INVER GROVE HEIGHTS
Northwest Area

Chapter 2

Unique Features of the Northwest Area (NWA)

Northwest Area (NWA)
Inver Grove Heights Stormwater Manual

Unique Features of the Northwest Area (NWA)

Chapter 2

Key Topics: general description of climate, geology, watersheds, soils, topography, wetland, and upland resources of the NWA

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I. Introduction

The NWA is characterized by varied physical topography, areas of extensive tree cover, and numerous landlocked basins, some of which are wetlands. The following information characterizes the area in order to orient the Manual user to its general setting and key features. The reference section at the end of this chapter lists some additional informational resources available for the NWA, but more site specific information will be necessary for the development of individual parcels.

II. Climate

The NWA is located at the edge of the drier plains of the west and the moister woodlands of the upper Midwest. Table 2.1 depicts the annual temperature and precipitation pattern in the NWA. The NWA has cold climate conditions typical for south central Minnesota. The seasonal effects of snow, ice and spring melt can be large for both water quantity and water quality management. A more in depth discussion of cold climate considerations is conducted in Chapter 6 and cold climate design modifications for specific BMPs is discussed in Chapter 8.

Table 2.1 Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Average Maximum Temperature (°F)	22.5	28.7	40.6	57.5	70.2	78.4	83.0	80.8	71.6	59.5	40.9	27.2	55.1
Average Minimum Temperature (°F)	5.4	10.7	22.4	35.8	47.7	57.2	62.5	60.4	51.3	39.9	25.9	12.1	35.9
Average Total Precipitation (Inches)	0.94	0.77	1.81	2.59	3.81	4.76	4.05	4.09	3.25	2.52	1.81	0.99	31.39
Average Total Snowfall (Inches)	11.1	8.0	9.9	3.0	0.0	0.0	0.0	0.0	0.0	0.4	7.2	9.5	49.1
Average Snow Depth (Inches)	8.0	9.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	2.0
Average Date of First Snowfall	November 12												
Average Date of Snowmelt	March 19												

Source: MN Climatology Working Group, 2006

III. Geology

Three general types of glacial deposits are found in the project area (Figure 2.1):

- Till – Primarily sandy loam-textured, unsorted sediment.
- Ice-contact deposits – Sand and gravel. Not as prevalent as the till.
- Outwash – Sand and gravel, but more continuous and consistent than the ice-contact deposits. Occurs only in the southwest part of the project area.

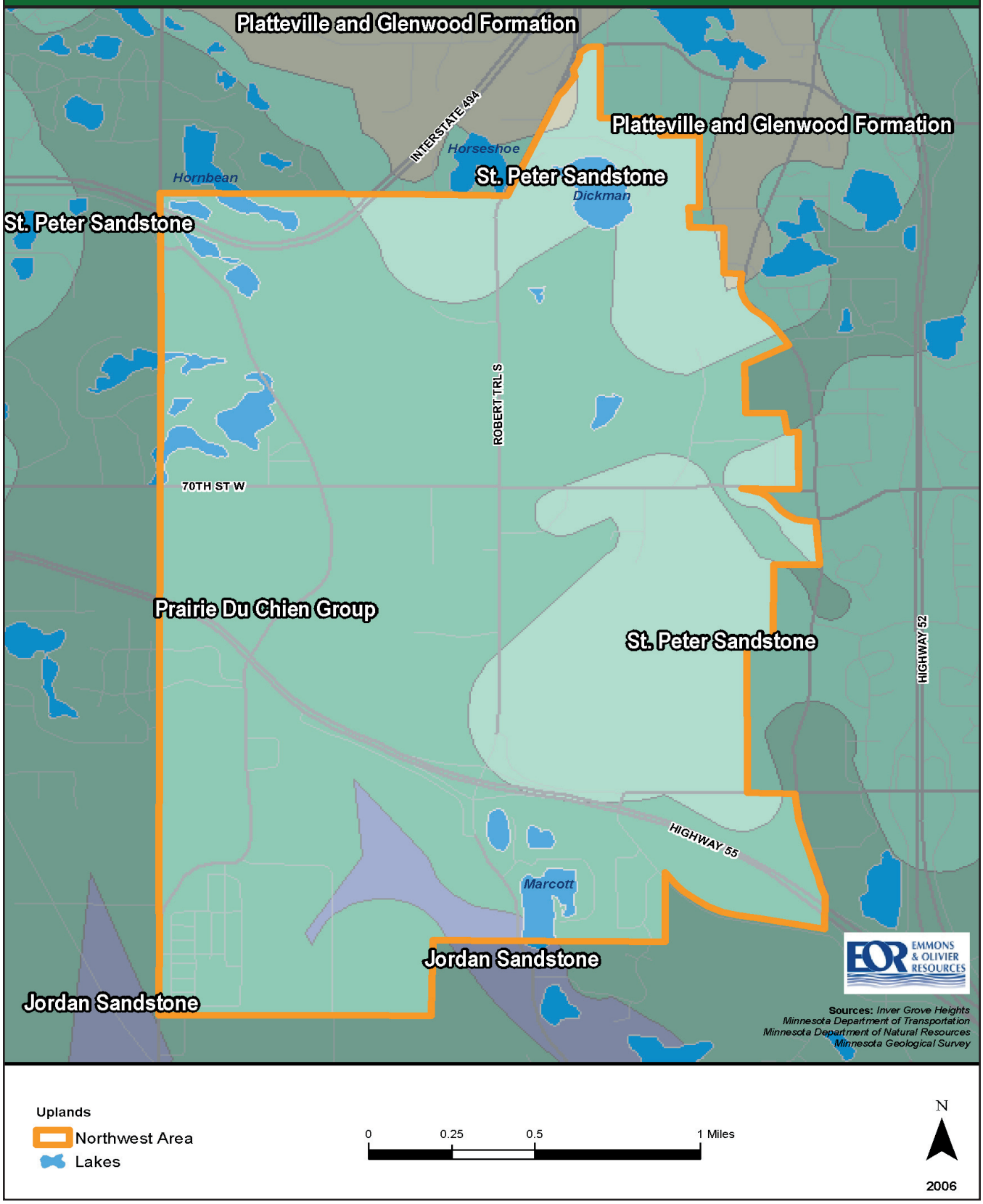
The bedrock is typical of other areas in the Twin Cities. From top to bottom, the most important bedrock formations are:

- Platteville and Glenwood Limestone/Dolomite
- St. Peter Sandstone
- Prairie du Chien Limestone/Dolomite
- Jordan Sandstone

A buried bedrock valley is mapped in the project area with branches entering it from the northwest and northeast. These branches meet and exit along the southern boundary of the project area. The bedrock valley is eroded completely through the Prairie du Chien Group and into the underlying Jordan Sandstone in the southern part of the project area. Minimum depth to bedrock within the project area is greater than 100 ft and bedrock is generally within 250 ft of the surface where the St. Peter Sandstone is present and generally greater than 200 ft where the Prairie du Chien Group is the uppermost bedrock unit.

No sinkholes, shallow limestone formations, or karst conditions are present within the project area.

Figure 2.1 Bedrock Geology Map



IV. Ground Water

The first groundwater encountered (water table) when drilling or excavating in the project area is typically in the glacial deposits. A perched water table occurs in some areas, meaning that the groundwater may not be laterally continuous and may not be hydraulically connected to lower aquifers. In addition, some areas may become seasonally saturated near the surface. As a result, it is difficult to predict the depth to groundwater at any location without a site-specific investigation. The depth to groundwater can vary from 0 to over 50 feet depending on the topography and location relative to surface water and perched aquifers.

The glacial deposits in which the water table occurs across most of the project area are not typically used for water supply. Residential and municipal wells are typically completed in the lower St. Peter Sandstone, Prairie du Chien, and Jordan bedrock aquifers. Deeper bedrock aquifers are less sensitive to pollution than the water table system.

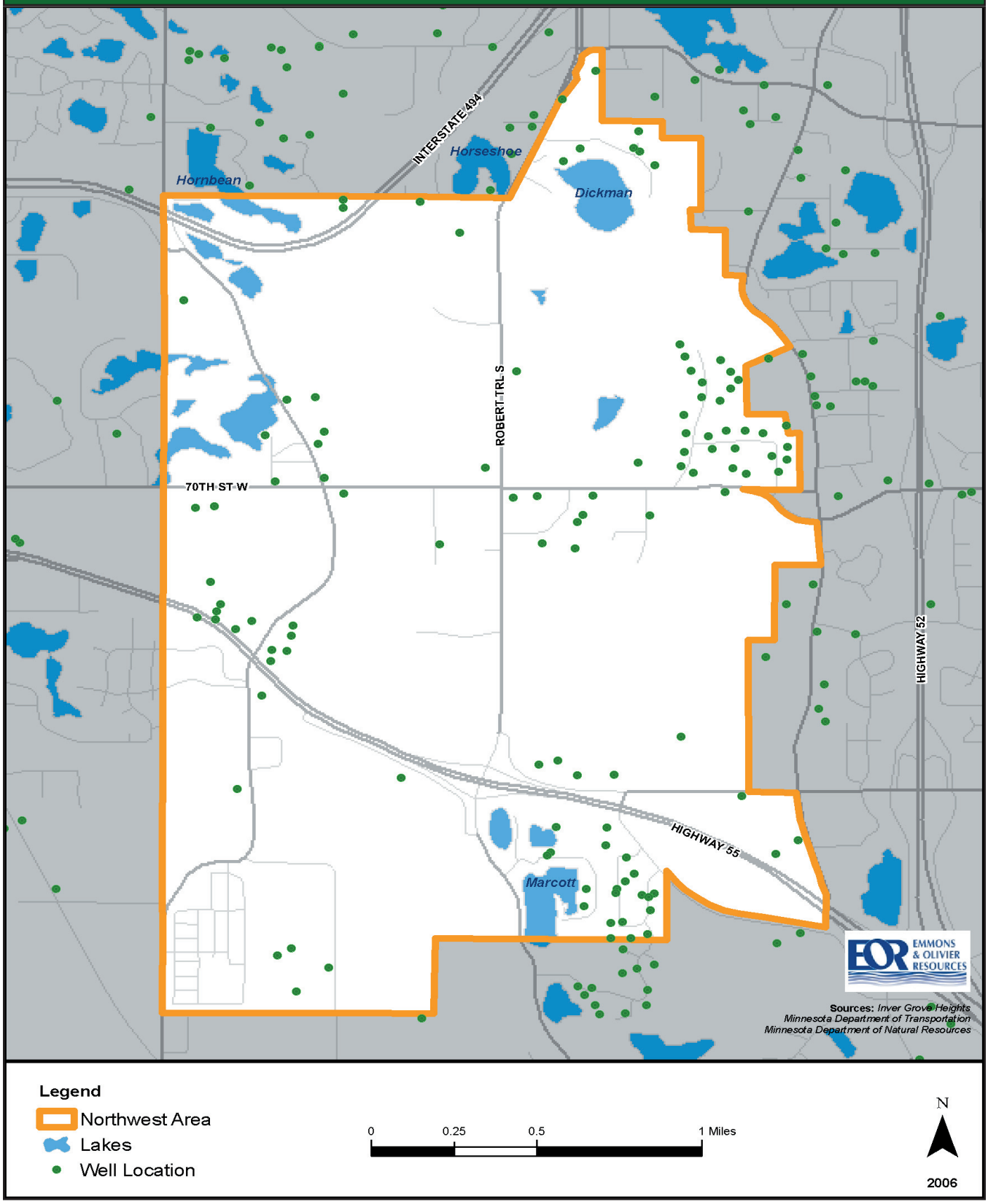
V. Drinking Water

The City of Inver Grove Heights currently operates six municipal supply wells with a total ground water appropriation of 1250 million gallons per year (2003). The NWA area will be served by expanding the existing municipal water supply system and will require additional appropriation of ground water. Five additional wells will likely be required to meet the ultimate system demand. The final number of new wells will depend on their capacities. While no municipal wells currently exist in the NWA, the city is exploring the addition of at least two wells just to the east of the NWA, on the site of the Inver Wood Golf Course.

New wells will be completed in the Jordan Sandstone portion of the Prairie du Chien-Jordan aquifer system. While the City's current wells will experience a gradual increase in pumping and additional wells will be constructed, the aquifer is expected to be able to accommodate the additional withdrawals, based on recent tests. An expansion of the water treatment facility is also planned to service the area (AUAR, 2005).

Currently, private wells service the majority of the area (Figure 2.2). Most water wells in the area are completed in buried quaternary or bedrock aquifers.

Figure 2.2 Private Well Location Map



VI. Watersheds

In the western portion of the NWA, the Board of Water and Soil Resources identifies a watershed divide between the Minnesota River drainage area and the Mississippi River drainage area (Figure 2.3). However, the NWA is characterized by its landlocked nature. Composed of numerous isolated basins, the area contains no tributary rivers or streams, and has no natural outlet to these river systems.

Administratively, the NWA is located within two watershed areas, the Lower Mississippi River Water Management Organization (LMRWMO) and the Gun Club Lake Water Management Organization (GCLWMO) (Figure 2.4). The approximate acreage within the LMRWMO is 2,650 acres and within the GCLWMO is 760 acres.

A total of 201 subwatersheds lie within the NWA area (Figure 2.5). The area within the LMRWMO can be sub-divided into a series of 154 subwatersheds and the area within the GCLWMO can be sub-divided into a series of 47 subwatersheds. Each of these subwatersheds was characterized for water quantity modeling under existing conditions, and was subsequently modeled for developed conditions in detail as part of the *Inver Grove Heights Northwest Area Surface Water Modeling Report*, August 2006.

Figure 2.3 Natural Watershed Divide Map

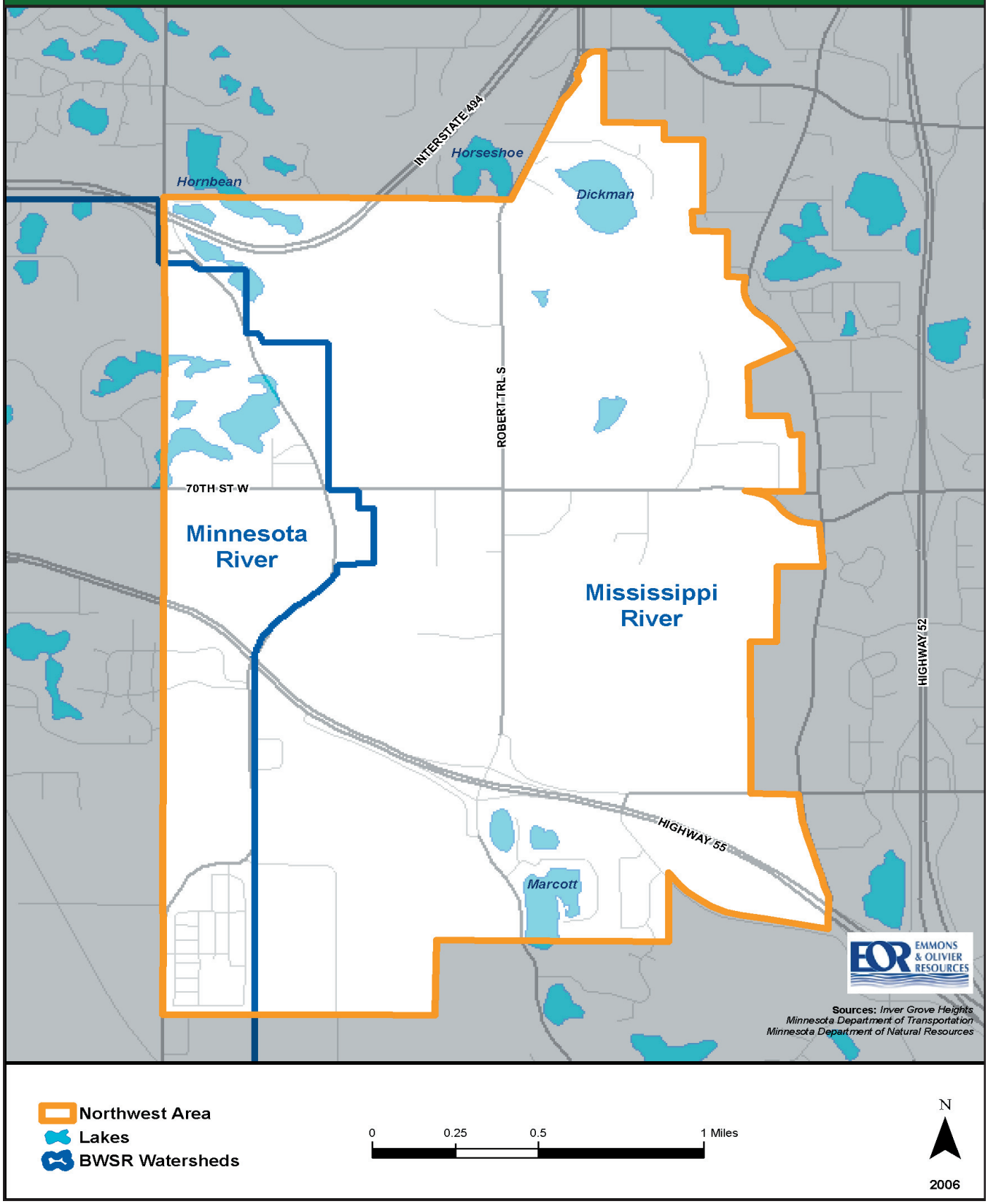


Figure 2.4 Watershed Management Organization Boundary Map

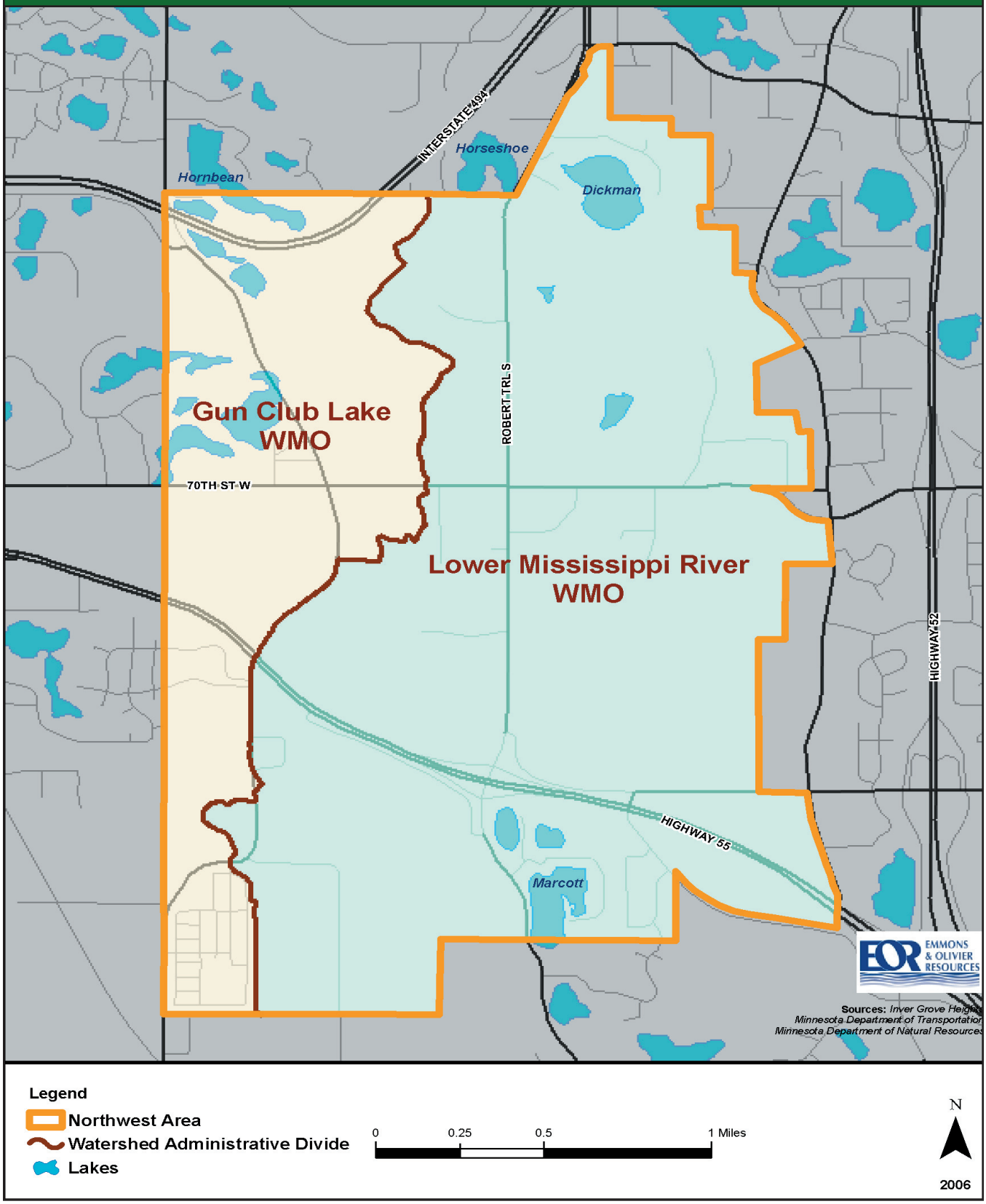
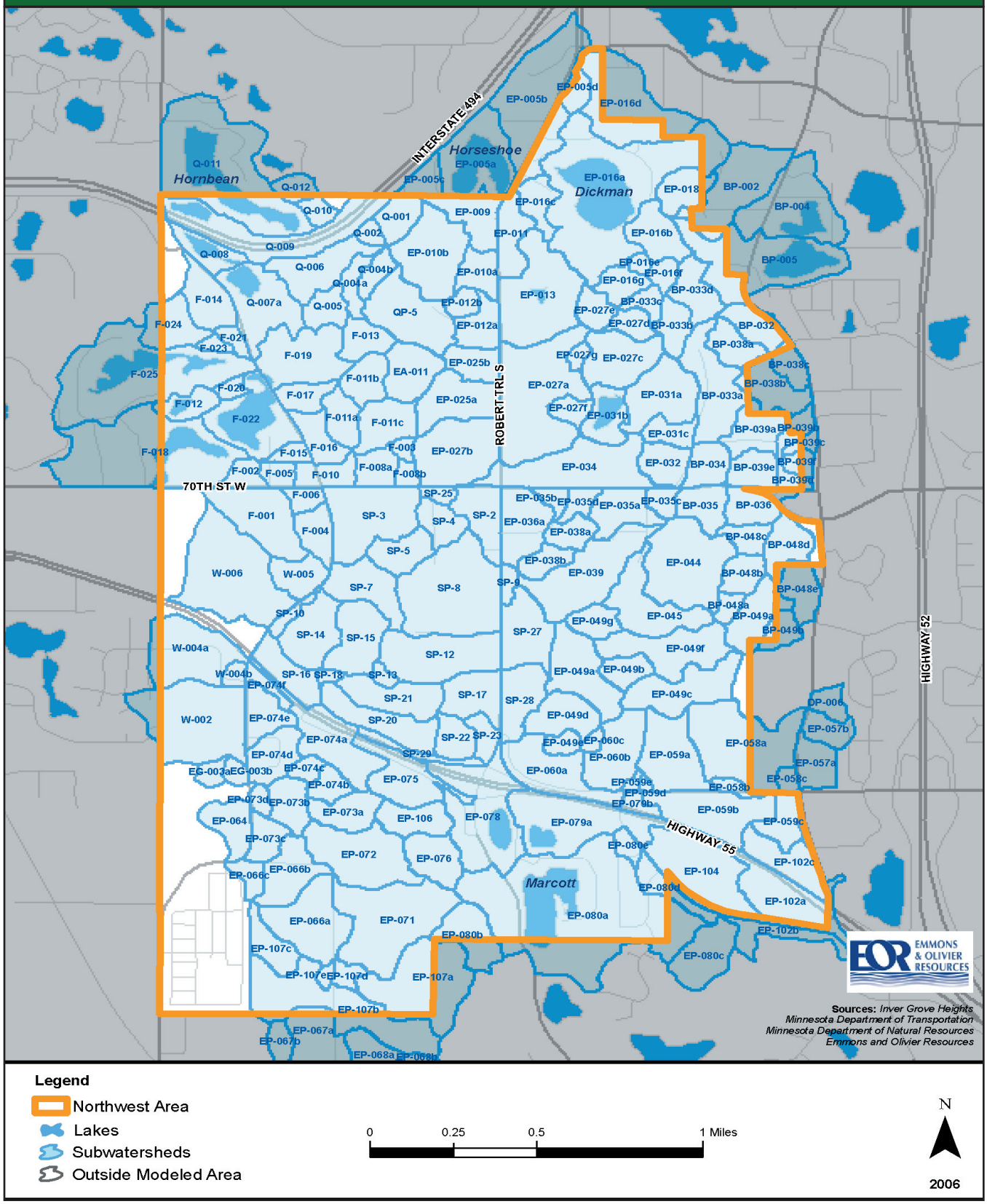


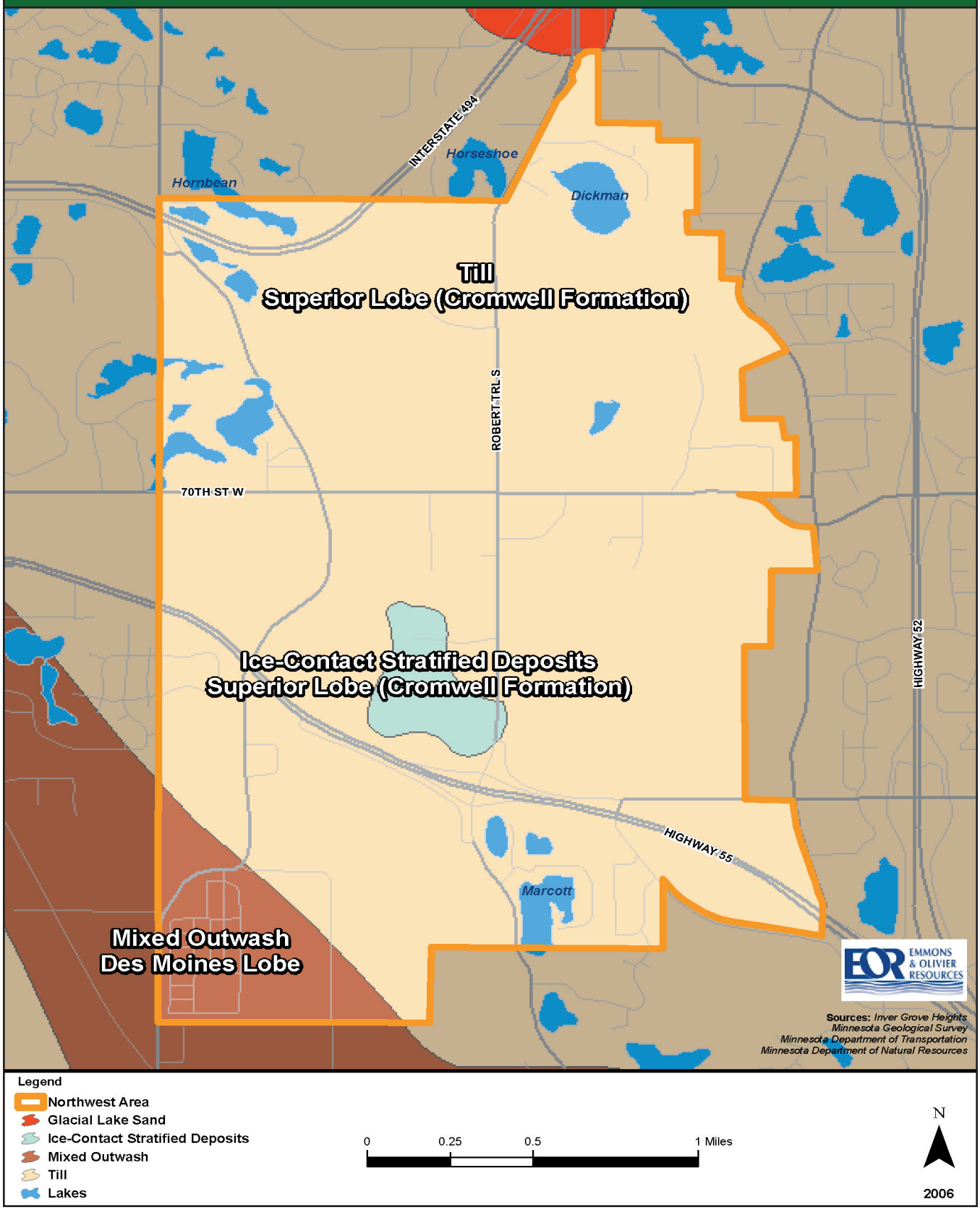
Figure 2.5 Subwatershed Map



VII. Surficial Geology and Soils

The NWA is located on the St. Croix Moraine, a geomorphic feature of hummocky terrain with glacial, fluvial and lacustrine sediments derived from the Superior Lobe (Figure 2.6). The moraine is composed primarily of unsorted sediment, mostly sandy loam-textured till. The moraine also includes deposits of stratified sand, gravelly sand and cobbly gravel with mudflow deposits and silty lake sediments. In the southwest corner of the project area sand and gravelly sand outwash of the New Ulm Formation were deposited consisting of a mixture of sediments. Much of this area was also covered by a thin mantle of loess (wind blown silt and fine sand with some clay).

Figure 2.6 Surficial Geology Map



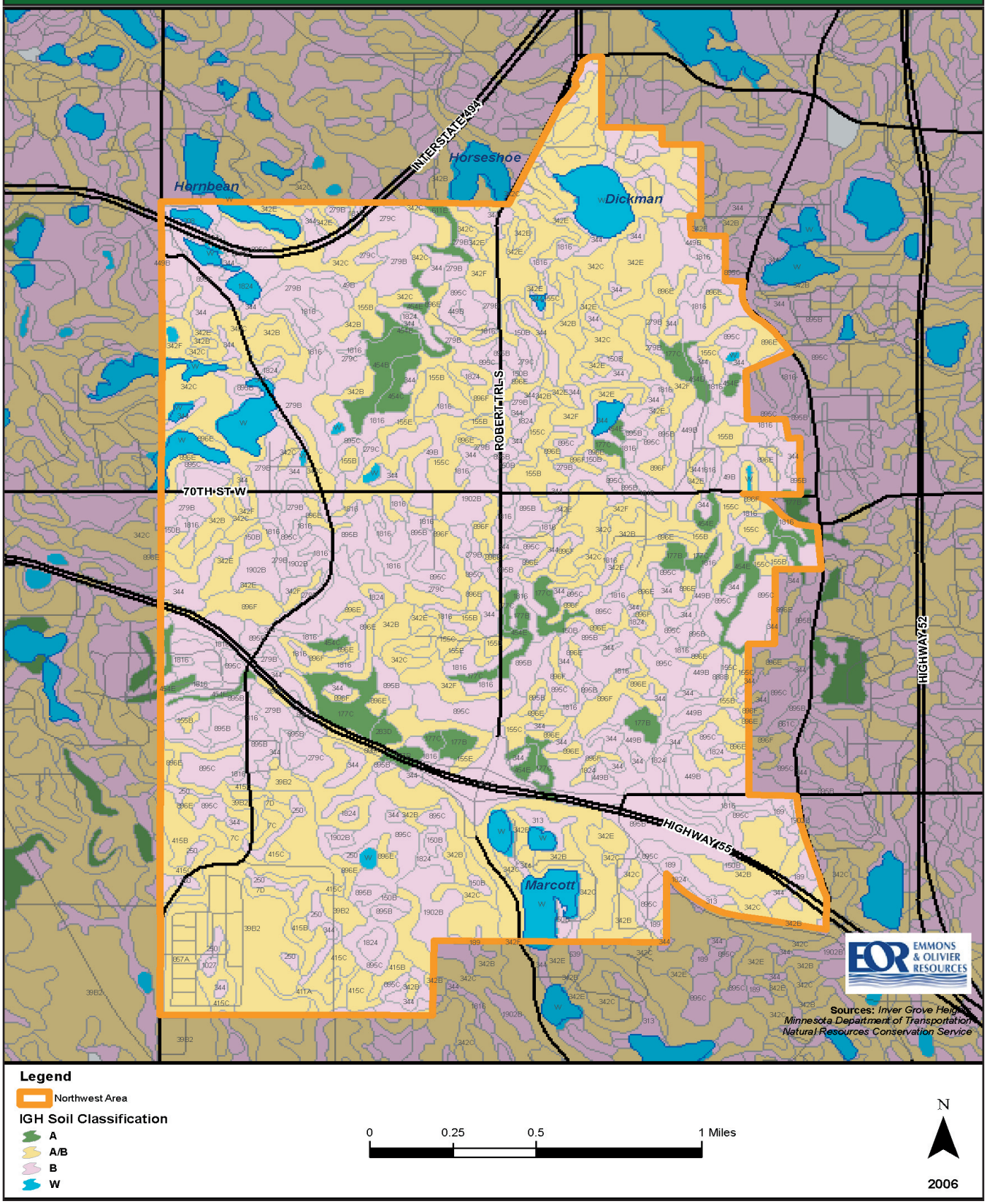
Soils are mapped in the *Soil Survey of Dakota County, Minnesota* (Hundley, 1983). Soils in the moraine belong to the Kingsley-Mahtomedi association consisting of gently sloping to very steep, well-drained and excessively drained soils. Soils in this association vary in texture from loamy sand to silty loam. Soils formed on the outwash plain belong to the Waukegan-Wadena-Hawick association of level to very steep, well drained and excessively drained soils formed in silty and loamy sediments over sandy sediments.

With development and calibration of the surface water model for the NWA, it became necessary to further subdivide hydrologic soil groups and reassign the classification for some soils to reflect actual conditions in this area (Figure 2.7). These new Inver Grove Heights Soil Classifications should be used for modeling and design purposes in sizing the stormwater management system for new developments (Table 2.2). Further detail regarding soil classifications can be found in the May 12, 2006, "Northwest Expansion Area Hydrologic & Hydraulic Analysis Update and Gun Club Lake Modeling Report".

Table 2.2 NWA Hydrologic Soil Classifications

Map Symbol	Soil Name	NWA Hydrologic Soil Type
177A,B,C	Gotham	A
283D	Plainfield	A
454B,C,E	Mahtomedi	A
611E	Hawick	A
7C,D	Hubbard	A/B
39B2	Wadena	A/B
129	Cylinder	A/B
155B,C,E	Chetek	A/B
342B,C,E,F	Kingsley	A/B
411A	Waukegan	A/B
415B,C	Kanaranzi	A/B
857A	Waukegan	A/B
858C	Chetek	A/B
889B,C,D	Wadena	A/B
	Hawick	A/B
896E,F	Kingsley	A/B
	Mahtomedi	A/B
49B	Antigo	B
94C	Terril	B
98	Colo	B
150B	Spencer	B
189	Auburndale	B
208	Kato	B
250	Kenebec	B
279B,C	Otterholt	B
313	Spillville	B
344	Quam	B
449B	Crystal Lake	B
539	Palms	B
861C	Kingsley	B
888B	Kingsley	B
895B,C	Kingsley	B
	Mahtomedi	B
	Spencer	B
1027	Udorthents	B
1029	Pits	B
1816	Kennebec Variant	B
1824	Quam	B
1902B	Jewett	B

Figure 2.7 Soils Series and NWA Soil Classification Map



VIII. Topography

Topography is extremely variable in the NWA. The area is characterized by morrainal and outwash plain creating flat areas, steep slopes, and undulating topography (Figure 2.8). The NWA is marked by landlocked basins throughout the area.

Steep slopes, which can be found throughout the area, are characterized in the PUD as those with a grade of 25% or more for a horizontal distance of 50 feet or more (Figure 2.9). Setting aside steep slope areas as open space upon new development is encouraged.

Figure 2.8 Topographic Map

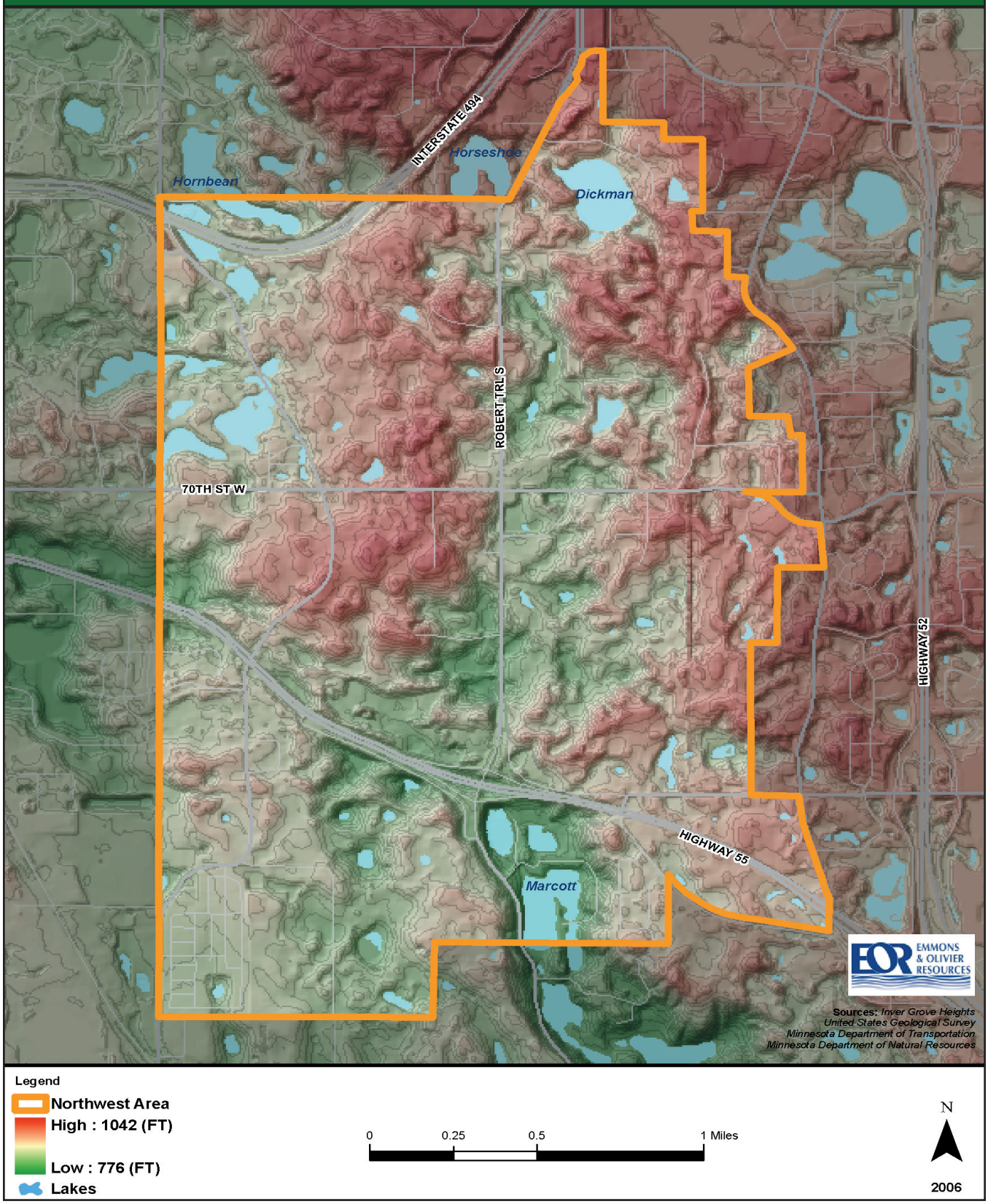
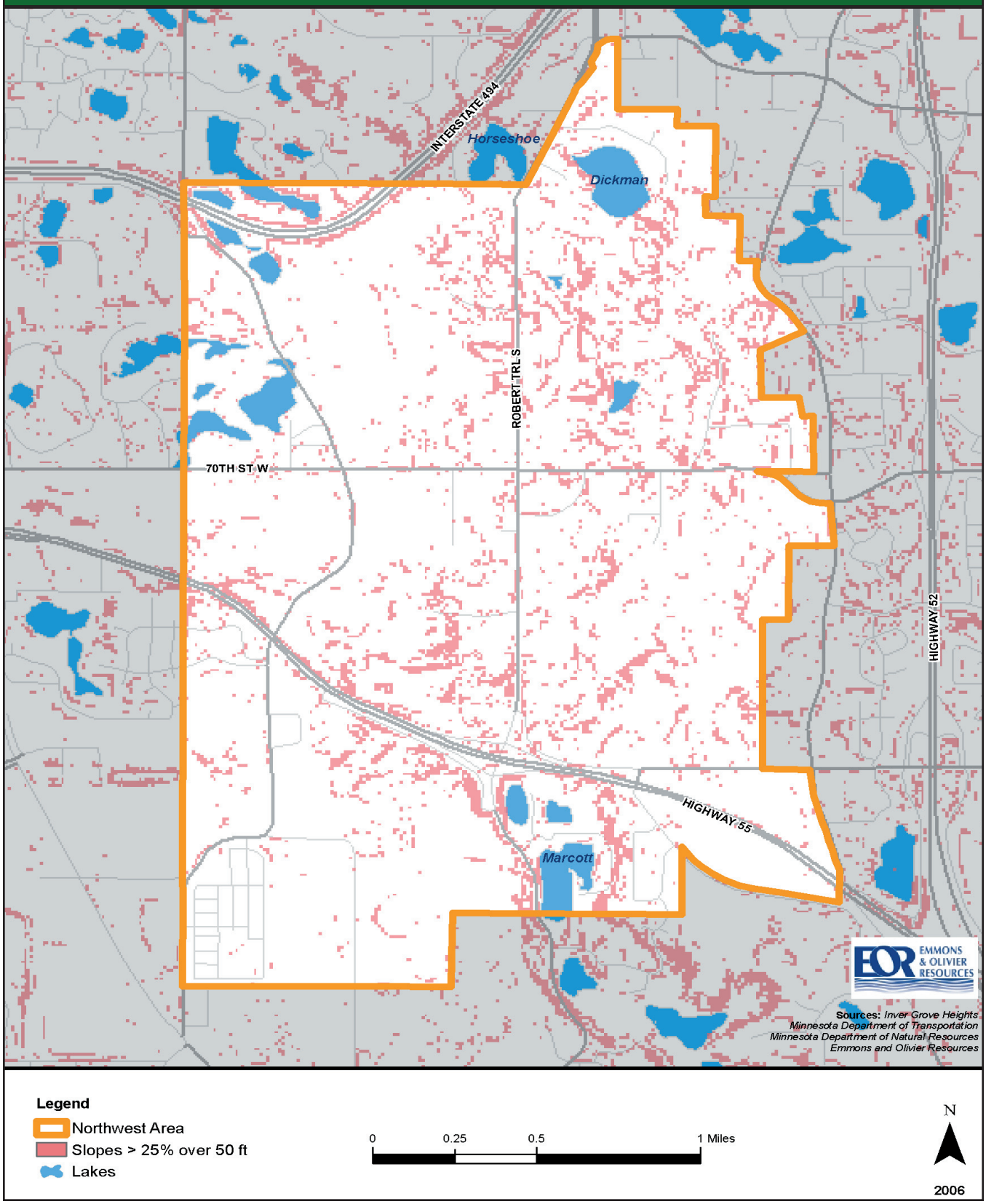


Figure 2.9 Steep Slopes Map



IX. Wetlands

Approximately 270 acres of wetland are identified in the NWA area. Wetlands were inventoried using the Minnesota Routine Assessment Methodology (MnRAM), and classified into four types based on their vegetative communities and susceptibility to stormwater impacts in the city's Natural Resources Inventory and Management Plan for the Northwest Area (BRAA, 2004). This report proposed wetland management classifications with the greatest protection begin given to the highest quality wetlands (Figure 2.10). The Wetland Management Standards adopted by the City are summarized in Table 2.3 as follows:

Table 2.3 Wetland Management Standards

Management Classification	Buffer Strip	Structural Setback from Edge of Buffer	Stormwater Quantity Required
Manage 1	60'	10'	Storm bounce—maintain HWL at or below existing conditions for 100-yr storm.
Manage 2	30'	10'	Storm bounce—maintain HWL bounce at or below existing conditions plus 0.5 ft. for 100-yr storm.
Manage 3	20'	10'	No requirement
Manage 4	15'	10'	No requirement

Source: BRAA, 2004

The most common wetland community types in the Northwest Area are wet meadow, shallow marsh, shallow open water and deep marsh. Some wetland types that are uncommon in the Metro Area, but do occur in the NWA, are Shrub Carr and Alder Thicket. Table 2.4 summarizes the wetland types and their quality rankings in the study area. Roughly two-thirds of these community types are classified as Management Classes 3 or 4. This indicates in a general sense that many of these areas are of somewhat lower quality and adversely affected by runoff, surrounding land uses and invasive species.

Table 2.4 Wetland Management Classification Summary			
Community Type	**Management Class**	**Number of Wetlands**	**Acres of Community Type**
Seasonally flooded basin	1	1	1.1
Sedge Meadow	1	3	10.7
	2	1	
	3	2	
Wet meadow	1	7	68.7
	2	8	
	3	19	
	4	20	
Alder thicket	1	1	3.5
Shrub carr	1	1	6.0
	2	1	
	3	1	
Hardwood swamp	1	4	14.8
	3	7	
	4	6	
Shallow marsh	1	8	52.4
	2	7	
	3	15	
Shallow open water	1	2	51.5
	2	2	
	3	10	
	4	10	
Source: BRAA, 2004 Deep marsh	1	6	49.5
	2	4	
	3	10	
	4	9	
Other	1	1	8.6
	4	2	
TOTAL		184	266.8

Source: BRAA, 2004

These standards, along with standards adopted in the Comprehensive Plan for water bodies, will guide wetland protection in the NWA area.

Several lakes and wetland basins in the NWA are classified as Minnesota Department of Natural Resources Public Waters and Public Waters wetland (Figure 2.11). Public waters have additional state level regulation for activities which may impact them. Additionally, the Minnesota Wetland Conservation Act also governs activities which have the potential to affect wetlands in the state.

Figure 2.10 Wetlands by Management Class Map

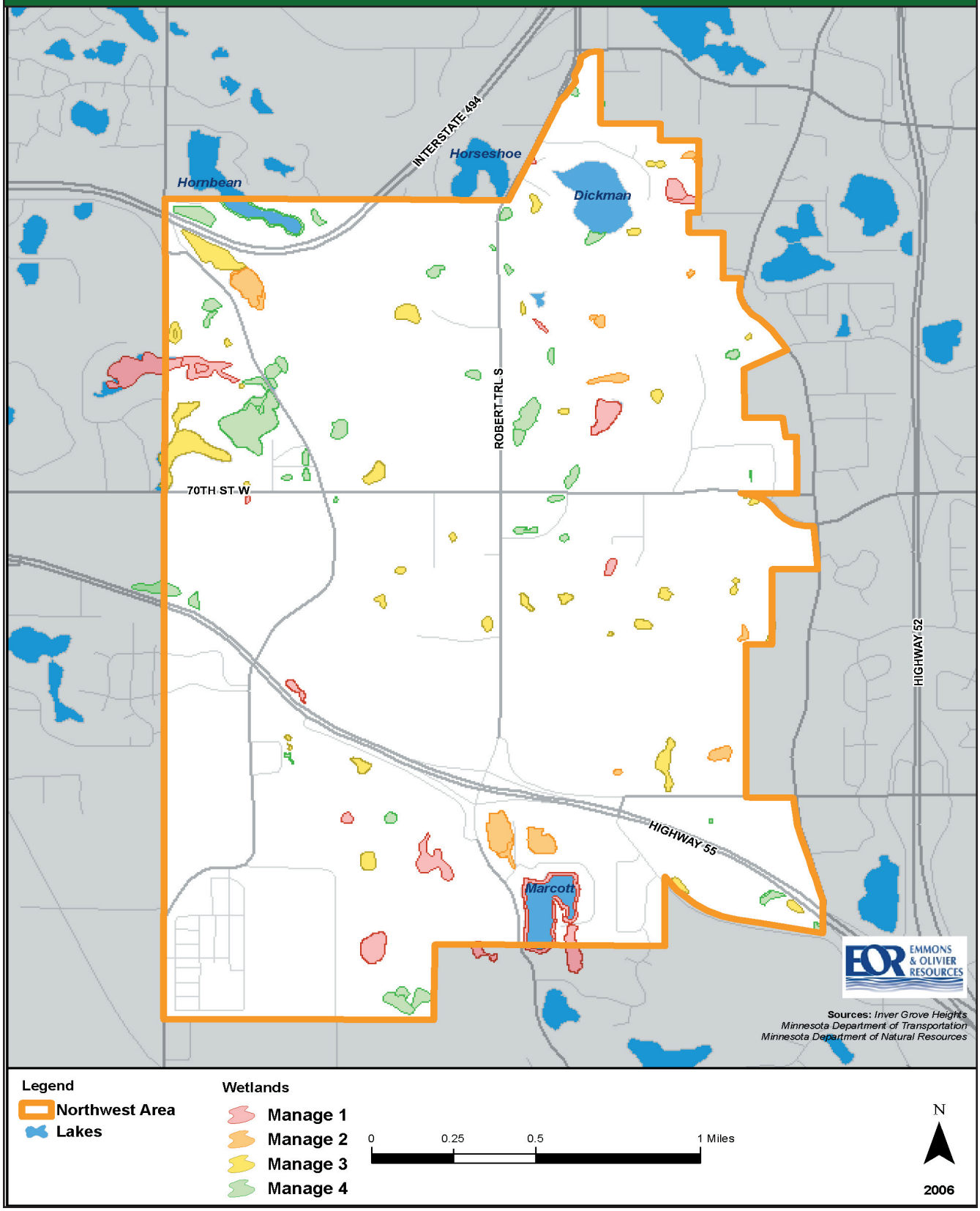
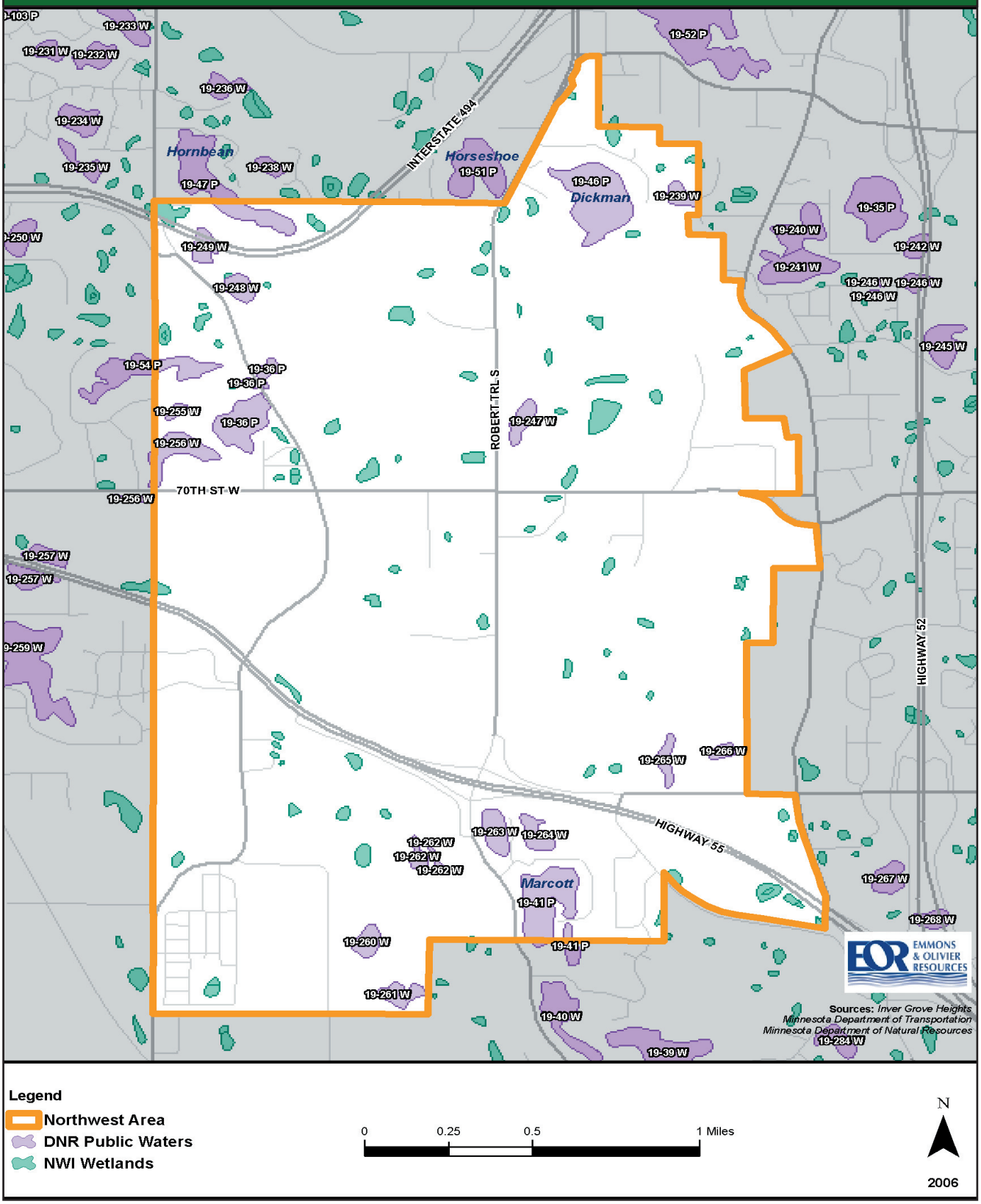


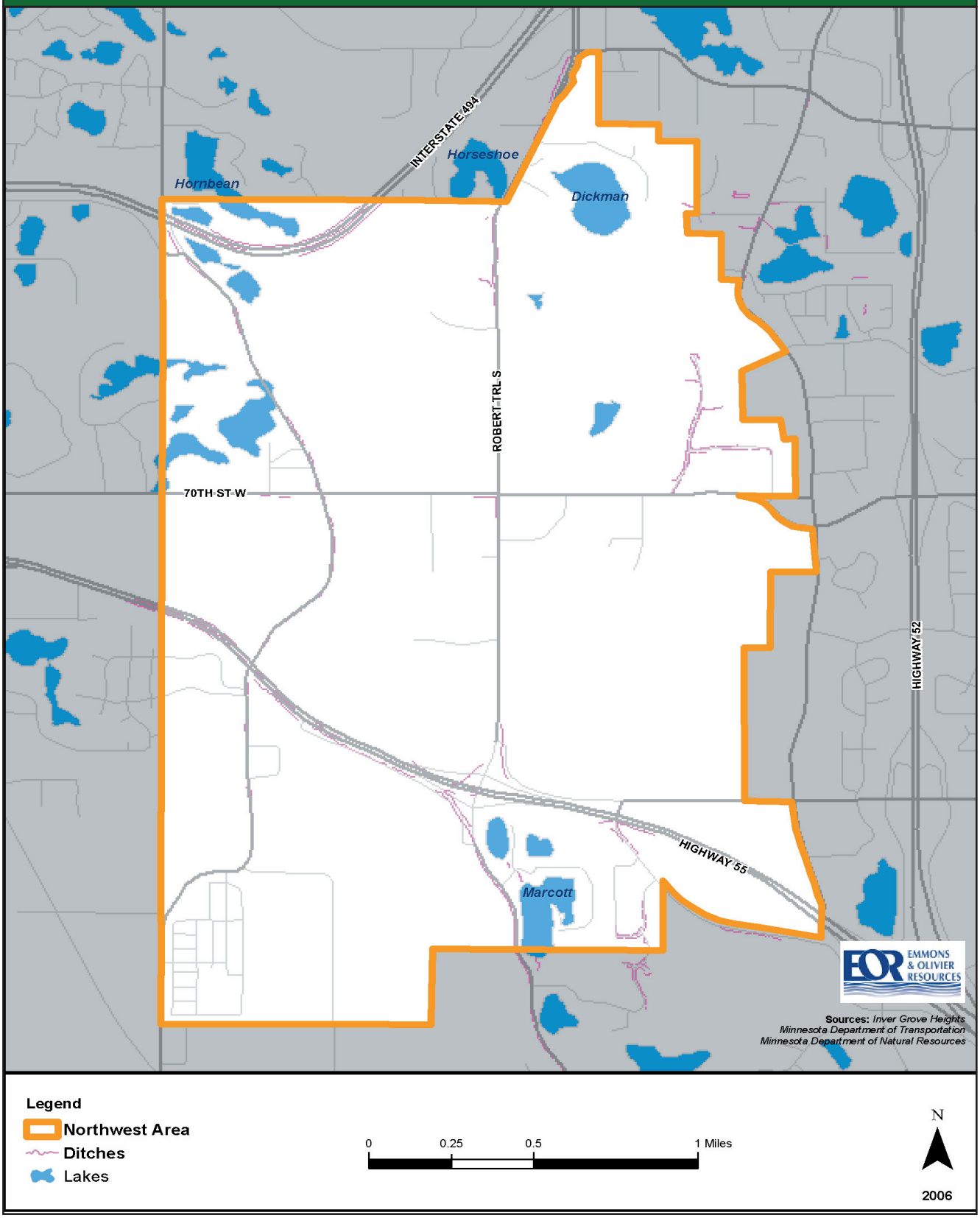
Figure 2.11 Public Waters and National Wetlands Inventory Map



X. Lakes and Ditches

The Northwest Area does not contain or drain to any MnDNR designated trout streams or Metropolitan Council priority lakes. However, a fair number of the natural basins are mapped as lakes including three of note (Dickman, Hornbean, and Marcott). Several non-jurisdictional ditches are also present in the area, mainly along roadways to act as conveyance for stormwater (Figure 2.12).

Figure 2.12 Lakes and Ditches Map



XI. Landlocked Basins

The NWA is characterized by many landlocked basins (Figure 2.13). These basins have been classified into three management categories according to their overflow potential into the regional system. Some subwatersheds are uncategorized for one or more of the following reasons:

- An existing outlet is present
- The basin is located in a golf course so the risk of flood damage is low
- The basin is located in an area that is already developed so no changes are proposed to limit new expenses for existing residents
- The area proposed to be developed has no basin

More information on these basins and the classification system can be found in the Technical Memorandum: Inver Grove Heights Low Impact Development (LID) Stormwater Plan: Overflow Contingencies & Cost Analysis (EOR, 2006).

Categories were determined as follows in Table 2.5:

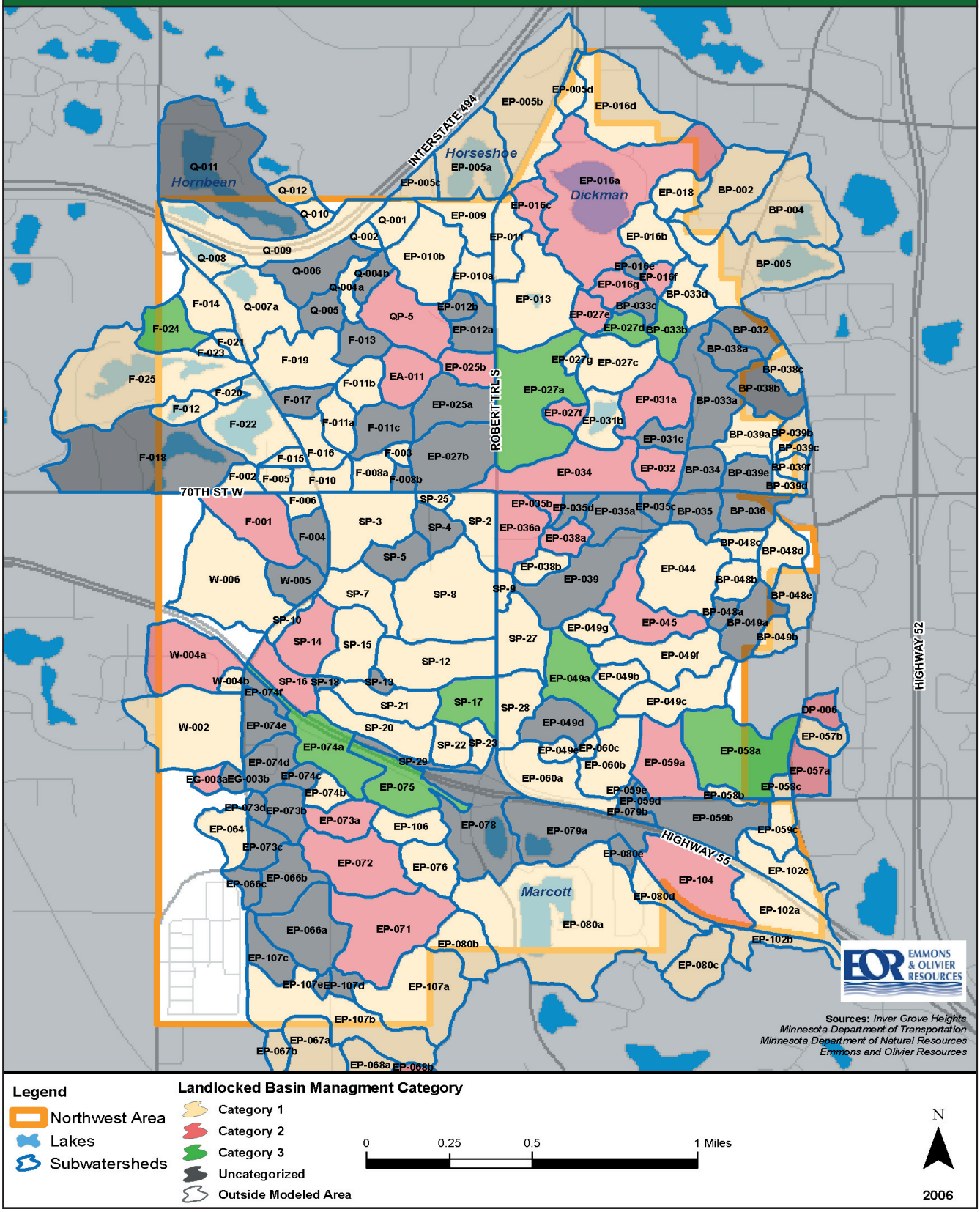
Table 2.5 Landlocked Basin Categories

Management Category	Definition*	Description
Category 1	NOF-HWL is between 0 – 6 feet	No additional infrastructure to be provided. Preserve existing natural overflow.
Category 2	NOF-HWL is between 6 – 18 feet	To ensure limitation of property damages in the event of extreme flooding, an emergency back-up outlet will be constructed for basins in this category.
Category 3	NOF-HWL is greater than 18 feet	A contingency overflow and location must be identified and an easement must be provided along the potential drainage way.

*NOF = natural overflow (elevation at which a landlocked basin would overflow)
HWL = high water level defined by critical event (as provided by City or updated by applicant's modeling results of critical event)

Source: EOR, 2006

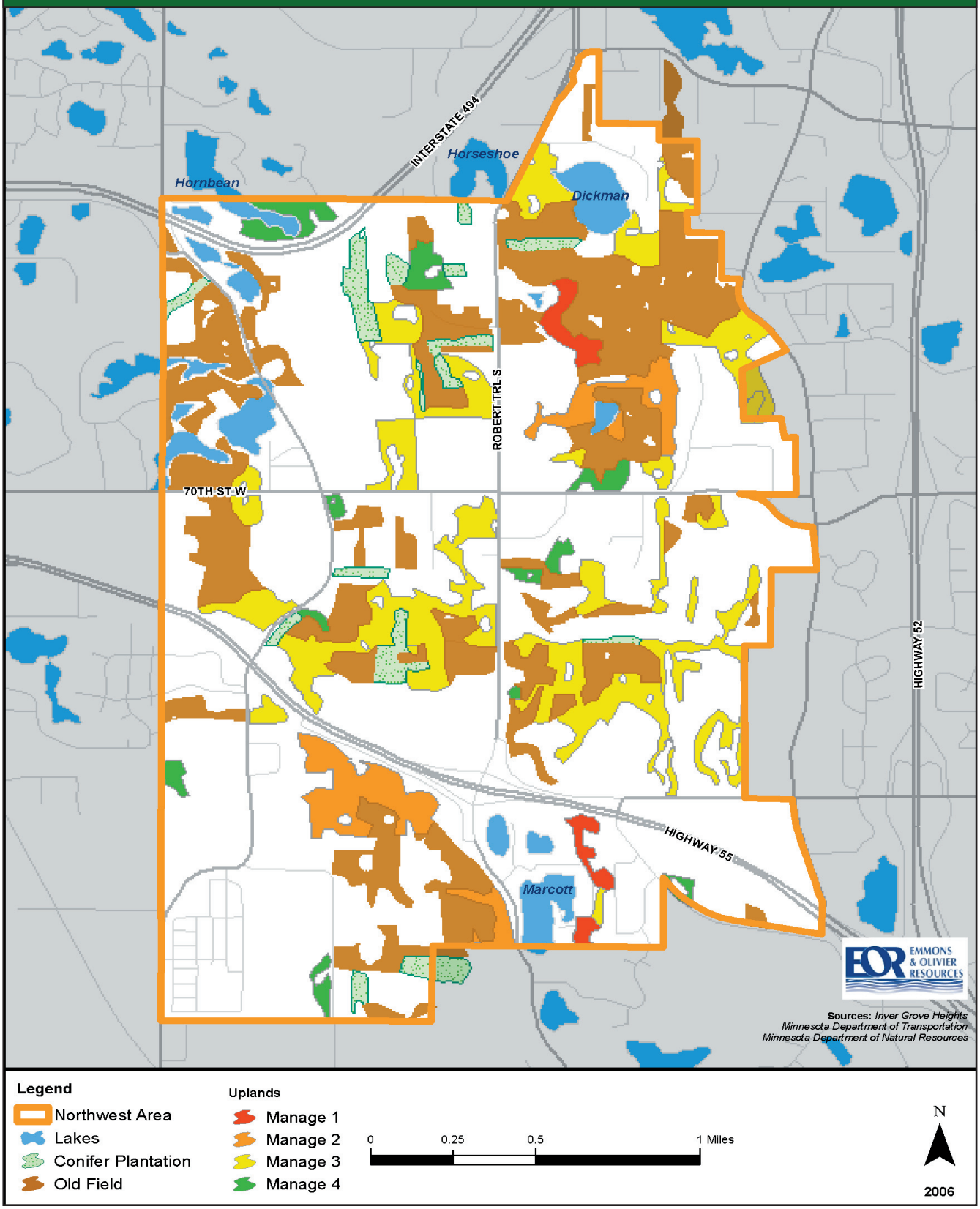
Figure 2.13 Landlocked Basin Classification Map



XII. Uplands

Upland areas of note were inventoried and divided into management classes (Figure 2.14) based upon quality (BRAA, 2004). The management standards included in that document are intended to reduce impact from development, maintain the current condition of upland natural sites and, in some cases to foster improvement of natural areas.

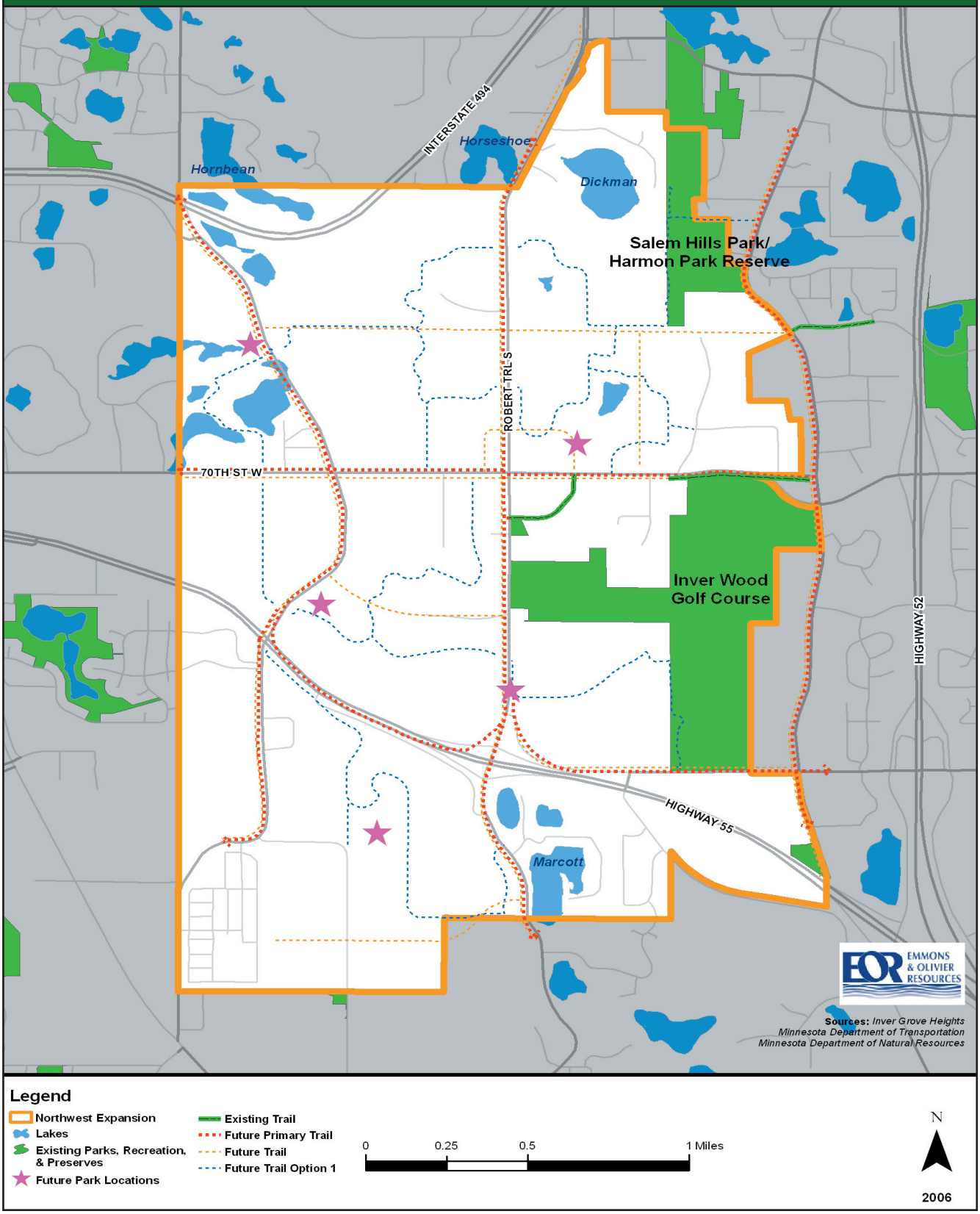
Figure 2.14 Upland Classification Map



XIII. Parks and Trails

Inver Grove Heights maintains an extensive network of parks and trails (Figure 2.16). Notable parkland in the NWA include Inver Wood Golf Course and Salem Hills Park. Several new parks and trails are envisioned by the city as the area develops.

Figure 2.15 Parks and Trails Map



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