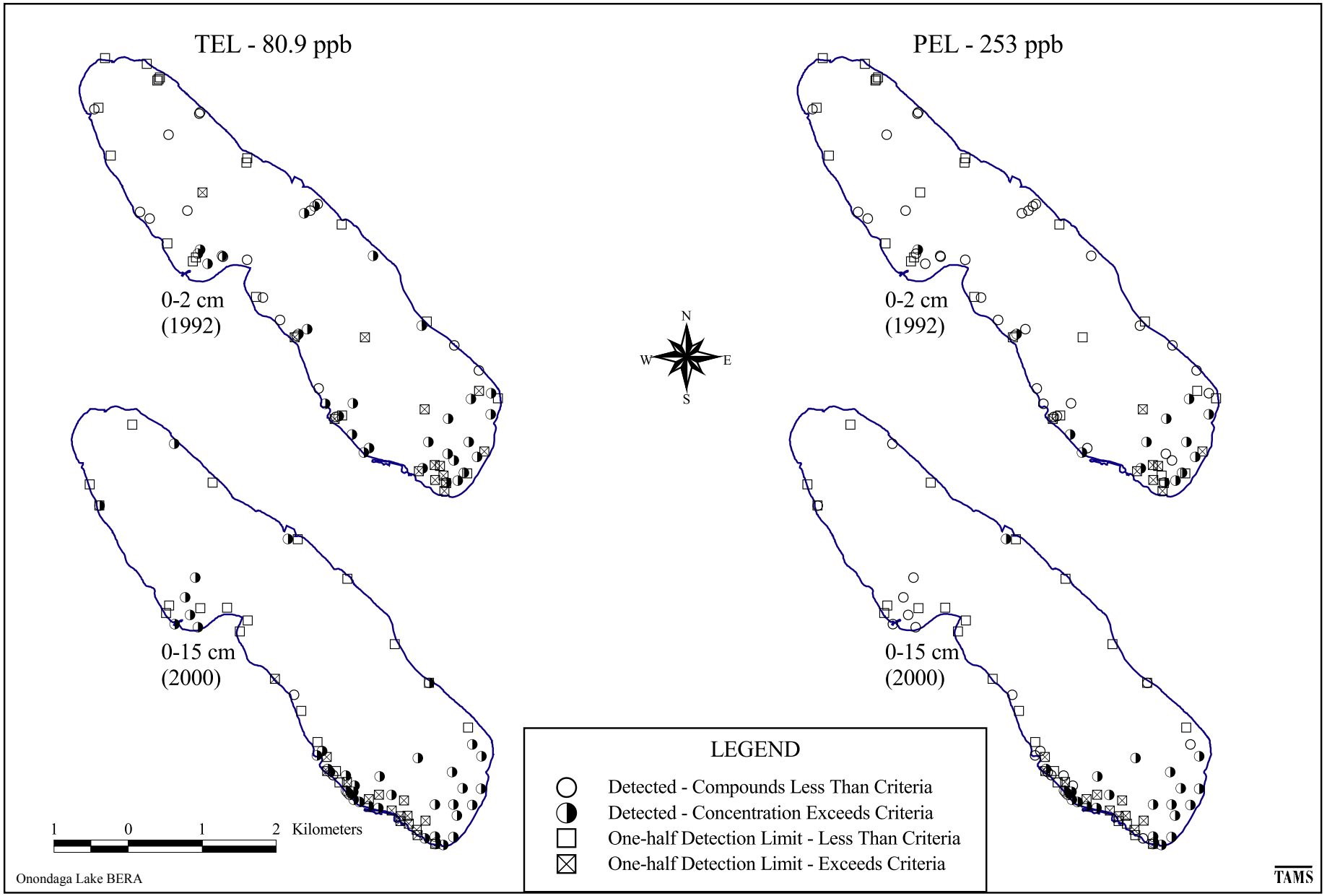

Figure F-73

Comparison of Benzo(k)fluoranthene Sediment Concentrations with the TEL and PEL

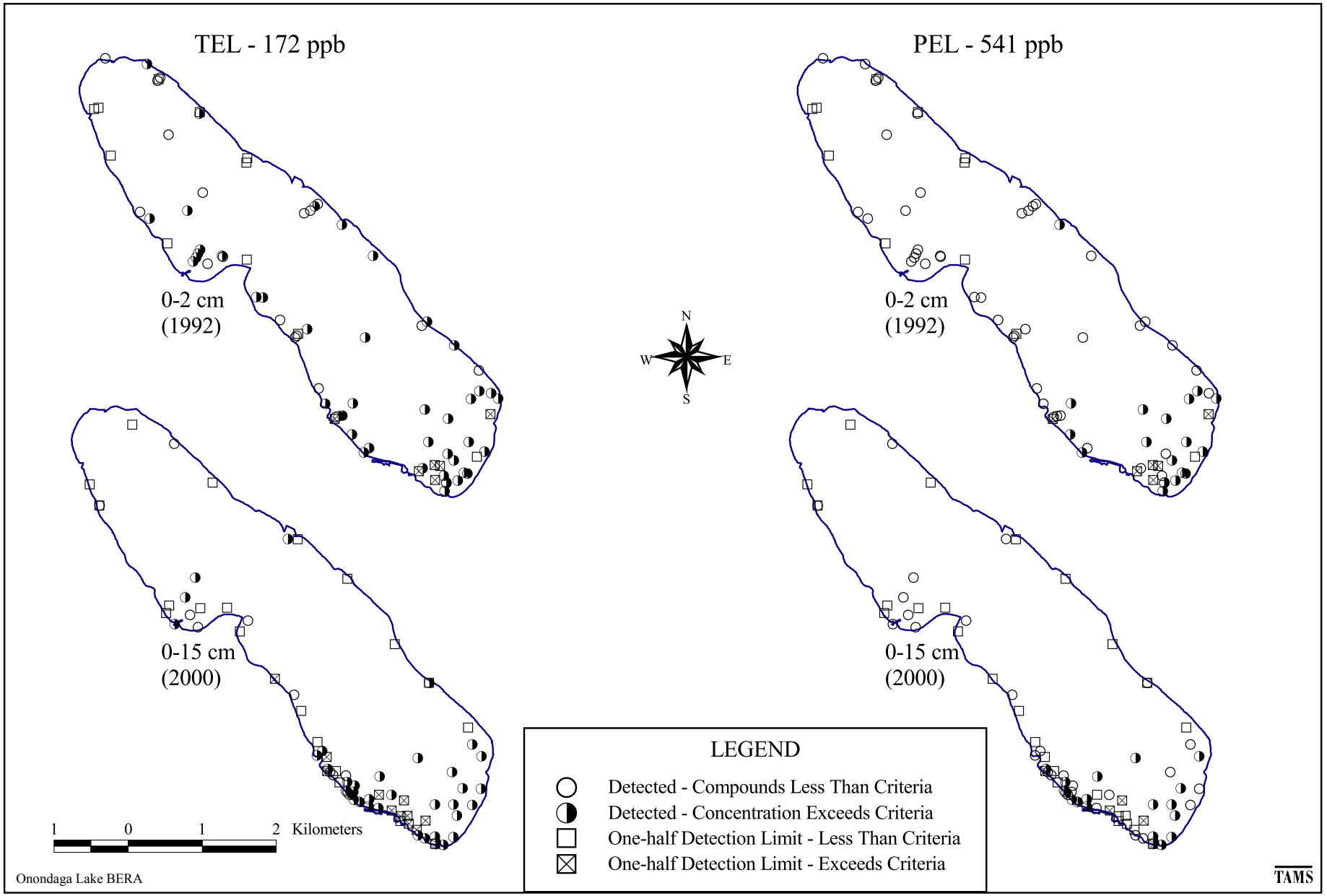

Figure F-74

Comparison of Chrysene Sediment Concentrations with the TEL and PEL

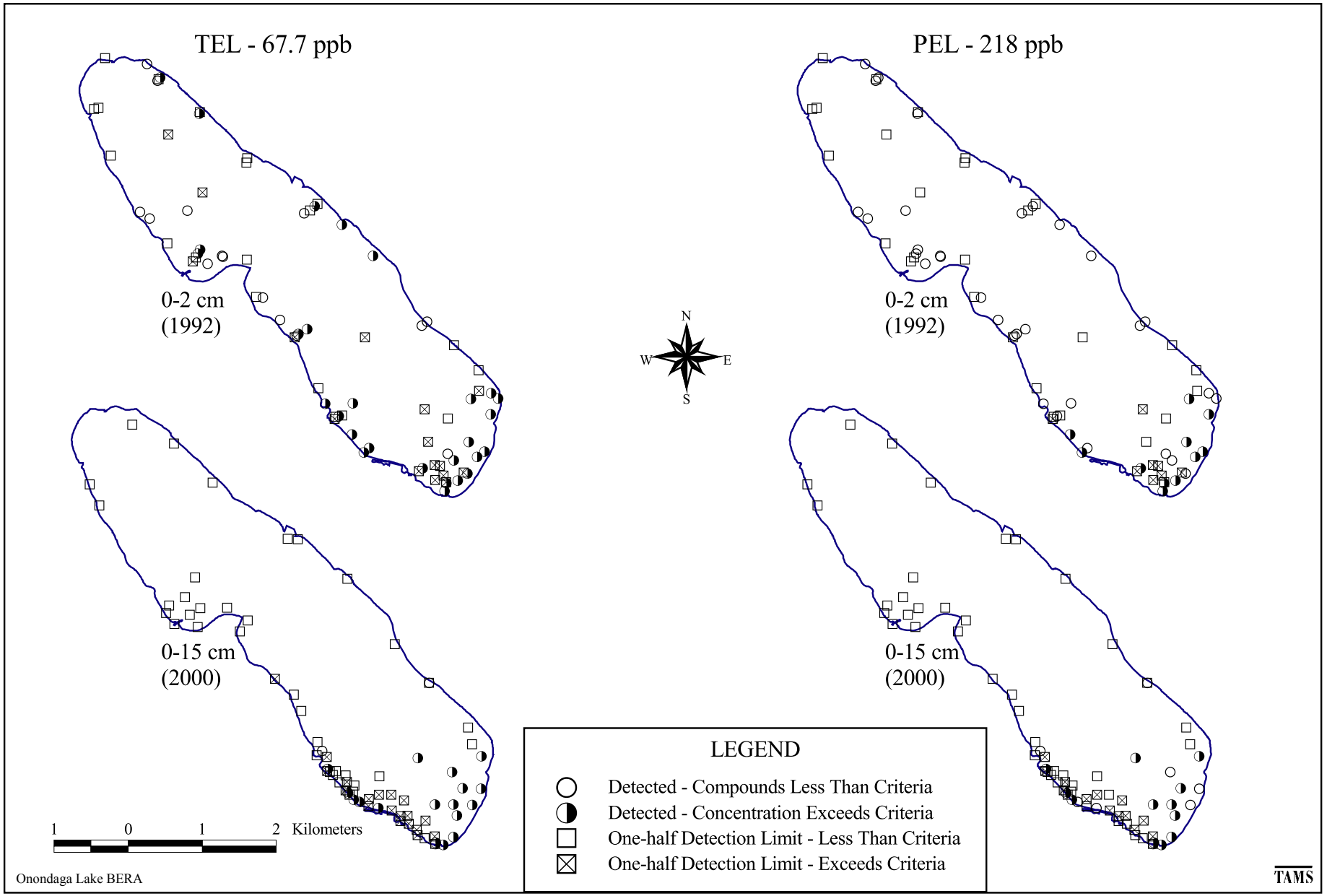

Figure F-75

Comparison of Dibenz(a,h)anthracene Sediment Concentrations with the TEL and PEL

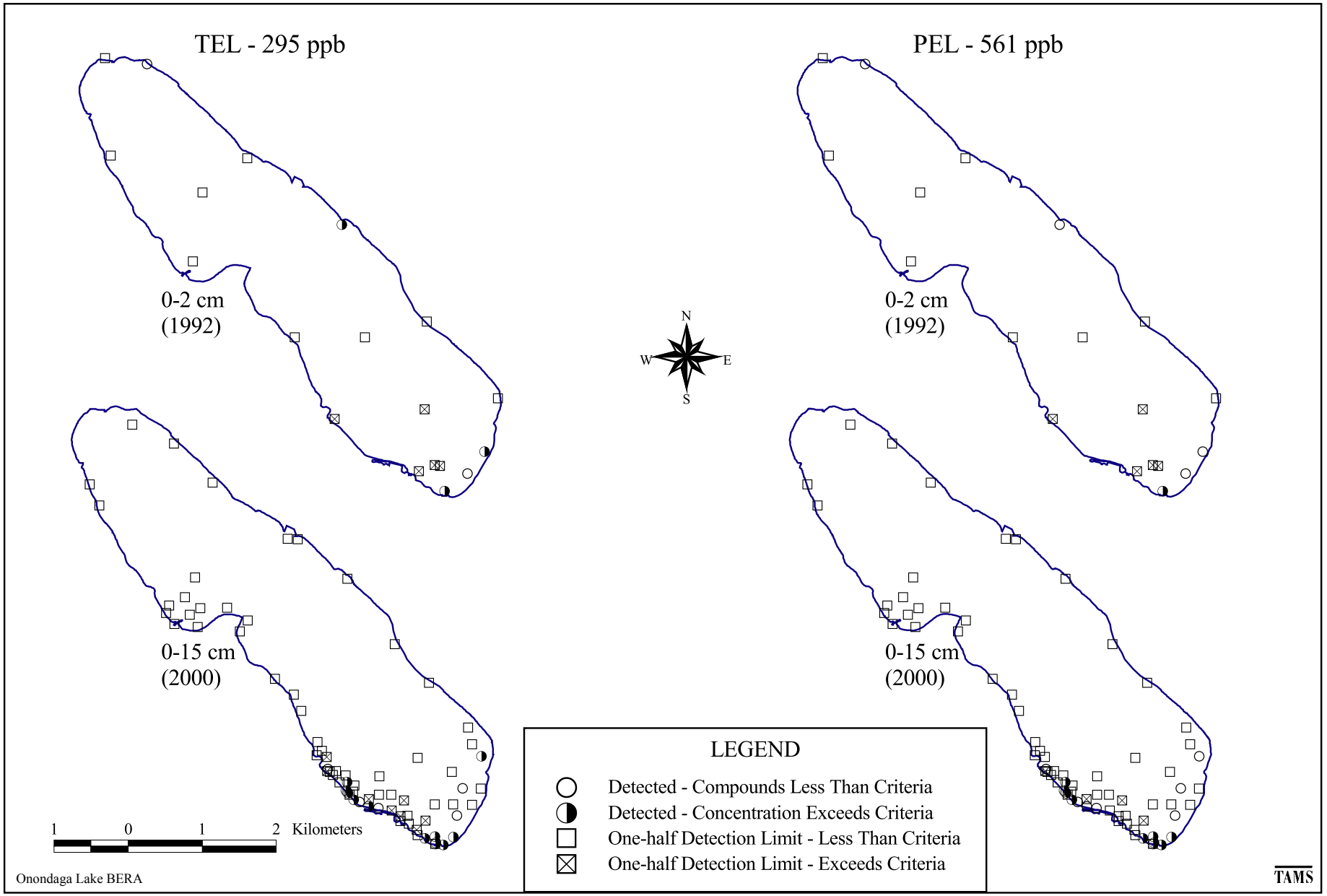

Figure F-76

Comparison of Dibenzofuran Sediment Concentrations with the TEL and PEL

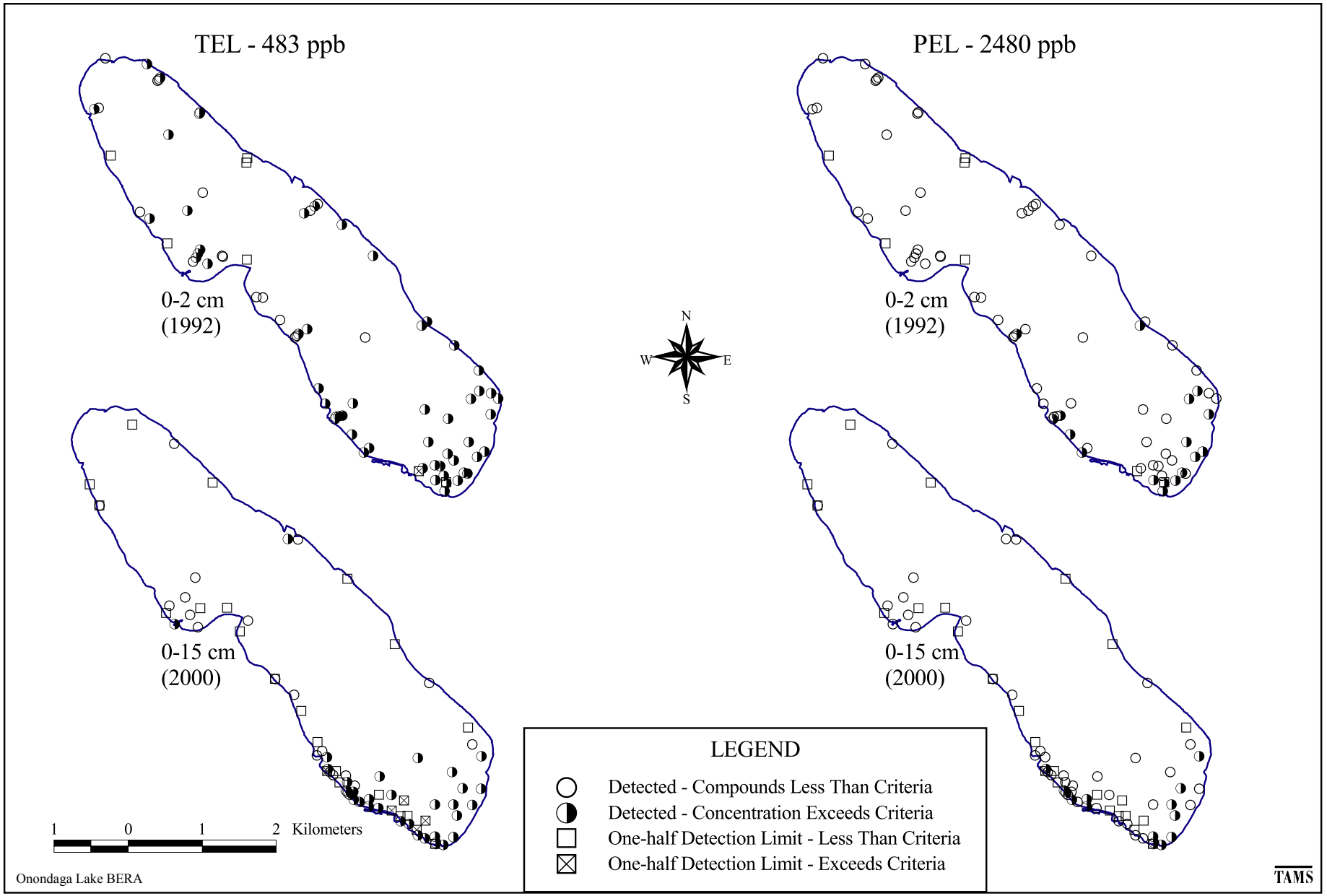

Figure F-77

Comparison of Fluoranthene Sediment Concentrations with the TEL and PEL

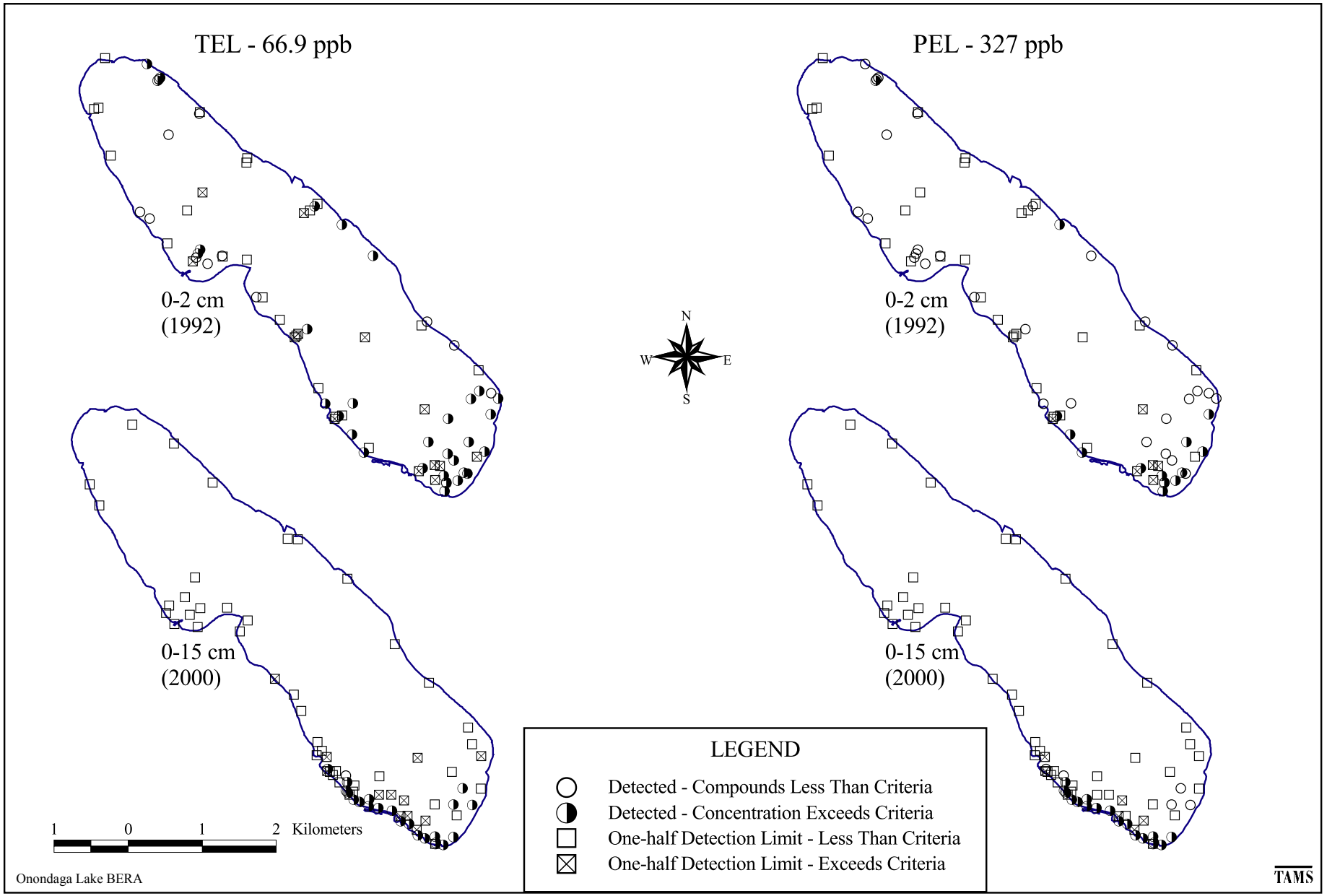

Figure F-78

Comparison of Fluorene Sediment Concentrations with the TEL and PEL

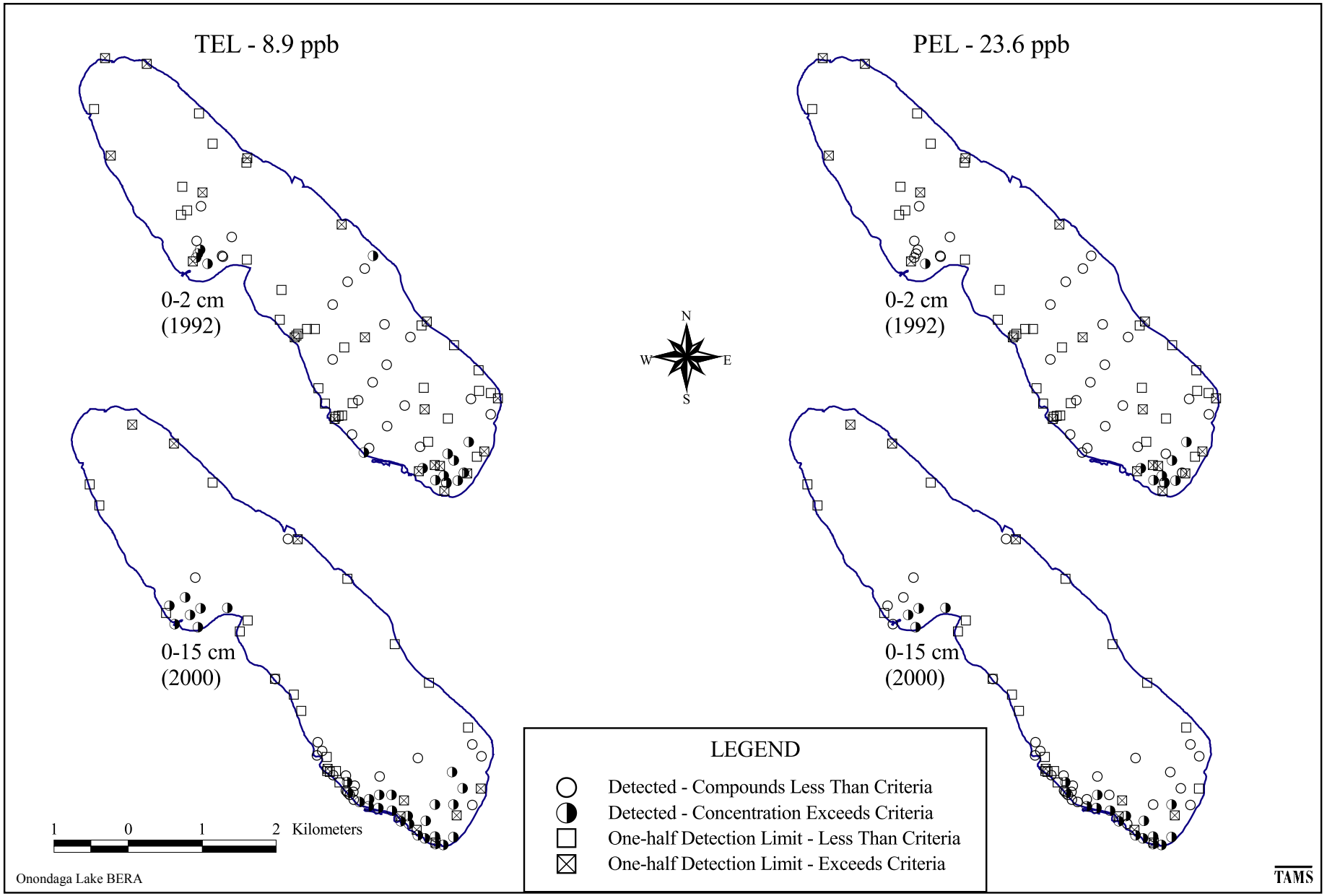

Figure F-79

Comparison of Hexachlorobenzene Sediment Concentrations with the TEL and PEL

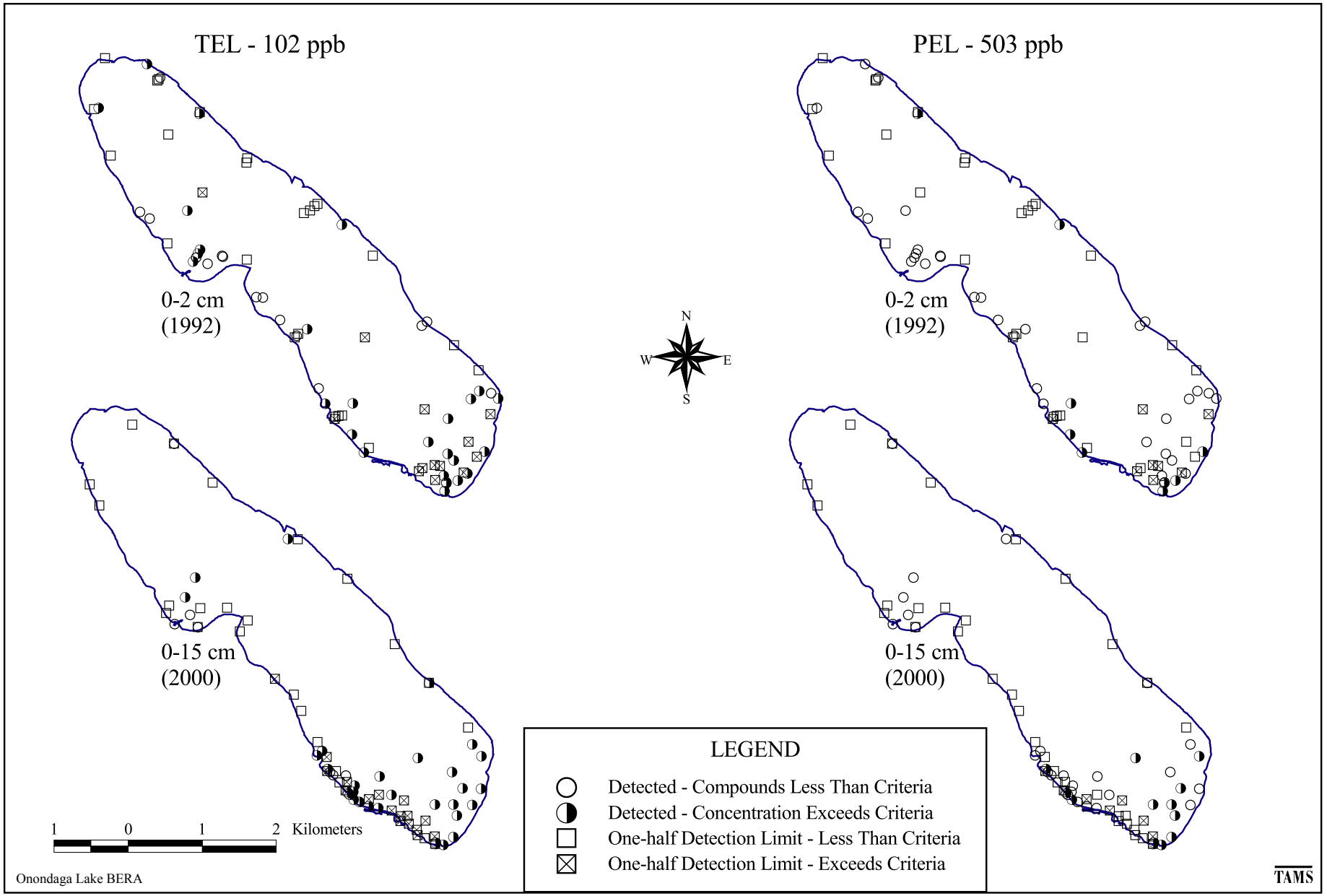

Figure F-80

Comparison of Indeno(1,2,3-cd)pyrene Sediment Concentrations with the TEL and PEL

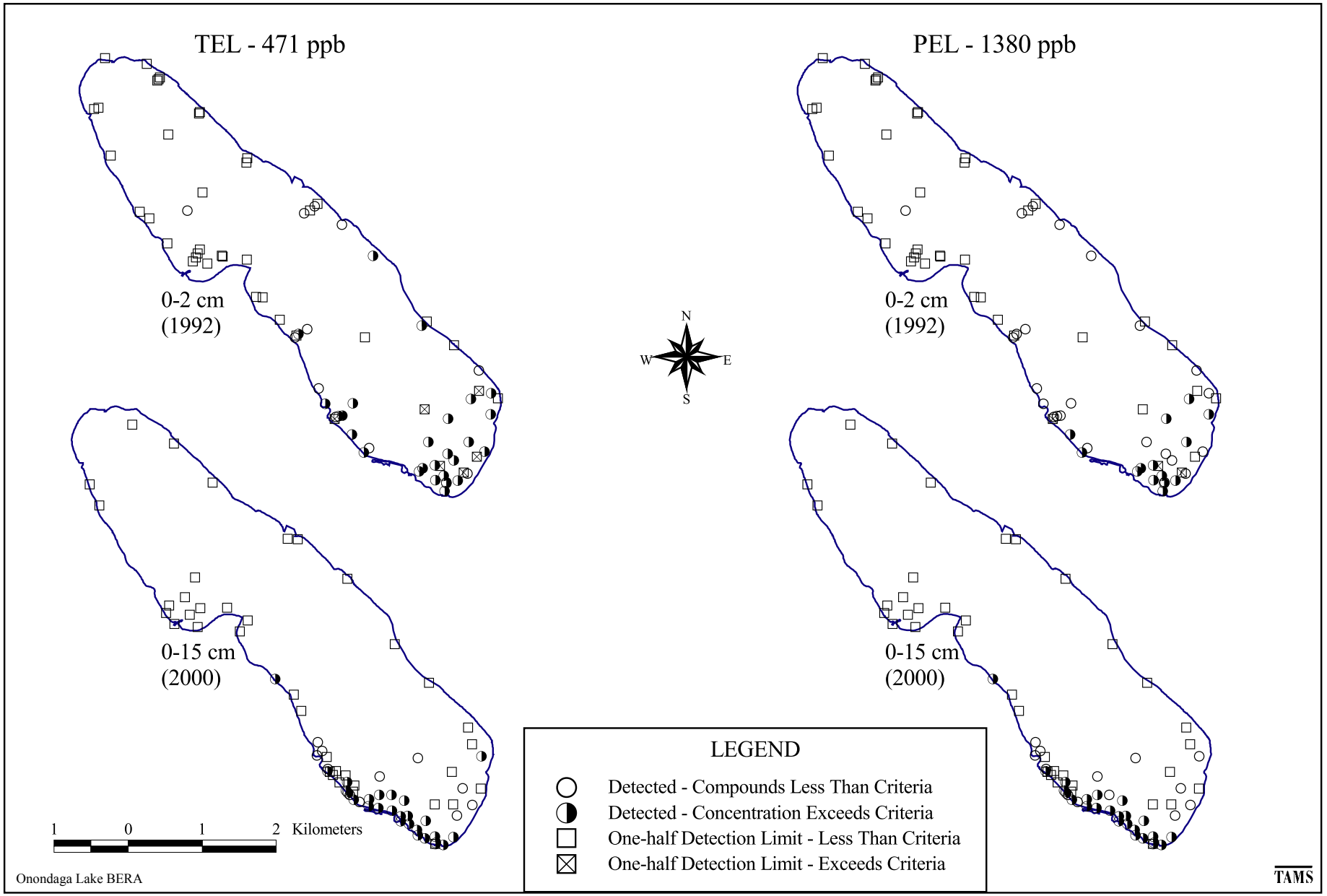

Figure F-81

Comparison of Naphthalene Sediment Concentrations with the TEL and PEL

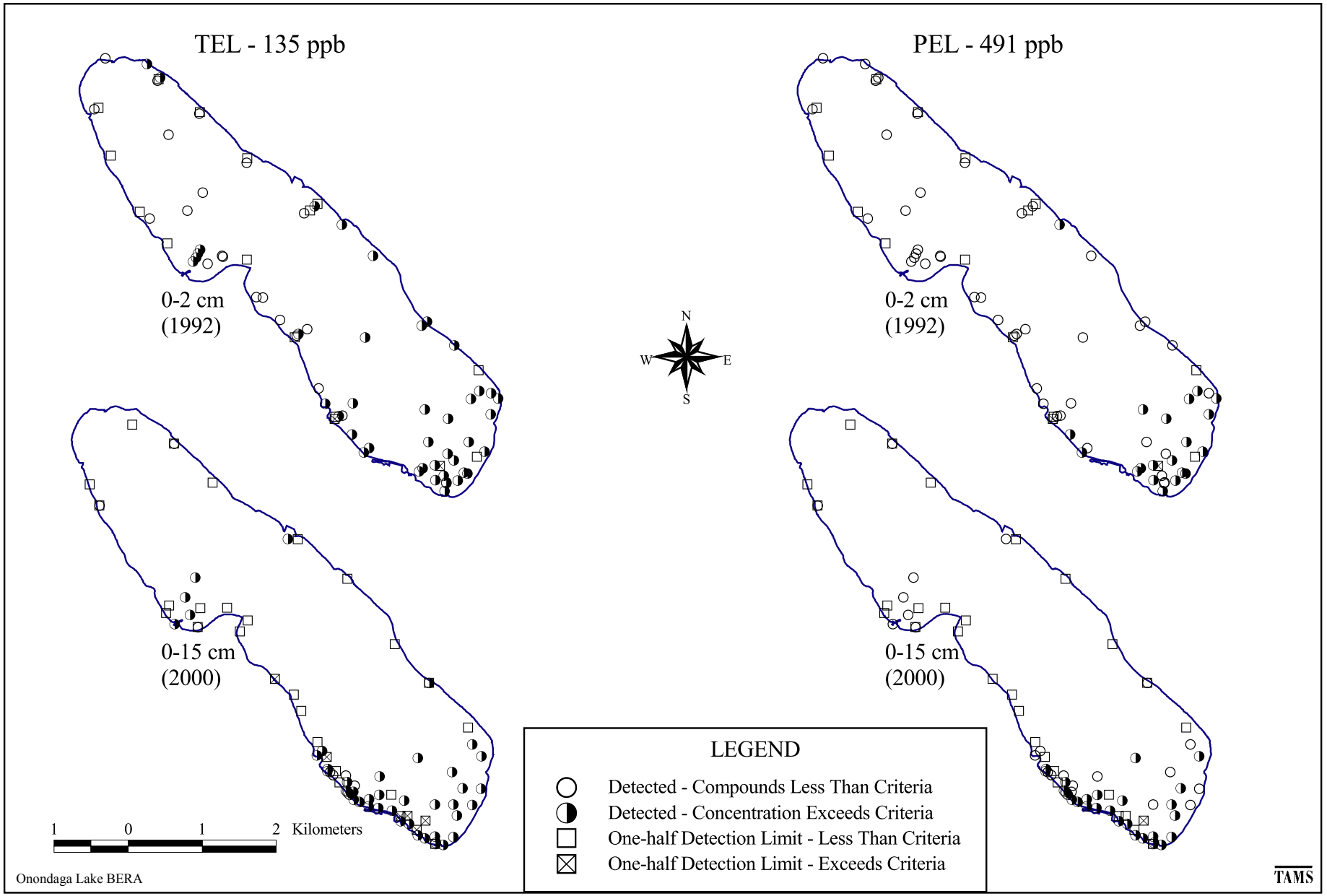

Figure F-82

Comparison of Phenanthrene Sediment Concentrations with the TEL and PEL

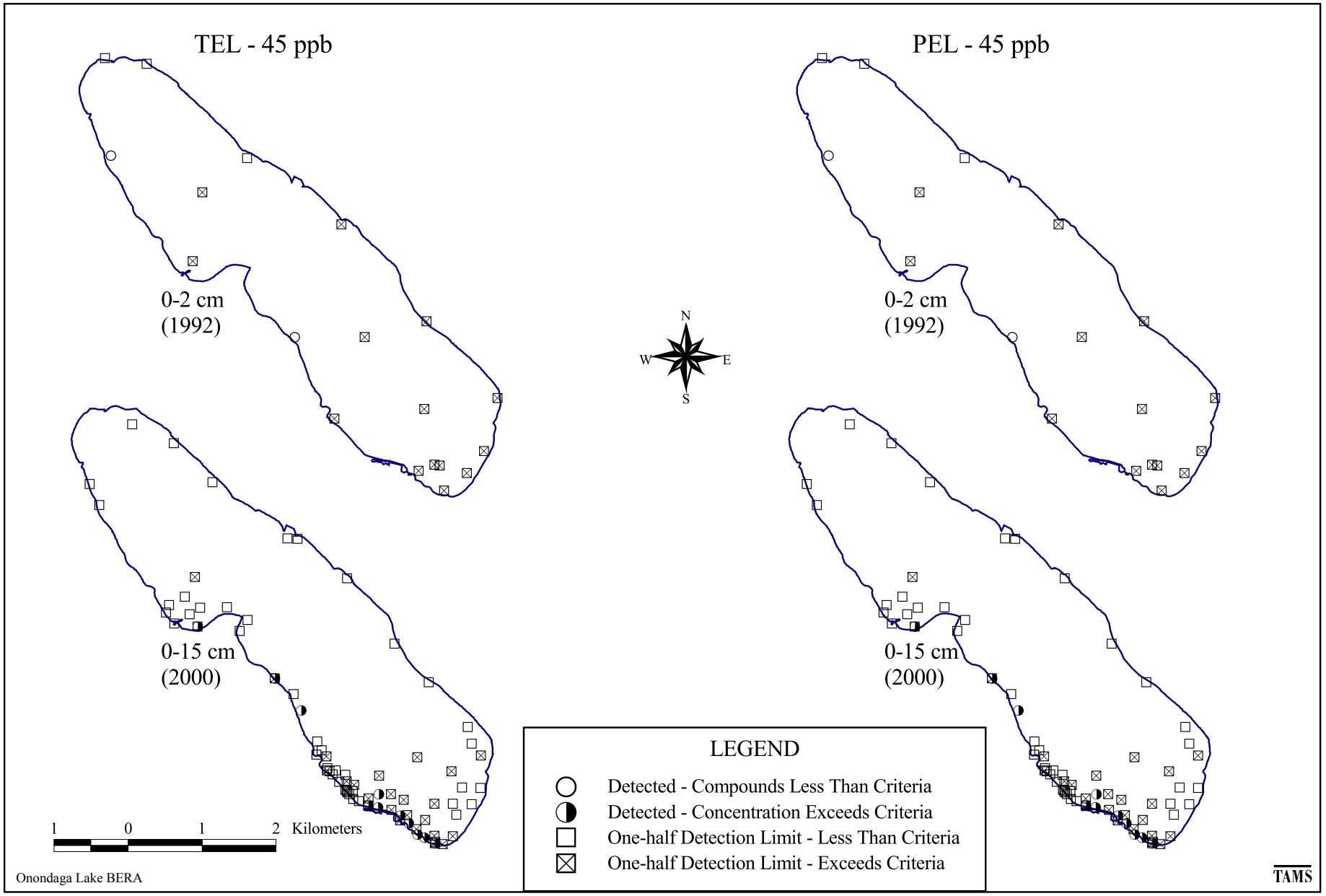

Figure F-83

Comparison of Phenol Sediment Concentrations with the TEL and PEL

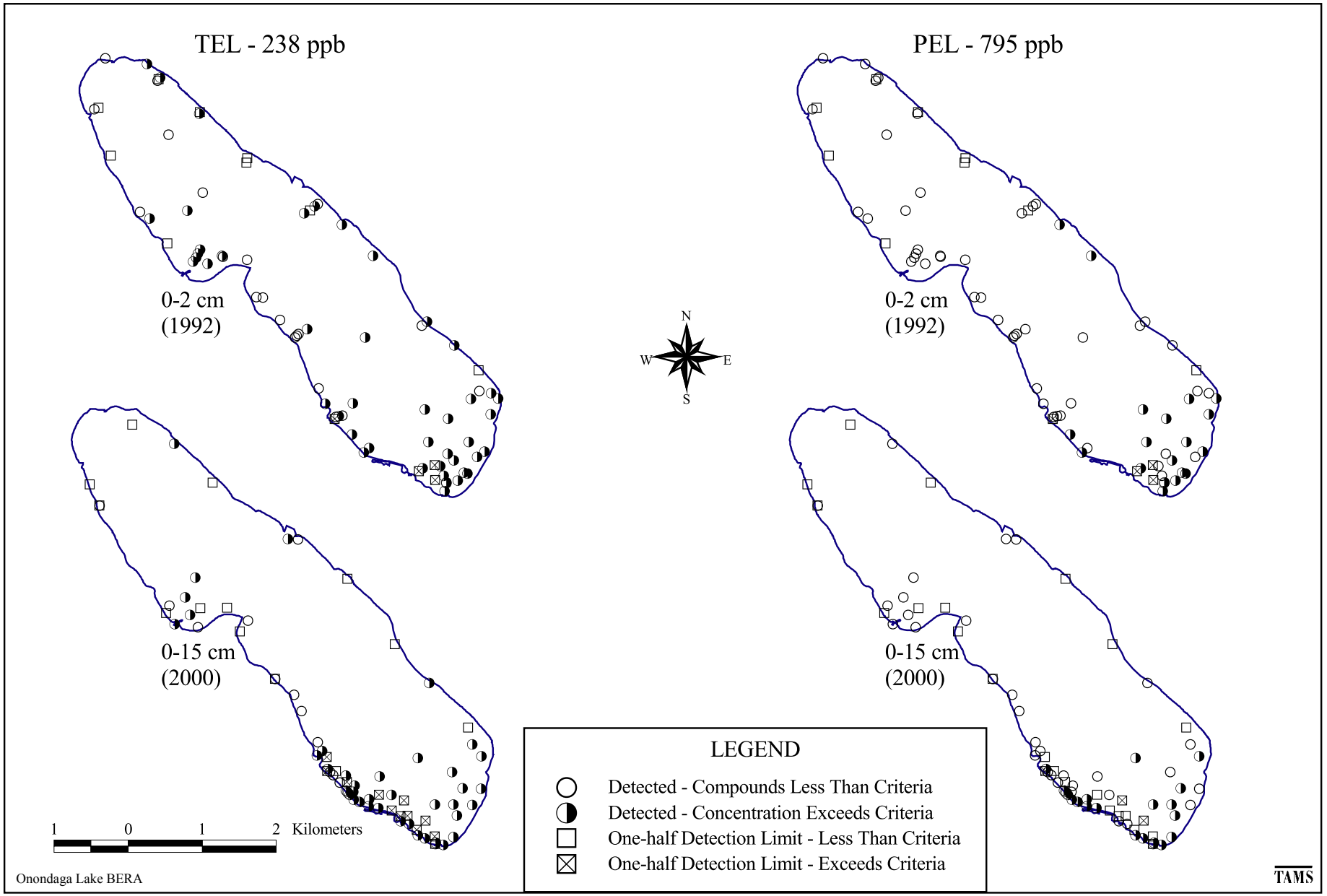

Figure F-84

Comparison of Pyrene Sediment Concentrations with the TEL and PEL

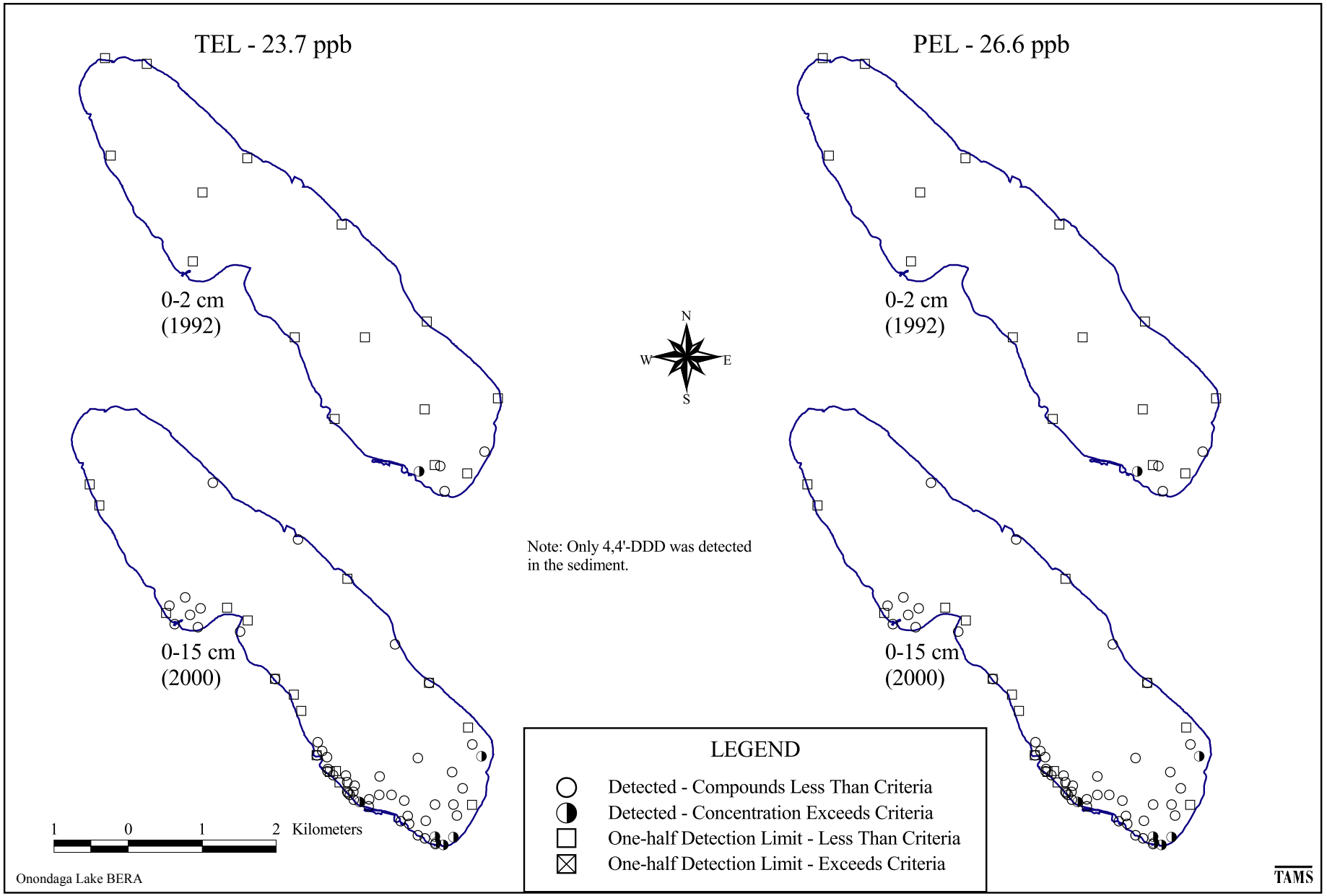

Figure F-85

Comparison of DDT and metabolites Sediment Concentrations with the TEL and PEL

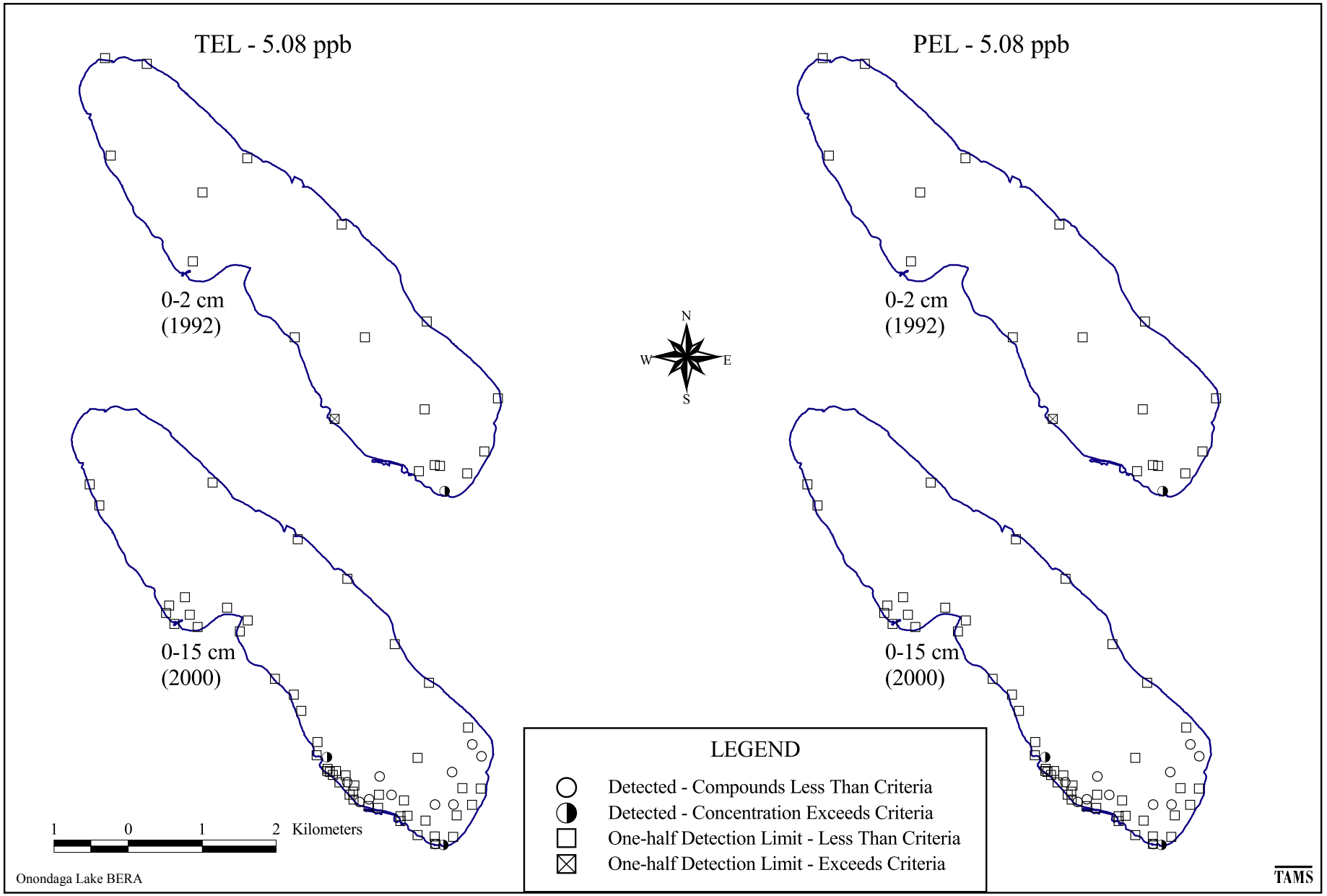

Figure F-86

Comparison of Chlordane Sediment Concentrations with the TEL and PEL

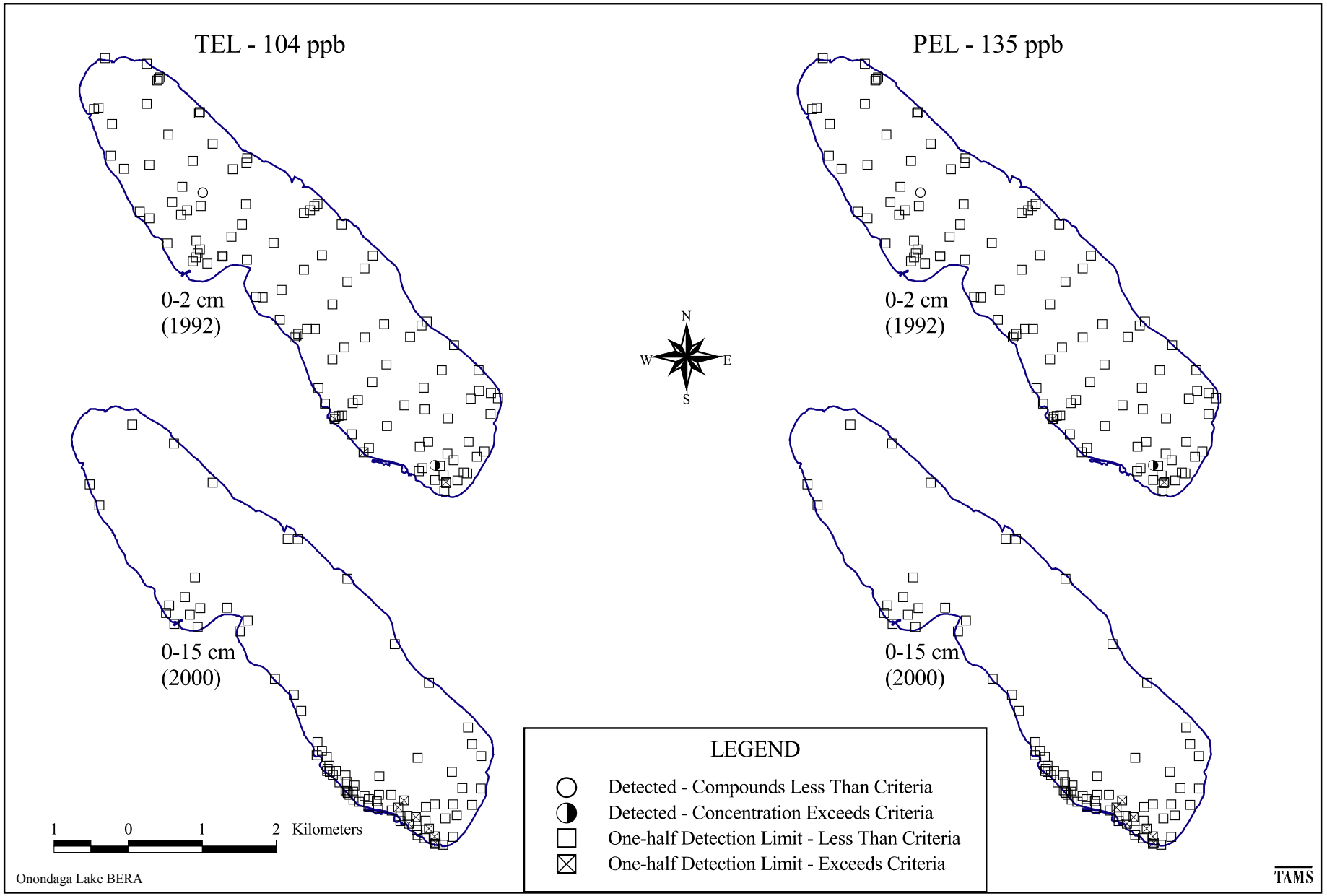

Figure F-87

Comparison of Aroclor-1016 Sediment Concentrations with the TELs and PELs

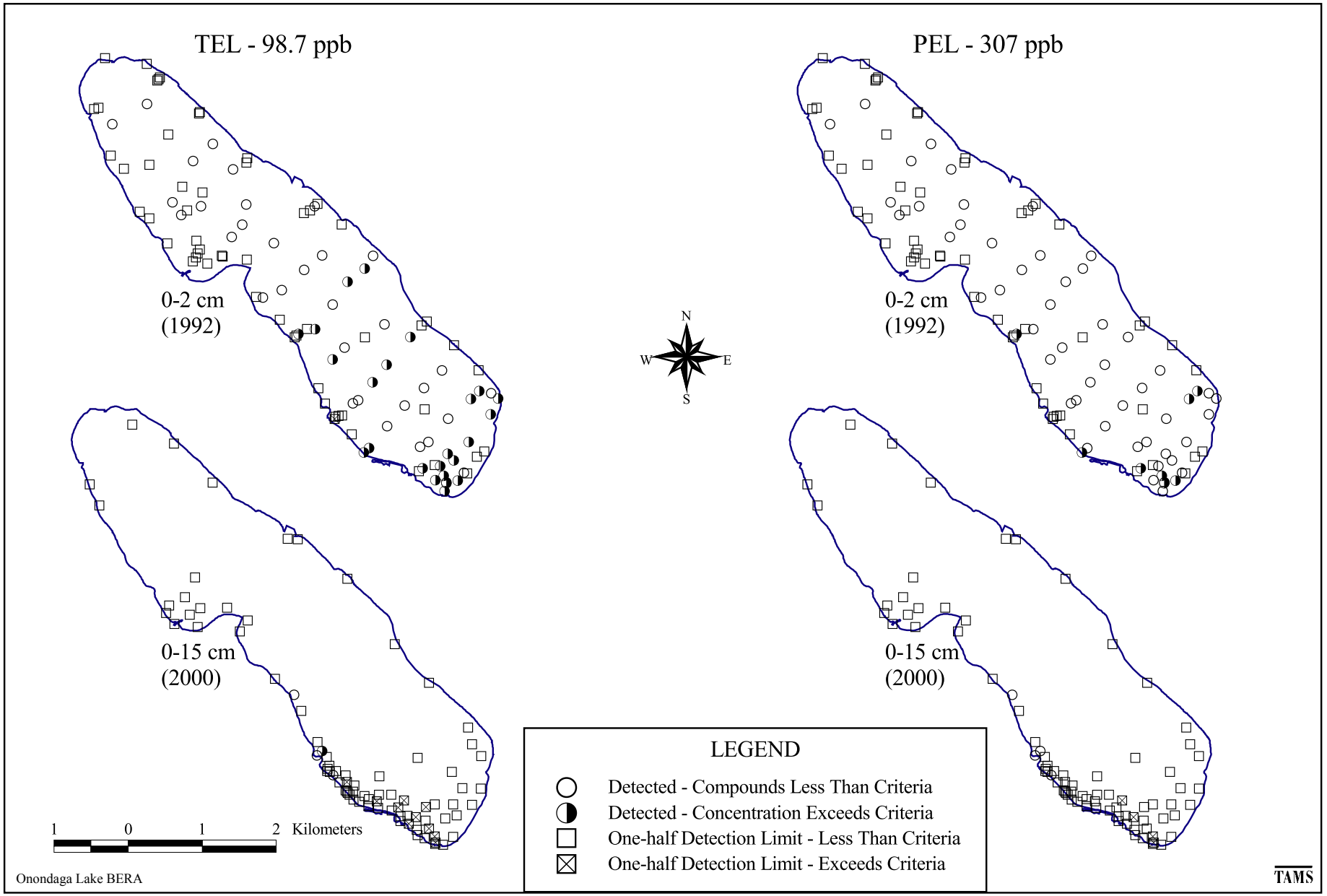

Figure F-88

Comparison of Aroclor-1248 Sediment Concentrations with the TEL and PEL

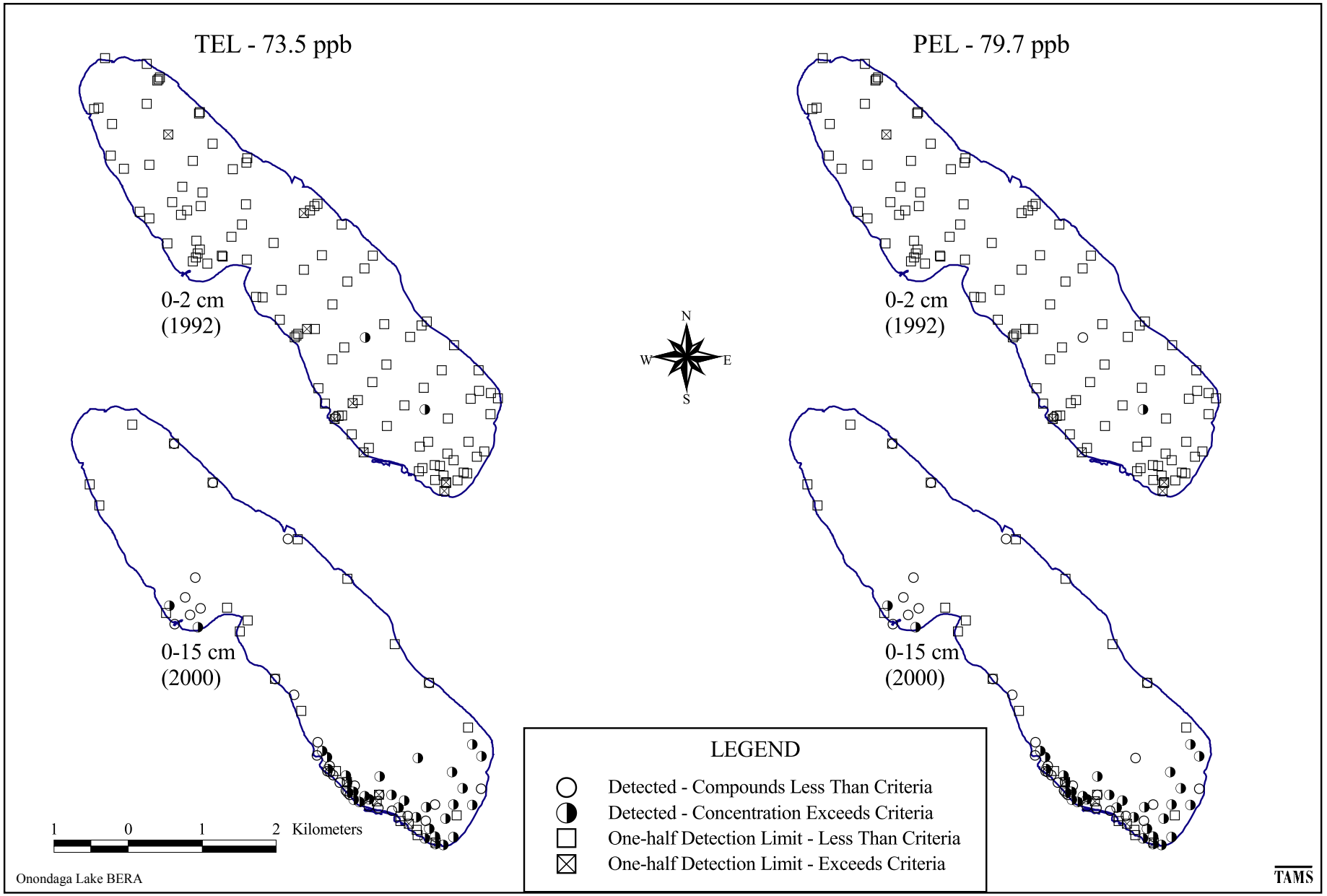

Figure F-89

Comparison of Aroclor-1254 Sediment Concentrations with the TEL and PEL

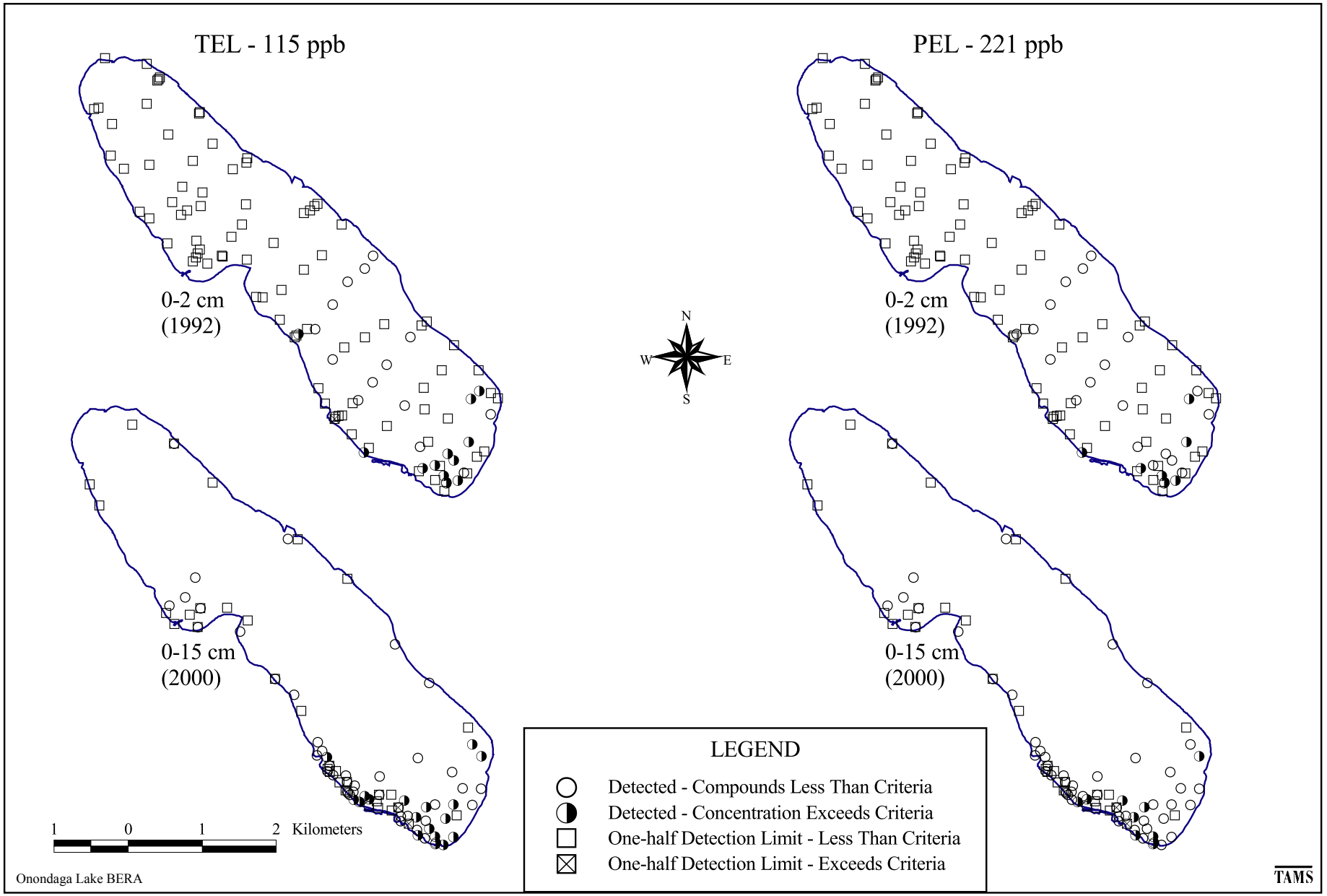

Figure F-90

Comparison of Aroclor-1260 Sediment Concentrations with the TEL and PEL

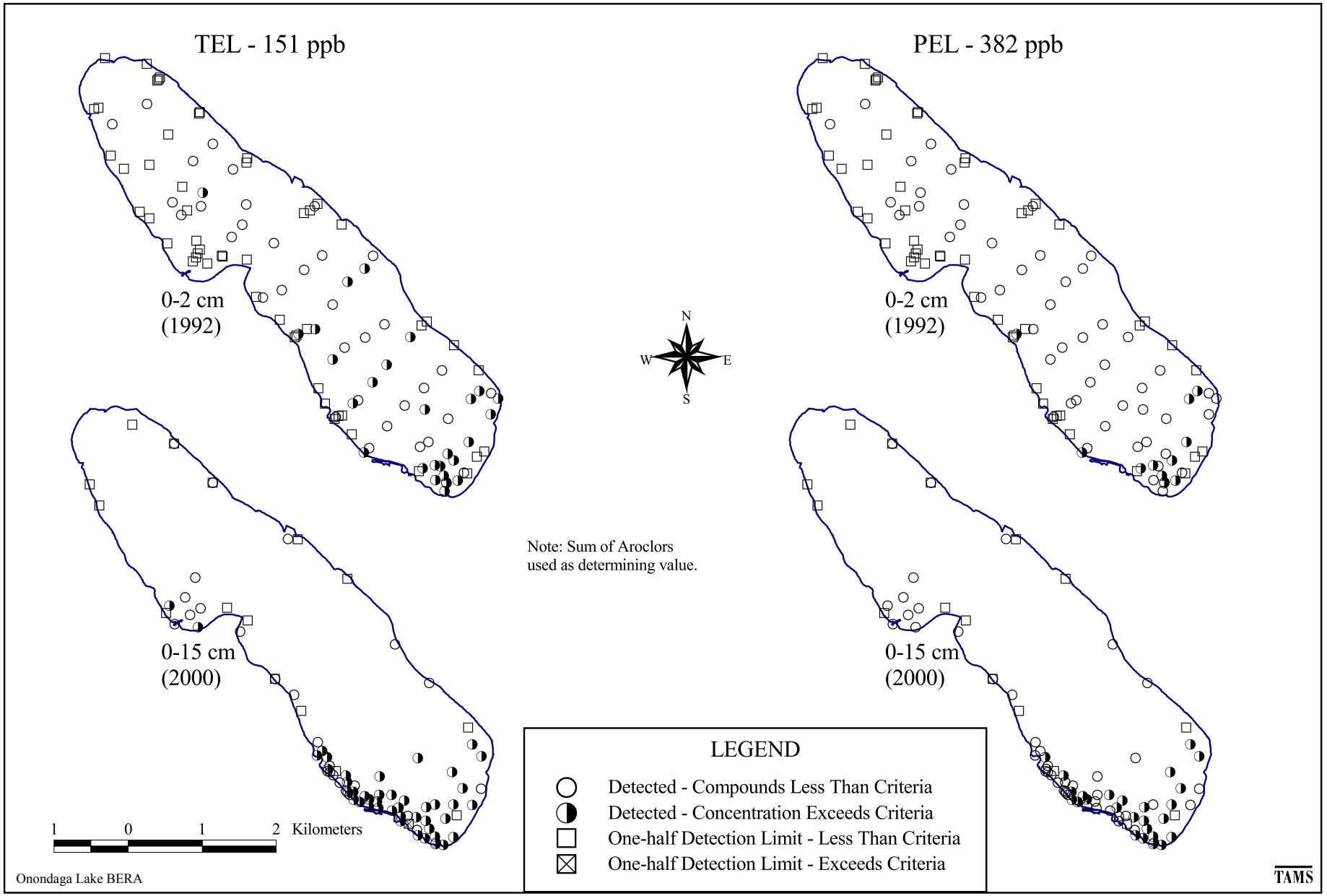

Figure F-91

Comparison of PCBs (Sum) Sediment Concentrations with the TEL and PEL

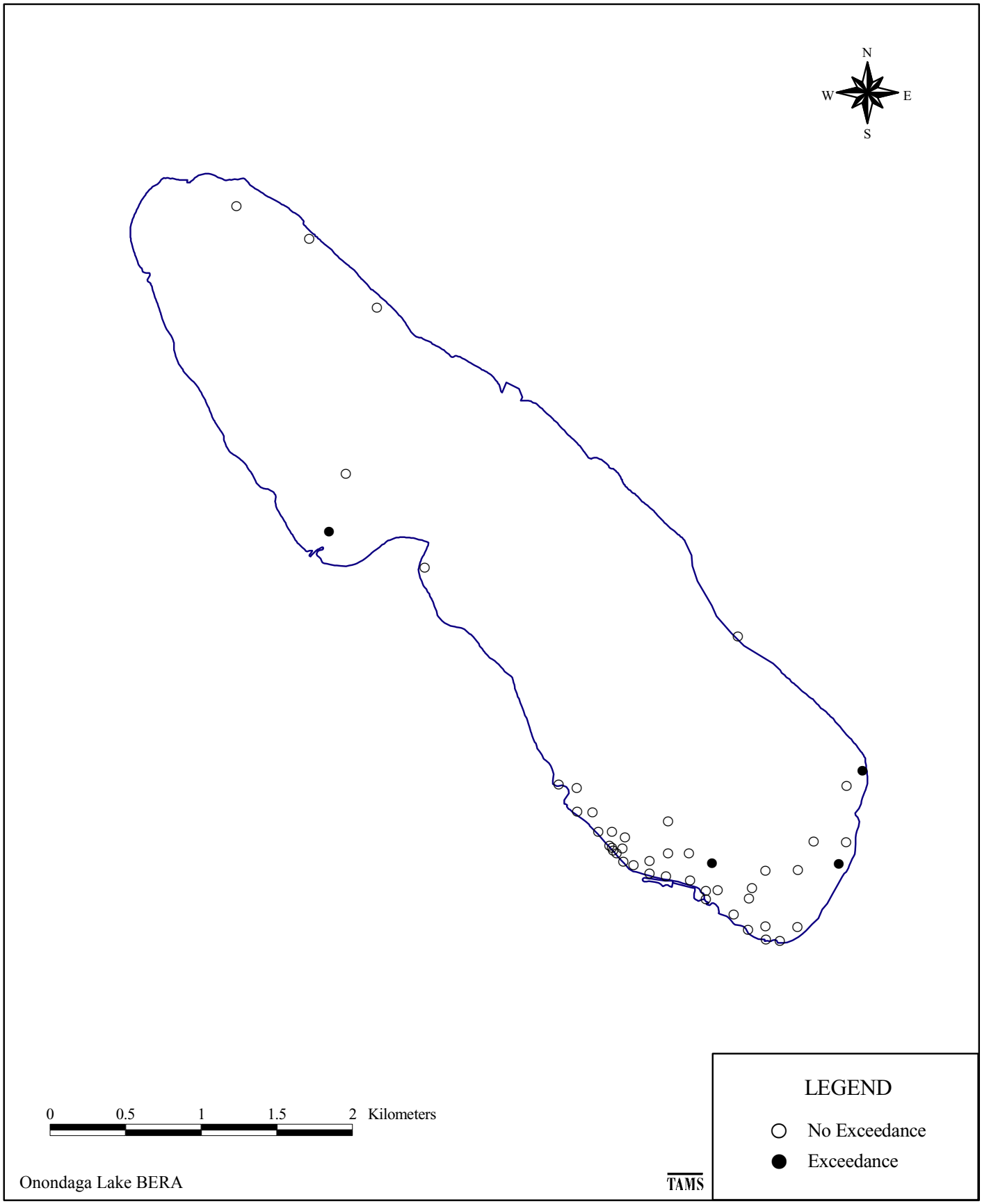

Figure F-92 Locations of Antimony Exceedances of Consensus Based Probable Effect Concentrations

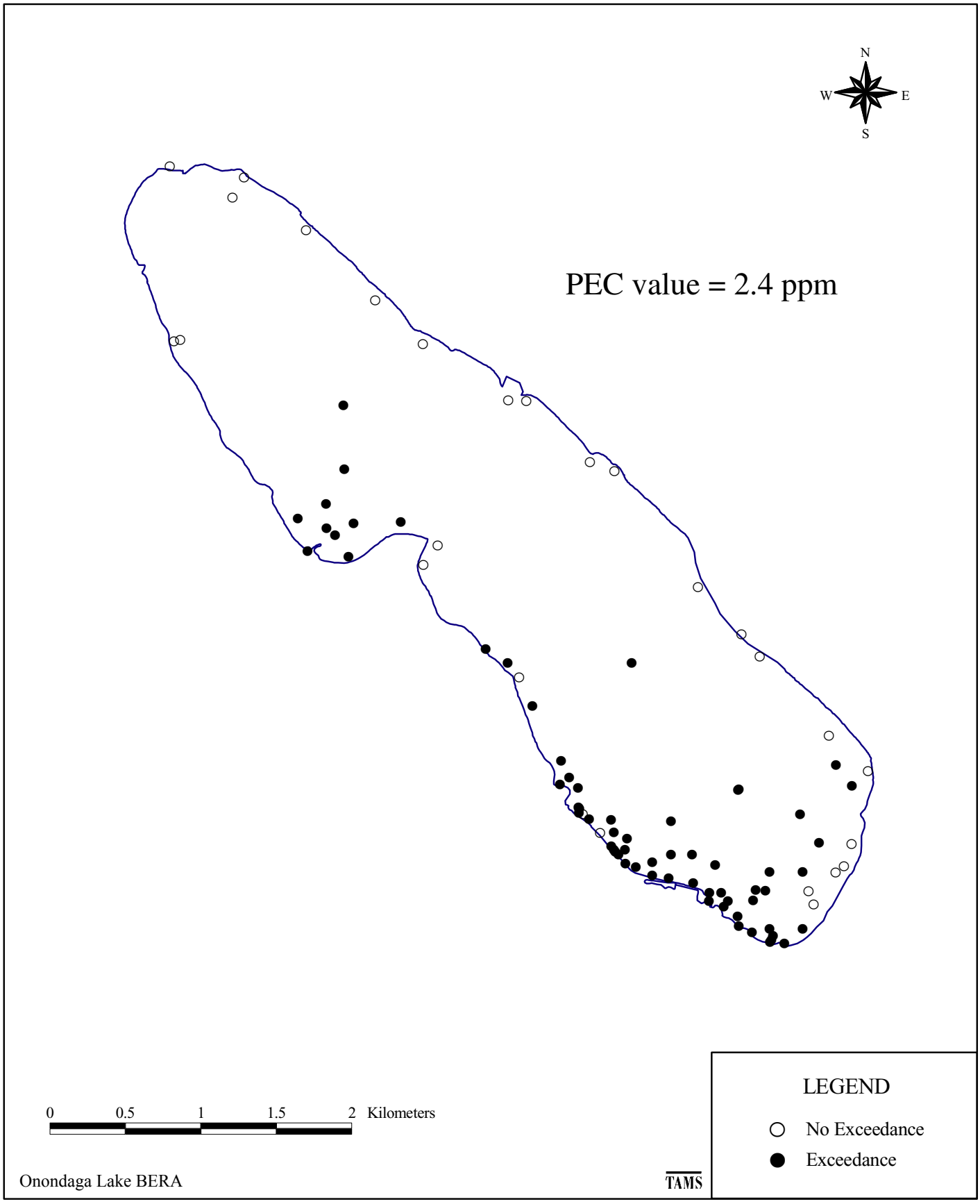

Figure F-93 Locations of Arsenic Exceedances of Consensus Based Probable Effect Concentrations

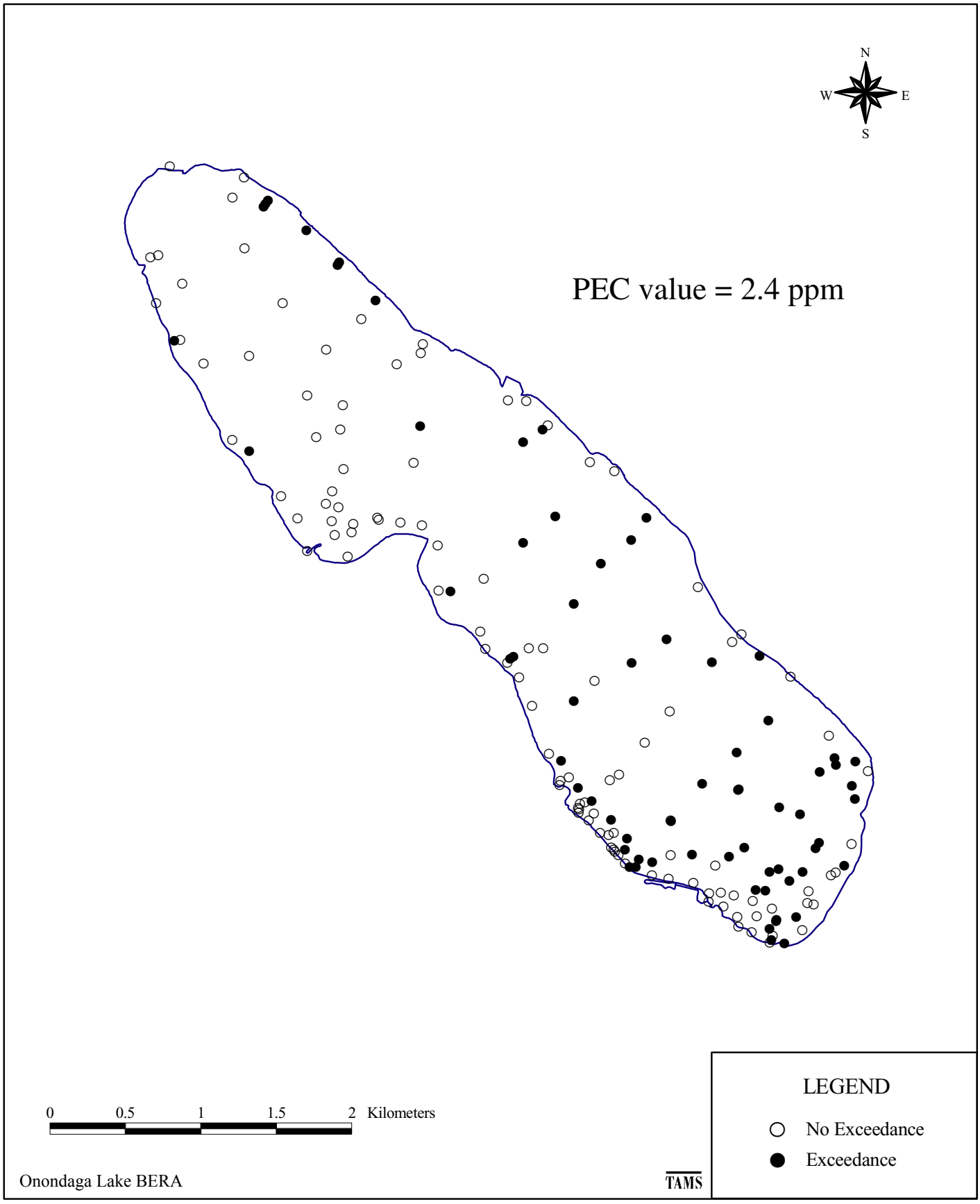

Figure F-94 Locations of Cadmium Exceedances of Consensus Based Probable Effect Concentrations

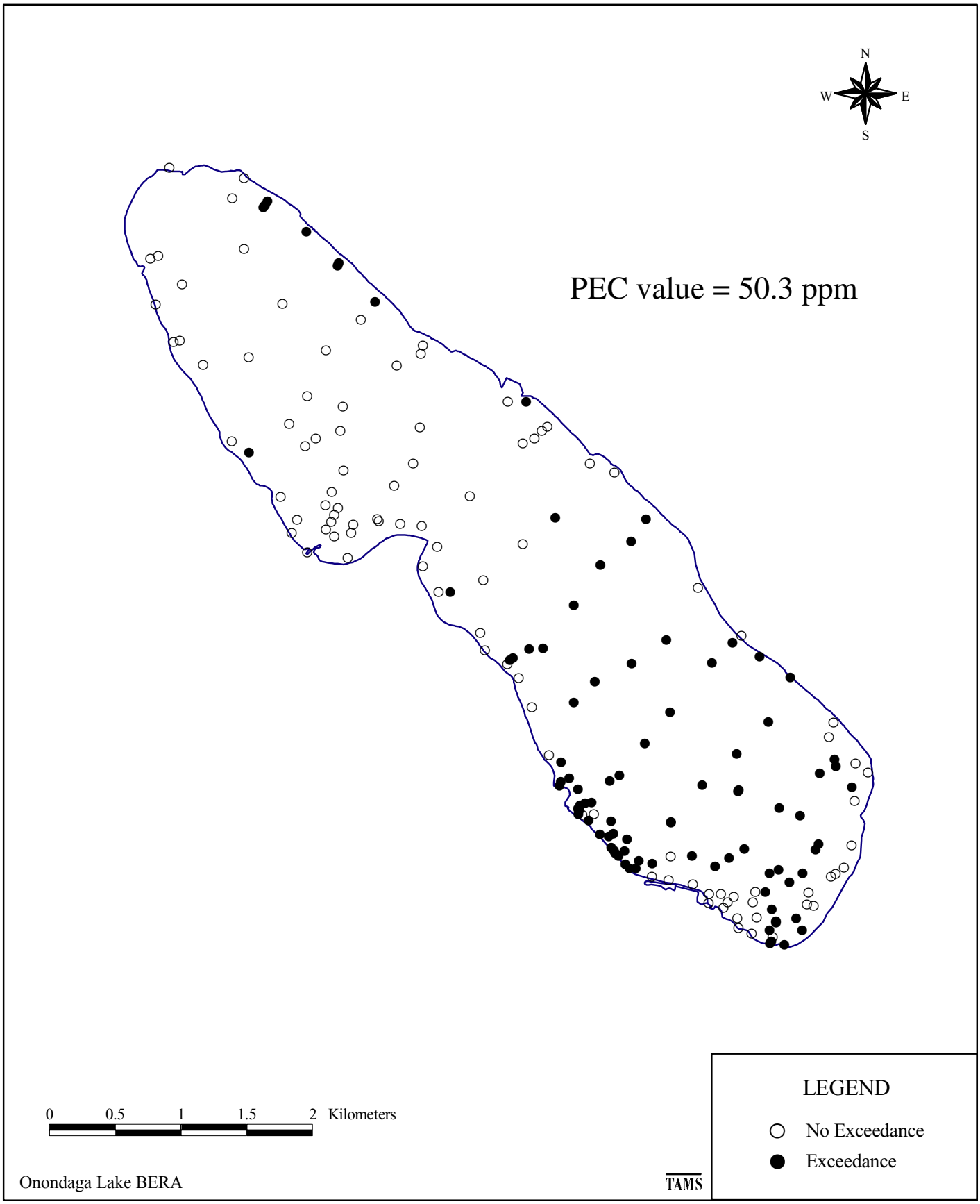

Figure F-95 Locations of Chromium Exceedances of Consensus Based Probable Effect Concentrations

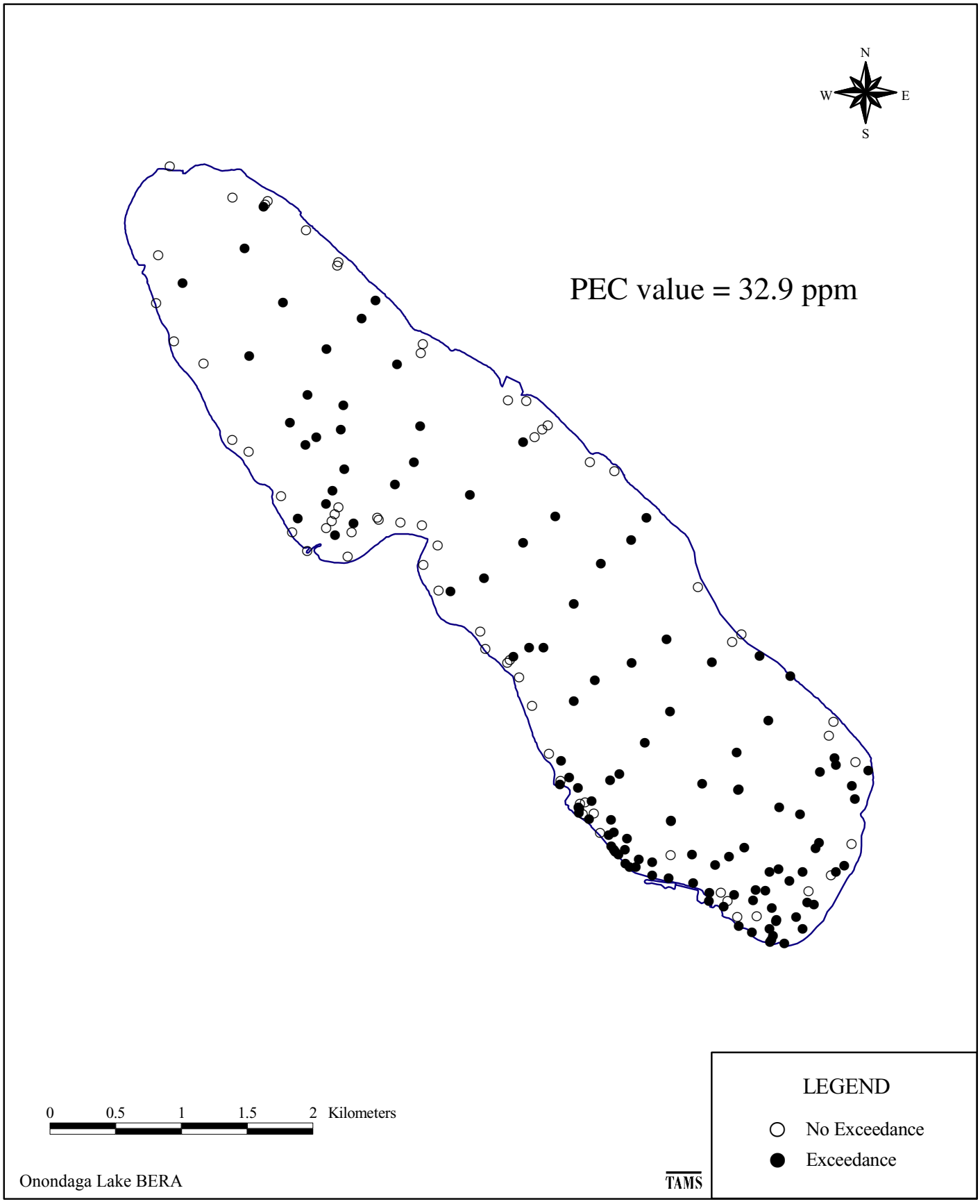

Figure F-96 Locations of Copper Exceedances of Consensus Based Probable Effect Concentrations

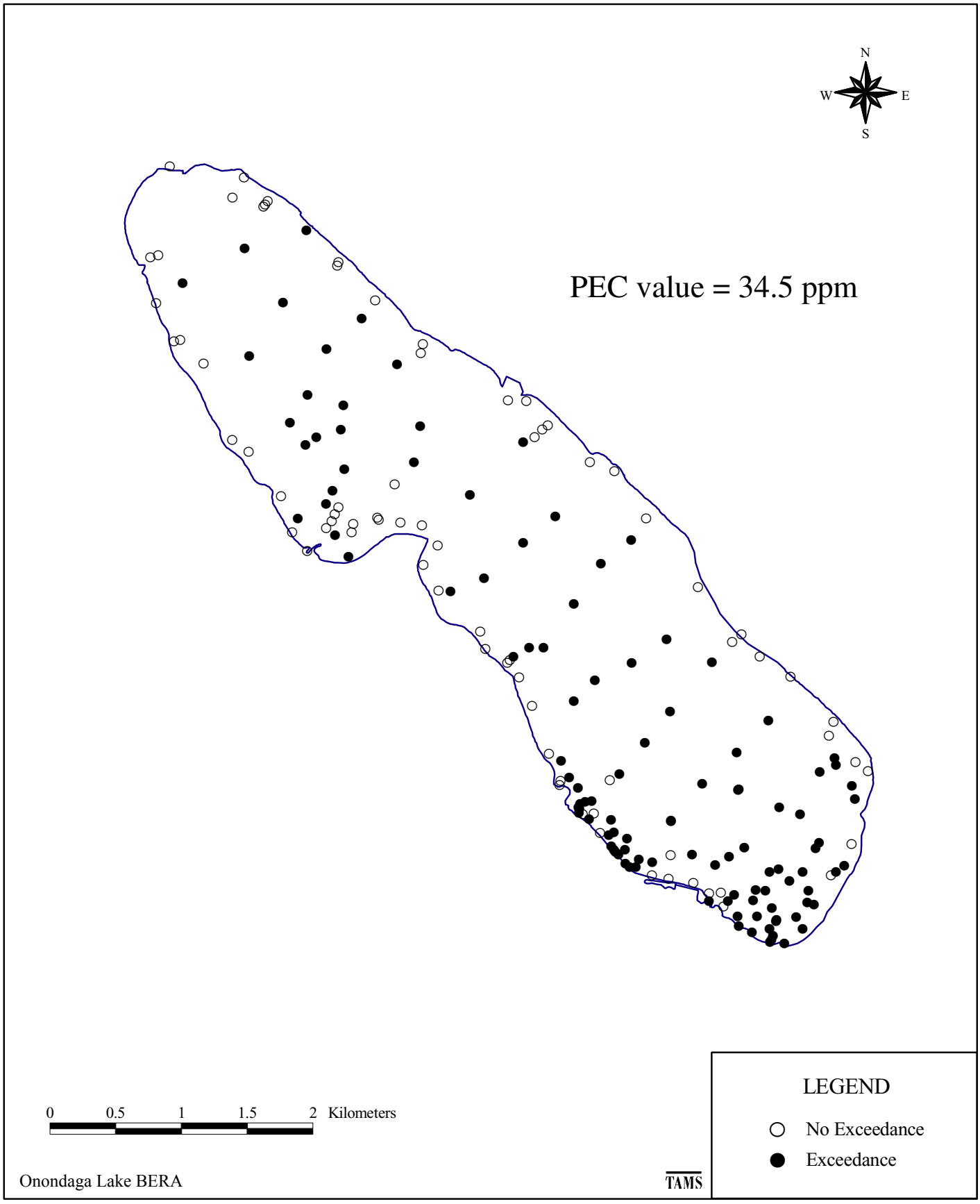

Figure F-97 Locations of Lead Exceedances of Consensus Based Probable Effect Concentrations

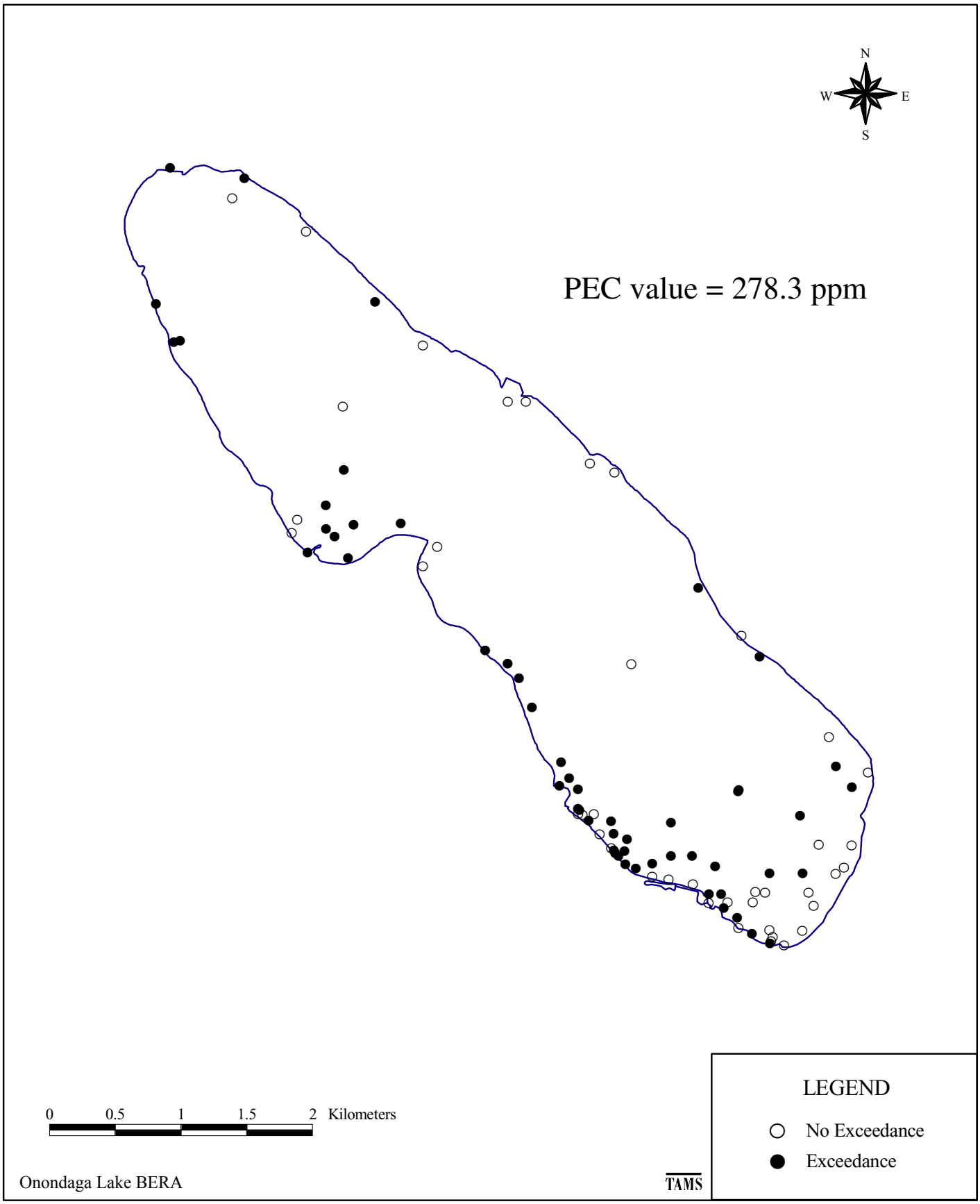

Figure F-98 Locations of Manganese Exceedances of Consensus Based Probable Effect Concentrations

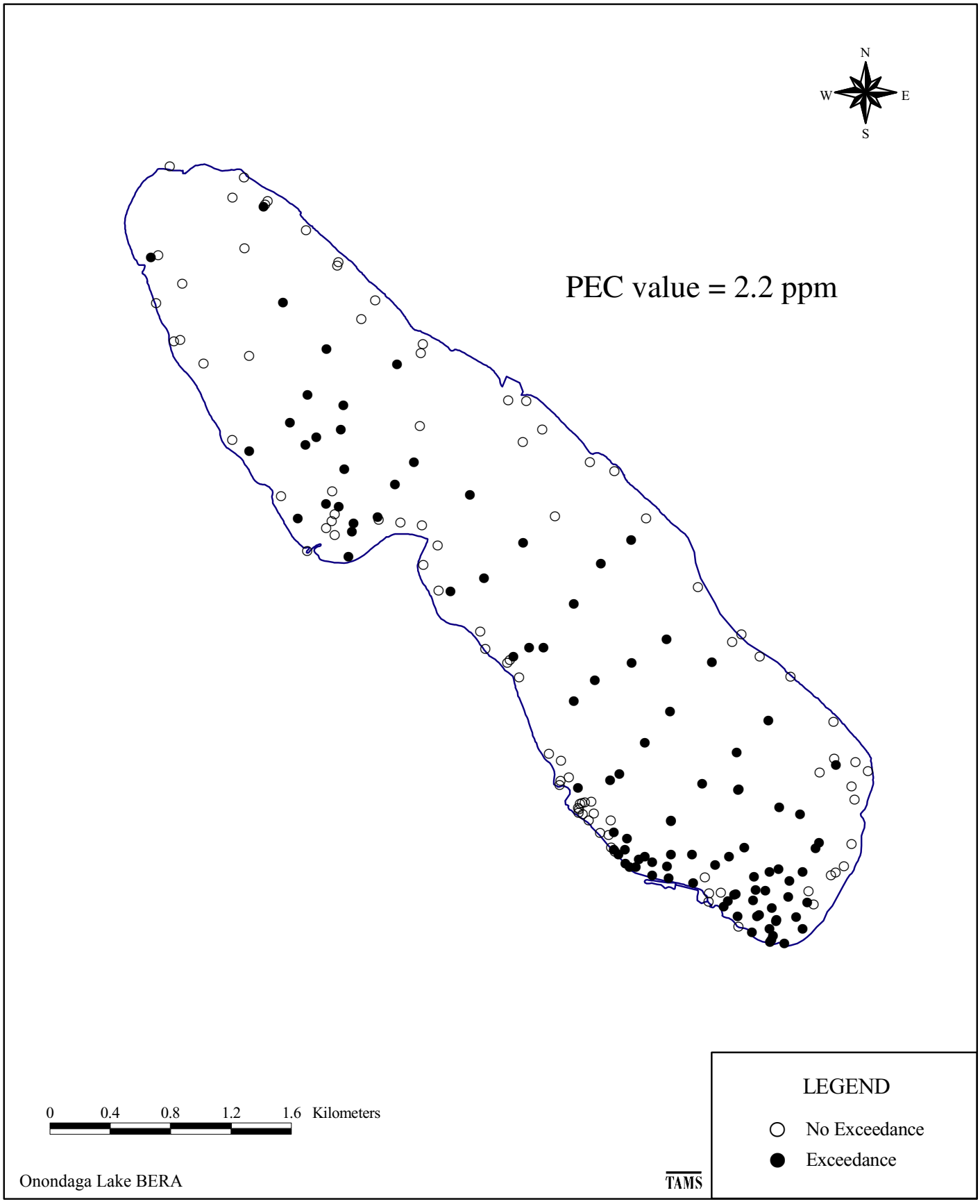

Figure F-99 Locations of Mercury Exceedances of Consensus Based Probable Effect Concentrations

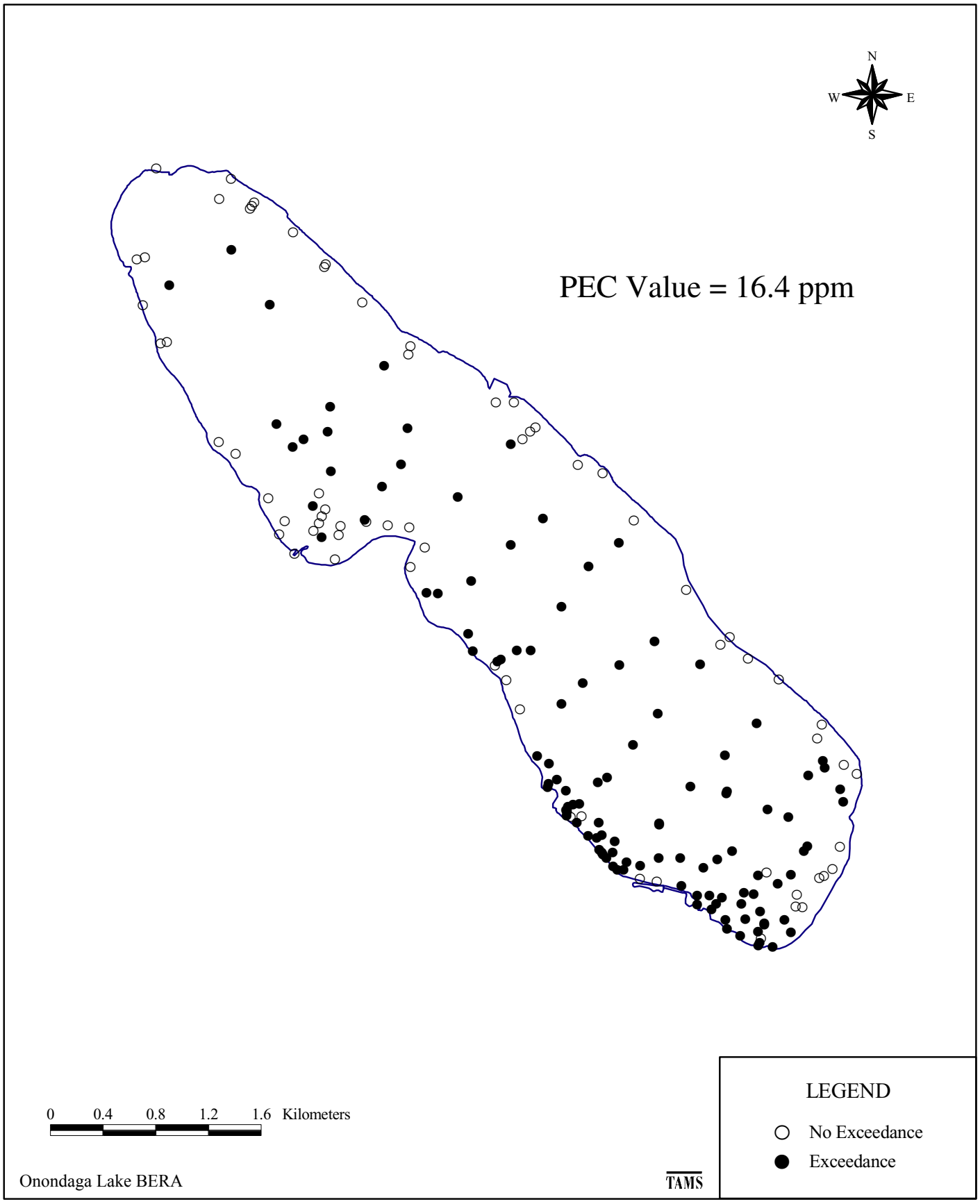

Figure F-100 Locations of Nickel Exceedances of Consensus Based Probable Effect Concentrations

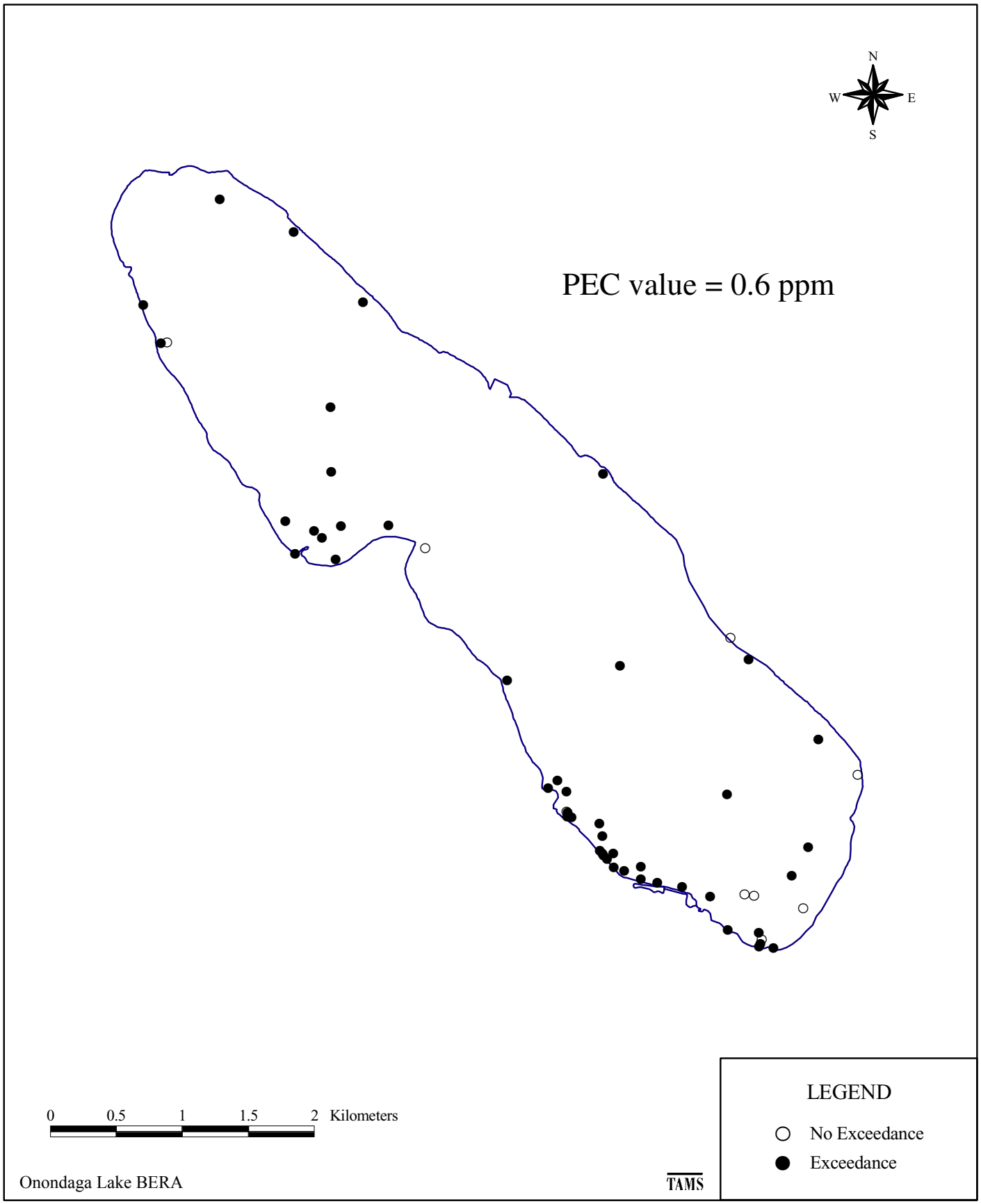

Figure F-101 Locations of Selenium Exceedances of Consensus Based Probable Effect Concentrations

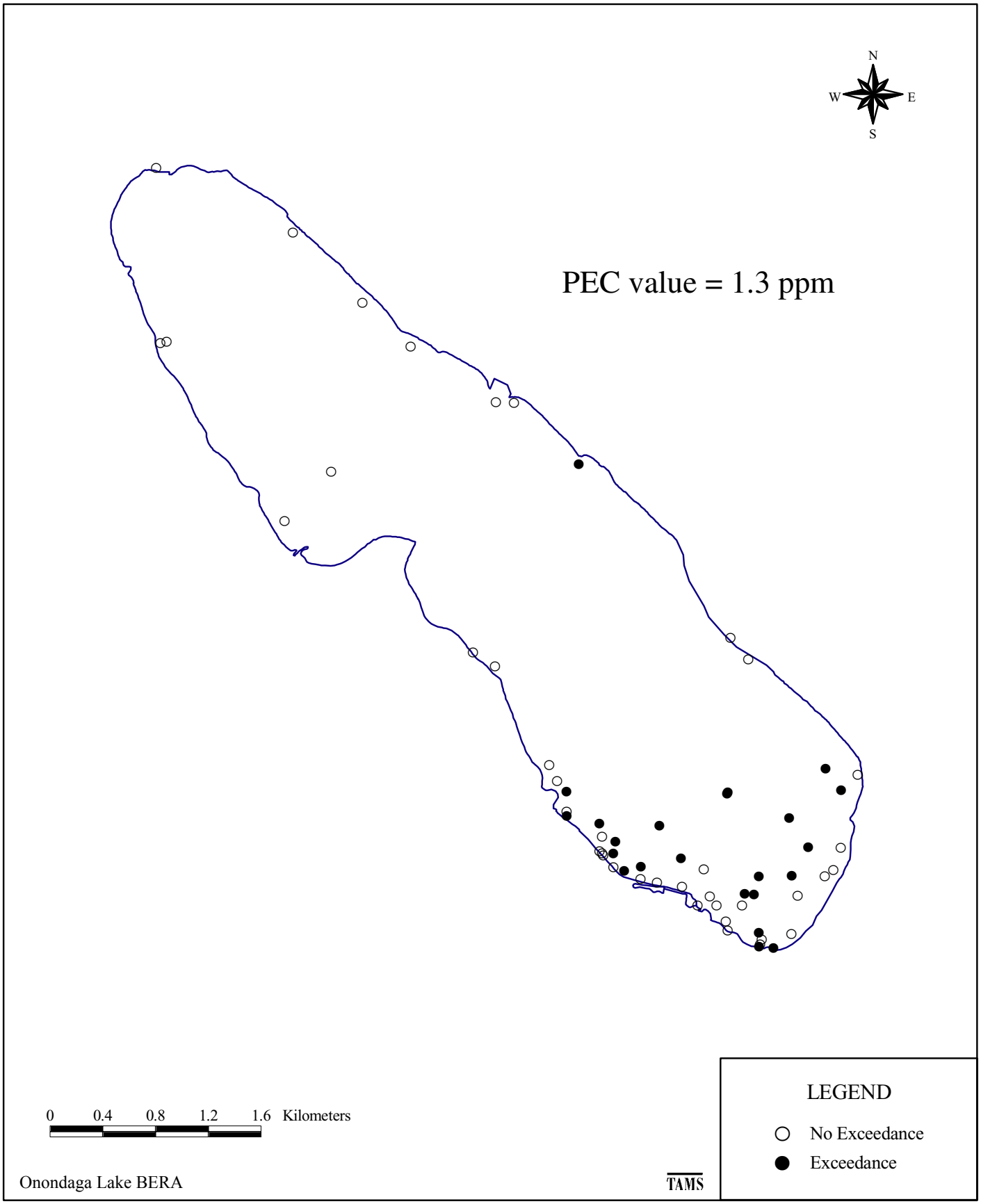

Figure F-102 Locations of Silver Exceedances of Consensus Based Probable Effect Concentrations

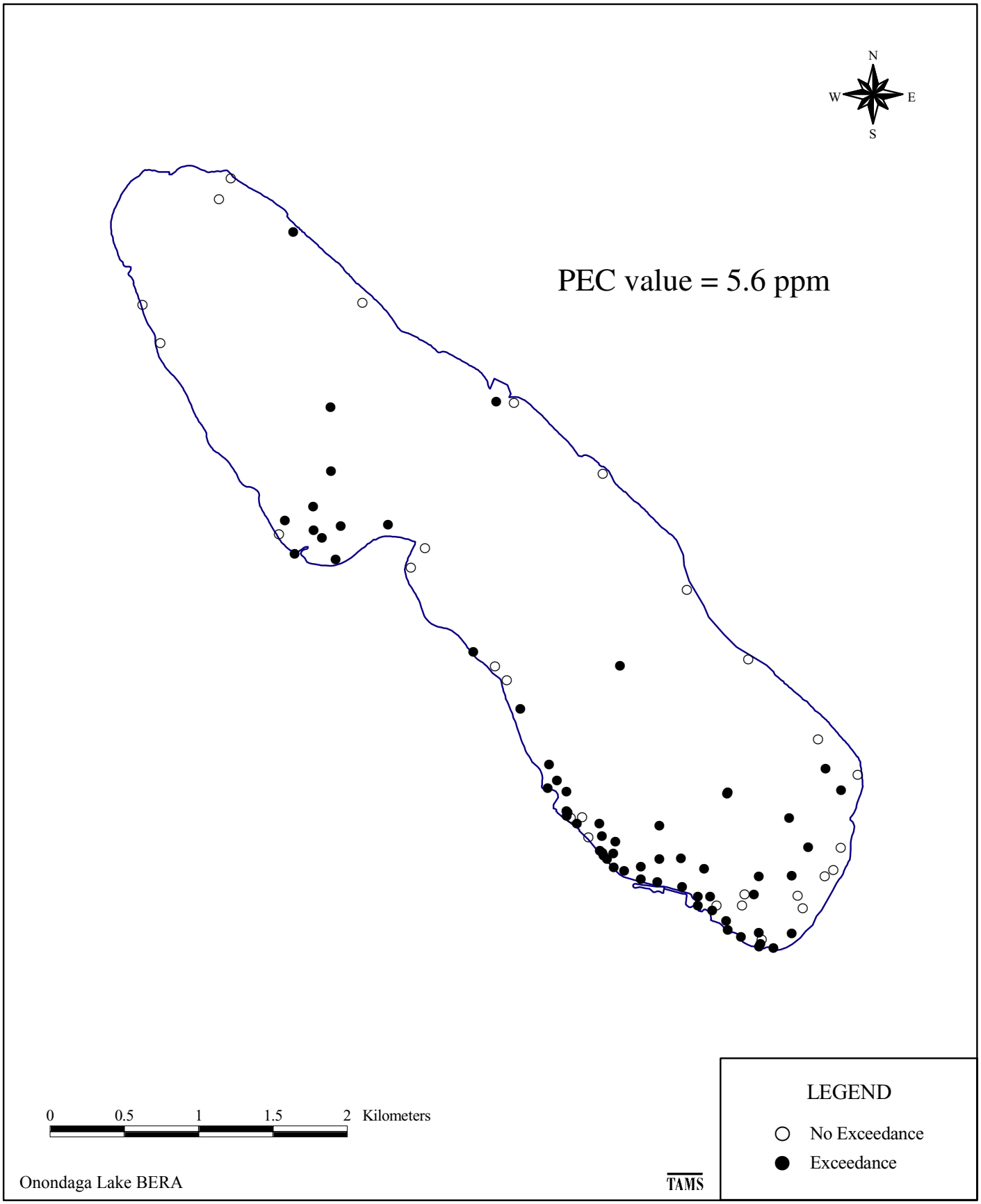

Figure F-103 Locations of Vanadium Exceedances of Consensus Based Probable Effect Concentrations

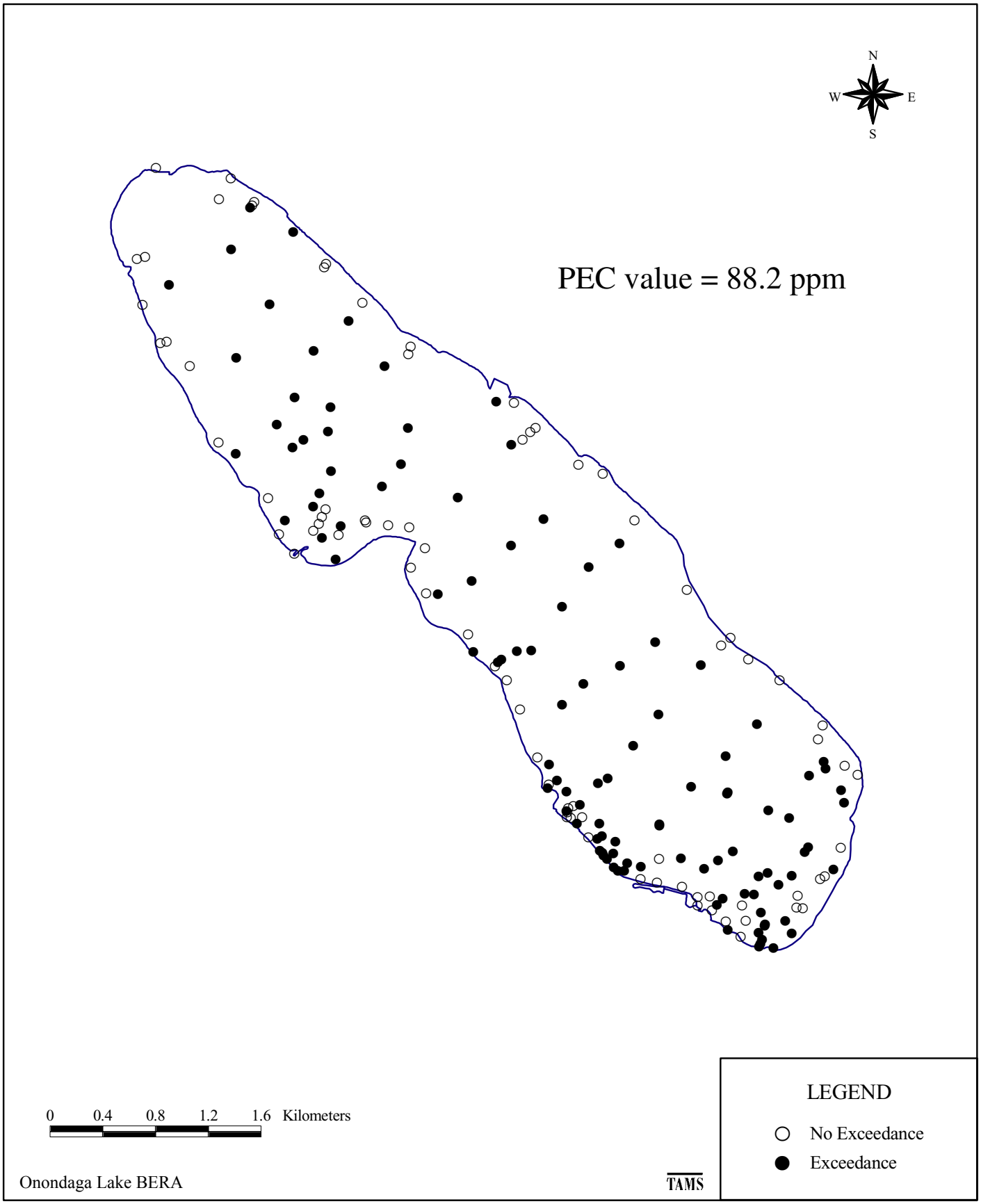

Figure F-104 Locations of Zinc Exceedances of Consensus Based Probable Effect Concentrations