Assessment of Potential Wildlife Corridors in Crooked, Burt, and Pickerel Lake Watersheds

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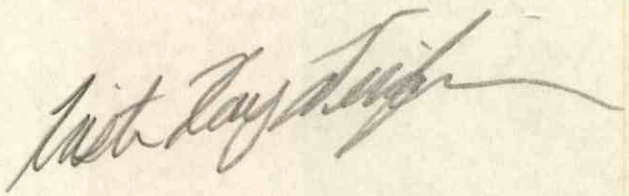
Abstract :

Habitat fragmentation and destruction is one of the greatest threats to native fauna in the United States. One means of reducing the impacts of habitat fragmentation on native species is through the creation of wildlife corridors. Utilizing datasets provided by the Tip of the Mitt Watershed Council, the National Land Cover Dataset, and the Michigan Geographic Data library, maps were created in ArcGIS in order to identify ideal wildlife corridors for umbrella species in three northern Michigan watersheds. Ideal corridors for individual species were identified, and then compiled in order to prioritize the overall value of parcels as wildlife corridors. Parcels for each watershed were prioritized according to the number of species for which they created viable habitat.



Introduction:

As the human population explodes, our agricultural and industrial endeavors are constantly expanding. Urban development, deforestation, and agriculture are all major causes of natural habitat destruction and fragmentation. Habitat loss is the single most important threat to the survival of United States Wildlife; in fact, some estimates predict that as much as thirty percent of the nation's plant and animal species are in danger of extinction inside of the next fifty years (Encyclopedia of Earth 2010, Ewing and Kostyack 2005). The expansion of human land development has resulted in the separation of habitat into smaller, unconnected pieces. Fragmentation reduces the viability of these environments as habitats for certain species, particularly those species that require a large territory in which to mate and find food (National Wildlife Federal 2014). The major consequence of habitat fragmentation and development is a decrease in biodiversity. As certain species disappear from a habitat, so do the ecological services they provide (Encyclopedia of Earth 2010). Such disappearances may reverberate throughout an ecosystem in a trophic cascade, leading the consequences far beyond those which are immediately foreseeable.

Beyond the intrinsic value of biodiversity conservation, minimizing the impact of habitat loss and fragmentation holds serious economic interest for humans. Economic ramifications of habitat loss range from topsoil erosion, the reduction of sustainable yields of fisheries and other biotic resources, loss of pollinators, reduction in water quality, and reduction of genetic materials of medicinal value (Encyclopedia of Earth 2010). In order to avoid these outcomes, steps must

be taken to prevent further habitat destruction and fragmentation and curb the effects of what damage has already been done.

In areas where significant portions of habitat have already been altered beyond viability, the use of wildlife corridors can help to reduce the negative impact of habitat fragmentation by providing a means for the dispersal of individuals between remaining, unspoiled areas. Such dispersal creates opportunity both for genetic exchange between isolated populations and for the re-colonization of habitats from which a population has been locally eradicated (Bond, 2003). Focusing on the Burt Lake, Crooked Lake, and Pickerel Lake watersheds in the northern part of Michigan's Lower Peninsula, the objective of this study is to identify potential wildlife corridors and prioritize them according to their value for certain umbrella species. Umbrella species are species whose habitat needs encompass the needs of many other species. By searching for land parcels that meet the habitat requirements of these umbrella species, we hope to create wildlife corridors which are viable for the greatest variety of species possible.

Materials and Methods:

Study Sites

The three sites chosen for this study were the Crooked Lake Watershed (Emmet County, MI), Burt Lake Watershed (Cheboygan County, MI), and Pickerel Lake Watershed (Emmet County, MI). These study sites were previously unassessed and were chosen for this project in order to build off of previous research conducted by Megan Lung (2013) and the Tip of the Mitt Watershed Council (TOTMWC).

Spatial Analysis

Spatial analysis was performed using ArcGIS in order to evaluate potential wildlife corridors. Information regarding watershed topography was accessed through the 1992 National Wetlands Inventory and the 1992 National Land Cover Dataset (NLCD), courtesy of the United States Geological Survey. The 1992 NLCD contained grid codes identifying specific topographical features. Parcels containing developed land, farmland, or barren land were not considered as potential wildlife corridors due to the risk of human interruption and lack of niches for wildlife. This was accomplished by selecting and exporting the following grid codes (as contained in the NLCD) as individual shapefiles to determine which parcels should not be prioritized: Low Intensity Residential, High Intensity Residential, Commercial/Industrial/Transportation, Bare Rock/Sand/Clay, Quarries/Strip Mines/Gravel Pits, Transitional, Pasture/Hay, Row Crops, Small Grains, Fallow, and Urban/Recreational Grasses.

Priority parcel maps indicating parcel protection status were provided by TOTMWCD. The datasets were used to determine which unprotected parcels could link separate parcels of protected land, widen pre-existing corridors, or fill gaps in protected land. Additionally, datasets specific to each county included county basemaps, watershed basemaps, parcel maps, hydrology maps (lakes), hydro maps (rivers and streams), and road inventory, courtesy of the Michigan Geographic Data Library. The datasets provided by the Michigan Geographic Data Library were used in order to further analyze the habitat cover of each parcel.

Study Species

To evaluate potential wildlife corridors in each of the watersheds, umbrella species were considered when prioritizing the parcels. Our project focused on a combination of passage species and corridor dwellers endemic to Michigan in order for the potential wildlife corridors to be beneficial to a variety of other species native to Michigan.

These species of interest were bald eagles, black bears, bobcats, great blue herons, minks, snapping turtles, marsh wrens, and red-spotted newts. The species were chosen in order for the project to be consistent with the wildlife corridor assessments conducted by Megan Lung (2013). All of the umbrella species were selected from habitat suitability index models constructed by the Department of Fish and Wildlife Services.

Identifying Potential Wildlife Corridors

Parcels which met species' habitat criteria and could expand protected land were identified as potential wildlife corridors. The species varied in spatial habitats and tolerance to disturbance from humans and roads.

Suitable habitats for bald eagles contain a varied forest structure with canopy openings for nesting. Parcels containing deciduous forests, evergreen forests and mixed forests were selected as potential corridors. Additionally, potential corridors were within 1200 meters of open water to allow for foraging and 600 meters away from roads due to bald eagles' low human tolerance (Peterson 1986).

Black bear habitats include various kinds of forests, grasslands, and wetlands for foraging. Parcels containing deciduous forests, evergreen forests, mixed forests, grassland, woody wetlands, and emergent herbaceous wetlands were selected as potential corridors. Potential corridors were 100 meters away from roads, and could support or connect at least 2,372 acres of territory (Rogers and Allen 1987).

Suitable habitats for bobcats include various kinds of forests, grasslands, and wetlands. Parcels containing deciduous forests, evergreen forests, mixed forests, grassland, woody wetlands, and emergent herbaceous wetlands were selected as potential corridors. Additionally,

potential corridors were required to contain or connect at least 247 acres of territory (Boyle & Fendley 1987).

Great blue herons require wetland habitats. Parcels containing woody wetlands and emergent herbaceous wetlands were selected as potential corridors. Potential corridors were within 400 meters of open water in order to allow blue herons to forage and maintain nesting colonies. Additionally, potential corridors were at least 100 meters away from roads due to risk of disturbance (Short and Cooper 1985).

Marsh wrens require emergent wetlands within a permanent source of water, for this species builds its nests in cattails. Only parcels containing emergent herbaceous wetlands were selected as potential corridors. Additionally, potential corridors could support or connect at least 0.988 acres of territory in order for males to be reproductively active and forage for two mates (Gutzwiller and Anderson 1987).

Minks require habitats in the riparian zones of river and wetland territories, and will travel up to 30 meters away from freshwater to seek out prey and mates. Parcels containing woody wetlands, emergent herbaceous wetlands, and open water were selected as potential corridors. Additionally, protected parcels could support or connect at least 20 acres of territory in order for minks to successfully forage.

Suitable habitats for red-spotted newts include deciduous forest and wetlands, for their permeable skin and eggs require a moisture rich environment. Parcels containing deciduous forest, woody wetlands, and emergent wetlands (92) were selected as potential corridors (Sousa 1985).

Snapping turtles are territorial and require at least 8.9 acres of aquatic habitat. Parcels containing woody wetlands, emergent herbaceous wetlands, and open water were selected as

potential wildlife corridors. Additionally, potential corridors were no further than 300 meters away from a permanent water source (Graves and Anderson 1987).

Results:

Burt Lake Site 1:

Cheboygan, Michigan. Thirty acre parcel of first priority to connect protected lands consisting primarily of wetlands to its North and South (Figure 25). This corridor would create viable habitat for five species: black bears, mink, red spotted newts, bobcats, and snapping turtles (Figures 1, 4, 7, 16, 22).The parcel is predominantly woody wetlands, with sections of mixed and deciduous forest to the south. The southern portion of the parcel also contains patches of herbaceous grasslands.

Burt Lake Site 2:

Cheboygan County, Michigan. Ten acre parcel of first priority. Serves to connect same parcels as Burt Lake Site 1. In conjunction with Burt Lake Site 1, would serve to widen corridor between two large areas of protected land, creating a total protected area of over two thousand acres (Figure 25). The parcel consists of woody wetlands to the north, with primarily deciduous forest to the south. Small sections of mixed forest may also be found in the southern portions of the parcel. This corridor would create viable habitat for four species: black bears, mink, red spotted newts, and bobcats (Figures 1, 4, 7, 16).

Burt Lake Site 3:

Cheboygan County, Michigan. Forty six acre parcel of first priority. Expand on already existing protected area, as well as expanding what is currently a very narrow corridor. The parcel is almost entirely composed of woody wetlands, with patches of deciduous forest throughout the

western half of the parcel. The sight is ideal to support four species: black bears, marsh wrens, bobcats, and snapping turtles (Figures 1, 10, 16, 22).

Crooked Lake Site 1:

Emmet County, Michigan. Parcel is 77.6 acres and connects two currently unconnected protects areas to its north and south, creating a total area of over two thousand acres (Figure 26). The eastern half of the parcel consists of deciduous forests with patches of herbaceous grasslands. The western half of the parcel is almost entirely evergreen forest, with small sections of mixed forests and herbaceous grasslands in the northwest corner. A river runs diagonally through the center of the parcel. The corridor would create viable habitat for four species: black bears, red spotted newts, bald eagles, and bobcats (Figures 2, 8, 14, 17).

Crooked Lake Site 2:

Emmet County, Michigan. Parcel is 42.87 acres and would join currently fragmented portions of wetlands. The parcel consists almost entirely of woody wetlands, with sections of herbaceous grasslands, and emergent herbaceous wetlands in its northwestern corner. The corridor would create viable habitat for five species: black bears, mink, red spotted newts, marsh wrens, and snapping turtles (Figures 2, 5, 8, 11, 23).

Crooked Lake Site 3:

Emmet County, Michigan. Parcel is 76.12 acres and connects and large protected zone to a smaller region of protected land. Parcel is composed almost entirely of woody wetlands, with some emergent herbaceous wetlands along where the Crooked River cuts through the parcel. The parcel also includes the intersection of the Crooked River with a smaller stream. The corridor would create viable habitat for six species: black bears, red spotted newts, marsh wrens, bobcats, blue herons, and snapping turtles (Figures 2, 8, 11, 17, 20, 23).

Pickerel Lake Site 1:

Emmet County, Michigan. Parcel is 75.54 acres and would join a small isolated area of protected wetlands to a much larger protected area. The parcel is entirely composed of emergent wetlands. A river cuts through the parcel's northwest corner. The parcel would provide viable habitat for six species: mink, red spotted newts, marsh wrens, bobcats, and blue herons (Figures 5, 8, 11, 17, 20).

Pickerel Lake Site 2:

Cheboygan County, Michigan. Parcel is 40 acres and, together with Pickerel Lake Site 3, is completely surrounded by protected land. Parcel is a mixture of woody and emergent herbaceous wetlands. This parcel would support six species: mink, red spotted newts, marsh wrens, bobcats, blue herons, and snapping turtles (Figures 6, 9, 12, 18, 21, 24).

Pickerel Lake Site 3:

Cheboygan County, Michigan. Parcel is 120 acres and, together with Pickerel Lake Site 2, completely surrounded by protected land. Parcel is a mixture of woody and emergent herbaceous wetlands. Patches of herbaceous grasslands and mixed forest are interspersed throughout the parcel. This parcel would support seven species: black bear, mink, red spotted newts, marsh wrens, bobcats, blue herons, and snapping turtles (Figures 3, 6, 9, 12, 18, 21, 24).

Discussion:

Ideally, top priority parcels for use as wildlife corridors should support all species in a given area. However, in practice, identifying wildlife corridors is largely a task of selecting relatively unaltered parcels from areas which have already been subjected to significant alteration, and such parcels are nearly impossible to find. As such, decisions must be made as to whether to prioritize certain species over others. Our prioritization of parcels was based

exclusively on the number of species of interest that a given parcel was able to support. The number of species supported by each parcel was given precedence over the relative abundance of each species because our species of interest are umbrella species. The objective of our study was not to create viable habitat for these species specifically, but rather to use these species as indicators of overall habitat viability. By definition, the habitat requirements of umbrella species encompass the needs of many other species. It follows logically that a parcel that supports the greatest number of umbrella species will support the greatest number of species overall, making for the most effective wildlife corridors.

Recommendations:

For each watershed, the three sites described above in the "Results" section created viable habitat for the most species, and should receive priority in the formation of new wildlife corridors.

Burt Lake Watershed

- Burt Lake Site 1 (FID 2953 of Burt Lake Cheboygan Parcel Map) should receive high priority protection status, and could be used as an effective corridor even if purchased alone. Burt Lake Site 2 (FID 2952 of Burt Lake Cheboygan Parcel Map) should can be utilized as an effective corridor only if protected together with Burt Lake Site 1.
- Burt Lake Site 3 (FID1028 of Burt Lake Cheboygan Parcel Map) should receive high priority parcel protection status, particularly in the interest of expanding viable habitat for large predators, such as black bears.

Crooked Lake Watershed

- Crooked Lake Site 1 (FID 5401 of Parcels Intersecting Crooked Lake Watershed Map) should receive high priority protection status, particularly in the interest of expanding viable bald eagle habitat.
- Crooked Lake Site 2 (FID 4615 of Parcels Intersecting Crooked Lake Watershed Map) should receive high priority protection status, particularly in the interest of expanding viable habitat for large predators, such as black bears.
- Crooked Lake Site 3 (FID 1545 of Parcels Intersecting Crooked Lake Watershed Map) should receive high priority protection status, as it is able to support one of the widest species varieties.

Pickerel Lake Watershed

- Pickerel Lake Site 1 (FID 362 of the Cheboygan Parcel Pickerel Map) should receive high priority protection status, as it is able to support one of the widest species varieties, and would connect a currently isolated patch of protected wetlands to a larger protected area.
- Pickerel Lake Sites 2 and 3 (FIDs 211 and 210 of the Cheboygan Parcel Pickerel Map) would be most effective if protected together. Individually, Pickerel Lake Site 3 supports the most umbrella species of any single parcel in our study.

Literature Cited

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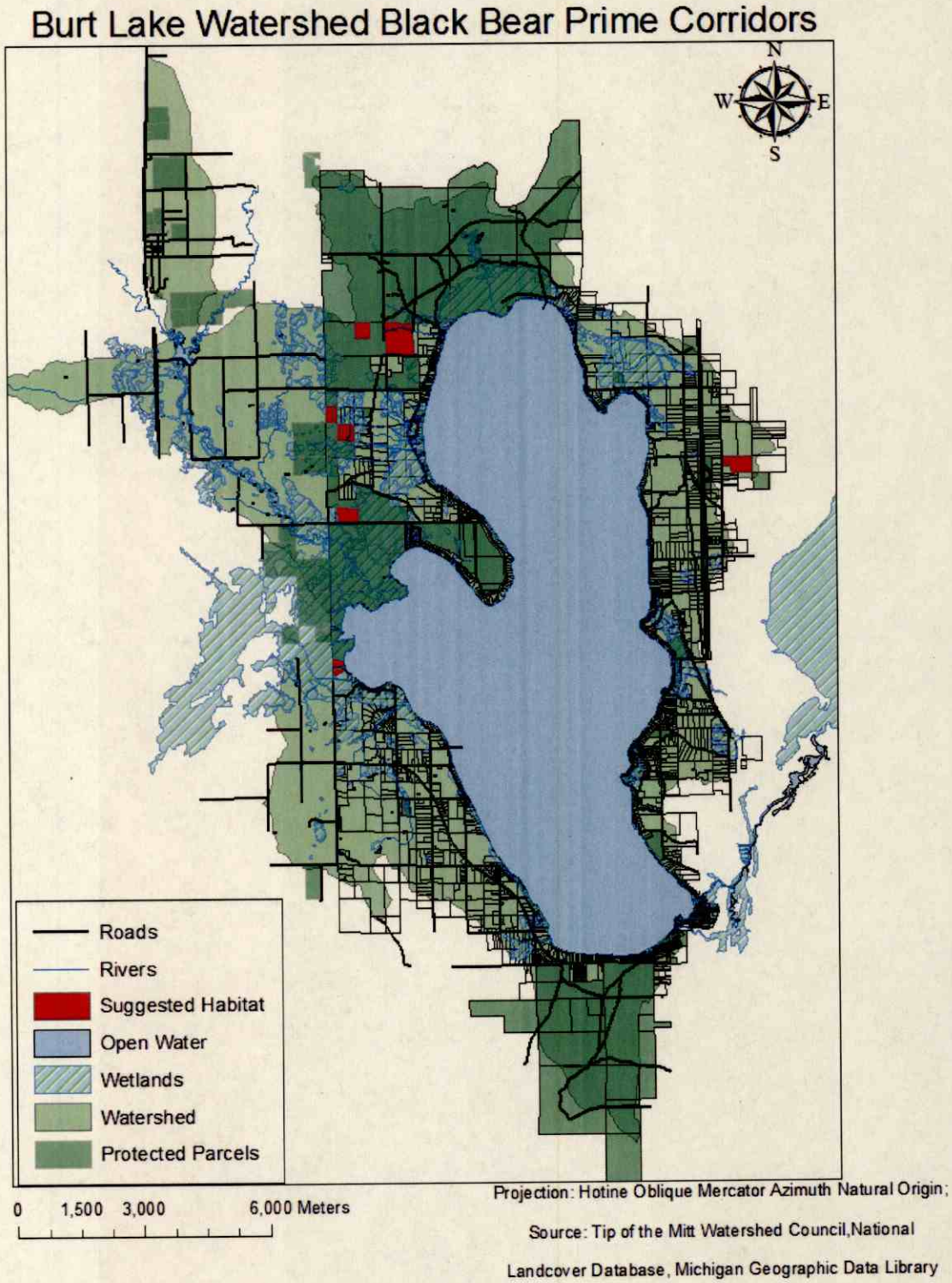
Rogers, L.L., and A.W. Allen. 1987. Habitat suitability index models: black bear, Upper Great Lakes Region. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.144). 54 pp.

Figure 1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Source: Tip of the Mitt Watershed Council,National
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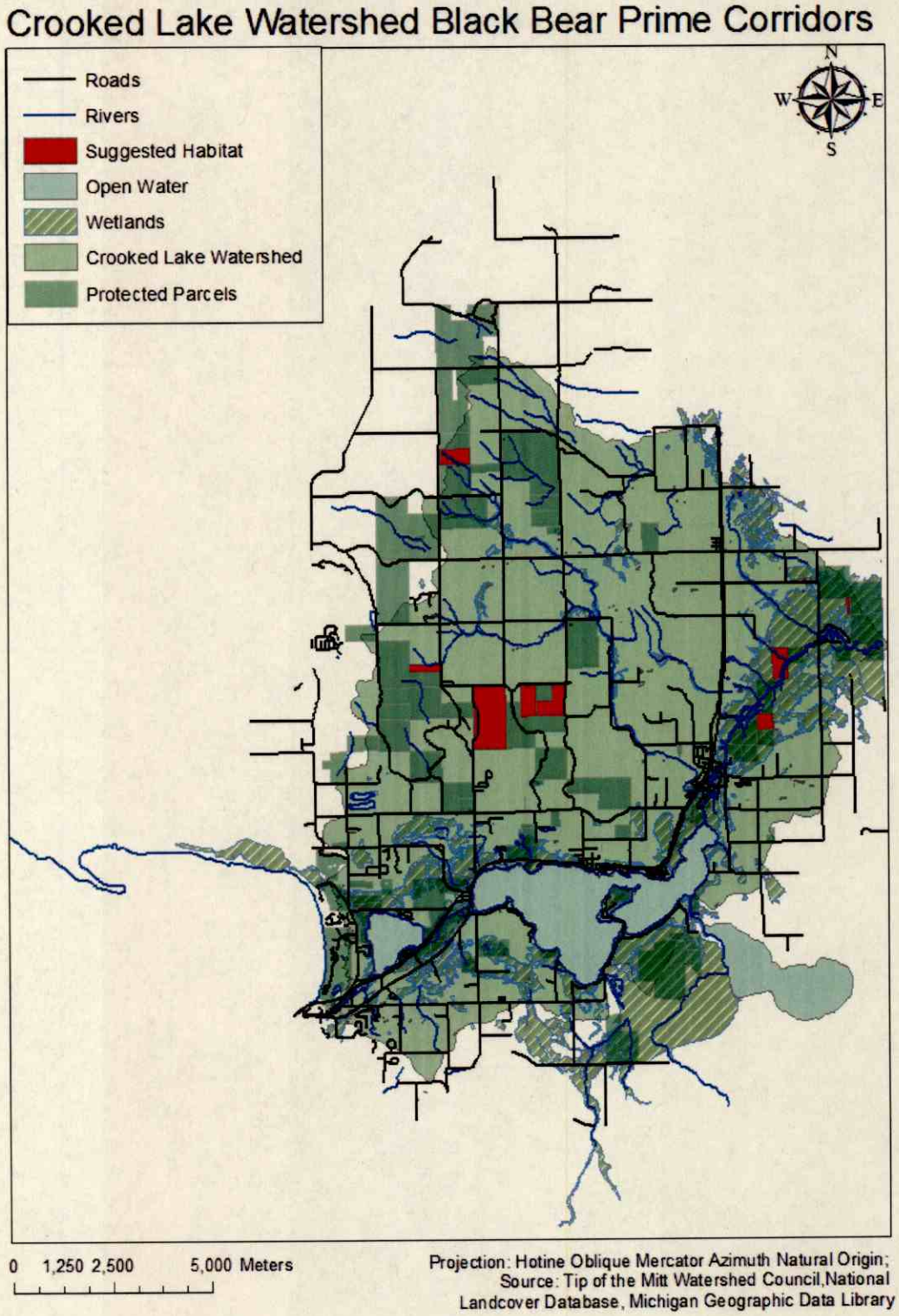
Figure 2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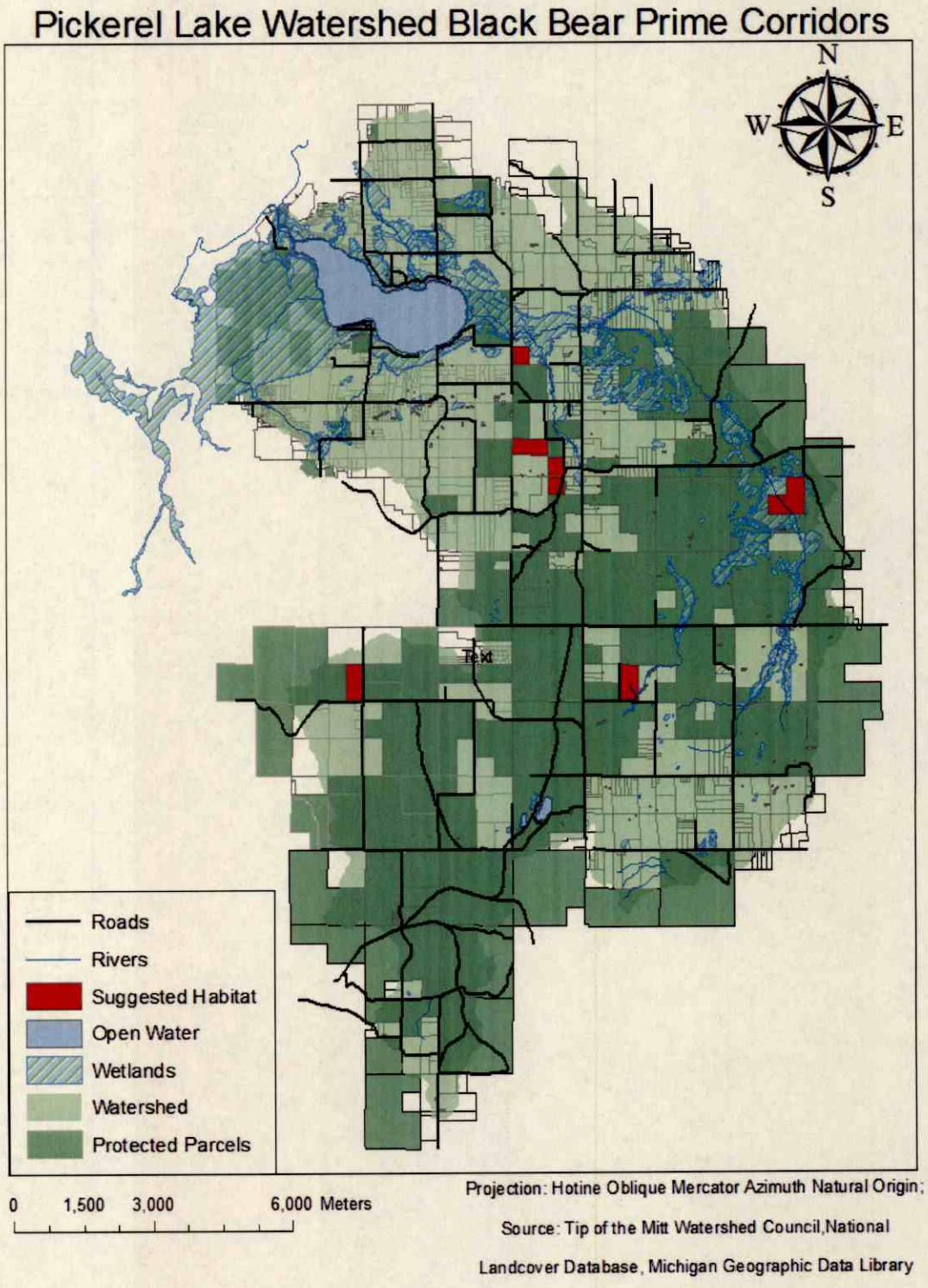
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Figure 4

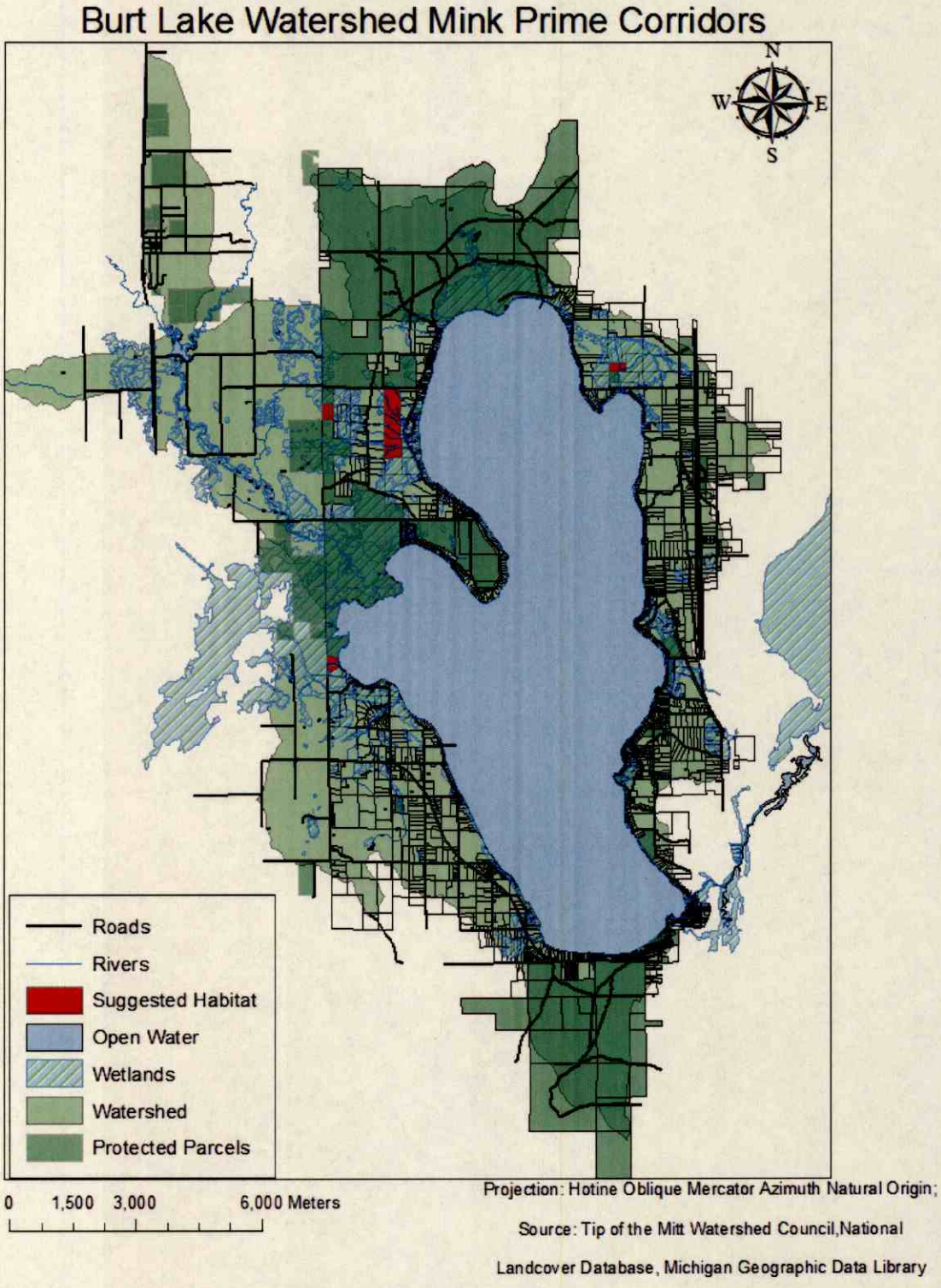
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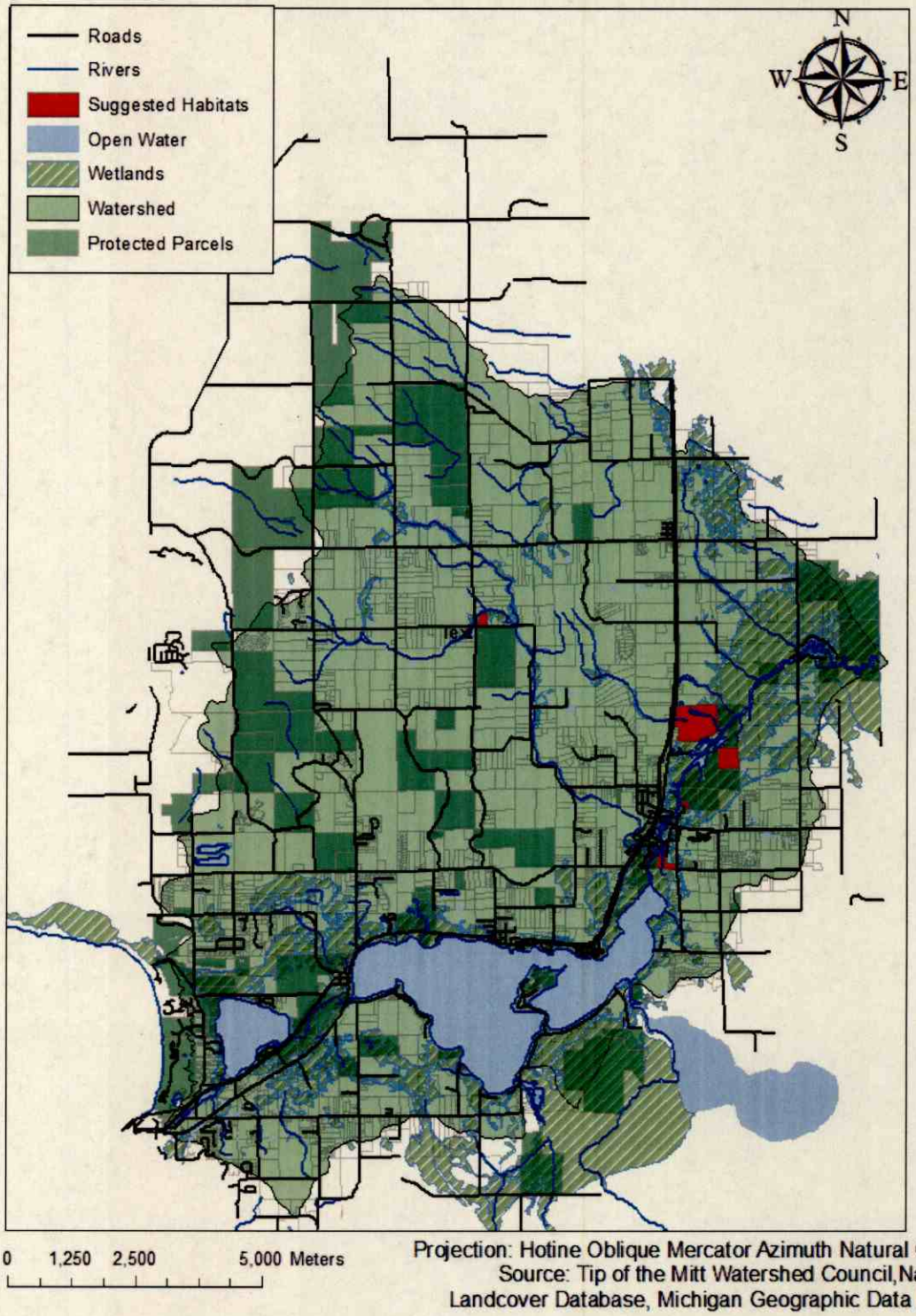
Figure 5

Crooked Lake Watershed Mink Prime Corridors



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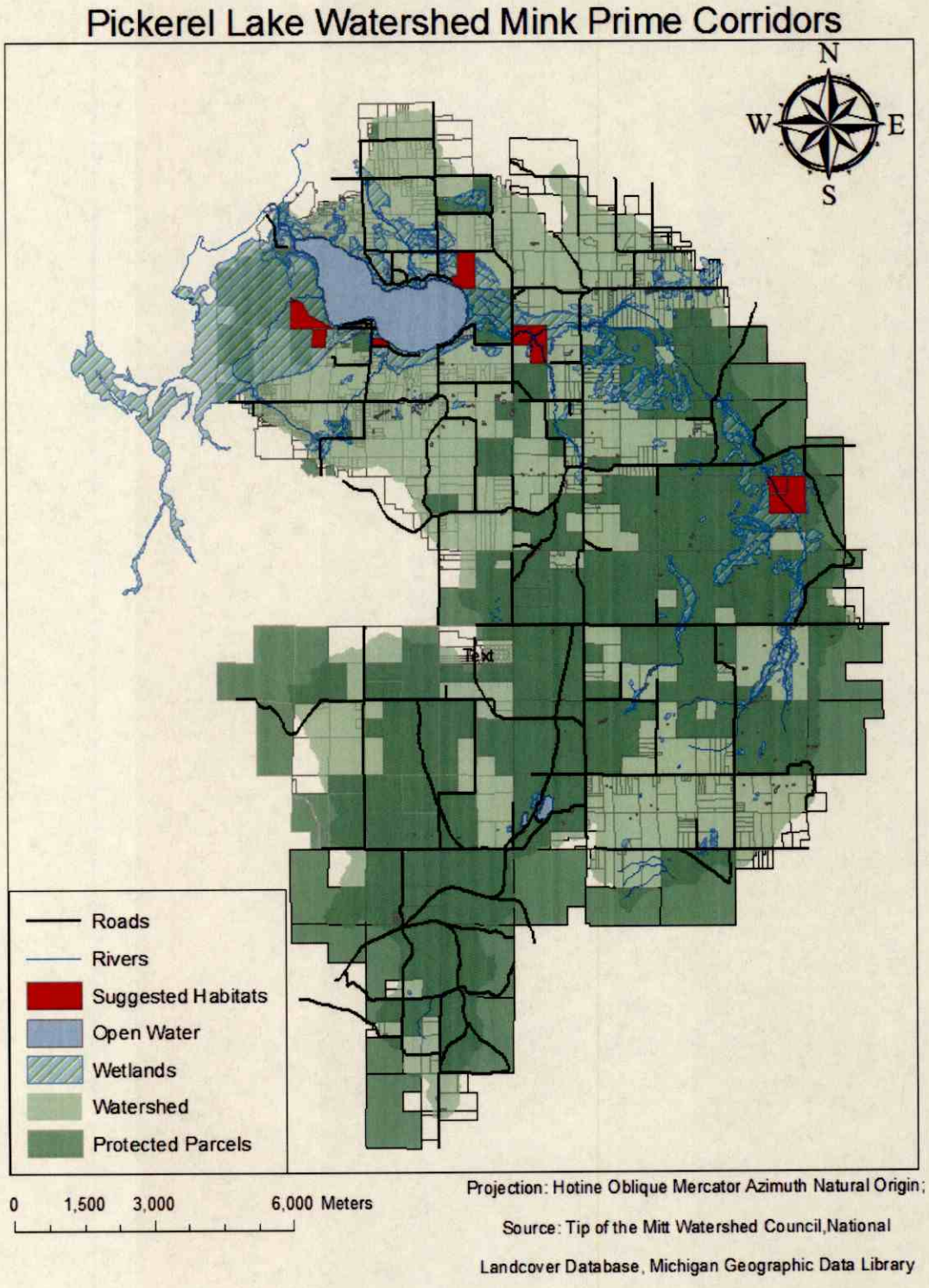
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Figure 7

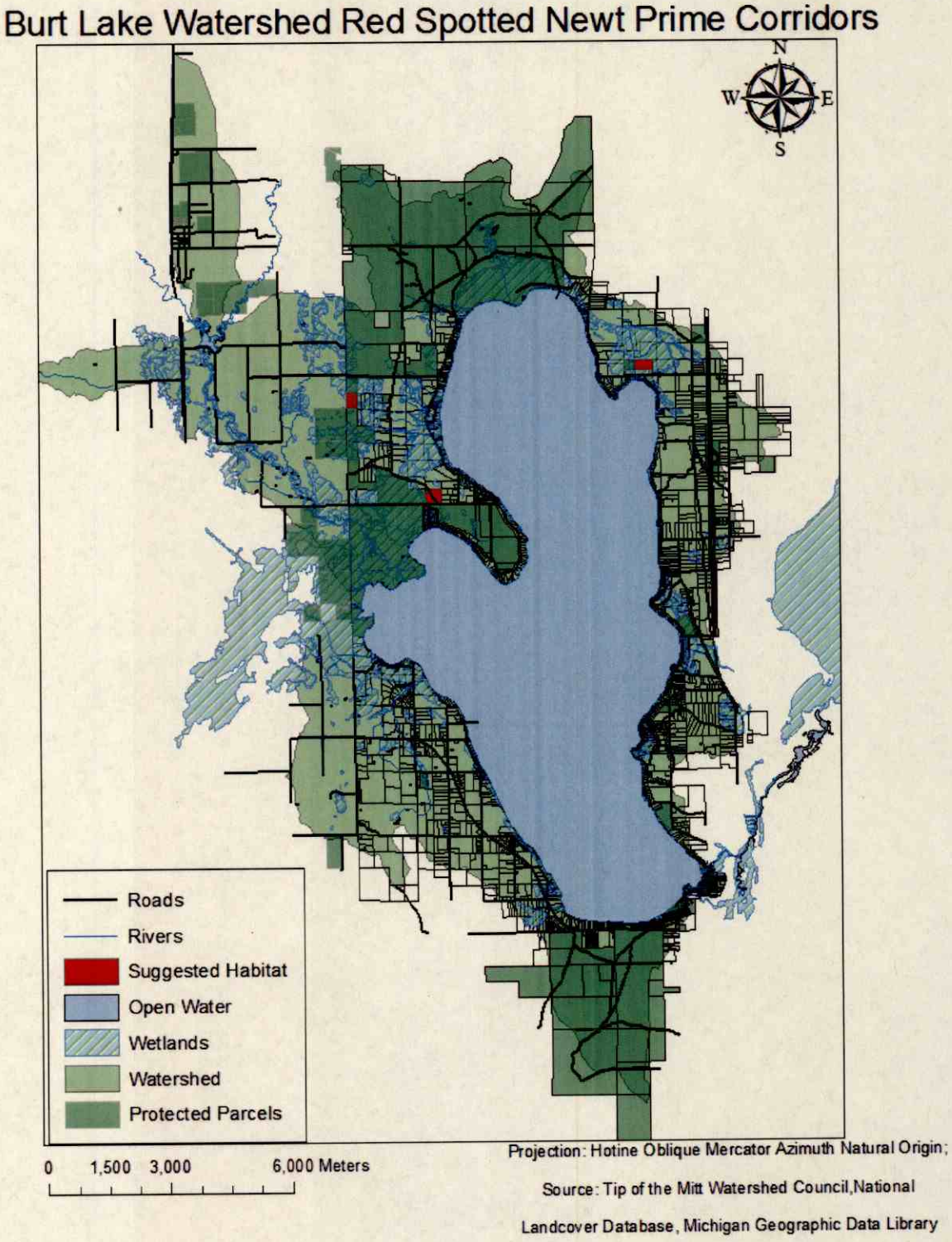
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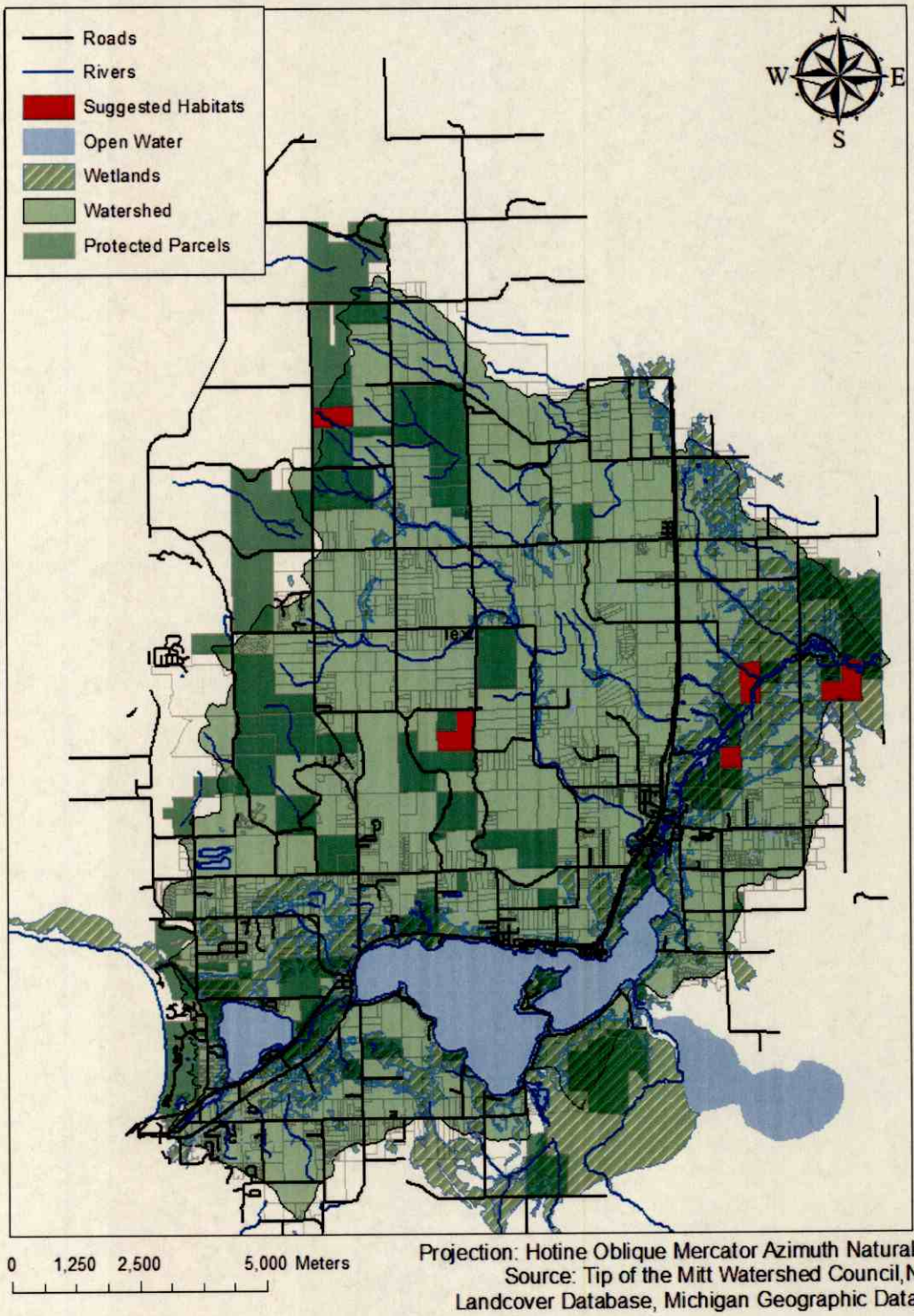
Figure 8

Crooked Lake Watershed Red Spotted Newt Prime Corridors



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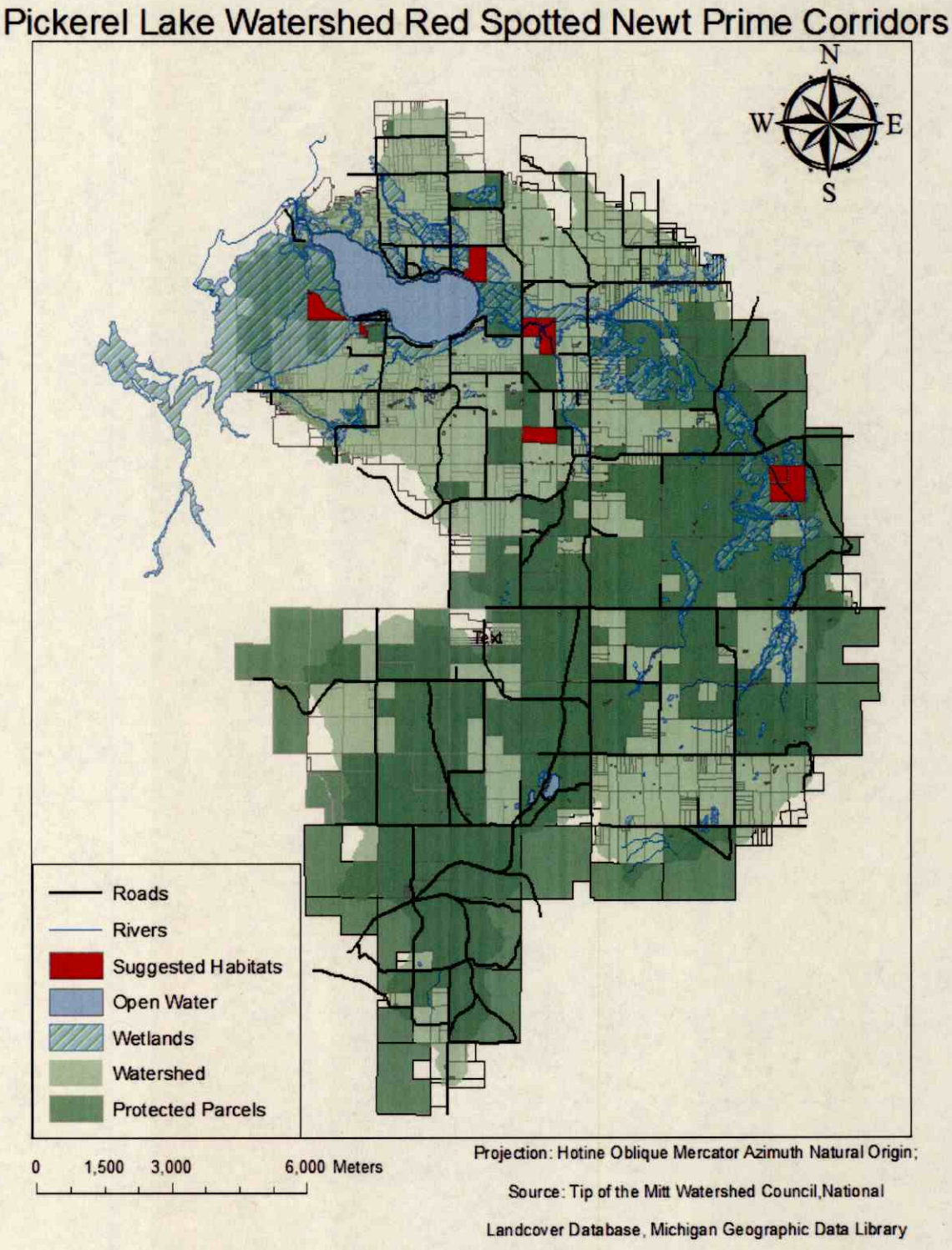
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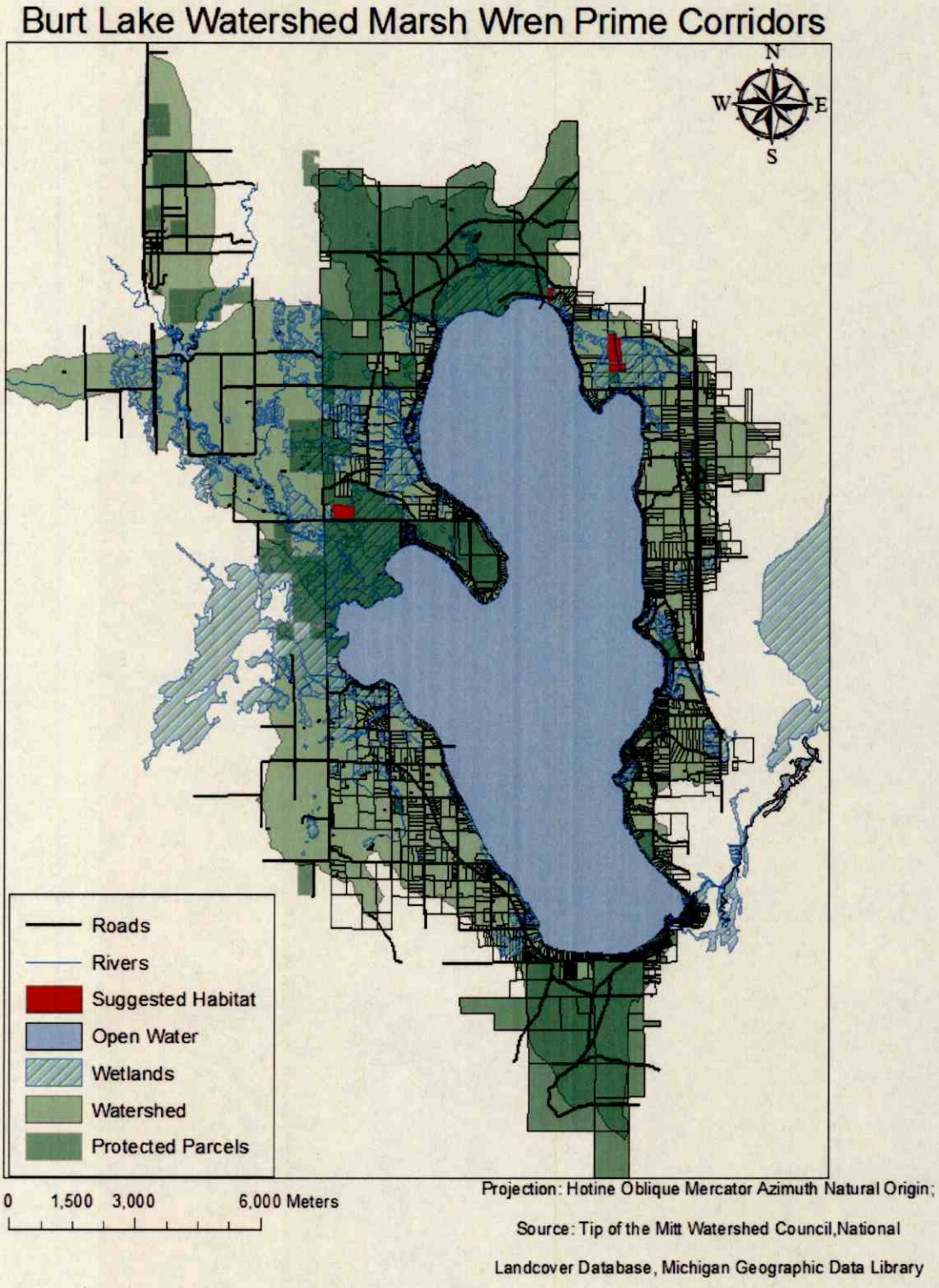
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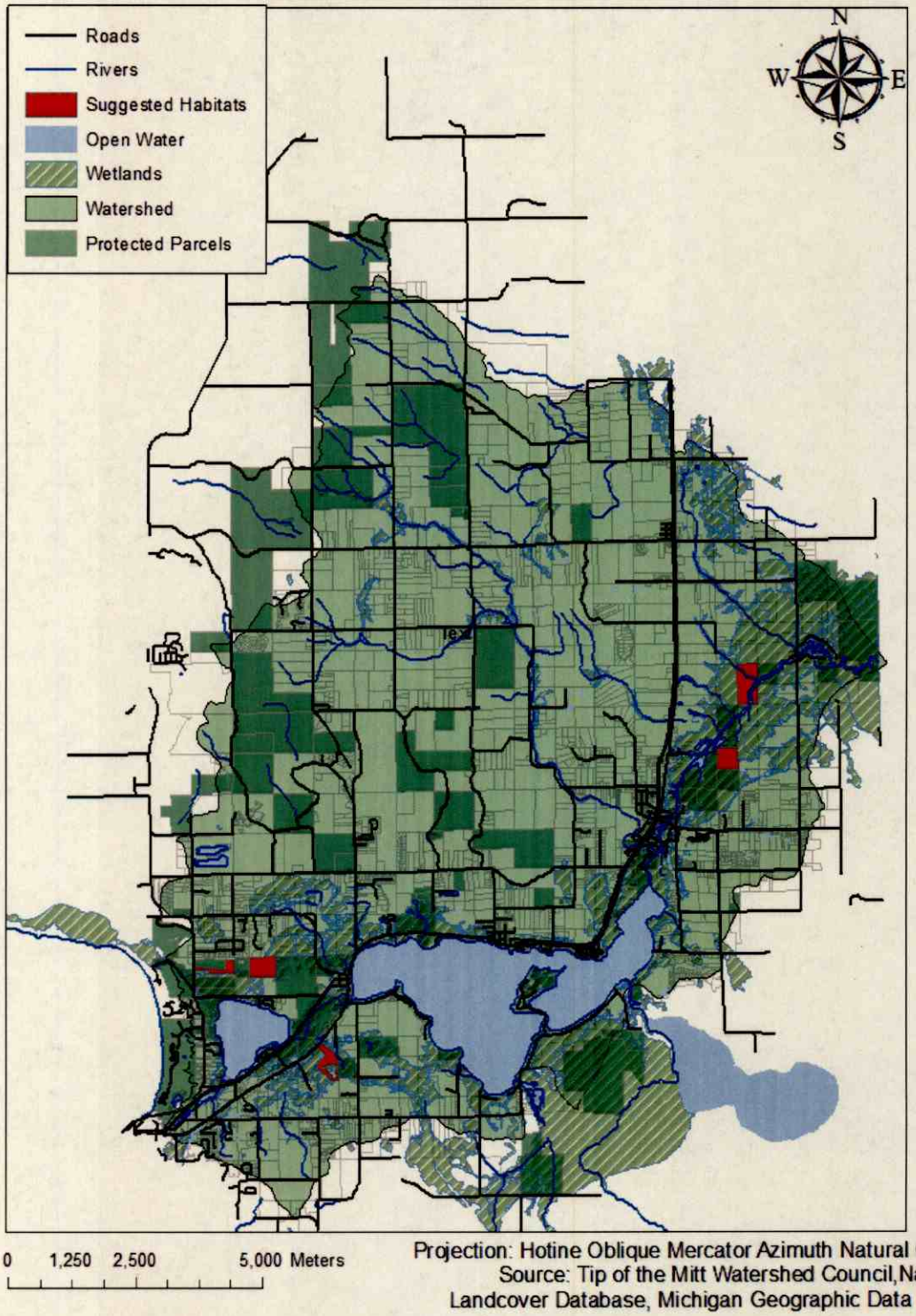
Figure 11

Crooked Lake Watershed Marsh Wren Prime Corridors



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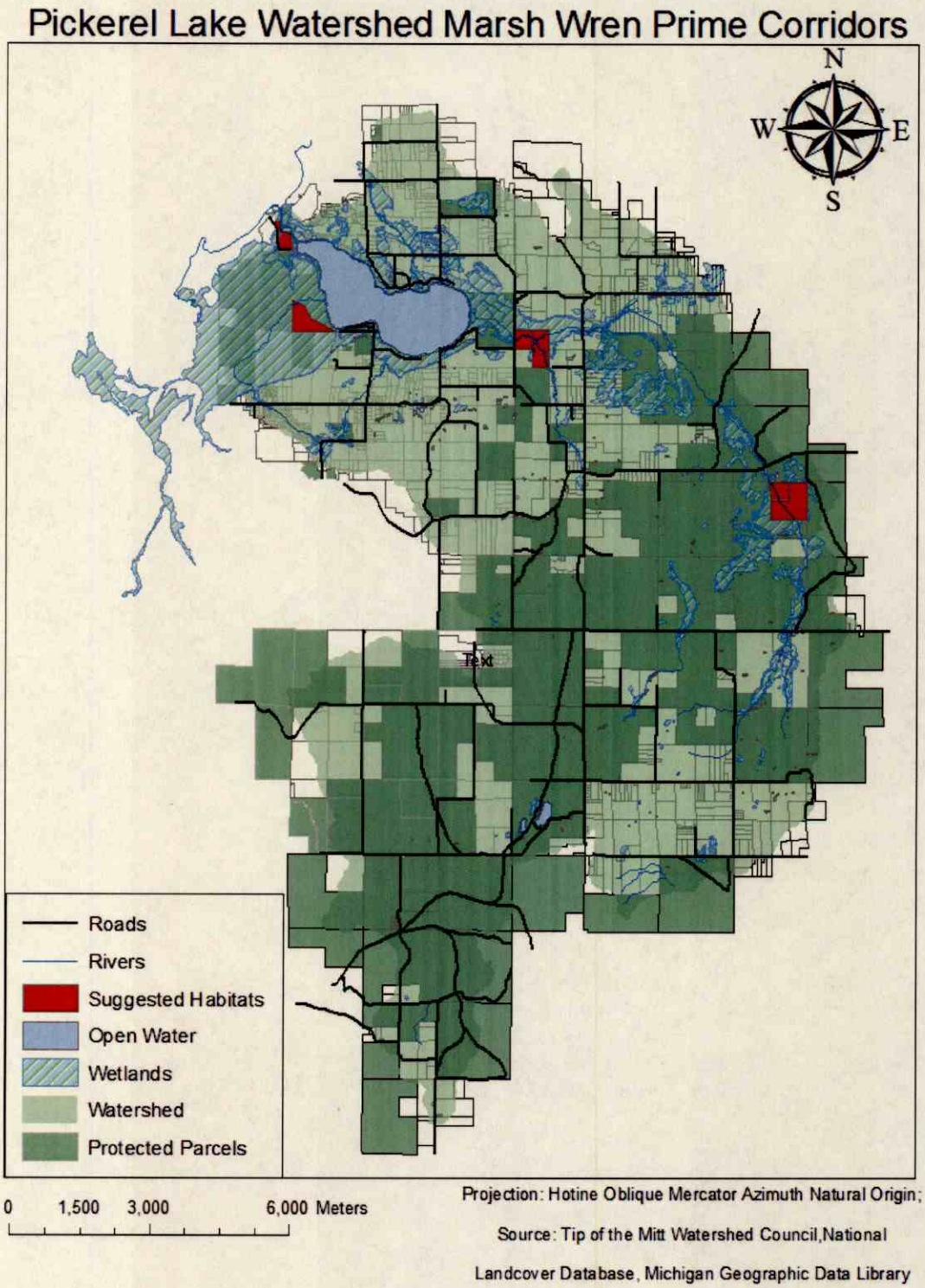
Pickerel Lake Watershed Marsh Wren Prime Corridors
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Figure 13

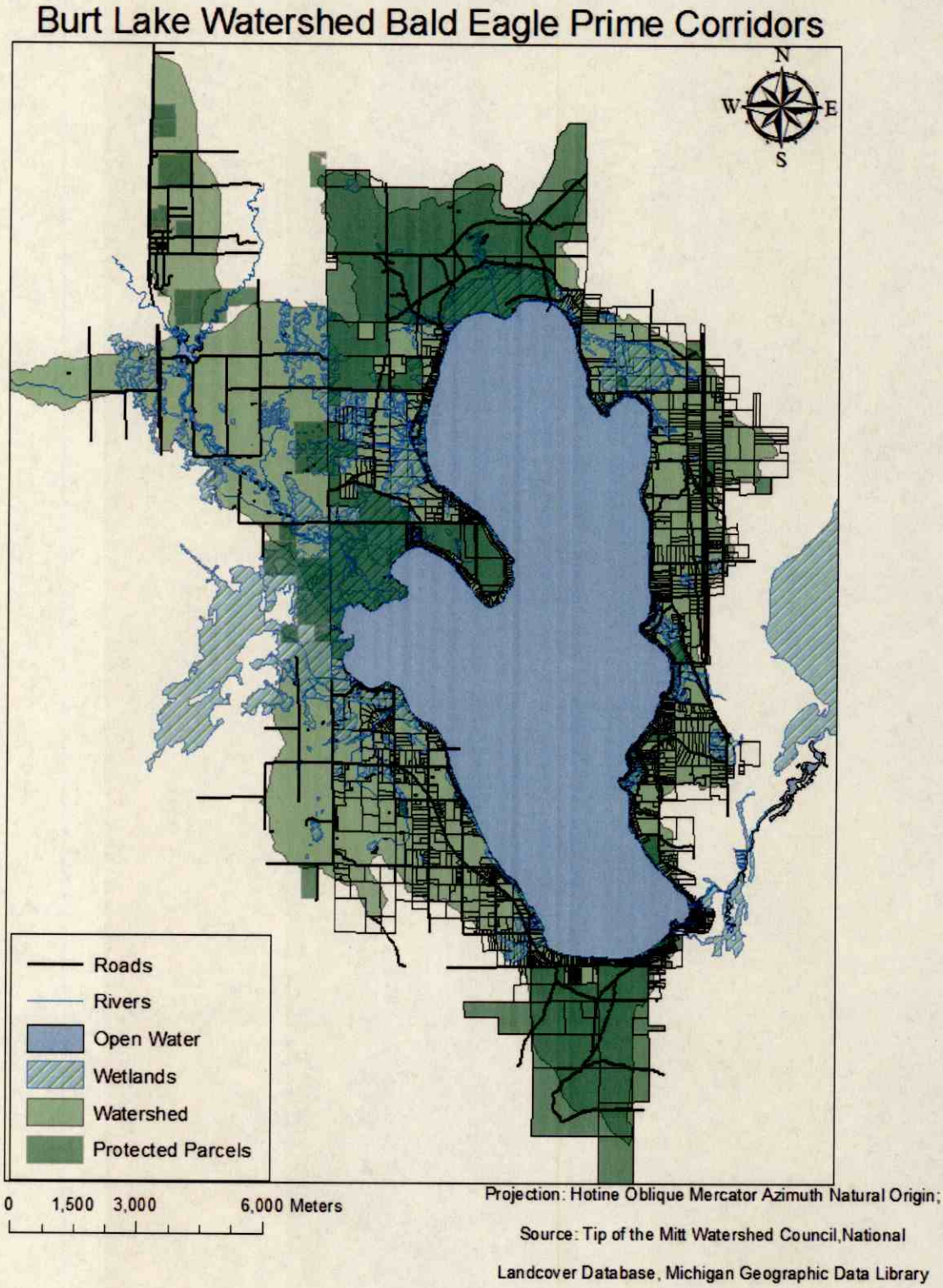
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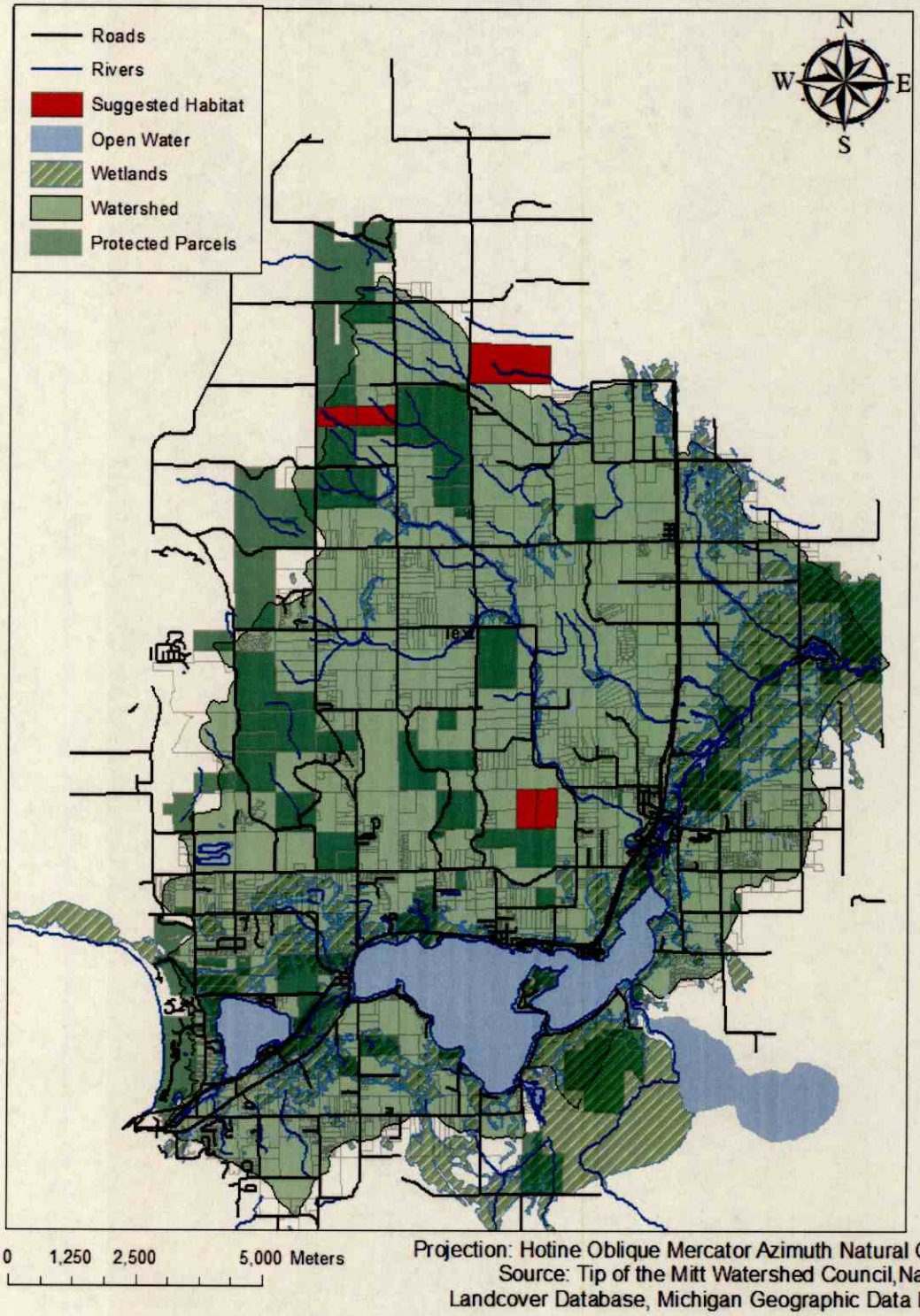
Figure 14

Crooked Lake Watershed Bald Eagle Prime Corridors



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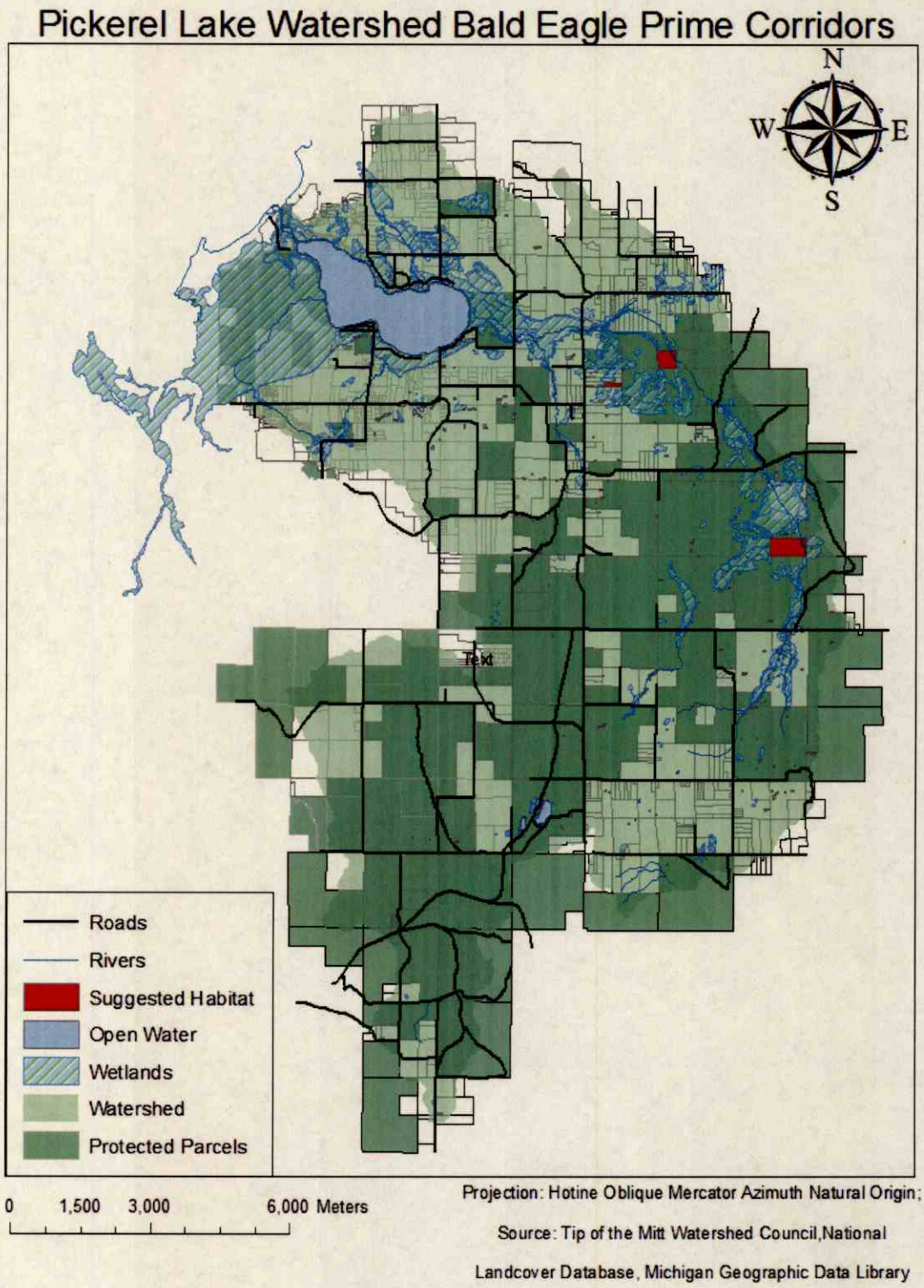
Pickerel Lake Watershed Bald Eagle Prime Corridors
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Figure 16

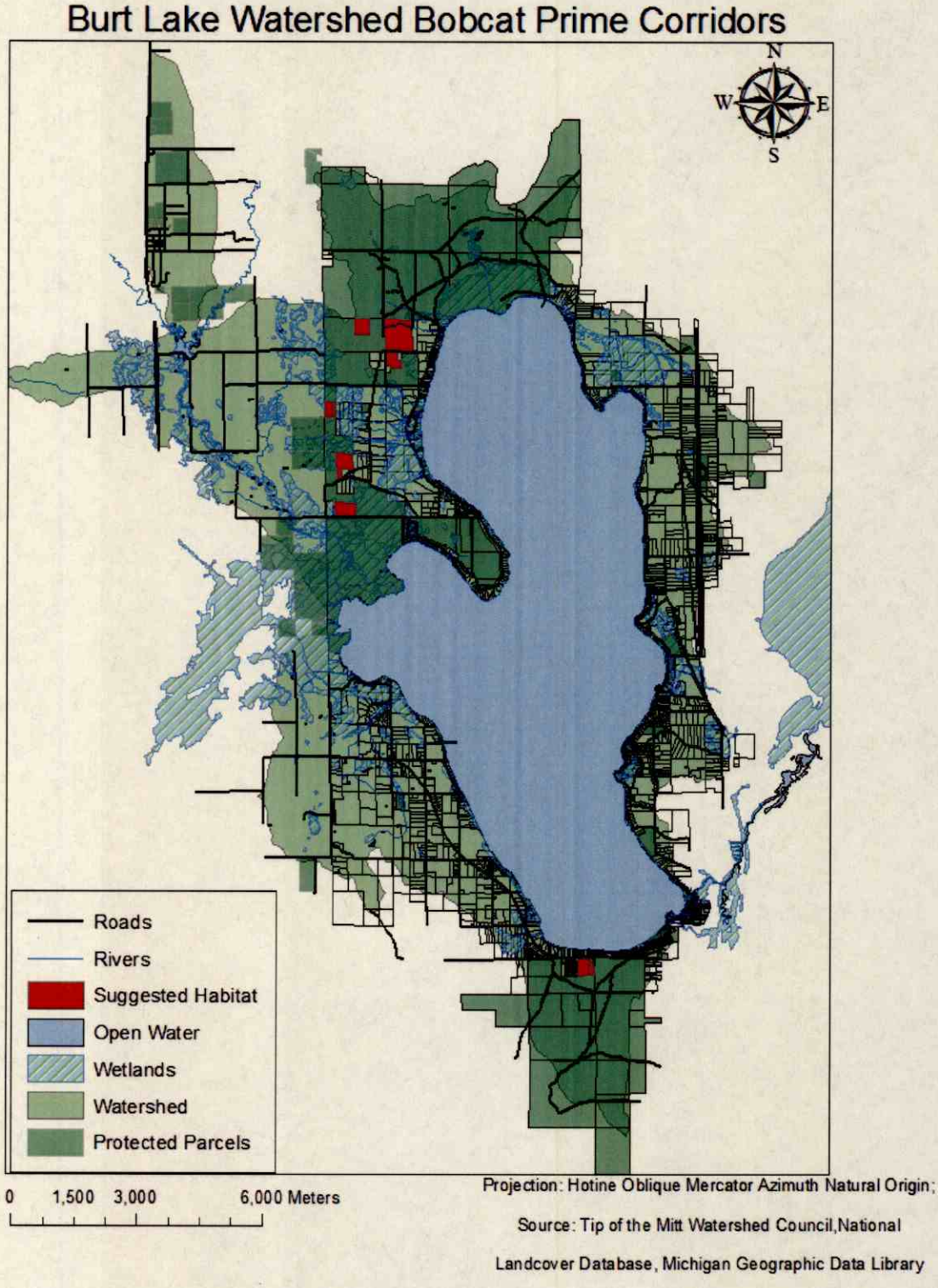
Burt Lake Watershed Bobcat Prime Corridors
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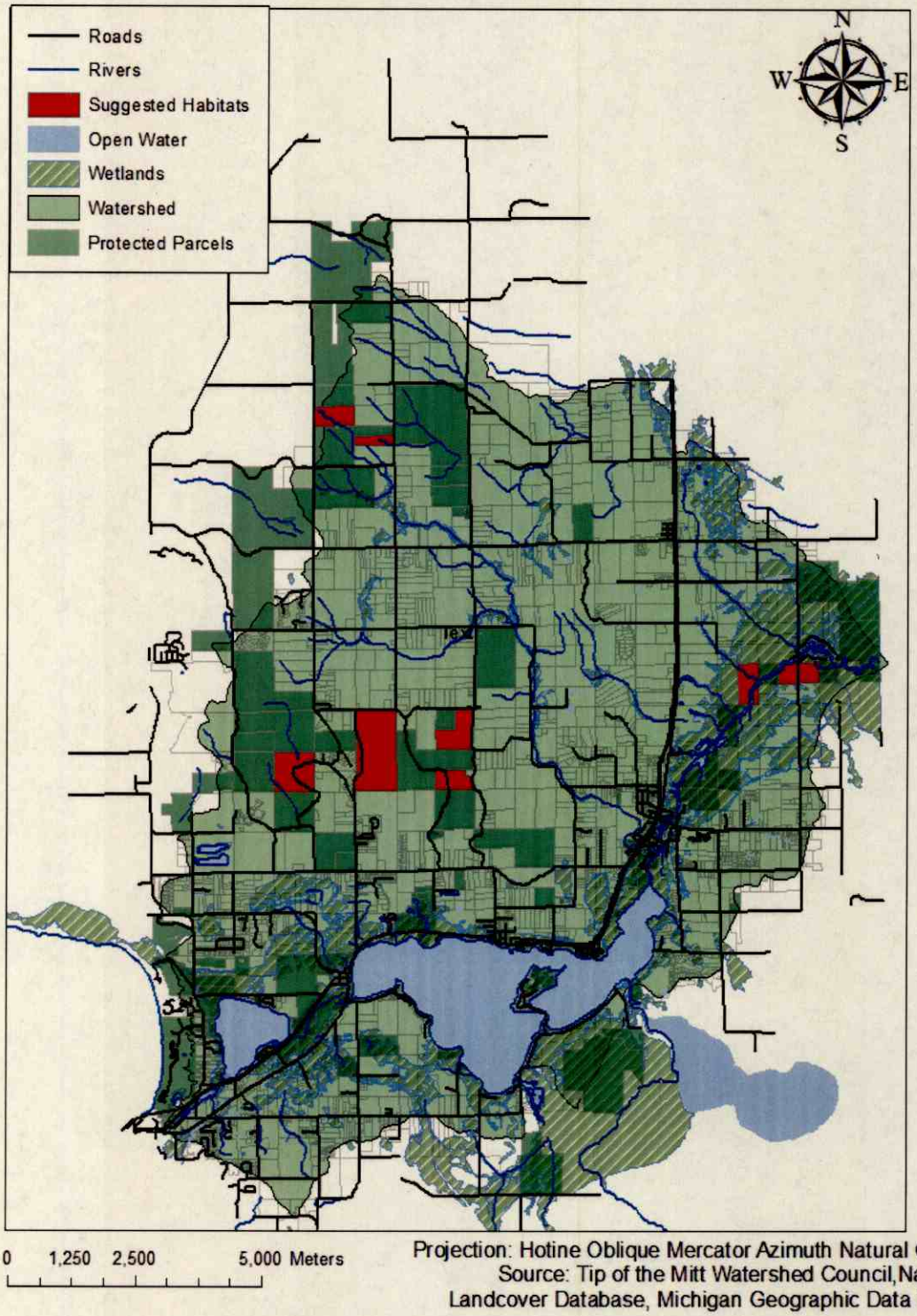
Figure 17

Crooked Lake Watershed Bobcat Prime Corridors



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Source: Tip of the Mitt Watershed Council, National Landcover Database, Michigan Geographic Data Library

Figure 18

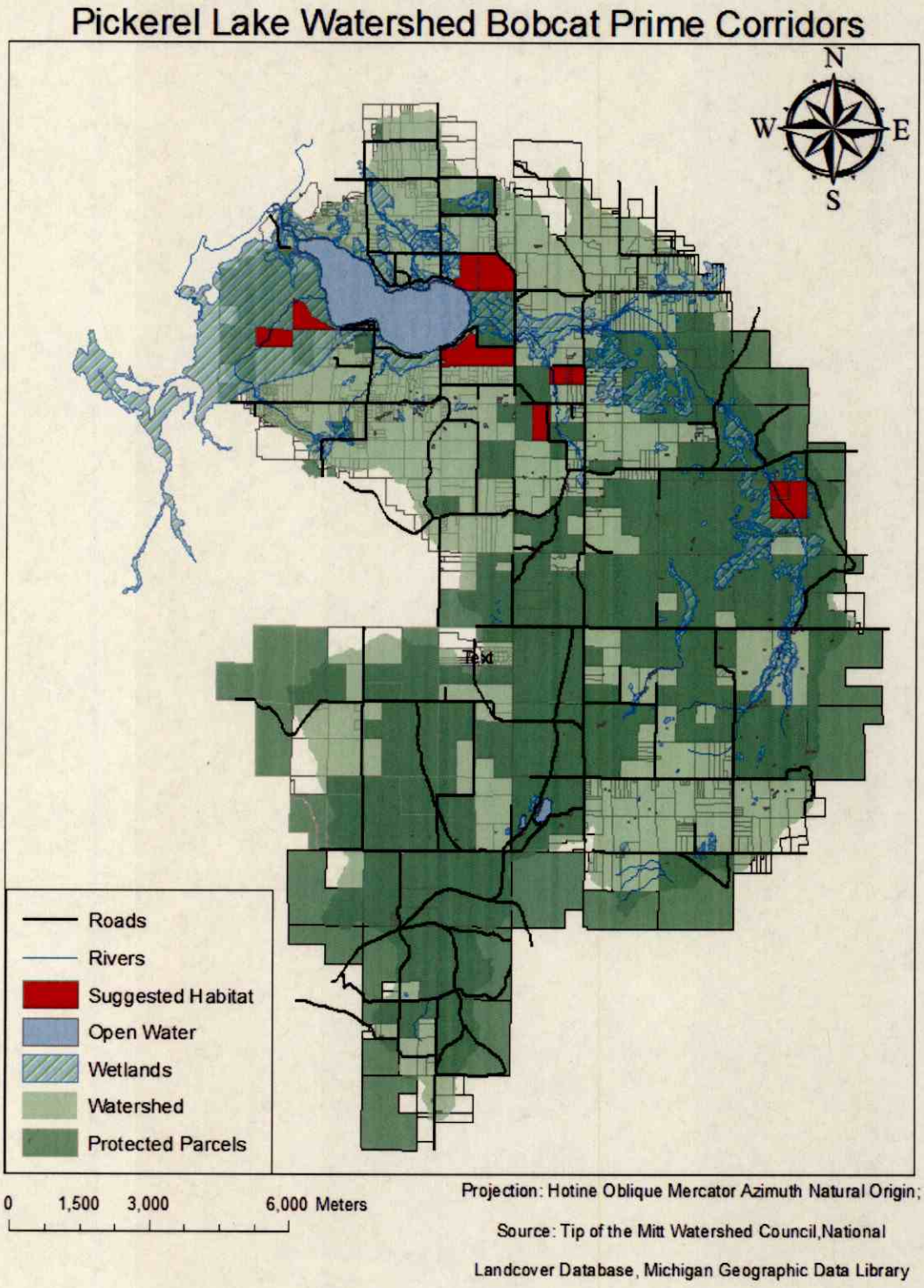

Pickerel Lake Watershed Bobcat Prime Corridors
N
W
E
S
Text
Roads
Rivers
Suggested Habitat
Open Water
Wetlands
Watershed
Protected Parcels
0
1,500
3,000
6,000 Meters
Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council,National
Landcover Database, Michigan Geographic Data Library

Figure 19

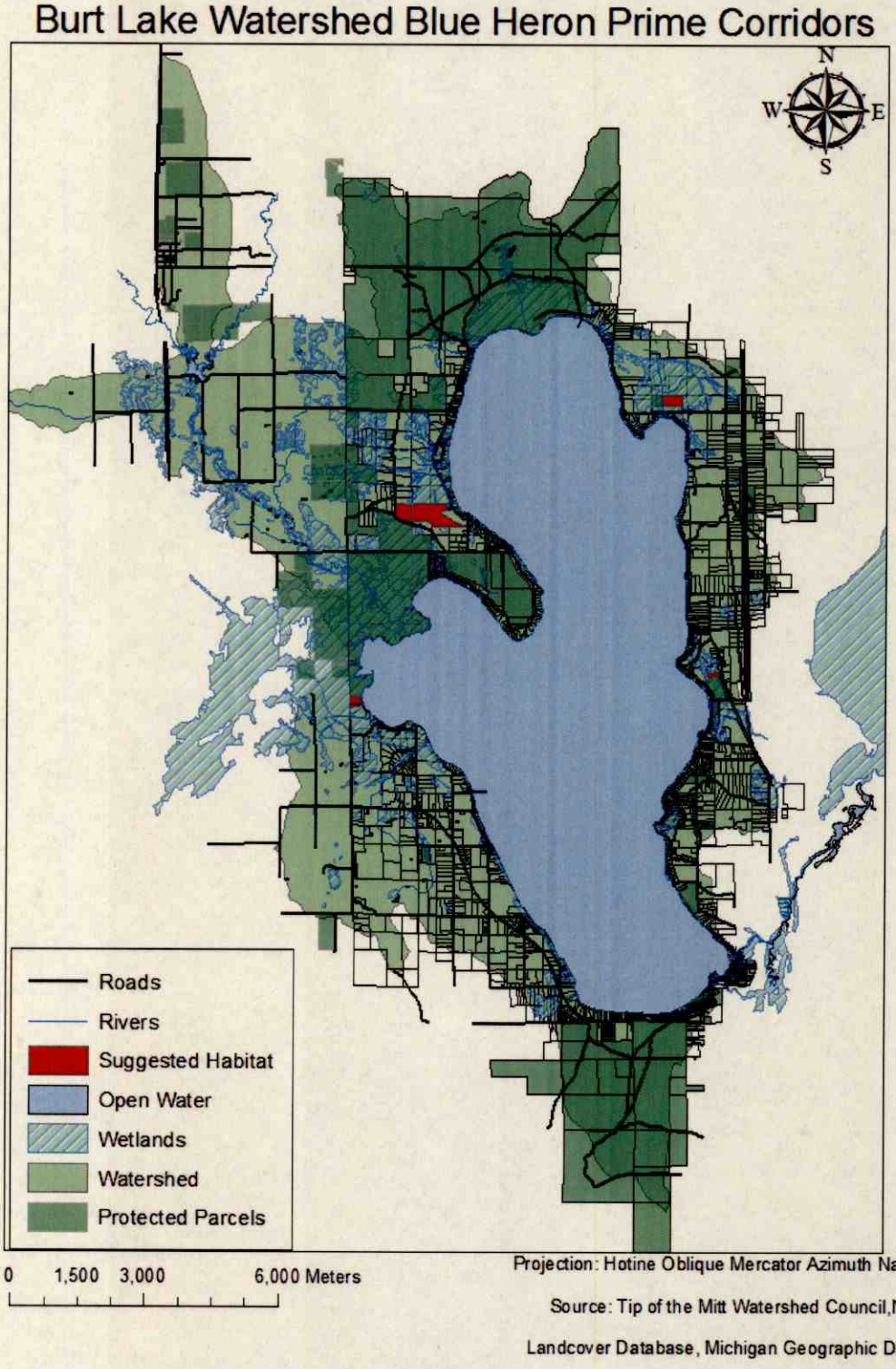
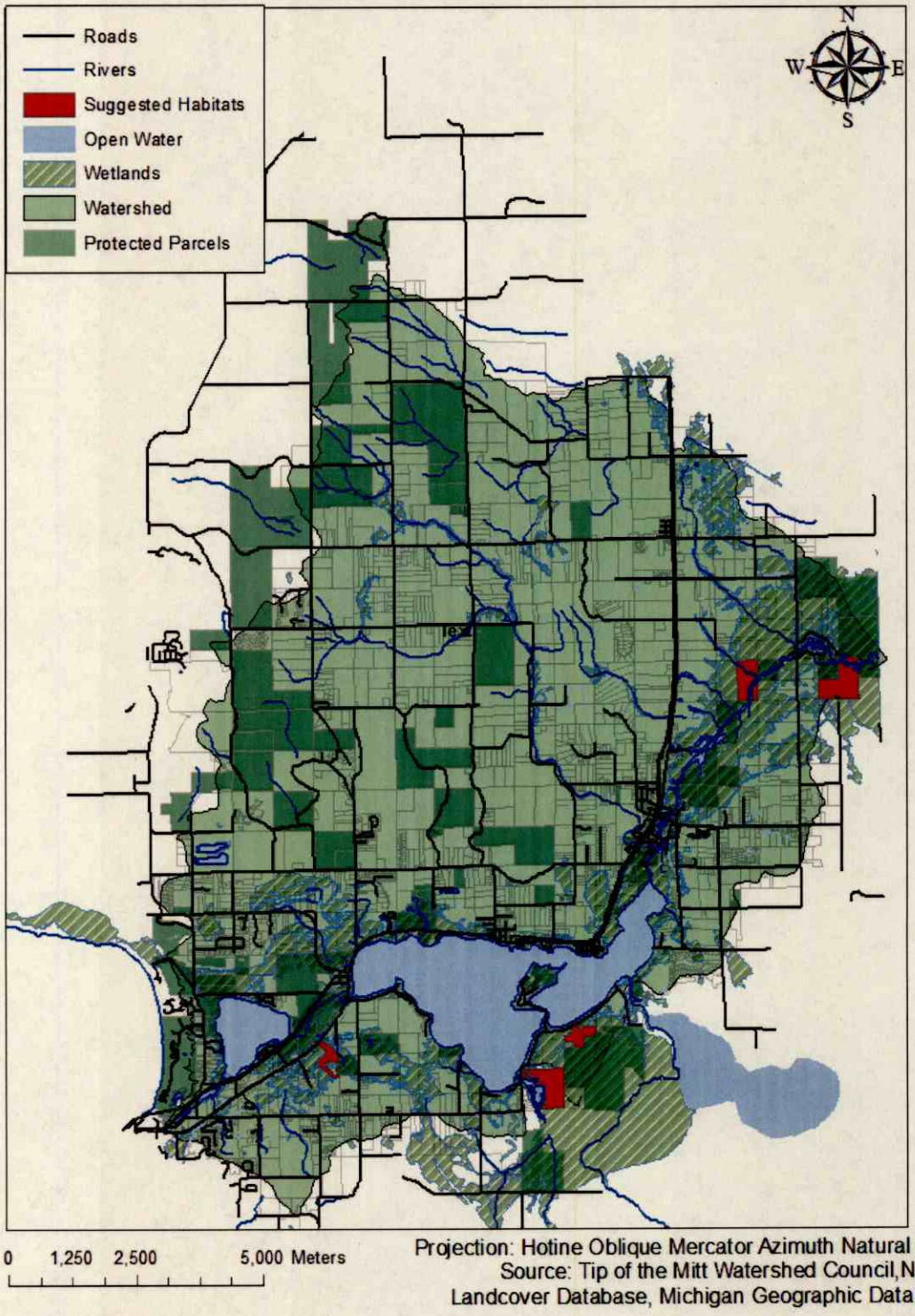

Burt Lake Watershed Blue Heron Prime Corridors
N
W
E
S
Roads
Rivers
Suggested Habitat
Open Water
Wetlands
Watershed
Protected Parcels
0
1,500
3,000
6,000 Meters
Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council,National
Landcover Database, Michigan Geographic Data Library

Figure 20

Crooked Lake Watershed Blue Heron Prime Corridors



Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council,National Landcover Database, Michigan Geographic Data Library

Figure 21

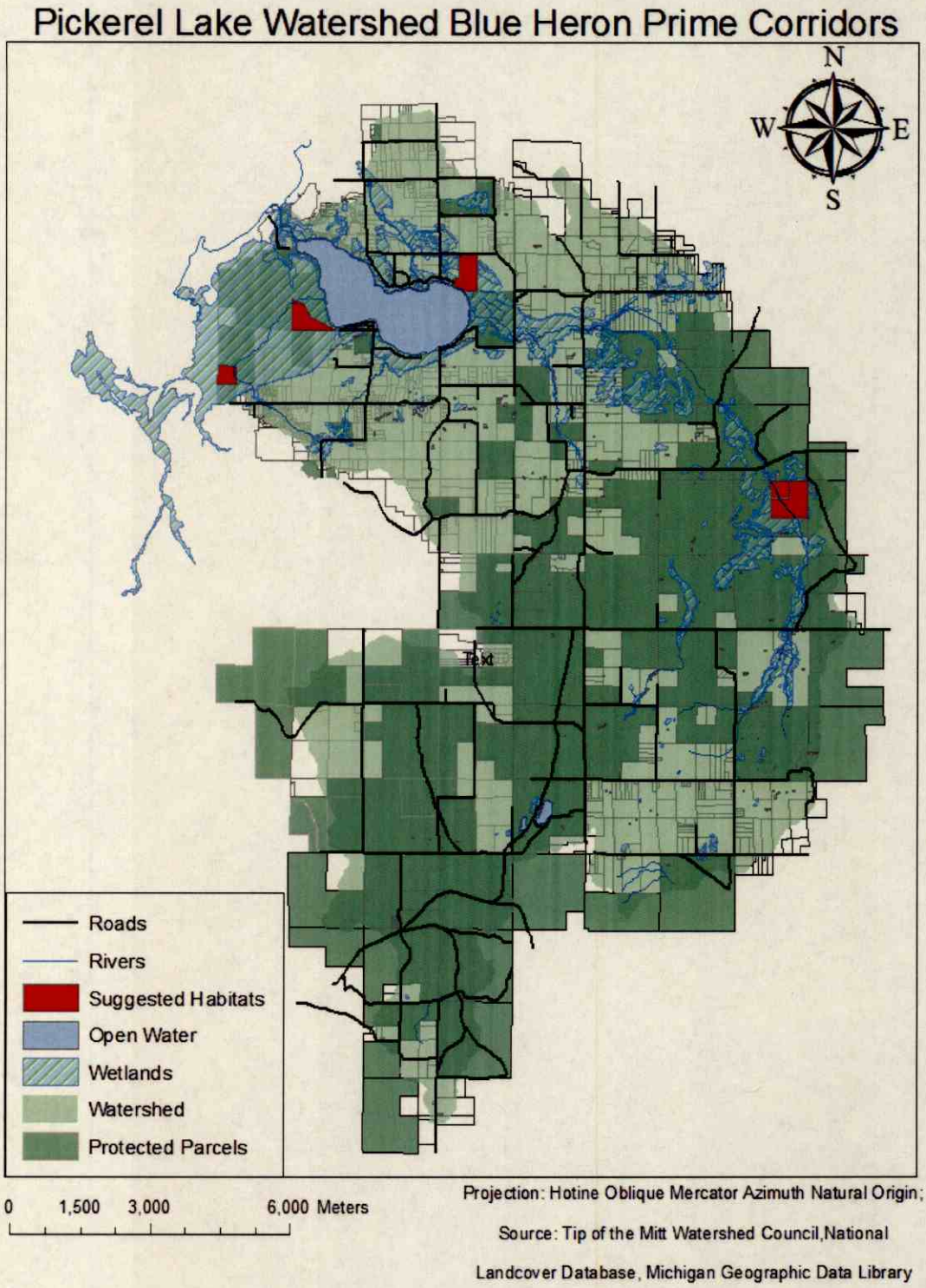

Pickerel Lake Watershed Blue Heron Prime Corridors
N
W
E
S
Roads
Rivers
Suggested Habitats
Open Water
Wetlands
Watershed
Protected Parcels
0
1,500
3,000
6,000 Meters
Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council, National
Landcover Database, Michigan Geographic Data Library

Figure 22

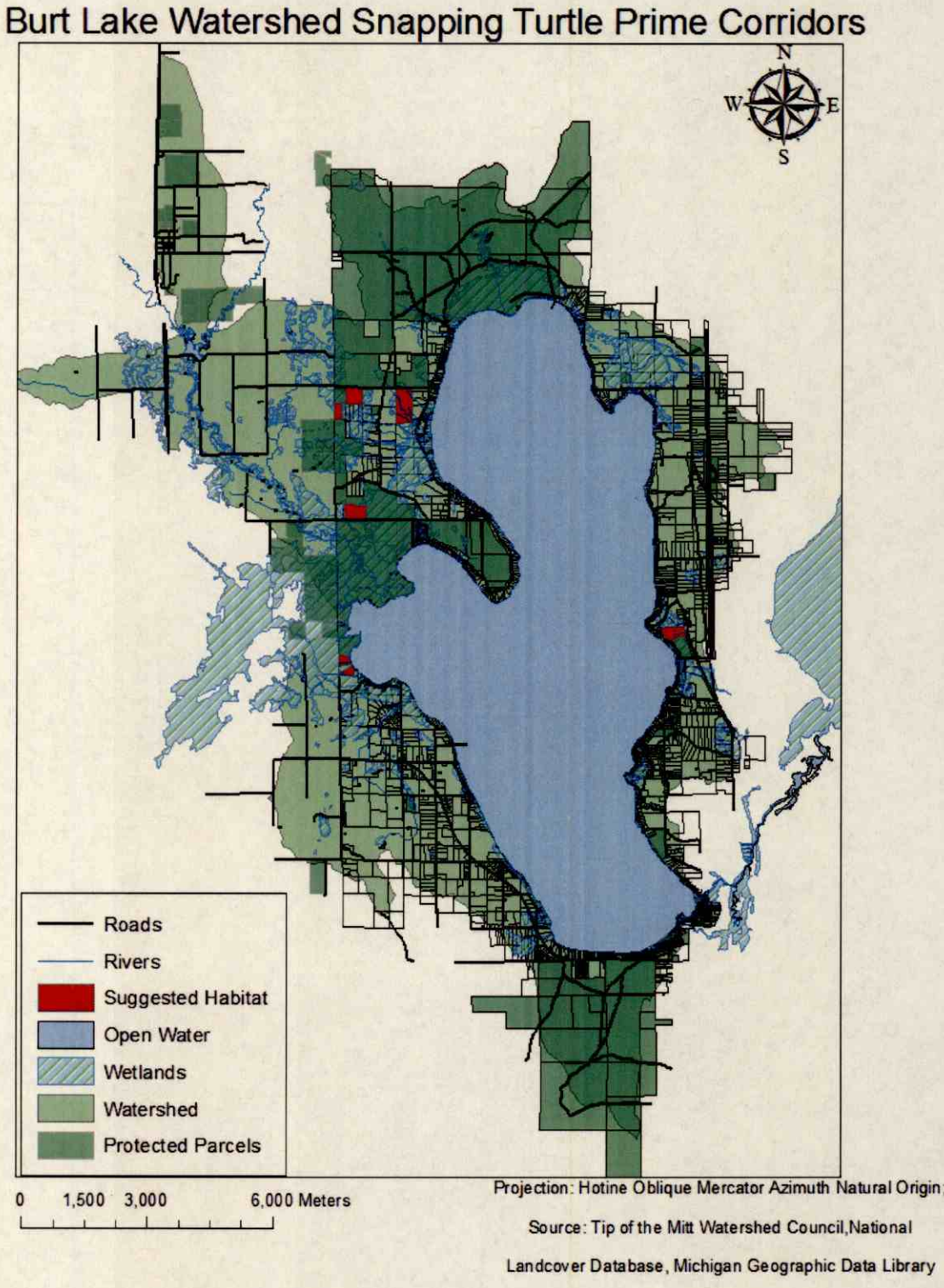
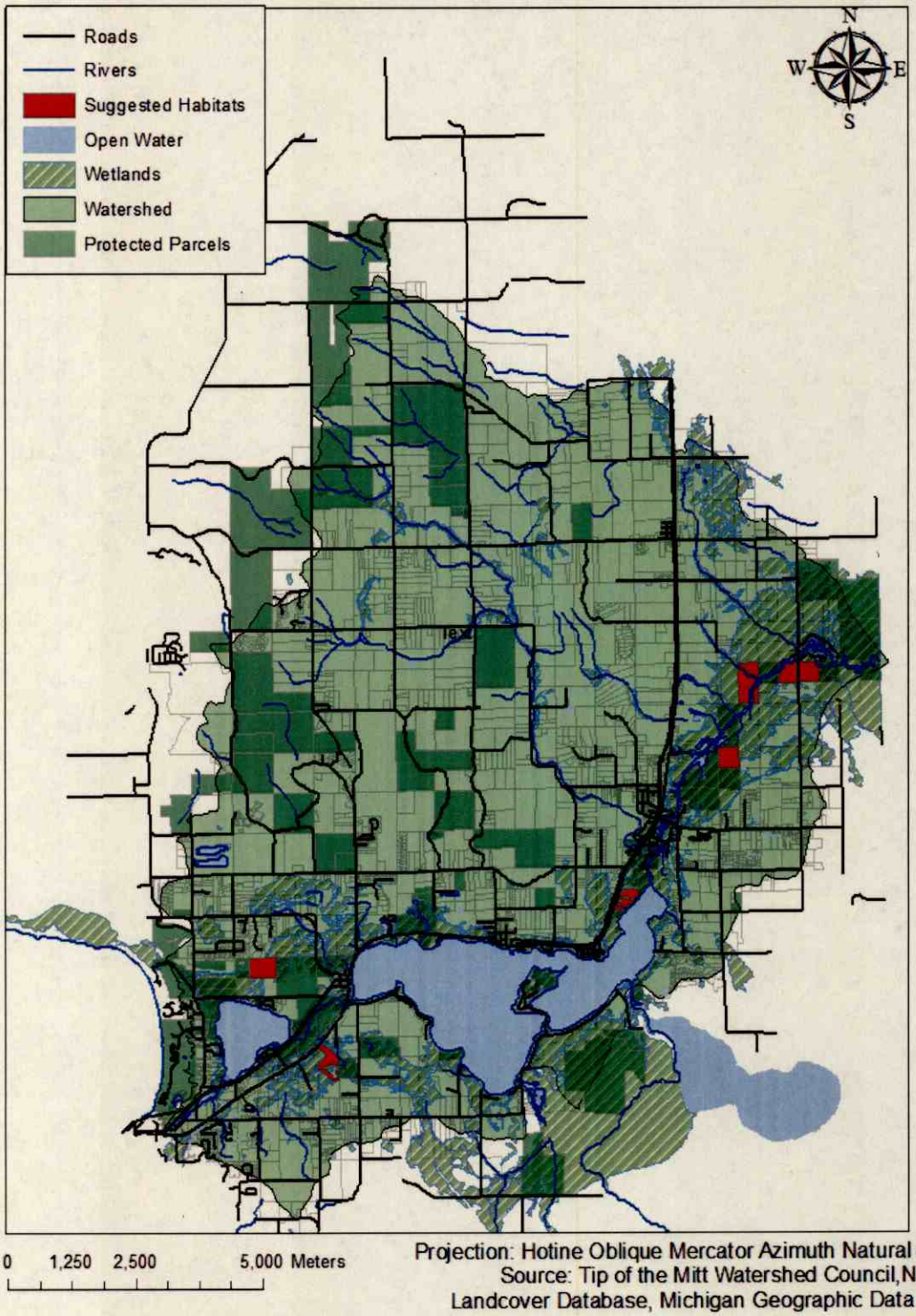

Burt Lake Watershed Snapping Turtle Prime Corridors
N
W
E
S
Roads
Rivers
Suggested Habitat
Open Water
Wetlands
Watershed
Protected Parcels
0
1,500
3,000
6,000 Meters
Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council,National
Landcover Database, Michigan Geographic Data Library

Figure 23

Crooked Lake Watershed Snapping Turtle Prime Corridors



Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council, National Landcover Database, Michigan Geographic Data Library

Figure 24

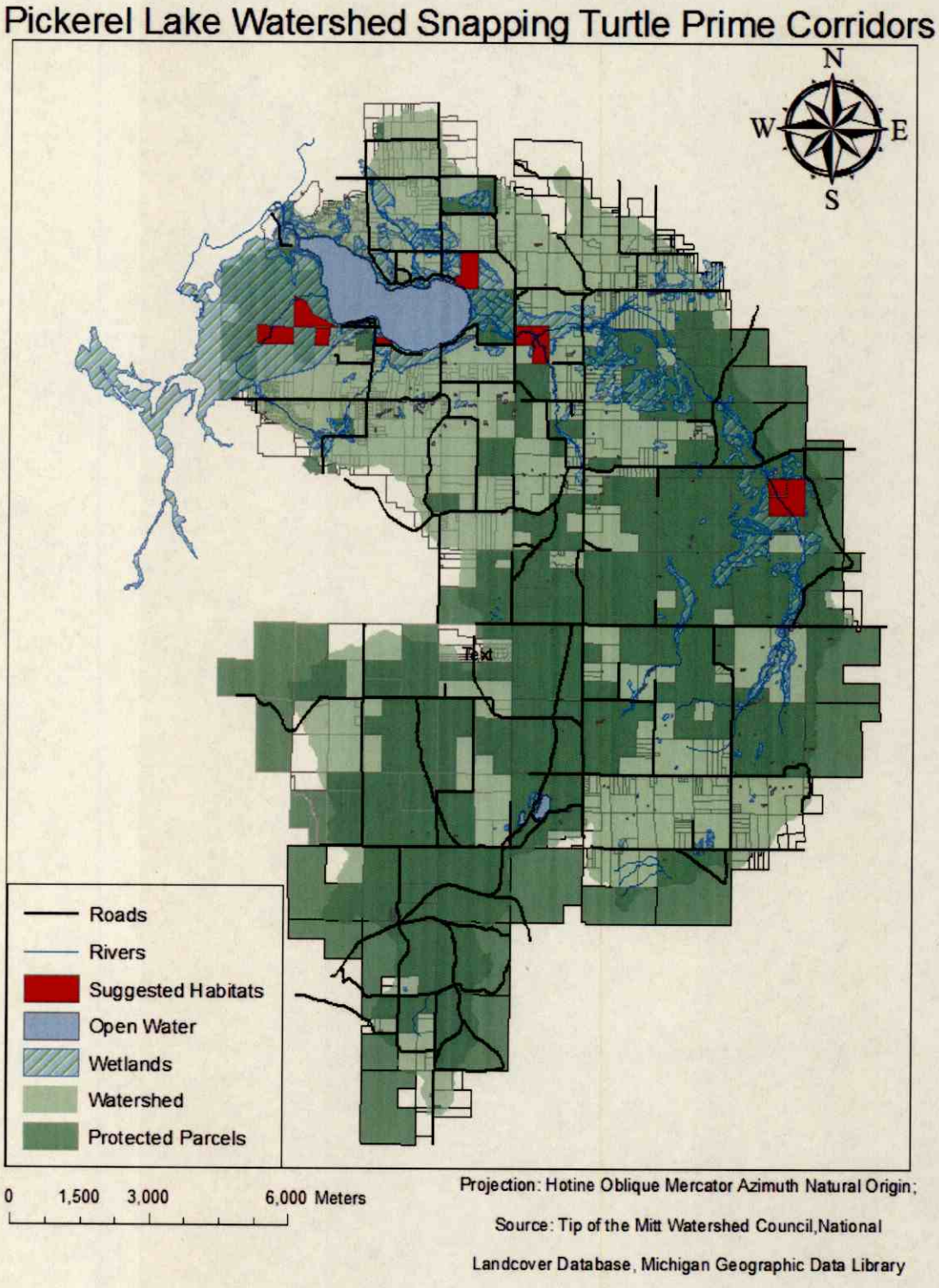
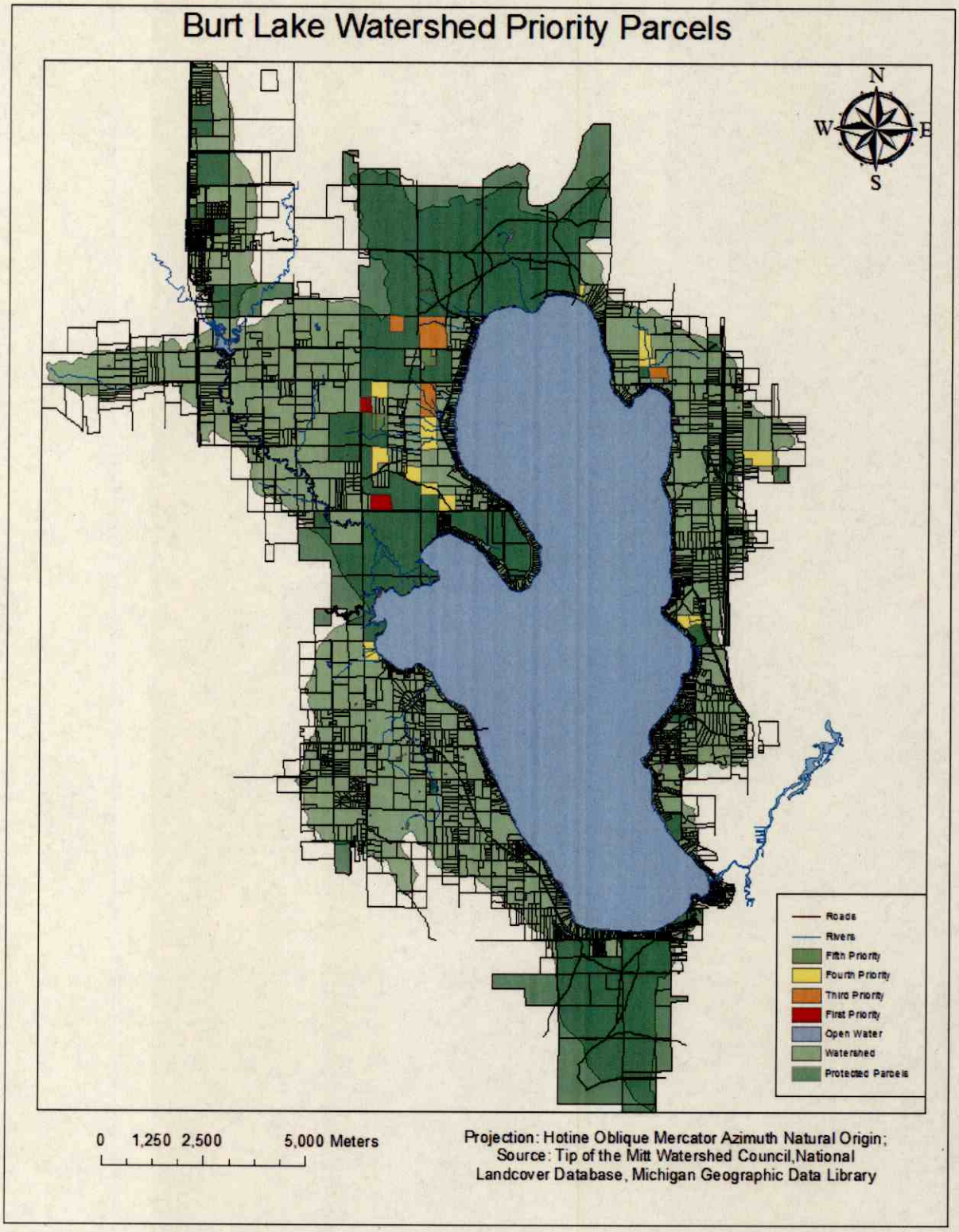
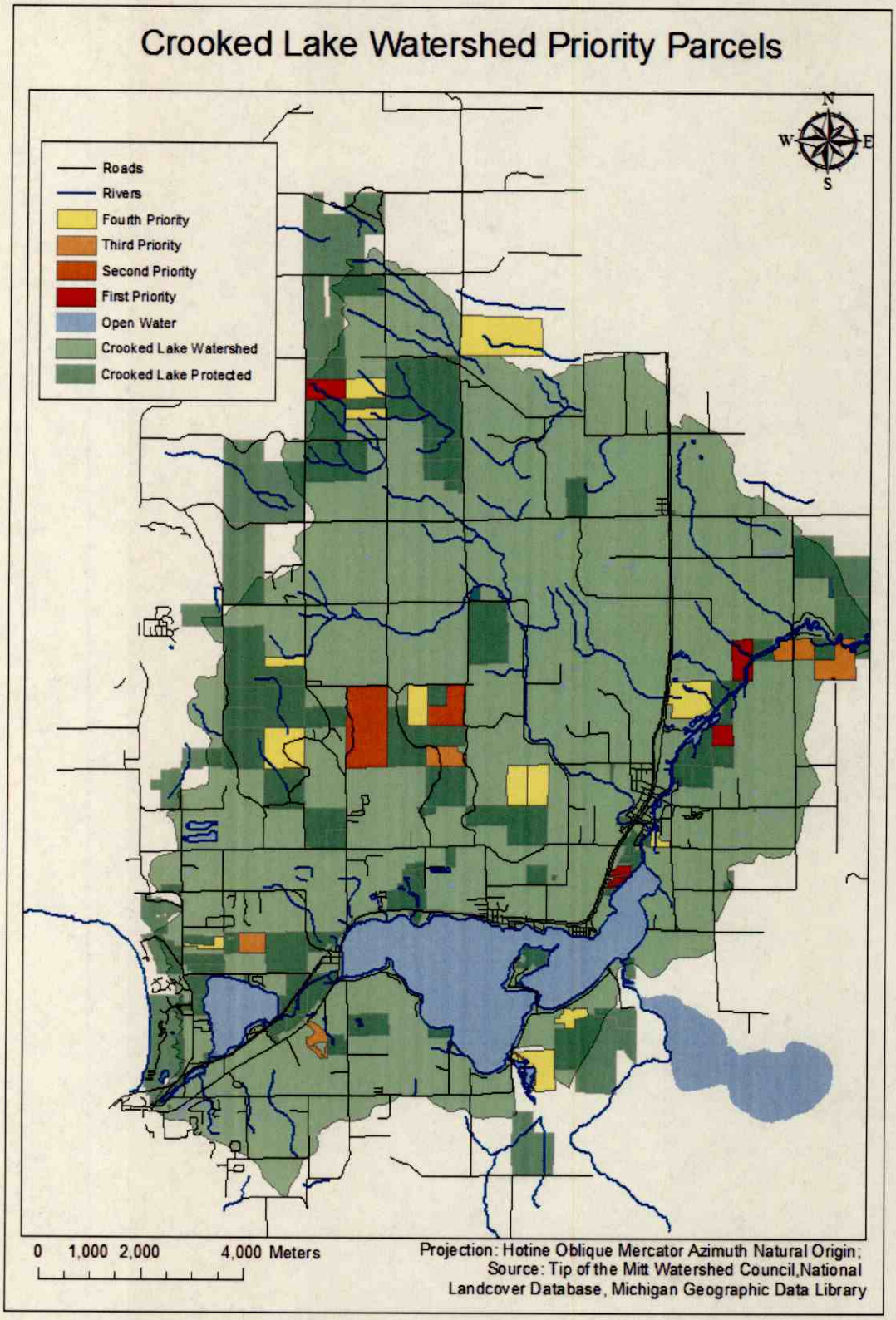

Pickerel Lake Watershed Snapping Turtle Prime Corridors
N
W
E
S
Text
Roads
Rivers
Suggested Habitats
Open Water
Wetlands
Watershed
Protected Parcels
0
1,500
3,000
6,000 Meters
Projection: Hotine Oblique Mercator Azimuth Natural Origin;
Source: Tip of the Mitt Watershed Council,National
Landcover Database, Michigan Geographic Data Library

Figure 25



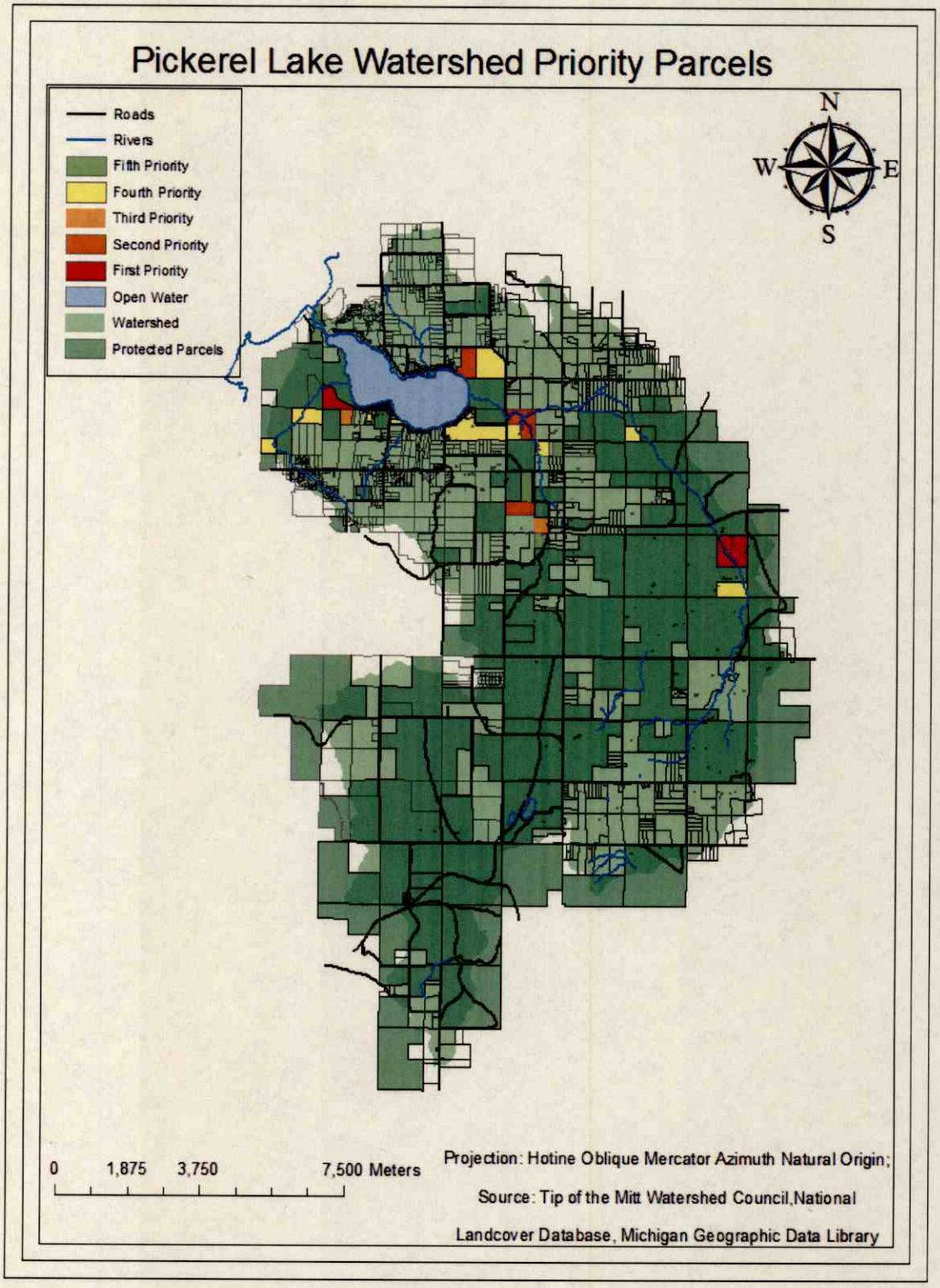
First Priority parcels from West to East: Burt Lake Site 1, Burt Lake Site 2, Burt Lake Site 3 (Burt Lake Site 3 south of Burt Lake Sites 1 and 2) No parcels fitting into the Second Priority category were found in the Burt Lake Watershed.

Figure 26



First Priority parcels from West to East: Crooked Lake Site 1, Crooked Lake Site 2, Crooked Lake Site 3. No parcels fitting into the Fifth Priority category were found in the Crooked Lake Watershed.

Figure 27



First priority parcels from West to East: Pickerel Site 1, Pickerel Site 2, Pickerel Site 3. Pickerel Lake Sites 2 and three are adjacent to each other.