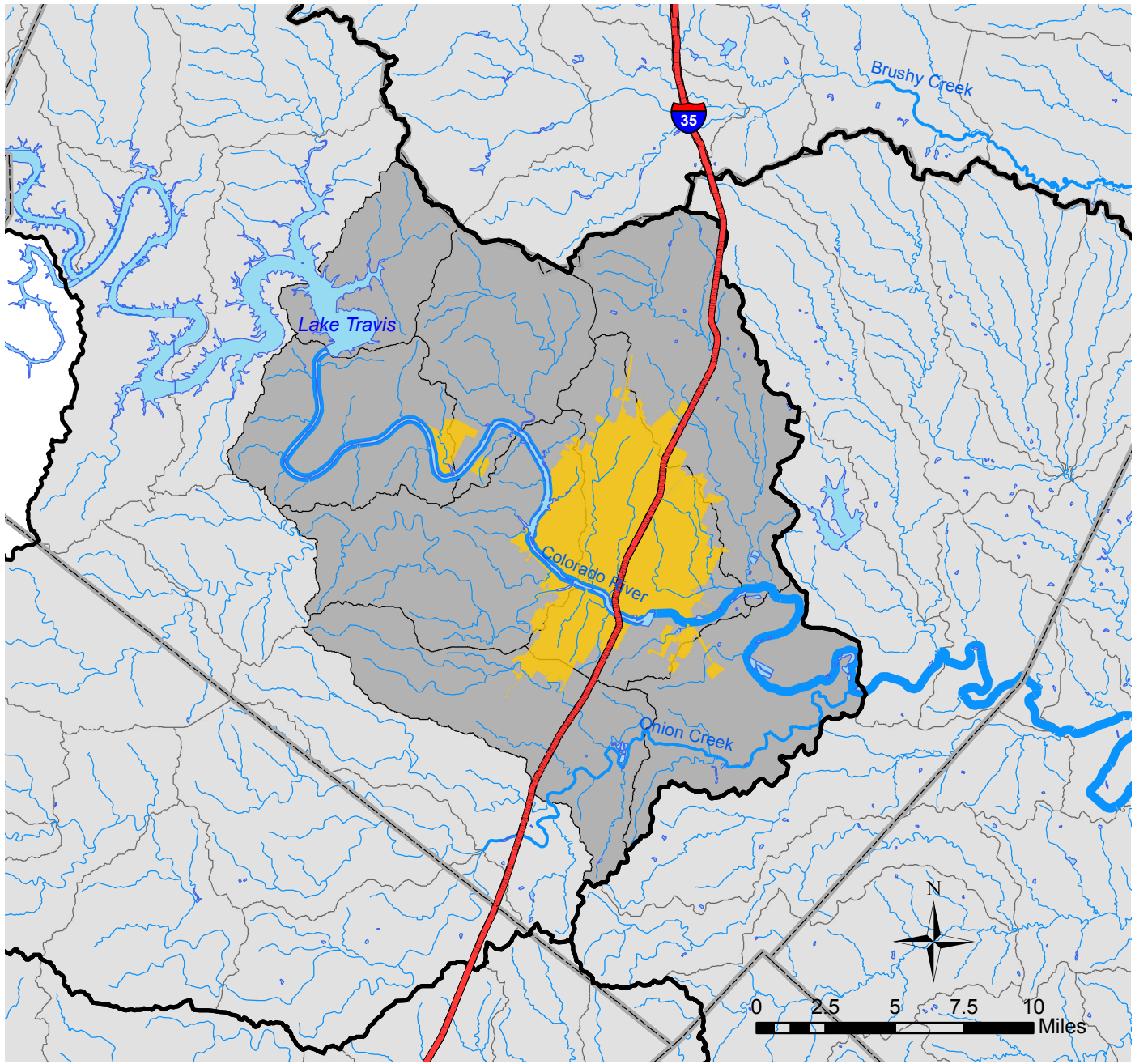
GROWTH TRENDS AND ENVIRONMENTAL INTEGRITY

AUSTIN, TEXAS

Prepared by Tom Hilde
17 November 2011
GIS In Water Resources

JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960

1960 - 1969

1970 - 1979

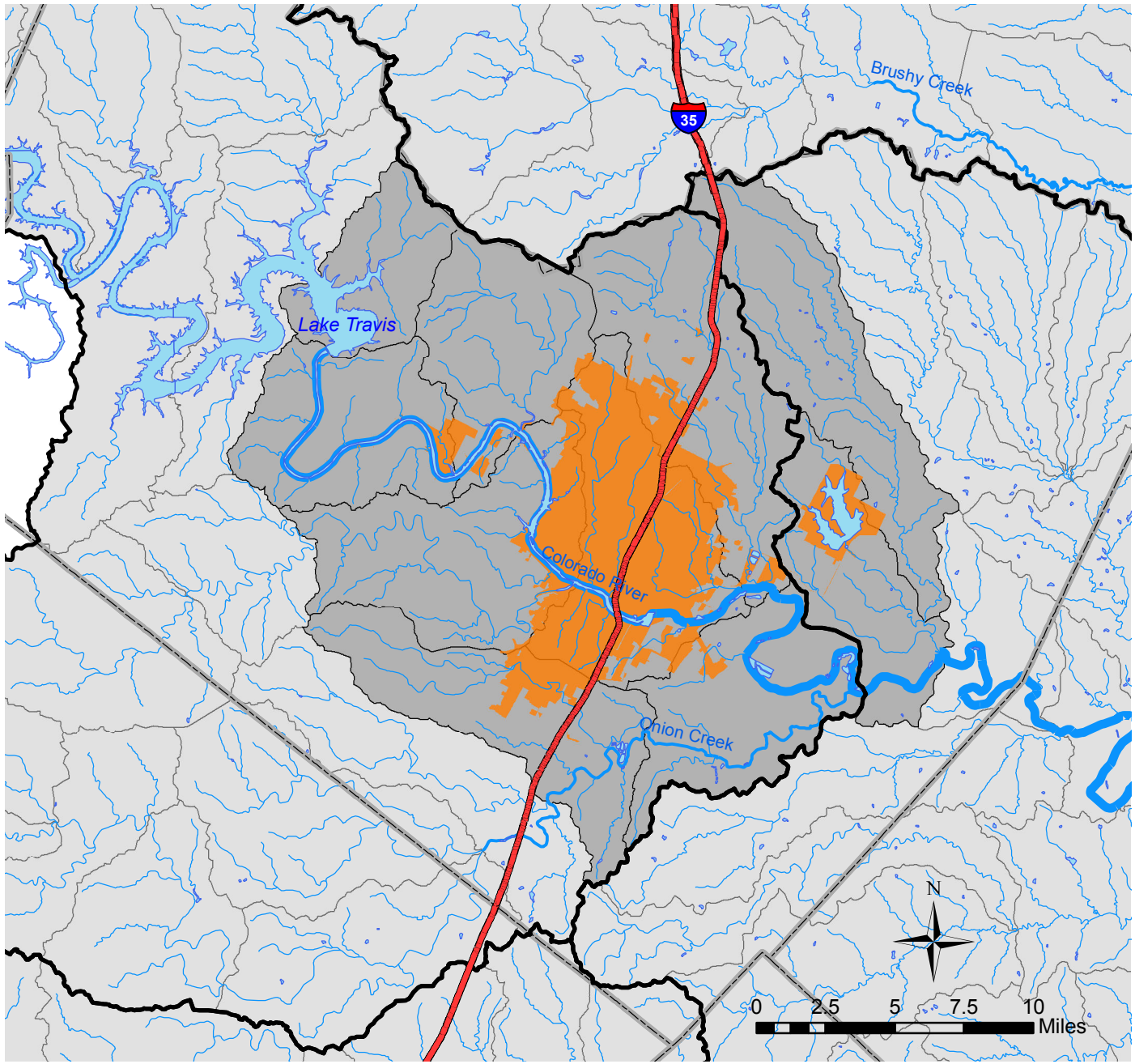
1980 - 1989

1990 - 1999

2000 - PRESENT

52 square miles
8 HUC12 watersheds

JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960

1960 - 1969

1970 - 1979

1980 - 1989

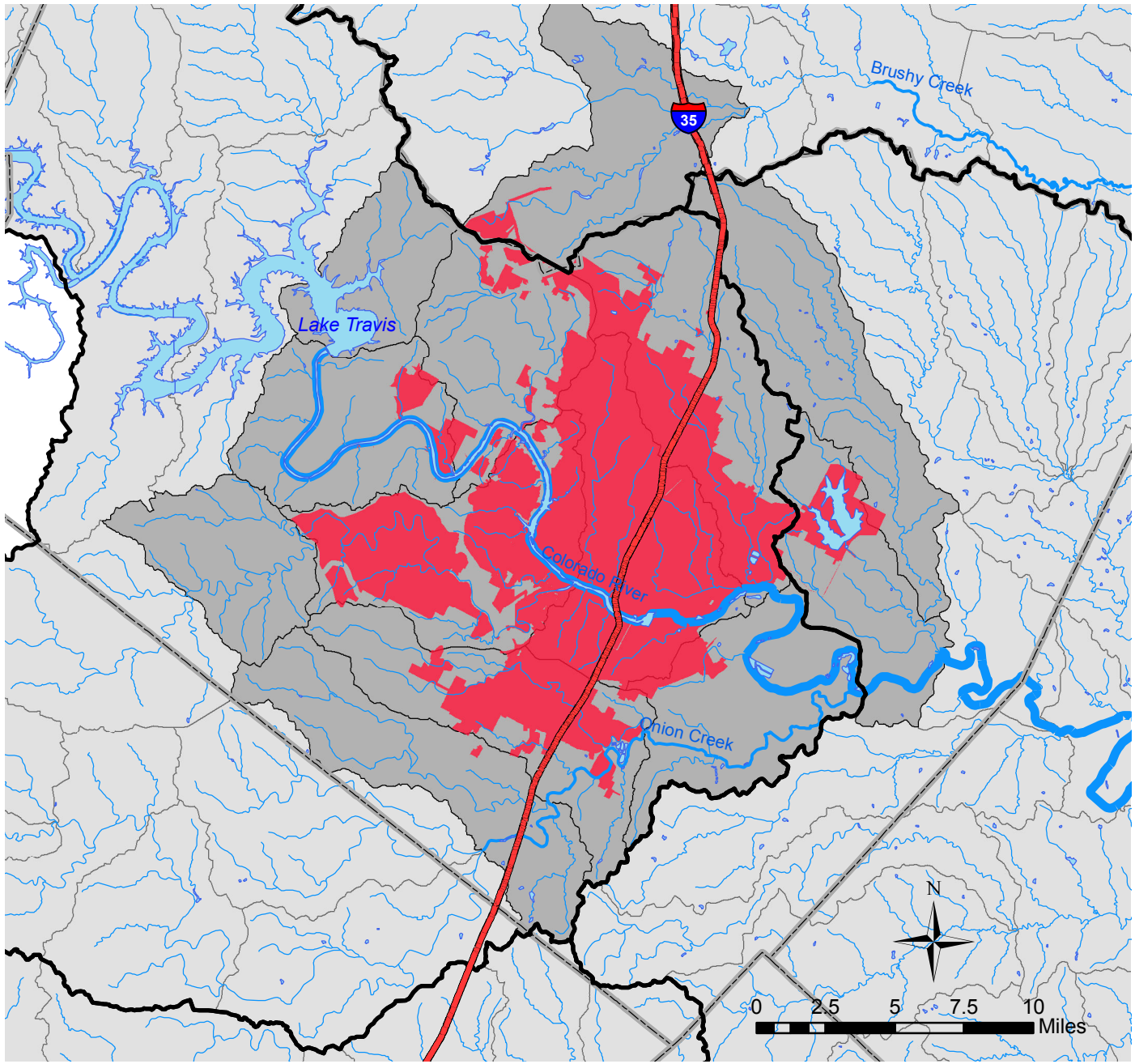
1990 - 1999

2000 - PRESENT

82 square miles

10 HUC12 watersheds

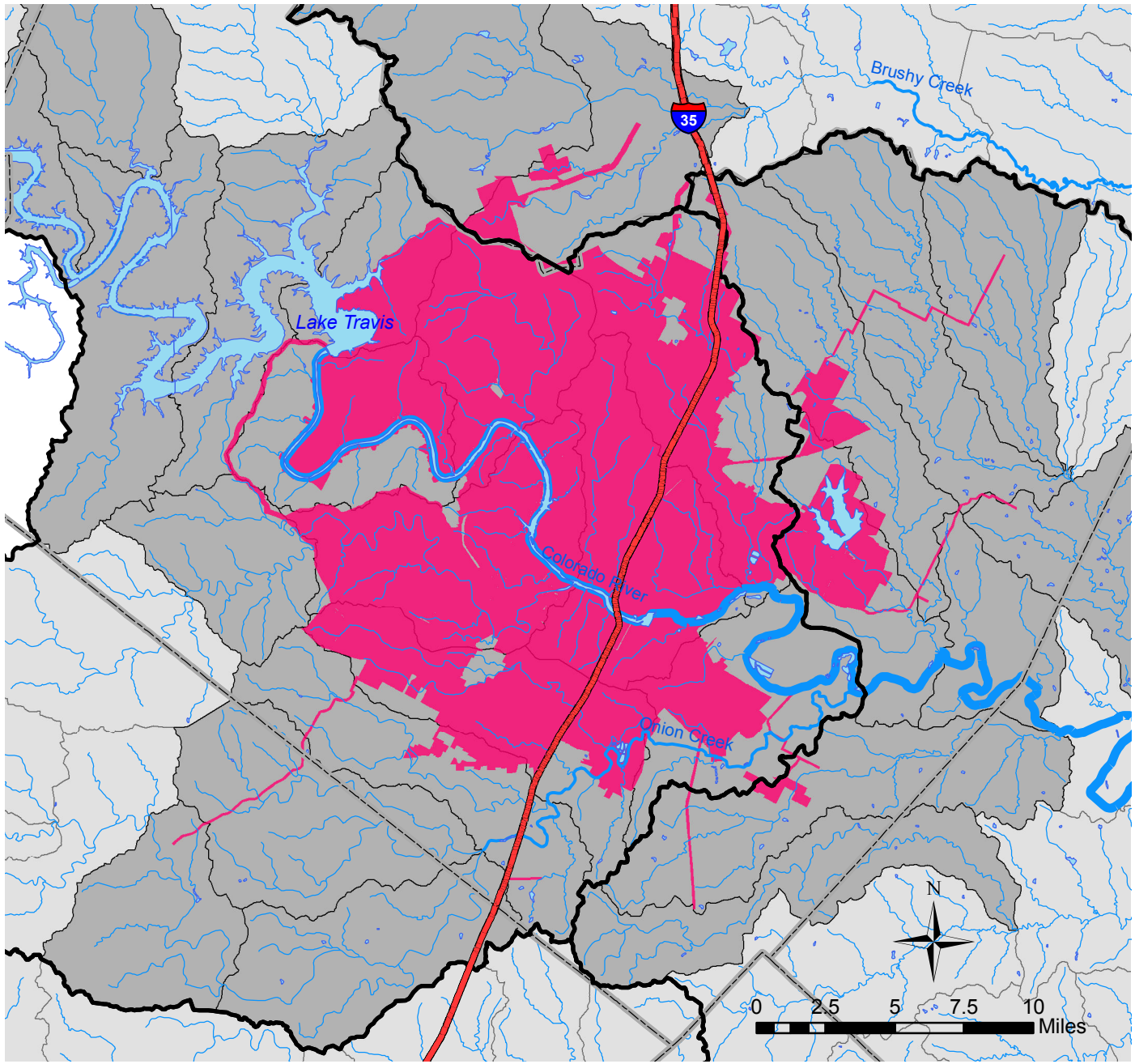
JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - PRESENT

160 square miles
13 HUC12 watersheds

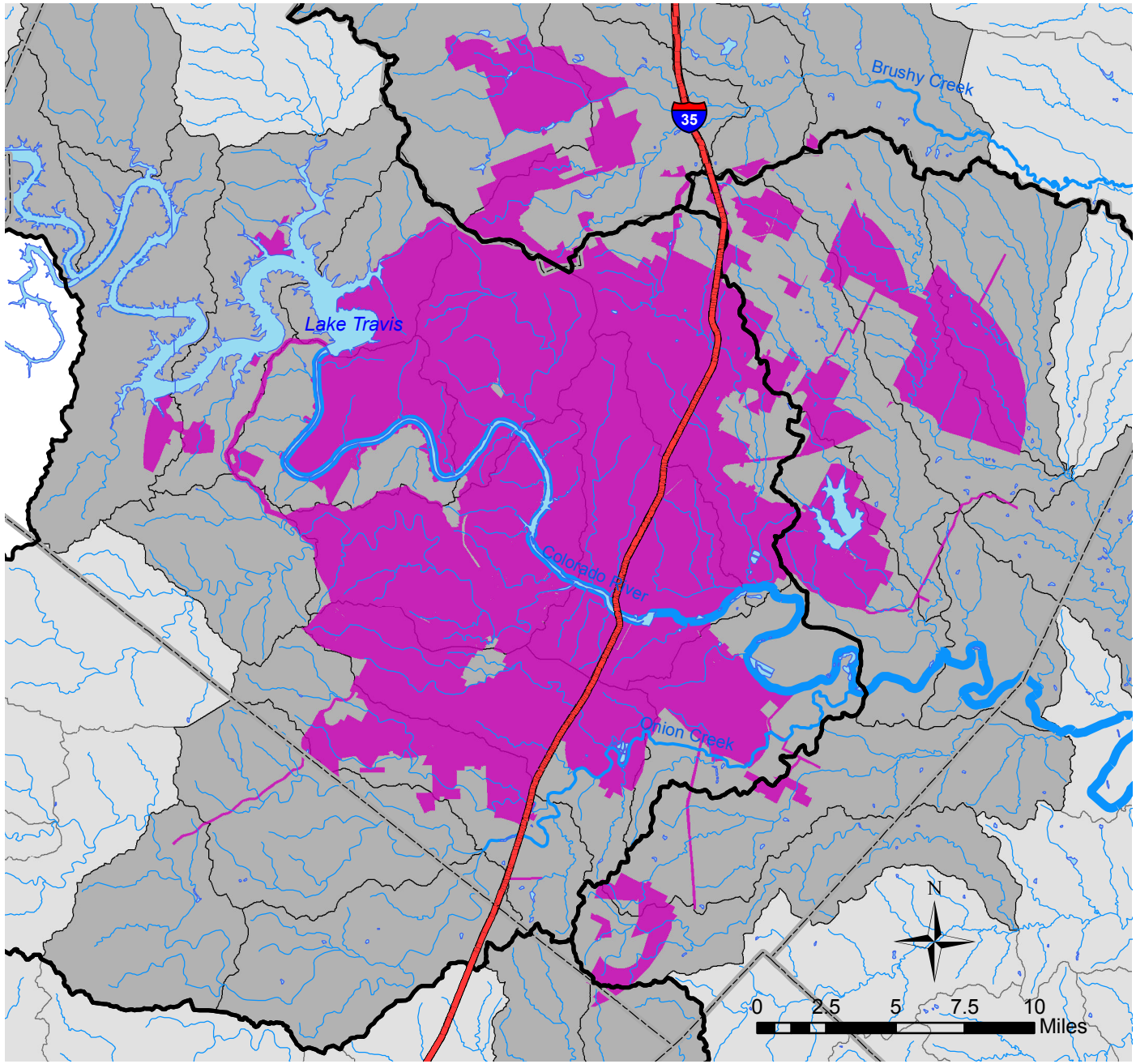
JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - PRESENT

362 square miles
27 HUC12 watersheds

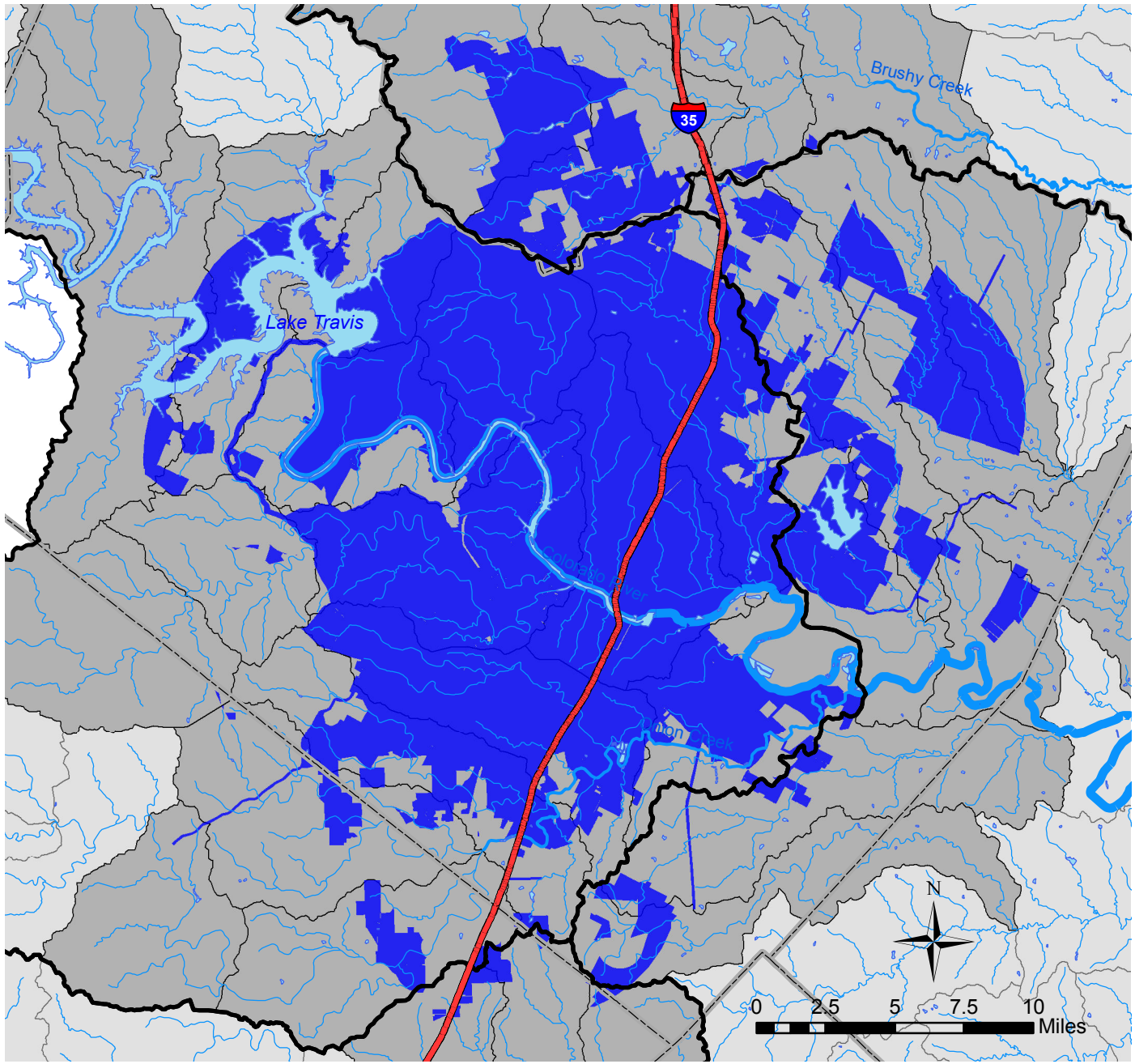
JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - PRESENT

487 square miles
31 HUC12 watersheds

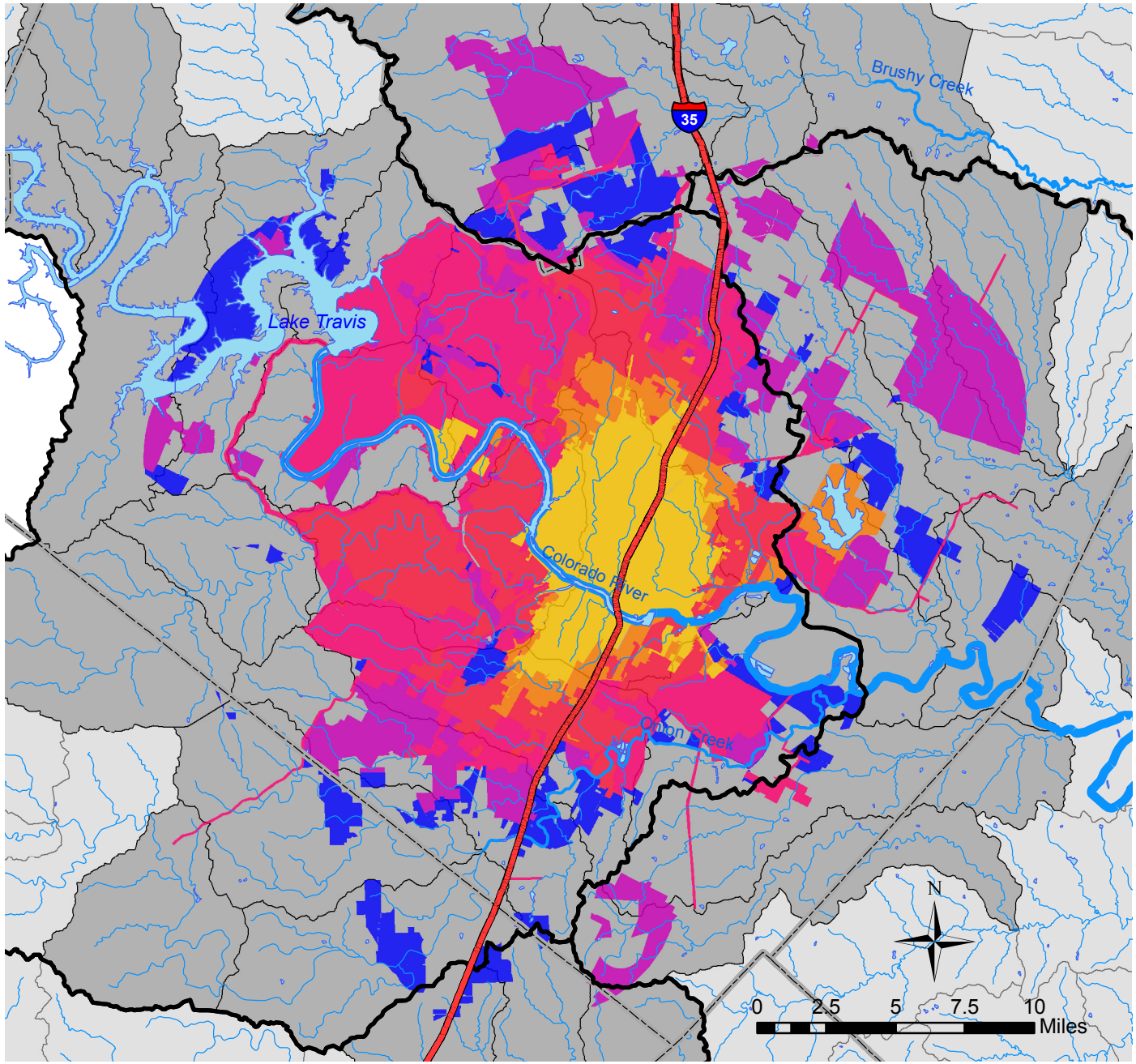
JURISDICTION HISTORY OF AUSTIN, TEXAS



BEFORE 1960
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - PRESENT

578 square miles
33 HUC12 watersheds

JURISDICTION HISTORY OF AUSTIN, TEXAS



Characterized by "sprawling" greenfield development

How does this growth impact previously undeveloped watersheds?

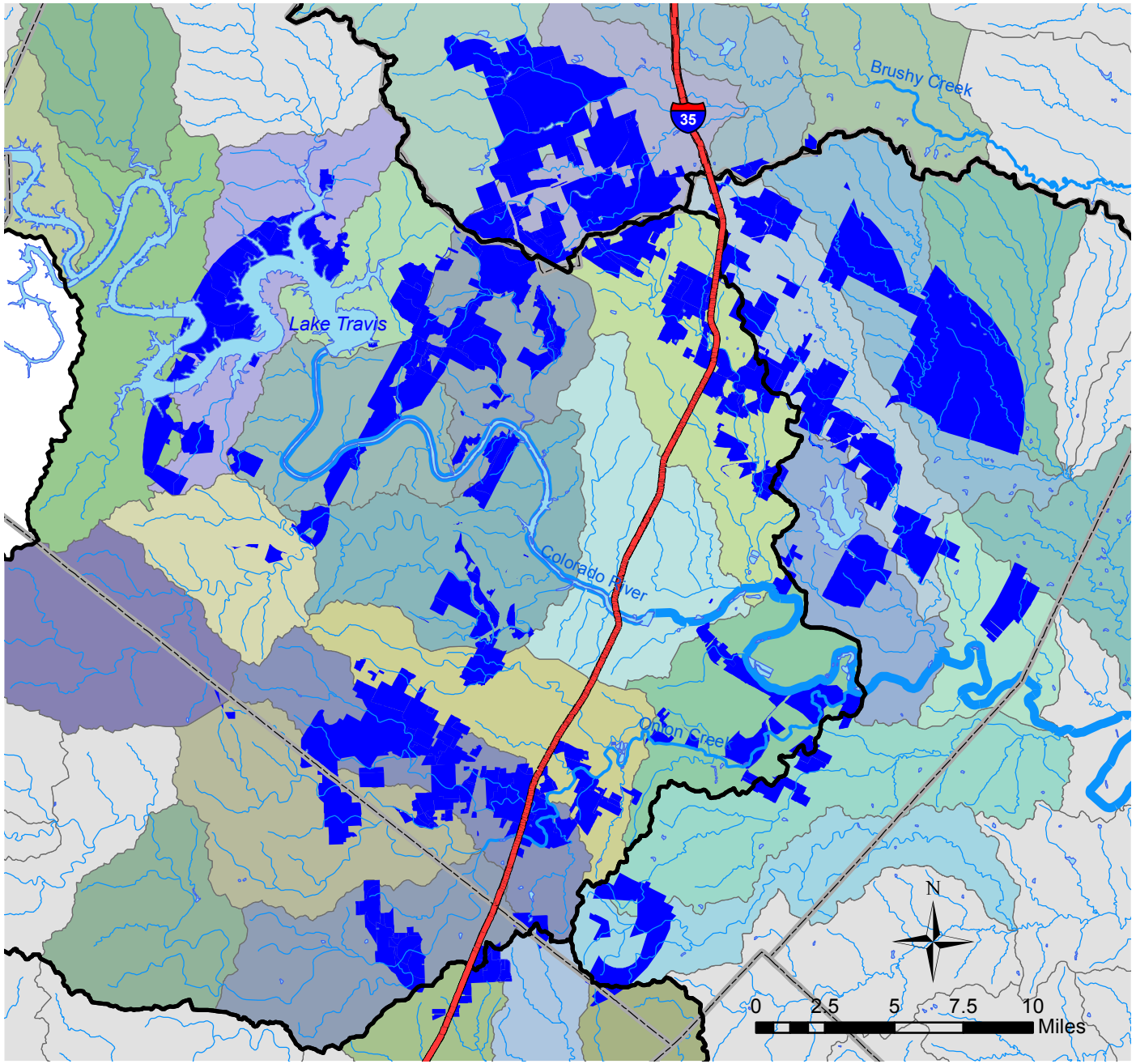
Methodology: Obtain *Jurisdiction History* spatial data, add attribute field to group and symbolize effective annexation dates by decade

ANNEXATION DATE

- BEFORE 1960
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1999
- 2000-PRESENT

WATERSHEDS

ANNEXATIONS SINCE 1990

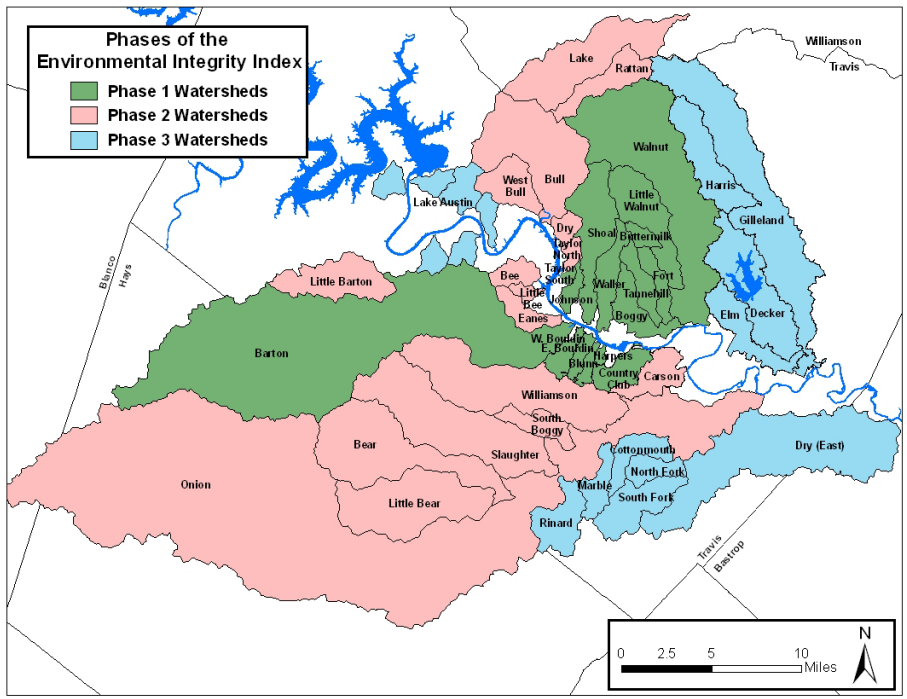


Scattered and undirected development patterns contribute to low-density population distribution

Encourages rural development with little regard for water systems

Methodology: Use *Select By Attribute* and Data > Export to create new feature class

AUSTIN ENVIRONMENTAL INTEGRITY INDEX



A tool developed to **monitor and assess the ecological integrity** of Austin watersheds.

Prioritizing subwatersheds to address through **Capital Improvement Projects, regulations and/or programs**.

Water chemistry data collected quarterly and biological and habitat surveys conducted once per year in the summer.

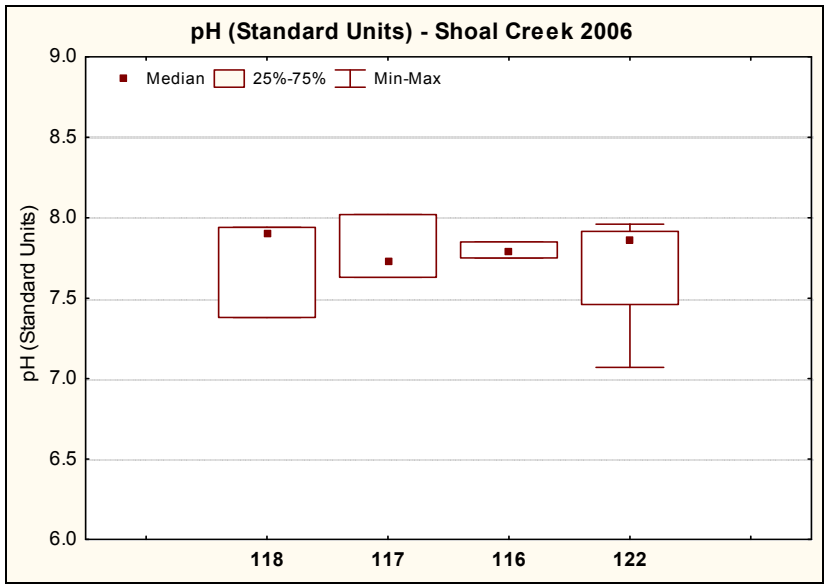
Watersheds are organized into three separate phases which have been sampled on a t**hree year rotating basis** since 1996.

Drawback: Each watershed is only monitored once every three years in our rapidly developing environment.

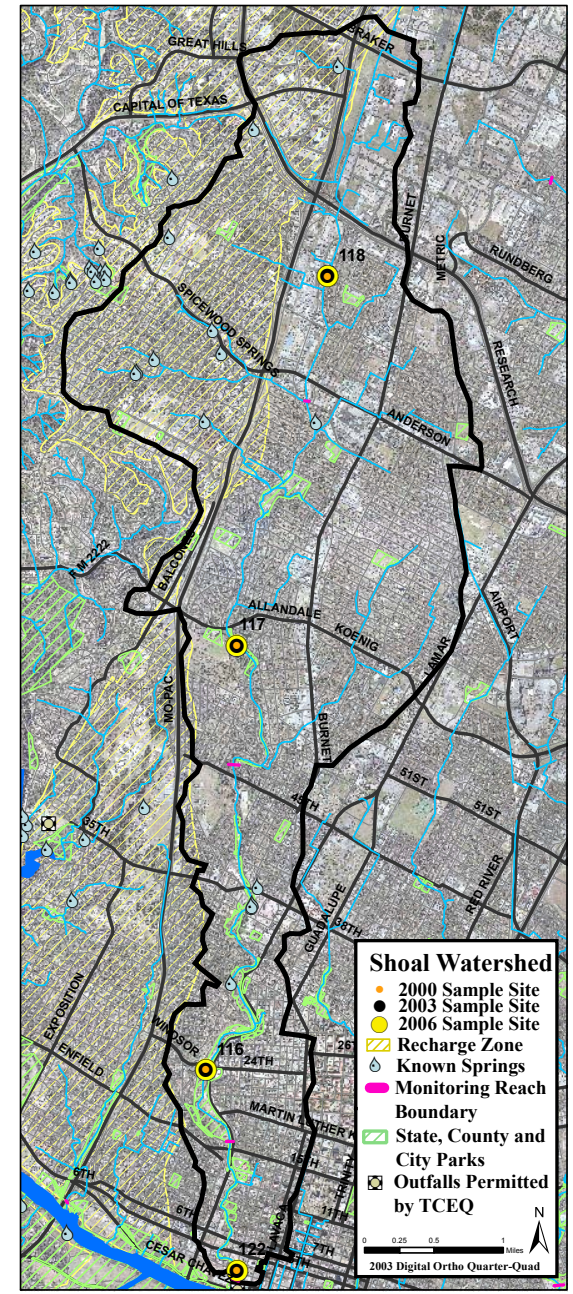
AUSTIN ENVIRONMENTAL INTEGRITY INDEX

Annual E.I.I. reports include **watershed summaries, historical results, and raw data.**

EXAMPLE FIELD PARAMETER DATA:



EXAMPLE SITE LOCATIONS:



EXAMPLE SUB-INDEX SCORES:

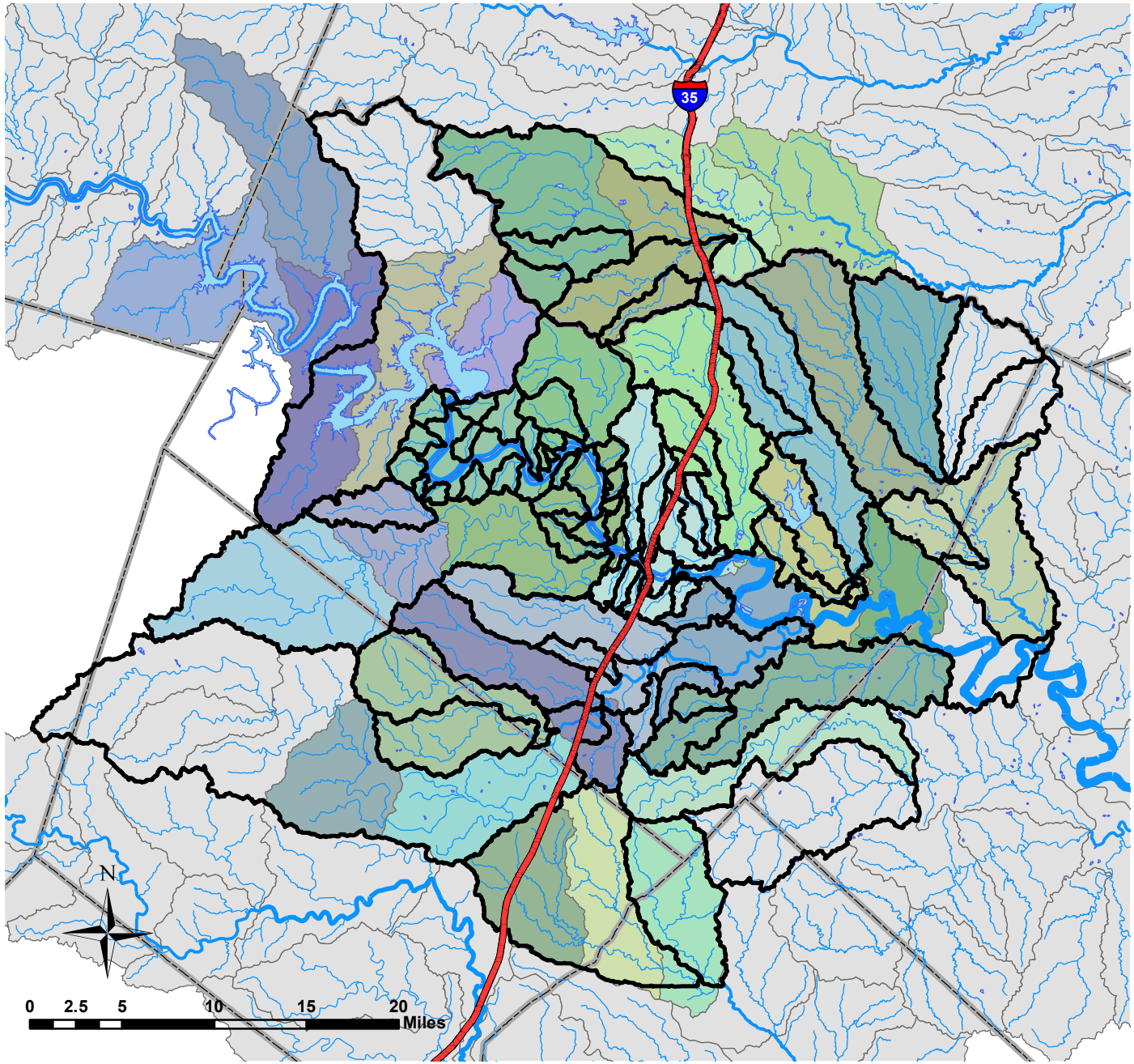
Sub-index scores for Shoal Creek Sites (upstream to downstream) 2000, 2003, 2006

Site Number	Site 118			Site 117			Site 116			Site 122		
Year of Sampling	2000	2003	2006	2000	2003	2006	2000	2003	2006	2000	2003	2006
Water Quality	64	68	70	62	62	67	53	51	48	44	32	34
Sediment	89	68	59	89	68	59	89	68	59	89	68	59
Contact Recreation	75	67	59	65	62	49	74	41	24	63	60	30
Non-Contact Rec.	63	68	53	77	65	72	63	66	79	64	34	59
Physical Integrity	42	54	58	45	65	57	26	32	47	33	35	46
Aquatic Life	62	37	56	39	36	59	38	36	64	37	45	38
Benthic Mac.	60	41	53	40	32	58	40	29	62	31	34	30
Diatom	64	32	59	37	40	60	36	43	66	42	56	45
Total EII Score	66	60	59	63	60	61	57	49	54	55	46	44

* sediment samples only collected at the downstream site, blank cells indicate parameter was not collected, blank columns indicate site was dropped

100-87.5 Excellent | 87.5-75 V. Good | 75-62.5 Good | 62.5-50 Fair | 50-37.5 Marginal | 37.5-25 Poor | 25-12.5 Bad | 12.5-0 V. Bad

HUC12 vs. CITY OF AUSTIN WATERSHEDS



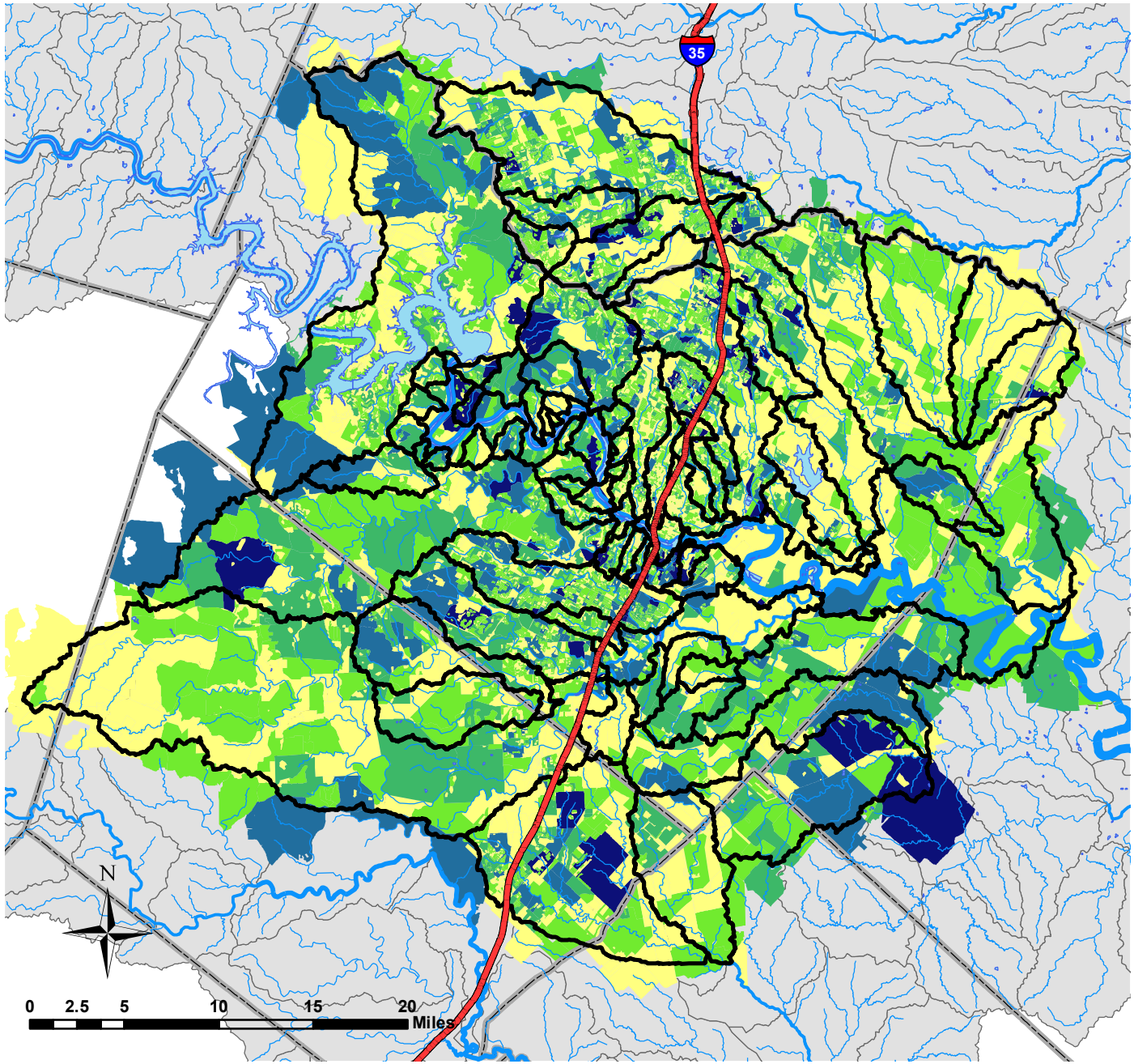
The *Environmental Integrity Index* utilizes watersheds defined by the City of Austin

CoA watershed boundaries preferred over HUC12 watersheds in order to integrate E.I.I. data

Image: HUC12 watersheds are symbolized in color, while CoA-defined watersheds are depicted by black outlines

COA Watersheds

2010 CENSUS BLOCK POPULATIONS

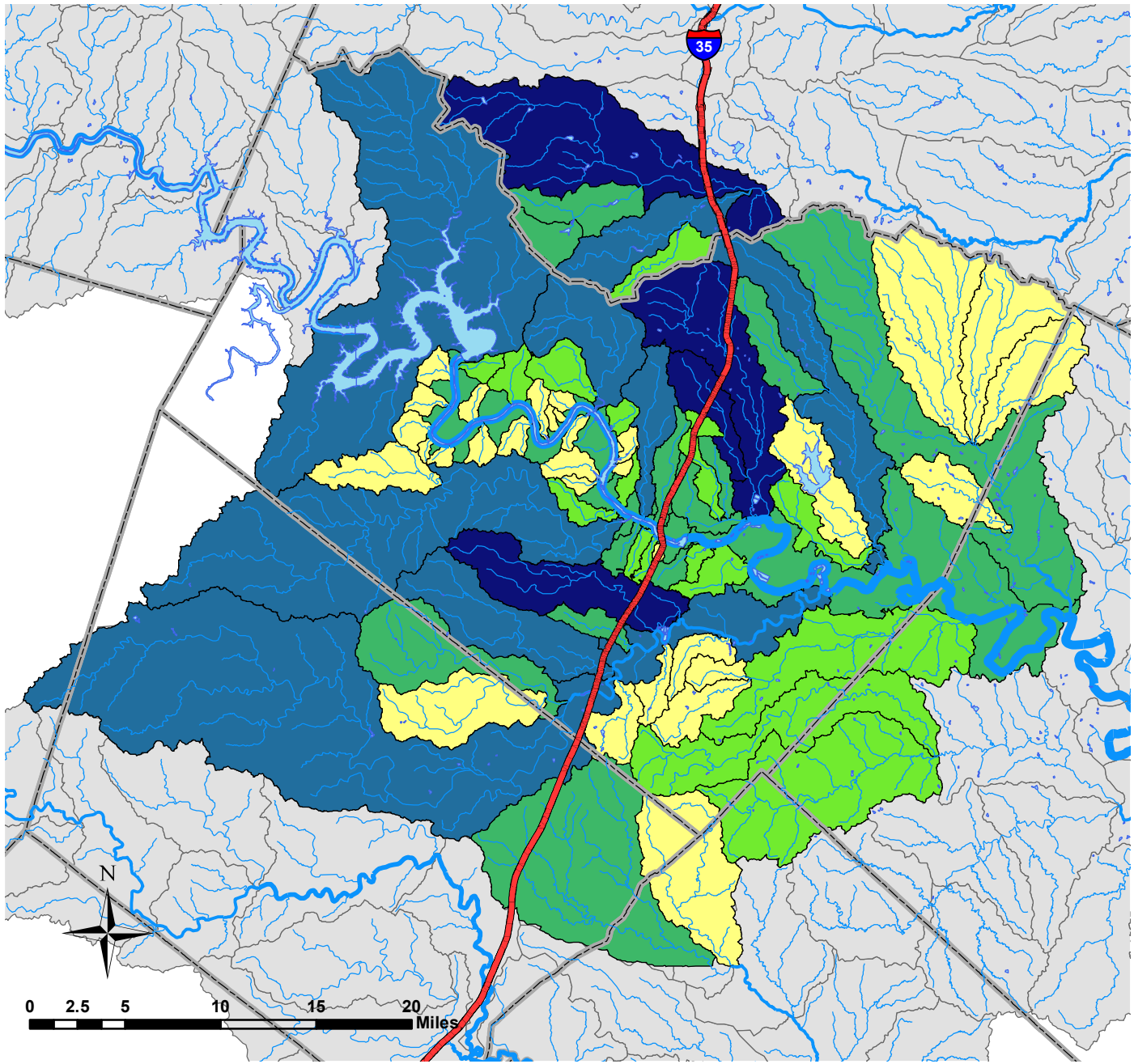


The E.I.I. reports include watershed populations from the year 2000, but lack updated figures

GIS allows updated watershed population figures to be derived from 2010 Census data

Updated population data will help us understand which watersheds have seen the most growth

2010 WATERSHED POPULATIONS



"Re-frame" human settlement in the context of water systems

Resulting data can be compared to E.I.I. 2000 watershed population data

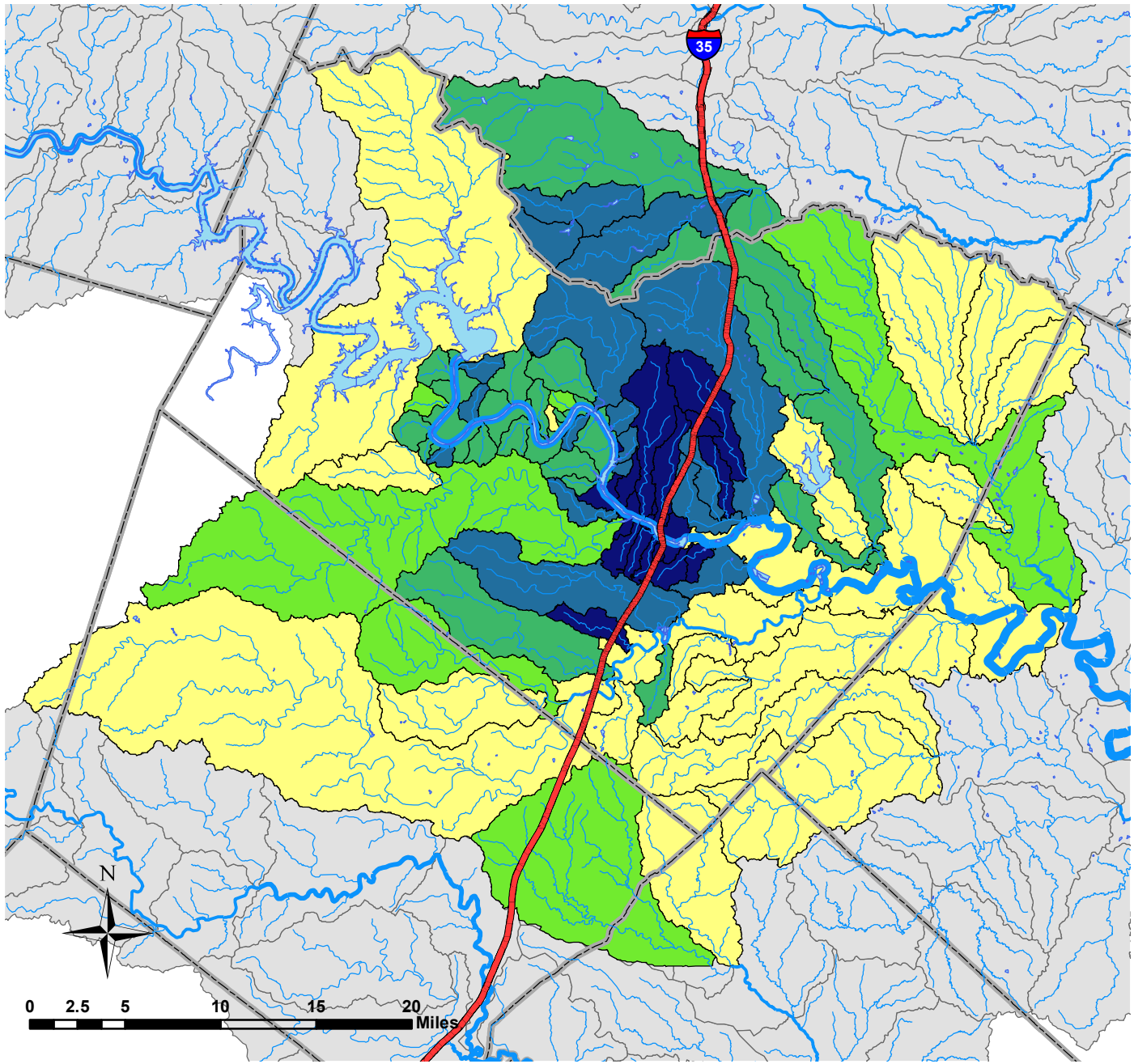
Methodology: *Union* tool used to create a geometric intersection of watershed boundaries and 2010 Census blocks. Resulting feature class included attribute fields from both input features. *Dissolve* tool used with *Watershed Code* as the dissolve feature to recreate watershed boundaries while summing the census block population data for each watershed using the statistics field.

CITY OF AUSTIN WATERSHEDS

TOTAL POPULATION

- LESS THAN 8,000
- 8,001 - 20,000
- 20,001 - 50,000
- 50,001 - 75,000
- OVER 75,000

2010 WATERSHED POPULATION DENSITIES



Density allows a better understanding of population distribution, with denser watersheds found in Austin's urban core

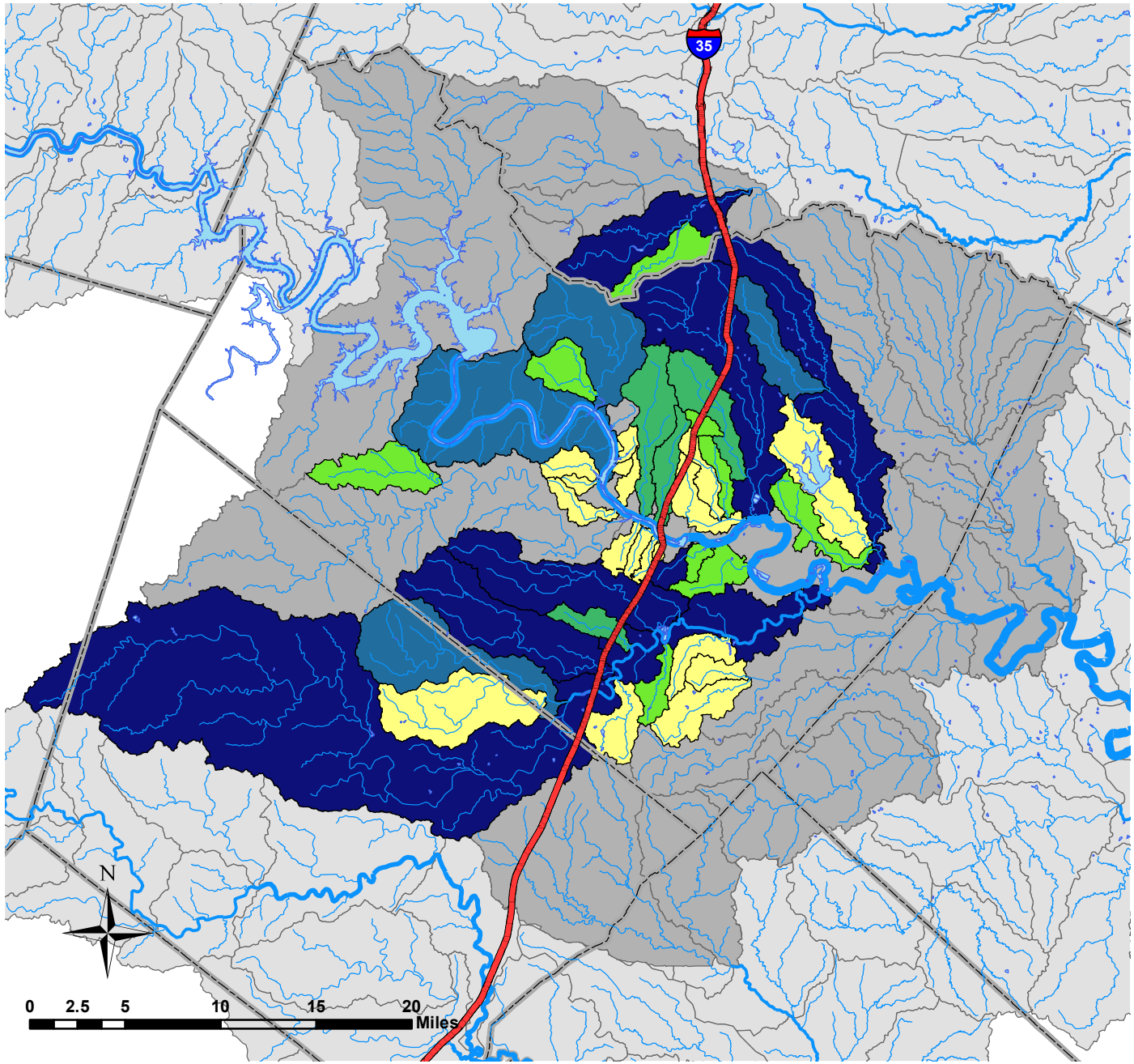
Methodology: After adding a new field, the area in sq. miles of each watershed was found using the attribute table's *Calculate Geometry* command. The resulting attribute data was used to normalize the symbology.

CITY OF AUSTIN WATERSHEDS

POPULATION PER SQ. MILE

- UNDER 500
- 501 - 1,000
- 1,001 - 2,500
- 2,501 - 5,000
- OVER 5,000

2000 - 2010 WATERSHED POPULATION CHANGE



Population change in each watershed derived from GIS analysis of 2010 Census data and 2000 E.I.I. data

Most population growth is seen outside the urban core

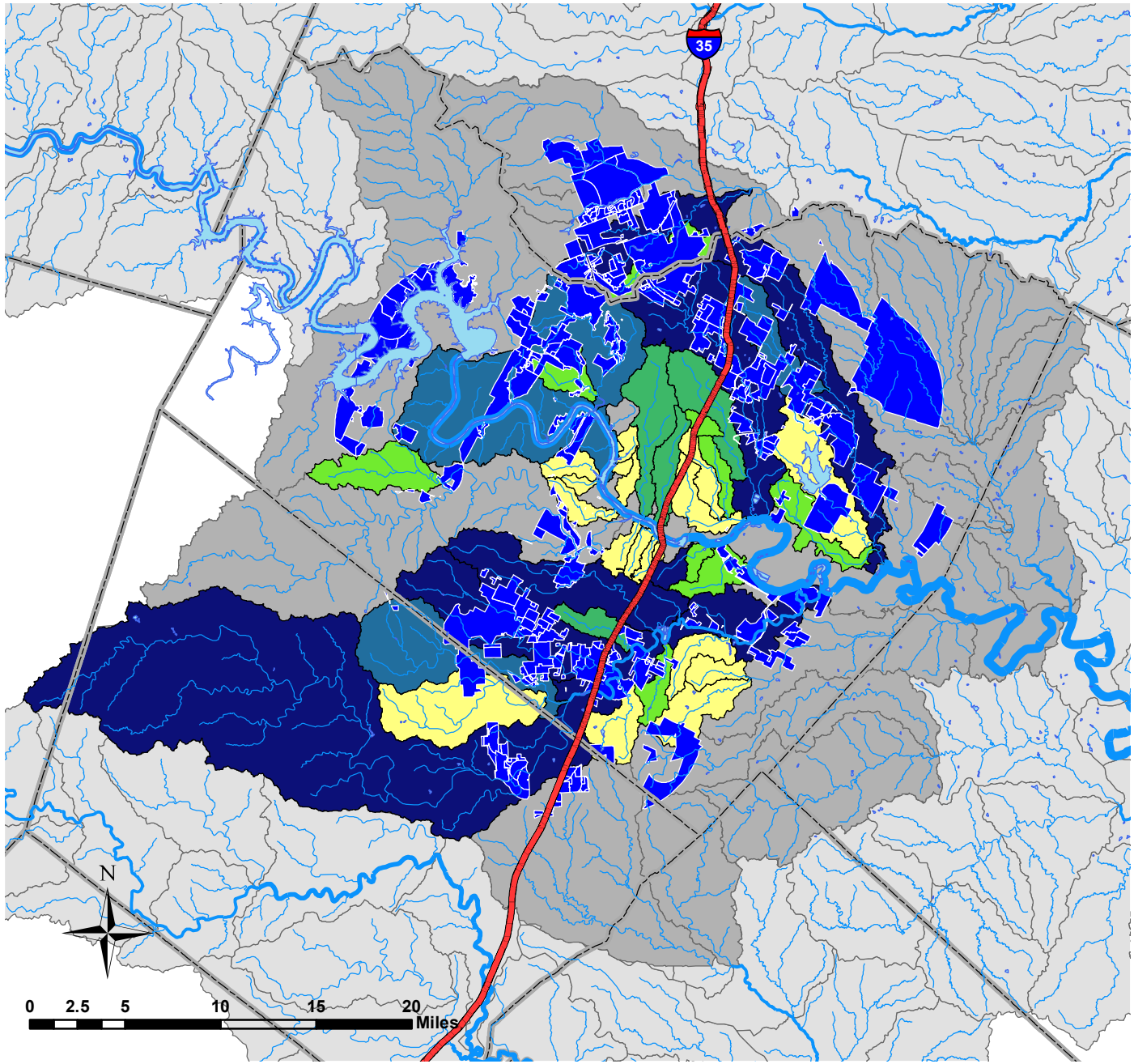
Methodology: After inputting 2000 population data, imported table was joined to the watershed attribute table. *Field Calculator* used to find the difference between 2000 and 2010 population values.

CITY OF AUSTIN EII WATERSHEDS

POPULATION CHANGE

- LESS THAN 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 20,000
- OVER 20,000
- NO EII DATA

POPULATION CHANGE vs. RECENT ANNEXATIONS



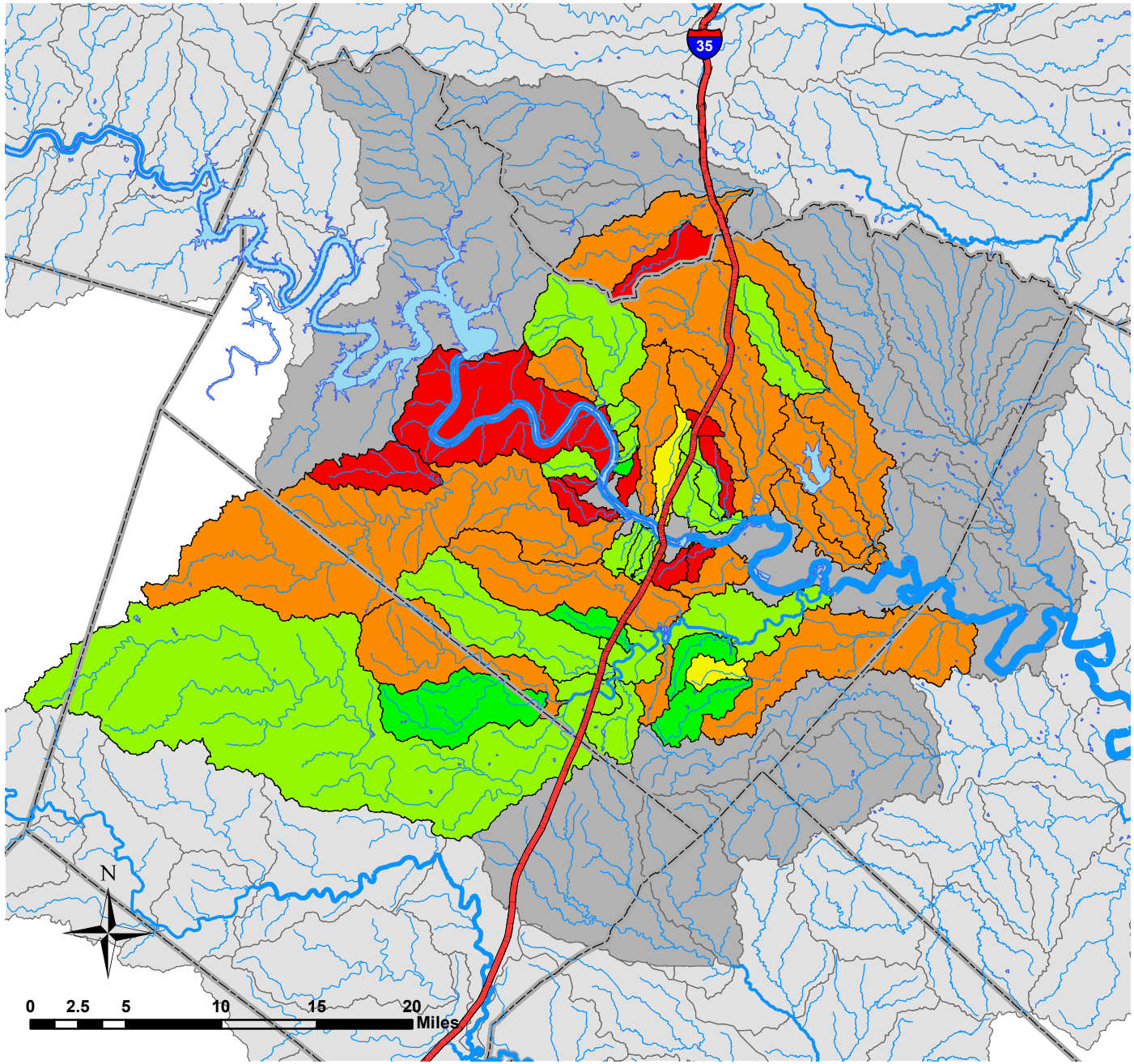
Correlation between municipal expansion and greenfield population growth

CITY OF AUSTIN EII WATERSHEDS

POPULATION CHANGE

- LESS THAN 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 20,000
- OVER 20,000
- NO EII DATA
- ANNEXATIONS SINCE 1990

TEN-YEAR CHANGE IN ENVIRONMENTAL INTEGRITY



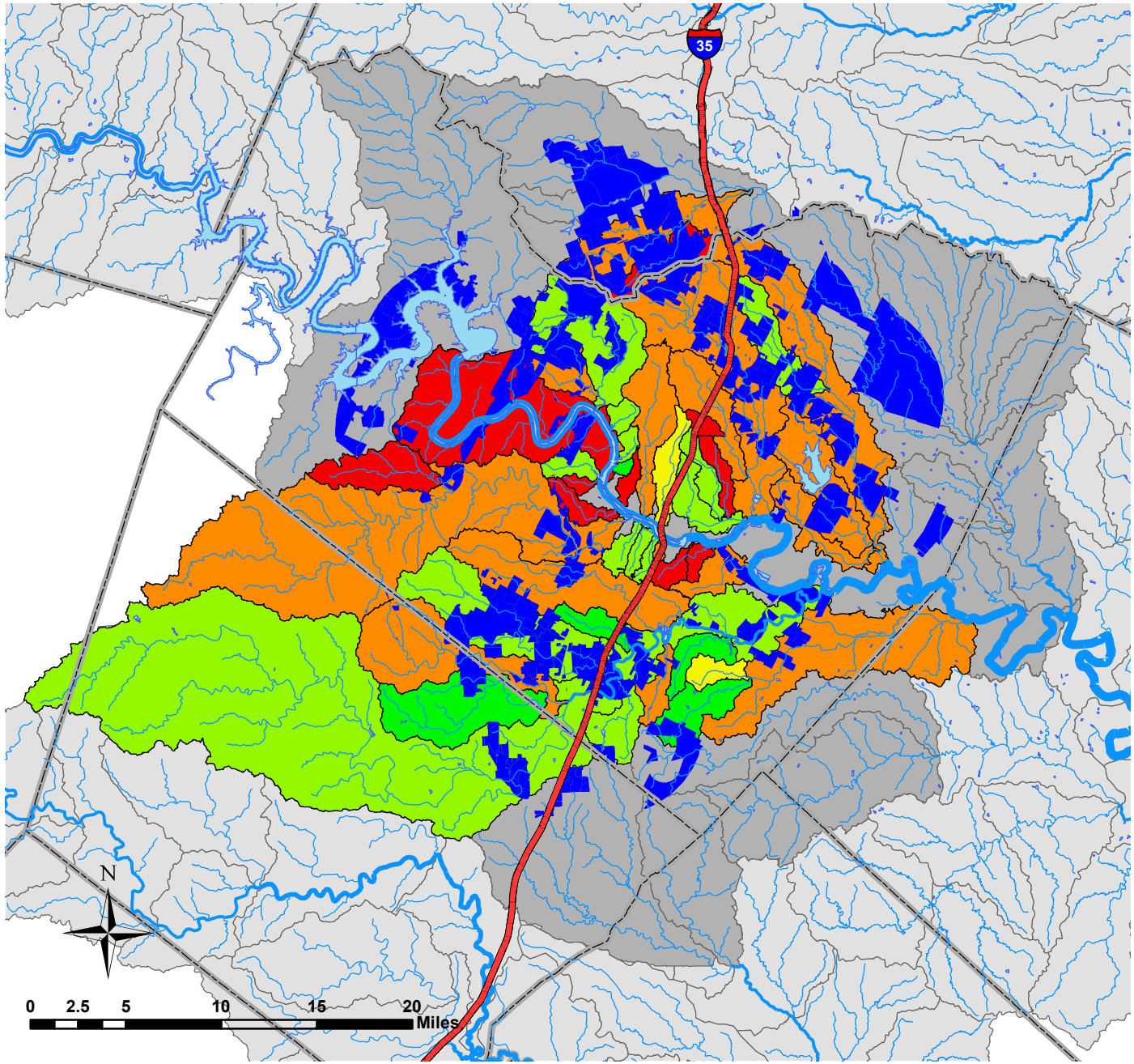
Change in *Overall E.I.I. Score* from earliest observation year to most recent, a ten-year span for all watersheds

Overall Index Scores are calculated from metrics of water quality, sediment quality, aquatic life, diatom, contact and non-contact recreation, and physical integrity, based on water and biological sampling

CHANGE IN OVERALL INDEX

- LOST 5 OR MORE POINTS
- LOST 0 - 5 POINTS
- NO CHANGE
- IMPROVED 0 - 5 POINTS
- IMPROVED MORE THAN 5 POINTS
- NO EII DATA

CHANGE IN ENV. INTEGRITY vs. RECENT GROWTH



Correlations can be seen between recent expansion and reduced *Environmental Integrity Index* scores, however other areas of recent development saw improvements over a similar time span

Attributable to the complex nature of water systems, climatic factors, and the challenges of data collection in a rapidly changing environment

CHANGE IN OVERALL INDEX

- LOST 5 OR MORE POINTS
- LOST 0 - 5 POINTS
- NO CHANGE
- IMPROVED 0 - 5 POINTS
- IMPROVED MORE THAN 5 POINTS
- NO EII DATA
- ANNEXATIONS SINCE 1990

FINDINGS

Municipal jurisdiction and infrastructure expansion serves to encourage greenfield development

Re-framing data can create a better understanding of complex systems

Other factors beyond human settlement determine the environmental integrity of a watershed

MOVING FORWARD

Explore land cover changes to better understand the physical results of recent population growth and development and the impacts on environmental integrity

Develop a better understanding of E.I.I. data and explore other possible correlations with population expansion

Make recommendations to improve the effectiveness of E.I.I. as a planning tool and increase its visibility as an education tool

DATA SOURCES

CITY OF AUSTIN
Environmental Integrity Index Reports
2000 Watershed Populations
Jurisdiction History
CoA Watersheds

CAPCOG
2010 Census Blocks and Demographic Data
County Boundaries
Regional Roads

USDA GEOSPATIAL GATEWAY
HUC12 Watershed Boundaries

NHDPLUS
NHD Flowlines
Flowline Attributes