OHIO STATEWIDE PMP STUDY
November 14, 2012

PRESENTERS
ODNR – Hung Thai
AWA – Bill Kappel
STANTEC – Rob Kirkbride

OHIO STATEWIDE PMP STUDY

- ODNR is the largest dam owner in Ohio
  189 impoundments

DIVISION	TOTAL	CLASS I	CLASS II	CLASS III	CLASS IV	ABAN.	EXEMPT	UNCLASS
Forestry	*16*	4	3	2	1	3	3	0
MRM	*8*	0	1	0	1	5	1	0
NAP	*8*	0	1	0	0	1	6	0
Parks	*67*	39	16	4	1	2	5	0
SWR	*1*	1	0	0	0	0	0	0
Wildlife	*89*	12	9	22	13	7	22	4
TOTAL	**189**	**56**	**30**	**28**	**16**	**18**	**37**	**4**

OHIO STATEWIDE PMP STUDY

- ODNR is the largest dam owner in Ohio
  114 dams regulated by Ohio Dam Safety

DIVISION	TOTAL	CLASS I	CLASS II	CLASS III
Forestry	*9*	4	3	2
MRM	*1*	0	1	0
NAP	*1*	0	1	0
Parks	*59*	39	16	4
SWR	*1*	1	0	0
Wildlife	*43*	12	9	22
TOTAL	**114**	**56**	**30**	**28**

OHIO STATEWIDE PMP STUDY

- Regulated dams that do not have sufficient capacity to safely pass the required design flood

CLASS I	Under Capacity	CLASS II	Under Capacity	CLASS III	Under Capacity
56	28 (~50%)	30	9 (~30%)	28	7(~25%)

OHIO STATEWIDE PMP STUDY

- Capital improvements to Indian Lake and Lake Loramie Dams – both are Class 1 in western Ohio

	Indian Lake Dam	Lake Loramie Dam
Height	16.4	23.3
Length	3960	6260
Drainage Area	98.32	77.7
Appr. % of PMF	50	40

OHIO STATEWIDE PMP STUDY

- Initial contract agreement:
  - Site specific study for each dam
  - Western half of the state
  - Storms were analyzed and allowed for statewide study
  - Cost remained same!

OHIO STATEWIDE PMP STUDY

- Overall team included:
  - Stantec – primary consultant
  - Applied Weather Associates – subconsultant
  - Board of Review: 3 subject-matter experts
  - ODNR
  - FERC

OHIO STATEWIDE PMP STUDY

- Review and approval process:

OHIO STATEWIDE PMP STUDY

- Major Tasks for PMP Development:
  - Storm based approach
    - Similar to NWS HMR 51 and WMO
    - All previous AWA PMP studies

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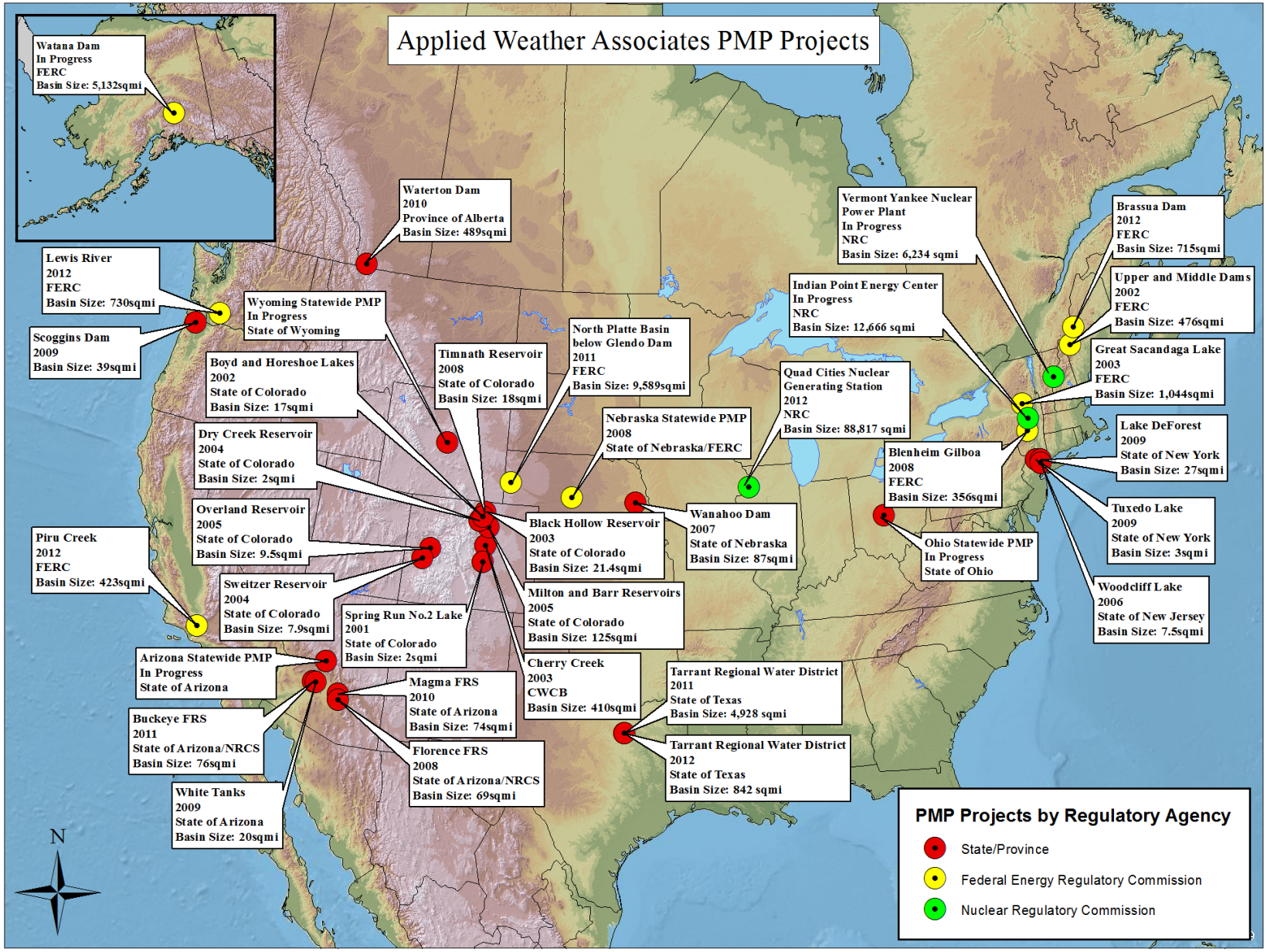
Applied Weather Associates PMP Projects
Watana Dam
In Progress
FERC
Basin Size: 5,132sqmi
Waterton Dam
2010
Province of Alberta
Basin Size: 489sqmi
Lewis River
2012
FERC
Basin Size: 730sqmi
Wyoming Statewide PMP
In Progress
State of Wyoming
Scoggins Dam
2009
Basin Size: 39sqmi
Boyd and Horeshoe Lakes
2002
State of Colorado
Basin Size: 17sqmi
Timnath Reservoir
2008
State of Colorado
Basin Size: 18sqmi
North Platte Basin
below Glendo Dam
2011
FERC
Basin Size: 9,589sqmi
Dry Creek Reservoir
2004
State of Colorado
Basin Size: 2sqmi
Nebraska Statewide PMP
2008
State of Nebraska/FERC
Overland Reservoir
2005
State of Colorado
Basin Size: 9.5sqmi
Black Hollow Reservoir
2003
State of Colorado
Basin Size: 21.4sqmi
Wanahoo Dam
2007
State of Nebraska
Basin Size: 87sqmi
Piru Creek
2012
FERC
Basin Size: 423sqmi
Sweitzer Reservoir
2004
State of Colorado
Basin Size: 7.9sqmi
Milton and Barr Reservoirs
2005
State of Colorado
Basin Size: 125sqmi
Spring Run No.2 Lake
2001
State of Colorado
Basin Size: 2sqmi
Arizona Statewide PMP
In Progress
State of Arizona
Cherry Creek
2003
CWCB
Basin Size: 410sqmi
Magma FRS
2010
State of Arizona
Basin Size: 74sqmi
Tarrant Regional Water District
2011
State of Texas
Basin Size: 4,928 sqmi
Buckeye FRS
2011
State of Arizona/NRCS
Basin Size: 76sqmi
Florence FRS
2008
State of Arizona/NRCS
Basin Size: 69sqmi
Tarrant Regional Water District
2012
State of Texas
Basin Size: 842 sqmi
White Tanks
2009
State of Arizona
Basin Size: 20sqmi
Vermont Yankee Nuclear
Power Plant
In Progress
NRC
Basin Size: 6,234 sqmi
Brassua Dam
2012
FERC
Basin Size: 715sqmi
Indian Point Energy Center
In Progress
NRC
Basin Size: 12,666 sqmi
Upper and Middle Dams
2002
FERC
Basin Size: 476sqmi
Quad Cities Nuclear
Generating Station
2012
NRC
Basin Size: 88,817 sqmi
Great Sacandaga Lake
2003
FERC
Basin Size: 1,044sqmi
Lake DeForest
2009
State of New York
Basin Size: 27sqmi
Blenheim Gilboa
2008
FERC
Basin Size: 356sqmi
Tuxedo Lake
2009
State of New York
Basin Size: 3sqmi
Ohio Statewide PMP
In Progress
State of Ohio
Woodcliff Lake
2006
State of New Jersey
Basin Size: 7.5sqmi
N
PMP Projects by Regulatory Agency
State/Province
Federal Energy Regulatory Commission
Nuclear Regulatory Commission

OHIO STATEWIDE PMP STUDY

- Major Tasks for PMP Development:
  - Storm Search
    - Biggest storms of record in wide region
      - Many storms already known from previous work
      - Short list of 45 storms
      - 10 new storms analyzed
    - PMP-type storms
      - MCC and synoptic

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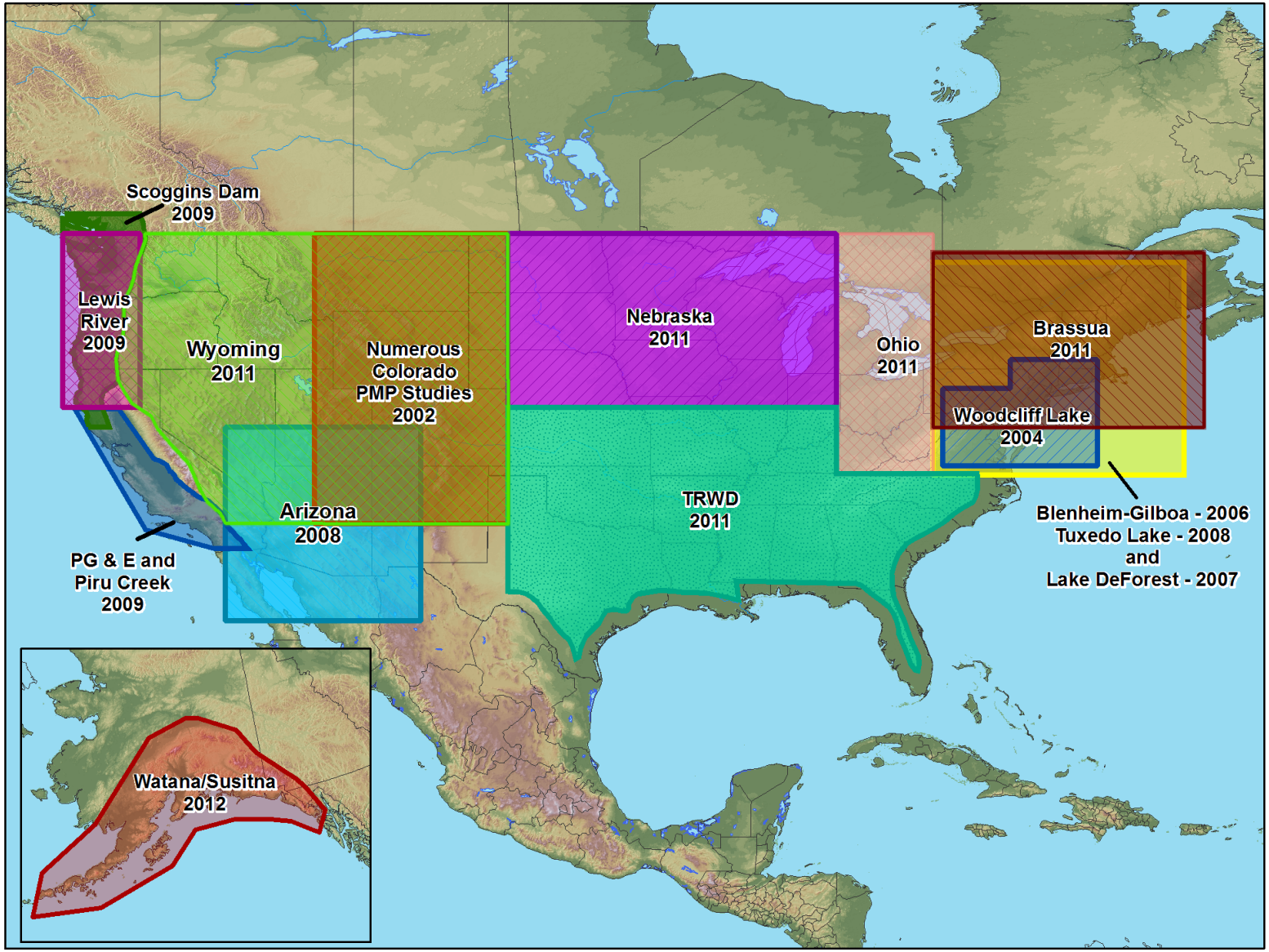
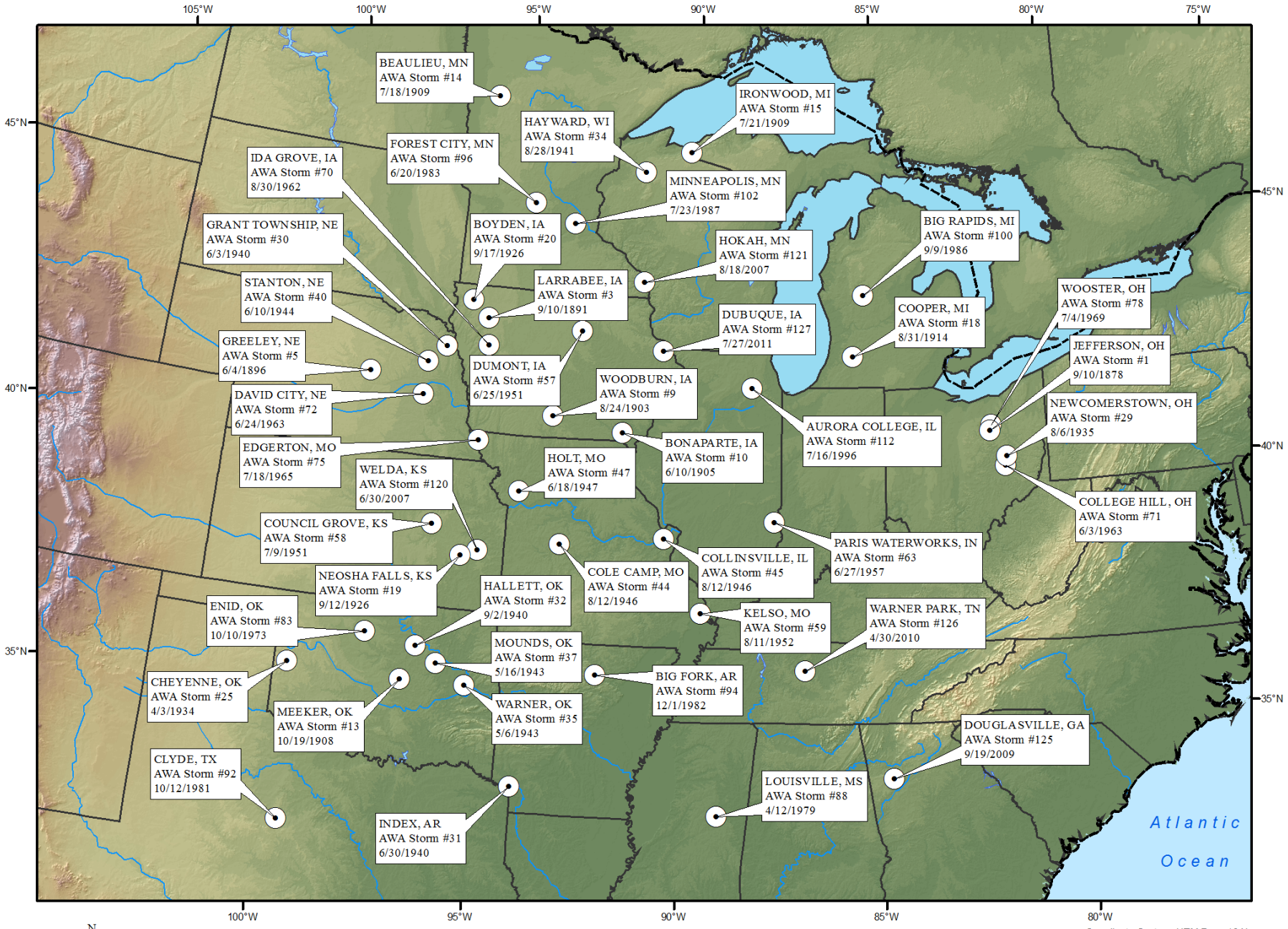
Storm Search Domains



Ohio Short Storm List Locations



OHIO STATEWIDE PMP STUDY

- Major Tasks for PMP Development:
  - Make the storms as big as physically possible
    - Maximize in-place
    - Transposition to Ohio
      - Adjust for elevation
      - Adjust for moisture

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OHIO STATEWIDE PMP STUDY

- Major Tasks for PMP Development:
  - Set of Grid Points to represent the region
    - Each storm transpositioned to each grid point as appropriate
    - Depth-Area, Depth Duration charts enveloped at each

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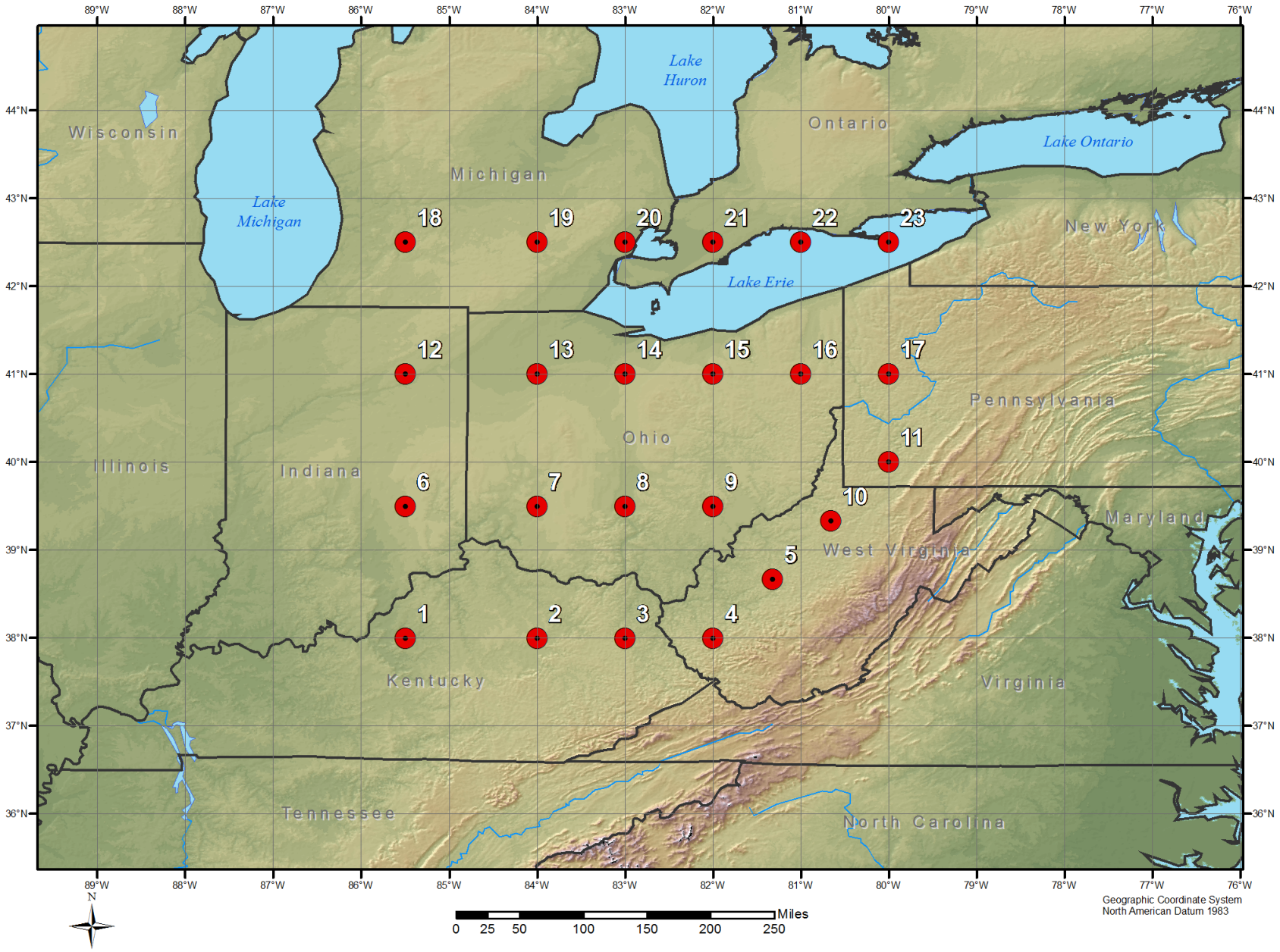
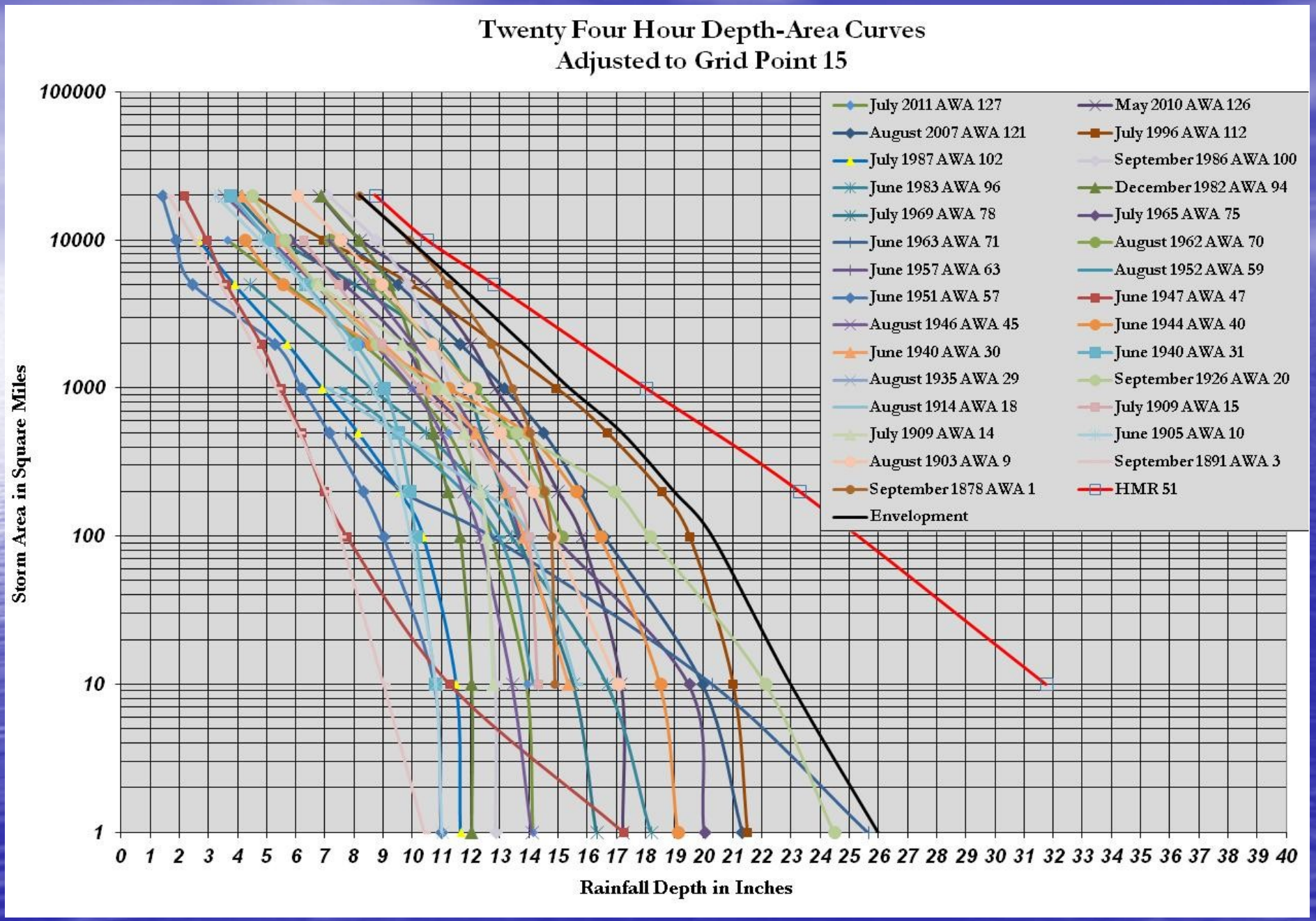
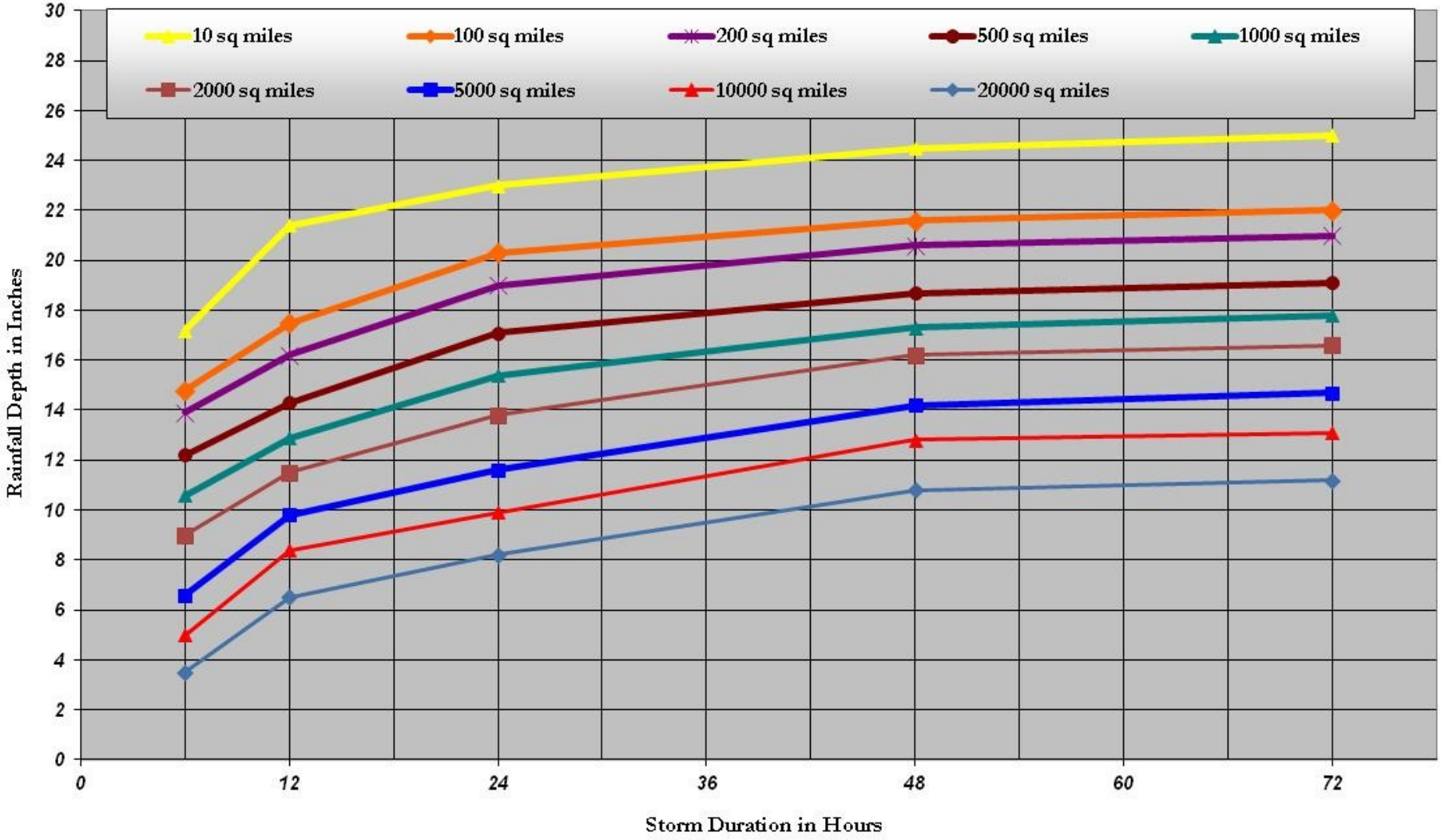
Ohio Grid Point Locations




Twenty Four Hour Depth-Area Curves
Adjusted to Grid Point 15
Storm Area in Square Miles
100000
10000
1000
100
10
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Rainfall Depth in Inches
July 2011 AWA 127
May 2010 AWA 126
August 2007 AWA 121
July 1996 AWA 112
July 1987 AWA 102
September 1986 AWA 100
June 1983 AWA 96
December 1982 AWA 94
July 1969 AWA 78
July 1965 AWA 75
June 1963 AWA 71
August 1962 AWA 70
June 1957 AWA 63
August 1952 AWA 59
June 1951 AWA 57
June 1947 AWA 47
August 1946 AWA 45
June 1944 AWA 40
June 1940 AWA 30
June 1940 AWA 31
August 1935 AWA 29
September 1926 AWA 20
August 1914 AWA 18
July 1909 AWA 15
July 1909 AWA 14
June 1905 AWA 10
August 1903 AWA 9
September 1891 AWA 3
September 1878 AWA 1
HMR 51
Envelopment

Depth-Duration Chart of Enveloped Storm Data
Grid Point 15



OHIO STATEWIDE PMP STUDY

- Major Tasks for PMP Development:
  - Develop full DAD of PMP at each grid point
    - Produce PMP contours based on data
  - Manually smooth PMP contours
    - Ensure spatial and temporal continuity

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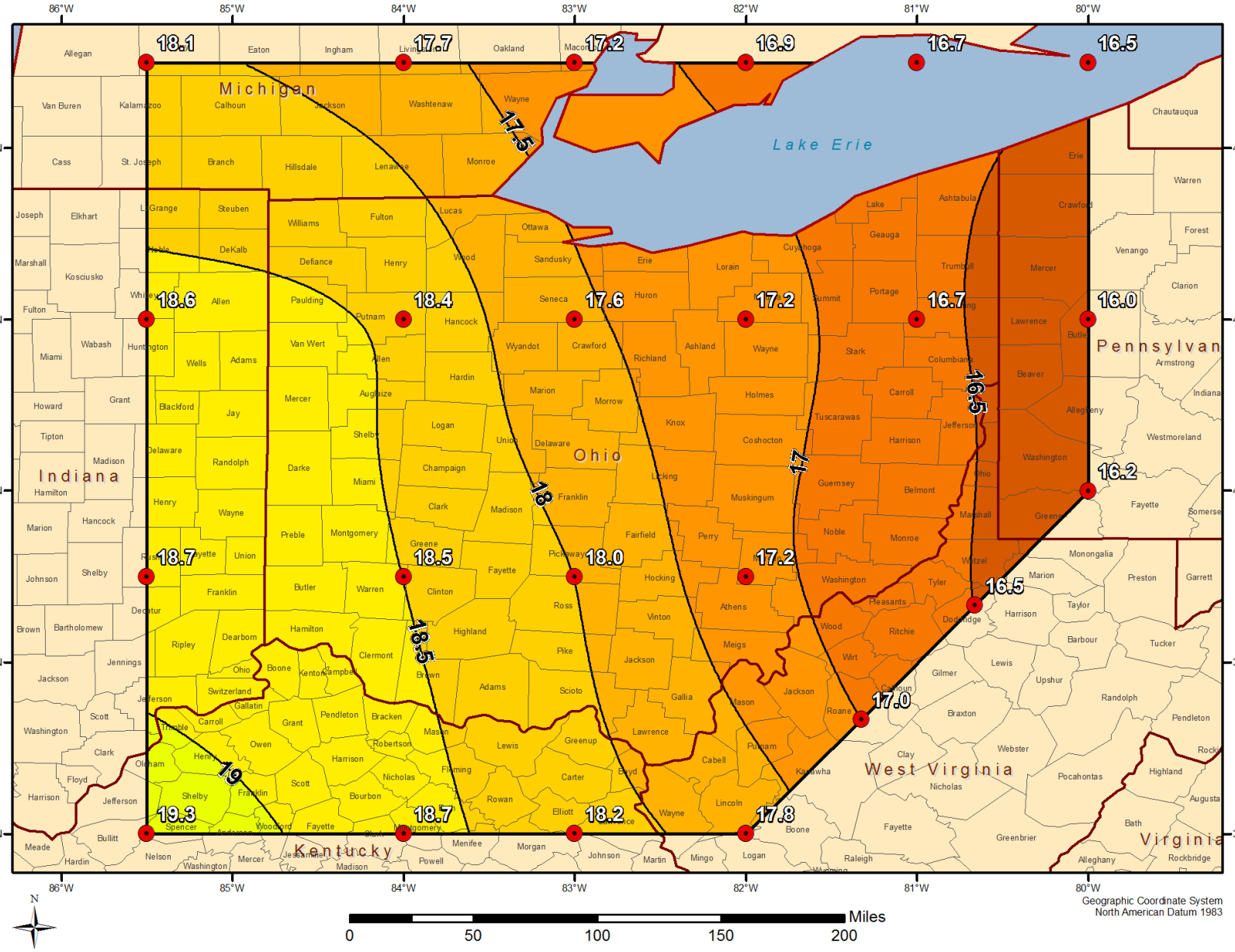
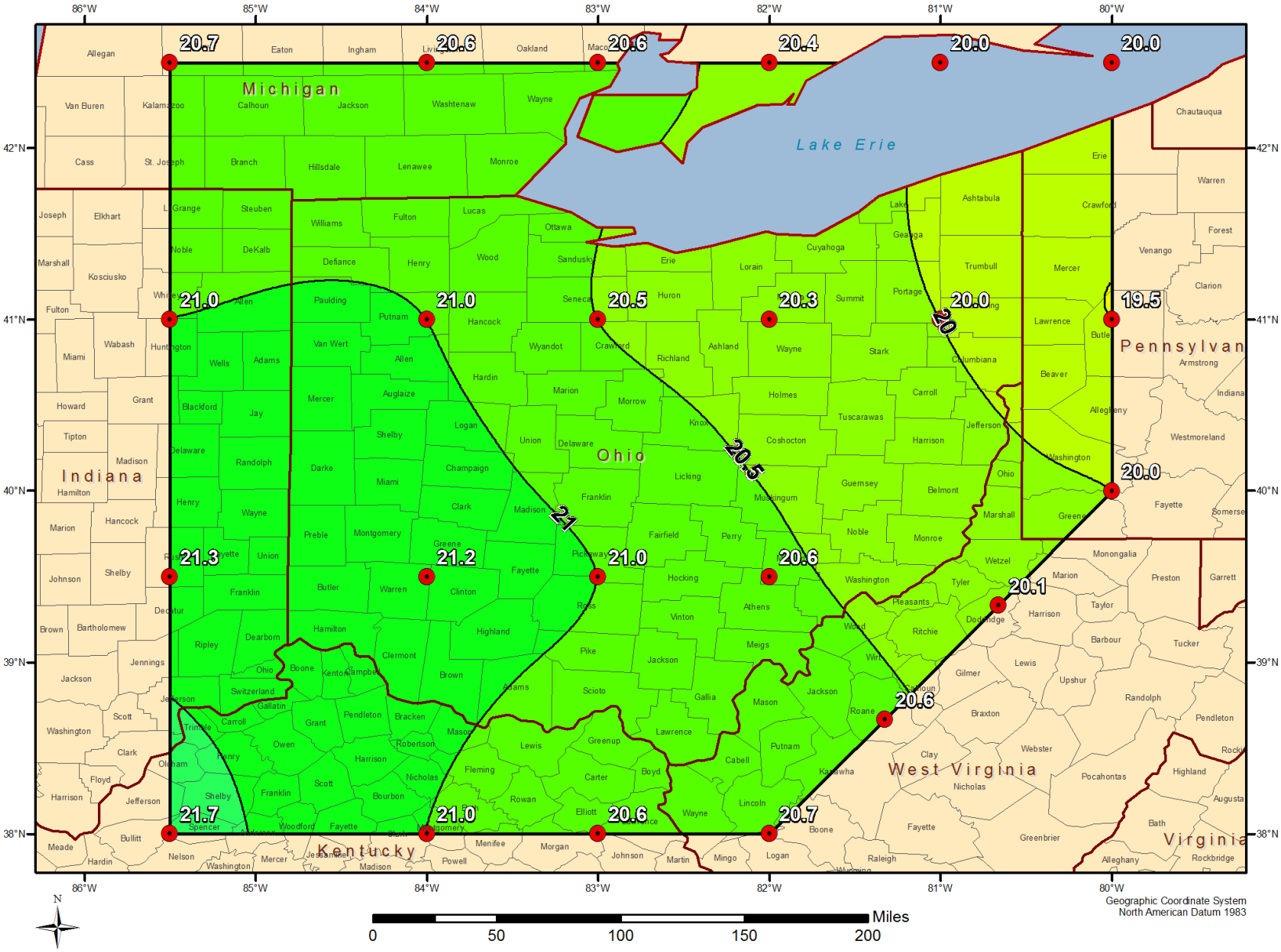
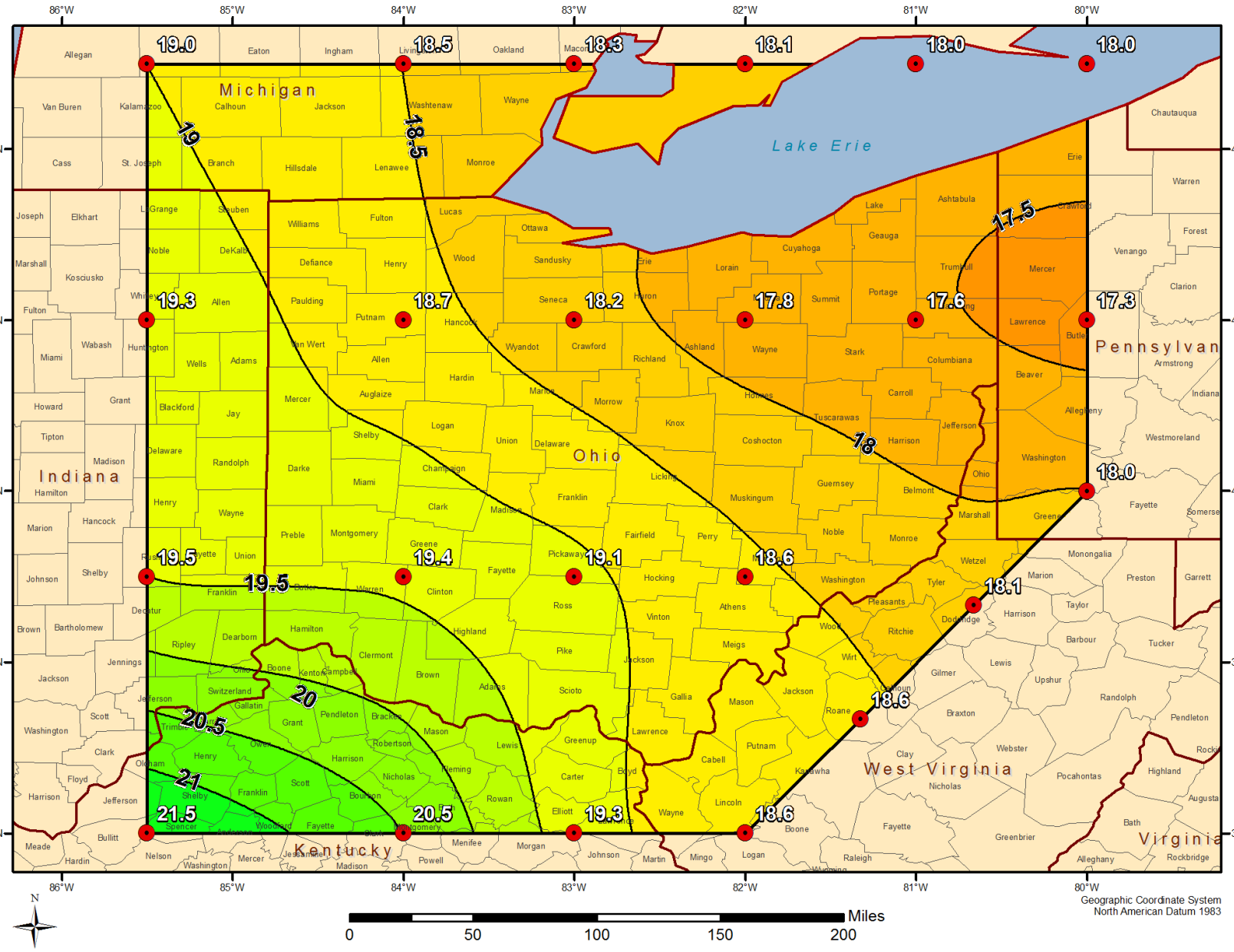
All-Season PMP - 6-hour 10 mi^2 (inches)
Ohio Statewide PMP Study



All-Season PMP - 24-hour 100 mi^2 (inches)
Ohio Statewide PMP Study



All-Season PMP - 72-hour 1,000 mi^2 (inches)
Ohio Statewide PMP Study



Grid Point 15 Site-Specific PMP vs HMR 51

	Area Size	6-Hour	12-Hour	24-Hour	48-Hour	72-Hour
HMR 51 PMP Values at the Basin Centroid in Inches	10sqmi	26.0	29.6	31.8	34.9	36.7
	200sqmi	18.1	21.5	23.3	26.2	27.8
	1000sqmi	13.1	15.9	18.0	20.5	22.3
	5000sqmi	7.8	10.9	12.8	15.3	17.0
	10000sqmi	6.2	8.9	10.5	13.5	15.0
	20000sqmi	4.3	7.0	8.7	11.3	12.5

	Area Size	6-Hour	12-Hour	24-Hour	48-Hour	72-Hour
Grid Point 15 PMP values in Inches	10sqmi	17.2	21.4	23.0	24.5	25.0
	100sqmi	14.8	17.5	20.3	21.6	22.0
	200sqmi	13.9	16.2	19.0	20.6	21.0
	500sqmi	12.2	14.3	17.1	18.7	19.1
	1000sqmi	10.6	12.9	15.4	17.3	17.8
	2000sqmi	9.0	11.5	13.8	16.2	16.6
	5000sqmi	6.6	9.8	11.6	14.2	14.7
	10000sqmi	5.0	8.4	9.9	12.8	13.1
	20000sqmi	3.5	6.5	8.2	10.8	11.2

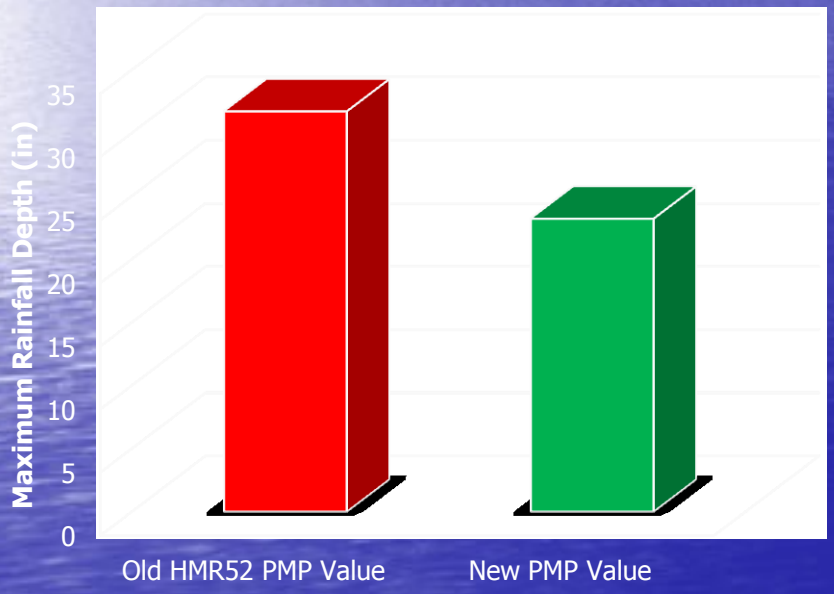
	Area Size	6-Hour	12-Hour	24-Hour	48-Hour	72-Hour
% Reduction from HMR 51	10sqmi	34%	28%	28%	30%	32%
	200sqmi	23%	25%	18%	21%	24%
	1000sqmi	19%	19%	14%	16%	20%
	5000sqmi	16%	10%	9%	7%	13%
	10000sqmi	19%	5%	6%	5%	13%
	20000sqmi	18%	7%	6%	5%	10%

OHIO STATEWIDE PMP STUDY

- Final Report provides all data/details
- PMP data provided on a gridded basis in GIS

PMP 72-hr Rainfall Depth

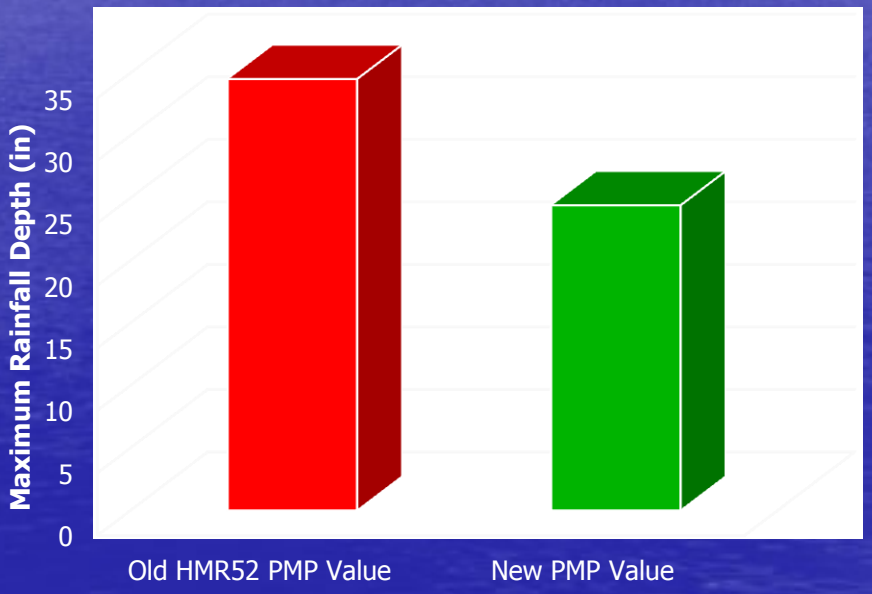
Indian Lake 72-hr PMP Rainfall Depth



HMR 52 Max 6hr – 31.7”

New PMP Max 6hr – 23.2”

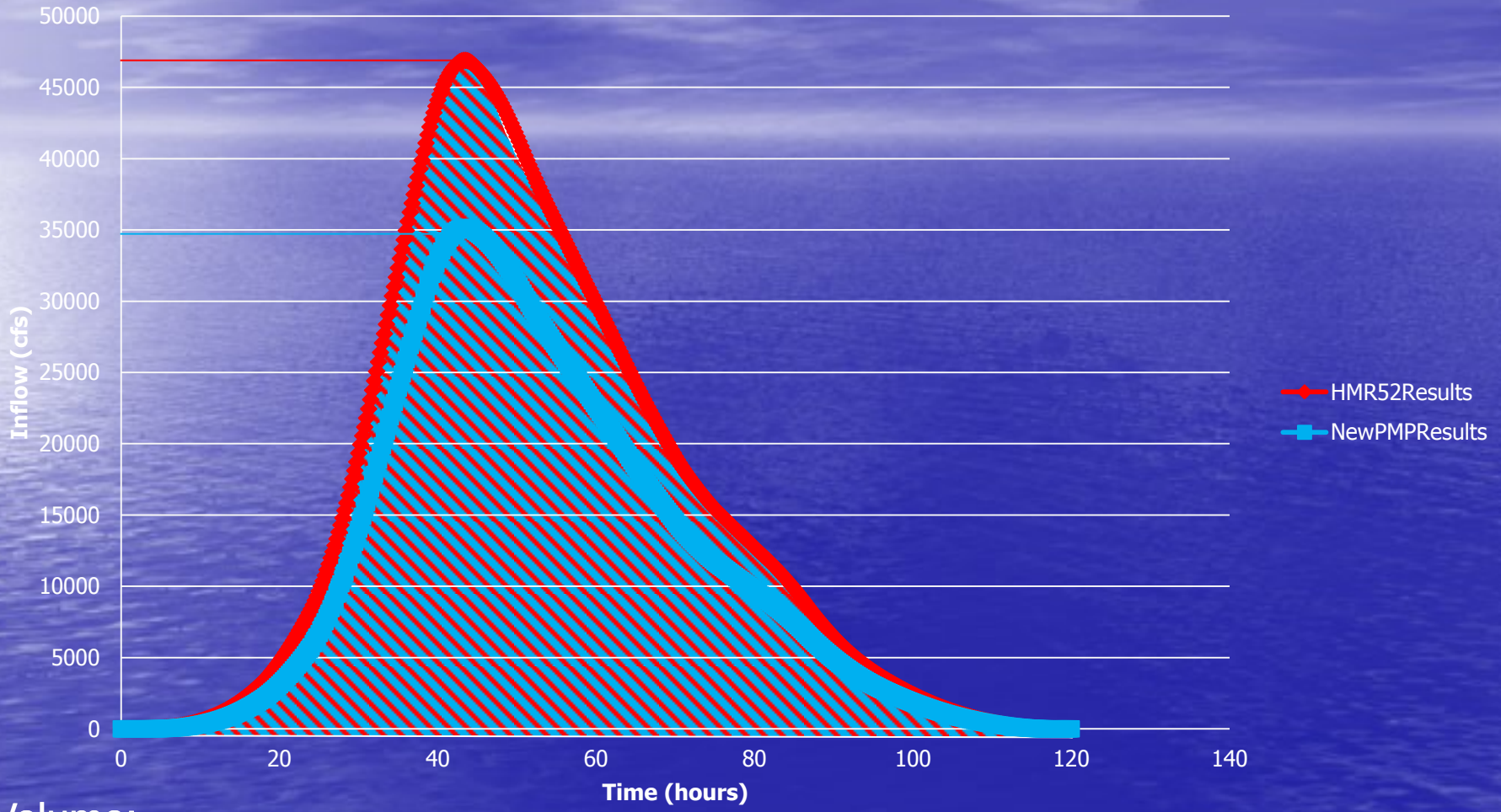
Lake Loramie 72-hr PMP Rainfall Depth



HMR 52 Max 6hr – 34.5”

New PMP Max 6hr – 24.4”

Indian Lake Dam Inflow Hydrograph



Volume:

HMR52: 149,570 ac-ft

New PMP: 111,850 ac-ft

Difference: 37,720 ac-ft

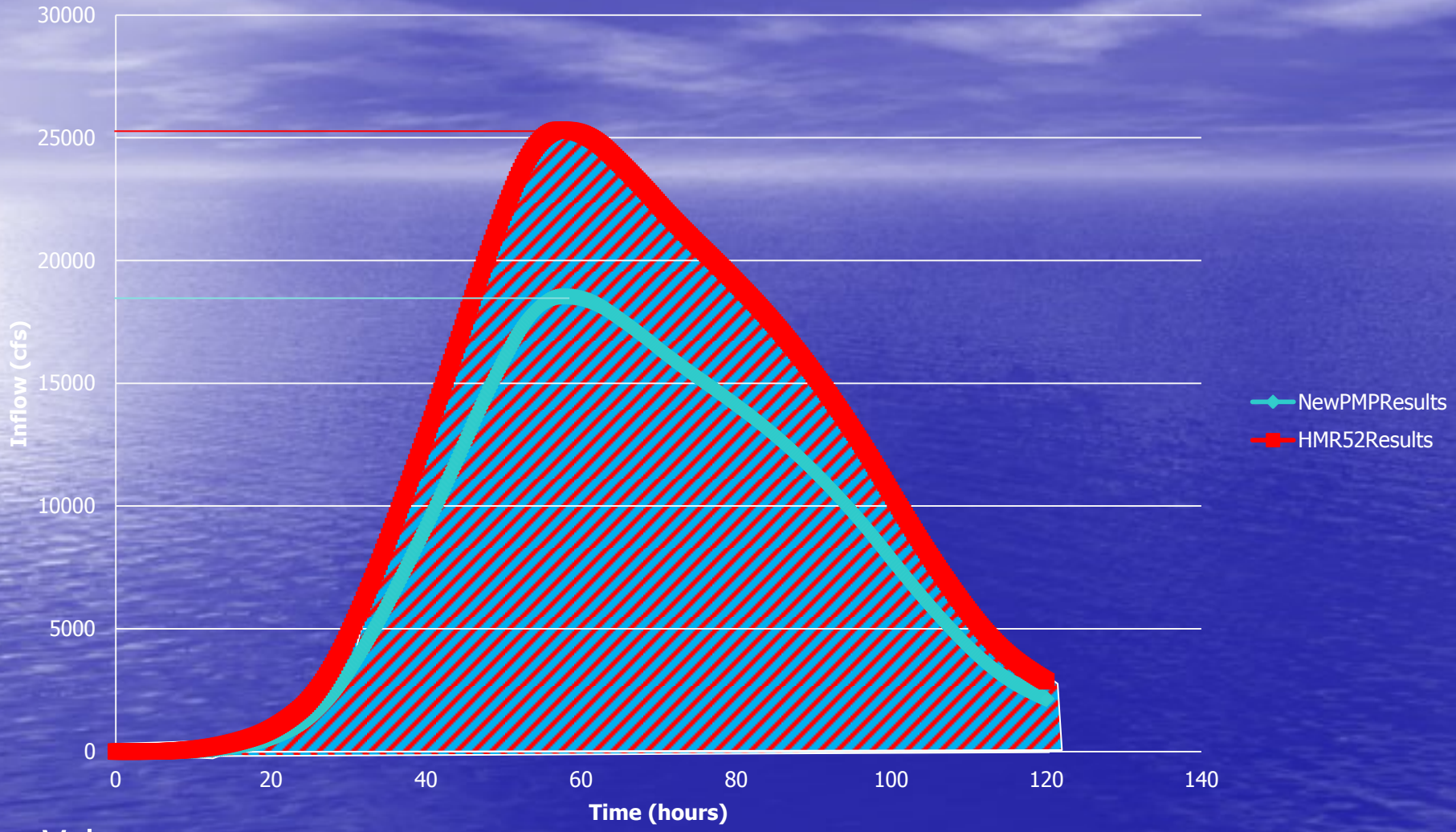
Peak Inflow:

HMR52: 47,300 cfs

New PMP: 35,170 cfs

Difference: 12,130 cfs

Lake Loramie Dam Inflow Hydrograph



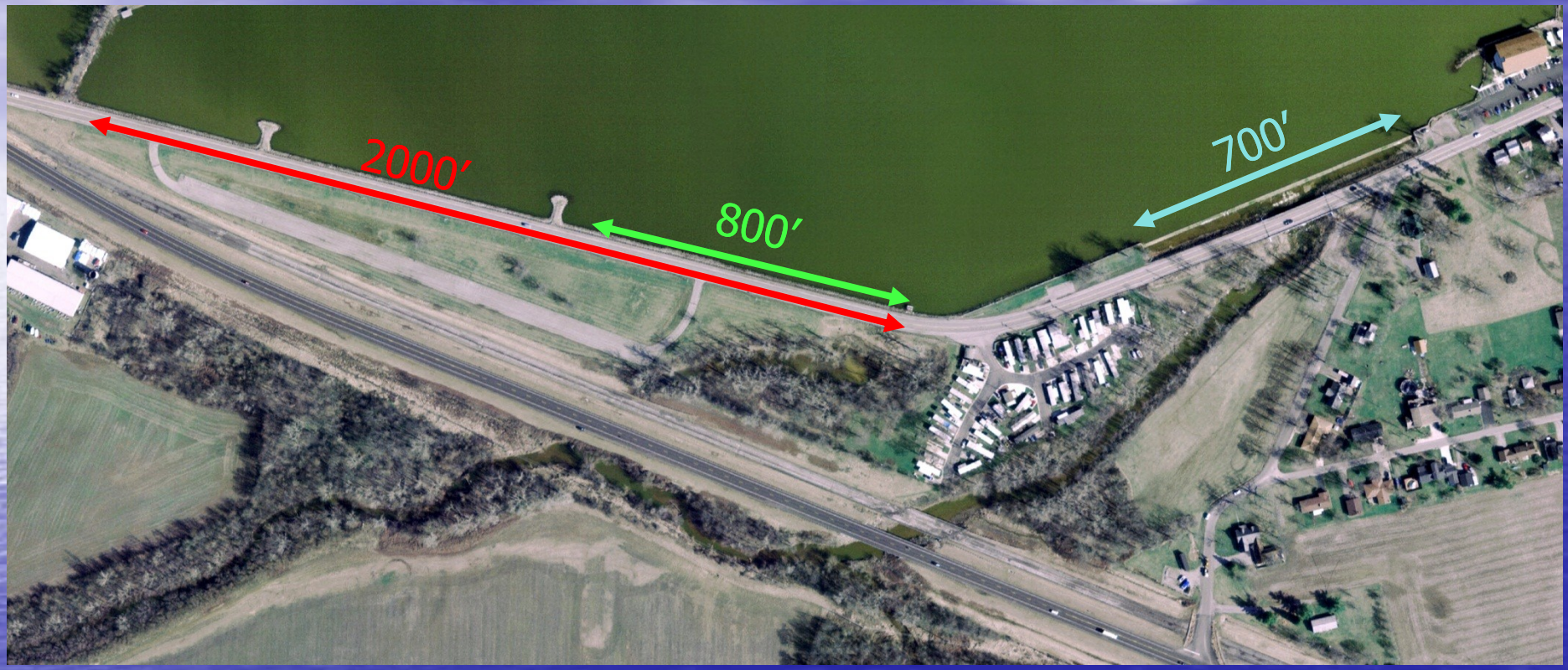
Volume:

HMR52: 116,060 ac-ft New PMP: 84,880 ac-ft Difference: 31,180 ac-ft

Peak Inflow:

HMR52: 25,320 cfs New PMP: 18,540 cfs Difference: 6,780 cfs

Indian Lake Existing Spillway



Existing Spillway Length:
700 feet

New Spillway at 100-year Elevation Using HMR52 PMP:
2000 feet

New Spillway at 100-year Elevation Using New PMP:
800 feet

Lake Loramie Existing Spillway

Existing Spillway Length:

226 feet

New Spillway at 100-year Elevation Using HMR52 PMP:

1150 feet

New Spillway at 100-year Elevation Using New PMP:

610 feet

Cost Benefit ???

- Potential savings at Indian Lake and Lake Loramie is almost $7,000,000.
- Cost of the study is less than $500,000.
- 100+ other state owned dams.
- Thousands of private owned dams.
- YOU DO THE MATH!

OHIO STATEWIDE PMP STUDY

QUESTIONS?

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