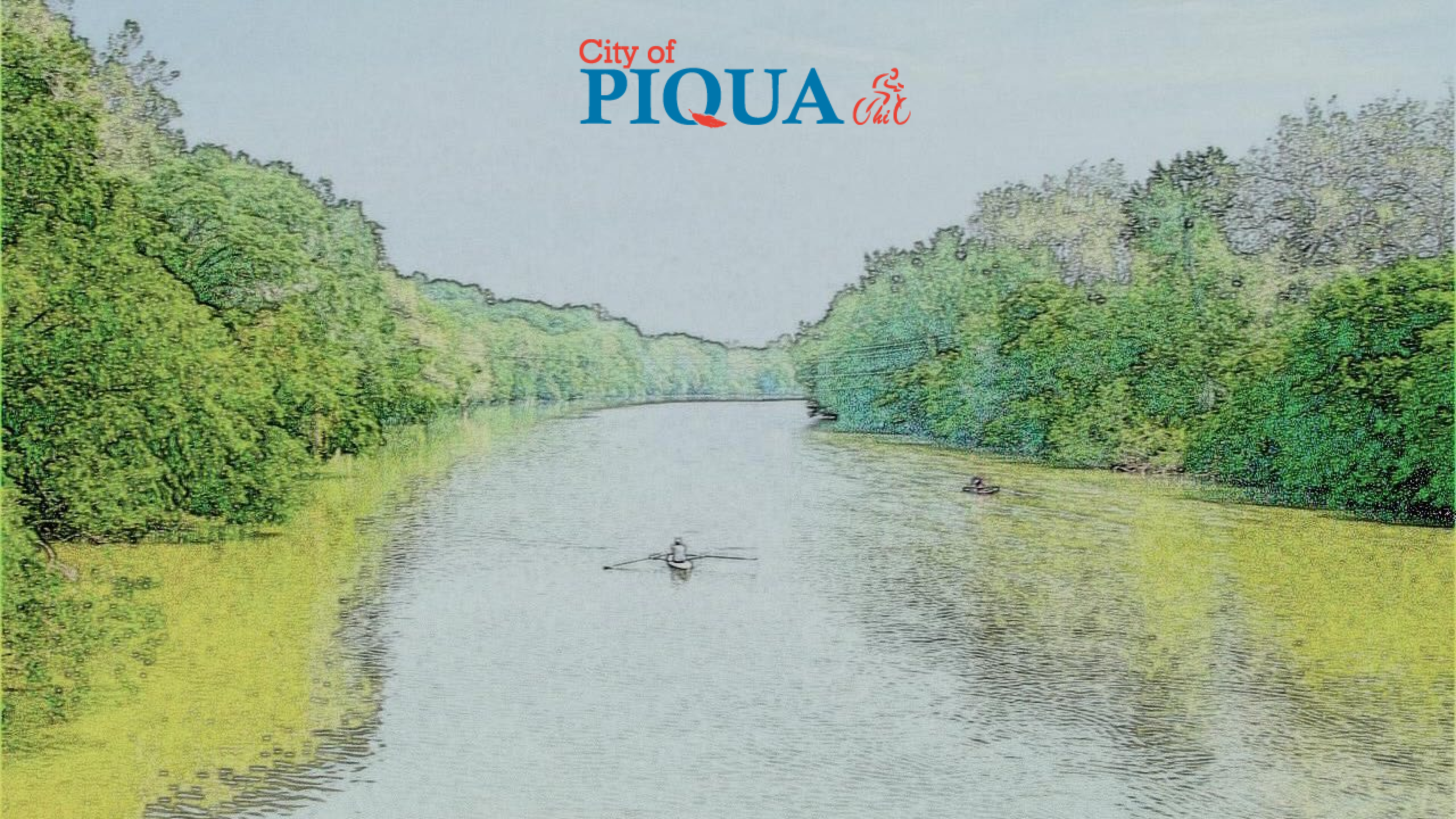

City of
PIQUA

GREAT MIAMI RIVER

DAM REMOVAL &
MODIFICATION

City of PIQUA

U.S. FISH & WILDLIFE SERVICE

Ohio Environmental Protection Agency

PROJECT DESIGN TEAM

FLATLAND RESOURCES

ECOSYSTEM SERVICES

KRIS BASS ENGINEERING

ChoiceOne Engineering

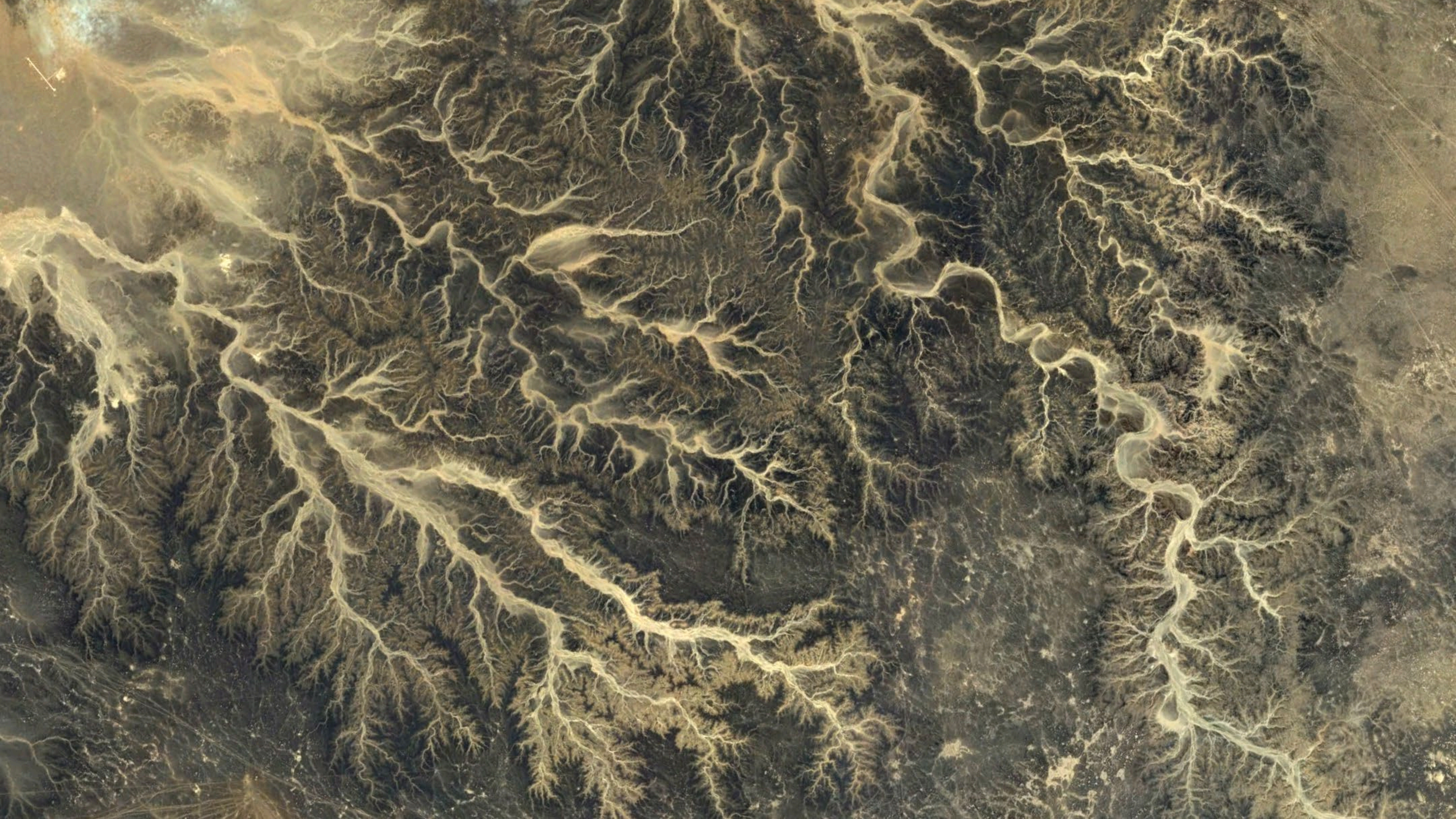
FLATLAND
RESOURCES

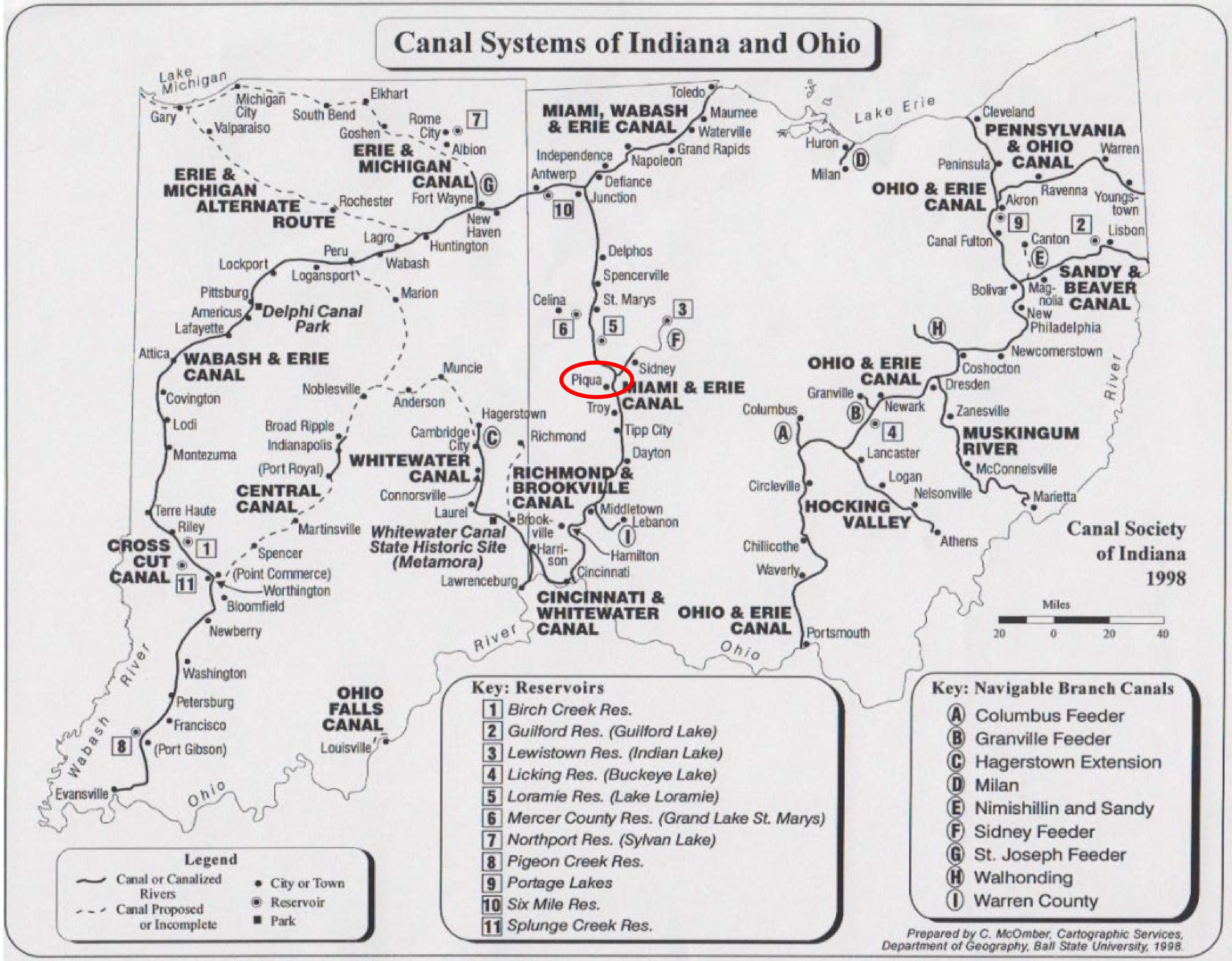
ECOSYSTEM SERVICES

KRIS BASS
ENGINEERING

ChoiceOne
Engineering

HOW DID WE GET HERE?





Canal Systems of Indiana and Ohio
Lake Michigan
Lake Erie
Gary
Michigan City
Valparaiso
South Bend
Elkhart
Goshen
Rome City
Albion
7
ERIE & MICHIGAN CANAL
ERIE & MICHIGAN ALTERNATE ROUTE
Fort Wayne
Rochester
New Haven
Huntington
Lagro
Peru
Wabash
Lockport
Logansport
Marion
Pittsburg
Americus
Delphi Canal Park
Lafayette
Attica
WABASH & ERIE CANAL
Covington
Lodi
Montezuma
Muncie
Noblesville
Anderson
Broad Ripple
Indianapolis
(Port Royal)
CENTRAL CANAL
Cambridge City
Hagerstown
Richmond
WHITEWATER CANAL
Connorsville
Laurel
Whitewater Canal State Historic Site (Metamora)
Brook-ville
Harri-son
Lawrenceburg
Terre Haute
Riley
CROSS CUT CANAL
1
11
Martinsville
Spencer
(Point Commerce)
Worthington
Bloomfield
Newberry
Washington
Petersburg
Francisco
(Port Gibson)
8
Evansville
Wabash River
Ohio
OHIO FALLS CANAL
Louisville
River
Toledo
MIAMI, WABASH & ERIE CANAL
Maumee
Waterville
Grand Rapids
Independence
Napoleon
Antwerp
Defiance
Junction
10
Delphos
Spencerville
Celina
St. Marys
6
5
3
Sidney
Piqua
MIAMI & ERIE CANAL
Troy
Tipp City
Dayton
RICHMOND & BROOKVILLE CANAL
Middletown
Lebanon
Hamilton
Cincinnati
CINCINNATI & WHITEWATER CANAL
OHIO & ERIE CANAL
Portsmouth
Ohio
Huron
Milan
Cleveland
PENNSYLVANIA & OHIO CANAL
Warren
Peninsula
OHIO & ERIE CANAL
Akron
Ravenna
Youngs-town
9
2
Canal Fulton
Canton
Lisbon
SANDY & BEAVER CANAL
Bolivar
Mag-nolia
New Philadelphia
Newcomerstown
Coshocton
Dresden
OHIO & ERIE CANAL
Granville
Newark
Columbus
4
Zanesville
MUSKINGUM RIVER
Lancaster
Logan
Nelsonville
McConnelsville
Marietta
Circleville
HOCKING VALLEY
Athens
Chillicothe
Waverly
River
Canal Society of Indiana 1998
Miles
20 0 20 40
Key: Reservoirs
1 Birch Creek Res.
2 Guilford Res. (Guilford Lake)
3 Lewistown Res. (Indian Lake)
4 Licking Res. (Buckeye Lake)
5 Loramie Res. (Lake Loramie)
6 Mercer County Res. (Grand Lake St. Marys)
7 Northport Res. (Sylvan Lake)
8 Pigeon Creek Res.
9 Portage Lakes
10 Six Mile Res.
11 Splunge Creek Res.
Key: Navigable Branch Canals
A Columbus Feeder
B Granville Feeder
C Hagerstown Extension
D Milan
E Nimishillin and Sandy
F Sidney Feeder
G St. Joseph Feeder
H Walhonding
I Warren County
Legend
Canal or Canalized Rivers
Canal Proposed or Incomplete
City or Town
Reservoir
Park
Prepared by C. McOmber, Cartographic Services, Department of Geography, Ball State University, 1998.

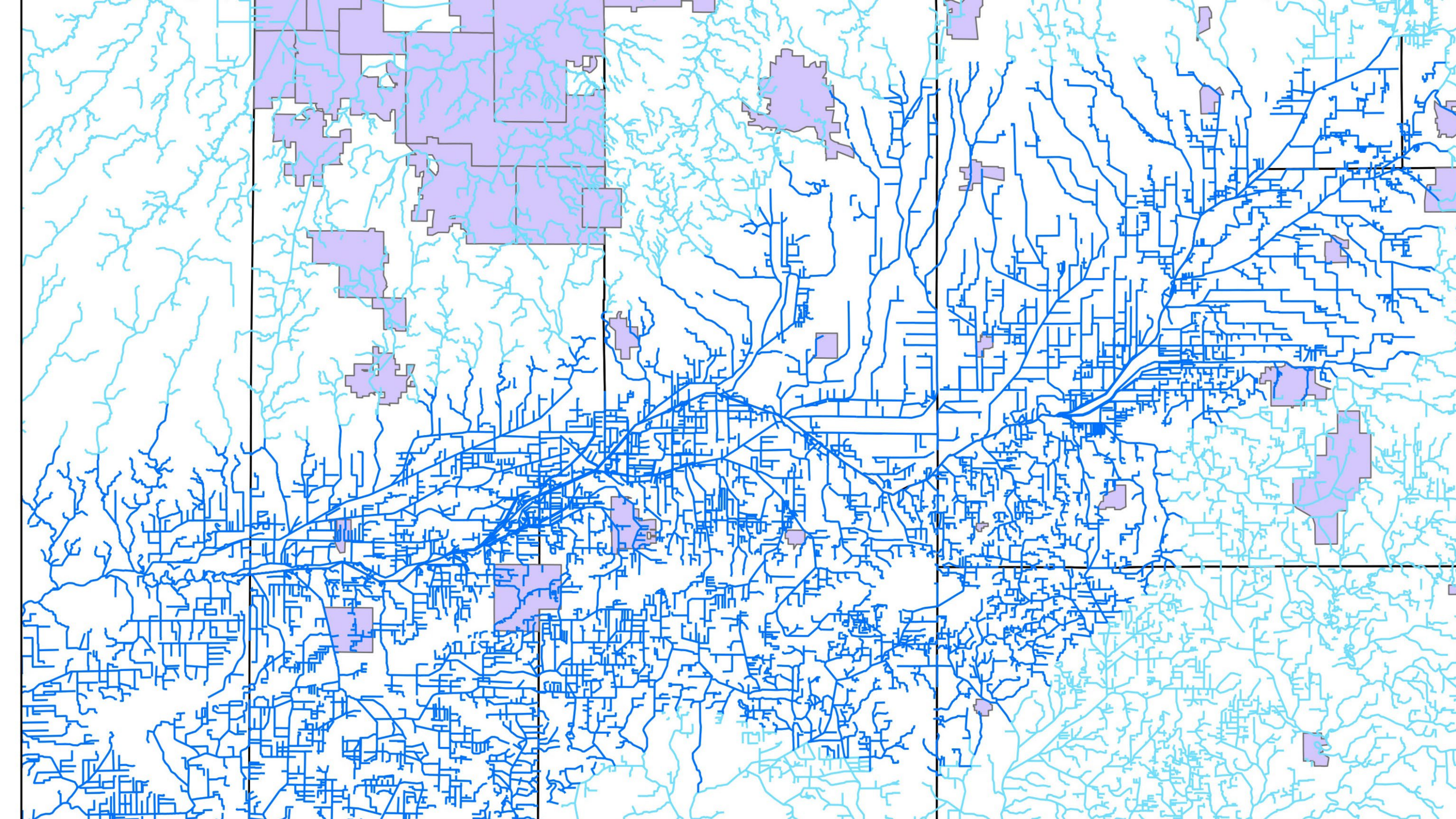
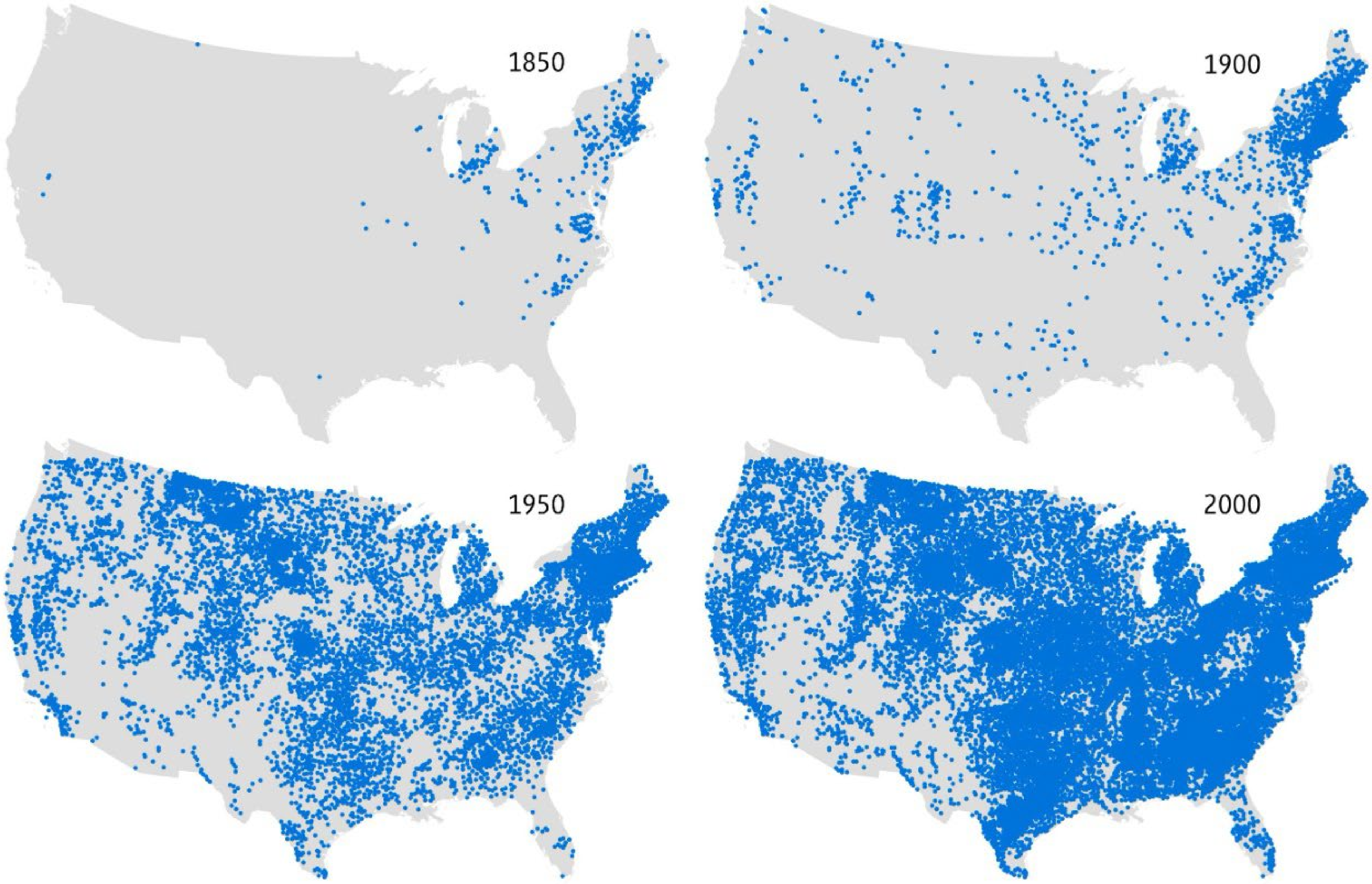



Photo by John Craddock

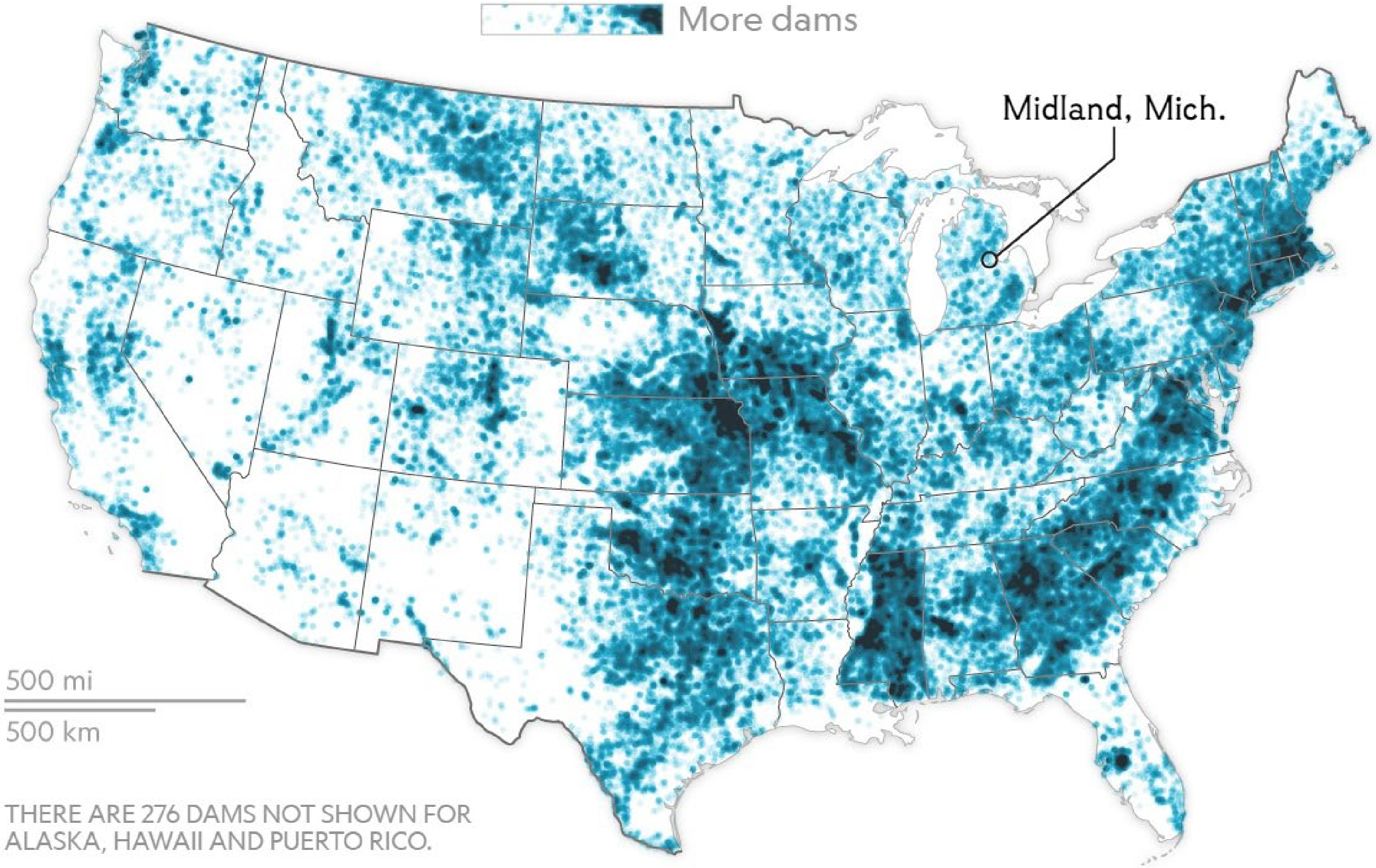
Growth of U.S. Dams and Reservoirs



SOURCE: JAMES P. M. SYVITSKI *ET AL.*, *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A* **369**, (2011)

There are more than 91,000 dams in the U.S.

The dams shown below are recorded in the National Inventory of Dams, which is compiled and maintained by the U.S. Army Corps of Engineers.

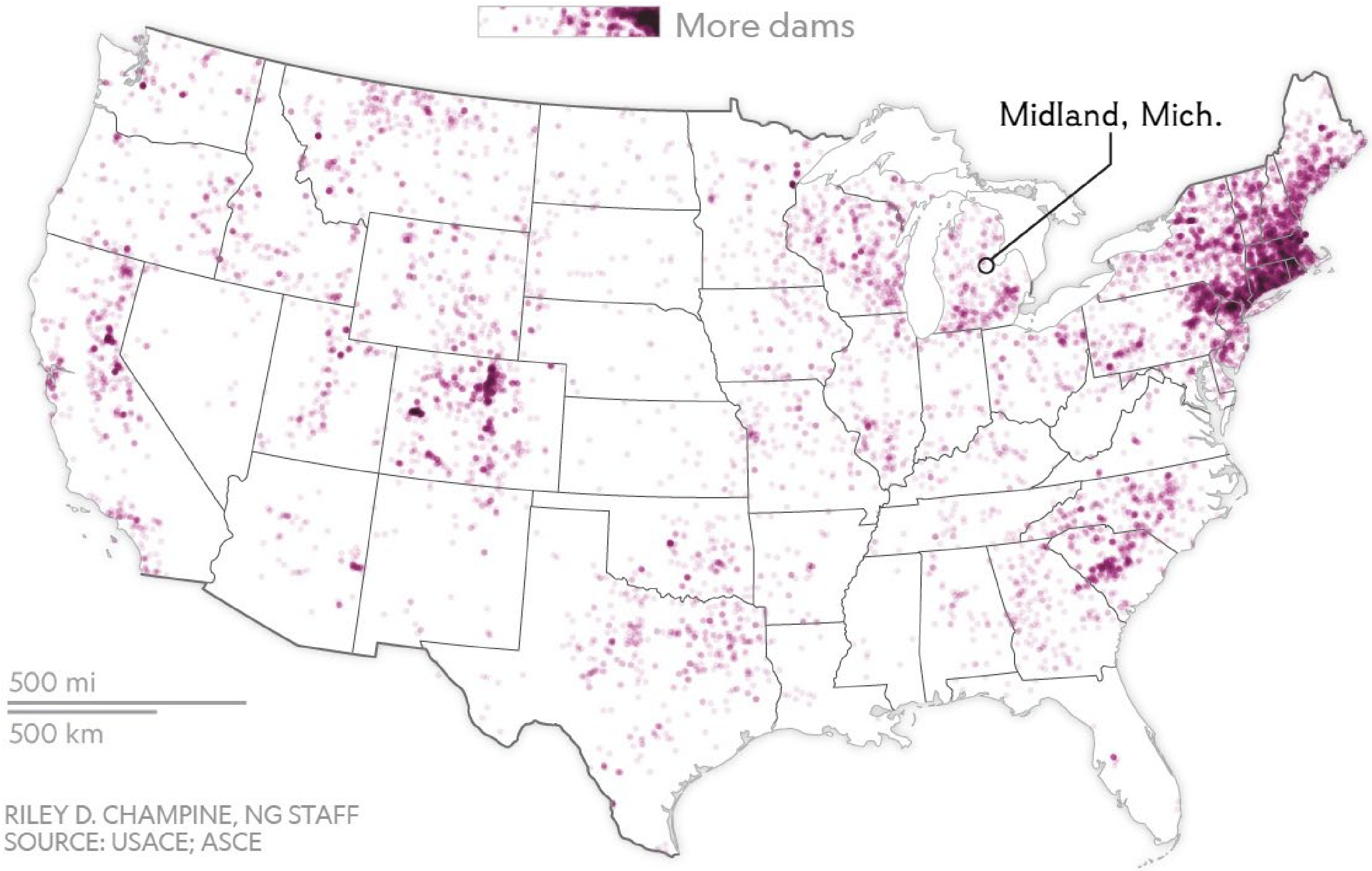


THERE ARE 276 DAMS NOT SHOWN FOR ALASKA, HAWAII AND PUERTO RICO.

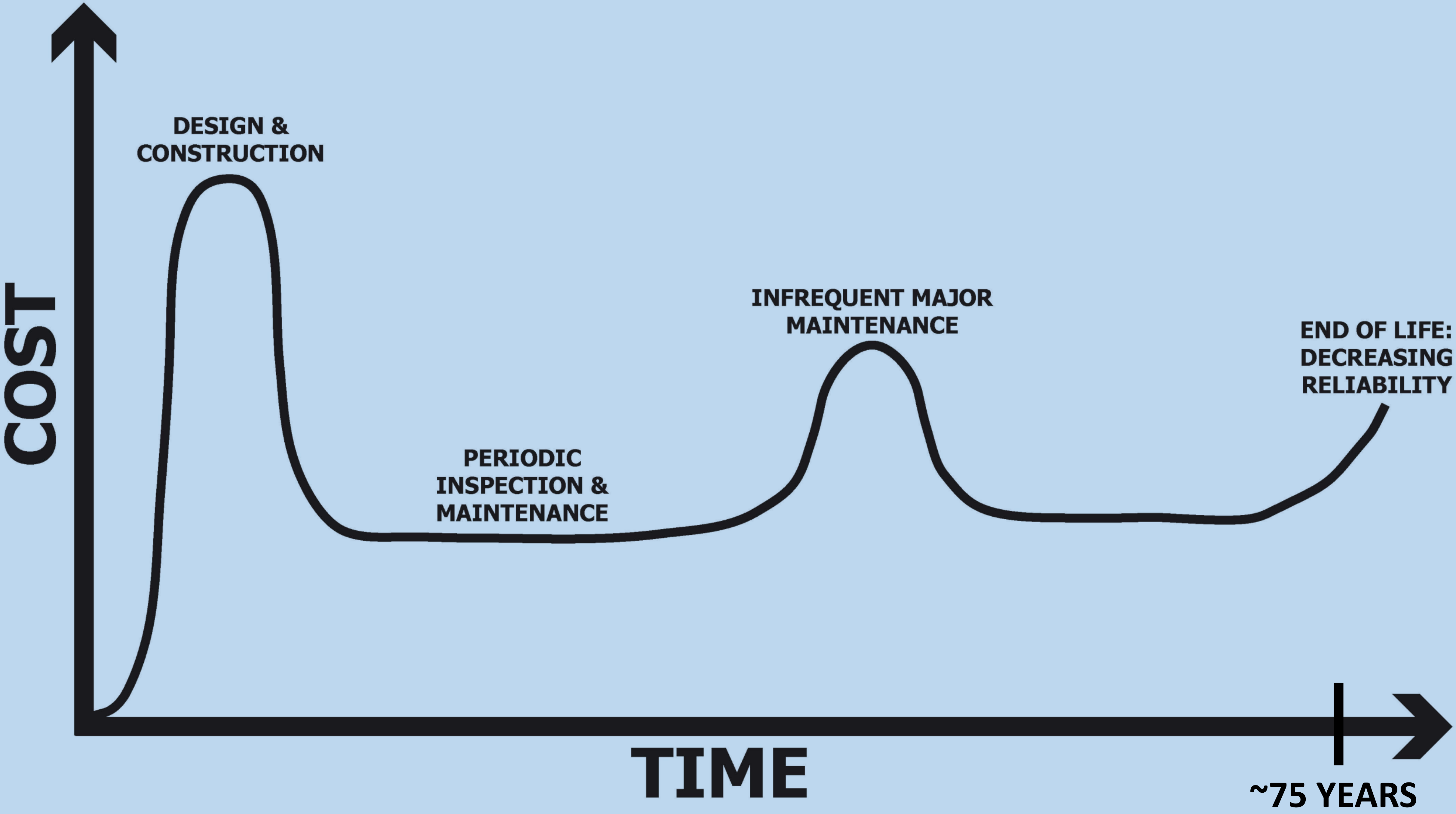
RILEY D. CHAMPINE, NG STAFF; SOURCE: USACE; ASCE

More than 8,000 dams are over 90 years old.

Old dams are not necessarily unsafe, but they need to be maintained for integrity. The dams near Midland were built in the 1920s and had a history of safety concerns.



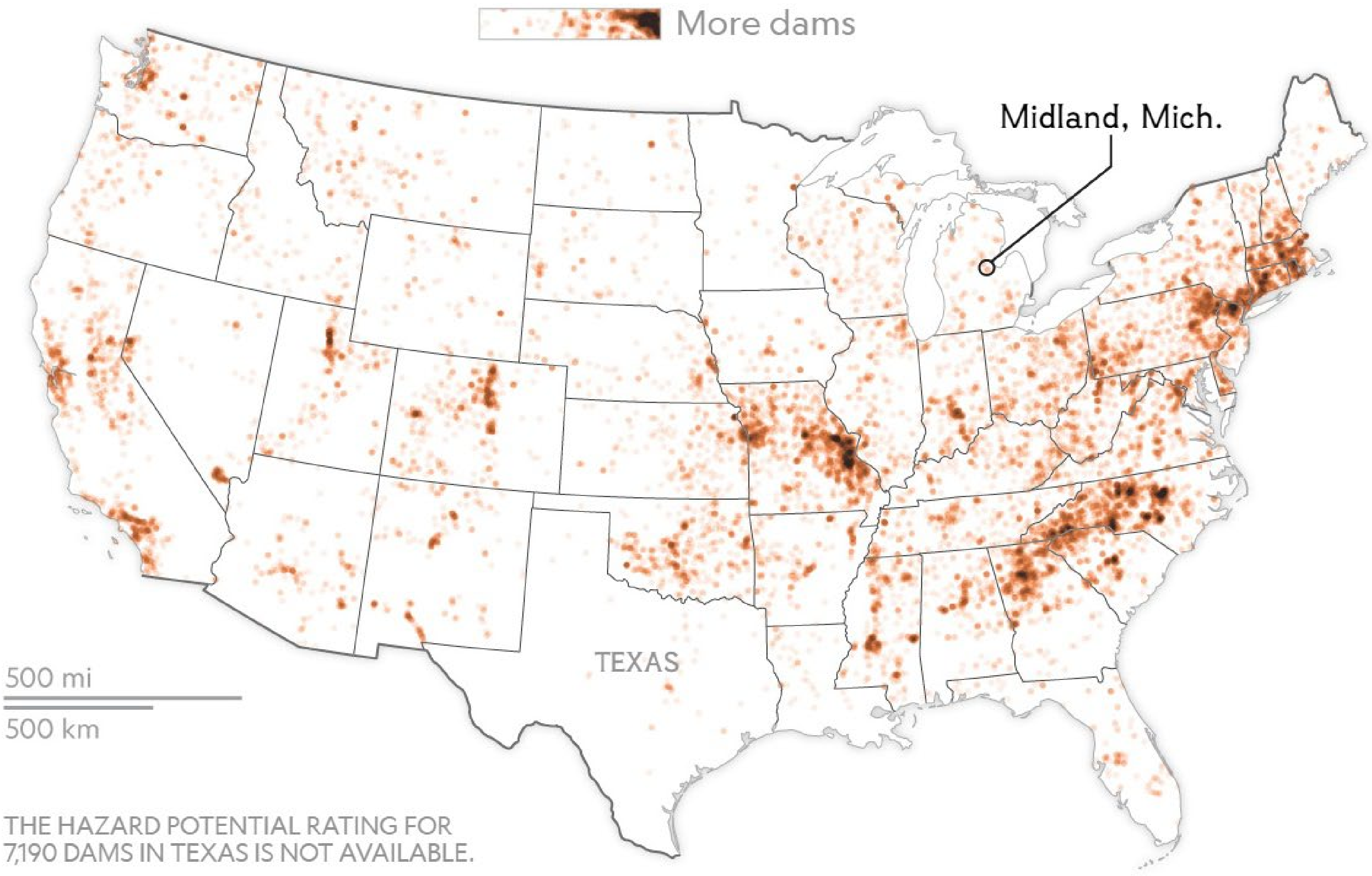
RILEY D. CHAMPINE, NG STAFF
SOURCE: USACE; ASCE


COST
DESIGN & CONSTRUCTION
PERIODIC INSPECTION & MAINTENANCE
INFREQUENT MAJOR MAINTENANCE
END OF LIFE: DECREASING RELIABILITY
TIME
~75 YEARS


Trail
Town

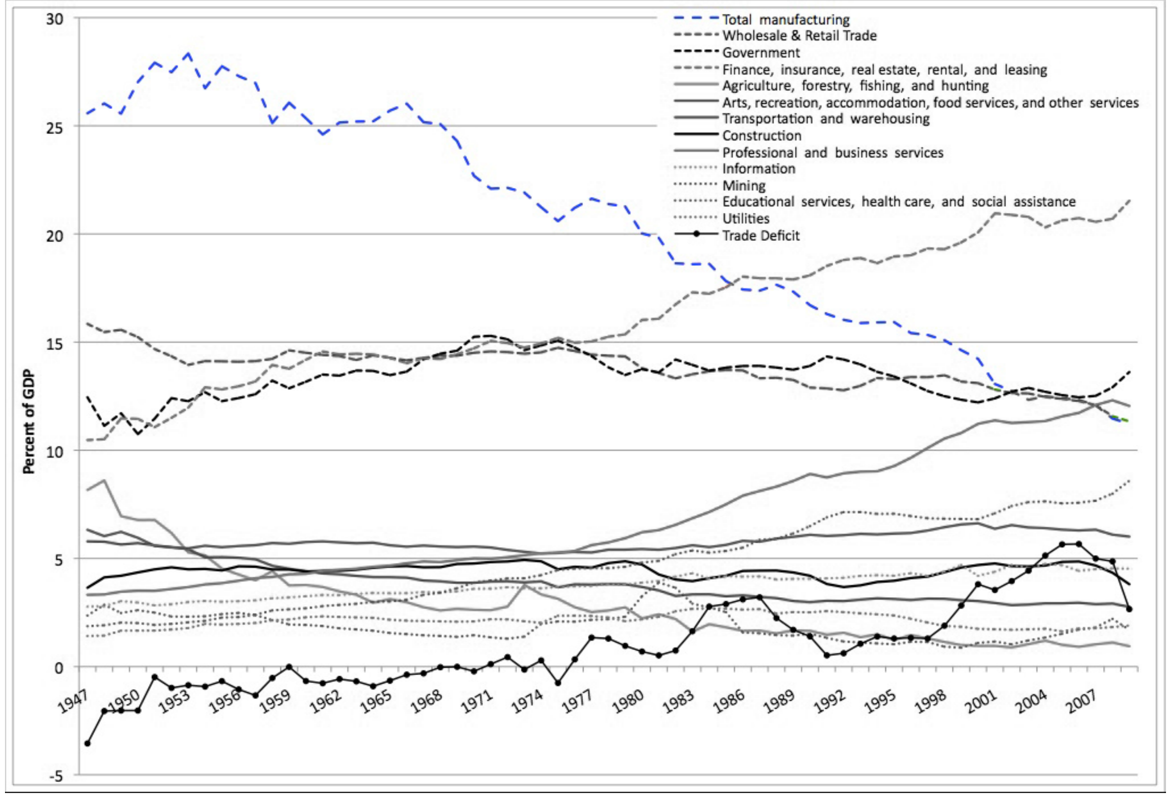
About 1 in 6 dams has a high hazard potential.

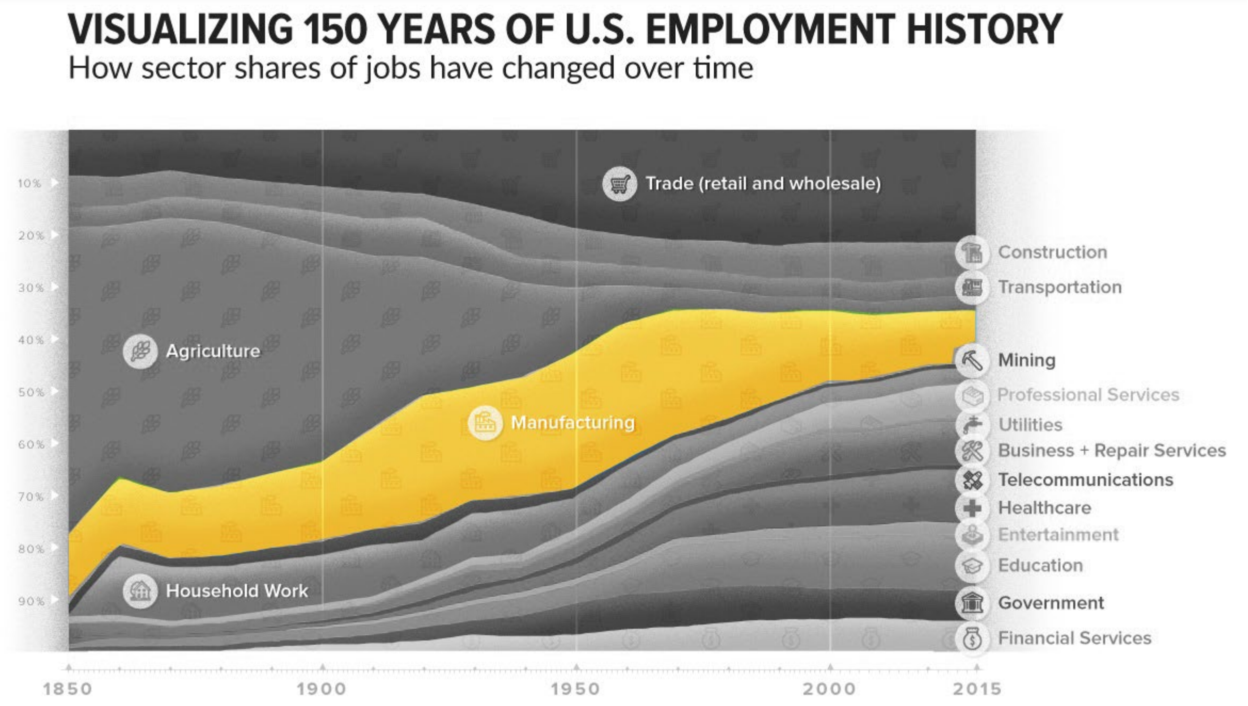
These 15,500 dams are deemed so crucial that if they were to fail, it would likely cause loss of life and heavy economic damage.



THE HAZARD POTENTIAL RATING FOR 7,190 DAMS IN TEXAS IS NOT AVAILABLE.

RILEY D. CHAMPINE, NG STAFF; SOURCE: USACE; ASCE


Percent of GDP
30
25
20
15
10
5
0
-5
Total manufacturing
Wholesale & Retail Trade
Government
Finance, insurance, real estate, rental, and leasing
Agriculture, forestry, fishing, and hunting
Arts, recreation, accommodation, food services, and other services
Transportation and warehousing
Construction
Professional and business services
Information
Mining
Educational services, health care, and social assistance
Utilities
Trade Deficit
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007


VISUALIZING 150 YEARS OF U.S. EMPLOYMENT HISTORY
How sector shares of jobs have changed over time
Trade (retail and wholesale)
Agriculture
Manufacturing
Household Work
Construction
Transportation
Mining
Professional Services
Utilities
Business + Repair Services
Telecommunications
Healthcare
Entertainment
Education
Government
Financial Services
10%
20%
30%
40%
50%
60%
70%
80%
90%
1850
1900
1950
2000
2015

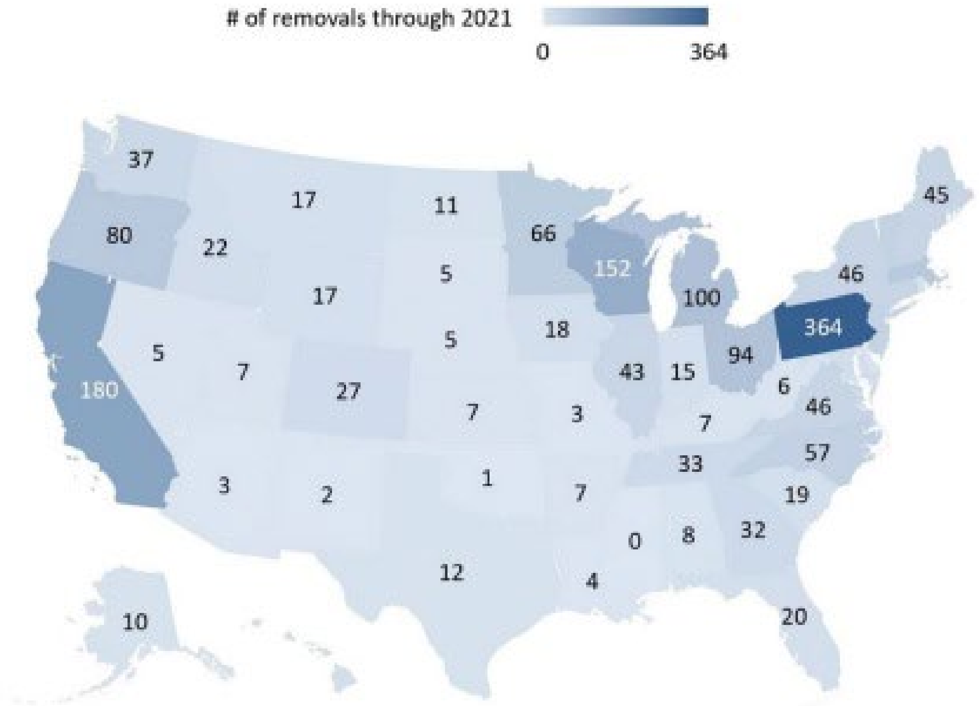


Figure 2. Map of number of dams removed by state from 1912 through 2021


Bird
(tertiary and quaternary
consumer)
Bird
(secondary consumer)
Grass (producer)
Snake
(tertiary
consumer)
Bird
(secondary and tertiary
consumer)
Cricket
(primary consumer)
Frog
(secondary
consumer)
Large fish
(tertiary
consumer)
Duck
(secondary
consumer)
Diatoms
(producers)
Snail
(primary
consumer)
Algae
(producer)
Small fish
(secondary
consumer)
Bacteria
(decomposers)
Decomposing
cordgrass
Zooplankton
(primary consumers)

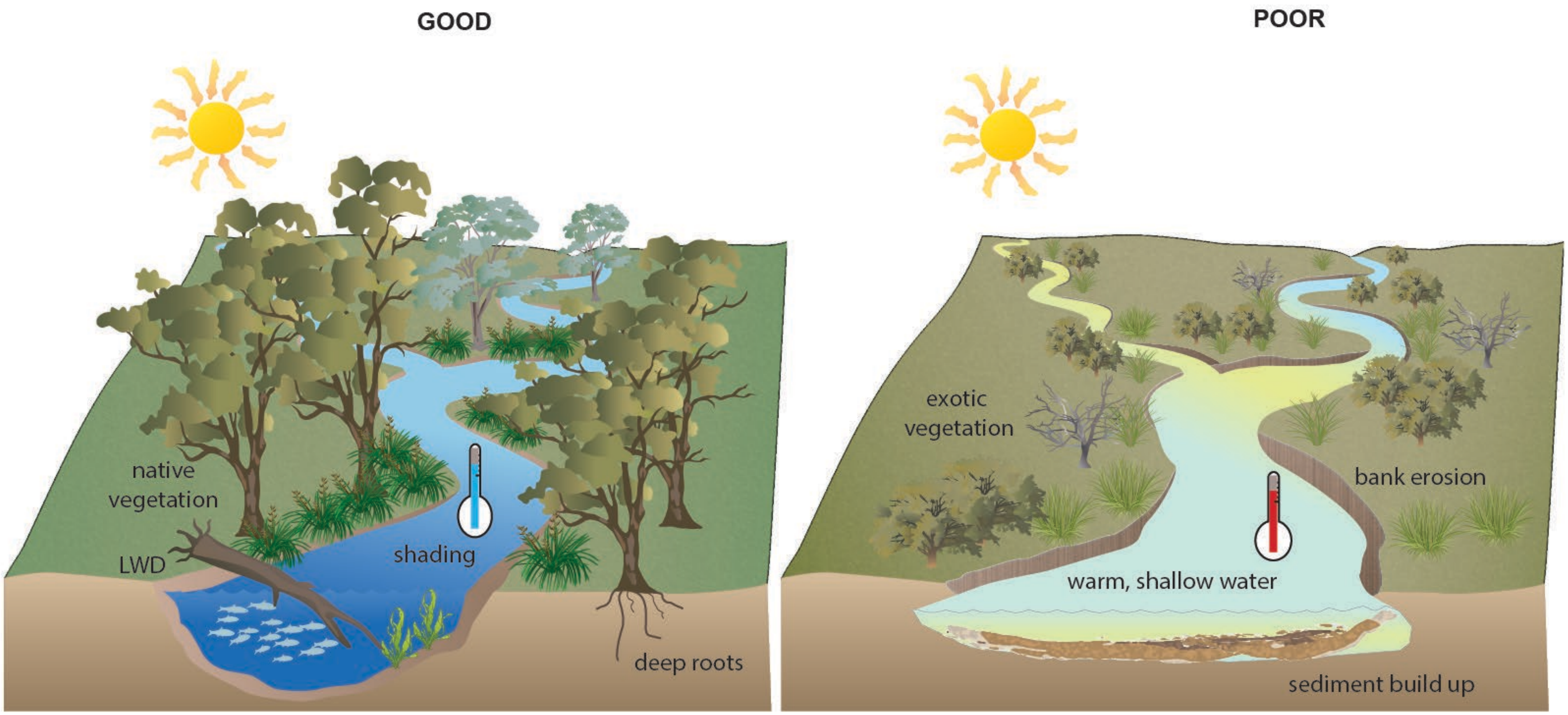



23





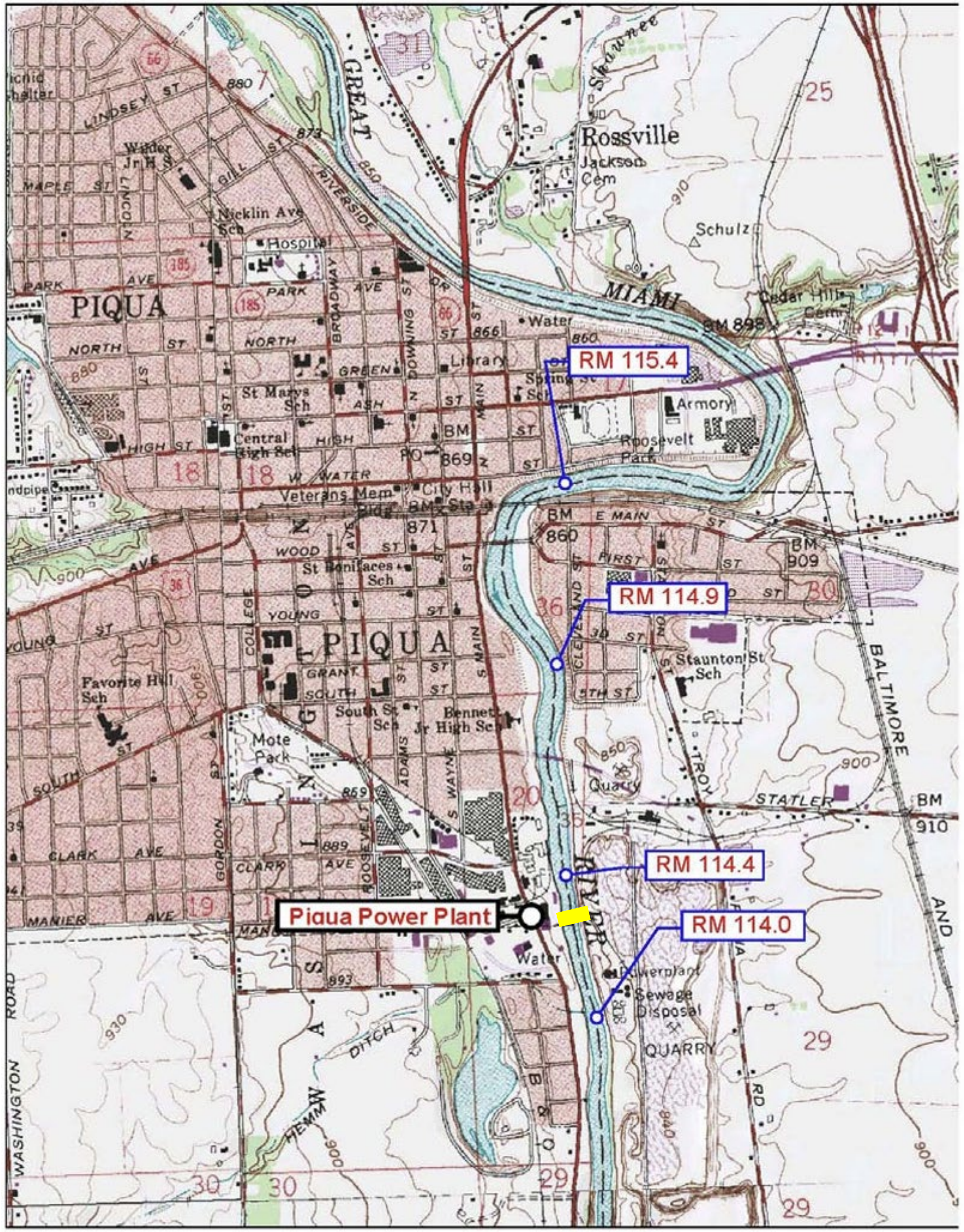
Riparian Vegetation Condition



Good vegetation will contract and deepen the channel
LWD - large woody debris provides habitat
Deep roots helps maintain the bank structure and reduces erosion

No vegetation and the channel will become wider and shallower
Absent LWD - loss of habitat
Loss of vegetation increases channel instability and erosion

Most symbols for diagrams courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science



0 ▬▬▬▬ 0.5 Mi

Table 3. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Great Miami River, 2009.

Key QHEI Components

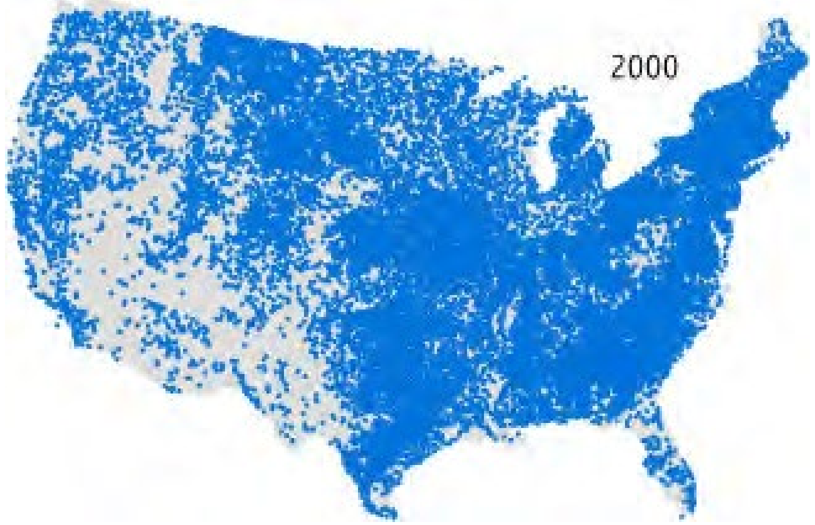
			WWH Attributes											MWH Attributes – High Influence						MWH Attributes – Moderate Influence														
River Mile	**QHEI**	**Habitat Rating**	No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max. Depth >40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD,HW sites)	**Total High Influence Attributes**	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total Moderate Influence Attributes**	**(MWH H.I.+1)/ (WWH+1) Ratio**	**(MWH M.I.+1)/ (WWH+1) Ratio**
Great Miami River Year: 2009																																		
115.4	**76.5**	Excellent	■	■		■		■		■	■	■	7						0						●			●				2	0.13	0.38
114.9	**56.0**	Fair	■	■				■		■	■		5				◆		1					●	●			●	●		●	5	0.33	1.17
114.4	**57.0**	Fair	■	■				■			■		4				◆		1		●			●	●			●	●		●	6	0.40	1.60
114.0	**74.0**	V. Good	■	■		■			■	■	■	■	7				◆		1		●				●			●	●	●		5	0.25	0.88

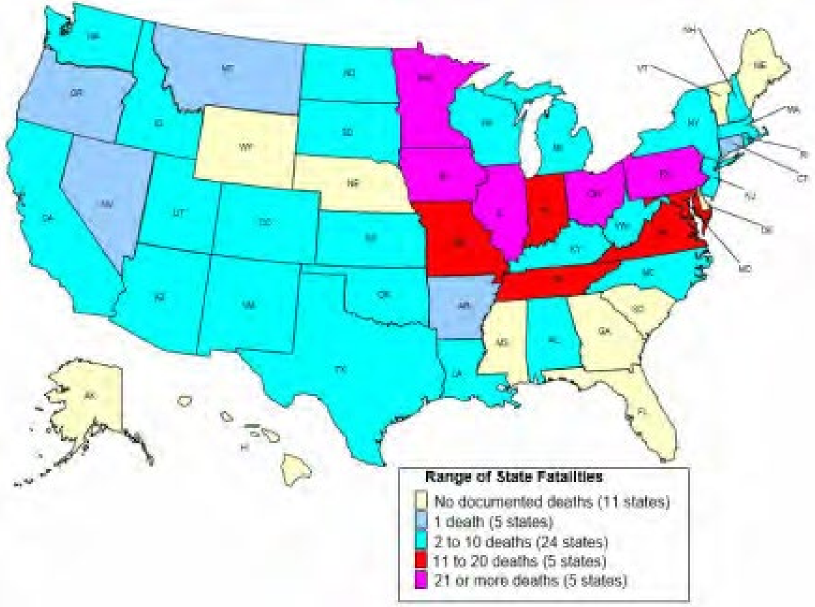
Table 4. Fish community summaries based on pulsed D.C. boat electrofishing sampling conducted by Ohio EPA in the Great Miami River, Piqua area, from July - September, 2009. Relative numbers are per 1.0 km. The applicable aquatic life use designation is WWH in the impounded section and EWH in the free-flowing section.

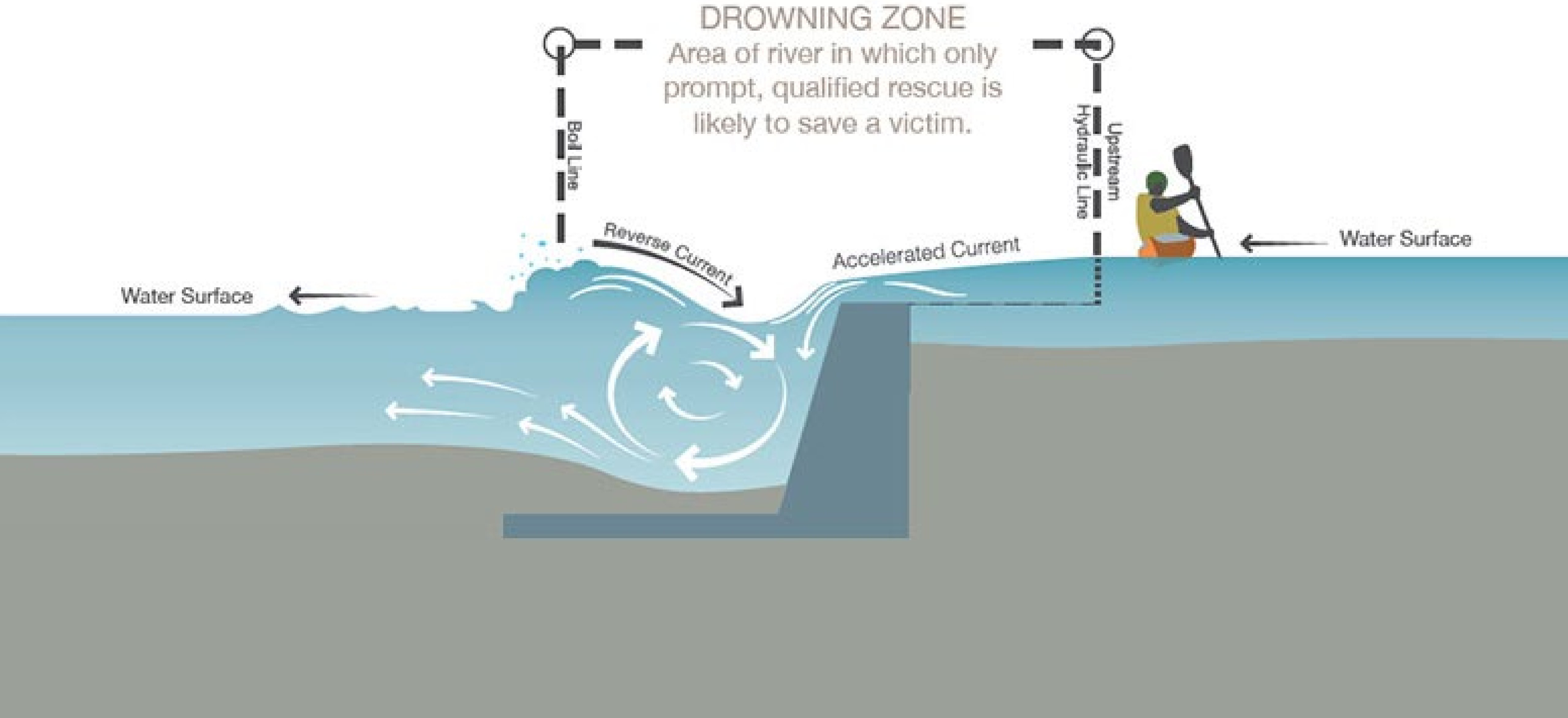
Stream River Mile	Sampling Method	Species (Mean)	Species (Total)	Relative Number	QHEI	Index of Biotic Integrity	Modified Index of Well-being	Narrative Evaluation
115.4	Boat	26.5	31	999	76.5	56	10.2	Exceptional
114.9	Boat	23.0	28	617	56.0	55	9.1	Very Good to Exceptional
114.4	Boat	20.5	25	495	57.0	41[ns]	8.9	Marginally Good to Good
114.0	Boat	31.0	34	1169	74.0	54	10.3	Exceptional

Table 5. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Great Miami River, Piqua area, 2009.

Stream/ River Mile	Density Number/ft^2	Total Taxa	Quantitative Taxa	Qualitative Taxa	Qualitative EPT[a]	ICI	Evaluation
Great Miami River							
115.4	2404	68	39	54	22	52	Exceptional
114.9A -Edge	2420	33	26	23	5	16-Low Fair*	Low Fair
114.9B - Mid	901	-	24	-	-	14-Low Fair*	Low Fair
114.4A - Edge	2709	34	26	16	3	14-Low Fair*	Low Fair
114.4B - Mid	1596	-	19	-	-	10-Poor*	Poor
114.0	3322	66	30	56	18	46	Exceptional


2000


Range of State Fatalities
No documented deaths (11 states)
1 death (5 states)
2 to 10 deaths (24 states)
11 to 20 deaths (5 states)
21 or more deaths (5 states)



DROWNING ZONE
Area of river in which only prompt, qualified rescue is likely to save a victim.
Boil Line
Upstream Hydraulic Line
Reverse Current
Accelerated Current
Water Surface
Water Surface

Table 1. Real Outdoor Recreation Value Added by Activity

[Millions of chained (2012) dollars]

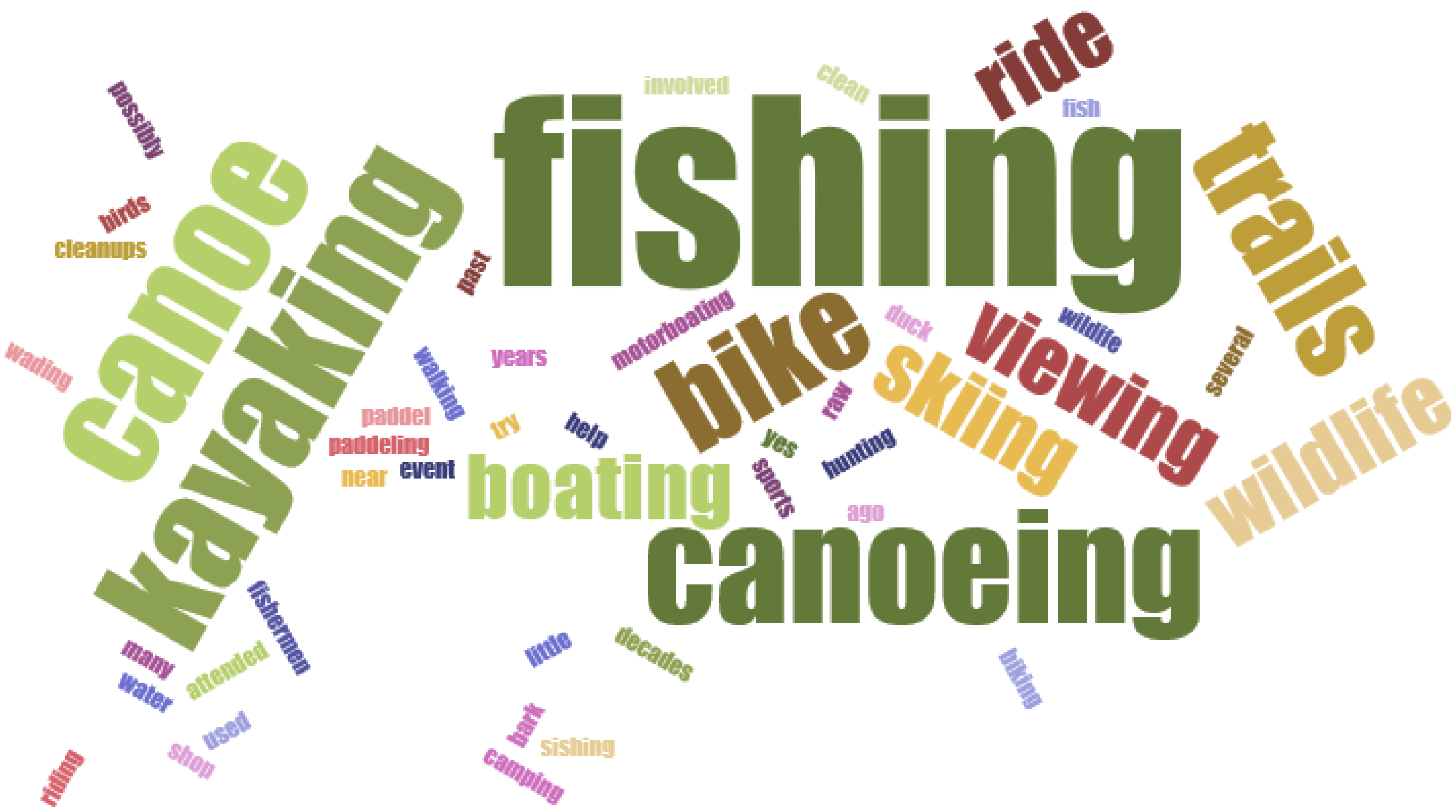
Bureau of Economic Analysis

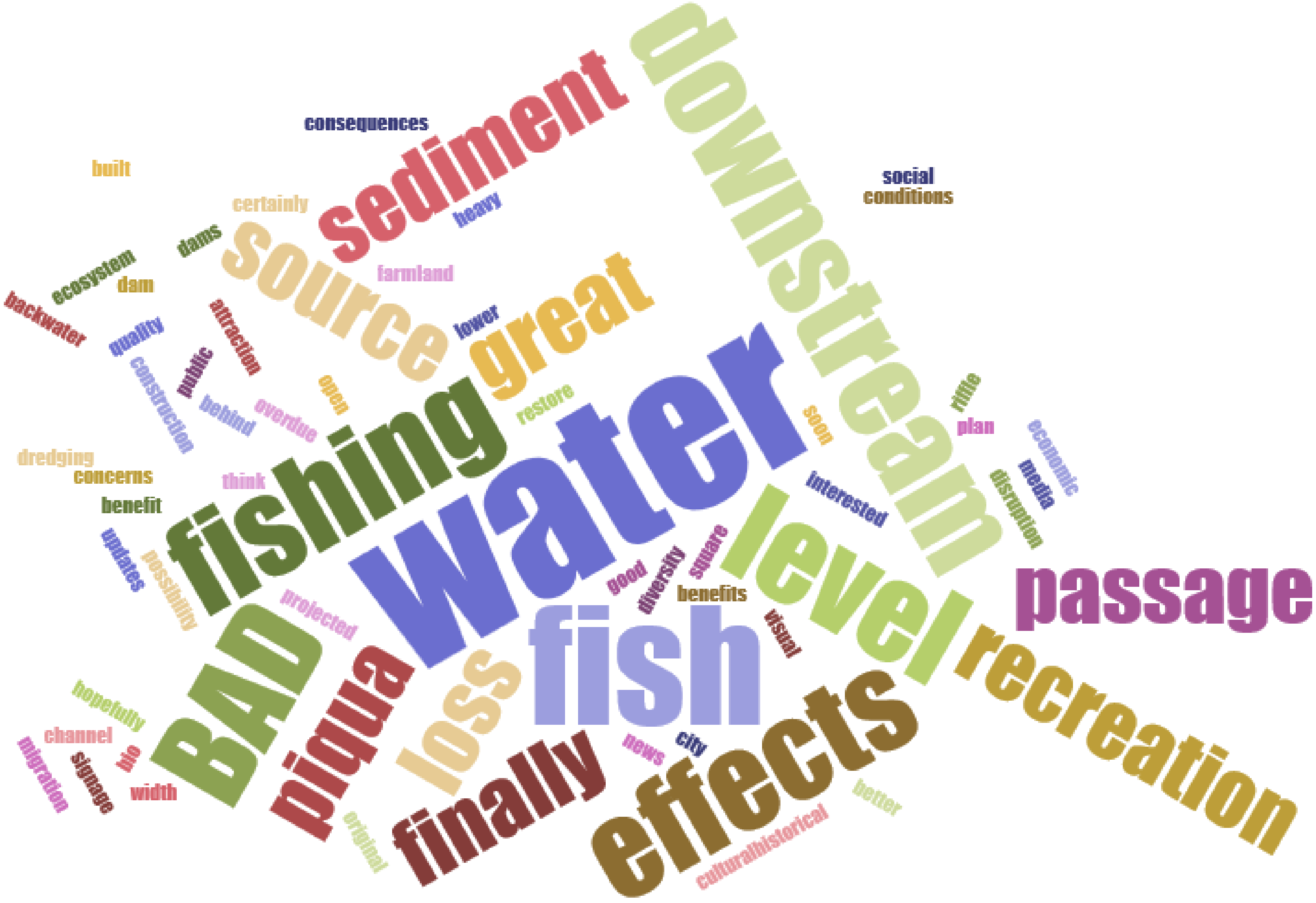
		2012	2013	2014	2015	2016	2017	2018	2019	2020
1	**Total Outdoor Recreation**	**359199**	**364246**	**367881**	**374998**	**377264**	**394182**	**405254**	**409526**	**331864**
2	**Total core outdoor recreation**	**183033**	**185266**	**188477**	**191912**	**195049**	**205967**	**211831**	**211910**	**181601**
3	**Conventional outdoor recreation**	**115516**	**116901**	**117563**	**121056**	**123964**	**129779**	**132131**	**131830**	**130753**
4	Bicycling	1850	1972	1975	1894	1923	1941	1872	1969	2107
5	Boating/fishing	17179	17009	17080	17779	18902	19713	20032	20080	25685
6	Canoeing	64	60	63	66	72	75	72	82	80
7	Kayaking	516	398	369	358	348	368	381	385	435
8	Fishing (excludes boating)	2590	2482	2521	2838	3963	4494	4766	4554	4670
9	Sailing	971	1042	1097	1088	1153	1160	1134	1204	856
10	Other boating	13037	13030	13035	13436	13410	13679	13758	13913	19556
11	Climbing/hiking/tent camping	3015	3086	3114	2972	2954	3411	3367	3643	3692
12	Equestrian	3698	3832	4064	4166	4702	5039	5789	5103	4356
13	Hunting/shooting/trapping	6510	7307	6798	7121	8943	9024	8651	8517	7763
14	Hunting/trapping	3470	3825	3539	3774	5072	5437	5085	5189	4649
15	Shooting (includes archery)	3040	3483	3260	3345	3849	3546	3533	3288	3081
16	Motorcycling/ATVing	8175	8195	8263	8294	8184	8129	8132	7658	7931
17	Recreational flying	1172	1115	1166	1169	1165	1163	980	1020	1333
18	RVing	12658	13069	13179	13594	14213	15466	15495	14665	15411

DAM REMOVAL IN PIQUA?

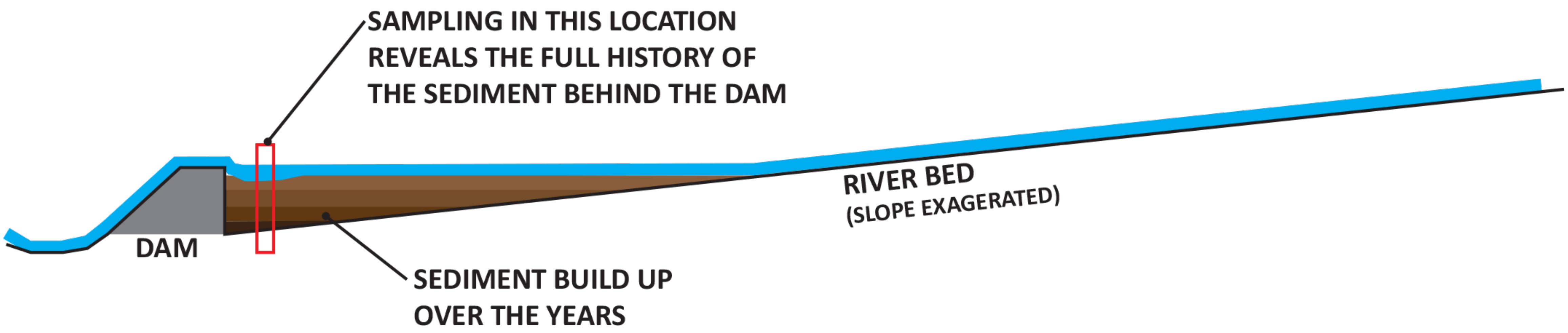

MEN'S

2019


fishing
canoeing
kayaking
canoe
boating
bike
viewing
skiing
trails
wildlife
ride
involved
clean
fish
possibly
birds
cleanups
past
wading
walking
years
motorboating
duck
wildlife
several
raw
paddel
paddeling
try
help
yes
hunting
event
near
sports
ago
fishermen
many
attended
water
little
decades
biking
used
shop
bark
sishing
camping
riding

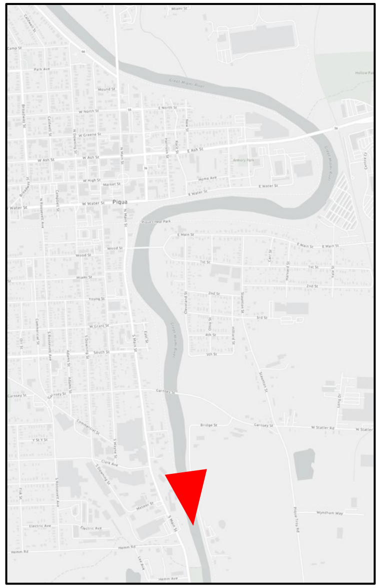

water
fish
fishing
downstream
sediment
source
great
level
passage
recreation
effects
BAD
piqua
loss
finally
consequences
built
certainly
heavy
social
conditions
dams
farmland
ecosystem
dam
backwater
attraction
lower
quality
public
construction
open
restore
behind
overdue
riffle
soon
plan
economic
dredging
concerns
think
interested
media
disruption
benefit
updates
possibility
good
diversity
square
benefits
projected
visual
hopefully
channel
news
city
migration
bio
signage
width
better
original
culturalhistorical

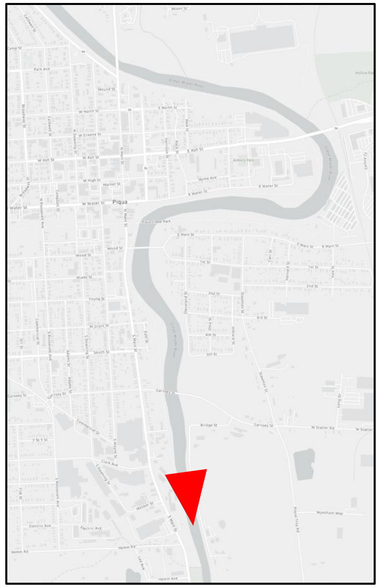

fishing
good
potential
recreation
boating
asset
clean
great
underutilized
utilized
unique
ground
watershed
natural
festival
local
recreational
hasnt
source
now
hope
ago
rural
piqua
surface
lot
system
history
southwestern
quality
significant
go
beauty
farm
sources
beautiful
crucial
years
scenic
drinking
changed
life
ohio
vital
factor
usage

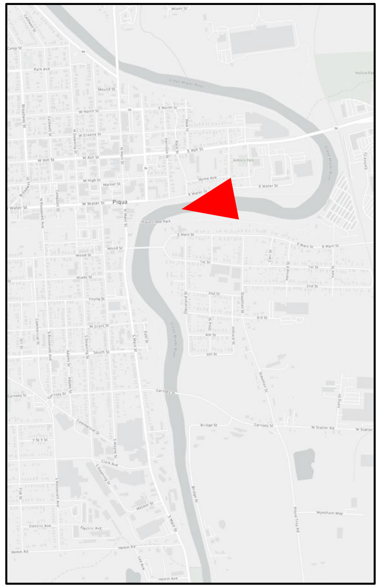


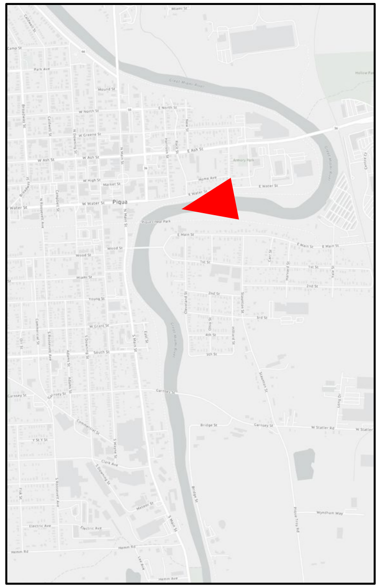
Based on an analysis of the sampling results and relatively low concentrations of chemicals detected, ***adverse effects are not expected to occur to ecological receptors from exposure to the sediments.*** *In addition, a conservative comparison of the sediment concentrations of chemicals detected to U.S. EPA Regional Screening Levels (RSLs) for residential soil does not indicate potential human health concerns.*

--Vanessa Steigerwald Dick, Ph.D.
Environmental Scientist


Piqua
Great Miami River
Piqua Lineal Park
Armory Park
W Water St
E Water St
W Ash St
E Ash St
W North St
E North St
N Main St
S Main St
Wood St
E Main St
Garnsey St
Bridge St
W Statler Rd
Piqua-Troy Rd
Wyndham Way
Hemm Rd
Hemm Ave
Clark Ave
Electric Ave
Commercial St
S Roosevelt Ave
N Roosevelt Ave
South St
Miami St
Young St
W Grant St
Market St
W High St
Home Ave
Mound St
Park Ave

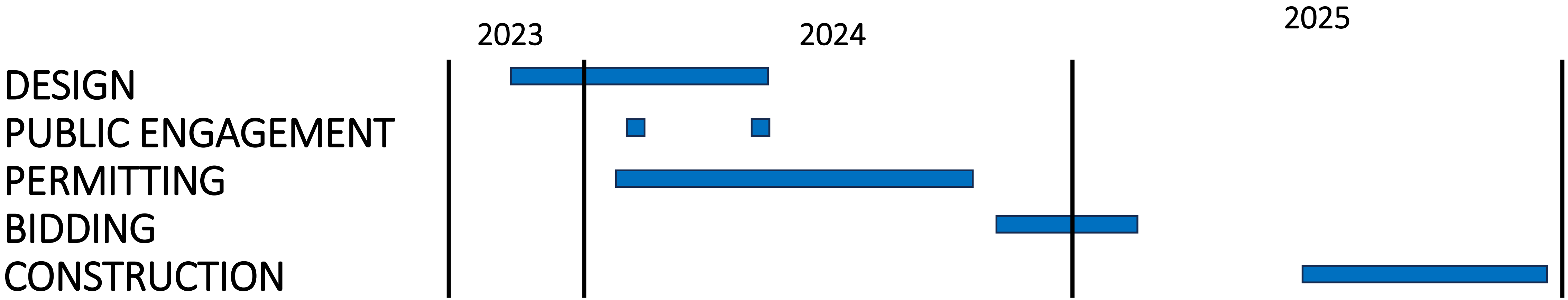







66
N STATE RT 66
CANAL RUN BIKE PATH
THE RIVERS EDGE BIKE PATH

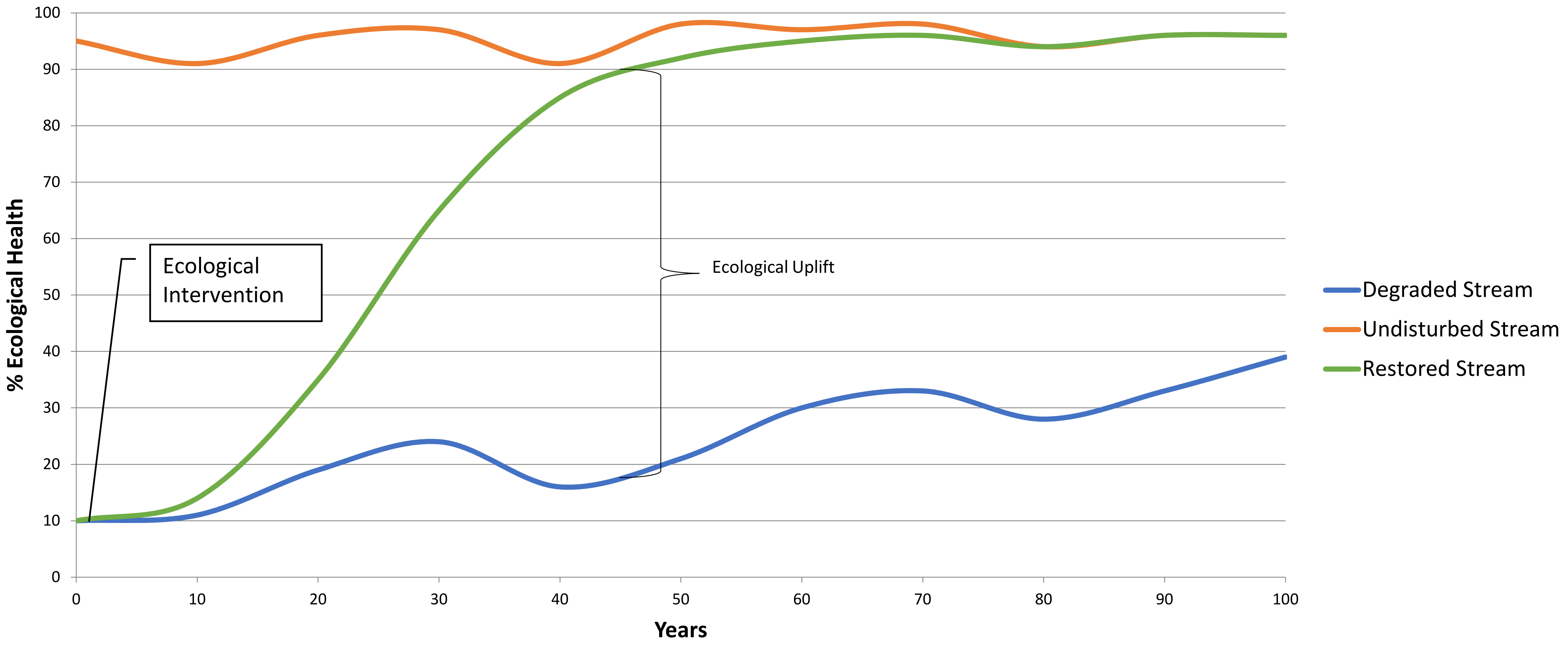
GOALS & TIMELINE



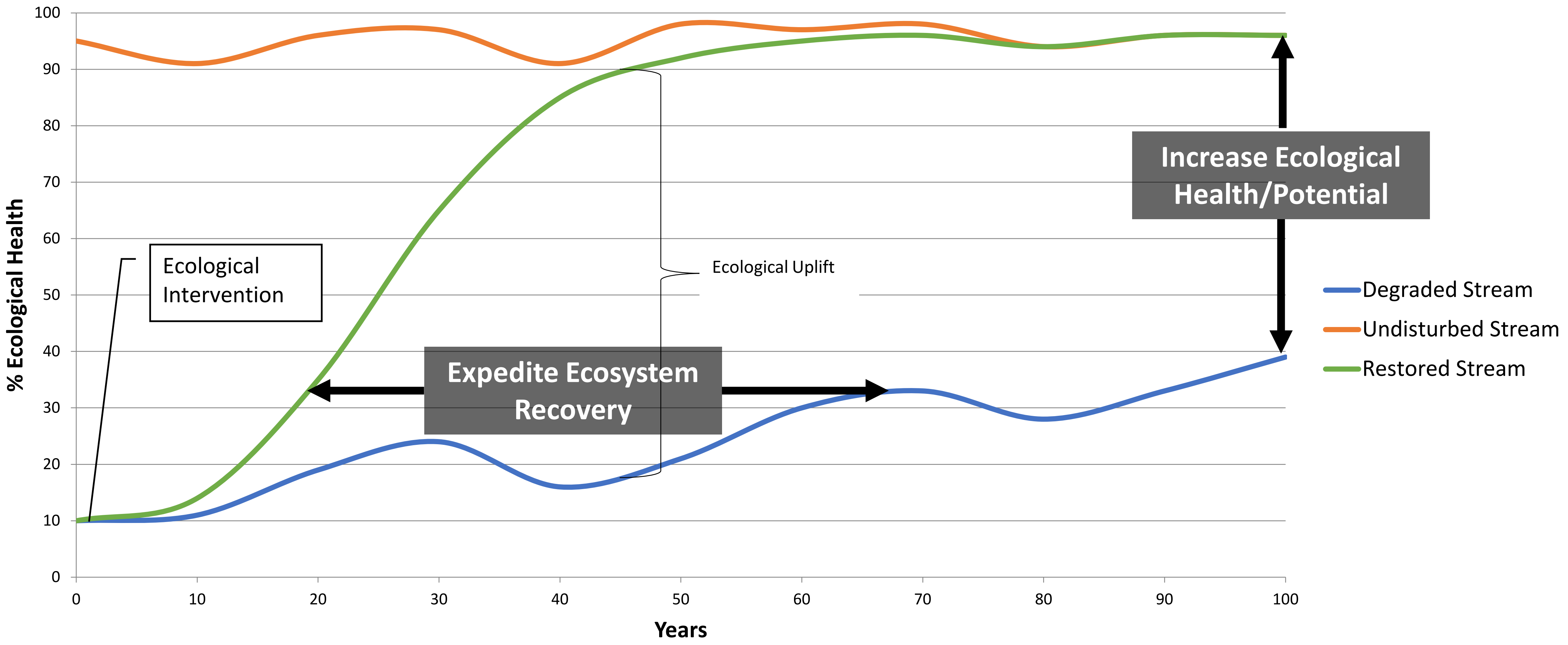
TIMELINE COULD CHANGE BASED ON ANY NUMBER OF FACTORS

DESIGN APPROACH

What Can Be Done?

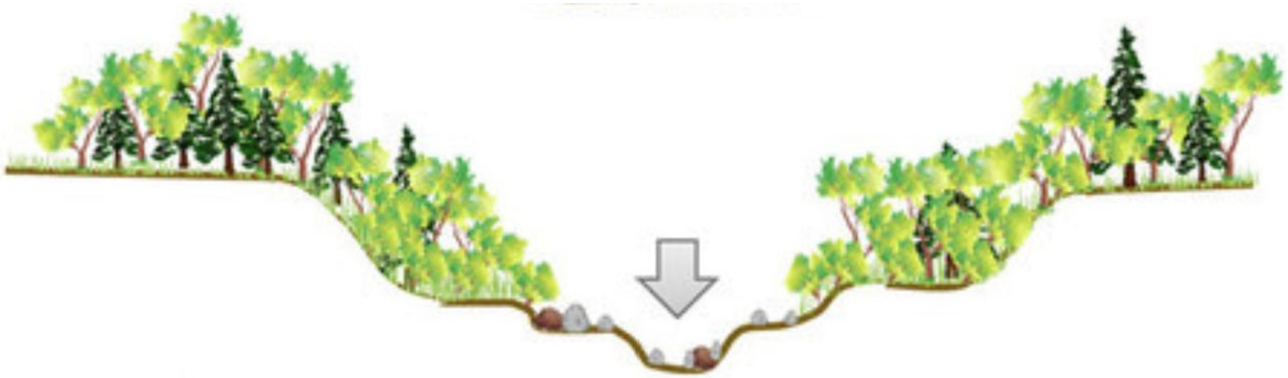


WHAT CAN BE DONE?



River Evolution

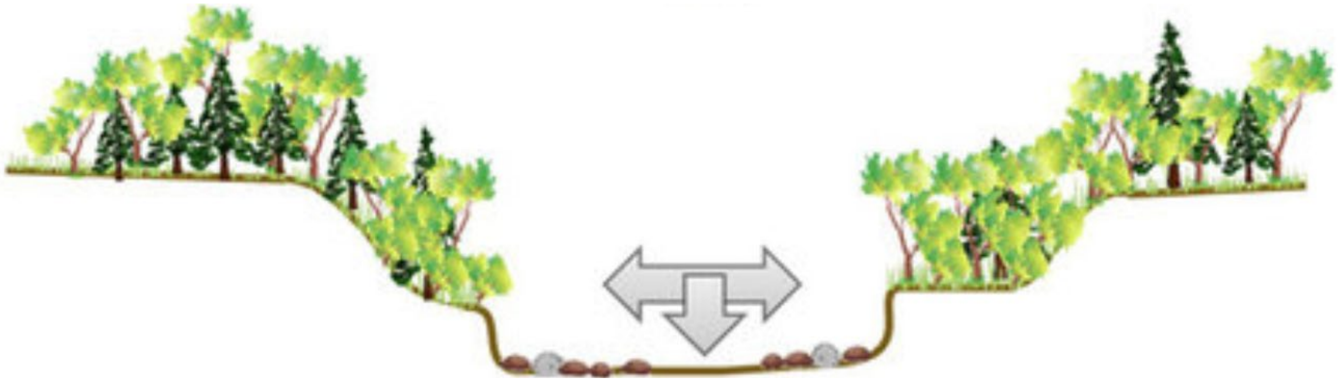
A riverscape is in **dynamic equilibrium** when it has slowly adjusted its shape to accommodate the sediment and water (i.e. hydrology) from its watershed and no longer aggrades or degrades excessively.



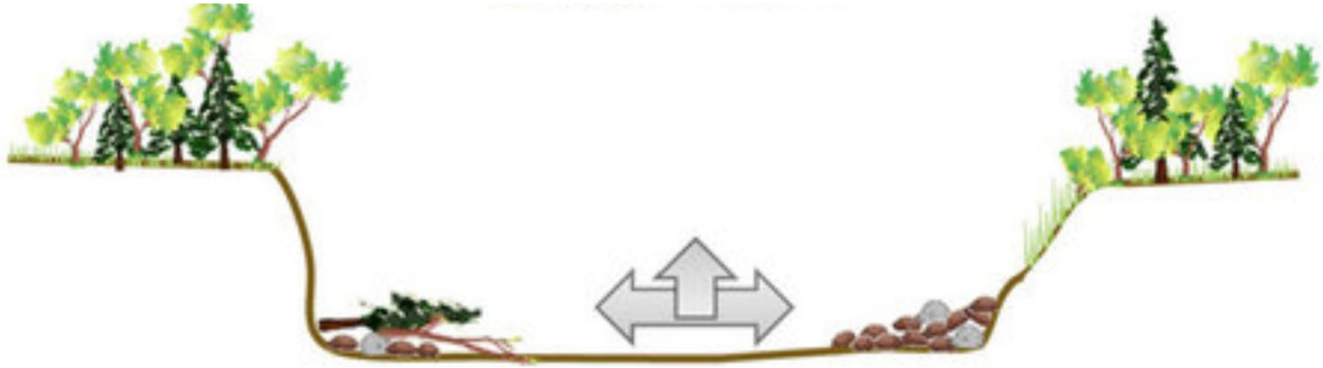
When watershed or local conditions change and increase the energy in the channel, a river can degrade vertically, which allows larger storms to be contained within its banks and creates a positive feedback loop causing more energy and more degradation.

CEM adapted from Schumm et al., 1984 and Hawley et al., 2012 (Hawley et al., 2020)

River Evolution



Depending on how much resistance, in the form of vegetation or bedrock, exists on the bed and banks of a river, the river can erode vertically and laterally (i.e. widen), which allows even larger storms to be contained within its banks.



Over many decades, this process can start to slow down and eventually, the river no longer degrades vertically because there is not enough energy or because the river has eroded to bedrock. Lateral erosion can continue even once a river has stopped degrading vertically. Sediment being transported from the watershed then starts to build up (i.e. aggrade) within the channel banks.

CEM adapted from Schumm et al., 1984 and Hawley et al., 2012 (Hawley et al., 2020)

River Evolution

Eventually, the riverscape will adjust towards dynamic equilibrium once again and will no longer excessively degrade vertically or laterally. This is due to a reduction of energy as a riverscape re-vegetates and finds a shape that accommodates the hydrology and sediment inflow from the watershed.

CEM adapted from Schumm et al., 1984 and Hawley et al., 2012 (Hawley et al., 2020)

QUESTIONS & COMMENTS