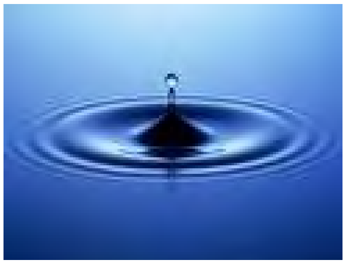

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Ohio River Basin Comprehensive Reconnaissance Report Appendices

US Army Corps of Engineers

Pittsburgh–Nashville–Louisville–Huntington
Great Lakes and Ohio River Division

US Army Corps
of Engineers®

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INTRODUCTION TO THE APPENDICES

The data and information contained within these Appendices to the Ohio River Basin Reconnaissance Report were developed through a collaborative effort of the four Ohio River Basin Districts (Pittsburgh, Huntington, Louisville and Nashville) and the Great Lakes and Ohio River Division office. The Geospatial Information Systems team (a sub-team within the ORB PDT) with members from each of the four Districts contributed data on existing US Army Corps of Engineers (USACE) projects, existing USACE authorities, sub-basin data, GIS layers, and other special data needs. Collection of problems, needs and opportunities (issues) was a four-District effort based upon meetings, presentations, stakeholder meetings and letters to key stakeholders (see Appendix E for more details on the Issues).

The development of the appendices as the foundation of the recon report required identifying geospatial database resources from other Federal agencies, state agencies, NGOs (TNC), academia, local governments and private corporations; assessing the accuracy and credibility of the data (agency POCs contact and email confirmation); securing metadata for GIS layers and organizing data into the HUC 4 or HUC 8 levels to develop appropriate GIS products for the report and the GIS Atlas. This process required extensive collaboration between layers of Federal and state government, NGOs, academia and private corporations.

Needless to say that such a large database undertaking met with numerous roadblocks and dead ends. In several instances, data that could have been used to support formulation of specific alternatives and to justify further study of those alternatives were either unavailable or were available only sporadically for the basin – there remain a significant number of data gaps. Some of the gaps encountered limited the capabilities of the geospatial systems to discover and display important relationships between existing conditions and known problems and potential solutions. Incomplete or unavailable data constrained the full potential of the planning process through geospatial analysis.

These gaps could be closed through cost-shared studies with the several states using programs such as the Section 22 Planning Assistance to States program or through other collaborative ventures with Federal and state agencies or NGOs (TNC) or academia. Pursuing several of the recommended Initial Watershed Assessments and following cost-shared Watershed Assessment Plans would also help to close the data gaps uncovered during this planning process. Closing the data gaps would enable water resources planners, natural resources planners, local government planners and other professionals to better characterize problems, needs and opportunities and formulate and evaluate better alternatives.

Several of the recommended alternatives attempt to address the data gaps uncovered during the planning process. Once developed the GIS databases would need to be maintained in an electronic library that could be accessed by agencies, stakeholders and the public and that could be updated with new information on an annual basis. The location of the electronic library and funding to maintain the information databases remains to be determined.

APPENDIX A – DETAILED BASINWIDE FLOOD INSURANCE POLICY AND CLAIM DATA, AND UNPROTECTED MAINSTEM OHIO RIVER COMMUNITIES

To characterize the extent and depth of the flood damage risk across the basin, the flood insurance policy database maintained by FEMA was explored. The national database includes all of the counties and municipalities within the US who are active participants in the regular program of the National Flood Insurance Program and who have enacted floodplain management ordinances for their jurisdictions. The database includes policy and claim information as well as information on the floodplain location (A, AE, X, B, and other designated zones for insurance purposes) of the insured structures. The policy and claim information is as recent as January of 2009 and the records extend back to 1978.

Using this database, a close estimate of the total number of flood insurance policies within the Ohio River Basin can be derived, the value of those policies (an indication of the risk exposure, and value of the structures) and the premiums being paid for that insurance (an indication of the willingness to pay by landowners to buy down the risk). The claim database shows the total number of claims made against the policies in place and the value of the payments made against those claims out of the insurance program. There data uncover instances where there have been more claims than policies issued indicating multiple damage events to policies issued as well as an estimate of the dollar damages that have been suffered in each jurisdiction.

Since the flood insurance program does not cover all of the potential flood damages (i.e., transportation facilities, utilities, accessory structures, garages, and vehicles) that do occur in floods, these data should be considered as a very conservative estimate of total flood damages. Correlating these data with the GIS mapping database for each municipal and county area facilitates display of the relative flood risk among the HUC 8 watersheds and HUC 4 sub-basins.

One limitation of this database is that it only accounts for structures which have been insured through the NFIP. The flood risks associated with other structures located within the floodplain are not accounted for in this database. Fortuitously, the RAND Corporation has conducted a study of the effectiveness of the national flood insurance program for FEMA (www.rand.org/pubs/technical_reports/2006/RAND_TR300.pdf). That study completed in 2006 sampled 100 communities within the US including five communities (Cincinnati, OH; New Hope, TN; Hanover, OH; Fairfax, OH and Borough of Fox Chapel, PA) within the Ohio River Basin to determine how effective the insurance program has been in reducing the financial impacts of flooding.

One of the aspects of that study was a determination, by regions of the US, of the levels of market penetration by the flood insurance program. One category of that market penetration study was targeted at structures known to be within the designated “Special Flood Hazard Area” (SFHA). Using the appropriate regional percentages of market penetration in the study, it is possible to derive an estimate of the total number of structures that may be within the special flood hazard areas of the basin. Likewise using average policy values and claim value data, a total picture of the level of flood risk by watershed (HUC 8) and sub-basin (HUC 4) can be estimated.

Table 1 shows the number of flood insurance policies in place within the counties of the basin (municipal policies included within the counties) as well as the amount of coverage associated with those policies. The coverage amount is a conservative estimate of the amount of potential damages located at properties insured and in the special flood hazard area (1% chance flood zone). These amounts do not include additional FEMA insurance coverage for contents.

The next column indicates what the average amount of structure coverage is for each county. The “Total At Risk in SFHA” column shows the estimated number of structures that may actually be located in the special flood hazard areas of the basin that do not have insurance but are still at risk from flooding based upon the market penetration rates in the RAND Corporation Study. As the table shows, there are 152,260 flood insurance policies in force (January 2009 data) with coverage valued at approximately $22.5 billion. In addition, based upon the market penetration data, there may be as many as 489,962 structures at risk in the special flood hazard area (the 1% chance floodplain). Based upon the average coverage amounts for the insured structures, the potential (and a very conservative estimate) amount of insurable flood damages is approximately $70.0 billion. Also shown are the insurance claim amounts paid out by FEMA for the policies in force across the basin since 1978. Again using the estimated number of potential properties located within the SFHA and the average claim data, the past insured damages could be as high as $6.3 billion.

These numbers of at–risk structures, estimated potential insurable flood damages, and potential damages although derived through the estimated figures of the RAND Corporation study, indicate a huge potential for flood damages across the basin and when distributed across the 152 HUC 8 watersheds and HUC 4 sub-basins in the GIS mapping show the relative risks across these regions. Considering that the insurance coverage amounts are a conservative estimate of the total insurable flood damages possible, these data indicate the need for more education of the public in the benefits of having flood insurance, and more emphasis on pre-disaster mitigation activities through FEMA, USACE and NRCS programs for flood risk reduction.

In addition, the communities located along the mainstem of the Ohio River that are not protected by either structural (floodwalls and levees) or nonstructural measures (floodproofing and evacuation) are listed in Table 2. For this reconnaissance level study only communities one square mile in size or larger were included for analysis – there are many other smaller communities also at risk. The table shows the population of each community, numbers of flood insurance policies in force (FEMA data), the value of their coverage, numbers and amounts of claims and using the RAND Corporation data on market penetration, an estimate of the potential at-risk structures and potential damages within the 1% chance flood zone.

Table 1 – NFIP Policies in Force, Value of Coverage, Potential at Risk, and Claims Data for Structures

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
1	AL	Blount	18	$4,197,200.00	$233,177.78	30	$6,881,076.22	$557,560.63	$1,028,350.89
2	AL	Colbert	145	$20,981,900.00	$144,702.76	238	$34,395,845.72	$877,006.29	$2,638,789.81
3	AL	Cullman	60	$9,583,900.00	$159,731.67	98	$15,711,206.73	$30,691.10	$603,755.32
4	AL	DeKalb	76	$14,648,400.00	$192,742.11	125	$24,013,738.89	$441,755.39	$2,751,915.20
5	AL	Etowah	510	$90,771,900.00	$177,984.12	836	$148,807,181.24	$530,029.76	$6,330,599.73
6	AL	Franklin	16	$1,798,400.00	$112,400.00	26	$2,948,252.00	$0.00	$0.00
7	AL	Jackson	200	$28,691,600.00	$143,458.00	328	$47,035,574.46	$274,591.12	$3,104,489.33
8	AL	Lauderdale	178	$26,918,000.00	$151,224.72	292	$44,127,373.03	$788,142.35	$2,839,258.49
9	AL	Lawrence	68	$8,828,100.00	$129,825.00	111	$14,472,891.00	$157,894.82	$977,895.25
10	AL	Limestone	169	$40,259,300.00	$238,220.71	277	$65,999,047.72	$162,175.13	$1,497,687.33
11	AL	Madison	3,482	$764,595,200.00	$219,585.07	5,708	$1,253,435,474.05	$6,385,673.76	$88,472,579.99
12	AL	Marion	15	$1,845,800.00	$123,053.33	25	$3,025,881.47	$148,077.50	$280,094.29
13	AL	Marshall	82	$16,047,800.00	$195,704.88	134	$26,308,606.76	$228,307.24	$4,384,477.47
14	AL	Morgan	840	$137,096,100.00	$163,209.64	1,377	$224,747,838.70	$937,084.01	$19,852,485.17
15	AL	Winston	64	$14,977,200.00	$234,018.75	105	$24,553,247.25	$0.00	$0.00
16	GA	Catoosa	289	$37,983,000.00	$131,429.07	474	$62,267,148.48	$1,878,173.45	$8,239,094.77
17	GA	Dade	19	$3,021,100.00	$159,005.26	31	$4,953,013.95	$105,855.87	$824,352.59
18	GA	Fannin	350	$69,456,500.00	$198,447.14	574	$113,863,017.16	$221,615.63	$7,947,275.00
19	GA	Gilmer	282	$65,891,900.00	$233,659.22	462	$108,020,657.34	$3,019,557.19	$16,231,875.45
20	GA	Habersham	59	$12,485,500.00	$211,618.64	97	$20,467,755.25	$3,500.00	$338,520.00
21	GA	Lumpkin	38	$7,654,900.00	$201,444.74	62	$12,550,007.11	$12,083.55	$188,201.29
22	GA	Rabun	126	$27,558,200.00	$218,715.87	207	$45,177,950.73	$226,374.47	$4,250,900.96
23	GA	Towns	89	$18,909,800.00	$212,469.66	146	$30,999,323.82	$21,716.29	$452,629.53
24	GA	Union	123	$21,310,800.00	$173,258.54	202	$34,935,851.32	$258,933.67	$3,071,257.95

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
25	GA	Walker	263	$29,489,800.00	$112,128.52	431	$48,344,210.15	$867,730.70	$6,450,380.88
26	GA	White	188	$33,737,900.00	$179,456.91	308	$55,308,621.17	$58,299.44	$4,491,971.85
27	GA	Whitfield	214	$44,962,800.00	$210,106.54	351	$73,709,577.08	$868,817.53	$6,626,055.78
28	IL	Alexander	242	$17,582,100.00	$72,653.31	1,100	$79,918,636.36	$852,213.41	$3,396,502.72
29	IL	Champaign	407	$74,900,200.00	$184,029.98	1,850	$340,455,454.55	$1,573,476.28	$17,326,970.94
30	IL	Clark	18	$1,857,900.00	$103,216.67	82	$8,445,187.67	$124,947.37	$1,277,899.23
31	IL	Clay	12	$1,176,000.00	$98,000.00	55	$5,345,900.00	$0.00	$0.00
32	IL	Coles	146	$18,687,700.00	$127,997.95	664	$84,944,556.36	$400,342.85	$8,570,436.42
33	IL	Crawford	48	$6,869,800.00	$143,120.83	218	$31,226,103.42	$475,259.19	$4,937,716.67
34	IL	Cumberland	10	$1,394,500.00	$139,450.00	45	$6,338,002.50	$17,807.12	$269,777.87
35	IL	Douglas	386	$44,499,200.00	$115,282.90	1,755	$202,269,614.92	$810,648.04	$10,614,347.15
36	IL	Edgar	8	$1,240,000.00	$155,000.00	36	$5,635,800.00	$5,134.88	$186,704.24
37	IL	Edwards	2	$168,000.00	$84,000.00	9	$763,560.00	$0.00	$0.00
38	IL	Effingham	5	$1,203,500.00	$240,700.00	23	$5,471,111.00	$0.00	$0.00
39	IL	Fayette	1	$105,000.00	$105,000.00	5	$477,750.00	$3,460.64	$15,745.91
40	IL	Ford	4	$630,200.00	$157,550.00	18	$2,864,259.00	$6,703.69	$121,873.08
41	IL	Franklin	109	$6,576,400.00	$60,333.94	495	$29,892,453.03	$396,040.97	$5,606,242.82
42	IL	Gallatin	40	$2,793,000.00	$69,825.00	182	$12,695,581.50	$190,954.00	$1,653,297.92
43	IL	Hamilton	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
44	IL	Hardin	7	$1,048,000.00	$149,714.29	32	$4,763,908.57	$104,666.15	$195,910.41
45	IL	Iroquois	750	$54,874,400.00	$73,165.87	3,409	$249,429,024.39	$7,258,427.71	$71,516,281.28
46	IL	Jasper	10	$863,700.00	$86,370.00	45	$3,925,516.50	$113,772.57	$1,034,192.66
47	IL	Jefferson	42	$3,500,600.00	$83,347.62	191	$15,911,893.95	$55,557.73	$3,535,508.74
48	IL	Johnson	11	$2,284,000.00	$207,636.36	50	$10,381,818.18	$17,408.97	$217,612.13
49	IL	Lawrence	63	$5,265,800.00	$83,584.13	286	$23,935,150.60	$71,082.99	$2,544,415.63
50	IL	Livingston	432	$34,179,400.00	$79,118.98	1,964	$155,361,196.80	$1,723,021.01	$16,585,259.69
51	IL	Marion	21	$5,368,200.00	$255,628.57	95	$24,399,747.14	$141,767.59	$1,933,102.35

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
52	IL	Massac	96	$12,574,800.00	$130,987.50	436	$57,157,705.50	$163,022.14	$3,092,884.39
53	IL	Moultrie	27	$3,629,300.00	$134,418.52	123	$16,497,184.78	$31,730.29	$778,851.70
54	IL	Pope	0	$0.00	$0.00	0	$0.00	$962.37	$0.00
55	IL	Pulaski	50	$8,286,500.00	$165,730.00	227	$37,665,457.10	$52,090.01	$789,233.10
56	IL	Richland	1	$175,000.00	$175,000.00	5	$796,250.00	$0.00	$0.00
57	IL	Saline	21	$5,766,100.00	$274,576.19	95	$26,208,297.38	$29,756.48	$1,420,128.01
58	IL	Shelby	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
59	IL	Union	119	$8,198,600.00	$68,895.80	541	$37,266,426.27	$262,195.89	$2,026,062.56
60	IL	Vermilion	111	$13,244,700.00	$119,321.62	505	$60,203,724.19	$1,143,997.33	$10,688,960.24
61	IL	Wabash	23	$4,174,000.00	$181,478.26	105	$18,973,552.17	$30,378.29	$352,894.47
62	IL	Wayne	63	$5,680,200.00	$90,161.90	286	$25,818,763.05	$16,725.73	$1,596,526.68
63	IL	White	114	$9,219,900.00	$80,876.32	518	$41,908,489.32	$317,372.04	$5,481,861.46
64	IL	Williamson	262	$22,730,500.00	$86,757.63	1,191	$103,320,533.42	$1,604,456.02	$12,017,375.59
65	IN	Adams	83	$9,900,100.00	$119,278.31	377	$45,000,129.24	$1,217,390.35	$5,403,351.26
66	IN	Allen	1,316	$185,300,900.00	$140,806.16	5,982	$842,277,074.19	$10,568,628.41	$54,080,096.49
67	IN	Bartholomew	1,153	$170,548,600.00	$147,917.26	5,241	$775,221,043.56	$14,044,384.17	$176,935,945.77
68	IN	Benton	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
69	IN	Blackford	8	$1,234,100.00	$154,262.50	36	$5,608,984.50	$10,661.97	$193,834.61
70	IN	Boone	604	$74,501,400.00	$123,346.69	2,745	$338,642,166.61	$138,617.00	$25,371,069.51
71	IN	Brown	157	$20,792,800.00	$132,438.22	714	$94,513,208.87	$2,118,669.43	$15,119,672.52
72	IN	Carroll	310	$37,843,100.00	$122,074.52	1,409	$172,013,979.93	$10,924,670.07	$43,982,409.57
73	IN	Cass	132	$15,457,600.00	$117,103.03	600	$70,261,818.18	$184,902.55	$4,437,661.20
74	IN	Clark	1,183	$178,276,900.00	$150,698.99	5,377	$810,349,134.46	$5,738,268.04	$72,432,433.29
75	IN	Clay	40	$2,413,500.00	$60,337.50	182	$10,970,564.25	$327,645.17	$5,957,244.48
76	IN	Clinton	31	$4,838,400.00	$156,077.42	141	$21,992,869.16	$107,483.89	$1,376,868.63
77	IN	Crawford	69	$5,011,900.00	$72,636.23	314	$22,781,627.77	$1,572,435.83	$4,215,203.19
78	IN	Daviess	17	$2,570,100.00	$151,182.35	77	$11,681,860.41	$78,981.62	$2,034,303.26

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
79	IN	Dearborn	162	$30,960,000.00	$191,111.11	736	$140,726,577.78	$1,331,351.95	$14,416,975.32
80	IN	Decatur	63	$8,236,000.00	$130,730.16	286	$37,435,888.25	$460,455.34	$8,790,399.41
81	IN	Delaware	427	$62,824,200.00	$147,129.27	1,941	$285,564,679.21	$1,464,015.14	$22,915,496.98
82	IN	Dubois	28	$4,158,500.00	$148,517.86	127	$18,901,867.68	$3,900.80	$248,227.41
83	IN	Fayette	76	$5,976,400.00	$78,636.84	345	$27,165,097.11	$61,320.11	$2,353,670.22
84	IN	Floyd	242	$42,118,000.00	$174,041.32	1,100	$191,445,454.55	$1,734,187.79	$20,734,854.01
85	IN	Fountain	30	$4,278,800.00	$142,626.67	136	$19,448,572.27	$108,196.70	$1,639,300.22
86	IN	Franklin	66	$6,083,200.00	$92,169.70	300	$27,650,909.09	$384,787.04	$6,075,584.84
87	IN	Fulton	76	$9,570,700.00	$125,930.26	345	$43,502,609.41	$1,851,093.93	$3,633,297.72
88	IN	Gibson	36	$2,101,000.00	$58,361.11	164	$9,550,212.22	$217,902.73	$1,426,304.11
89	IN	Grant	149	$17,633,900.00	$118,348.32	677	$80,153,768.14	$1,042,479.90	$8,023,185.93
90	IN	Greene	42	$4,422,300.00	$105,292.86	191	$20,101,459.36	$105,070.73	$6,686,351.02
91	IN	Hamilton	878	$198,333,900.00	$225,892.82	3,991	$901,517,932.63	$2,040,116.32	$39,332,949.87
92	IN	Hancock	377	$52,465,400.00	$139,165.52	1,714	$238,479,596.97	$687,476.45	$21,816,428.59
93	IN	Harrison	157	$16,847,100.00	$107,306.37	714	$76,578,117.48	$1,408,814.87	$11,296,479.14
94	IN	Hendricks	344	$69,283,600.00	$201,405.81	1,564	$314,926,186.93	$206,119.02	$11,936,886.83
95	IN	Henry	92	$10,194,500.00	$110,809.78	418	$46,338,434.89	$43,131.89	$2,254,611.72
96	IN	Howard	303	$56,186,400.00	$185,433.66	1,377	$255,392,221.54	$3,571,542.65	$16,788,322.68
97	IN	Huntington	95	$14,399,300.00	$151,571.58	432	$65,451,639.22	$441,001.79	$4,231,853.18
98	IN	Jackson	339	$45,259,100.00	$133,507.67	1,541	$205,723,303.19	$626,766.76	$17,885,021.63
99	IN	Jasper	150	$15,893,200.00	$105,954.67	682	$72,242,010.83	$775,290.98	$7,048,118.61
100	IN	Jay	179	$11,658,500.00	$65,131.28	814	$52,993,418.66	$16,212.17	$2,638,174.00
101	IN	Jefferson	163	$17,914,200.00	$109,903.07	741	$81,428,281.73	$1,690,341.90	$10,265,501.78
102	IN	Jennings	22	$2,045,000.00	$92,954.55	100	$9,295,454.55	$37,957.06	$1,265,235.33
103	IN	Johnson	787	$133,384,500.00	$169,484.75	3,577	$606,292,719.59	$9,925,945.47	$138,162,595.14
104	IN	Knox	134	$19,573,700.00	$146,072.39	609	$88,971,230.84	$616,385.73	$7,661,926.21
105	IN	Kosciusko	856	$114,097,400.00	$133,291.36	3,891	$518,624,666.63	$2,632,595.26	$39,245,943.38

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
106	IN	Lawrence	43	$5,448,600.00	$126,711.63	195	$24,765,787.67	$767,196.33	$3,946,013.76
107	IN	Madison	361	$45,241,700.00	$125,323.27	1,641	$205,644,204.84	$2,059,886.29	$20,119,571.50
108	IN	Marion	6,378	$997,281,800.00	$156,362.78	28,991	$4,533,099,233.06	$10,794,815.30	$273,320,103.78
109	IN	Marshall	96	$12,510,200.00	$130,314.58	436	$56,864,071.58	$796,506.80	$2,482,597.91
110	IN	Martin	9	$830,700.00	$92,300.00	41	$3,775,993.00	$132,304.85	$676,573.93
111	IN	Miami	116	$19,268,500.00	$166,107.76	527	$87,583,637.89	$36,033.58	$1,583,285.48
112	IN	Monroe	239	$42,254,500.00	$176,797.07	1,086	$192,065,266.19	$252,558.31	$13,065,202.17
113	IN	Montgomery	49	$6,252,000.00	$127,591.84	223	$28,418,529.80	$61,160.53	$1,946,040.69
114	IN	Morgan	364	$70,952,500.00	$194,924.45	1,655	$322,512,249.66	$7,233,997.53	$78,743,490.88
115	IN	Noble	226	$26,351,700.00	$116,600.44	1,027	$119,780,136.54	$1,133,881.78	$9,318,421.89
116	IN	Ohio	57	$6,314,500.00	$110,780.70	259	$28,702,172.02	$23,919.38	$1,032,878.69
117	IN	Orange	47	$8,534,100.00	$181,576.60	214	$38,792,023.91	$1,238,265.05	$3,187,264.40
118	IN	Owen	120	$12,809,000.00	$106,741.67	545	$58,222,242.08	$2,918,315.97	$15,159,956.63
119	IN	Parke	37	$1,659,300.00	$44,845.95	168	$7,542,191.19	$84,333.69	$1,575,915.55
120	IN	Perry	64	$5,343,600.00	$83,493.75	291	$24,289,166.81	$76,100.75	$962,542.14
121	IN	Pike	8	$443,300.00	$55,412.50	36	$2,014,798.50	$44,000.00	$1,599,840.00
122	IN	Posey	136	$14,391,500.00	$105,819.85	618	$65,415,716.69	$662,503.64	$5,688,145.84
123	IN	Pulaski	83	$5,845,400.00	$70,426.51	377	$26,569,807.93	$1,681,075.75	$5,662,673.64
124	IN	Putnam	54	$6,170,200.00	$114,262.96	245	$28,045,844.26	$235,990.89	$5,265,814.90
125	IN	Randolph	58	$7,539,700.00	$129,994.83	264	$34,271,836.34	$26,331.30	$771,331.55
126	IN	Ripley	15	$2,763,000.00	$184,200.00	68	$12,558,756.00	$23,123.19	$525,513.03
127	IN	Rush	42	$5,015,500.00	$119,416.67	191	$22,797,835.83	$70,648.06	$1,123,951.76
128	IN	Scott	47	$5,502,400.00	$117,072.34	214	$25,011,334.81	$41,459.60	$1,476,238.16
129	IN	Shelby	462	$55,219,400.00	$119,522.51	2,100	$250,997,272.73	$1,330,035.57	$24,287,606.06
130	IN	Spencer	154	$14,386,000.00	$93,415.58	700	$65,390,909.09	$208,526.83	$4,293,199.44
131	IN	Starke	71	$7,674,100.00	$108,085.92	323	$34,882,567.51	$80,164.91	$5,174,324.28
132	IN	Sullivan	10	$396,400.00	$39,640.00	45	$1,801,638.00	$0.00	$0.00

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
133	IN	Switzerland	98	$9,094,300.00	$92,798.98	445	$41,337,305.46	$999,333.57	$5,237,095.75
134	IN	Tippecanoe	240	$40,570,700.00	$169,044.58	1,091	$184,412,426.40	$1,903,142.06	$15,970,436.19
135	IN	Tipton	104	$10,412,700.00	$100,122.12	473	$47,330,727.61	$373,046.59	$4,521,802.94
136	IN	Union	5	$555,700.00	$111,140.00	23	$2,526,212.20	$27,064.62	$307,589.41
137	IN	Vanderburgh	1,128	$193,582,900.00	$171,616.05	5,127	$879,921,804.68	$4,012,888.20	$40,986,377.05
138	IN	Vermillion	67	$6,760,000.00	$100,895.52	305	$30,727,731.34	$391,228.66	$2,291,320.93
139	IN	Vigo	1,157	$169,757,100.00	$146,721.78	5,259	$771,623,048.43	$15,977,197.03	$154,743,125.47
140	IN	Wabash	85	$12,116,500.00	$142,547.06	386	$55,074,481.65	$70,672.08	$2,100,374.22
141	IN	Warren	3	$115,000.00	$38,333.33	14	$522,866.67	$1,983.17	$27,050.44
142	IN	Warrick	232	$43,634,100.00	$188,078.02	1,055	$198,337,673.08	$292,773.68	$8,344,445.52
143	IN	Washington	34	$2,454,300.00	$72,185.29	155	$11,156,237.21	$1,894,461.21	$7,913,215.68
144	IN	Wayne	158	$17,315,000.00	$109,588.61	718	$78,704,346.20	$327,390.95	$5,734,771.52
145	IN	Wells	37	$5,097,800.00	$137,778.38	168	$23,171,567.68	$416,550.33	$3,502,771.72
146	IN	White	221	$31,695,000.00	$143,416.29	1,005	$144,068,833.71	$2,783,526.32	$24,745,056.33
147	IN	Whitley	86	$12,125,300.00	$140,991.86	391	$55,115,128.17	$95,461.55	$2,665,491.04
148	KY	Adair	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
149	KY	Allen	9	$1,207,000.00	$134,111.11	15	$1,978,138.89	$144,120.01	$265,721.27
150	KY	Anderson	38	$5,084,300.00	$133,797.37	62	$8,335,576.05	$359,716.30	$830,012.06
151	KY	Ballard	15	$1,417,500.00	$94,500.00	25	$2,323,755.00	$119,563.80	$113,079.76
152	KY	Barren	4	$840,000.00	$210,000.00	7	$1,377,600.00	$18,286.28	$11,995.80
153	KY	Bath	29	$2,117,700.00	$73,024.14	48	$3,471,567.52	$390,318.28	$452,578.81
154	KY	Bell	415	$38,134,100.00	$91,889.40	680	$62,515,113.86	$3,090,151.25	$6,738,213.46
155	KY	Boone	79	$12,004,900.00	$151,960.76	130	$19,680,437.96	$282,772.97	$1,831,096.37
156	KY	Bourbon	113	$12,390,700.00	$109,652.21	185	$20,313,072.35	$2,696,476.15	$2,345,174.68
157	KY	Boyd	298	$37,340,900.00	$125,305.03	489	$61,214,014.99	$3,819,922.29	$7,647,985.40
158	KY	Boyle	19	$2,820,700.00	$148,457.89	31	$4,624,463.42	$10,894.16	$84,838.27
159	KY	Bracken	128	$10,314,900.00	$80,585.16	210	$16,909,989.19	$1,809,042.60	$4,081,822.57

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
160	KY	Breathitt	91	$7,350,500.00	$80,774.73	149	$12,049,973.52	$920,817.26	$1,881,746.83
161	KY	Breckinridge	39	$3,029,600.00	$77,682.05	64	$4,966,213.54	$86,009.56	$499,871.92
162	KY	Bullitt	701	$87,124,300.00	$124,285.73	1,149	$142,826,680.56	$3,147,449.04	$18,937,096.79
163	KY	Butler	13	$1,791,600.00	$137,815.38	21	$2,936,845.85	$341,598.59	$227,483.31
164	KY	Caldwell	8	$945,800.00	$118,225.00	13	$1,549,929.75	$91,435.95	$599,362.65
165	KY	Calloway	30	$6,252,400.00	$208,413.33	49	$10,249,767.73	$24,653.87	$121,247.73
166	KY	Campbell	587	$90,597,900.00	$154,340.55	962	$148,521,906.59	$3,311,455.77	$10,950,563.19
167	KY	Carroll	132	$11,665,200.00	$88,372.73	216	$19,122,974.45	$505,517.77	$4,207,268.86
168	KY	Carter	196	$19,205,200.00	$97,985.71	321	$31,483,789.86	$4,178,542.25	$5,457,753.70
169	KY	Casey	17	$4,166,600.00	$245,094.12	28	$6,830,773.06	$0.00	$0.00
170	KY	Christian	553	$86,785,100.00	$156,935.08	907	$142,271,067.37	$16,486,928.13	$20,644,184.48
171	KY	Clark	126	$15,297,700.00	$121,410.32	207	$25,078,515.17	$1,914,352.27	$2,425,942.36
172	KY	Clay	53	$4,134,000.00	$78,000.00	87	$6,777,420.00	$216,202.63	$569,268.08
173	KY	Clinton	4	$774,000.00	$193,500.00	7	$1,269,360.00	$0.00	$0.00
174	KY	Crittenden	16	$1,125,100.00	$70,318.75	26	$1,844,460.81	$2,900.00	$76,067.00
175	KY	Cumberland	26	$5,303,000.00	$203,961.54	43	$8,692,840.77	$0.00	$0.00
176	KY	Daviess	1,878	$194,588,100.00	$103,614.54	3,079	$318,997,038.12	$1,412,709.41	$27,880,091.88
177	KY	Edmonson	1	$60,500.00	$60,500.00	2	$99,220.00	$0.00	$0.00
178	KY	Elliott	3	$265,000.00	$88,333.33	5	$434,600.00	$10,003.65	$49,217.96
179	KY	Estill	6	$503,600.00	$83,933.33	10	$825,904.00	$40,700.33	$133,497.08
180	KY	Fayette	680	$123,150,000.00	$181,102.94	1,115	$201,884,503.68	$3,357,576.08	$13,561,079.48
181	KY	Fleming	25	$1,664,000.00	$66,560.00	41	$2,727,628.80	$363,528.34	$595,895.65
182	KY	Floyd	1,250	$132,013,100.00	$105,610.48	2,049	$216,414,883.41	$17,187,374.20	$21,280,980.94
183	KY	Franklin	434	$98,552,300.00	$227,079.03	711	$161,562,189.87	$11,392,829.97	$8,417,207.34
184	KY	Gallatin	71	$10,253,500.00	$144,415.49	116	$16,808,519.23	$68,899.56	$1,336,536.63
185	KY	Garrard	12	$1,865,100.00	$155,425.00	20	$3,057,209.75	$5,980.94	$58,822.54
186	KY	Grant	0	$0.00	$0.00	0	$0.00	$0.00	$0.00

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187	KY	Graves	79	$6,018,500.00	$76,183.54	130	$9,866,530.82	$739,870.78	$2,129,348.10
188	KY	Grayson	14	$2,185,300.00	$156,092.86	23	$3,582,331.07	$0.00	$0.00
189	KY	Green	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
190	KY	Greenup	471	$52,789,400.00	$112,079.41	772	$86,539,871.38	$3,681,910.22	$7,501,090.60
191	KY	Hancock	123	$12,356,400.00	$100,458.54	202	$20,256,459.32	$26,668.45	$2,688,713.13
192	KY	Hardin	417	$65,784,300.00	$157,756.12	684	$107,843,657.85	$2,775,957.68	$9,302,315.83
193	KY	Harlan	521	$37,054,400.00	$71,121.69	854	$60,745,034.63	$2,180,628.17	$5,336,603.21
194	KY	Harrison	150	$14,640,100.00	$97,600.67	246	$24,000,003.93	$2,841,900.82	$6,352,940.11
195	KY	Hart	7	$1,041,100.00	$148,728.57	11	$1,707,404.00	$677.50	$7,777.70
196	KY	Henderson	443	$44,751,100.00	$101,018.28	726	$73,362,508.70	$3,477,292.34	$11,745,646.59
197	KY	Henry	25	$2,209,600.00	$88,384.00	41	$3,621,976.32	$275,420.10	$663,924.45
198	KY	Hopkins	147	$17,870,800.00	$121,570.07	241	$29,295,954.99	$145,077.87	$1,520,037.61
199	KY	Jackson	23	$3,034,800.00	$131,947.83	38	$4,974,433.04	$61,594.04	$211,099.57
200	KY	Jefferson	5,506	$784,004,700.00	$142,390.97	9,026	$1,285,253,676.59	$45,033,533.90	$142,675,687.85
201	KY	Jessamine	105	$14,354,900.00	$136,713.33	172	$23,532,466.07	$1,080,405.50	$1,999,679.56
202	KY	Johnson	443	$53,501,700.00	$120,771.33	726	$87,707,764.31	$1,416,287.95	$8,716,532.19
203	KY	Kenton	416	$59,233,400.00	$142,387.98	682	$97,104,331.25	$1,508,125.56	$6,014,598.76
204	KY	Knott	71	$6,368,800.00	$89,701.41	116	$10,440,346.93	$771,970.55	$1,044,763.40
205	KY	Knox	178	$18,279,500.00	$102,693.82	292	$29,966,056.74	$568,446.15	$2,154,189.44
206	KY	Larue	22	$4,446,000.00	$202,090.91	36	$7,289,419.09	$61,371.99	$147,579.18
207	KY	Laurel	20	$2,694,400.00	$134,720.00	33	$4,417,468.80	$4,863.29	$159,467.28
208	KY	Lawrence	48	$4,675,100.00	$97,397.92	79	$7,664,242.06	$203,913.71	$1,458,724.53
209	KY	Lee	28	$4,934,900.00	$176,246.43	46	$8,089,711.07	$70,813.68	$464,335.42
210	KY	Leslie	31	$3,275,800.00	$105,670.97	51	$5,370,198.58	$299,298.85	$475,323.99
211	KY	Letcher	120	$8,717,200.00	$72,643.33	197	$14,290,396.53	$342,651.78	$1,925,898.80
212	KY	Lewis	137	$13,427,400.00	$98,010.22	225	$22,012,115.08	$583,579.70	$2,520,503.17
213	KY	Lincoln	15	$1,155,400.00	$77,026.67	25	$1,894,085.73	$116,373.57	$119,234.42

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214	KY	Livingston	16	$1,910,000.00	$119,375.00	26	$3,131,206.25	$2,821.14	$18,499.63
215	KY	Logan	87	$11,954,500.00	$137,408.05	143	$19,597,135.52	$58,919.93	$933,684.49
216	KY	Lyon	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
217	KY	Madison	59	$8,312,500.00	$140,889.83	97	$13,626,864.41	$115,328.77	$697,162.41
218	KY	Magoffin	122	$13,875,700.00	$113,735.25	200	$22,747,049.18	$1,626,980.65	$1,948,479.82
219	KY	Marion	14	$914,000.00	$65,285.71	23	$1,498,307.14	$180,765.83	$319,121.22
220	KY	Marshall	92	$11,456,300.00	$124,525.00	151	$18,780,860.50	$128,914.30	$972,142.74
221	KY	Martin	301	$40,896,600.00	$135,869.10	493	$67,043,250.18	$5,256,496.85	$6,060,200.48
222	KY	Mason	19	$2,142,600.00	$112,768.42	31	$3,512,736.32	$40,894.49	$318,465.84
223	KY	McCracken	187	$25,611,700.00	$136,960.96	307	$41,986,752.68	$588,699.56	$1,983,205.90
224	KY	McCreary	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
225	KY	McLean	83	$7,512,300.00	$90,509.64	136	$12,315,646.52	$597,445.14	$1,231,732.73
226	KY	Meade	13	$2,085,000.00	$160,384.62	21	$3,417,796.15	$168,972.90	$900,203.12
227	KY	Menifee	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
228	KY	Mercer	72	$8,011,300.00	$111,268.06	118	$13,132,968.60	$1,870,303.82	$1,936,420.70
229	KY	Metcalfe	1	$165,000.00	$165,000.00	2	$270,600.00	$22,716.47	$6,209.17
230	KY	Monroe	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
231	KY	Montgomery	25	$2,777,100.00	$111,084.00	41	$4,552,222.32	$751,998.39	$933,845.27
232	KY	Morgan	32	$3,416,600.00	$106,768.75	52	$5,601,088.63	$104,410.73	$497,944.26
233	KY	Muhlenberg	19	$2,429,700.00	$127,878.95	31	$3,983,429.21	$507.00	$15,793.05
234	KY	Nelson	74	$9,568,700.00	$129,306.76	121	$15,686,202.66	$932,410.18	$2,308,381.20
235	KY	Nicholas	27	$3,092,600.00	$114,540.74	44	$5,069,573.19	$395,076.25	$624,502.67
236	KY	Ohio	23	$2,249,600.00	$97,808.70	38	$3,687,387.83	$14,361.20	$270,708.62
237	KY	Oldham	326	$67,692,000.00	$207,644.17	534	$110,971,274.72	$8,172,155.62	$10,600,594.97
238	KY	Owen	49	$3,137,600.00	$64,032.65	80	$5,143,743.02	$654,273.96	$1,072,608.72
239	KY	Owsley	4	$193,700.00	$48,425.00	7	$317,668.00	$0.00	$0.00
240	KY	Pendleton	313	$32,889,900.00	$105,079.55	513	$53,917,369.29	$4,784,839.26	$16,588,843.73

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241	KY	Perry	370	$40,746,800.00	$110,126.49	607	$66,798,321.64	$4,599,686.89	$6,627,045.32
242	KY	Pike	1,233	$180,952,300.00	$146,757.75	2,021	$296,642,898.23	$21,893,040.96	$26,626,126.73
243	KY	Powell	106	$8,201,500.00	$77,372.64	174	$13,445,043.92	$612,995.45	$1,746,233.10
244	KY	Pulaski	13	$2,168,400.00	$166,800.00	21	$3,554,508.00	$103,195.74	$366,516.87
245	KY	Robertson	1	$140,000.00	$140,000.00	2	$229,600.00	$0.00	$0.00
246	KY	Rockcastle	10	$1,232,000.00	$123,200.00	16	$2,019,248.00	$1,667.41	$27,328.85
247	KY	Rowan	192	$19,581,200.00	$101,985.42	315	$32,099,909.90	$653,162.85	$2,569,787.59
248	KY	Russell	6	$1,160,000.00	$193,333.33	10	$1,902,400.00	$0.00	$0.00
249	KY	Scott	89	$14,561,400.00	$163,611.24	146	$23,870,879.33	$578,143.34	$3,667,439.71
250	KY	Shelby	36	$4,546,800.00	$126,300.00	59	$7,454,226.00	$52,453.70	$515,969.56
251	KY	Simpson	18	$1,600,900.00	$88,938.89	30	$2,624,586.61	$95,405.63	$312,824.46
252	KY	Spencer	14	$1,668,500.00	$119,178.57	23	$2,735,148.21	$358,373.84	$293,738.56
253	KY	Taylor	5	$805,000.00	$161,000.00	8	$1,320,200.00	$5,389.67	$14,731.76
254	KY	Todd	9	$456,100.00	$50,677.78	15	$747,497.22	$0.00	$0.00
255	KY	Trigg	20	$1,862,000.00	$93,100.00	33	$3,052,749.00	$0.00	$0.00
256	KY	Trimble	19	$2,581,300.00	$135,857.89	31	$4,231,973.42	$214,044.11	$303,067.00
257	KY	Union	5	$333,500.00	$66,700.00	8	$546,940.00	$55,765.99	$91,456.22
258	KY	Warren	239	$17,591,100.00	$73,602.93	392	$28,837,627.53	$320,066.11	$2,508,038.04
259	KY	Washington	14	$2,361,000.00	$168,642.86	23	$3,870,353.57	$220,402.42	$505,823.55
260	KY	Wayne	5	$691,900.00	$138,380.00	8	$1,134,716.00	$0.00	$0.00
261	KY	Webster	14	$1,697,900.00	$121,278.57	23	$2,783,343.21	$53,689.79	$410,726.89
262	KY	Whitley	45	$5,962,800.00	$132,506.67	74	$9,775,016.80	$32,927.76	$269,897.87
263	KY	Wolfe	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
264	KY	Woodford	137	$20,874,200.00	$152,366.42	225	$34,219,975.02	$4,139,024.21	$3,343,825.35
265	MD	Garrett	165	$25,113,500.00	$152,203.03	589	$89,691,723.73	$947,843.36	$6,494,821.09
266	MS	Alcorn	84	$17,608,900.00	$209,629.76	138	$28,866,018.21	$406,791.90	$4,667,937.05
267	MS	Itawamba	36	$6,137,900.00	$170,497.22	59	$10,062,746.06	$51,649.20	$1,524,167.89

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
268	MS	Prentiss	15	$2,014,200.00	$134,280.00	25	$3,301,945.20	$0.00	$0.00
269	MS	Tishomingo	34	$4,978,100.00	$146,414.71	56	$8,161,155.71	$79,075.41	$440,766.34
270	NC	Alleghany	19	$3,578,700.00	$188,352.63	31	$5,867,184.47	$11,622.97	$181,027.76
271	NC	Ashe	246	$45,649,800.00	$185,568.29	403	$74,835,981.07	$559,555.36	$4,029,597.96
272	NC	Avery	246	$48,821,200.00	$198,460.16	403	$80,035,014.37	$2,588,914.00	$9,757,544.28
273	NC	Buncombe	845	$210,282,300.00	$248,854.79	1,385	$344,726,101.86	$16,930,138.92	$66,063,309.69
274	NC	Caldwell	247	$45,052,400.00	$182,398.38	405	$73,856,752.26	$339,160.47	$5,282,032.98
275	NC	Cherokee	149	$33,768,100.00	$226,631.54	244	$55,357,020.85	$593,512.71	$5,369,311.65
276	NC	Clay	100	$23,446,800.00	$234,468.00	164	$38,436,339.24	$5,855.10	$479,913.27
277	NC	Graham	34	$5,907,800.00	$173,758.82	56	$9,685,316.82	$10,846.72	$302,298.09
278	NC	Haywood	670	$112,710,200.00	$168,224.18	1,098	$184,770,709.36	$7,830,639.54	$36,599,409.55
279	NC	Henderson	336	$80,269,800.00	$238,898.21	551	$131,589,914.39	$1,157,868.57	$6,314,625.40
280	NC	Jackson	315	$64,861,100.00	$205,908.25	516	$106,328,963.27	$383,052.49	$10,989,137.52
281	NC	Macon	159	$35,842,200.00	$225,422.64	261	$58,758,665.74	$800,415.70	$11,590,908.69
282	NC	Madison	85	$18,965,800.00	$223,127.06	139	$31,090,524.38	$921,668.59	$2,732,453.22
283	NC	McDowell	90	$17,094,900.00	$189,943.33	148	$28,024,239.40	$560,587.38	$3,938,526.76
284	NC	Mitchell	42	$8,122,100.00	$193,383.33	69	$13,314,442.50	$788,037.65	$2,358,973.57
285	NC	Surry	50	$17,267,500.00	$345,350.00	82	$28,308,339.50	$1,406,362.75	$2,022,448.33
286	NC	Swain	78	$18,825,800.00	$241,356.41	128	$30,862,244.18	$264,204.16	$3,753,753.99
287	NC	Transylvania	242	$55,636,000.00	$229,900.83	397	$91,206,255.87	$505,000.42	$4,355,299.27
288	NC	Watauga	566	$114,089,800.00	$201,572.08	928	$187,032,690.33	$1,515,444.71	$10,733,860.18
289	NC	Wilkes	63	$18,759,500.00	$297,769.84	103	$30,753,669.21	$433,570.12	$4,070,829.27
290	NC	Yancey	121	$24,669,100.00	$203,876.86	198	$40,441,013.85	$641,944.42	$3,441,516.09
291	NY	Allegany	449	$39,798,000.00	$88,636.97	1,604	$142,135,587.66	$1,702,064.19	$5,844,494.80
292	NY	Cattaraugus	800	$101,709,900.00	$127,137.38	2,857	$363,249,279.61	$2,281,041.84	$25,163,150.13
293	NY	Chautauqua	695	$86,848,200.00	$124,961.44	2,482	$310,171,785.82	$6,579,729.88	$11,224,612.18
294	OH	Adams	156	$12,105,200.00	$77,597.44	709	$55,023,565.82	$1,047,814.37	$6,350,381.98

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
295	OH	Allen	368	$44,483,200.00	$120,878.26	1,673	$202,196,693.30	$1,613,612.04	$25,463,559.13
296	OH	Ashland	121	$13,323,800.00	$110,114.05	550	$60,562,727.27	$491,452.30	$10,011,065.37
297	OH	Ashtabula	124	$19,306,900.00	$155,700.81	564	$87,759,202.55	$1,648,504.22	$9,678,780.40
298	OH	Athens	831	$112,026,600.00	$134,809.39	3,777	$509,211,450.52	$4,204,007.06	$52,235,755.75
299	OH	Auglaize	132	$14,930,300.00	$113,108.33	600	$67,865,000.00	$233,124.13	$3,496,861.95
300	OH	Belmont	480	$45,412,700.00	$94,609.79	2,182	$206,421,535.65	$6,130,171.64	$27,981,027.38
301	OH	Brown	231	$22,239,400.00	$96,274.46	1,050	$101,088,181.82	$1,518,243.25	$15,477,237.01
302	OH	Butler	987	$147,316,600.00	$149,256.94	4,486	$669,620,366.34	$3,253,279.09	$51,940,858.29
303	OH	Carroll	99	$9,887,900.00	$99,877.78	450	$44,945,000.00	$430,096.04	$7,443,969.92
304	OH	Champaign	111	$14,012,100.00	$126,235.14	505	$63,691,937.43	$181,968.33	$5,400,712.99
305	OH	Clark	311	$50,986,500.00	$163,943.73	1,414	$231,757,414.34	$425,926.08	$12,042,122.87
306	OH	Clermont	638	$92,284,600.00	$144,646.71	2,900	$419,475,454.55	$8,310,345.73	$47,817,465.51
307	OH	Clinton	58	$6,331,200.00	$109,158.62	264	$28,778,578.76	$14,649.58	$965,553.82
308	OH	Columbiana	203	$24,338,900.00	$119,896.06	923	$110,631,690.63	$527,744.74	$6,243,152.61
309	OH	Coshocton	77	$9,885,500.00	$128,383.12	350	$44,934,090.91	$164,090.06	$1,595,320.03
310	OH	Crawford	152	$15,508,500.00	$102,029.61	691	$70,493,274.57	$1,695,323.01	$13,160,849.67
311	OH	Darke	85	$13,099,900.00	$154,116.47	386	$59,544,439.58	$109,228.23	$3,516,784.91
312	OH	Delaware	403	$96,608,500.00	$239,723.33	1,832	$439,129,981.32	$894,353.75	$28,246,467.01
313	OH	Fairfield	2,651	$425,280,300.00	$160,422.60	12,050	$1,933,092,272.73	$4,313,172.48	$99,566,529.47
314	OH	Fayette	73	$9,046,500.00	$123,924.66	332	$41,120,679.86	$4,000.86	$1,327,565.37
315	OH	Franklin	1,873	$273,489,700.00	$146,016.92	8,514	$1,243,135,530.97	$1,730,744.67	$51,520,758.92
316	OH	Gallia	281	$30,795,300.00	$109,591.81	1,277	$139,978,337.48	$1,113,302.06	$12,153,737.80
317	OH	Geauga	114	$23,388,600.00	$205,163.16	518	$106,311,445.16	$223,802.84	$4,832,089.82
318	OH	Greene	1,157	$166,113,800.00	$143,572.86	5,259	$755,062,596.75	$621,574.50	$36,729,395.92
319	OH	Guernsey	266	$33,960,900.00	$127,672.56	1,209	$154,367,611.21	$8,230,079.85	$30,063,163.88
320	OH	Hamilton	2,159	$383,560,100.00	$177,656.37	9,814	$1,743,455,646.02	$16,858,351.56	$153,045,137.10
321	OH	Hardin	53	$3,637,500.00	$68,632.08	241	$16,534,153.30	$49,764.08	$2,397,732.90

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
322	OH	Harrison	125	$7,455,600.00	$59,644.80	568	$33,888,982.46	$867,705.07	$4,979,925.93
323	OH	Highland	3	$867,500.00	$289,166.67	14	$3,944,233.33	$11,992.37	$81,787.96
324	OH	Hocking	313	$33,995,900.00	$108,613.10	1,423	$154,527,114.40	$1,047,915.51	$17,962,660.65
325	OH	Holmes	146	$16,704,400.00	$114,413.70	664	$75,929,506.96	$394,999.59	$3,590,925.04
326	OH	Jackson	112	$12,477,500.00	$111,406.25	509	$56,715,807.81	$1,461,309.26	$7,293,509.13
327	OH	Jefferson	309	$25,994,000.00	$84,122.98	1,405	$118,154,927.83	$3,150,835.14	$18,594,560.91
328	OH	Knox	223	$25,064,100.00	$112,395.07	1,014	$113,928,135.98	$96,011.66	$3,892,850.36
329	OH	Lawrence	732	$104,823,600.00	$143,201.64	3,327	$476,470,518.54	$3,042,815.09	$35,399,536.24
330	OH	Licking	868	$110,848,600.00	$127,705.76	3,945	$503,856,692.25	$1,202,743.58	$23,491,904.25
331	OH	Logan	209	$22,740,500.00	$108,806.22	950	$103,365,909.09	$710,433.62	$10,545,499.05
332	OH	Madison	71	$11,676,400.00	$164,456.34	323	$53,074,993.97	$53,125.98	$1,318,872.89
333	OH	Mahoning	263	$50,190,400.00	$190,838.02	1,195	$228,137,314.37	$1,930,397.53	$11,481,063.32
334	OH	Marion	377	$38,991,500.00	$103,425.73	1,714	$177,234,467.00	$502,253.70	$13,448,156.73
335	OH	Medina	374	$63,235,700.00	$169,079.41	1,700	$287,435,000.00	$1,227,323.55	$12,879,321.20
336	OH	Meigs	418	$32,492,000.00	$77,732.06	1,900	$147,690,909.09	$2,022,676.77	$18,746,760.31
337	OH	Mercer	144	$23,352,800.00	$162,172.22	655	$106,149,828.06	$707,901.75	$8,274,233.76
338	OH	Miami	354	$54,422,000.00	$153,734.46	1,609	$247,372,587.51	$678,303.13	$20,212,051.55
339	OH	Monroe	75	$7,821,500.00	$104,286.67	341	$35,552,367.53	$1,073,521.27	$4,409,326.94
340	OH	Montgomery	1,372	$191,510,000.00	$139,584.55	6,236	$870,499,492.42	$978,241.63	$50,838,891.43
341	OH	Morgan	142	$11,277,700.00	$79,420.42	645	$51,261,911.73	$1,495,060.28	$6,701,296.23
342	OH	Morrow	27	$3,773,300.00	$139,751.85	123	$17,151,744.78	$13,000.00	$1,595,490.00
343	OH	Muskingum	205	$26,446,300.00	$129,006.34	932	$120,210,689.10	$1,202,992.63	$10,190,659.93
344	OH	Noble	113	$10,937,800.00	$96,794.69	514	$49,717,624.71	$2,555,959.94	$9,444,915.57
345	OH	Perry	116	$14,048,400.00	$121,106.90	527	$63,856,033.34	$784,357.08	$5,743,999.41
346	OH	Pickaway	134	$18,622,700.00	$138,975.37	609	$84,648,510.02	$552,712.10	$6,601,008.10
347	OH	Pike	138	$19,769,700.00	$143,258.70	627	$89,861,882.02	$1,598,509.64	$11,936,870.74
348	OH	Portage	280	$51,103,700.00	$182,513.21	1,273	$232,290,043.22	$147,986.42	$4,708,668.91

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349	OH	Preble	179	$20,488,200.00	$114,459.22	814	$93,128,598.03	$273,354.74	$8,896,494.03
350	OH	Richland	355	$54,841,400.00	$154,482.82	1,614	$249,279,652.66	$6,339,460.78	$51,926,941.59
351	OH	Ross	308	$47,374,900.00	$153,814.61	1,400	$215,340,454.55	$970,806.62	$15,803,828.70
352	OH	Scioto	533	$71,703,400.00	$134,527.95	2,423	$325,924,912.35	$1,937,702.35	$20,410,998.32
353	OH	Shelby	299	$31,445,100.00	$105,167.56	1,359	$142,932,177.12	$212,764.78	$6,571,965.56
354	OH	Stark	524	$94,389,600.00	$180,132.82	2,382	$429,043,963.88	$3,228,041.31	$37,143,059.68
355	OH	Summit	1,148	$226,958,800.00	$197,699.30	5,218	$1,031,630,549.64	$3,661,929.09	$65,665,309.76
356	OH	Trumbull	680	$101,194,200.00	$148,815.00	3,091	$459,973,771.65	$2,391,680.26	$30,930,830.26
357	OH	Tuscarawas	472	$66,235,200.00	$140,328.81	2,145	$301,068,453.05	$938,737.58	$18,309,223.10
358	OH	Union	106	$17,500,200.00	$165,096.23	482	$79,546,663.81	$269,457.93	$3,606,395.00
359	OH	Vinton	11	$1,327,300.00	$120,663.64	50	$6,033,181.82	$140,793.30	$1,005,666.43
360	OH	Warren	735	$108,017,000.00	$146,961.90	3,341	$490,986,497.24	$1,159,841.93	$44,033,267.07
361	OH	Washington	1,177	$150,879,700.00	$128,190.06	5,350	$685,816,818.18	$17,235,203.90	$92,764,930.45
362	OH	Wayne	135	$18,837,200.00	$139,534.81	614	$85,624,143.76	$154,112.49	$1,432,872.55
363	OH	Wyandot	155	$13,300,300.00	$85,808.39	705	$60,456,299.13	$1,431,004.10	$15,275,968.77
364	PA	Allegheny	3,763	$726,154,400.00	$192,972.20	13,439	$2,593,409,398.45	$51,846,485.22	$253,743,609.01
365	PA	Armstrong	531	$62,766,900.00	$118,205.08	1,896	$224,167,668.86	$3,847,930.10	$21,151,681.39
366	PA	Beaver	493	$73,471,600.00	$149,029.61	1,761	$262,397,932.73	$9,573,227.52	$33,778,912.68
367	PA	Butler	610	$92,374,700.00	$151,433.93	2,179	$329,909,426.52	$10,610,094.88	$41,129,598.58
368	PA	Cambria	1,180	$171,921,900.00	$145,696.53	4,214	$614,007,410.13	$2,849,633.47	$25,019,128.83
369	PA	Cameron	195	$15,797,300.00	$81,011.79	696	$56,419,044.30	$512,959.56	$6,870,008.20
370	PA	Clarion	146	$17,766,700.00	$121,689.73	521	$63,452,673.84	$2,460,318.47	$8,971,215.80
371	PA	Clearfield	384	$44,104,900.00	$114,856.51	1,371	$157,517,664.08	$1,782,509.86	$8,230,934.33
372	PA	Crawford	591	$74,473,600.00	$126,012.86	2,111	$265,976,602.80	$1,422,691.85	$11,246,778.71
373	PA	Elk	157	$18,313,300.00	$116,645.22	561	$65,404,142.95	$1,991,525.97	$9,463,292.60
374	PA	Erie	448	$79,551,200.00	$177,569.64	1,600	$284,111,428.57	$3,852,396.80	$18,128,926.12
375	PA	Fayette	496	$57,043,000.00	$115,006.05	1,771	$203,725,164.29	$3,995,621.77	$15,353,501.67

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376	PA	Forest	26	$2,542,400.00	$97,784.62	93	$9,080,279.38	$24,942.88	$154,413.06
377	PA	Greene	163	$16,775,700.00	$102,918.40	582	$59,912,920.23	$2,262,290.10	$7,568,790.57
378	PA	Indiana	335	$39,109,600.00	$116,745.07	1,196	$139,677,309.64	$887,512.52	$5,559,406.31
379	PA	Jefferson	289	$39,417,000.00	$136,391.00	1,032	$140,774,610.31	$6,867,189.36	$25,774,184.82
380	PA	Lawrence	280	$36,724,900.00	$131,160.36	1,000	$131,160,357.14	$890,400.24	$9,678,263.48
381	PA	McKean	303	$32,130,100.00	$106,039.93	1,082	$114,750,054.17	$937,699.56	$7,866,063.58
382	PA	Mercer	152	$27,276,000.00	$179,447.37	543	$97,414,798.42	$780,785.82	$5,727,802.57
383	PA	Potter	215	$19,681,300.00	$91,540.93	768	$70,290,618.69	$416,740.23	$7,804,833.00
384	PA	Somerset	540	$55,859,700.00	$103,443.89	1,929	$199,498,780.79	$1,440,770.56	$13,620,719.99
385	PA	Venango	231	$33,069,500.00	$143,158.01	825	$118,105,357.14	$6,030,211.88	$13,555,653.41
386	PA	Warren	271	$32,843,400.00	$121,193.36	968	$117,298,203.41	$738,726.37	$7,687,996.82
387	PA	Washington	923	$127,291,000.00	$137,910.08	3,296	$454,610,911.30	$9,169,169.50	$50,884,722.92
388	PA	Westmoreland	1,109	$160,333,800.00	$144,575.11	3,961	$572,620,094.68	$7,199,186.12	$37,567,705.48
389	SC	Greenville	848	$168,296,200.00	$198,462.50	1,390	$275,894,629.00	$6,126,006.32	$23,921,710.52
390	SC	Pickens	103	$20,156,200.00	$195,691.26	169	$33,042,469.61	$354,868.24	$2,723,613.74
391	TN	Anderson	205	$37,141,500.00	$181,178.05	336	$60,888,506.85	$161,167.21	$2,354,933.23
392	TN	Bedford	108	$14,179,000.00	$131,287.04	177	$23,244,369.91	$193,768.74	$2,450,482.53
393	TN	Benton	27	$4,249,500.00	$157,388.89	44	$6,966,032.22	$17,612.84	$389,772.15
394	TN	Bledsoe	10	$854,200.00	$85,420.00	16	$1,400,033.80	$0.00	$0.00
395	TN	Blount	310	$59,380,000.00	$191,548.39	508	$97,344,890.32	$914,029.59	$27,324,108.10
396	TN	Bradley	295	$50,744,700.00	$172,015.93	484	$83,188,624.97	$1,248,169.66	$5,248,933.30
397	TN	Campbell	82	$7,484,100.00	$91,269.51	134	$12,269,360.52	$122,024.35	$820,186.67
398	TN	Cannon	46	$7,459,500.00	$162,163.04	75	$12,228,715.11	$18,208.68	$343,279.14
399	TN	Carroll	14	$1,735,300.00	$123,950.00	23	$2,844,652.50	$3,842.74	$9,798.99
400	TN	Carter	747	$96,818,400.00	$129,609.64	1,225	$158,718,667.28	$2,534,888.86	$19,771,971.65
401	TN	Cheatham	420	$89,928,400.00	$214,115.24	689	$147,422,623.73	$1,620,982.40	$6,683,106.60
402	TN	Chester	5	$308,400.00	$61,680.00	8	$505,776.00	$28,148.42	$230,817.04

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
403	TN	Claiborne	36	$3,156,000.00	$87,666.67	59	$5,174,086.67	$150,731.47	$684,320.87
404	TN	Clay	100	$17,814,700.00	$178,147.00	164	$29,203,637.71	$0.00	$0.00
405	TN	Cocke	154	$23,987,600.00	$155,763.64	252	$39,324,087.64	$305,762.87	$3,356,212.79
406	TN	Coffee	132	$15,174,000.00	$114,954.55	216	$24,875,014.09	$31,843.78	$861,334.44
407	TN	Cumberland	13	$2,388,000.00	$183,692.31	21	$3,914,483.08	$0.00	$0.00
408	TN	Davidson	4,104	$781,712,200.00	$190,475.68	6,728	$1,281,495,628.41	$6,948,746.02	$59,028,105.92
409	TN	Decatur	92	$14,410,600.00	$156,636.96	151	$23,623,985.78	$171,852.69	$2,159,901.89
410	TN	DeKalb	10	$1,027,900.00	$102,790.00	16	$1,684,728.10	$5,261.26	$86,232.05
411	TN	Dickson	40	$6,955,400.00	$173,885.00	66	$11,401,639.45	$329,337.83	$981,576.43
412	TN	Fentress	5	$566,000.00	$113,200.00	8	$928,240.00	$0.00	$0.00
413	TN	Franklin	55	$9,377,200.00	$170,494.55	90	$15,371,788.22	$90,925.89	$819,787.82
414	TN	Giles	144	$18,862,800.00	$130,991.67	236	$30,923,202.75	$113,152.30	$2,671,186.35
415	TN	Grainger	6	$1,005,000.00	$167,500.00	10	$1,648,200.00	$0.00	$0.00
416	TN	Greene	84	$13,884,100.00	$165,286.90	138	$22,760,006.79	$205,469.70	$1,571,843.21
417	TN	Grundy	9	$1,011,300.00	$112,366.67	15	$1,657,408.33	$0.00	$0.00
418	TN	Hamblen	71	$10,962,000.00	$154,394.37	116	$17,969,960.28	$37,464.81	$726,754.87
419	TN	Hamilton	2,653	$453,962,600.00	$171,112.93	4,349	$744,200,927.50	$15,865,060.11	$71,354,707.48
420	TN	Hancock	14	$1,282,300.00	$91,592.86	23	$2,102,056.07	$53,713.61	$410,909.12
421	TN	Hardin	113	$17,127,100.00	$151,567.26	185	$28,077,834.29	$1,449,561.83	$2,295,139.56
422	TN	Hawkins	209	$36,425,600.00	$174,285.17	343	$59,713,584.08	$257,512.95	$3,151,038.82
423	TN	Henderson	28	$4,679,900.00	$167,139.29	46	$7,671,693.21	$45,413.46	$2,084,477.81
424	TN	Henry	91	$11,944,200.00	$131,254.95	149	$19,580,612.70	$37,657.82	$401,270.97
425	TN	Hickman	12	$1,906,700.00	$158,891.67	20	$3,125,399.08	$26,600.23	$87,204.42
426	TN	Houston	25	$5,907,000.00	$236,280.00	41	$9,682,754.40	$123,410.58	$280,964.75
427	TN	Humphreys	109	$9,982,000.00	$91,577.98	179	$16,364,069.54	$20,335.72	$1,211,263.27
428	TN	Jackson	87	$13,671,200.00	$157,140.23	143	$22,411,339.59	$1,926.50	$274,757.43
429	TN	Jefferson	55	$8,033,200.00	$146,058.18	90	$13,168,605.67	$49,800.14	$561,247.58

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
430	TN	Johnson	49	$7,358,200.00	$150,167.35	80	$12,062,942.98	$65,930.85	$662,028.15
431	TN	Knox	747	$164,156,200.00	$219,753.95	1,225	$269,108,488.56	$2,885,771.33	$12,757,713.77
432	TN	Lawrence	50	$6,118,300.00	$122,366.00	82	$10,030,341.02	$647,208.05	$2,040,447.84
433	TN	Lewis	16	$2,043,700.00	$127,731.25	26	$3,350,390.69	$85,235.71	$745,244.22
434	TN	Lincoln	83	$11,543,900.00	$139,083.13	136	$18,925,041.84	$206,624.75	$969,497.58
435	TN	Loudon	70	$16,384,200.00	$234,060.00	115	$26,858,385.00	$283,327.66	$1,354,660.37
436	TN	Macon	43	$3,570,300.00	$83,030.23	70	$5,852,801.09	$7,319.11	$257,962.03
437	TN	Marion	170	$29,505,300.00	$173,560.59	279	$48,369,600.34	$554,791.82	$3,221,144.42
438	TN	Marshall	159	$20,581,600.00	$129,444.03	261	$33,740,879.60	$421,856.62	$3,665,371.55
439	TN	Maury	248	$42,669,700.00	$172,055.24	407	$69,950,779.16	$1,000,096.61	$5,146,826.30
440	TN	McMinn	56	$5,438,000.00	$97,107.14	92	$8,914,435.71	$309,172.71	$1,051,187.21
441	TN	McNairy	32	$5,249,000.00	$164,031.25	52	$8,605,079.38	$24,744.40	$649,045.61
442	TN	Meigs	3	$421,200.00	$140,400.00	5	$690,768.00	$0.00	$0.00
443	TN	Monroe	66	$11,580,500.00	$175,462.12	108	$18,985,001.52	$14,538.08	$393,255.06
444	TN	Montgomery	346	$80,307,300.00	$232,102.02	567	$131,650,588.53	$489,885.09	$6,615,898.14
445	TN	Moore	7	$1,733,800.00	$247,685.71	11	$2,843,432.00	$0.00	$0.00
446	TN	Morgan	10	$1,002,500.00	$100,250.00	16	$1,643,097.50	$4,405.33	$24,067.79
447	TN	Overton	5	$221,200.00	$44,240.00	8	$362,768.00	$6,538.86	$26,809.33
448	TN	Perry	65	$6,187,900.00	$95,198.46	107	$10,144,348.06	$174,638.45	$1,094,674.90
449	TN	Pickett	5	$1,202,000.00	$240,400.00	8	$1,971,280.00	$0.00	$0.00
450	TN	Polk	109	$17,954,600.00	$164,721.10	179	$29,434,013.52	$464,695.37	$2,863,324.68
451	TN	Putnam	94	$12,134,000.00	$129,085.11	154	$19,892,014.89	$6,490.43	$500,087.63
452	TN	Rhea	198	$22,234,700.00	$112,296.46	325	$36,450,309.46	$473,095.27	$3,937,487.02
453	TN	Roane	95	$15,563,800.00	$163,829.47	156	$25,514,802.23	$430,601.24	$2,682,473.48
454	TN	Robertson	75	$12,662,600.00	$168,834.67	123	$20,758,222.27	$63,838.94	$490,562.35
455	TN	Rutherford	1,084	$235,597,600.00	$217,340.96	1,777	$386,225,751.92	$2,047,665.55	$30,837,322.59
456	TN	Scott	24	$4,364,300.00	$181,845.83	39	$7,153,815.08	$0.00	$0.00

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
457	TN	Sequatchie	59	$5,282,700.00	$89,537.29	97	$8,660,046.51	$60,859.34	$1,962,105.12
458	TN	Sevier	1,363	$251,136,500.00	$184,252.75	2,234	$411,699,875.05	$2,089,063.16	$22,994,410.82
459	TN	Smith	194	$32,908,200.00	$169,629.90	318	$53,947,396.11	$921,240.88	$2,138,556.47
460	TN	Stewart	5	$960,600.00	$192,120.00	8	$1,575,384.00	$0.00	$0.00
461	TN	Sullivan	225	$41,357,000.00	$183,808.89	369	$67,797,908.67	$441,991.48	$3,076,010.52
462	TN	Sumner	1,435	$392,911,100.00	$273,805.64	2,352	$644,116,826.69	$404,456.31	$25,715,332.19
463	TN	Trousdale	68	$11,042,800.00	$162,394.12	111	$18,103,696.24	$37,779.56	$526,458.17
464	TN	Unicoi	143	$14,541,700.00	$101,690.21	234	$23,839,235.88	$208,490.23	$2,036,515.19
465	TN	Union	4	$319,500.00	$79,875.00	7	$523,980.00	$87,415.95	$114,689.73
466	TN	Van Buren	4	$148,000.00	$37,000.00	7	$242,720.00	$0.00	$0.00
467	TN	Warren	42	$6,204,300.00	$147,721.43	69	$10,170,620.36	$228,924.83	$829,551.29
468	TN	Washington	92	$16,361,700.00	$177,844.57	151	$26,822,517.33	$187,768.76	$1,287,240.20
469	TN	Wayne	72	$8,042,500.00	$111,701.39	118	$13,184,114.93	$690,188.30	$3,133,189.42
470	TN	White	26	$2,168,200.00	$83,392.31	43	$3,554,180.15	$0.00	$0.00
471	TN	Williamson	961	$232,923,800.00	$242,376.48	1,575	$381,842,334.82	$2,586,706.98	$14,554,014.44
472	TN	Wilson	1,113	$256,004,000.00	$230,012.58	1,825	$419,678,650.82	$811,048.89	$15,255,996.85
473	VA	Alleghany	198	$26,747,700.00	$135,089.39	707	$95,527,114.03	$2,539,526.59	$10,145,767.42
474	VA	Bath	36	$4,289,100.00	$119,141.67	129	$15,318,044.08	$177,105.68	$1,518,031.82
475	VA	Bland	68	$6,458,100.00	$94,972.06	243	$23,064,914.21	$583,099.79	$4,165,047.50
476	VA	Bristol	62	$15,665,300.00	$252,666.13	221	$55,947,860.95	$54,630.53	$1,344,093.14
477	VA	Buchanan	313	$48,265,700.00	$154,203.51	1,118	$172,377,940.58	$3,002,728.91	$12,340,553.45
478	VA	Carroll	17	$2,584,700.00	$152,041.18	61	$9,230,419.82	$102,649.62	$566,532.58
479	VA	Craig	63	$6,322,500.00	$100,357.14	225	$22,580,357.14	$1,270,568.40	$3,811,705.20
480	VA	Dickenson	71	$8,133,500.00	$114,556.34	254	$29,048,050.63	$427,053.73	$1,424,842.29
481	VA	Floyd	15	$2,275,000.00	$151,666.67	54	$8,124,783.33	$329,976.08	$1,767,681.86
482	VA	Franklin	132	$35,379,700.00	$268,028.03	471	$126,356,454.33	$632,238.85	$15,687,176.90
483	VA	Galax	0	$0.00	$0.00	0	$0.00	$3,227.01	$0.00

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484	VA	Giles	115	$15,054,400.00	$130,907.83	411	$53,765,153.25	$497,924.96	$5,112,569.01
485	VA	Grayson	28	$2,843,500.00	$101,553.57	100	$10,155,357.14	$14,562.73	$485,424.33
486	VA	Highland	25	$3,408,700.00	$136,348.00	89	$12,174,512.92	$43,800.97	$1,303,662.87
487	VA	Lee	96	$8,216,200.00	$85,585.42	343	$29,343,815.96	$787,348.70	$5,293,144.61
488	VA	Montgomery	207	$33,872,700.00	$163,636.23	739	$120,974,629.87	$817,342.62	$5,754,792.62
489	VA	Norton	37	$3,849,600.00	$104,043.24	132	$13,748,274.16	$94,602.87	$892,915.95
490	VA	Patrick	23	$4,591,100.00	$199,613.04	82	$16,396,215.39	$941,702.81	$2,495,208.67
491	VA	Pulaski	132	$22,584,100.00	$171,091.67	471	$80,657,744.42	$297,770.98	$3,899,393.70
492	VA	Radford	17	$4,260,800.00	$250,635.29	61	$15,216,068.71	$21,413.89	$1,300,037.26
493	VA	Russell	74	$6,647,300.00	$89,828.38	264	$23,740,742.12	$315,548.31	$1,774,388.57
494	VA	Scott	65	$7,072,800.00	$108,812.31	232	$25,259,689.11	$423,531.52	$4,096,608.63
495	VA	Smyth	191	$19,851,400.00	$103,934.03	682	$70,897,560.19	$1,159,102.36	$7,530,191.27
496	VA	Tazewell	427	$52,429,900.00	$122,786.65	1,525	$187,249,642.86	$3,079,039.09	$15,098,182.03
497	VA	Washington	116	$18,159,400.00	$156,546.55	414	$64,855,670.91	$598,707.43	$5,511,966.69
498	VA	Wise	418	$37,993,100.00	$90,892.58	1,493	$135,689,902.55	$1,770,676.99	$9,754,143.36
499	VA	Wythe	68	$8,780,000.00	$129,117.65	243	$31,357,511.76	$83,637.50	$2,539,025.41
500	WV	Barbour	170	$16,973,400.00	$99,843.53	607	$60,619,000.45	$3,483,122.44	$7,579,723.86
501	WV	Boone	681	$63,712,000.00	$93,556.53	2,432	$227,542,589.84	$3,034,209.72	$18,541,765.90
502	WV	Braxton	60	$8,311,400.00	$138,523.33	214	$29,684,165.10	$281,215.05	$1,883,174.16
503	WV	Brooke	445	$37,457,600.00	$84,174.38	1,589	$133,777,503.60	$6,570,855.90	$20,516,690.71
504	WV	Cabell	965	$126,601,200.00	$131,192.95	3,446	$452,147,330.28	$5,256,428.07	$38,792,101.48
505	WV	Calhoun	125	$7,473,000.00	$59,784.00	446	$26,689,371.12	$2,051,129.50	$4,239,285.85
506	WV	Clay	81	$8,729,600.00	$107,772.84	289	$31,177,604.74	$85,776.93	$1,459,671.06
507	WV	Doddridge	70	$5,064,100.00	$72,344.29	250	$18,086,071.43	$381,911.13	$2,121,728.50
508	WV	Fayette	347	$35,118,900.00	$101,207.20	1,239	$125,425,076.60	$1,308,240.74	$10,392,882.48
509	WV	Gilmer	209	$20,656,900.00	$98,836.84	746	$73,774,784.05	$5,158,176.04	$9,948,882.02
510	WV	Grant	133	$23,744,200.00	$178,527.82	475	$84,800,714.29	$3,002,225.55	$11,228,796.35

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511	WV	Greenbrier	768	$78,138,500.00	$101,742.84	2,743	$279,066,362.12	$11,608,323.94	$57,369,382.71
512	WV	Hancock	137	$11,889,100.00	$86,781.75	489	$42,461,443.35	$2,747,251.69	$6,964,781.24
513	WV	Harrison	373	$39,301,900.00	$105,367.02	1,332	$140,363,627.52	$5,217,031.71	$11,337,384.38
514	WV	Jackson	268	$35,358,000.00	$131,932.84	957	$126,278,194.48	$3,010,085.65	$12,365,121.80
515	WV	Kanawha	3,579	$427,959,000.00	$119,575.02	12,782	$1,528,424,658.36	$15,732,360.14	$169,128,031.82
516	WV	Lewis	190	$21,897,800.00	$115,251.58	679	$78,206,263.93	$1,761,095.74	$5,128,870.11
517	WV	Lincoln	237	$25,798,000.00	$108,852.32	846	$92,135,869.79	$3,112,434.89	$13,650,042.82
518	WV	Logan	1,051	$100,346,400.00	$95,477.07	3,754	$358,379,863.60	$24,505,981.44	$54,076,964.58
519	WV	Marion	277	$26,920,100.00	$97,184.48	989	$96,143,630.79	$2,359,529.66	$10,193,271.17
520	WV	Marshall	363	$34,648,000.00	$95,449.04	1,296	$123,742,993.50	$3,031,812.26	$10,235,761.38
521	WV	Mason	193	$18,172,800.00	$94,159.59	689	$64,903,260.68	$989,537.77	$4,837,436.10
522	WV	McDowell	511	$53,002,200.00	$103,722.50	1,825	$189,293,571.43	$6,745,718.36	$16,349,184.60
523	WV	Mercer	423	$58,067,300.00	$137,274.94	1,511	$207,382,625.96	$3,308,943.15	$16,230,043.85
524	WV	Mingo	630	$72,834,900.00	$115,610.95	2,250	$260,124,642.86	$24,833,433.55	$42,361,808.56
525	WV	Monongalia	282	$46,936,800.00	$166,442.55	1,007	$167,630,953.02	$2,478,299.09	$8,757,874.19
526	WV	Monroe	49	$4,153,700.00	$84,769.39	175	$14,834,642.86	$271,135.21	$2,372,433.09
527	WV	Nicholas	187	$19,410,300.00	$103,798.40	668	$69,322,796.57	$2,864,913.40	$18,050,576.07
528	WV	Ohio	1,471	$131,274,400.00	$89,241.60	5,254	$468,837,015.37	$26,228,523.61	$51,434,634.11
529	WV	Pendleton	124	$11,480,000.00	$92,580.65	443	$41,000,264.52	$404,789.95	$2,987,754.62
530	WV	Pleasants	88	$9,555,600.00	$108,586.36	314	$34,127,608.23	$691,116.34	$4,344,219.09
531	WV	Pocahontas	451	$44,123,300.00	$97,834.37	1,611	$157,582,795.00	$14,082,917.21	$39,725,911.70
532	WV	Preston	129	$15,390,400.00	$119,305.43	461	$54,965,202.98	$1,100,998.65	$6,420,773.27
533	WV	Putnam	484	$73,694,400.00	$152,261.16	1,729	$263,194,068.20	$1,199,820.17	$14,205,295.56
534	WV	Raleigh	428	$47,203,100.00	$110,287.62	1,529	$168,582,342.45	$2,082,699.96	$12,013,406.33
535	WV	Randolph	349	$34,445,800.00	$98,698.57	1,246	$123,020,855.28	$4,504,845.22	$13,368,986.26
536	WV	Ritchie	87	$5,875,200.00	$67,531.03	311	$20,982,567.72	$378,658.20	$2,219,865.84
537	WV	Roane	138	$15,249,100.00	$110,500.72	493	$54,461,387.14	$951,841.46	$5,155,215.19

Number	State	County	Total Policies in Force	Total Current Policies Coverage	Average Policy Coverage	Total At Risk In SFHA **	Potential Coverage of At Risk in SFHA	Claims Payments Existing	Potential Claims for Total At Risk in SFHA
538	WV	Summers	254	$20,587,900.00	$81,054.72	907	$73,527,982.70	$5,010,887.67	$14,854,825.62
539	WV	Taylor	50	$4,426,200.00	$88,524.00	179	$15,807,730.68	$289,713.90	$1,916,081.89
540	WV	Tucker	234	$44,660,800.00	$190,858.12	836	$159,502,039.18	$7,112,107.18	$19,111,444.02
541	WV	Tyler	117	$7,436,400.00	$63,558.97	418	$26,558,753.03	$302,450.56	$3,082,487.59
542	WV	Upshur	345	$30,640,700.00	$88,813.62	1,232	$109,430,817.68	$2,471,943.34	$9,257,690.78
543	WV	Wayne	416	$44,649,800.00	$107,331.25	1,486	$159,463,111.44	$2,235,661.60	$12,166,830.75
544	WV	Webster	190	$18,819,700.00	$99,051.05	679	$67,213,072.78	$824,802.92	$5,134,738.69
545	WV	Wetzel	461	$40,481,600.00	$87,812.58	1,646	$144,577,268.30	$5,357,875.39	$22,853,281.81
546	WV	Wirt	96	$7,043,600.00	$73,370.83	343	$25,155,923.92	$500,792.29	$2,641,563.76
547	WV	Wood	726	$102,124,900.00	$140,667.91	2,593	$364,732,187.62	$10,884,605.98	$39,974,871.76
548	WV	Wyoming	734	$73,072,000.00	$99,553.13	2,621	$260,971,570.79	$10,177,622.47	$43,032,136.89
550	*Total*		*152,260*	*$22,571,556,800.00*	*$133,165.75*	*489,962*	*$70,164,488,548.59*	*$1,025,417,533.01*	*$6,283,826,023.64*

*Notes: ** "Total At Risk in SFHA" is based upon application of Market Penetration Rates from Rand Corporation Study (2006) to each region of the basin.*

Table 2 – Major Unprotected Ohio River Communities and Potential Damages in SFHA

City/Town Name *	State	River Mile	Population	Insurance Policies In Force	Market Penetration Rates	Potentially At Risk In SFHA	Claims Since 1978	Claims Per Policy *	Claim Payments Since 1978	Annually Over 31 Years	Per Payment	Potential Damages In SFHA
McKees Rocks	PA	3	6,622	73	0.28	261	76	1.04	$1,884,165	$60,780	$24,792	$6,463,537
Stowe Township	PA	4	6,706	8	0.28	29	4	0.5	$20,746	$669	$5,186	$148,186
Bellevue	PA	4	8,770	3	0.28	11	1	0.33	$8,191	$264	$8,191	$87,766
Kennedy Township	PA	5	7,504	0	0	0	0	0	$0	$0	$0	$0
Avalon	PA	5	5,294	0	0	0	0	0	$0	$0	$0	$0
Ben Avon	PA	6	1,917	4	0.28	14	5	1.25	$57,263	$1,847	$11,453	$163,609
Emsworth	PA	7	2,598	25	0.28	89	21	0.84	$262,817	$8,478	$12,515	$1,117,420
Coraopolis	PA	10	6,131	66	0.28	236	25	0.38	$74,968	$2,418	$2,999	$706,839
Sewickley	PA	12	3,902	22	0.28	79	13	0.59	$89,868	$2,899	$6,913	$543,160
Edgeworth	PA	13	1,730	7	0.28	25	2	0.29	$1,319	$43	$659	$16,483
Leetsdale	PA	14	1,232	53	0.28	189	15	0.28	$29,949	$966	$1,997	$377,927
Ambridge	PA	16	7,769	4	0.28	14	7	1.75	$103,371	$3,335	$14,767	$210,962
Aliquippa	PA	18	11,734	34	0.28	121	31	0.91	$487,056	$15,711	$15,711	$1,907,823
Harmony Township	PA	18	3,373	21	0.28	75	57	2.71	$403,482	$13,016	$7,079	$530,897
Baden	PA	20	4,377	0	0	0	0	0	$0	$0	$0	$0
Economy	PA	21	9,363	17	0.28	61	13	0.76	$214,030	$6,904	$16,464	$999,590
Conway	PA	22	2,290	3	0.28	11	3	1	$0	$0	$0	$0
Freedom	PA	23	1,763	7	0.28	25	3	0.43	$7,113	$229	$2,371	$59,276
Monaca	PA	24	6,286	5	0.28	18	4	0.8	$21,379	$690	$5,345	$95,442

City/Town Name *	State	River Mile	Population	Insurance Policies In Force	Market Penetration Rates	Potentially At Risk In SFHA	Claims Since 1978	Claims Per Policy *	Claim Payments Since 1978	Annually Over 31 Years	Per Payment	Potential Damages In SFHA
Rochester	PA	25	4,014	2	0.28	7	2	1	$3,542	$114	$1,771	$12,651
Beaver	PA	27	4,775	7	0.28	25	3	0.43	$1,445	$47	$482	$12,042
Toronto	OH	30	5,676	5	0.22	23	12	2.4	$620,505	$20,016	$51,709	$1,175,198
Industry	PA	32	1,921	5	0.28	18	21	4.2	$61,951	$1,998	$2,950	$52,679
Midland	PA	36	3,137	1	0.28	4	1	1	$18,861	$608	$18,861	$67,360
Ohioville	PA	39	3,759	0	0	0	0	0	$0	$0	$0	$0
East Liverpool	OH	42	13,089	18	0.22	82	6	0.33	$35,106	$1,132	$5,851	$478,715
Chester	WV	43	2,592	6	0.28	21	5	0.83	$47,359	$1,528	$9,472	$202,966
Newell	WV	45	1,602	0	0	0	0	0	$0	$0	$0	$0
New Cumberland	WV	56	1,099	73	0.28	261	85	1.16	$1,382,351	$44,592	$16,263	$4,239,983
Weirton	WV	63	20,411	77	0.28	275	161	2.09	$2,121,691	$68,442	$13,178	$3,624,007
Steubenville	OH	67	19,015	9	0.22	41	10	1.11	$45,039	$1,453	$4,504	$184,249
Mingo Junction	OH	70	3,631	4	0.22	18	8	2	$145,181	$4,683	$18,148	$329,958
Follansbee	WV	70	3,115	12	0.28	43	14	1.17	$130,119	$4,197	$9,294	$398,323
Hooverson Heights	WV	71	2,909	0	0	0	0	0	$0	$0	$0	$0
Wellsburg	WV	73	2,891	323	0.28	1,154	359	1.11	$3,876,689	$125,054	$10,799	$12,456,930
Tiltonsville	OH	83	1,329	0	0	0	0	0	$0	$0	$0	$0
Yorkville	OH	84	1,230	21	0.22	95	11	0.52	$43,015	$1,388	$3,910	$373,269
Martins Ferry	OH	88	7,226	30	0.22	136	26	0.87	$286,548	$9,243	$11,021	$1,502,876
Wheeling	WV	89	31,419	1354	0.28	4,836	2,792	2.06	$25,081,608	$809,084	$8,983	$43,441,077
Bridgeport	OH	91	2,186	25	0.22	114	50	2	$207,236	$6,685	$4,145	$470,992

City/Town Name *	State	River Mile	Population	Insurance Policies In Force	Market Penetration Rates	Potentially At Risk In SFHA	Claims Since 1978	Claims Per Policy *	Claim Payments Since 1978	Annually Over 31 Years	Per Payment	Potential Damages In SFHA
Benwood	WV	94	1,585	94	0.28	336	78	0.83	$903,396	$29,142	$11,582	$3,888,242
Bellaire	OH	94	4,892	52	0.22	236	66	1.27	$455,664	$14,699	$6,904	$1,631,855
McMechen	WV	96	1,937	41	0.28	146	23	0.56	$100,452	$3,240	$4,367	$639,524
Shadyside	OH	98	3,675	10	0.22	45	10	1	$41,764	$1,347	$4,176	$189,839
Glen Dale	WV	99	1,552	15	0.28	54	35	2.33	$219,181	$7,070	$6,262	$335,481
Moundsville	WV	101	9,998	60	0.28	214	82	1.37	$699,503	$22,565	$8,531	$1,827,970
Powhatan Point	OH	110	1,744	76	0.22	345	77	1.01	$1,117,492	$36,048	$14,513	$5,013,543
New Martinsville	WV	127	5,984	279	0.28	996	274	0.98	$3,237,307	$104,429	$11,815	$11,772,792
Paden City	WV	133	2,860	1	0.28	4	1	1	$0	$0	$0	$0
Sistersville	WV	138	1,588	24	0.28	86	16	0.67	$50,863	$1,641	$3,179	$272,480
St. Marys	WV	154	2,017	0	0	0	0	0	$0	$0	$0	$0
Marietta	OH	172	14,515	581	0.22	2,641	751	1.29	$10,169,605	$328,052	$13,541	$35,761,653
Williamstown	WV	172	2,996	41	0.28	146	52	1.27	$795,765	$25,670	$15,303	$2,240,822
Boaz	WV	176	1,345	0	0	0	0	0	$0	$0	$0	$0
Vienna	WV	180	10,861	166	0.28	593	72	0.43	$519,803	$16,768	$7,219	$4,280,121
Belpre	OH	187	6,660	241	0.22	1,095	109	0.45	$1,052,911	$33,965	$9,660	$10,581,799
Blennerhassett	WV	188	3,225	0	0	0	0	0	$0	$0	$0	$0
Washington	WV	193	1,170	0	0	0	0	0	$0	$0	$0	$0
Ravenswood	WV	220	4,031	31	0.28	111	9	0.29	$58,108	$1,874	$6,456	$714,820
New Haven	WV	245	1,559	16	0.28	57	10	0.63	$86,784	$2,799	$8,678	$495,906
Pomeroy	OH	250	1,966	44	0.22	200	86	1.95	$505,335	$16,301	$5,876	$1,175,197

City/Town Name *	State	River Mile	Population	Insurance Policies In Force	Market Penetration Rates	Potentially At Risk In SFHA	Claims Since 1978	Claims Per Policy *	Claim Payments Since 1978	Annually Over 31 Years	Per Payment	Potential Damages In SFHA
Mason	WV	251	1,064	11	0.28	39	1	0.09	$0	$0	$0	$0
Middleport	OH	253	2,525	173	0.22	786	12	0.07	$14,308	$462	$1,192	$937,621
Gallipolis	OH	269	4,180	89	0.22	405	14	0.16	$49,004	$1,581	$3,500	$1,416,037
Burlington	OH	313	2,794	0	0	0	0	0	$0	$0	$0	$0
South Point	OH	316	3,742	24	0.22	109	21	0.88	$442,320	$14,268	$21,063	$2,297,765
Coal Grove	OH	323	2,027	45	0.22	205	20	0.44	$61,620	$1,988	$3,081	$630,203
Westwood	KY	324	4,888	0	0	0	0	0	$0	$0	$0	$0
Worthington	KY	330	1,673	45	0.61	74	13	0.29	$48,929	$1,578	$3,764	$277,656
Greenup	KY	335	1,198	176	0.61	289	80	0.45	$450,280	$14,525	$5,628	$1,623,960
Franklin Furnace	OH	338	1,537	0	0	0	0	0	$0	$0	$0	$0
Wheelersburg	OH	347	6,471	0	0	0	0	0	$0	$0	$0	$0
South Shore	KY	354	1,226	16	0.61	26	1	0.06	$1,356	$44	$1,356	$35,556
Vanceburg	KY	378	1,731	54	0.61	89	13	0.24	$88,130	$2,843	$6,779	$600,131
Manchester	OH	397	2,043	85	0.22	386	85	1	$602,525	$19,436	$7,089	$2,738,751
Aberdeen	OH	410	1,603	38	0.22	173	19	0.5	$226,448	$7,305	$11,918	$2,058,621
Ripley	OH	417	1,745	98	0.22	445	68	0.69	$863,154	$27,844	$12,693	$5,654,352
Augusta	KY	427	1,204	107	0.61	175	98	0.92	$1,809,043	$58,356	$18,460	$3,237,999
New Richmond	OH	450	2,219	280	0.22	1,273	327	1.17	$4,603,601	$148,503	$14,078	$17,917,824
Fort Thomas	KY	464	16,495	0	0	0	0	0	$0	$0	$0	$0
Ludlow	KY	473	4,409	90	0.61	148	44	0.49	$398,307	$12,849	$9,052	$1,335,606
Villa Hills	KY	476	7,948	0	0	0	0	0	$0	$0	$0	$0

City/Town Name *	State	River Mile	Population	Insurance Policies In Force	Market Penetration Rates	Potentially At Risk In SFHA	Claims Since 1978	Claims Per Policy *	Claim Payments Since 1978	Annually Over 31 Years	Per Payment	Potential Damages In SFHA
Aurora	IN	496	3,965	65	0.22	295	42	0.65	$495,688	$15,990	$11,802	$3,486,980
Rising Sun	IN	506	2,470	13	0.22	59	3	0.23	$19,392	$626	$6,464	$381,966
Warsaw	KY	528	1,811	0	0	0	0	0	$0	$0	$0	$0
Vevay	IN	538	1,735	11	0.22	50	10	0.91	$108,608	$3,503	$10,861	$543,042
Carrollton	KY	545	3,846	30	0.61	49	18	0.6	$255,275	$8,235	$14,182	$697,473
Madison	IN	559	12,004	75	0.22	341	40	0.53	$494,170	$15,941	$12,354	$4,211,677
Prospect	KY	594	4,657	0	0	0	0	0	$0	$0	$0	$0
West Point	KY	631	1,100	160	0.61	262	136	0.85	$1,602,651	$51,698	$11,784	$3,090,938
Brandenburg	KY	647	2,049	3	0.61	5	3	1	$161,330	$5,204	$53,777	$264,476
Cloverport	KY	711	1,256	22	0.61	36	10	0.45	$58,636	$1,891	$5,864	$211,475
Lewisport	KY	738	1,639	94	0.61	154	3	0.03	$26,668	$860	$8,889	$1,369,855
Rockport	IN	747	2,160	11	0.22	50	3	0.27	$11,369	$367	$3,790	$189,484
Owensboro	KY	757	54,067	1480	0.61	2,426	129	0.09	$605,384	$19,529	$4,693	$11,386,046
Newburgh	IN	778	3,088	22	0.22	100	14	0.64	$54,596	$1,761	$3,900	$389,973
Henderson	KY	804	27,373	229	0.61	375	196	0.86	$3,094,638	$99,827	$15,789	$5,927,334
Mount Vernon	IN	829	7,478	2	0.22	9	3	1.5	$42,961	$1,386	$14,320	$130,184
Ledbetter	KY	929	1,700	0	0	0	0	0	$0	$0	$0	$0
Metropolis	IL	943	6,482	51	0.22	232	27	0.53	$158,669	$5,118	$5,877	$1,362,307
Cairo	IL	979	3,632	87	0.22	395	46	0.53	$92,708	$2,991	$2,015	$796,996
Totals			*537,781*	*7,782*		*25,177*	*7,096*		*$74,729,665*	*$2,410,634*	*$771,861*	*$238,476,521*

Communities highlighted in yellow have been impacted by flooding damages more than once during the period.

APPENDIX B – FUTURE SCENARIOS OF THE OHIO RIVER BASIN

As described briefly in the main report, the following scenarios are meant to be narratives portraying what could occur (not a prediction of an official future or merely trend analysis) should existing driving forces continue into the future. These scenarios show a limited range of possibilities of future conditions for the sake of brevity and are only offered to challenge the organizations involved in the water resources planning arena.

Many more potential futures are possible as one can imagine. A major earthquake in the New Madrid region, a nuclear plant accident, a pandemic outbreak sweeping the region or any number of major cultural system catastrophes (fiscal or political breakdown) could befall the region leading to an entire host of "wicked problems" that might require water resources actions or contingencies far beyond anything addressed in the alternatives identified in the plan.

The four narratives of the future, each based upon various directions of the major driving forces described in the summary plan are displayed below.

1. "NO ACTIONS"

This scenario considers that a "project-oriented" planning process remains in place for water resources development and management for the future. A few authorized watershed assessments are completed, but a full spectrum of basinwide initiatives are generally unfunded in lieu of specific project initiatives.

This scenario also uses the current climatic patterns, national energy policies and international agreements as the basis for future development of the basin. Population projections already published by the US Census are accepted as probable and current patterns of regional tourism and transportation development are also accepted as the norm. Federal investments are based upon historical norms with the normal ebb and flow of funding depending upon changes in political ideology.

Basin population has continued to increase with a total of approximately 30 million persons by the year 2030. Although unevenly distributed among the states, this influx of immigrants combined with natural increases shows no indications of slowing in the next 20 years. Household formation has slowed slightly with fewer marriages and more singles living at home with parents or married couples returning home to parents due to ongoing economic uncertainty.

Despite these limiting effects, new households are being formed across the basin with an increasing need for new dwelling units. This expanding housing market likewise generates a demand from existing homeowners for larger homes and community amenities. Although the mortgage industry continues to be cautious, owners with equity in their homes have the ability to leverage good rates. New residential development continues.

Ongoing improvements in communications technology allow many to work from home. This realization of the “electronic cottage” is fortunate considering the rising cost of fuel. Although the basin population uses local recreation resources more frequently to reduce vacation costs, household savings in reduced home-to-work travel and acquisition of more fuel-efficient vehicles results in travel to destination resort locations and more growth of these profitable ventures.

As much of the basin land-use remains uncontrolled in rural areas where the housing expansion is taking place, low-density private and resort development continues to spread into heretofore untouched wildlife habitat and sensitive ecosystems. With its needs for increased sewer and water capacity, highway capacity, solid waster disposal and attending commercial and institutional development, residential and vacation resort development continues to consume arable land and forests. Without strategic protection of riparian and wetland habitat these resources continue to be threatened by this new development. Water quality continues to be degraded in many areas without the benefit of improved water management strategies or modification of water control facilities. Overall aquatic species health and productivity in the basin are marginal in several locations where new development and pre-existing non-point and point pollution sources continue.

Visitation to USACE facilities continues to grow and as existing recreation facilities age and become less inviting to a culturally diverse population, demands for upgraded facilities increase along with more vandalism and abuse of project lands (forest fires and theft). Limited federal funds for recreation development combined with lack of financial sponsorship by local jurisdictions result in minimal facility upgrades thus exacerbating the project management issues – project staff make do with limited funds while regional recreation demands remain unmet.

Projected climate changes are only slightly attenuated by national and international efforts to reduce greenhouse gases, but intense rainfall events do occur and those occurring in higher elevations of the basin where stream gradients are greater result in flash flooding with attendant loss of life and flood damages. FEMA disaster declarations provide some limited financial relief and post-disaster grants through FEMA programs manage to acquire some structures with repetitive damages. Participation rates in the flood insurance program remain constant but not high enough to reduce the growing financial effects of flooding. A lack of comprehensive stormwater management results in continuing urban and suburban damages and degradation of streams and aquatic ecosystems. Many smaller rural communities subjected to flooding continue to lose businesses, homes and tax revenues that support basic local infrastructure. Some communities are approaching insolvency due to recurring flood damages and lack of reinvestment capital.

Despite the intensity of infrequent storms, water levels in reservoirs, rivers and streams slowly decline in response to lesser annual amounts of rainfall and higher rates of evaporation as predicted by climate change experts. Local demands for M&I and irrigation water supply increase as a result of population increases and the warming climate. Groundwater withdrawals increase exponentially to meet public water and irrigation needs leading to instances of ground surface subsidence and degradation of surface streams. Productive gas extraction operations in the north and eastern portions of the basin are shut down for lack of sufficient water supplies leading to increases in natural gas prices.

Studies of existing reservoir projects indicate limited capability to meet the growing demand without significant impacts to individual projects authorized uses and downstream aquatic species. Failure to analyze existing reservoir storage across multiple projects in systems-based studies results in losses of benefits and impacts on water users. More frequent drought conditions occur throughout the basin and emergency transport of water to affected communities by state agencies increases. The best efforts of the geographically limited USACE environmental infrastructure program to improve potable water service do little to expand the availability of water in underserved communities. Water supply rates increase dramatically and in 2025 following 3 years of record low water levels in basin reservoirs and the Ohio River, two states in the lower basin file suit against Federal water control managers and three states in the headwaters of the basin for managing reservoir levels to support recreation and aquatic species while failing to release sufficient volumes of water into the lower basin to support M&I water supplies.

2. "CLIMATE CHANGES"

This scenario presumes that the current philosophy and processes in place for water resources development and management stay essentially as they have been for the last 23 years – that period when 1986 WRDA language that launched USACE into a project-oriented planning methodology was enacted. Although some planning for the basin has taken place at the watershed level, most of the planning, design, construction and management activities have remained project oriented. Opportunities to resolve issues at a more strategic level have been limited by historical business processes, failure to work collaboratively with basin states and annual, project-oriented budgeting procedures.

Many of USACE's 83 operating flood control projects continue to exhibit significant deficiencies and annual funding for project-by-project rehabilitation has been limited for decades by redirection of federal funds to other pressing national priorities. Although several of the most deficient projects have been rehabilitated, many more continue to be regarded as potentially dangerous and subject to possible failure under extreme weather conditions. Emergency evacuation plans for downstream communities have been prepared and coordinated, but the functional adequacy of local readiness remains questionable.

To add to this stressed reservoir situation, numerous levees and floodwalls have shown similar deficiencies. Although USACE had identified these deficiencies through a dedicated inspection program as a result of the Levee Safety Act in 2007, limited federal funding was provided to resolve the identified problems and local jurisdictions suffering from recessional aftershocks of 2008 and 2009 have been unable to fully comply with the recommended repairs. Several local protection projects along the Ohio River mainstem are confronted with the potential of critical emergency situations were there to be a regional flood that would require full use of the flood control gates and pump stations and while maintaining high crests for several days.

In addition to the unresolved deficiencies mentioned above, several levee projects have been de-certified by FEMA due to the identified deficiencies leading to mandatory purchase of flood insurance by several thousands of residents living within the presumed protection limits. This new requirement resulted in several major commercial employers and many residents leaving incorporated communities to seek locations outside of identified flood hazard areas. This out-migration further exacerbates the plight of the communities with local protection projects as their declining tax base (revenues that could be used to make needed repairs) dwindles further.

Basin population has risen to approximately 30 million persons as had been projected by the US Census in 2008. Based upon the historical trend, this increase has led to the formation of approximately 1.3 million new households. In turn, demand for new housing units has soared with both single-family and multi-family units being constructed. Much of this new housing has settled in around existing urban areas resulting in a continuing sprawl development pattern. Infill projects within urban areas have failed to materialize due to lack of authority to initialize tax increment financing projects. Concerns for regional stormwater management resulting from flood damages occurring in suburban areas have risen dramatically. Numerous, intensive rainfall events have generated significant damages due to flash flooding and uncontrolled stormwater runoff. Some loss of life has occurred in these intense rainfall events.

As climatic changes continue the localized drought events of the past begin to coalesce into a prolonged period of regional drought in the northwestern and more agriculturally dominant portions of the basin. Drought conditions in Illinois, Indiana, and Ohio reach historical levels and water withdrawals from both surface and subsurface sources begin to seriously deplete those once dependable resources. Losses to crops, livestock and other agricultural products begin to accumulate in several sub-basin areas. Conflicts arise between agricultural interests and natural resources agencies fearing that further withdrawals for irrigation will exceed ecosystem thresholds for numerous aquatic species – many of which are on the endangered species list.

Generally, aquatic species throughout the region begin to suffer the effects of severe drought and lack of a unified water management system exacerbates the ability of water managers to address the impacts. Reservoir levels that support lake species are reduced and downstream aquatic habitat conditions worsen. The limited inability to control oxygen content and temperature of released water presented by single-port intake structures at many reservoirs exacerbates the plight of downstream aquatic species.

In 2023 after an unusually warm summer when many new record high temperatures were recorded by the national weather service in several basin cities, a series of intense thunderstorms “trained” across the mid-section of the basin in late August hitting parts of Indiana, Illinois, Ohio, Kentucky, northern Tennessee, southern West Virginia and portions of the upper Kanawha River basin in Virginia. Although sporadic flooding is reported with some structure damages, the primary effects are saturation of the soils in several watersheds and reservoir storage of unabated upstream stormwater runoff in the region. Water managers hurriedly empty swelled flood storage with concern for potential oncoming rainfall events.

As these rainfall events are occurring, a hurricane forms in the Atlantic and grows in strength as it churns along the eastern coast. Gaining strength to a category 3 storm, the eye hits the North Carolina coast causing significant damages to unprotected structures and property. The storm moves inland and continues unabated in a northwest direction losing wind speed but maintaining heavy rainfall as a tropical storm. The storm surges into the eastern mountainous portions of the Ohio River Basin in Virginia, West Virginia and Pennsylvania dropping rainfall amounts of 7 to 8 inches across an already saturated landscape. Significant flood damages ensue throughout the upper basin and several local protection projects require emergency operations to avoid failure of the embankments and to reduce interior flooding.

At least one community suffers substantial interior flood damages to a neighborhood when the antiquated pump station equipment fails at the peak of the storm. Five reservoirs still releasing storage from previous storms are forced to raise flood storage pools to near-record levels shutting down numerous waterside recreation areas over a holiday weekend. Thanks to an effective storm warning and emergency evacuation system in the upper basin loss of life is minimal but some flooding tragedies do occur as desperate drivers unwittingly test flooded roadways.

Normally these consecutive, damaging flooding events would only affect a portion of the basin, but due to the climatic changes that have been slowly taking place, this scene worsens dramatically. As in the early 2000s when Hurricane Katrina was closely followed by Hurricane Rita in the Gulf Coast, a second hurricane emerges in the Caribbean and quickly moves toward the mouth of the Mississippi River. Growing in intensity to a category 4 storm, the eye hits the coast with a furious combination of powerful winds, storm surge and high waves.

Thanks to several years of ongoing authorized flood risk reduction programs through several Federal and state agencies many previous at-risk structures have been acquired and moved above the limits of the storm surge and many more have been elevated in accordance with revised local floodplain management ordinances. These actions reduce the property damages and loss of life as many residents with longer warning times evacuated northward to avoid the storm's fury. Unfortunately, these pre-emptive actions along the Gulf Coast do little to help the next target of the storm. Losing some intensity as it moves into Mississippi, the hurricane, still packing winds of 85 mph and dropping 10 inches of rain in some locations moves northward at 20 mph toward the lower portion of the Ohio River basin. Within 24 hours this downgraded tropical storm hits portions of Tennessee, Illinois, Kentucky and Indiana with 50 mph winds and torrential rainfall.

At this point the floodwaters from the first tropical storm are still moving southward into the lower reaches of the Ohio River basin when the second storm moves into the lower basin. Rainfall amounts in the lower portion of the basin in Alabama, Tennessee, Kentucky, Illinois and Indiana begin to exceed anything previously recorded and the ensuing flood waters converge along the Ohio River. Not since the regional flood events of 1997 has the mainstem Ohio River experienced this level of flooding. Commercial river traffic shuts down and personnel at several locks and dams are evacuated. Normally the existing flood risk reduction infrastructure would be able to handle this convergence of flood waters, but limited local and state funding for cost-sharing have delayed rehabilitation efforts for most local protection projects. Bedlam ensues as several levees and floodwalls are overtopped by record flood levels. Despite the best efforts of emergency crews, two levees unexpectedly fail at night due to piping and underseepage (caused by unmitigated vegetation growth on the embankments) leading to losses of life and catastrophic damages to major regional industries and urban commercial areas. More severe damages occur to a large number of unprotected communities along the mainstem Ohio River and its tributaries.

The weakening but still powerful storm plows into Ohio dumping more rain on several watersheds still saturated from the previous training thunderstorms. Eight reservoirs reach maximum flood control pool and one saturated dam embankment fails due to uncontrolled underseepage under the massive hydraulic pressures. Despite heroic efforts to warn those living downstream, several small communities are devastated by the rush of water and wreckage gathered by the torrent. Weeks later flood victims are still unaccounted for and despite the surge of massive FEMA disaster assistance, the social fabric of several affected communities remain in tatters for several years. When this convergent event is over, losses to life and property are substantial and needed repairs are delayed due to lack of funding.

3. “ECONOMIC CHANGES”

This scenario includes the possibility of future climatic changes that have been projected by Federal agencies while accounting for other trends in population, rehabilitation of existing infrastructure, ongoing flood damages and economic upheavals due to changes in national energy policy and international agreements related to global climate change.

Since 2015, management of basin water resources has been incrementally modified through recommendations of a basinwide water management plan prepared as a collaborative effort by a cadre of Federal and state agencies, NGOs, academia, watershed associations, industries and public water users. In accordance with the recommendations of this systems-based document, water resources are being managed in such a way that adequate flows of water to support healthy and diverse aquatic ecosystems as well as needs for water supply, hydropower, and recreation are being met. Past conflicts between users have been largely resolved through this collaborative effort and the Council of Ohio River Basin Governors (CORBG) has been instrumental in providing a forum for collaboration and discussion of common water resources issues confronting the states.

Representatives from the 15 member states have met numerous times with representatives of Federal agencies to decide how reinvestment in the current water management and flood risk reduction infrastructure can be financed through partnerships and how best to address anticipated threats to the water-rich region in the event of climatic changes. Contingency plans coordinated among the Council members that address droughts and extreme flooding events are in place and can be deployed should monitoring data indicate environmental or climatic changes that would signal an adverse change. Several of the CORBG members have expressed concern about national policies and international agreements that may affect their energy-based state revenues.

As anticipated, climate change begins to manifest itself as a series of weather extremes across the basin in 2018, and as predicted annual rainfall amounts decrease in the southern portions of the basin and thunderstorms across the region intensify. Due to the pre-emptive steps taken through collaborative efforts by the 15 states and Federal agencies, the effects of the climate changes are mitigated through integrated regulation of the reservoir system (attributed to the basin water management plan) and enactment of previously agreed upon water conservation measures. When larger tropical storms from the Gulf surge into the basin, newly upgraded flood warning systems operated and maintained by Federal agencies (with state support) are activated informing the affected public of imminent emergency evacuations. Losses of life and flood damages are minimized in many communities.

Despite these actions, other forces at work outside of the basin have hindered efforts to provide additional flood risk reduction infrastructure and to maintain or rehabilitate many existing local protection projects. With ongoing changes in national policy and international agreements that stress a growing need to reduce greenhouse gases, the exploration, extraction and use of fossil fuels such as coal and natural gas is significantly reduced. As market prices of coal and natural gas plummet, numerous energy firms close facilities and the annual severance tax revenues supporting local communities in several states follow this precipitous plunge. Annual operation and maintenance of floodwalls and levees takes a backseat to the more immediate fiscal needs of security, fire protection, education and maintenance of water and sewer facilities.

In time, operating equipment in pump stations and at gate closures in these economically devastated communities begins to deteriorate to a point of inoperability. States are unable to assist due to similar economic woes and decisions to support the more immediate financial needs of other communities like the supply of potable water. Federal agencies saddled with long-standing legal prohibitions against assuming 100% responsibility for rehabilitation of local protection projects are powerless to act as well. Relationships between Federal agencies and economically stressed communities are strained as legal requirements for maintenance of local protection projects are unmet due to lack of local revenues. As thunderstorms increase in intensity and flood events become flashier in nature, several affected communities suffer significant commercial and residential damages as un-rehabilitated component systems (gated openings and pump stations) fail during flooding events.

Opportunities to justify or financially support additional flood risk reduction facilities in at-risk watersheds are likewise thwarted by the receding economic conditions of the affected states and communities. By 2030 some areas of the basin, previously characterized as “energy rich” are locked in financial stress, losing population and begin to lapse into total dependence on government subsidies. Abandoned energy facilities continue to contribute to poor water quality and impact aquatic habitat during each rainfall event.

The Council of Ohio River Basin Governors meets with the basin’s congressional membership and representatives of Federal water resources agencies to determine what strategies may be possible to assist local communities in rehabilitating aging and deteriorating infrastructure before more damaging events occur.

On the environmental front, the constrained economy of the region limits non-Federal participation in cost shared ecosystem restoration projects. Long-standing, programmatic cost-sharing rates set at 65% Federal and 35% non-Federal have become burdensome in a depressed economic environment. Opportunities to improve deteriorating aquatic habitat slip by without sufficient non-Federal resources to match limited Federal funds. Program funds steer toward regions unaffected by the fossil-fuel energy market turndown. Climate changes (warming waters) exacerbate the deterioration of regional species aquatic habitat approaching thresholds of species survivability. The additional of new multi-level intakes at numerous reservoirs helps to mitigate some of the aquatic habitat impacts by allowing more precise mixing of water temperatures and oxygen content downstream, but lowered water levels due to reduced precipitation and higher rates of evaporation reduce this effect.

4. "NEW PARADIGM"

This scenario addresses the future of basinwide water resources development and management under a new paradigm of planning and operations that recognize the importance of sustainability and systems strategic planning and public lands management. Adaptive management strategies have been developed through comprehensive modeling and collaborative processes and are being implemented by USACE and other Federal water managers.

As a result of basinwide collaborative planning efforts between 2010 and 2015 and a subsequent massive Ohio River Basin water awareness and public education program through meetings and various media networks, the general mindset of the region's population begins to gradually realize the importance of water resources to their everyday lives. As a result of several meetings between the 15 governors and their designated lead agencies, an Ohio River Basin Governors Council is established to facilitate annual meetings between the major stakeholders, Federal agencies and invited members of the basin's Congressional leadership. Through this collaborative basin partnership of public and private entities, the strategic recommendations of a basin water management plan completed in 2015 are being implemented.

The basin's system of water control structures have been integrated through a massive hydrologic and hydraulic modeling effort and are being operated through a series of inter-agency agreements to balance sufficient storage for water supply, recreation and hydropower while enhancing downstream aquatic habitat for threaten and endangered species. Productivity and diversity of aquatic species have reached levels not seen since the 1930s. Some previously extirpated aquatic species have re-colonized or have been reintroduced with the assistance of local watershed associations. State revenues from recreation fishing licenses have soared.

Basinwide water conservation measures enacted by the executive offices of each state have significantly reduced the M&I water demands while absorbing new population growth. Enactment of stream corridor protections through land use zoning, subdivision regulations and transfer of development rights have saved miles of high quality aquatic and riparian habitat despite the new growth in households. Geographic and programmatic expansions of the environmental infrastructure programs to cover virtually all basin counties and to address municipal stormwater programs have led to significant reductions in bacterial loading of streams and rivers.

Multiple cost-shared projects and programs for reinvestment in infrastructure have been moving forward and numerous flood risk reduction actions have emerged as municipalities and counties have embraced a variety of land use controls and stormwater management techniques. Several watershed-based ecosystem restoration projects have been completed and many more are underway.

Based upon studies in 2010 and 2011, several reservoir intake structures have been modified through addition of multi-level ports to allow blending of lake waters with varying temperature levels and oxygen content. In addition, the operation of several reservoirs in the system has been modified to mimic natural, seasonal flows for downstream aquatic species leading to improvements in diversity of species and greater production. Through USACE and other Federal agency programs, safe access to the tailwaters of several dams has been improved. As a result of downstream water quality improvements and improved access, recreational fishing below many dams has improved dramatically.

In 2020 the anticipated changes in climate across the basin begin to be manifested in warmer daytime and nighttime temperatures as well as less frequent but heavier rainstorms. Higher evaporation rates at reservoirs and less frequent precipitation threaten M&I and irrigation water supplies. Using the previously developed basinwide water management plan, USACE in collaboration with other Federal water managers, the states and water users manage to maintain a balanced delivery of sufficient, high-quality water to meet the needs with previously developed strategic water conservation measures in place. Several major Atlantic and Gulf cyclones penetrate into the basin dropping copious amounts of rainfall but past efforts to rehabilitate at-risk dams and cost-shared efforts with sponsors of local protection projects managed to rehabilitate several aged levees and floodwalls and associated pump stations.

Despite record rainfall and high flood waters, the basin escapes with only minor damages to some unprotected communities and few losses of life. Past efforts to identify at-risk areas using HAZUS data and GIS technology all encapsulated in an easy-to-use electronic library, allow citizens and agencies to mitigate potential damages prior to flooding events and save lives. A reliable and financially supported basinwide flood warning system with upgraded stream and rain gages allows advanced warnings of impending flood events to the basin population.

Recreation visitation at USACE reservoirs, although hindered by higher temperatures has been enhanced by the development of recreation facilities that better meet the diverse interests of the surrounding population and the opportunities for visitors to catch glimpses of known threatened and endangered species using enhanced T&E species habitat on USACE lands. Funding support for project land use management, project safety and recreation facilities maintenance has been enhanced by sweeping USACE policy changes that return collected recreation fees back to the originating projects. The accident rates at USACE facilities drop as the upgraded facilities and adequate funding allow for enhanced monitoring of visitors activities on the lake.

As climate change and demographic experts anticipated in 2009, climate change does result in some re-population of the basin by earlier migrants to the south and southwest were temperature and drought conditions now make habitation there uncomfortable and impractical. This influx of population is accommodated without significant impacts to habitat or services due to local and state actions to protect sensitive environments through land use controls and urban infill strategies (TIF zones) and to increase public services capacities through Federal assistance. Employment losses to various industrial sectors due to changes in energy use and demand are replaced in part through increased employment in home building to meet the new demand and increased basin production spurred by greater regional use of intermodal container shipping.

APPENDIX C – WATER RESOURCES ISSUES

1. GENERAL ISSUES

The water resources issues team collected issues from key stakeholders, the public and USACE staff in a joint effort with the communications team and categorized the issues according to scope, general themes and USACE business lines. Comments were received on several water resources themes. Over 200 comments have been received. Those comments, issues and concerns received by the team through the web site, emails, letters and phone calls are listed below, categorized, scoped and evaluated in the matrix table according to existing USACE business lines. Table 3 shows the comments received from the stakeholders. Table 4 shows the comments received from the general public and Table 5 shows the comments received from USACE staff members. Only agency or department names were used to identify the commenter.

A number of comments were received during a meeting sponsored by the Nashville District on June 23, 2009. Although that meeting was attended by representatives from Federal agencies, NGOs (TNC) and Tennessee State agencies, their comments are listed under the more general heading of “June 23, 2009 ORBCS meeting” in Table 3.

2. MATRIX TABLE OF ISSUES BY SCOPE AND USACE BUSINESS LINES

For the purpose of relating the geographic scope of issues and formulated alternatives to USACE business lines (read as primary missions) a matrix crosswalk table (Table 6) is provided below. The shaded boxes indicate the geographic scope of each specific issue received and which USACE business line may address the particular issue. Where the issue doesn’t appear to fall within the purview of an existing USACE business line (i.e., local regulatory controls, state program, information sharing), the category “Other” is marked.

The abbreviations in the table (under the “Other” category) are as follows: WQ = Water Quality, STRMWTR = Stormwater-related, COMM = Communications, ERO = Erosion-related, REG = Regulatory Permit Program, GIS = Geographic Information Systems, PLAN = Planning Processes and IM = Information Management and data sharing.

Table 3 – Key Stakeholders Issues of the Ohio River Basin

ID #	Key Stakeholder Issues	Agency/Org.
1	Out of basin diversions or transfers for water supply and other uses (Tenn-Tom).	TDEC/WPC
2	Promote understanding and policy reform on relationships between land use, water quality and water quantity.	TDEC/WPC
3	Emphasize basin-scale water resources planning (rather than a collection of small scale project)s	TDEC
4	Sedimentation as the largest pollutant (in tons contributed) that can be resolved by retention at individual development sites	Cumberland River Compact
5	Water quantity (Communities away from the main stem are water deficient)	Cumberland River Compact
6	Build a searchable database of invaluable basin resources – a water library.	Cumberland River Compact
7	Rare Species and natural resources management on USACE lands	TN Environment and Conservation
8	Restoration and proper management of aquatic species in waterways especially below dams.	TN Environment and Conservation
9	Promote municipal planning for protection of water quality and native aquatic habitats	TN Environment and Conservation
10	USACE opportunities for aquatic species inventories or management	TN Environment and Conservation
11	Reimbursement of project costs for uses (i.e., hydropower users) that are restricted by project operational changes	USDOE/SEPA
12	Long-range look at ORB navigation connectivity with other waterways (Tenn-Tom) and blue water ports.	TENN-TOM Waterway Authority
13	Report should reference other pertinent reports by stakeholder/partnering organizations.	June 23, 2009 ORBCS meeting.
14	Report needs funding estimates for more detailed studies following the recon phase.	June 23, 2009 ORBCS meeting.
15	Consider multiple use demands on single drop of water (i.e., hydro, water supply, recreation, etc.)	TNC
16	Groundwater use issues in report.	June 23, 2009 ORBCS meeting.
17	Forecasting effects of climate change on basin.	June 23, 2009 ORBCS meeting.
18	Biologically diverse watersheds also fastest areas of population and development growth (Tenn/Cumb).	June 23, 2009 ORBCS meeting.

ID #	Key Stakeholder Issues	Agency/Org.
19	Maintain communication among stakeholders in basin coalition.	June 23, 2009 ORBCS meeting.
20	Process for moving forward from recon to feasibility and how stakeholders involved?	June 23, 2009 ORBCS meeting.
21	Need to ensure that public's and stakeholders' input is incorporated into the report.	June 23, 2009 ORBCS meeting.
22	How will ORB study fit into current Memphis study?	June 23, 2009 ORBCS meeting.
23	SARP sharing GIS data and priority list of projects for ORB study	Southeast Aquatic Resources Partnership (SARP)
24	Consideration of statewide wildlife action plans.	TNC
25	Time frame for the study unrealistic considering the scope and complexity	June 23, 2009 ORBCS meeting.
26	Issues associated with future land use and development and resulting runoff.	TN Dept. of ECD Land Planning Area Office
27	How would stakeholder input be weighed?	June 23, 2009 ORBCS meeting.
28	Invite NOAA as part of the study (climate change?)	June 23, 2009 ORBCS meeting.
29	How will the effort be coordinated with various state laws?	TDEC
30	Involvement of the newly formed HUD/DOT/EPA partnership in the ORB study?	Cumberland Region Tomorrow
31	How might the upcoming 2009 Transportation Bill reauthorization affect the ORB study……….Add Transportation of America as a stakeholder.	June 23, 2009 ORBCS meeting.
32	Most pressing problems in the basin are conserving federally endangered mollusks and especially in the Cumberland River – hydropower conflicts with water temperatures of releases.	USFWS
33	An issue to be addressed in this study would be how to mitigate the effects of the reservoir water level fluctuations on the tributaries to the reservoirs. I suggest that at summer pool the streams have a "drowned mouth" saturating the soils etc.... When the water level is adjusted to winter pool these saturated areas become expose and erode at an accelerated rate, causing the all tributary streams to "head cut." Basically the reservoirs are changing the stream gradient annually, this process results in accelerated sedimentation of the reservoirs and the streams become incised, effectively de-watering the riparian areas and affecting the aquatic ecosystems in general. If there is a way to stabilize the stream gradients at low pool it would reduce the head cutting dynamics and make it possible to begin restoring some of the streams. Please contact me if you want discuss this further. Thank you for the opportunity to comment. Wm. Patrick Fowler, PhD. Environmental Stewardship Manager Land Between the Lakes NRA	NRA

ID #	Key Stakeholder Issues	Agency/Org.
34	NWS – Most pressing water resources issues is the monitoring of river levels for flood forecasting and warning, drought issues and water supply and navigation.	National Weather Service
35	Milton WV – Issue is FDR, waiting on flood protection for 20 years.	Milton, WV
36	Issues regarding wetland delineation of wetland areas for shovel-ready projects (interested in future partnering and relationship building) – IN EDC.	IN Economic Development Corp
37	Issues of the Mad River Aquifer and VOC and Nitrate contamination.	City of Urbana
38	Installation of a water distribution line from Louisville Water Company (source the Ohio River) to Shelby County, KY to ensure adequate future supplies (population growth and demographics) and redundancy in supply in the event of a disaster.	Shelby County Fiscal Court
39	Will the report address water resources issues after ranking them?	June 23, 2009 ORBCS meeting.
40	Providing streamflow information and understanding to meet local, state, regional and national needs and to develop and operate a Federally-funded stable network of streamgages to meet national needs. Ensure that USGS has a seat at the basin table.	USGS
41	Revisit Chautaugua Lake Water Level Management Plan and assessment of the Warner Dam – NY	NY
42	Assessment of the Union City USACE built dam on French Creek – NY	NY
43	Jamestown NY 6th street bridge rubble removal from the Chadakoin River – NY	NY
44	Impingement of railroad right-of-way structures on drainage – NY	NY
45	Algae assessment and management, nutrient management, and invasive species identification and management – NY	NY
46	Requests interested party status for aspects of study and future plan writing affecting Chautaugua County – NY	NY
47	Extensive stormwater management education needed for local county and municipal officials and land management and water ecology education needed for general public – NY	NY
48	Adverse effects of operations and maintenance of Federal water control facilities on T&E species in Ohio River drainage handling Tennessee and Cumberland separately. Consultation has not occurred yet except for navigation activities – USFWS	USFWS
49	Impacts continue to occur to endangered species from Hydropower operations at Center Hill, Dale Hollow and Wolf Creek dams – USFWS	USFWS

ID #	Key Stakeholder Issues	Agency/Org.
50	Concerns for fish passage on the Cumberland river – USFWS	USFWS
51	Ensuring appropriate water levels in Barkley Lake for shorebirds through combined operations at Kentucky Dam and TVA projects – USFWS	USFWS
52	Gravel dredging on the Tennessee and Cumberland rivers affecting areas of high mussel diversity; impacts to mussel resources not being addressed adequately – USFWS	USFWS
53	Concerns for bank stabilization below USACE dams be addressed in ORB study – USFWS	USFWS
54	Concerns for floodplain dependent species like alligator gar and sicklefin chub that require floodplain habitat for reproduction; lack of connectivity between rivers and floodplains a threat to many species – USFWS.	USFWS
55	Portion of the study should target the necessity of deepening the navigation channel to increase capacity. Is there sufficient justification for national economic development (NED) to confirm federal cost sharing? BHJ-MPC	BHJ-MPO
56	FEMA shares common interest in reducing flood damages through Risk Mapping, Assessment and Planning (RISK MAP) and the NFIP programs and offered data sources for the study – FEMA Region III.	FEMA
57	Completion of the Lower Monongahela River Locks #2, #3, and #4 project to support the movement of coal on the river before the imminent failure of old L&D #3 that would lose the navigation pool – CONSOL Energy	CONSOL
58	Concerned about loss of navigation pool behind L&D #3 as many communities have municipal drinking water and fire suppression intakes and sewer effluent outfalls in that pool area that would be lost if the dam fails – CONSOL Energy	CONSOL
59	Several industrial plants and utility power plants taking cooling and processing water from Navigation pool #3 as well – CONSOL Energy	CONSOL
60	Operation and management of the Oakdale dam outflows on Freeman Lake are causing severe flooding along the Tippecanoe River in past two years in Carroll County. Numerous residences being flooded to keep lake levels stable. Requests that any flow changes to lake operations be shared with the Carroll County floodplain administrator – Carroll County Area Plan Commission	CARROLL PLAN COMMISSION
61	Will the data collected for the study affect Indiana DNR, Division of Water or FIRM maps? – Carroll County Area Plan Commission	CARROLL PLAN COMMISSION
62	Water supply issues with regard to the cost of accessing water at USACE facilities – Kentucky Infrastructure Authority	Kentucky Infrastructure Authority
63	Concerned about water quality in rivers and streams – Kentucky Infrastructure Authority	Kentucky Infrastructure Authority
64	Opportunity to improve GIS database of water and wastewater infrastructure and accuracy of existing data – Kentucky Infrastructure Authority	Kentucky Infrastructure Authority

ID #	Key Stakeholder Issues	Agency/Org.
65	Boat ramps and public access to the basin waterways is an issue with boaters and fishermen, economic analysis of ramp closures and ramp needs should be done – KYDF&WR	KYDF&WR
66	Minimum flow requirements below dams – KYDF&WR	KYDF&WR
67	Modification of operations and discharges to modify winter pool levels for fisheries resources – KYDF&WR	KYDF&WR
68	Restricted access below dams on tributary streams and rivers; restriction distances have been based upon Ohio River L&D projects and may not apply in tributaries – KYDF&WR	KYDF&WR
69	Low head dams on tributaries in the basin generate public safety issues, fisheries impacts (migration passage & fish assemblages), and public concerns for failing infrastructure – KYDF&WR	KYDF&WR
70	Threats to the aquatic habitat in the basin and the need for USACE to become more engaged with National Fish Habitat Initiative Partners: some needed projects may be on USACE -owned land and at reservoirs – KYDF&WR	KYDF&WR
71	USACE reservoirs have physically degraded tributaries that add to the sediment loading in the lake and impairment of the stream habitat on project lands – KYDF&WR	KYDF&WR
72	Aquatic nuisance species (exotic/invasive aquatic plants) threaten USACE and other non-Federal impoundments – KYDF&WR	KYDF&WR
73	Limited recreation access to USACE dams with hydropower hampers fishing opportunities and needs for ADA access to USACE facilities along the Ohio River – KYDF&WR	KYDF&WR
74	A plan or list of potential funding partners and funding sources needs to incorporated into the recon report – KYDF&WR	KYDF&WR
75	USACE cost sharing match rates are too high for restoration activities (i.e., Ohio River Mainstem Study restoration needs) – KYDF&WR	KYDF&WR
76	Flow modeling needed to support habitat improvements along the Ohio River and major tributaries – KYDF&WR	KYDF&WR
77	Fleeting operations permitted by USACE have potential negative effects on mussel beds, current permitting is based on biological assessments and mussel surveys funded by fleeting companies – KYDF&WR	KYDF&WR
78	Outdated data and information on mussel beds in the Ohio River and major navigable tributaries being used to make decisions by USACE regulatory offices, resource agencies and private industries using the river – KYDF&WR	KYDF&WR
79	Lack of pre-identified habitat improvement projects and pre-determined (or programmatic) partnership requirements (including funding commitments) on USACE property that has been leased to state natural resources for wildlife management areas and is encumbered by NEPA requirements and USACE program processing. Reduces opportunities for successful partnering on projects – KYDF&WR	KYDF&WR

ID #	Key Stakeholder Issues	Agency/Org.
80	City floodwall and levee needing rehabilitation (trees growing on earthen levee) and municipality without sufficient funds to comply (in debt due to EPA unfunded mandates) now with new mandates to repair protection system – Brookport, IL.	Brookport, IL
81	Surface and subsurface water pollution affecting quality of drinking water supplies – City of Tipp City, OH	Tipp City, OH
82	Sedimentation and nutrient loading from watersheds leading to eutrophication and reduced storage capacity – ODNR	ODNR
83	Aging and deteriorating dams requiring repair and maintenance – ODNR	ODNR
84	Water level management practices that compromise sport fishing opportunities by reduced retention of sportfish in reservoirs (emigration via dam outflows), reduce compromise recruitment of naturally spawning fishes, reduce littoral cover, reduce littoral areas for fishing opportunities, negatively impact foodweb interactions – ODNR	ODNR
85	Effects of changing land use on the flow and water quality of headwater streams – KDNRDMP	KDNRDMP
86	Opportunities for data sharing at the HUC 12 watershed level – KDNRDMP	KDNRDMP
87	Coordination of water quality data collection and storage efforts – KDNRDMP	KDNRDMP
88	Improvements in user-friendly GIS capabilities and increased availability of efficient, timely, online data summaries and reports – KDNRDMP	KDNRDMP
89	Water quality credit trading – Gallia S&W CD	Gallia S&W CD
90	Erosion – Gallia S&W CD	Gallia S&W CD
91	Floodplain development – Gallia S&W CD	Gallia S&W CD
92	Funding for upgrading pump stations built in the 1940s and 1950s – New Boston, OH	
93	Siltation across the entire basin increasing – how to keep soil on the properties where it originates and keep the water on individual properties to avoid flash flooding and enhance round water supplies – Cumberland River Compact	Cumberland River Compact
94	How to get more stakeholders involved and educated about the process and volunteer – Cumberland River Compact	Cumberland River Compact
95	Request permission to encapsulate a concrete trough being used to store and pump stormwater from Wellsville into the Ohio River – Columbiana County Port Authority.	Columbiana County Port Authority
96	Inquiry about what the planning is about, referred to web site – ODNR	ODNR
97	Flooding damages from Canoe Creek/Green River in City of Henderson and Henderson County, Kentucky, requesting assistance through the Section 205 program – City of Henderson	City of Henderson

ID #	Key Stakeholder Issues	Agency/Org.
98	Concerns for water supply – ADEM (regulatory responsibility for NPDES and TMDL in Tennessee River basin in AL)	ADEM
99	Concerns for water quality – ADEM	ADEM
100	Concerns for river flows associated with hydropower and navigation – ADEM	ADEM
101	Concerns for hydrologic data availability – ADEM	ADEM
102	Concerns for changes in system operations – ADEM	ADEM
103	Concerns for conflicts between recreation boaters and the navigation industry – Life on the water magazine	LWM
104	Opportunities for waterway tourism as a source of revenues for waterfront communities – life on the water magazine	LWM
105	Education of recreation boaters about the towing industry – Life on the water magazine	LWM
106	Flooding in the headwaters of the Great Miami River, need relief in form of reservoir, dikes or dams to control flooding – Village of Russells Point, OH	Russells Point, OH
107	Indian Lake spillway failure would threaten residences downstream in Logan County, OH – Village of Russells Point, OH	Russells Point, OH
108	Will the study include tributaries of the Ohio River like the Great Miami – Village of Russells Point, OH	Russells Point, OH
109	Concerns for the decertified Karnak Levee due to lack of maintenance of a drainage structure and flows threaten Cairo, IL and the MR&T levee system – IDNR	IDNR
110	Concerns for the Old Shawneetown Levee that was overtopped leading to buyouts in Old Shawneetown but not all purchased leading to limited maintenance of the existing levee and the need for upgrades to the levee – IDNR	IDNR
11	Concerns for the Brookport Levee because the city of Brookport economic conditions aren't sufficient to finance maintenance of the levee which is experiencing some deterioration of drainage structures through the embankment that result in interior evacuations when levee failures appear imminent – IDNR	IDNR
112	Concerns for flooding at the confluence of the Ohio River/Wabash River/Saline River floodplains in Gallatin County leading to failure of several agriculture levees and flooding of homes and facilities – IDNR	IDNR
113	Concerns for the condition of and deficiencies in levees with respect to potential climate change effects of high flows and stages – IDNR	IDNR
114	Concerns for long term funding of streamgage data, lack of data on stream flows, needs for LiDAR DEMs for emergency response and floodplain mapping in Illinois – IDNR	IDNR

ID #	Key Stakeholder Issues	Agency/Org.
115	An assessment of the current levee risks would greatly benefit state of Illinois and be used for Ohio River hazard Mitigation Plan for the state to assist in certification and accreditation of levees – IDNR	IDNR
116	Issues of erosion, sedimentation and both point and non-point pollution sources affecting water quality in the Cumberland basin – Cumberland River Compact (CRC).	Cumberland River Compact
117	Opportunity to work jointly on a Tennessee-Cumberland River Basin Study for infrastructure, watershed ecology, impaired waters, and objective historical measurements of river health, flows and supply – CRC	Cumberland River Compact
118	Identifying and working on Section 205 and Section 14 projects in the Cumberland basin – CRC	Cumberland River Compact
119	Opportunity to link to CRC and ORB web sites to share information – CRC	Cumberland River Compact
120	Building a common database from the ORBCS with links to the CRC web site – CRC	Cumberland River Compact
121	Willing to participate in upcoming meetings on the ORBCS – CRC	Cumberland River Compact
122	Loss of riparian zone habitat due to residential development effects (stone slope protection) requires regulations or manual for responsible riparian land ownership.	Ohio River Consortium for Research and Education
123	Funding upkeep, demo or construction of monitoring stations for water quality for ORSANCO and TVA 305b reports	Tennessee State Parks
124	Air and water quality impact study on reduction of coal-fired power plants and increase of nuclear power plants	Tennessee State Parks
125	River basin plans and watershed plans too generic in nature	Tennessee State Parks
126	Encourage state (TN?) to use consistent data collection to support how water quality supports aquatic life – avoid exclusion of some data.	Tennessee State Parks
127	Stricter regulatory legislation on water use by utility districts in TN and states dependent on TN for water.	Tennessee State Parks
128	Impact study needed on air quality and water quality in rivers downstream of mining operations	Tennessee State Parks
129	Enforce laws related to development along waterways	Tennessee State Parks
130	Coal-related fly ash clean up needed	Tennessee State Parks
131	Issues of concern include riparian areas, water quality, watershed connectivity, hydrologic conditions (ecosystem flows), sediment, physical habitat and non-native aquatic nuisance species.	Southeast Aquatic Resource Partnership

ID #	Key Stakeholder Issues	Agency/Org.
132	Fish habitat subject to many stressors including modified hydrologic regimes, excessive nutrient input, degraded water quality, urbanization, habitat loss due to reservoir aging, eutrophication, erosion and siltation, exotic nuisance species and climate change	Southeast Aquatic Resource Partnership
133	Issues of water quantity and water quality due to increasing human demands and threat of climate change	Tennessee Wildlife Resources Agency
134	Need for watershed planning for future conservation of fish and wildlife resources in the basin	US Fish & Wildlife Service – Columbus Unit (USFWS–CU)
135	Water quality degradation from runoff of land use conversion and CSOs	USFWS–CU
136	Water quality effects on T&E species (esp. mussels)	USFWS–CU
137	Water quality degradation from pharmaceuticals, bacteria, pesticides, nutrient loading and sedimentation.	USFWS–CU
138	Impacts of existing and future hydropower facilities on fish and wildlife resources	USFWS–CU
139	Prevention and control of aquatic and terrestrial invasive species	USFWS–CU
140	Invasive species effects on indigenous aquatic and terrestrial species in basin	USFWS–CU
141	Bank erosion on rivers and lakes due to flow regulation at reservoirs and navigation locks and dams	USFWS–CU
142	Terrestrial and aquatic ecosystem restoration opportunities	USFWS–CU
143	Environmental contaminant spill response and remediation	USFWS–CU
144	Sufficiency of water supplies in view of projected population increases and potential climate change.	USFWS–CU
145	Lack of ecological connectivity between the rivers and floodplains and effects on riparian and aquatic species	USFWS–CU
146	Poor structural condition of navigation locks present an impediment to waterborne goods movement	Kentuckiana Regional Planning and Development Agency – KIPDA
147	Inadequate lock chamber capacities present an impediment to waterborne goods movement	KIPDA
148	Need to maintain/improve road/rail connections between the Ohio River, private and public port facilities and rail and highway networks to increase use of the inland waterways	KIPDA
149	Need improved/revised floodplain information to determine potential exposure of current and future populations and planned highway and railway infrastructure to flood hazards.	KIPDA

ID #	Key Stakeholder Issues	Agency/Org.
150	Inundation of CSO outfalls by Markland L&D navigation pool that exacerbate CSO effects.	Metropolitan Sewer District of Greater Cincinnati – MSDGC
151	Requests planning assistance and participation by ACOE in design and implementation of CSO reduction efforts.	MSDGC
152	Requests continuing engagement by the ACOE in the Lick Run Aquatic Restoration project for flood control, recreation and ecosystem restoration.	MSDGC
153	Requests ACOE assistance through a watershed approach to address stormwater flows in the West Fork Mill Creek as the MSDGC separates combined sewer and stormwater flows in CSO project.	MSDGC
154	MSDGC interested in ACOE evaluation of a dual purpose tunnel that would address stormwater problems in the Sharonville and Evendale communities.	MSDGC
155	Engineering practices that under-estimate actual rainfall rates and convey water to nearest stream – no ground water recharge	Duquesne Univ.
156	Development practices that do not consider the value and function of natural infrastructure – soils, wetlands, etc.	Duquesne Univ.
157	State laws that have unintentionally limited stormwater management techniques for local codes	Duquesne Univ.
158	State laws that do not carefully define local government and landowner roles in stream maintenance and protection	Duquesne Univ.
159	State enforcement of water quality and quantity regulations that do not discourage violations	Duquesne Univ.
160	Uncertainty and gaps in divisions of state, county and municipal enforcement arms	Duquesne Univ.
161	Gaps and delays in providing aid to flood victims and lack of economic comparison between payments and better stormwater management practices	Duquesne Univ.
162	Ongoing protocols and practices that thwart innovation and use of more efficient and eco-friendly stormwater practices.	Duquesne Univ.
163	Lack of well-defined and simplified stormwater management guidelines and process steps for planners, engineers, etc.	Duquesne Univ.
164	Lack of community education about stormwater planning and management strategies, methods and techniques	Duquesne Univ.

Table 4 – Ohio River Basin Issues from the Public

ID #	Public Issues
1	Issues of bank erosion along the Cumberland River due to operation of dams and reservoirs causing loss of private property, trees, powerlines, riparian zone (dysfunctional) and farmland and affecting water quality, aquatic habitat, reservoir longevity and eutrophication.
2	Issue is floatable debris in waterways especially bottles, cans and other debris being thrown into waterways from perspective of a boater and environmentally conscience citizen. Thinks that a "bottle bill" (nickel deposit on bottles and cans) in TN would help.
3	Issue is river banks washing away and suggests that riprap may be one solution.
4	Concerns about dam safety and ongoing generation of hydroelectric power being endangered by too much concern over mussels and "saber-tooth tigers" (T&E species vs Hydro issue).
5	Kentucky Lake area lack of enforcement of floodable property for private development with septic systems that are flooded frequently (extended period of time) and thus pollute the river.
6	Issue is the built environment and lack of gray-water infrastructure to reduce load on storm/sewer system in Pittsburgh.
7	Issue is water quality with respect to pharmaceuticals, pesticides contamination and runoff.
8	Issue is wetlands preservation, stormwater management and drinking water shortages in some areas, and capacity to store and share water.
9	Erosion of Old Hickory Lake and destruction of islands (tree loss) in the lake by bird life. Asked TWRA to help. Is there a plan to protect the islands?
10	Runoff erosion from Center Hill Dam construction into the Caney River rising temperatures and affecting trout habitat.
11	USACE and TVA failure to keep summer lake levels (lake levels being lower) that are conducive to boaters and tourism despite years of public requests and promises by both agencies to compromise.
12	Determination of ownership and control of debris on the Ohio River in the form of rusting and discarded barges, loading facilities, boats and junk affecting commercial navigation, hydropower, dams, visual quality and other facilities on the river. Who can remove this debris?
13	Resident of Brookport, Illinois concerned about rundown condition of the floodwall protecting the city and the limited funding capability of the city to maintain the structure…also concerned that much of the city is now being declare to be in the floodplain due to loss of certification.
14	Navigation on the Ohio River should include opportunities for transportation cost savings associated with container-on-barge movements between such points as Weirton, WV and NOLA or Brownsville, TX. Should be studies of this opportunity. Included copy of University of Michigan study on subject.

Table 5 – Ohio River Basin Issues from USACE

ID #	USACE Staff Issues
1	Several large communities are still vulnerable to major flood damage including Chattanooga and Knoxville
2	Newly and rapidly developing rural areas and small towns have inadequate floodplain mapping
3	Inadequate levee heights or channel capacity due to increased flood heights (from development or just longer period of record).
4	Old flood insurance mapping based on short periods of record, insufficiently detailed studies and poor base mapping.
5	Current Flood Damage Reduction infrastructure risk is too high
6	Due to unregulated private levees, there are some areas in the basin that lack a comprehensive inventory of levees and their condition.
7	Disaster declarations continually occur in areas with flood problems where it can't be economically justified.
8	Fully develop the impacts, including environmental, of flooding chemical major industrial centers.
9	Some high hazard dams do not have Emergency Action Plans
10	Ensure that new and existing dams are safe through the development of technologically and economically feasible programs and procedures for national dam safety hazard reduction;
11	Encourage acceptable engineering policies and procedures to be used for dam site investigation, design, construction, operation and maintenance, and emergency preparedness;
12	Encourage the establishment and implementation of effective dam safety programs in each State based on State standards;
13	Develop and encourage public education and awareness projects to increase public acceptance and support of State dam safety programs;
14	Develop technical assistance materials for Federal and State dam safety programs; and
15	Develop mechanisms with which to provide Federal technical assistance for dam safety to the non-Federal sector.
16	Aging infrastructure (locks, dams, gates, levees, pumps, relief wells, instrumentation, monoliths, etc) causing increased O&M, diminished reliability of authorized purposes, etc.
17	Dams not designed to be managed for all current purposes. Water temperatures changed by impoundment, but many dams are not designed to control water quality parameters in their releases.
18	Water Management – Changing Economic, Climate and regional impacts of our projects (i.e., Recreation and Water Supply were not primary purposes for any of our reservoirs, but now they are a major regional economic driver and life requisites. We also now realize that our dams have and continue to cause significant unmitigated environmental impact, but we have no mechanisms to fund the studies to make operational or physical changes without cost sharing or a 100% partner funded study. A 100% partner funded study could be perceived as biased.) There are increasing pool level management conflicts (i.e., recreation vs. FDR, Hydro, and Ecosystem).

ID #	USACE Staff Issues
19	A system operation H&H model needs to be developed and existing basin models updated.
20	Sedimentation studies need to be done in reservoir to update storage capacity.
21	New surveying/datum controls influencing project purpose operation are needed
22	Comprehensive understanding of water related issues within basin watersheds are not known at this time.
23	Potential to quantify and include external benefits to the nation such as reduced carbon emissions per ton mile, highway maintenance costs, highway congestion and delay in major traffic corridors, and increased safety to highway users
24	Environmental Compliance/Stewardship costs should be associated with business line cause (example navigation impact monitoring has been paid with very limited stewardship money)
25	Modify P&G & ER 1105-2-100 to look at other justifications for rural & depressed areas.
26	Legal and funding limitations to water supply and management studies prevent changes to current water supply permits and forces management through legal mandates rather than through a holistic review
27	Inconsistent approach regarding calculation of water supply storage costs and annual operation and maintenance fees across districts within LRD.
28	Shoreline management costs are not offset by current fees collected (i.e., fees are too low).
29	Project maintenance affected by encroachments.
30	More transparent, better understood regulatory processes
31	Cost sharing rules for FRM feasibility studies and project construction limits protection for financially incapable communities and favors wealthier cities and towns. Economic benefit evaluations disregard loss of life in overall calculation of project benefits.
32	Nutrient loadings in streams and rivers by point and non-point sources
33	Capture of sediments and nutrients by reservoir pools affecting lake water quality
34	Dam tail waters devoid of nutrients and sediment loadings affecting stream productivity and initiating scour
35	Lack of protection for and no management of riparian zones
36	Mussel population sustainability
37	Fish migration and pool connectivity issues associated with dams and other man-made obstacles
38	Invasive species issues
39	Sustainability of T&E species habitat in basin
40	River and stream impairments – USEPA 303(d) reports
41	Stream flow changes due to watershed development runoff
42	Lack of adequate sewage treatment systems and CFOs
43	Competition for water capacity with recreation/M&I water supply/hydro

44	There are a number of non-Federal hydropower retrofits (FERC) being requested; there is no basin-wide strategy for assessing the cumulative impacts of those retrofits.
45	Current hydropower units in the basin are in need of retrofits to increase efficiency and allow adjustments of flow for water quality and downstream species.
46	Minerals extraction within and around USACE lands/facilities may increase resulting in additional threats to water quality and land disturbances at projects.
47	Competing interests for water storage may endanger ability to provide reliable hydropower generation.
48	Gas extraction from Marcellus Shale deposits may threaten water quality from well discharges.
49	Comprehensive analysis of potential impacts of energy production facilities and fuel processing and transportation on basin resources.
50	Land use management conflicts are rising between users and requests for different recreation types and upgraded facilities are rising.
51	Issues of sustainability in managing lands and facilities (needs vs. funding and personnel)
52	Carry capacity issues given rising visitation and impacts on the resource.
53	Changing demographics (cultural diversity) changing recreation-use patterns.
54	Need re-examination of project purposes and land management in the context of the environmental operating principles so that future generations can be served.
55	User fees need to be re-examined to better address user demands.
56	Increased demands for riverfront recreation facilities
57	Changing infrastructure requirements for today's campers and recreation users.
58	Funding limitations for maintenance or expansion of USACE facilities.
59	Potential use of the waterway for moving containers that would increase traffic and increase need/demand for new terminals.
60	Effects of channel maintenance with respect to aquatic species and habitat impacts
61	Inefficiencies at existing locks (i.e., Wilson L&D)
62	Needs for rehabilitating navigation aids and mooring structures
63	Potential additional public benefits to the nation through investing in public port development.
64	Embankment erosion situation at Brookville, IN where an un-relocated roadway within the lake impoundment area has been washed away severing access to a local homeowner's property.

Table 6 – Issues Scope and Matrix Comparison with USACE Business Lines (Missions)

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Several large communities are still vulnerable to major flood damage including Chattanooga and Knoxville				✓	✓							
Newly and rapidly developing rural areas and small towns have inadequate floodplain mapping			✓		✓							
Inadequate levee heights or channel capacity due to increased flood heights (from development or just longer period of record).				✓	✓							
Old flood insurance mapping based on short periods of record, insufficiently detailed studies and poor base mapping.	✓	✓			✓							
Current Flood Damage Reduction infrastructure risk is too high	✓	✓			✓							
Due to unregulated private levees, there are some areas in the basin that lack a comprehensive inventory of levees and their condition.			✓		✓							
Disaster declarations continually occur in areas with flood problems where protection can't be economically justified.	✓	✓			✓							
Fully develop the impacts, including environmental, of flooding chemical major industrial centers.			✓		✓							
Some high hazard dams do not have Emergency Action Plans				✓	✓							
Ensure that new and existing dams are safe through the development of technologically and economically feasible programs and procedures for national dam safety hazard reduction	✓	✓			✓							

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	Sub-basin	Watershed	Project/Local	Flood Risk Reduction	Navigation	Ecosystem Restoration	Water Supply	Environmental Infrastructure	Hydropower	Recreation	Other
Encourage acceptable engineering policies and procedures to be used for dam site investigation, design, construction, operation and maintenance, and emergency preparedness	✓	✓			✓							
Encourage the establishment and implementation of effective dam safety programs in each State based on State standards			✓		✓							
Develop and encourage public education and awareness projects to increase public acceptance and support of State dam safety programs			✓		✓							
Develop technical assistance materials for Federal and State dam safety programs; and	✓	✓			✓							
Develop mechanisms with which to provide Federal technical assistance for dam safety to the non-Federal sector.	✓	✓			✓							
Aging infrastructure (locks, dams, gates, levees, pumps, relief wells, instrumentation, monoliths, etc) causing increased O&M, diminished reliability of authorized purposes, etc.	✓	✓			✓							
Dams not designed to be managed for all current purposes. Water temperatures changed by impoundment, but many dams are not designed to control water quality parameters in their releases.				✓	✓							

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Water management – changing economic, climate and regional impacts of our projects (i.e., Recreation and Water Supply were not primary purposes for any of our reservoirs, but now they are a major regional economic driver and life requisites. We also now realize that our dams have and continue to cause significant unmitigated environmental impact, but we have no mechanisms to fund the studies to make operational or physical changes without cost sharing or a 100% partner funded study. A 100% partner funded study could be perceived as biased.) There are increasing pool level management conflicts (i.e., recreation vs. FDR, Hydro, and Ecosystem).	✓	✓			✓							
A system operation H&H model needs to be developed and existing basin models updated.	✓				✓							
Sedimentation studies need to be done in reservoir to update storage capacity.				✓	✓							
New surveying/datum controls influencing project purpose operation are needed				✓	✓							
Comprehensive understanding of water related issues within basin watersheds are not known at this time.			✓									✓ IM
Potential to quantify and include external benefits to the nation such as reduced carbon emissions per ton mile, highway maintenance costs, highway congestion and delay in major traffic corridors, and increased safety to highway users	✓					✓						
Environmental Compliance/Stewardship costs should be associated with business line cause (example navigation impact monitoring has been paid with very limited stewardship money)	✓					✓						✓
Modify P&G & ER 1105-2-100 to look at other justifications for rural & depressed areas.	✓				✓							

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	Sub-basin	Watershed	Project/Local	Flood Risk Reduction	Navigation	Ecosystem Restoration	Water Supply	Environmental Infrastructure	Hydropower	Recreation	Other
Legal and funding limitations to water supply and management studies prevent changes to current water supply permits and forces management through legal mandates rather than through a holistic review	✓							✓				
Inconsistent approach regarding calculation of water supply storage costs and annual operation and maintenance fees across districts within LRD.	✓							✓				
Shoreline management costs are not offset by current fees collected (i.e., fees are too low).				✓							✓	
Project maintenance affected by encroachments.				✓							✓	
More transparent, better understood regulatory processes	✓					✓						
Cost sharing rules for FRM feasibility studies and project construction limits protection for financially incapable communities and favors wealthier cities and towns. Economic benefit evaluations disregard loss of life in overall calculation of project benefits.	✓				✓							
Nutrient loadings in streams and rivers by point and non-point sources	✓						✓					
Capture of sediments and nutrients by reservoir pools affecting lake water quality				✓			✓					
Dam tail waters devoid of nutrients and sediment loadings affecting stream productivity and initiating scour		✓					✓					
Lack of protection for and no management of riparian zones	✓						✓					
Mussel population sustainability		✓					✓					
Fish migration and pool connectivity issues associated with dams and other man-made obstacles		✓					✓					

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Invasive species issues	✓						✓					
Sustainability of T&E species habitat in basin	✓						✓					
River and stream impairments – USEPA 303(d) reports on impaired streams	✓						✓					✓ WQ
Stream flow changes due to watershed development runoff		✓										✓ WQ
Lack of adequate sewage treatment systems and CSOs	✓						✓					✓ WQ
Competition for water capacity with recreation/M&I water supply/hydro		✓			✓	✓	✓	✓		✓	✓	
There are a number of non-Federal hydropower retrofits (FERC) being requested; there is no basin-wide strategy for assessing the cumulative impacts of those retrofits.	✓									✓		
Current hydropower units in the basin are in need of retrofits to increase efficiency and allow adjustments of flow for water quality and downstream species.		✓								✓		
Minerals extraction within and around USACE lands/facilities may increase resulting in additional threats to water quality and land disturbances at projects.				✓							✓	
Competing interests for water storage may endanger ability to provide reliable hydropower generation.				✓						✓		
Gas extraction from Marcellus Shale deposits may threaten water quality from well discharges.		✓					✓					✓ WQ
Comprehensive analysis of potential impacts of energy production facilities and fuel processing and transportation on basin resources.	✓											✓ PLAN
Land use management conflicts are rising between users and requests for different recreation types and upgraded facilities are rising.				✓							✓	

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Issues of sustainability in managing lands and facilities (needs vs. funding and personnel)				✓							✓	
Carry capacity issues given rising visitation and impacts on the resource.				✓							✓	
Changing demographics (cultural diversity) changing recreation-use patterns.				✓							✓	
Need re-examination of project purposes and land management in the context of the environmental operating principles so that future generations can be served.				✓	✓		✓	✓		✓	✓	
User fees need to be re-examined to better address user demands.	✓										✓	
Increased demands for riverfront recreation facilities	✓										✓	
Changing infrastructure requirements for today's campers and recreation users.				✓							✓	
Funding limitations for maintenance or expansion of USACE facilities.				✓							✓	
Potential use of the waterway for moving containers that would increase traffic and increase need/demand for new terminals.	✓					✓						
Effects of channel maintenance with respect to aquatic species and habitat impacts	✓					✓	✓					
Inefficiencies at existing locks (i.e., Wilson L&D)				✓		✓						
Needs for rehabilitating navigation aids and mooring structures	✓					✓						
Potential additional public benefits to the nation through investing in public port development.	✓					✓						

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Embankment erosion situation at Brookville, IN where an un-relocated roadway within the lake impoundment area has been washed away severing access to a local homeowner's property.				✓							✓	✓ ERO
Out of basin diversions or transfers for water supply and other uses (Tenn-Tom).	✓						✓	✓		✓	✓	
Promote understanding and policy reform on relationships between land use, water quality and water quantity.	✓							✓				✓ IM
Emphasize basin-scale water resources planning (rather than a collection of small scale project)s	✓											✓ PLAN
Sedimentation as the largest pollutant (in tons contributed) that can be resolved by retention at individual development sites				✓								✓ WQ
Water quantity (Communities away from the main stem are water deficient)				✓				✓				
Build a searchable database of invaluable basin resources – a water library.	✓											✓ IM
Rare Species and natural resources management on USACE lands				✓			✓				✓	
Restoration and proper management of aquatic species in waterways especially below dams.				✓			✓					
Promote municipal planning for protection of water quality and native aquatic habitats	✓						✓					✓ WQ
USACE opportunities for aquatic species inventories or management				✓			✓					✓
Reimbursement of project costs for uses (i.e., hydropower users) that are restricted by project operational changes				✓						✓		

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Long-range look at ORB navigation connectivity with other waterways (Tenn-Tom) and blue water ports.	✓					✓						
Report should reference other pertinent reports by stakeholder/partnering organizations.	✓											✓ PLAN
Report needs funding estimates for more detailed studies following the recon phase.			✓									✓ PLAN
Consider multiple use demands on single drop of water (i.e., hydro, water supply, recreation, etc.)	✓				✓	✓	✓	✓		✓	✓	✓
Groundwater use issues in report.	✓							✓				
Forecasting effects of climate change on basin	✓											✓ PLAN
Biologically diverse watersheds also fastest areas of population and development growth (Tenn/Cumb).			✓			✓						✓
Maintain communication among stakeholders in basin coalition.	✓				✓							✓ COMM
Process for moving forward from recon to feasibility and how stakeholders involved?	✓											✓ PLAN
Need to ensure that public's and stakeholders' input is incorporated into the report.	✓											✓ COMM
How will ORB study fit into current Memphis study?	✓											✓ PLAN
SARP sharing GIS data and priority list of projects for ORB study		✓					✓					
Consideration of statewide wildlife action plans.				✓							✓	
Time frame for the study unrealistic considering the scope and complexity	✓											✓ PLAN

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Issues associated with future land use and development and resulting runoff.			✓		✓							✓ STRMWTR
How would stakeholder input be weighed?	✓											✓ IM
Invite NOAA as part of the study (climate change?)	✓							✓				✓ PLAN
How will the effort be coordinated with various state laws?	✓											✓ PLAN
Involvement of the newly formed HUD/DOT/EPA partnership in the ORB study?	✓								✓			✓ PLAN
How might the upcoming 2009 Transportation Bill reauthorization affect the ORB study? Add Transportation of America as a stakeholder.	✓					✓						
Most pressing problems in the basin are conserving federally endangered mollusks and especially in the Cumberland River – hydropower conflicts with water temperatures of releases.		✓					✓					
An issue to be addressed in this study would be how to mitigate the effects of the reservoir water level fluctuations on the tributaries to the reservoirs. I suggest that at summer pool the streams have a "drowned mouth" saturating the soils etc.... When the water level is adjusted to winter pool these saturated areas become expose and erode at an accelerated rate, causing the all tributary streams to "head cut." Basically the reservoirs are changing the stream gradient annually, this process results in accelerated sedimentation of the reservoirs and the streams become incised, effectively de-watering the riparian areas and affecting the aquatic ecosystems in general. If there is a way to stabilize the stream gradients at low pool it would reduce the head cutting dynamics and make it possible to begin restoring some of the streams. Please contact me if you want discuss this further. Thank you for the opportunity to comment. Wm. Patrick Fowler, PhD. Environmental Stewardship Manager Land Between the Lakes NRA				✓			✓				✓	

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
NWS – Most pressing water resources issues is the monitoring of river levels for flood forecasting and warning, drought issues and water supply and navigation.					✓							
Revisit Chautaugua Lake Water Level Management Plan and assessment of the Warner Dam – NY				✓	✓							
Assessment of the Union City USACE built dam on French Creek – NY				✓	✓							
Jamestown NY 6th street bridge rubble removal from the Chadakoin River – NY				✓		✓						
Impingement of railroad right-of-way structures on drainage – NY			✓									✓
Milton WV – Issue is FDR, waiting on flood protection for 20 years.				✓								
Issues regarding wetland delineation of wetland areas for shovel-ready projects (interested in future partnering and relationship building) – IN EDC.				✓								✓ REG
Issues of the Mad River Aquifer and VOC and Nitrate contamination.			✓					✓				
Installation of a water distribution line from Louisville Water Company (source the Ohio River) to Shelby County, KY to ensure adequate future supplies (population growth and demographics) and redundancy in supply in the event of a disaster.				✓					✓			
Will the report address water resources issues after ranking them	✓											✓ PLAN
Providing streamflow information and understanding to meet local, state, regional and national needs and to develop and operate a federally funded stable network of streamgages to meet national needs. Ensure that USGS has a seat at the basin table.	✓				✓							
Algae assessment and management, nutrient management, and invasive species identification and management – NY	✓						✓					

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Requests interested party status for aspects of study and future plan writing affecting Chautaugua County – NY			✓									✓
Extensive stormwater management education needed for local county and municipal officials and land management and water ecology education needed for general public – NY	✓				✓		✓					✓ STRMWTR
Adverse effects of operations and maintenance of Federal water control facilities on T&E species in Ohio River drainage handling Tennessee and Cumberland separately. Consultation has not occurred yet except for navigation activities – USFWS		✓					✓					
Impacts continue to occur to endangered species from Hydropower operations at Center Hill, Dale Hollow and Wolf Creek dams – USFWS				✓			✓			✓		
Concerns for fish passage on the Cumberland river – USFWS		✓					✓					
Ensuring appropriate water levels in Barkley Lake for shorebirds through combined operations at Kentucky Dam and TVA projects – USFWS		✓					✓			✓		
Gravel dredging on the Tennessee and Cumberland rivers affecting areas of high mussel diversity; impacts to mussel resources not being addressed adequately – USFWS		✓					✓					
Concerns for bank stabilization below USACE dams be addressed in ORB study – USFWS	✓				✓	✓						
Concerns for floodplain dependent species like alligator gar and sicklefin chub that require floodplain habitat for reproduction; lack of connectivity between rivers and floodplains a threat to many species – USFWS	✓						✓					

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Portion of the study should target the necessity of deepening the navigation channel to increase capacity. Is there sufficient justification for national economic development (NED) to confirm federal cost sharing? BHJ-MPC	✓					✓						
FEMA shares common interest in reducing flood damages through Risk Mapping, Assessment and Planning (RISK MAP) and the NFIP programs and offered data sources for the study – FEMA Region III.	✓				✓							
Completion of the Lower Monongahela River Locks #2, #3, and #4 project to support the movement of coal on the river before the imminent failure of old L&D #3 that would lose the navigation pool – CONSOL Energy		✓				✓						
Concerned about loss of navigation pool behind L&D #3 as many communities have municipal drinking water and fire suppression intakes and sewer effluent outfalls in that pool area that would be lost if the dam fails – CONSOL Energy		✓						✓				
Several industrial plants and utility power plants taking cooling and processing water from Navigation pool #3 as well – CONSOL Energy		✓						✓				
Operation and management of the Oakdale dam outflows on Freeman Lake are causing severe flooding along the Tippecanoe River in past two years in Carroll County. Numerous residences being flooded to keep lake levels stable. Requests that any flow changes to lake operations be shared with the Carroll County floodplain administrator – Carroll County Area Plan Commission				✓	✓							
Will the data collected for the study affect Indiana DNR, Division of Water or FIRM maps? – Carroll County Area Plan Commission		✓			✓							
Water supply issues with regard to the cost of accessing water at USACE facilities – Kentucky Infrastructure Authority	✓							✓				

Issues	Scope of Issues: Basin	Sub-basin	Watershed	Project/Local	USACE Business Lines (Missions): Flood Risk Reduction	Navigation	Ecosystem Restoration	Water Supply	Environmental Infrastructure	Hydropower	Recreation	Other
Concerned about water quality in rivers and streams – Kentucky Infrastructure Authority	✓											✓ WQ
Opportunity to improve GIS database of water and wastewater infrastructure and accuracy of existing data – Kentucky Infrastructure Authority				✓					✓			
Boat ramps and public access to the basin waterways is an issue with boaters and fishermen, economic analysis of ramp closures and ramp needs should be done – KYDF&WR	✓										✓	
Minimum flow requirements below dams – KYDF&WR	✓						✓					
Modification of operations and discharges to modify winter pool levels for fisheries resources – KYDF&WR				✓			✓					
Restricted access below dams on tributary streams and rivers; restriction distances have been based upon Ohio River L&D projects and may not apply in tributaries – KYDF&WR				✓							✓	
Low head dams on tributaries in the basin generate public safety issues, fisheries impacts (migration passage & fish assemblages), and public concerns for failing infrastructure – KYDF&WR			✓				✓				✓	
Threats to the aquatic habitat in the basin and the need for USACE to become more engaged with National Fish Habitat Initiative Partners: some needed projects may be on USACE-owned land and at reservoirs – KYDF&WR	✓						✓					
USACE reservoirs have physically degraded tributaries that add to the sediment loading in the lake and impairment of the stream habitat on project lands – KYDF&WR				✓			✓					✓ WQ

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Aquatic nuisance species (exotic/invasive aquatic plants) threaten USACE and other non-Federal impoundments – KYDF&WR				✓			✓					
Limited recreation access to USACE dams with hydropower hampers fishing opportunities and needs for ADA access to USACE facilities along the Ohio River – KYDF&WR	✓					✓				✓	✓	
A plan or list of potential funding partners and funding sources needs to incorporated into the recon report – KYDF&WR	✓											✓ PLAN
USACE cost sharing match rates are too high for restoration activities (i.e., Ohio River Mainstem Study restoration needs) – KYDF&WR	✓						✓					
Flow modeling needed to support habitat improvements along the Ohio River and major tributaries – KYDF&WR	✓						✓					
Fleeting operations permitted by USACE have potential negative effects on mussel beds, current permitting is based on biological assessments and mussel surveys funded by fleeting companies – KYDF&WR	✓					✓	✓					✓ REG
Outdated data and information on mussel beds in the Ohio River and major navigable tributaries being used to make decisions by USACE regulatory offices, resource agencies and private industries using the river – KYDF&WR	✓					✓	✓					
Lack of pre-identified habitat improvement projects and pre-determined (or programmatic) partnership requirements (including funding commitments) on USACE property that has been leased to state natural resources for wildlife management areas and is encumbered by NEPA requirements and USACE program processing. Reduces opportunities for successful partnering on projects – KYDF&WR				✓			✓					

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
City floodwall and levee needing rehabilitation (trees growing on earthen levee) and municipality without sufficient funds to comply (in debt due to EPA unfunded mandates) now with new mandates to repair protection system – Brookport, IL.				✓	✓							
Surface and subsurface water pollution affecting quality of drinking water supplies – City of Tipp City, OH				✓				✓				✓ WQ
Sedimentation and nutrient loading from watersheds leading to eutrophication and reduced storage capacity – ODNR			✓									✓ WQ
Aging and deteriorating dams requiring repair and maintenance – ODNR				✓	✓							
Water level management practices that compromise sport fishing opportunities by reduced retention of sport fish in reservoirs (emigration via dam outflows), reduce compromise recruitment of naturally spawning fishes, reduce littoral cover, reduce littoral areas for fishing opportunities, negatively impact food web interactions – ODNR	✓						✓				✓	
Effects of changing land use on the flow and water quality of headwater streams – KDNRDMP			✓									✓ WQ
Opportunities for data sharing at the HUC 12 watershed level – KDNRDMP			✓									✓ IM
Coordination of water quality data collection and storage efforts – KDNRDMP	✓											✓ WQ
Improvements in user-friendly GIS capabilities and increased availability of efficient, timely, online data summaries and reports – KDNRDMP	✓											✓ GIS
Water quality credit trading – Gallia S&W CD	✓											✓ WQ
Erosion – Gallia S&W CD	✓											✓ ERO
Floodplain development – Gallia S&W CD	✓				✓							

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Funding for upgrading pump stations built in the 1940s and 1950s – New Boston, OH				✓	✓							
Siltation across the entire basin increasing – how to keep soil on the properties where it originates and keep the water on individual properties to avoid flash flooding and enhance round water supplies – Cumberland River Compact	✓				✓			✓				
How to get more stakeholders involved and educated about the process and volunteer – Cumberland River Compact	✓											✓ COMM
Request permission to encapsulate a concrete trough being used to store and pump stormwater from Wellsville into the Ohio River – Columbiana County Port Authority.				✓	✓							
Inquiry about what the planning is about, referred to web site – ODNR	✓											✓ PLAN
Flooding damages from Canoe Creek/Green River in City of Henderson and Henderson County, Kentucky, requesting assistance through the Section 205 program – City of Henderson			✓		✓							
Concerns for water supply – ADEM (regulatory responsibility for NPDES and TMDL in Tennessee River basin in AL)		✓						✓				✓ WQ
Concerns for water quality – ADEM	✓											✓ WQ
Concerns for river flows associated with hydropower and navigation – ADEM	✓					✓				✓		
Concerns for hydrologic data availability – ADEM	✓											✓ IM
Concerns for changes in system operations – ADEM		✓										✓
Concerns for conflicts between recreation boaters and the navigation industry – Life on the Water Magazine	✓					✓					✓	

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Opportunities for waterway tourism as a source of revenues for waterfront communities – life on the water magazine	✓					✓					✓	
Education of recreation boaters about the towing industry – Life on the water magazine						✓					✓	
Flooding in the headwaters of the Great Miami River, need relief in form of reservoir, dikes or dams to control flooding – Village of Russells Point, OH		✓			✓							
Indian Lake spillway failure would threaten residences downstream in Logan County, OH – Village of Russells Point, OH				✓	✓							
Will the study include tributaries of the Ohio River like the Great Miami – Village of Russells Point, OH		✓			✓							✓ PLAN
Concerns for the decertified Karnak Levee due to lack of maintenance of a drainage structure and flows threaten Cairo, IL and the MR&T levee system – IDNR				✓	✓							
Concerns for the Old Shawneetown Levee that was overtopped leading to buyouts in Old Shawneetown but not all purchased leading to limited maintenance of the existing levee and the need for upgrades to the levee – IDNR				✓	✓							
Concerns for the Brookport Levee because the city of Brookport economic conditions aren't sufficient to finance maintenance of the levee which is experiencing some deterioration of drainage structures through the embankment that result in interior evacuations when levee failures appear imminent – IDNR				✓	✓							
Concerns for flooding at the confluence of the Ohio River/Wabash River/Saline River floodplains in Gallatin County leading to failure of several agriculture levees and flooding of homes and facilities – IDNR				✓	✓							

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Concerns for the condition of and deficiencies in levees with respect to potential climate change effects of high flows and stages – IDNR				✓	✓							
Concerns for long term funding of streamgage data, lack of data on stream flows, needs for LiDAR DEMs for emergency response and floodplain mapping in Illinois – IDNR		✓			✓							
An assessment of the current levee risks would greatly benefit state of Illinois and be used for Ohio River hazard Mitigation Plan for the state to assist in certification and accreditation of levees – IDNR		✓			✓							
Issues of erosion, sedimentation and both point and non-point pollution sources affecting water quality in the Cumberland basin – Cumberland River Compact (CRC).		✓					✓					✓ WQ
Opportunity to work jointly on a Tennessee-Cumberland River Basin Study for infrastructure, watershed ecology, impaired waters, and objective historical measurements of river health, flows and supply – CRC		✓					✓		✓			
Identifying and working on Section 205 and Section 14 projects in the Cumberland basin – CRC				✓	✓							
Opportunity to link to CRC and ORB web sites to share information – CRC	✓											✓ IM
Building a common database from the ORBCS with links to the CRC web site – CRC	✓											✓ IM
Willing to participate in upcoming meetings on the ORBCS – CRC		✓										✓ COMM
Loss of riparian zone habitat due to residential development effects (stone slope protection) requires regulations or manual for responsible riparian land ownership.	✓						✓					
Funding upkeep, demo or construction of monitoring stations for water quality for ORSANCO and TVA 305b reports	✓						✓					✓ WQ

Issues	Scope of Issues: Basin	Sub-basin	Watershed	Project/Local	USACE Business Lines (Missions): Flood Risk Reduction	Navigation	Ecosystem Restoration	Water Supply	Environmental Infrastructure	Hydropower	Recreation	Other
Air and water quality impact study on reduction of coal-fired power plants and increase of nuclear power plants		✓					✓					
River basin plans and watershed plans too generic in nature	✓											✓ PLAN
Encourage state (TN?) to use consistent data collection to support how water quality supports aquatic life – avoid exclusion of some data.		✓					✓					
Stricter regulatory legislation on water use by utility districts in TN and states dependent on TN for water.		✓						✓				
Impact study needed on air quality and water quality in rivers downstream of mining operations		✓					✓					✓ WQ
Enforce laws related to development along waterways	✓											✓ REG
Coal-related fly ash clean up needed	✓						✓					✓ WQ
Issues of concern include riparian areas, water quality, watershed connectivity, hydrologic conditions (ecosystem flows), sediment, physical habitat and non-native aquatic nuisance species.	✓						✓					
Fish habitat subject to many stressors including modified hydrologic regimes, excessive nutrient input, degraded water quality, urbanization, habitat loss due to reservoir aging, eutrophication, erosion and siltation, exotic nuisance species and climate change	✓						✓					
Issues of water quantity and water quality due to increasing human demands and threat of climate change	✓							✓				
Need for watershed planning for future conservation of fish and wildlife resources in the basin			✓				✓					

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Water quality degradation from runoff of land use conversion and CSOs	✓						✓					✓ WQ
Water quality effects on T&E species (esp. mussels)		✓					✓					✓ WQ
Water quality degradation from pharmaceuticals, bacteria, pesticides, nutrient loading and sedimentation.	✓						✓					✓ WQ
Impacts of existing and future hydropower facilities on fish and wildlife resources			✓							✓		
Prevention and control of aquatic and terrestrial invasive species	✓						✓					
Invasive species effects on indigenous aquatic and terrestrial species in basin	✓						✓					
Bank erosion on rivers and lakes due to flow regulation at reservoirs and navigation locks and dams				✓			✓					✓ WQ
Terrestrial and aquatic ecosystem restoration opportunities	✓						✓					
Environmental contaminant spill response and remediation	✓						✓					✓ WQ
Sufficiency of water supplies in view of projected population increases and potential climate change.	✓							✓				
Lack of ecological connectivity between the rivers and floodplains and effects on riparian and aquatic species		✓					✓					
Poor structural condition of navigation locks present an impediment to waterborne goods movement				✓		✓						
Inadequate lock chamber capacities present an impediment to waterborne goods movement				✓		✓						

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Need to maintain/improve road/rail connections between the Ohio River, private and public port facilities and rail and highway networks to increase use of the inland waterways	✓					✓						
Need improved/revised floodplain information to determine potential exposure of current and future populations and planned highway and railway infrastructure to flood hazards.	✓				✓							
Inundation of CSO outfalls by Markland L&D navigation pool that exacerbate CSO effects.				✓		✓			✓			
Requests planning assistance and participation by ACOE in design and implementation of CSO reduction efforts.				✓					✓			
Requests continuing engagement by the ACOE in the Lick Run Aquatic Restoration project for flood control, recreation and ecosystem restoration.				✓			✓					
Requests ACOE assistance through a watershed approach to address stormwater flows in the West Fork Mill Creek as the MSDGC separates combined sewer and stormwater flows in CSO project.				✓					✓			
MSDGC interested in ACOE evaluation of a dual purpose tunnel that would address stormwater problems in the Sharonville and Evendale communities.				✓					✓			
Engineering practices that under-estimate actual rainfall rates and convey water to nearest stream – no ground water recharge		✓			✓							
Development practices that do not consider the value and function of natural infrastructure – soils, wetlands, etc.	✓						✓					✓

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
State laws that have unintentionally limited stormwater management techniques for local codes		✓			✓							✓ STRMWTR
State laws that do not carefully define local government and landowner roles in stream maintenance and protection		✓					✓					✓
State enforcement of water quality and quantity regulations that do not discourage violations		✓					✓					✓ WQ
Uncertainty and gaps in divisions of state, county and municipal enforcement arms		✓										✓
Gaps and delays in providing aid to flood victims and lack of economic comparison between payments and better stormwater management practices	✓				✓							✓ STRMWTR
Ongoing protocols and practices that thwart innovation and use of more efficient and eco-friendly stormwater practices.		✓			✓							✓ STRMWTR
Lack of well-defined and simplified stormwater management guidelines and process steps for planners, engineers, etc.				✓	✓							✓ STRMWTR
Lack of community education about stormwater planning and management strategies, methods and techniques				✓	✓							✓ STRMWTR
Issues of bank erosion along the Cumberland River due to operation of dams and reservoirs causing loss of private property, trees, powerlines, riparian zone (dysfunctional) and farmland and affecting water quality, aquatic habitat, reservoir longevity and eutrophication.		✓					✓					✓ WQ

Issues	Scope of Issues				USACE Business Lines (Missions)							
	Basin	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
Issue is floatable debris in waterways especially bottles, cans and other debris being thrown into waterways from perspective of a boater and environmentally conscience citizen. Thinks that a "bottle bill" (nickel deposit on bottles and cans) in TN would help.		✓									✓	✓ WQ
Issue is river banks washing away and suggests that riprap may be one solution.	✓						✓					
Concerns about dam safety and ongoing generation of hydroelectric power being endangered by too much concern over mussels and "saber-tooth tigers" (T&E species vs Hydro issue).		✓					✓			✓		
Kentucky Lake area lack of enforcement of floodable property for private development with septic systems that are flooded frequently (extended period of time) and thus pollute the river.				✓								✓ WQ
Issue is the built environment and lack of gray-water infrastructure to reduce load on storm/sewer system in Pittsburgh.		✓							✓			
Issue is water quality with respect to pharmaceuticals, pesticides contamination and runoff.	✓											✓ WQ
Issue is wetlands preservation, stormwater management and drinking water shortages in some areas, and capacity to store and share water.		✓					✓					
Erosion of Old Hickory Lake and destruction of islands (tree loss) in the lake by bird life. Asked TWRA to help. Is there a plan to protect the islands?				✓			✓					
Runoff erosion from Center Hill Dam construction into the Caney River rising temperatures and affecting trout habitat.			✓				✓					✓ WQ

	Scope of Issues				USACE Business Lines (Missions)							
Issues	*Basin*	*Sub-basin*	*Watershed*	*Project/Local*	*Flood Risk Reduction*	*Navigation*	*Ecosystem Restoration*	*Water Supply*	*Environmental Infrastructure*	*Hydropower*	*Recreation*	*Other*
USACE and TVA failure to keep summer lake levels (lake levels being lower) that are conducive to boaters and tourism despite years of public requests and promises by both agencies to compromise.				✓							✓	
Determination of ownership and control of debris on the Ohio River in the form of rusting and discarded barges, loading facilities, boats and junk affecting commercial navigation, hydropower, dams, visual quality and other facilities on the river. Who can remove this debris?	✓					✓						
Resident of Brookport, Illinois concerned about rundown condition of the floodwall protecting the city and the limited funding capability of the city to maintain the structure…also concerned that much of the city is now being declare to be in the floodplain due to loss of certification.				✓	✓							
Navigation on the Ohio River should include opportunities for transportation cost savings associated with container-on-barge movements between such points as Weirton, WV and NOLA or Brownsville, TX. Should be studies of this opportunity. Included copy of University of Michigan study on subject.	✓					✓						

APPENDIX D – FRAMEWORK FOR USACE FRR INFRASTRUCTURE REINVESTMENT STRATEGY

1. GENERAL CONCEPTS

As discussed in the report sections above, the needs for USACE-operated FDR facilities repair and rehabilitation across the entire basin are monumental in scope and cost. Efforts underway to address the DSAC Is and IIs are proceeding on a project-by-project schedule as Federal funds are provided. Whether conducted on a project-by-project basis or as a component-based strategy for reducing risks, this work is of paramount importance to USACE and those living downstream of or within the protection limits of these facilities.

Other than emergency repairs conducted under PL 84-99 for local protection projects as a direct result of flood damages, there has not been a strategic program instituted at this time to engage in repair or major rehabilitation of local protection projects operated by non-Federal sponsors. As past Congressional legislation and Federal policy have placed those OMRR&R responsibilities upon the non-Federal sponsor for local protection projects, any opportunities to address non-emergency related rehabilitation needs at those projects would require adjustments in law and policy. Despite the legal and policy foundation of non-Federal OMRR&R of local protection projects, the reality of the limited fiscal and technical resources of non-Federal sponsors to maintain these complex structures may cast doubts on the safety of these structures in the future.

As a part of this reconnaissance study (not necessarily a requirement of the 905(b) format), a preliminary framework for a basin-wide reinvestment strategy has been developed that may open up the agency and public discourse about the needs for wise investment in the aging components of the basin FDR system. Those aspects of the reinvestment strategy are shown below in outline form:

2. FRAMEWORK FOR A BASIN INFRASTRUCTURE STRATEGIC REINVESTMENT PLAN

a. Systems Assessment Methodology
b. Risk–informed approach to reinvestment
c. Asset management
    i. Use Asset Management Principles in reinvestment strategy development
    ii. Assessment of existing conditions/reliability at facilities
    iii. Consequences of unsatisfactory performance
    iv. Budgetary limitations (resource constrained) – using risk informed approach to establish rehabilitation and maintenance priorities.
d. Goals and Objectives of a Reinvestment Program
    i. Goal – Protect human safety and health

1. Reduce annual loss of life and property damage as a result of flooding

ii. Goal – Prolong safe and reliable operation of existing infrastructure
   1. Reduce risks to property and infrastructure,
   2. Reduce potential of catastrophic infrastructure failures, and
   3. Reduce rate of increase in future O&M costs.

e. Key Assumptions
   i. Continuing Federal Interest in FDR at all justifiable structures, and
   ii. Changes in authorized project purposes will require Congressional action.
   iii. Changes in traditional methods of project justification are anticipated reflecting language contained in WRDA 07
   iv. Competing stakeholder views of authorized project purposes
   v. All benefits generated by projects are not commensurable

f. Key Constraints
   i. Limited reinvestment funding at all levels
   ii. Various environmental and regulatory limitations.
   iii. Existing contractual or interagency agreements.

Preparation of a Basinwide Infrastructure Reinvestment Plan identified as Alternative REHAB.1 in the main report would allow water resources planners to work closely with stakeholders, the public and other agencies to determine the critical needs of aging infrastructure, to prioritize those needs and to map a strategy for addressing those needs within present fiscal constraints. Other structural and nonstructural options to rehabilitation of the existing infrastructure would be a large part of the reinvestment plan.

APPENDIX E – COMMUNICATIONS PLAN AND ACTIVITIES

1. COMMUNICATION PLAN – PUBLIC INVOLVEMENT PROCESS

The Ohio River Basin Comprehensive (ORBC) Reconnaissance Study is a multi-faceted watershed approach to planning. The study covers a large area and diverse population so it was important to develop a communication plan that targets all sectors of the population. To ensure maximum public participation and to build consensus in this important planning study, clarity and consistency both internally and externally was key. A number of key points regarding the basin and the study process were developed by the team to support District members at meetings, Congressional visits and internal USACE briefings. Internal communication was also vital as the ORBC planning effort was likewise being coordinated among four USACE districts (over 40 members in the PDT). For that purpose a SharePoint site was established for access by all of the USACE team members and other coordinating USACE personnel. For security reasons, the SharePoint site was not made available to the general public during the study period.

Since the scale of this planning effort is so large a number of public relations tools were used to communicate with the public, provide information on the progress of the study, and generate public input into the project in an effort to develop consensus and direction. These tools focused on awareness and engaging input and included:

- Press Releases
- Direct Mailings
- Website
- Feedback Forms
- Presentations at Stakeholder meetings
- Partnering Meetings

An initial press release was distributed to numerous media throughout the basin. A copy of the press release released by the Louisville District is included below. The Communications Team began their strategic communication plan for educating the stakeholders and to solicit their input on the direction and emphasis of the study by developing a list of strategic stakeholders, customers, state and federal agencies, and congressional interests within the Ohio River Basin. This involved including compiling existing lists (sponsors and key stakeholders) possessed by each USACE district and researching other stakeholders that might not have previously included. After developing this list the team prioritized the list by those needing to be personally met with on a one-on-one basis at partnering meetings, those to whom individual letters would be sent to and those to who emails or other communications would be directed. The list was divided into geographical areas and partnering sessions were set up to educate our stakeholders, identify issues, problems, and opportunities in a collaborative effort.

An effective means of participating in partnering meetings was identifying existing stakeholder meetings through out the watershed that were already scheduled. The Communication Team managed to participate and make presentations at many of these meetings. In a six month period the ORBC Communication Team participated and made

US Army Corps
of Engineers

News Release

Public Affairs Office
PO Box 59
Louisville, KY 40201

FOR IMMEDIATE RELEASE
July 8, 2009

Contact:Carol Labashosky
(502) 315-6769 or
Todd Hornback (502) 315-6768

Army Corps of Engineers solicits input on new Ohio River Basin Comprehensive Study

Huntington, W. Va. — The U.S. Army Corps of Engineers is conducting a reconnaissance study of the Ohio River Basin, including the Cumberland and Tennessee River basins. Using a collaborative watershed approach, the study will identify current and future water resource issues within the basin.

"The study enables the Corps along with other organizations to collectively identify the most pressing problems and future water resource needs while collaborating," said S. Michael Worley, project manager, Huntington District, W. Va.

The Corps is seeking input from local, state and federal agencies on their most pressing water resource priorities for the future. The Corps encourages input from environmental non-profit agencies and groups

All water resources categories are being considered including:

- Flood Damage Reduction
- Environmental Degradation/Ecosystem Restoration/Fish and Wildlife Habitat
- Water Supply/Water Quality
- Hydropower
- Navigation

Water resources issues being considered include:

- Existing aging water resources infrastructure ranging from small flood reduction projects to large reservoirs

Products of the study include:

- GIS database of existing water resources projects in the study area
- Web site for information exchange and collaboration with stakeholders
- Report including identification of the greatest water resources problems, needs and opportunities
- Formulating a framework to establish a collaborative partnership to champion the water resource issues in the basin

Potential outcomes of the study are:

- Recommendations for planning to develop solutions to problems and needs
- Basin-wide water management plan and reinvestment strategy
- Formation of multi-state Ohio River Basin collaborative partnership

The study is expected to be completed in December 2009 with a draft report available through the website for public comment at the end of October 2009. The preliminary information gathering phase is underway. The Corps requests interested parties to provide input by September 30, 2009 through the study web site at: http://www.orboutreach.com/ For information contact project manager S Michael Worley 304-399-5802, Huntington, W.Va. In Louisville, Ky., Ms. Sharon Bond 502-315-6857 or Mr. Roger Setters 502-315-6891.

presentations in over 35 stakeholder meetings spanning the entire the watershed, covering seven states including three national meetings. A standard ORBC presentation was developed by the team to utilize at each meeting. This ensured that the same consistent message was being communicated throughout the entire watershed. Accompany each presentation were details regarding the ORBC Website and a link.

2. STUDY WEB SITE

The dotcom website (www.orbouteach.com) managed by a USACE consultant proved to be a useful and efficient means of conveying the ORBC planning effort across the entire watershed. In addition to facilitating user feedback on basin issues and concerns through an easy-to-use email-form, the web site was filled with pertinent information on the Ohio River Basin; USACE study processes and project and funding authorities as well as listings of the top issues being received from the public and stakeholders. In order for the public to determine their location within or outside of the basin boundary and simple geographic locator-system using Google maps was incorporated into the web site. During a six-month time frame over 800 hits were received on the website. Figure 1 shows the home page of the web site.

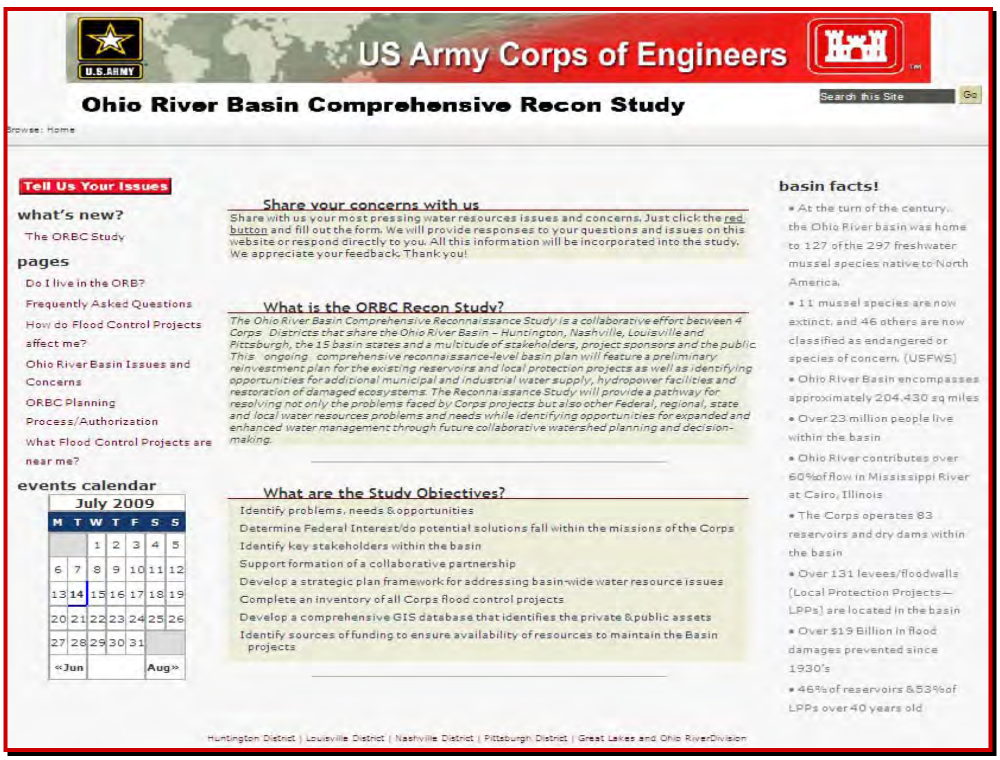


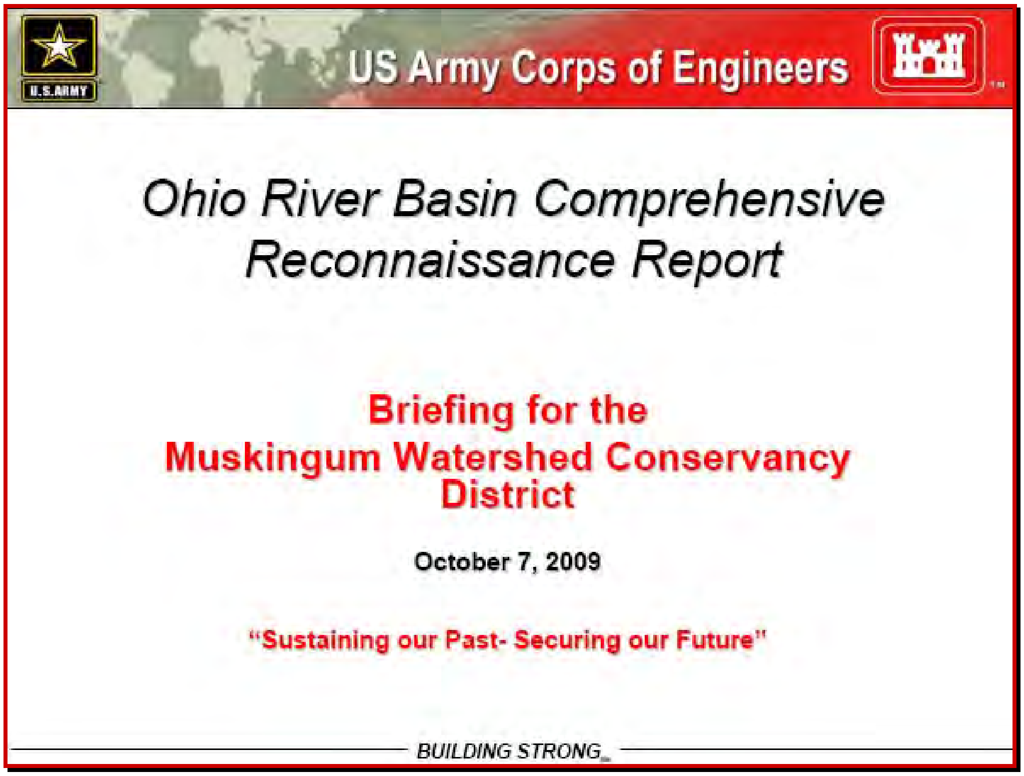
Figure 1 – Ohio River Basin Study Web Site Homepage

Comments received from concerned public and stakeholders through the various communication methods mentioned above have been incorporated into the study and alternatives to address the issues were formulated in view of the many comments. A comprehensive listing of the comments is included in the Appendices of the report.

3. OHIO RIVER BASIN PRODUCT DELIVERY TEAM SPEAKING ENGAGEMENTS

Date	Event	Place
June 2009		
2	American Heritage River Alliance National Meeting	Washington DC
05	TNC USACE Partnership Meeting	Roanoke, WV
11	TN Nature Conservancy	Nashville, TN
20	Cumberland River Compact Summer Board Meeting	Nashville, TN
26	Alabama Stakeholders' Briefing	Florence, AL
27	Briefing for stakeholders	Nashville, TN
July 2009		
1	State of Tennessee Partnering Meeting	Nashville, TN
10	New River Community Partners Quarterly Meeting	Hinton, WV
20	Ohio River Basin Fish Habitat Partnership Collaboration Meeting	Cincinnati, OH
August 2009		
2	Brown Bag Luncheon for employees	Nashville District
3	Cumberland Region Tomorrow	Nashville, TN
4	WV & OH USF&WS Partnering Meeting	Williamstown, WV
6	USF&WS Statewide Meeting	Columbus, OH
7	WVDNR	South Charleston, WV
11	Inland Water Users Board Meeting	Paducah, KY
13	Operations Manager/Functional Chief Briefing	Nashville, TN
13	Water Sustainability Workshop	Cincinnati, OH
26–27	Ohio Flood Plain Managers Conference	Columbus, OH
25–27	TN TOM Development Opportunity Conference	Pt. Clear, FL
26	Cincinnati and Hamilton Co., MSD	Cincinnati, OH
31	Indiana Corn & Soybean Growers Assoc Mtg.	Louisville, KY
September 2009		
4	Mtg with Terry Cooke, Director, KY TNC	Louisville, KY
17	TEAM Cumberland Meeting	Nashville, TN
23	LDP Briefing	Gatlinburg, TN
25	National Waterways Conference	Charleston, WV
October 2009		
7	Muskingum Conservancy District Partnering	Cincinnati, OH
8–9	Ohio River Basin Summit	Cincinnati, OH
14	Monongahela River Recreational User Group	Point Marion, PA
14	Tri-Agency Meeting (USGA, NWS, USACE)	Wilmington, OH
18–20	Ohio River Basin Consortium for Research & Education Symposium (Hanover College)	Hanover, IN
19–20	Tennessee River Valley Authority Fall Mtg	Chattanooga, TN
20–23	National Assoc of Floodplain Mgrs Mtg	Colorado Springs, CO
26–29	The Nature Conservancy/USACE Partnering Mtg	Stevenson, WA
27	Commonwealth of KY/Corps Partnering Meeting	
29–30	Southeastern Water Trails Forum	Chattanooga, TN

4. POWERPOINT PRESENTATIONS


U.S. ARMY
US Army Corps of Engineers
Ohio River Basin Comprehensive
Reconnaissance Report
Briefing for the
Muskingum Watershed Conservancy
District
October 7, 2009
"Sustaining our Past- Securing our Future"
BUILDING STRONG


U.S. ARMY
US Army Corps of Engineers
Ohio River Basin Comprehensive
Reconnaissance Report
Briefing for the
Ohio River Basin Summit
October 8, 2009
"Sustaining our Past- Securing our Future"
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U.S. ARMY
US Army Corps of Engineers
Ohio River Basin Comprehensive
Reconnaissance Report
Briefing for the
Tri-Agency Meeting of
NWS/USGS/Corps
October 14, 2009
"Sustaining our Past- Securing our Future"
BUILDING STRONG


U.S. ARMY
US Army Corps of Engineers
Ohio River Basin Comprehensive
Reconnaissance Report
National Association of Flood and
Stormwater Management
Agencies
October 21, 2009
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APPENDIX F – USACE INVENTORY OF PROJECTS

This Appendix is dedicated to the documentation and display of the Corps of Engineers constructed facilities for flood risk reduction including all reservoirs (single and multiple purpose structures) and local protection projects (LPPs) including levees floodwalls, channels and diversions and combinations of structures that may be operated by non-Federal sponsors.

The two figures below (pie-charts) provide a graphic presentation of the ages of the basin's flood risk reduction structures. Figure 2 shows the ages of multi-purpose reservoir projects (in particular the dam and appurtenances) and Figure 3 shows the ages of local protection projects (floodwalls and levees – LPPs). In both cases, the charts show that a high percentage of the flood risk reduction structures are older than 30 years (80% of dams and 69% of LPPs) and a significant number are older than 50 years (33% of dams and 29% of LPPs). The concerns raised by many stakeholders for rehabilitation of these aging protective structures are evident in these figures.

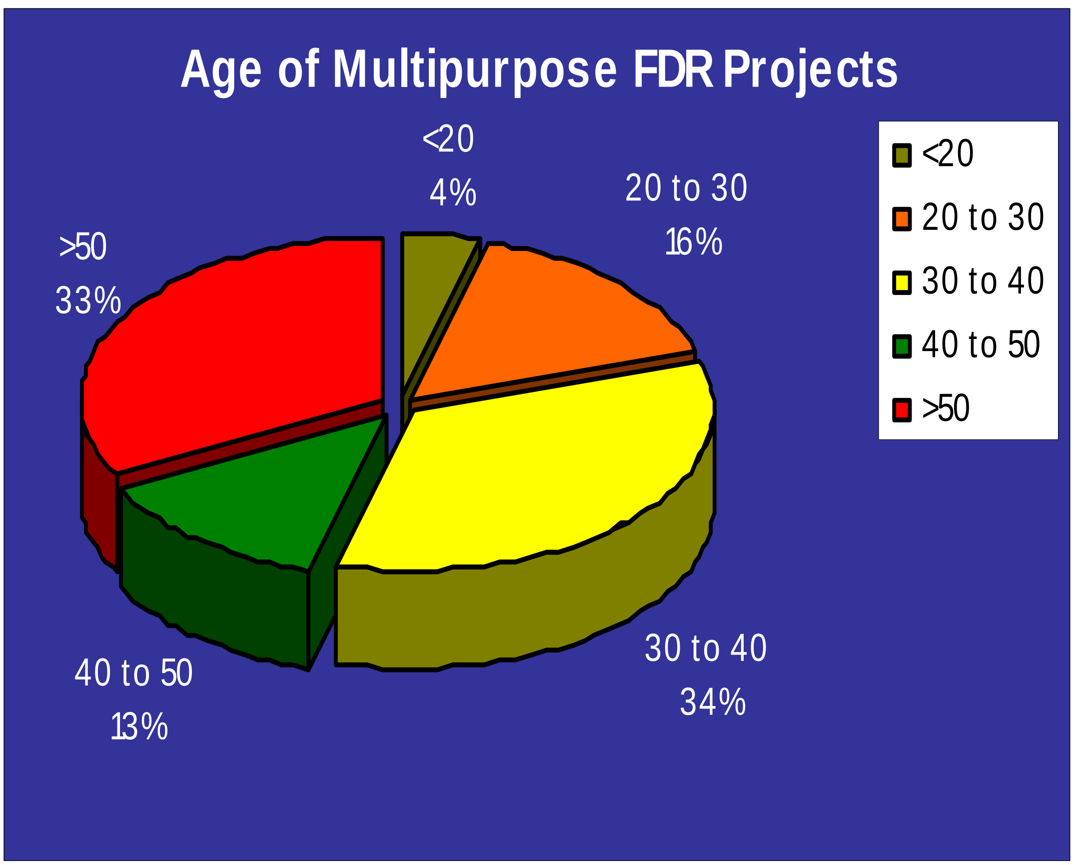


Figure 2 – Age of Multi-purpose Flood Risk Reduction Projects (Dams)

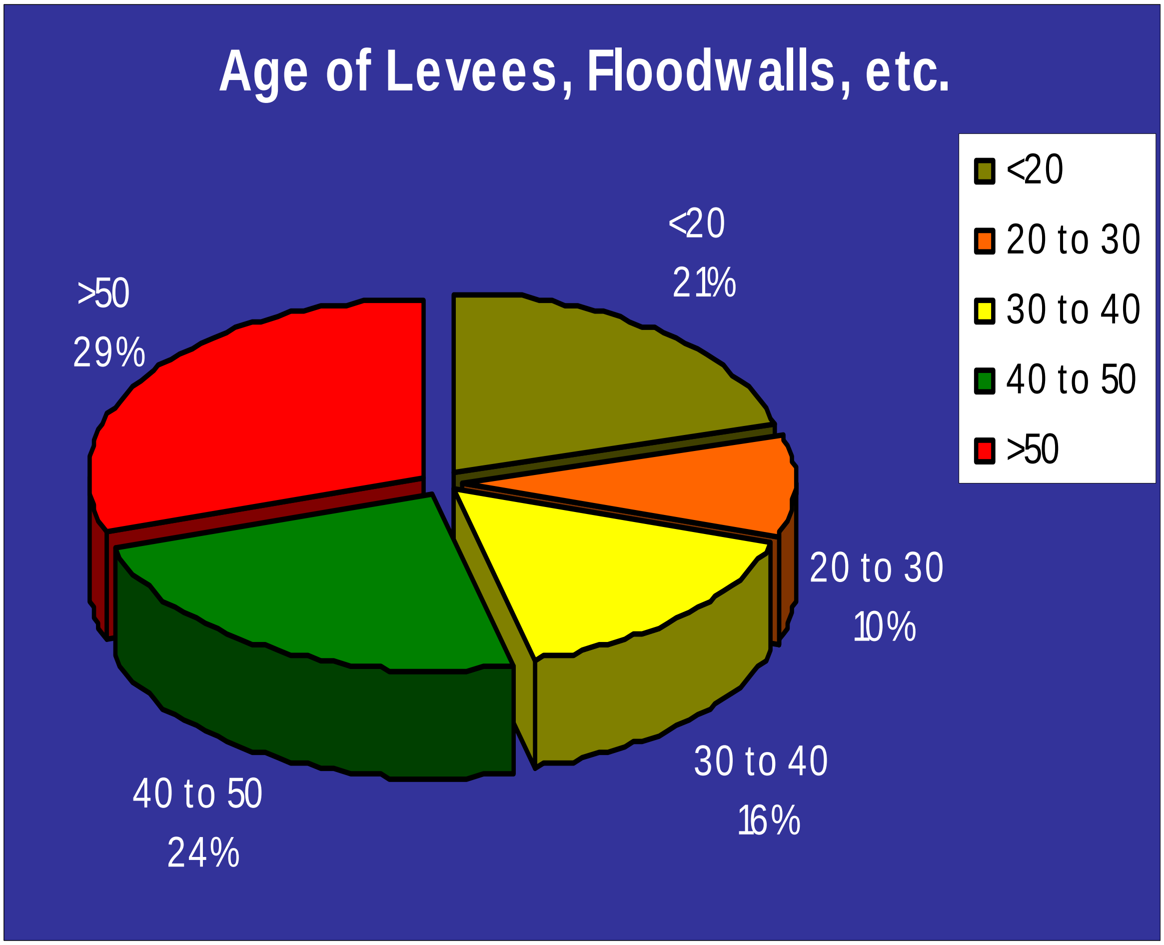


Figure 3 – Age of Local Protection Projects (Levees and Floodwalls)

Information for each flood risk reduction structure is presented in the following tables for general use and understanding of the level of commitment that has been and continues to be made by the Federal government in reducing flood risks. Maps of the sub-basins in Appendix I show the approximate locations of each of these structures. The various authorized purposes for each project are shown in the table as well as the amounts of authorized storage (for multi-purpose structures) dedicated to various purposes in the reservoirs.

Table 7 – USACE Inventory of Flood Risk Reduction Projects – Single and Multi-purpose Dams

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Alum Creek Lake	OH	Delaware	05060001	Y	8442	3387	2936890	Y	N	N	123	879,588	4,235,000.00	01-Aug-74
Atwood Lake	OH	Tuscarawas	05040001	Y	109	1540	1265011	N	N	N	70	56,714	1,034,000.00	01-Sep-36
Barren River Lake	KY	Allen	05110002	Y	24667	10000	1400000	Y	N	Y	940	2,202,141	6,232,000.00	01-Oct-64
Beach City Lake	OH	Tuscarawas	05040001	Y	224	420	231180	N	N	N	300	66,997	5,604,000.00	01-Sep-36
Beech Fork Lake	WV	Wayne	05090102	Y	12610	720	1121743	N	N	N	78	1,031,028	659,000.00	01-Jan-78
Berlin Lake	OH	Portage	05030103	Y	7900	3590	556064	Y	N	Y	249	2,789,295	40,086,200.00	01-Jul-43
Bluestone Lake	WV	Summers	05050002	Y	21931	2040	1967205	N	N	N	4565	2,671,675	34,509,000.00	01-Apr-49
Bolivar Lake	OH	Tuscarawas	05040001	N	713	0	481312	N	N	N	504	77,884	3,645,000.00	01-Sep-38
Brookville Lake	IN	Franklin	05080003	Y	17337	5260	593000	Y	N	Y	379	668,887	1,532,000.00	01-Jan-74
Buckhorn Lake	KY	Perry	05100202	Y	5876	1230	264000	N	N	N	408	1,458,692	13,000.00	01-Dec-61
Burnsville Lake	WV	Braxton	05030203	Y	13224	968	656944	N	N	N	165	1,589,960	4,366,000.00	01-Jan-76
Burr Oak Lake (Tom Jenkins Dam)	OH	Athens	05030204	Y	99	0	47573	Y	N	N	33	392,877	455,000.00	01-Feb-50
C. J. Brown Lake	OH	Clark	0508001	Y	4253	2120	1000000	N	N	N	82	918,895	515,000.00	02-Jan-74
Caesar Creek Lake	OH	Warren	05090202	Y	11900	2830	80000	Y	N	Y	237	1,634,014	41,790,000.00	01-Jan-78
Cagles Mill Lake	IN	Putnam	05120203	Y	7259	1462	467000	N	N	N	295	732,035	27,931,000.00	01-Jun-53

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Carr Creek Lake	KY	Knott	05100201	Y	3906	710	690000	Y	N	Y	58	2,067,250	19,000.00	02-Jan-76
Cave Run Lake	KY	Bath	05100101	Y	22524	8270	404000	Y	N	Y	826	925,095	5,192,000.00	01-Jun-84
Cecil Harden Lake	IN	Parke	05120108	Y	5262	2060	1100000	N	N	N	216	821,687	22,450,000.00	01-Jul-60
Center Hill Lake	TN	DeKalb	05130108	Y	39079	14590	3311350	Y	Y	N	2195	5,577,004	5,474,000.00	01-Nov-48
Charles Mill Lake	OH	Ashland	05040002	Y	111	0	1111915	N	N	N	215	53,959	2,013,000.00	31-Aug-36
Cheatham Lake	TN	Cheatham and Dickson	05130205	Y	10725	5630	2336667	Y	Y	N	14160	5,525,359	0.00	12-Dec-52
Clendening Lake	OH	Harrison	05040001	Y	87	0	249508	N	N	N	69	50,113	925,000.00	01-Jun-36
Conemaugh River Lake	PA	Indiana	05010007	Y	8100	900	100575	N	Y	Y	1351	1,003,019	89,984,600.00	01-Dec-52
Cordell Hull Reservoir	TN	Smith	05130106	Y	31625	11960	2388224	Y	Y	N	8096	4,608,643	0.00	04-Oct-70
Crooked Creek Lake	PA	Armstrong	05010006	N	2600	550	328002	N	N	Y	277	1,343,300	23,182,352.00	01-Jul-40
Dale Hollow Lake	TN	Clay	05130105	Y	52551	21880	3418005	Y	Y	N	935	4,969,736	2,735,000.00	01-May-43
Deer Creek Lake	OH	Pickaway	05060002	Y	7223	1277	3725063	N	N	N	227	809,256	1,831,000.00	01-May-68
Delaware Lake	OH	Delaware	05060001	Y	7703	1300	1034658	N	N	N	386	857,344	2,191,000.00	01-Jul-48
Dewey Lake	KY	Floyd	05070203	Y	12437	1100	1640878	N	N	N	206	1,303,976	1,520,000.00	01-Jul-49
Dillon Lake	OH	Muskingum	05040006	Y	7797	1560	1389554	N	N	N	742	1,003,453	12,809,000.00	01-Jul-59

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Dover Dam	OH	Tuscarawas	05040001	N	146	0	244841	N	N	N	1405	101,076	8,270,000.00	01-Nov-38
East Branch Lake	PA	Elk	05010005	Y	1500	1160	211928	N	N	Y	73	1,028,355	5,356,951.00	01-Dec-52
East Lynn Lake	WV	Wayne	05090102	Y	24821	1005	439543	N	N	N	133	1,643,934	2,213,000.00	01-Apr-71
Fishtrap Lake	KY	Pike	05070202	Y	15429	1131	477124	N	N	N	392	1,595,938	15,139,000.00	01-Feb-69
Grayson Lake	KY	Carter	05090104	Y	16980	1510	1091059	Y	N	N	196	1,098,747	2,668,000.00	01-Jan-68
Green River Lake	KY	Taylor	05120108	Y	33793	8210	1200000	Y	N	Y	682	1,995,544	6,485,000.00	01-Jun-69
J. Percy Priest Reservoir	TN	Davidson	05130203	Y	33951	14200	7119513	Y	Y	N	892	3,898,774	4,011,000.00	01-Jan-68
J.E. Roush Lake	IN	Huntington	05120101	Y	12761	900	280000	N	N	N	707	801,650	24,282,000.00	01-Oct-68
John Flannagan Lake	VA	Dickenson	05070202	Y	8273	1145	516453	Y	N	N	221	1,283,478	6,190,000.00	01-Dec-63
Kinzua Dam & Allegheny Reservoir	PA	Warren	05010001	Y	25000	12080	256775	N	Y	Y	2180	1,357,325	58,549,795.00	01-Jan-66
Lake Barkley	KY, TN	Lyon and Livingston	05130205	Y	108963	45210	3144244	Y	Y	N	17598	8,198,308	2,088,000.00	14-Feb-66
Lake Cumberland	KY	Russell	05130103	Y	98830	35820	4446775	Y	Y	N	5789	8,055,162	14,631,000.00	01-Dec-50
Laurel Lake	KY	Laurel, Whitley	05130101	Y	1167	5600	365820	Y	Y	N	282	1,414,678	0.00	01-Jan-74
Leesville Lake	OH	Carroll	05040001	Y	161	0	29719	N	N	N	48	53,009	707,000.00	01-Oct-36
Loyalhanna Lake	PA	Westmoreland	05020006	Y	3400	750	200102	N	N	Y	290	984,308	28,139,120.00	01-Jun-42

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Mahoning Creek Lake	PA	Armstrong	05010006	Y	2600	280	80107	N	N	Y	340	989,354	29,756,640.00	01-Jun-41
Martins Fork	KY	Harlan	05130101	Y	1324	340	199154	N	N	Y	56	0	53,000.00	01-Dec-78
Martins Fork Dam & Lake	KY	Harlan	05130101	Y	1446	274	176626	N	N	N	56	696,271	0.00	01-Dec-78
Michael J. Kirwan Lake	OH	Portage	05030103	Y	6300	2650	190489	N	N	Y	81	797,727	21,595,820.00	01-Nov-66
Mississinewa Lake	IN	Miami	05120103	Y	18497	3180	513000	N	N	Y	809	845,968	47,402,000.00	01-Oct-67
Mohawk Dam	OH	Coshocton	05040003	N	269	0	27367	N	N	N	1504	110,854	13,601,000.00	01-Sep-36
Mohicanville Dam	OH	Ashland	05040002	N	63	0	8085	N	N	N	271	47,597	3,482,000.00	01-Oct-36
Monroe lake	IN	Monroe	05120208	Y	26367	10672	882000	Y	N	Y	441	845,891	4,256,000.00	01-Feb-65
Mosquito Creek Lake	OH	Trumbull	05030103	Y	11400	7850	1002702	Y	N	Y	97	991,931	9,140,722.00	01-Apr-44
Nolin Lake	KY	Edmonson	05110001	Y	17950	5790	2200000	Y	N	Y	703	2,375,195	5,274,000.00	01-Mar-63
North Branch Kokosing River Lake	OH	Knox	05040003	Y	1212	0	251059	N	N	N	45	272,411	0.00	01-May-72
North Fork of Pound River Lake	VA	Wise	05070202	Y	90	154	102529	Y	N	N	17	353,906	360,000.00	01-Jan-66
Old Hickory Lock & Dam	TN	Davidson, Sumner	05130201	Y	34737	19550	8610560	Y	Y	N	11674	7,738,847	0.00	14-Jun-54
Old Hickory Lock & Dam	TN	Davidson, Sumner	05130201	Y	34737	19550	8610560	Y	Y	N	11674	7,738,847	0.00	14-Jun-54

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Paint Creek Lake	OH	Highland	05060003	Y	9614	1190	1177358	Y	N	N	576	800,058	3,292,000.00	01-Jul-73
Paintsville Lake	KY	Johnson	05070203	Y	13236	1139	840992	N	N	N	92	953,813	790,000.00	01-May-84
Patoka lake	IN	Dubois	05120209	Y	26551	8748	601000	Y	N	N	168	798,915	15,418,000.00	01-Aug-80
Piedmont Lake	OH	Harrison	05040001	Y	111	0	150491	N	N	N	86	50,395	707,000.00	01-May-37
Pleasant Hill Lake	OH	Ashland	05040002	Y	64	0	939871	N	N	N	197	60,074	2,666,000.00	01-May-37
R.D. Bailey Lake	WV	Wyoming	05070101	Y	18659	630	351627	N	N	N	540	1,651,018	6,572,000.00	01-Jan-80
Rough River Lake	KY	Grayson	05110004	Y	14497	5100	1600000	Y	N	N	454	4,931,158	14,988,000.00	01-Sep-59
Salamonie Lake	IN	Wabash	05120102	Y	12761	2860	280000	N	N	N	553	679,871	33,527,000.00	01-Sep-66
Senecaville Lake	OH	Guernsey	05040005	Y	138	0	1695700	N	N	N	118	49,923	1,469,000.00	01-Sep-36
Shenango River Lake	PA	Mercer	05030102	Y	14600	3560	572245	N	N	N	589	2,095,817	5,787,250.00	01-May-65
Stonewall Jackson Lake	WV	Lewis	05020002	Y	20800	2630	591108	N	N	Y	102	859,300	10,184,290.00	01-Jun-90
Summersville Lake	WV	Nicholas	05050005	Y	9346	2790	824399	Y	N	N	803	1,647,719	14,710,000.00	01-Mar-66
Sutton Lake	WV	Braxton	05050007	Y	13154	1440	501399	N	N	N	537	1,947,464	7,670,000.00	01-May-60
Tappan Lake	OH	Harrison	05040001	Y	91	0	1319608	N	N	N	71	53,644	1,143,000.00	01-Oct-36

Name	State	County	Watershed	Multi-purpose Lake	Land Acres	Water Acres	Recreation Visits	Water Supply	Hydro-power	Multi-port intakes	Sq Miles Controlled	O&M Costs	Average Annual Damages Prevented	Initial Operation date
Taylorsville Lake	KY	Spencer	05140102	Y	26367	3050	882000	N	N	N	353	891,673	10,546,000.00	01-Jan-83
Tionesta Lake	PA	Forest	05010003	N	2800	600	671540	N	N	Y	478	1,859,543	30,112,247.00	01-Dec-40
Tygart Lake	WV	Taylor	05020001	Y	5600	1740	434875	Y	N	Y	1184	2,105,010	54,391,237.00	01-Feb-38
Union City Lake	PA	Erie	05010004	N	2500	0	31338	N	N	Y	0	219,880	3,662,937.00	01-Sep-71
West Fork of Mill Creek Lake	OH	Hamilton	05090203	Y	1386	181	777000	N	N	N	30	550,021	11,027,000.00	01-Dec-52
William H. Harsha Lake	OH	Clermont	05090202	Y	10691	2120	935000	Y	N	Y	342	933,508	4,672,000.00	01-Feb-79
Wills Creek Lake	OH	Coshocton	05040005	Y	131	0	45975	N	N	N	842	61,341	9,249,000.00	01-Jun-36
Woodcock Creek Lake	PA	Crawford	05010004	Y	1700	333	294861	N	N	Y	46	770,524	1,369,020.00	01-Jul-73
Yatesville Lake	KY	Lawrence	05070204	Y	18516	2242	219447	N	N	N	208	935,297	1,390,000.00	01-Jan-92
Youghiogheny River Lake	PA	Fayette	05020006	Y	3900	2840	538311	N	Y	N	434	2,036,554	25,209,666.00	01-Jan-48
Totals					*1,109,212*	*346,171*	*92,513,710*				*105,723*	*$131,467,893*	*$922,900,847*	

Table 8 – USACE Inventory of Flood Risk Reduction Projects –
Local Protection Projects (Levees, Floodwalls, Channels, and Diversions)

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Ambraw NFL	IL	Lawrence	05120111	N	Y	N	9930	N	N		N	N	Local	0.00
Amsterdam LPP	OH	Jefferson	05030101	N	N	N	4113	Y	N	15-Sep-58	N	N	Village of Amsterdam	89,606.00
Ashland LPP	KY	Boyd	05090103	N	N	Y	14307	N	N	21-Dec-53	Y	Y	City of Ashland	177,000.00
Athens LPP	OH	Athens	05030204	N	N	N	26000	Y	N	01-Sep-71	N	N	Local	2,225,000.00
Barbourville, KY LPP	KY	Knox	05130101	N	N	Y	0	N	N	17-Nov-59	N	N	100% Local	1,536,000.00
Barbourville, KY LPP Section 202	KY	Knox	05130101	N	N	Y	0	N	Y	03-Jun-99	N	N	100% Local	0.00
Bardstown FDRP	KY	Nelson	05140103	N	N	Y	696	N	N		Y	N	City of Bardstown	0.00
Big Run LPP	PA	Jefferson	05010006	N	N	N	13460	Y	N	01-Jul-64	N	N	Borough of Big Run	202,950.00
Blocksom-Jenckes NFL	IN	Vigo	05120111	N	Y	N	18140	N	N		N	N	Local	0.00
Bolivar LPP	NY	Allegany	05010001	N	N	Y	4750	N	N	01-Jul-82	N	N	New York State Department of Environmental Conserv	7,812.00
Bradford LPP	PA	McKean	05010001	N	N	N	36168	Y	N	05-Jul-61	N	N	Bradford District Flood Control Authority	2,921,720.00
Brevoort Levee	IN	Knox	05120111	N	Y	N	218750	N	N	01-Sep-47	Y	Y	Brevoort Levee Conservation District	4,390,000.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Brookport LFPP	IL	Massac	05140206	N	N	Y	23064	N	N	01-May-49	Y	Y	City of Brookville	383,000.00
Brookville LPP	PA	Jefferson	05010006	N	N	N	16524	Y	N	01-Jun-62	N	N	Borough of Brookville	1,750,994.00
Buckhannon LPP	WV	Upshur	05020001	N	N	N	24170	Y	Y	01-Sep-69	N	N	City of Buckhannon	453,058.00
Burgetts Fork, Burgettstown LPP	PA	Washington	05030101	N	N	N	9900	Y	N	26-Nov-65	N	N	Washington County Planning Commission	381,606.00
Burgetts Fork, Slovan LPP	PA	Washington	05030101	N	N	N	9450	Y	N	26-Nov-52	N	N	Washington County Planning Commission	56,506.00
Butler LPP	PA	Butler	05030105	N	N	N	20268	Y	Y	27-Nov-64	N	N	County of Butler	1,302,620.00
Cannelton LFPP	IN	Perry	05140201	N	N	Y	8574	N	N	01-Oct-50	Y	Y	City of Cannelton	166,000.00
Cattletsburg LPP	KY	Boyd	05070204	N	N	Y	0	N	N	01-Jan-60	Y	Y	Local	229,000.00
Ceredo - Kenova LPP	WV	Wayne	05090102	N	N	N	0	N	N		Y	Y	Local	1,029,000.00
Chartiers Creek, Canonsburg-Houston LPP	PA	Washington	05030101	N	N	N	20600	Y	N	01-Mar-70	N	N	Washington County Planning Commission	1,398,384.00
Chartiers Creek, James G. Fulton LPP	PA	Allegheny	05030101	N	N	N	69700	Y	Y	01-Sep-70	N	N	Chartiers Valley District Flood Control Authority	8,317,991.00
Chillicothe LPP	OH	Ross	05060002	N	Y	N	0	N	N	01-Jan-78	Y	Y	Local	138,000.00
Cincinnati LFPP	OH	Hamilton	05090203	N	N	Y	7325	N	N	01-Mar-48	Y	Y	City of Cincinnati	2,979,000.00
Coal Creek - Lake City, TN LPP	TN	Anderson	06010207	N	N	N	132002	Y	Y	13-May-60	N	N	100% Local	0.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Covington LFPP	KY	Kenton	05090203	N	N	Y	15133	N	N	01-Nov-52	Y	Y	City of Covington	248,000.00
Dayton LFPP	KY	Campbell	05090203	N	N	Y	8144	N	N	01-Jan-83	Y	Y	City of Dayton	995,000.00
Delphi LFPP	IN	Carroll	05120105	N	Y	N	6429	N	N	01-Aug-51	N	Y	City of Delphi	22,000.00
DuBois LPP	PA	Clearfield	05010006	N	N	N	26250	Y	N	01-Sep-73	N	N	City of DuBois	1,107,931.00
Duck Creek LPP				N	N	N	0	N	N		N	N	Local	0.00
Elkins LPP	WV	Randolph	05020001	N	N	N	6500	N	Y	03-May-46	N	N	City of Elkins	1,714,220.00
England Pond Levee	IL	Lawrence	05120113	N	Y	N	31608	N	N	01-Jan-72	N	N	England Pond Levee District	554,000.00
Etna LPP	PA	Allegheny	5010009	N	N	Y	4000	N	N	01-Oct-87	N	N	Borough of Etna	45,502.00
Evansville LFPP	IN	Vanderburg h	05140202	N	N	Y	96226	N	N	01-Jan-49	Y	Y	Evansville-Vanderburgh Levee Authority District	580,000.00
Frankfort LFPP	KY	Franklin	05100205	N	N	Y	4457	N	N	01-Mar-71	Y	Y	City of Frankfort	2,407,000.00
Friendsville LPP	MD	Garrett	05020006	N	N	N	2000	Y	N	04-Oct-57	N	N	Town of Friendsville	101,410.00
Galax LPP	VA	Galax	05050001	N	N	N	13700	Y	N	08-Mar-51	N	N	Local	85,000.00
Gill Township Levee	IN	Sullivan	05120111	N	Y	N	58652	N	N	01-Jan-48	Y	Y	Gill Township Levee Association	1,407,000.00
Golconda LFPP	IL	Pope	05140203	N	N	Y	5956	N	N	03-Jun-46	Y	Y	City of Golconda	26,000.00
Grahn LPP	KY	Carter	05090104	N	N	N	0	Y	N	01-Oct-64	N	N	Local	23,000.00
Granville LPP	PA	Washington	05020005	N	N	N	4810	N	Y	14-Oct-52	N	N	Washington County Planning Commission	198,137.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Griffithsville LPP	WV	Lincoln	05070102	N	N	N	0	Y	N	01-Dec-68	N	N	Local	19,000.00
Hagerstown LFPP	IN	Wayne	05080003	N	Y	N	510	N	N		N	N	City of Hagerstown, IN	0.00
Harlan, KY LPP	KY	Harlan	05130101	N	N	Y	18480	N	Y	01-Sep-96	Y	N	100% Local	0.00
Harrisburg LFPP	IL	Saline	05140204	N	N	Y	19562	N	N	01-Jun-50	Y	Y	City of Harrisburg	139,000.00
Hawesville LFPP	KY	Hancock	05140201	N	N	Y	4712	N	N	01-Oct-53	Y	Y	City of Hawesville	40,000.00
Honey Creek NFL	IN	Vigo	05120111	N	Y	N	35440	N	N		N	N	Local	0.00
Huntington LPP	WV	Cabell	05090101	N	N	Y	0	N	N	01-Jan-43	Y	Y	City of Huntington	3,618,000.00
Indianapolis LFPP	IN	Marion	05120201	N	N	Y	5125	N	N	01-Jul-41	N	N	City of Indianapolis	381,000.00
Inez LPP	KY	Martin	05070201	N	N	N	0	Y	N	01-Mar-71	N	N	Local	40,000.00
Ironton LPP	OH	Lawrence	05090103	N	N	Y	0	N	Y	01-Jan-43	Y	Y	Local	4,112,000.00
Island Creek LPP (Construction)	WV	Logan	05070101	N	N	N	0	N	N		N	N	Local	0.00
Island NFL	IN	Sullivan	05120111	N	Y	N	61350	N	N		N	N	Local	0.00
Jeffersonville-Clarksville LFPP	IN	Clark	05140101	N	N	Y	34984	N	N	01-Oct-49	Y	Y	City of Jeffersonville	1,711,000.00
Johnsonburg LPP	PA	Elk	05010005	N	N	Y	7049	N	N	04-Dec-55	N	N	Borough of Johnsonburg	117,809.00
Johnstown LPP	PA	Cambria	05010007	N	N	Y	57439	N	N	01-Nov-43	N	N	City of Johnstown - URA	44,490,705.00
Kittanning LPP	PA	Armstrong	05010006	Y	N	N	4590	N	N	05-Nov-40	N	N	Borough of Kittanning	157,975.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Latrobe (current) LPP	PA	Westmoreland	05010008	N	N	N	23400	N	Y	01-Oct-67	N	N	City of Latrobe	1,037,902.00
Latrobe (previous) LPP	PA	Westmoreland	05010008	N	N	N	11590	Y	Y	03-Jun-50	N	N	City of Latrobe	0.00
Lawrenceburg LFPP	IN	Dearborn	05090203	N	N	Y	19531	N	N	01-Sep-44	Y	Y	Lawrenceburg Conservancy District	5,704,000.00
Lebanon Junction LFPP	KY	Bullitt	05140103	N	N	Y	6663	N	N		N	Y	City of Lebanon Junction	0.00
Leetonia LPP	OH	Columbiana	05030101	N	N	N	7920	Y	Y	28-Dec-60	N	N	Village of Leetonia	117,265.00
Levee Unit No. 5	IN	Gibson	05120113	N	Y	N	220397	N	N	01-Mar-68	Y	Y	Wabash Levee Unit 5 Commission	2,617,000.00
Levee Unit No. 8	IN	Daviess	05120202	N	Y	N	97531	N	N	01-Dec-41	Y	Y	Wabash Levee Unit 8 Commission	714,000.00
Louisville LFPP	KY	Jefferson	05140101	N	N	Y	64802	N	N	01-Feb-57	Y	Y	City of Louisville	1,778,000.00
Loyall, KY LPP	KY	Harlan	05130101	N	N	Y	9800	N	Y	01-Feb-99	Y	N	100% Local	0.00
Lyford Levee	IN	Parke	05120108	N	Y	N	41001	N	N	01-Nov-43	N	N	Lyford Dike and Levee Association	68,000.00
Lynn Camp Creek – Corbin, KY LPP	KY	Knox and Whitley	05130101	N	N	N	10560	Y	Y	19-Sep-64	N	N	100% Local	0.00
Marianna LPP	PA	Washington	05020005	N	N	N	7761	Y	N	02-Aug-79	N	N	Township of West Bethlehem	38,640.00
Mason J. Niblack Levee	IN	Knox	05120111	N	Y	N	93914	N	N	01-Apr-63	Y	Y	Mason J. Niblack Levee Association	46,000.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Massillon LPP	OH	Stark	05040001	N	N	N	0	N	N	01-Oct-51	Y	Y	City of Massillon	88,000.00
Matewan LPP	WV	Mingo	05070201	N	N	N	0	N	N		N	N	Local	0.00
Maysville LPP	KY	Mason	05090201	N	N	Y	0	N	N	01-Nov-56	Y	Y	Local	623,000.00
McGinnis NFL	IL	Knox	05120202	N	Y	N	99280	N	N		N	N	Local	0.00
Middlesborough, KY LPP	KY	Bell	05130101	N	Y	N	21120	N	Y	01-Mar-45	N	N	100% Federal	4,477,000.00
Middlesborough, KY LPP Section 202	KY	Bell	05130101	N	Y	N	0	Y	N	01-Jun-06	N	N	100% Local	0.00
Mill Creek LPP				N	N	N	0	N	N		N	N	Local	0.00
Millvale LPP	PA	Allegheny	05010009	N	N	N	6125	Y	N	01-Sep-80	N	N	Borough of Millvale	393,819.00
Mount Carmel LFPP	IL	Wabash	05120113	N	N	Y	17498	N	N	01-Oct-68	Y	Y	City of Mount Carmel	114,000.00
Mount Vernon LPP	OH	Knox	05040003	N	N	N	0	Y	N		N	N	Local	18,000.00
Muncie LFPP	IN	Delaware	05120201	N	N	Y	30629	N	N	01-May-50	Y	Y	City of Muncie	159,000.00
New Albany LFPP	IN	Floyd	05140101	N	N	Y	18774	N	N	01-Jul-54	Y	Y	City of New Albany	421,000.00
Newark LPP	OH	Licking	05040006	N	Y	N	0	N	N	01-Nov-41	Y	N	Local	49,000.00
Newport LFPP	KY	Campbell	05090203	N	N	Y	12641	N	N	01-Sep-51	Y	Y	City of Newport	1,220,000.00
Oil City (ice jam) LPP	PA	Venango	05010003	N	Y	N	0	N	N	18-Dec-89	N	N	City of Oil City	0.00
Oil City LPP	PA	Venango	05010003	N	Y	N	825	N	N	26-May-58	N	N	City of Oil City	0.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Olean LPP	NY	Cattaraugus	05010001	N	N	Y	46491	N	N	26-Sep-52	N	N	New York State Department of Environmental Conserv	6,057,160.00
Olive Hill LPP	KY	Carter	05090103	N	N	N	0	Y	N	16-Nov-59	N	N	Local	40,000.00
Paducah LFPP	KY	McCracken	05140206	N	N	Y	64547	N	N	01-Jul-49	Y	Y	City of Paducah	4,438,000.00
Parkersburg LPP	WV	Wood	05030203	N	N	Y	0	N	N	01-Jan-50	Y	Y	City of Parkersburg	2,831,000.00
Pineville, KY LPP	KY	Bell	05130101	N	N	Y	6336	N	N	22-Oct-57	Y	N	100% Local	799,000.00
Pineville, KY LPP Section 202	KY	Bell	05130101	N	N	Y	0	N	N	11-Oct-91	N	N	100% Local	0.00
Piney River – Spring City, TN LPP	TN	Rhea	06010101	N	N	N	11616	Y	N	17-Nov-58	N	N	100% Local	0.00
Pittsburgh LPP	PA	Allegheny	05030101	N	N	N	5600	N	N		N	N	City of Pittsburgh	0.00
Point Pleasant LPP	WV	Mason	05050008	N	N	Y	0	N	N	01-Jan-51	Y	Y	City of Point Pleasant	928,000.00
Portage LPP	PA	Cambria	05010007	N	N	N	2259	Y	N	11-Jan-65	N	N	Borough of Portage	53,014.00
Portsmouth/New Boston LPP	OH	Scioto	05090103	N	N	Y	0	N	N	01-Jan-45	Y	Y	Local	3,626,000.00
Portville LPP	NY	Cattaraugus	05010001	N	N	Y	24240	N	N	24-Oct-50	N	N	New York State Department of Environmental Conserv	1,359,263.00
Prestonsburg LPP	KY	Floyd	05070203	N	Y	N	265	N	N	14-Dec-59	Y	N	Local	142,000.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Princeton LPP	WV	Mercer	05050002	N	N	N	0	Y	N	01-Jan-61	N	N	Local	101,000.00
Punxatawney LPP	PA	Jefferson	05010006	N	N	Y	33979	N	N	17-May-47	N	N	Borough of Punxsutawney	4,031,074.00
Rainelle LPP	WV	Greenbrier	05050005	N	N	N	23000	Y	N	01-Jan-62	N	N	Local	74,000.00
Reevesville LFPP	IL	Massac	05140203	N	Y	N	26033	N	N	01-Oct-54	N	Y	Cache River Drainage District	0.00
Reynoldsville LPP	PA	Jefferson	05010006	N	N	N	11400	Y	Y	03-Nov-57	N	N	Borough of Reynoldsville	601,406.00
Ridgway, Elk Creek LPP	PA	Elk	05010005	N	N	N	12372	Y	Y	04-Oct-62	N	N	Borough of Ridgway	619,764.00
Rio Vista, KY LPP	KY	Harlan	05130101	N	Y	N	6000	N	N	01-Feb-99	Y	N	100% Local	0.00
Rochester-McCleary's Bluff Levee	IL	Wabash	05120113	N	Y	N	47169	N	N	01-Jan-72	N	N	Rochester-McCleary's Bluff Levee Association	621,000.00
Roseville LPP	OH	Muskingum	05040004	N	N	N	0	N	N	31-Oct-60	N	N	Local	28,000.00
Rosiclare LFPP	IL	Hardin	05140203	N	Y	N	3387	N	N	01-Sep-53	Y	Y	City of Rosiclare	46,000.00
Rushville LFPP	IN	Rush	05120205	N	N	Y	6264	N	N	01-Jan-02	Y	Y	City of Rushville	94,000.00
Russell & Allison NFL	IL	Lawrence	05120112	N	Y	N	118270	N	N		N	N	Local	0.00
Russell LPP	KY	Greenup	05090103	N	Y	N	0	N	N	01-Jan-51	Y	N	Local	373,000.00
Sainte Marie NFL	IL	Jasper	05120112	N	Y	N	50302	N	N		N	N	Local	0.00
Salamanca LPP	NY	Cattaraugus	05010001	N	N	Y	11363	N	N	01-Sep-70	N	N	New York State Department of Environmental Conserv	630,612.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Shawneetown LFPP	IL	Gallatin	05140203	N	N	Y	20681	N	N	01-Jan-34	N	N	City of Old Shawneetown	81,000.00
South Frankfort LFPP	KY	Franklin	05100205	N	N	Y	3405	N	N	01-Nov-96	Y	Y	City of Frankfort	2,954,000.00
South Williamson LPP	KY	Pike	05070201	N	N	Y	0	N	N	01-Feb-72	N	N	Local	49,000.00
Southwest Jefferson County LFPP	KY	Jefferson	05140101	N	N	Y	72002	N	N	01-Jan-81	Y	Y	City of Louisville	456,000.00
Sturgis LFPP	KY	Union	05140205	N	N	Y	21428	N	N	01-Jan-70	Y	Y	City of Sturgis	85,000.00
Sykesville LPP	PA	Jefferson	05010006	N	N	N	7260	Y	Y	01-Sep-61	N	N	Borough of Sykesville	282,347.00
Tarentum LPP	PA	Allegheny	05010009	N	N	N	5130	Y	N	27-Dec-62	N	N	Borough of Tarentum	166,202.00
Taylorsville LFPP	KY	Spencer	05140102	N	Y	N	8181	N	N	01-Apr-49	N	Y	City of Taylorsville	354,000.00
Tell City LFPP	IN	Perry	05140201	N	N	Y	9812	N	N	01-Oct-43	Y	Y	City of Tell City	348,000.00
Terre Haute LFPP	IN	Vigo	05120111	N	Y	N	2397	N	N	01-Nov-64	N	N	City of Terre Haute	110,000.00
Turtle Creek LPP	PA	Westmoreland	5020005	N	N	N	39081	Y	N	12-Oct-62	N	N	County of Allegheny	9,075,454.00
Uniontown LFPP	KY	Union	05140202	N	Y	N	9978	N	N	01-May-51	Y	N	City of Uniontown	536,000.00
Vincennes LFPP	IN	Knox	05120111	N	N	Y	14109	N	N	01-Nov-60	Y	Y	City of Vincennes	14,972,000.00
Wallsend, KY LPP	KY	Bell	05130101	N	Y	N	3660	N	N	22-Oct-57	Y	N	100% Local	0.00
Wallsend, KY LPP Section 202	KY	Bell	05130101	N	Y	N	0	N	N	10-Jan-91	N	N	100% Local	0.00

Name	State	County	Watershed	Floodwall	Levee	Floodwall & Levee	Length of Alignment	Channel	Diversion	Initial Operation	Pump Stations	Gate Openings	O&M Responsibility	Average Annual Damages Prevented
Washington Courthouse LPP	OH	Fayette	05060003	N	N	N	0	Y	N	01-Jan-68	N	N	Local	86,000.00
Washington LPP	PA	Washington	5030101	N	N	N	10150	Y	Y	19-Oct-62	N	N	Washington County Planning Commission	960,168.00
Wellsville LPP	OH	Columbiana	5030101	N	N	Y	7677	N	N	01-Jun-39	N	N	Village of Wellsville	0.00
West Columbus LPP	OH	Franklin	05060001	N	N	Y	0	N	N		Y	Y	Local	0.00
West Terre Haute LFPP	IN	Vigo	05120111	N	N	Y	15065	N	N	01-Jan-72	Y	Y	West Vigo Levee Association	521,000.00
West Williamson LPP	WV	Mingo	05070201	Y	N	N	0	N	N	01-Jan-89	Y	Y	Local	211,000.00
White Oak - Sunbright, TN LPP	TN	Morgan	05130104	N	N	N	3693	Y	N		N	N	100% Local	0.00
Williamsburg, KY LPP	KY	Whitley	05130101	N	N	Y	5470	N	N	01-Aug-99	N	N	100% Local	0.00
Williamson CBD LPP	WV	Mingo	05070201	Y	N	N	0	N	N	14-Oct-63	Y	Y	Local	0.00
Wilmore LPP	PA	Cambria	5010007	N	N	N	4400	Y	N	04-Apr-59	N	N	Borough of Wilmore	69,952.00
Youngstown LPP	OH	Mahoning	5030103	N	N	N	12619	Y	N	01-Mar-73	N	N	City of Youngstown	282,872.00
Totals							*2,829,850*							*$173,252,850*

APPENDIX G – GIS ATLAS

1. MAPPING HISTORY

Maps have been a common communication tool since the beginning of human history – from clay tablets in Babylonian, through the first world map in 1507, to the present day geographical information system (GIS) generated maps. The art of creating maps is known as cartography and can be divided into two types, general and thematic.

General cartography is considered a map produced with a number of geographical features, road maps are a good example. They show different types of boundaries, numerous types of roads, and symbols that represent a variety of interest. However, a thematic map is different.

Thematic maps are meant to illustrate a specific topic or theme. There are many types – proportional symbols, isarithmic, dot, and dasymetric but choropleth is the most common but all are used to evaluate the spatial distribution of a map theme for a given region and scale.

A historical example of thematic maps comes from the London physician John Snow (1854). Snow used thematic mapping to isolate a specific water pump that was responsible for cholera outbreak. He then persuaded the local council to disable the pump by showing a spot map of cholera cases centered on the pump and used statistics to make a connection. It was later discovered that that the well had been dug 3 feet from a cesspool that had begun to leak.

Choropleth Maps are widely used to show spatial distribution across a specific region. This makes them uniquely suited for comparing complex numerical themes for a given study region. Also, by using different statistical methods for display, the ability to quantify various planning hypotheses is achieved.

2. OHIO RIVER ATLAS DEVELOPMENT

This atlas is a collection of themes derived from existing sources and aggregated to the hydraulic unit code (HUC) level eight for the Ohio River Basin. Watersheds have become the base unit of study recognized by Congress and recently adopted by the Executive Office for use in the budgeting process.

The intent was to develop a GIS process that could be integrated into the watershed study process. USACE implemented guidance for watershed studies from Water Resources Development Act (WRDA) of 2000. Direction was given for collaborative study efforts between states, local, tribal, Federal, and nongovernment interests that would investigated problems, needs and opportunities.

3. WATERSHED STUDY CONCEPTS

To develop an integrated watershed study with GIS two main sources were reviewed. The USACE Watershed Notebook (DRAFT), an online resource published by the System-wide Water Resources Program (https://swwrp.usace.army.mil/) and the Environmental Protection Agencies (EPA) comprehensive guide entitled, "Watershed Analysis and Management (WAM): Guide for States and Communities".

Both refer to generalized steps in the process: The USACE Watershed Notebook indicates 4 steps: (1) Organizing Stakeholders, Identifying Problems and Opportunities, (2) Inventorying and Forecasting Conditions, (3) Formulating, Evaluating, and Comparing Alternative Plan, and (4) Selecting a Plan, Adaptive Management, while EPA's WAM refers to a five step process (1) Scoping, (2) Watershed Assessment, (3) Synthesis, (4) Management Solutions, and (5) Adaptive Management. The similarity of both was noted and combined resulting in the following:

- Scoping
- Organizing Stakeholders
- Identifying Problems and Opportunities
- Watershed Assessment
- Scoping
- Science Based Analysis
- Team Consensus building
- Inventorying and Forecasting Conditions
- Synthesis
- Formulate and Evaluate
- Key Findings
- Solutions
- Options
- Create Plans
- Compare Plans
- Adaptive Management
- Select Plan
- Monitor
- Adaptive Management

By indentifying the similarities in both sources, a broader range of concepts could be evaluated for the purpose of integrating GIS into the Ohio River Basin study.

4. MAPPING CONCEPTS IN WATERSHED STUDY

Concise and well structured for extracting an automated mapping process, the EPA WAM document does not mention GIS directly but the overall process references mapping data in a manner for deriving an automated process. However detailed the WAM manual was, it did not address large scale basin studies or the time needed to scope and asses the watershed. It focused on a process that was well illustrated but did not propose a timeline. The process described was open-ended and ongoing.

Step two, “Watershed Assessment”, of the five step watershed study process contains an overview of integrating map data into the study process. It includes five steps of its own: (1) determine the scope of the watershed assessment, (2) identify the assessment team, (3) conduct assessment team orientation, (4) conduct assessment using technical modules, (5) conduct pre-Synthesis assessment team meeting. The process goal is to define a model for evaluating a specific watershed problem based on selection the appropriate technical module that will answers “Critical Questions”. Answering these questions support the generation of hypotheses:

> “Generating hypotheses is a vital part of any scientific assessment. Hypotheses can help to determine the required scope of assessment and to focus data collection and analysis on specific objectives. A hypothesis is defined as an assumption that needs verification or proof. Hypotheses are clearly defined statements that can be evaluated during the Watershed Assessment. Data from the assessment can then be used to support or disprove the hypotheses. Often, further data collection and evaluation of competing hypotheses are necessary following the initial Watershed Assessment.” page 51 EPA WAM 2003

This process is done by meeting with watershed groups and the technical staff responsible for generating the technical modules. The technical advisors then generate hypotheses to support the watershed problems. An assessment team then assesses the watershed using the information published by the technical advisors and the hypothesis is refined and approved. Finally, an analyst is prepared with preliminary maps, tables, and graphs that summarize the findings of the assessment team.

5. MAPPING CONCEPTS EVALUATED

Evaluation of the “Watershed Assessment” process concluded that the people and time involved in the process was extensive and costly. Three teams were described: watershed groups, technical advisors, and an assessment team. Depending on the size of the watershed and the level of detail, this process would take a large amount of time. Also, cost would increase drastically based on the more technical modules chosen to support the study problems. Of particular interest is this reference to GIS:

> “The assessment team leader should periodically monitor the progress of the Watershed Assessment. The team leader may need to ensure that information sources are being shared and dialogue and interaction are occurring among team members. If GIS is being relied upon for analyses or map production, the team leader should coordinate regularly with the GIS specialist(s) to ensure a smooth and efficient transfer of information.” Pg 54 EPA WAM 2003

To ensure the smooth and efficient transfer of map information to the assessment team, technical advisors, and watershed groups a concept was developed to evaluate the watershed using GIS and publish the maps for review, this concept was defined as the “Map Recon” concept.

6. MAP RECON

The “Map Recon” concept developed through multiple meetings with the ORBCRS Project Delivery Team (PDT). The PDT was broken out into supporting teams that included a GIS team, report writing, and water resource team. Charters were developed by each team resulting in a GIS charter of:

7. FOCUS

- Develop GIS/Data and a screening process that identifies and supports Federal Interests related to water resource issues for the Ohio River Basin using a study process that combines steps from USACE Guidance and EPA's Watershed Analysis and Management (WAM).
- Support Water Resource Issues Team in development of federal interest screening criteria (Step 3a of Watershed Study Process).
- Map Recon Process: Develop watershed maps from various federal and non-Federal sources that cover the entire watershed and that reflect federal interests based on Emergency Support Function #14 of the National Response Frame Work.
- Map Recon Formula: Set of guidelines developed by the PDT for use in the Map Recon Process to develop a watershed atlas showing multiple themes at the HUC8 watershed level for visual comparison.
- Support Report Writing Team with detailed basin data collection and GIS manipulation.
- Aggregation/disaggregation of basin data to the HUC8 watershed level.

8. EXPECTATIONS

- Finalize USACE data layers (Projects, Authorities, Levee/Wall Protected Areas).
- Produce watershed atlas for review by the Water Resource.
- Support Water Resource Team in evaluating the watershed atlas for creation of Report Appendices based on Civil Works business lines.
- Support Report Writing Team in developing the report summary.
- Team support will consist of table and figure creation.

A major step in meeting PDT expectations was to provide the report writing team and water resources team a means to evaluate the watershed for developing report hypotheses. The Map Recon process eliminates the resource and time issues derived from the Watershed Assessment process described in the WAM and enhances the scoping process. Existing data sources are mined and published into thematic maps using various aggregation methods. The maps are then generated from a standard project area template and that enhances the viewer's ability to recognize spatial patterns and distributions of themes in the project area.

The data mining process presented to the PDT was based on evaluating government interest from the National Response Framework (NRF). The NRF is a guide for Federal Agencies, States, Communities and private-sector to respond to national incidents through a collaborative effort. The NRF describes agency responsibilities and a doctrine for responding. Fifteen major functions have been identified with appendixes for that describe operational concepts for each. Although intended for specific events, one of the appendices was of specific interest, Emergency Support Function #14 – Long Term Community Recovery. USACE is recognized in this appendix for their part in developing national strategies and plans. By reviewing this appendix, the agencies and organizations that would cooperate in a comprehensive data mining effort can be identified.

USACE's participation in the NRF falls under the Civil Works program but is narrowly focused on immediate hazard response. However, the coordination needed for spatial data mining and the integration of spatial analysis into the USACE planning process should not follow diverging paths but should be integrated into all USACE processes and programs in a comprehensive manner. Appendix #14 of the NRF was given to members of the GIS Team to facilitate GIS data mining outside of USACE.

9. MAP RECON FORMULA

The Map Recon Formula is the integration of geospatial analysis into the USACE six-step planning process that supports the watershed study approach. A major concept is the coordination of Federal, State, and Local Partners in the gathering and sharing of geospatial data. Aggregation can then be done to a specific HUC level depending on the scope of the project. The HUC analysis process was developed by Seaber, P.R., Kapinos, F.P., and Knapp, G.L., 1987, Hydrologic Unit Maps: U.S. Geological Survey Water-Supply Paper 2294, 63 p, and was adopted by the U.S. Geological Survey (USGS). HUC is a cataloging system that divides and sub-divides into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units (http://water.usgs.gov/GIS/huc.html).

The *Water Resources Development Act of 1986* established the Congressional directive of watershed and river basin assessments for USACE. The MEMORANDUM FOR Commanders, Major Subordinate Commands, SUBJECT: Implementation guidance for Section 202 of the *Water Resources Development Act* (WRDA) 2000, Watershed and River Basin Assessments, which Amends Section 729, WRDA 86, Study of Water Resource Needs of River Basins and Regions, is to establish "Budgetary Priority" for watershed assessments. It goes on to say that traditional reporting and review procedures will be utilized. As a result, identification by watershed units has been integrated into the budgeting process used by USACE and the Office of Management and Budget (OMB).

The Map recon formula consists of aggregating data gathered from various national sources and aggregating the data to the HUC8 watershed level. The watersheds become the base unit of study for creating a series of thematic maps allowing for evaluation in a team environment. It also begins to addresses a major concern with how USACE studies evaluated and ranked for budgeting purposes. By selecting themes that support Civil Works hypotheses they can then be combined in a GIS process that ranks the watersheds by Federal Concerns.

Two thematic map types were chosen by the PDT for evaluating the Ohio River Basin, equal interval and standard deviation. Both types are best suited for comparing the geographical distribution of numerical datasets. The standard deviation maps give the added feature of identifying the mean and the numerical majority of values. In addition, the use of a consistent equal interval creates the ability to rank the watersheds by values. Through a series of data tests the optimum interval was determined to be from one to five. When these equal interval maps are created it would be important for the values to indicate the same direction of interest. A low value would indicate a low interest while the larger number would indicate a higher interest. This direction of interest would have to be agreed upon by the PDT.

Once the Map Recon has been performed by the PDT and the map themes chosen that support a specific hypothesis in the report, they are then combined in such a manner that a new thematic map is created representing the addition of the ranked watershed values (1–5). In this same manner, the combined maps produced would be ranked by the same equal interval and could then be combined with additional maps themes. For example, a combined map could be created for the individual Civil Works mission areas and an overall map be created that combines them into one theme.

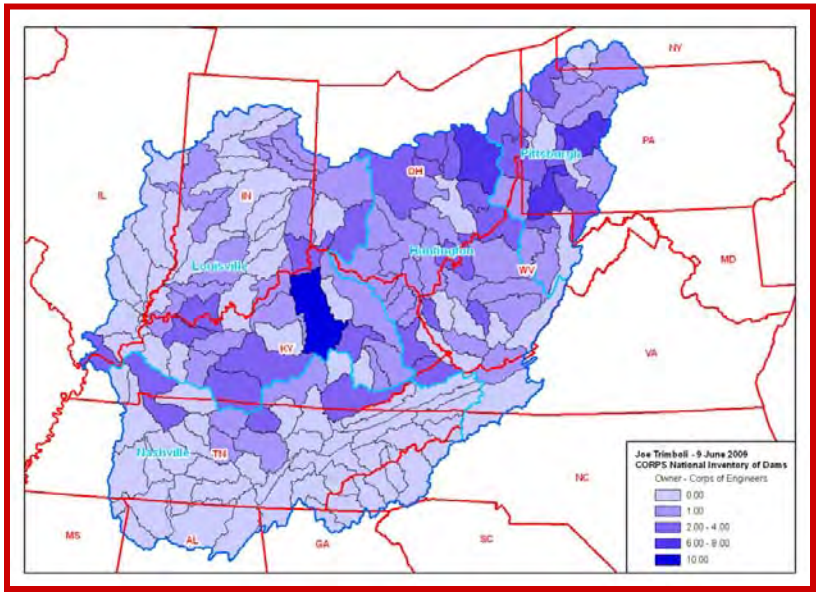
10. MAP RECON SUMMARY

The Map Recon concept has been developed through the Ohio River Basin PDT meetings and within the limited time of the study process. It would be considered a working prototype at best; however, initial response by PDT members and others has been positive. Benefits include integrating the science of spatial analysis from many fields in a manner that would reduce study cost and resources. There are many current efforts in government that collect GIS data for use in hazard response. A major industry has been created around GeoICT, the integration of geospatial information and imaging technology with information communication technologies. At the heart of this phenomenon is publishing the complex databases, both spatial and non-spatial, into web portals for the duel purpose of open government, information sharing and hazard response.

11. GIS ATLAS EXAMPLES

Below is a sampling of the range of GIS format mapping that has been developed for the GIS Atlas and applied to the HUC 8 watershed level. The maps depict in order from left to right and down by page: (p.81) number of USACE-owned dams, building permits in 2007, median household income, and location quotient for manufacturing; (p. 82) agricultural buildings, flood insurance policies in force, average precipitation in 2007, and maximum average temperature in 2007; (p. 83) land resource regions, dams with a water supply purpose, dams with a hydropower purpose, and dams with a flood control purpose; (p.84) cultivated land cover; (p.85) forested land cover; (p.86) urban land cover; (p.87) shrub and grass land cover; and (p.88) wetland cover. Figures on pages

84-88 are displayed against the HUC 4 sub-basins and with the major water areas (except for the wetland land cover map) shown.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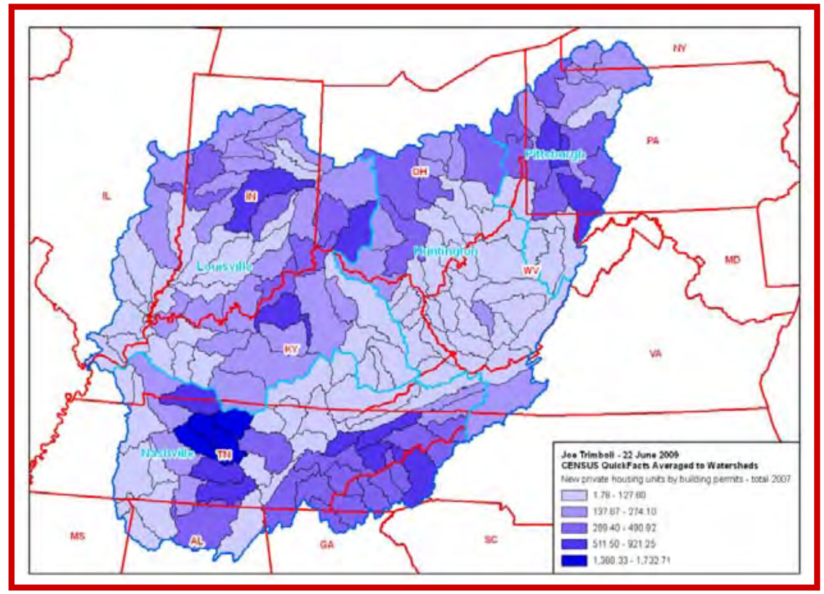
Joe Trimboli - 9 June 2009
CORPS National Inventory of Dams
Owner - Corps of Engineers
0.00
1.00
2.00 - 4.00
6.00 - 8.00
10.00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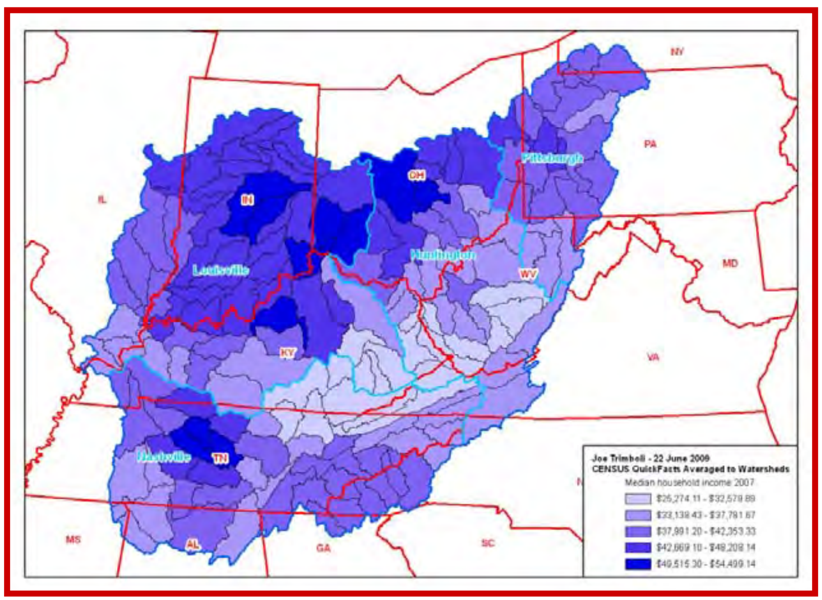
Joe Trimboli - 22 June 2009
CENSUS QuickFacts Averaged to Watersheds
New private housing units by building permits - total 2007
1.78 - 127.80
137.87 - 274.10
289.40 - 490.92
511.50 - 921.25
1,388.33 - 1,732.71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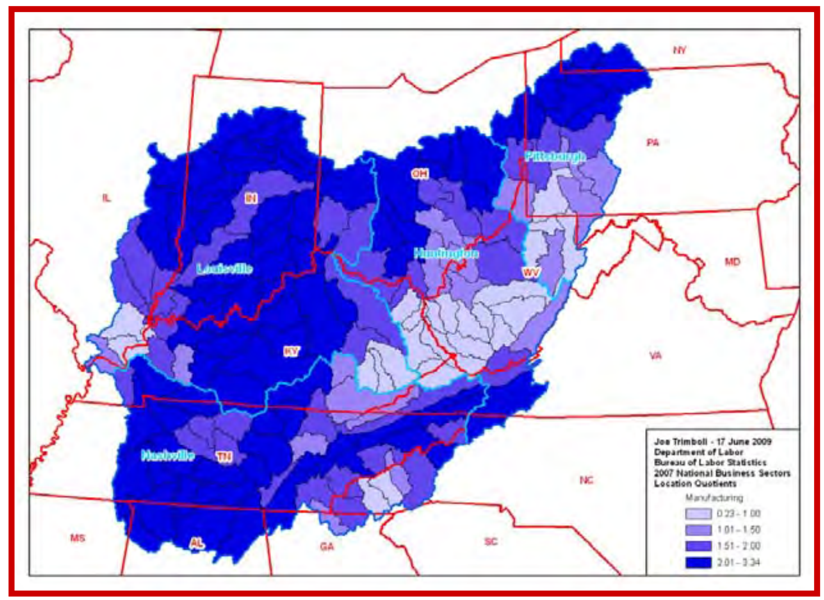
Joe Trimboli - 22 June 2009
CENSUS QuickFacts Averaged to Watersheds
Median household income 2007
$26,274.11 - $32,579.89
$33,138.43 - $37,781.67
$37,991.20 - $42,353.33
$42,869.10 - $48,208.14
$49,515.30 - $54,499.14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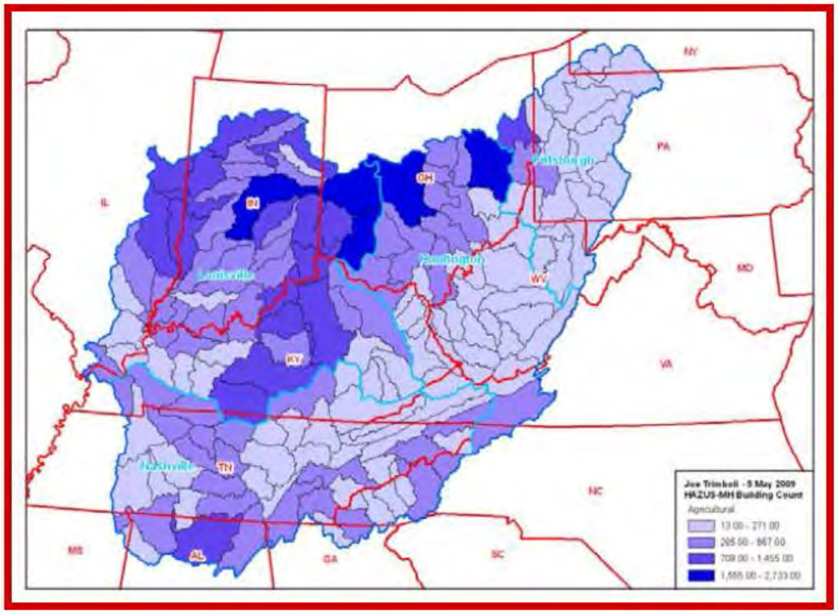
Joe Trimboli - 17 June 2009
Department of Labor
Bureau of Labor Statistics
2007 National Business Sectors
Location Quotients
Manufacturing
0.23 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 3.34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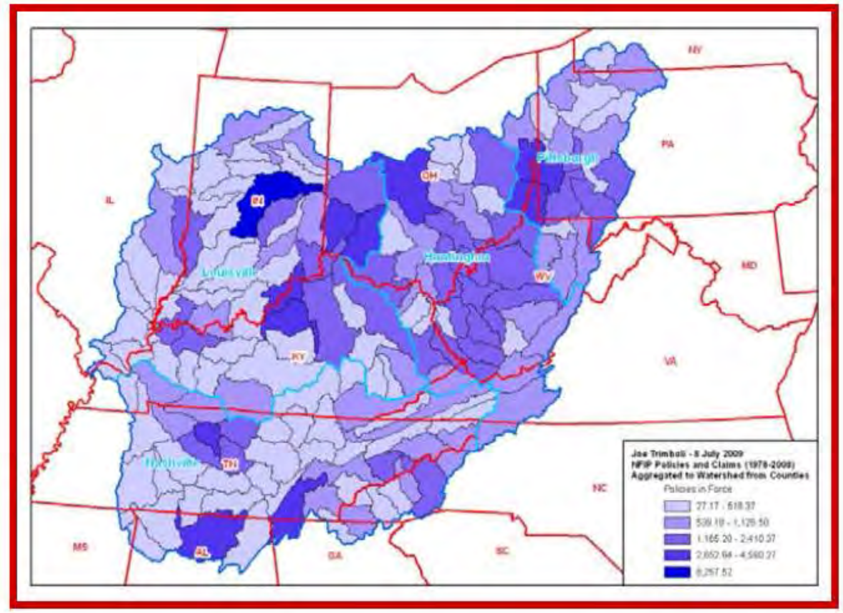
Joe Trimboli - 5 May 2009
HAZUS-MH Building Count
Agricultural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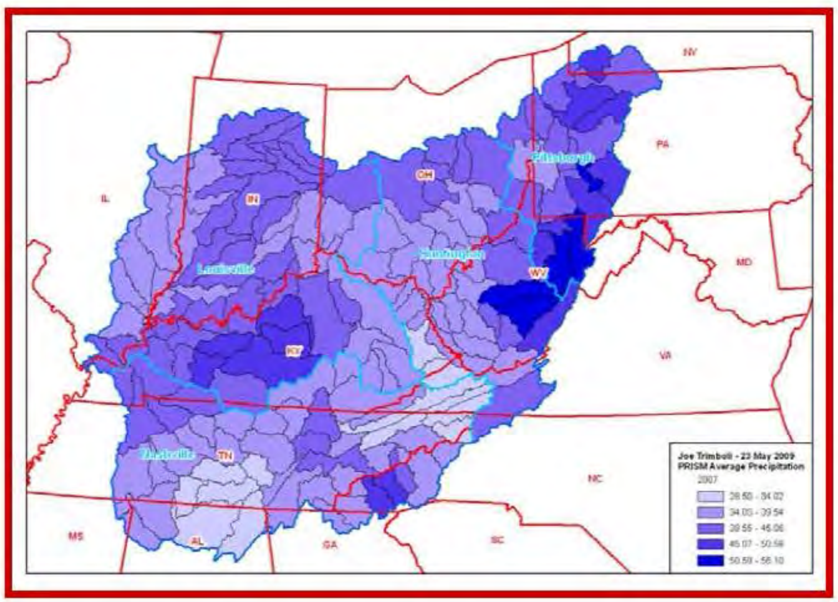
Joe Trimboli - 8 July 2009
NFIP Policies and Claims (1978-2008)
Aggregated to Watershed from Counties
Policies in Force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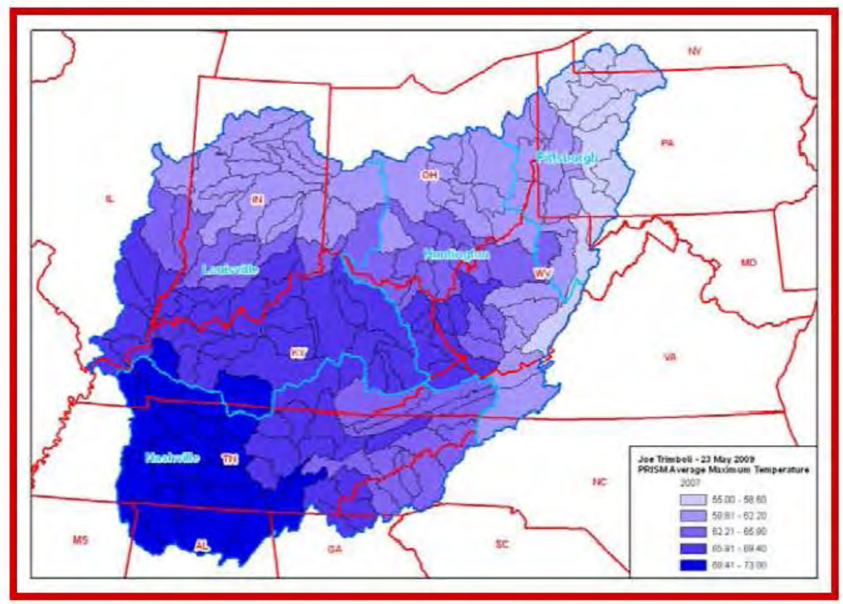
Joe Trimboli - 23 May 2009
PRISM Average Precipitation
2007
28.50 - 34.02
34.03 - 39.54
39.55 - 45.06
45.07 - 50.58
50.59 - 56.10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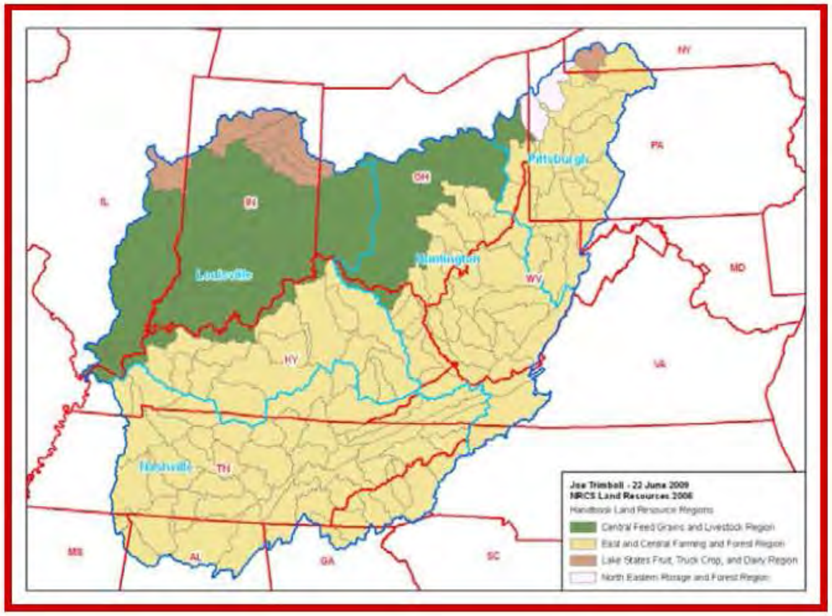
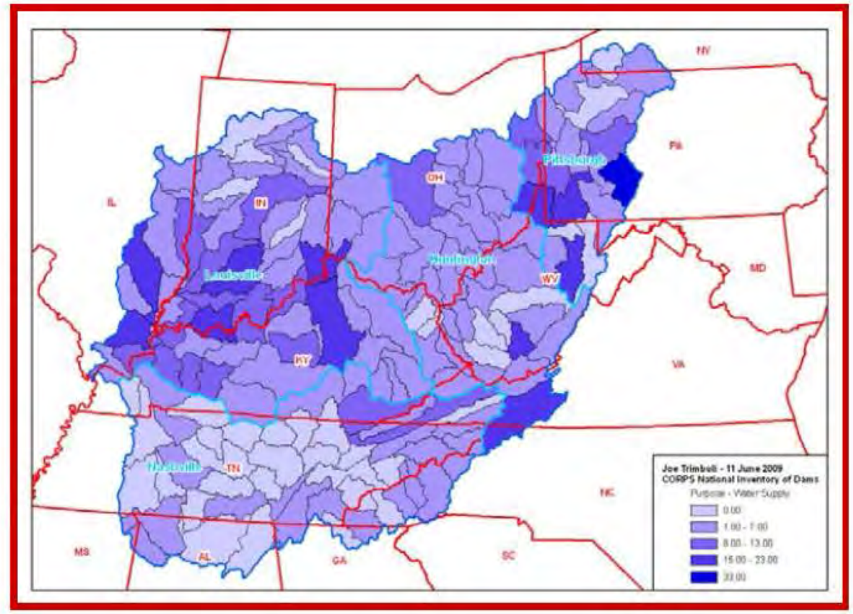
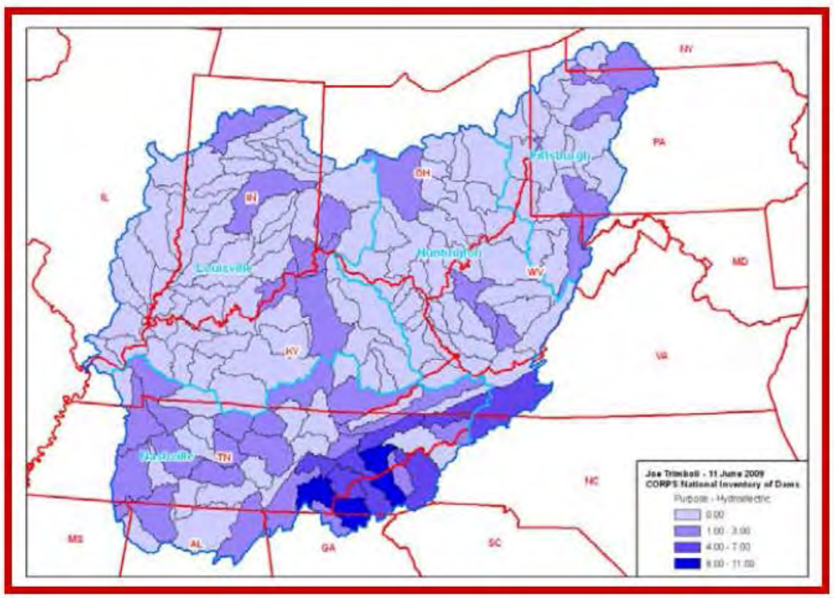
SC
Joe Trimboli - 23 May 2009
PRISM Average Maximum Temperature
2007
55.00 - 58.60
58.61 - 62.20
62.21 - 65.90
65.91 - 69.40
69.41 - 73.00


Joe Trimboli - 22 June 2009
NRCS Land Resources 2006
Handbook Land Resource Regions
Central Feed Grains and Livestock Region
East and Central Farming and Forest Region
Lake States Fruit, Truck Crop, and Dairy Region
North Eastern Forage and Forest Region
Pittsburgh
Louisville
Huntington
Nashville


Joe Trimboli - 11 June 2009
CORPS National Inventory of Dams
Purpose - Water Supply
0.00
1.00 - 7.00
8.00 - 13.00
15.00 - 23.00
33.00
Louisville
Nashville


Joe Trimboli - 11 June 2009
CORPS National Inventory of Dams
Purpose - Hydroelectric
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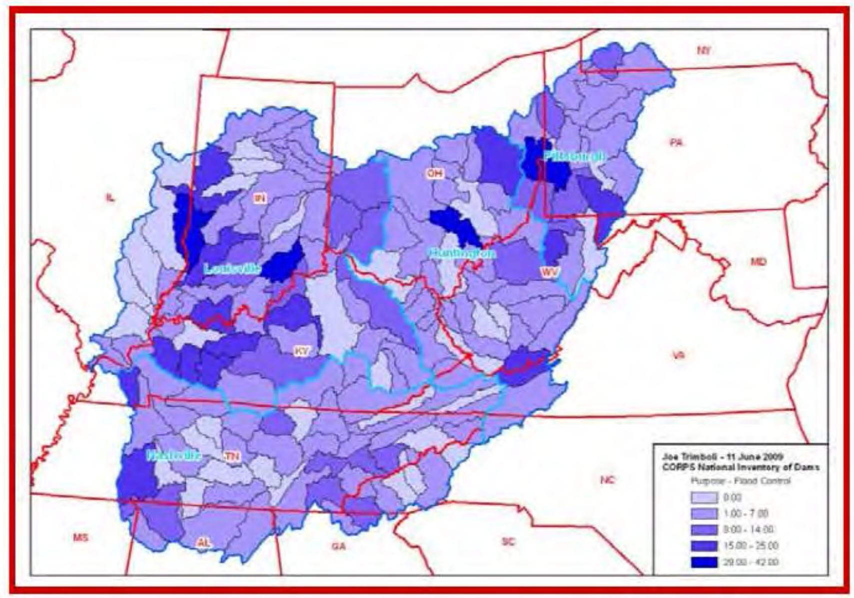
Huntington
Nashville


Joe Trimboli - 11 June 2009
CORPS National Inventory of Dams
Purpose - Flood Control
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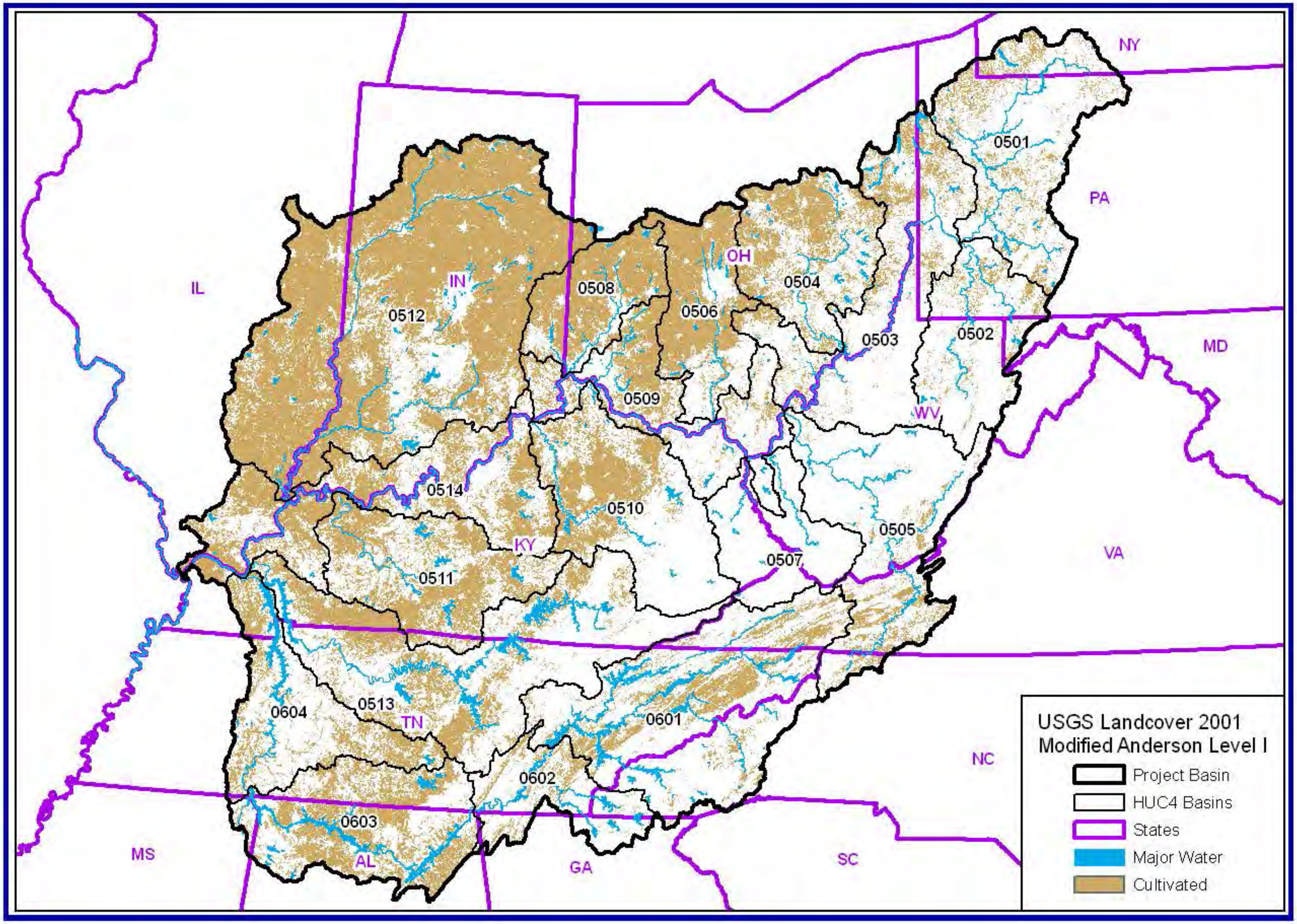
8.00 - 14.00
15.00 - 25.00
29.00 - 42.00
Pittsburgh
Louisville
Huntington
Nashville


USGS Landcover 2001
Modified Anderson Level I
Project Basin
HUC4 Basins
States
Major Water
Cultivated
NY
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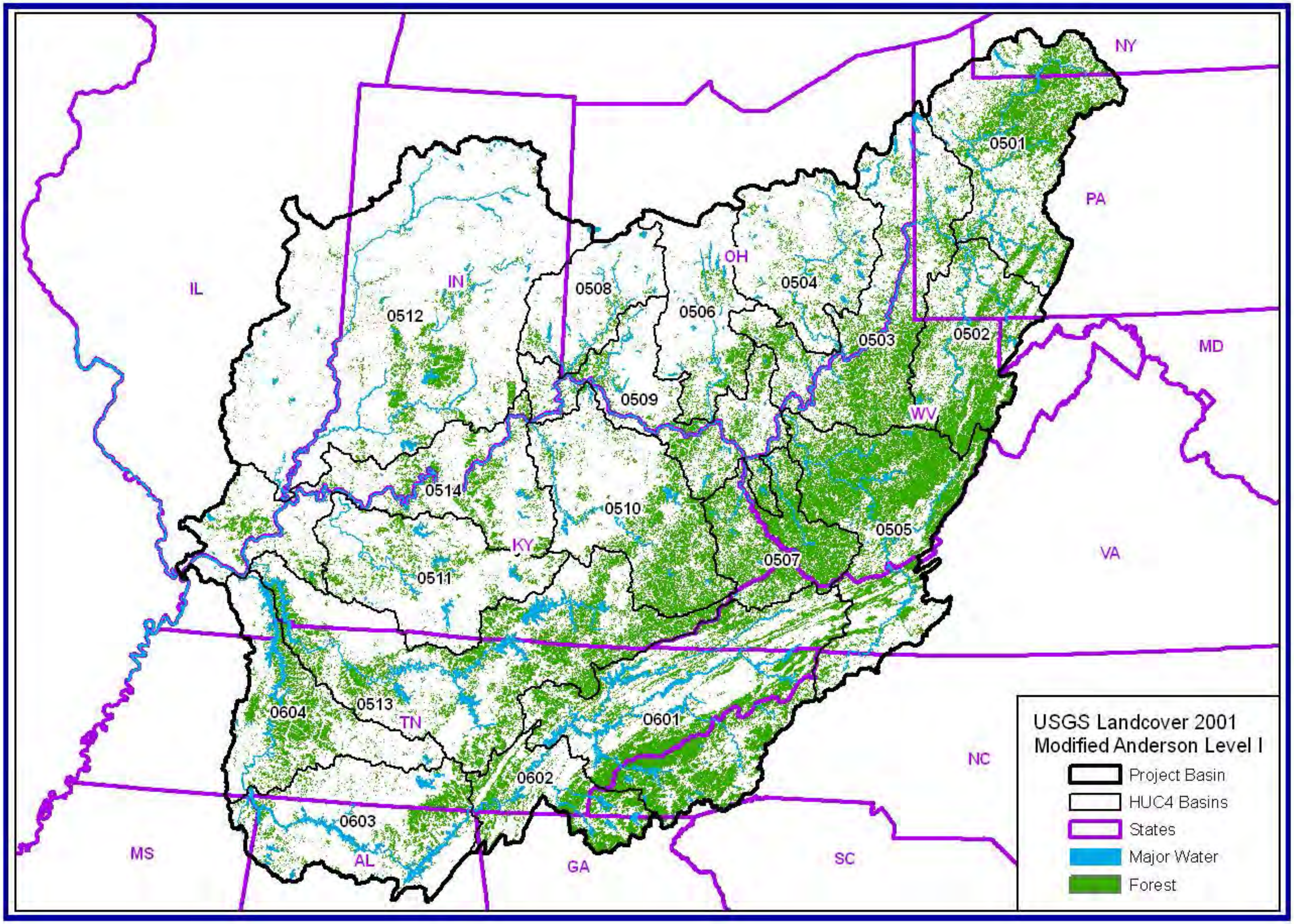
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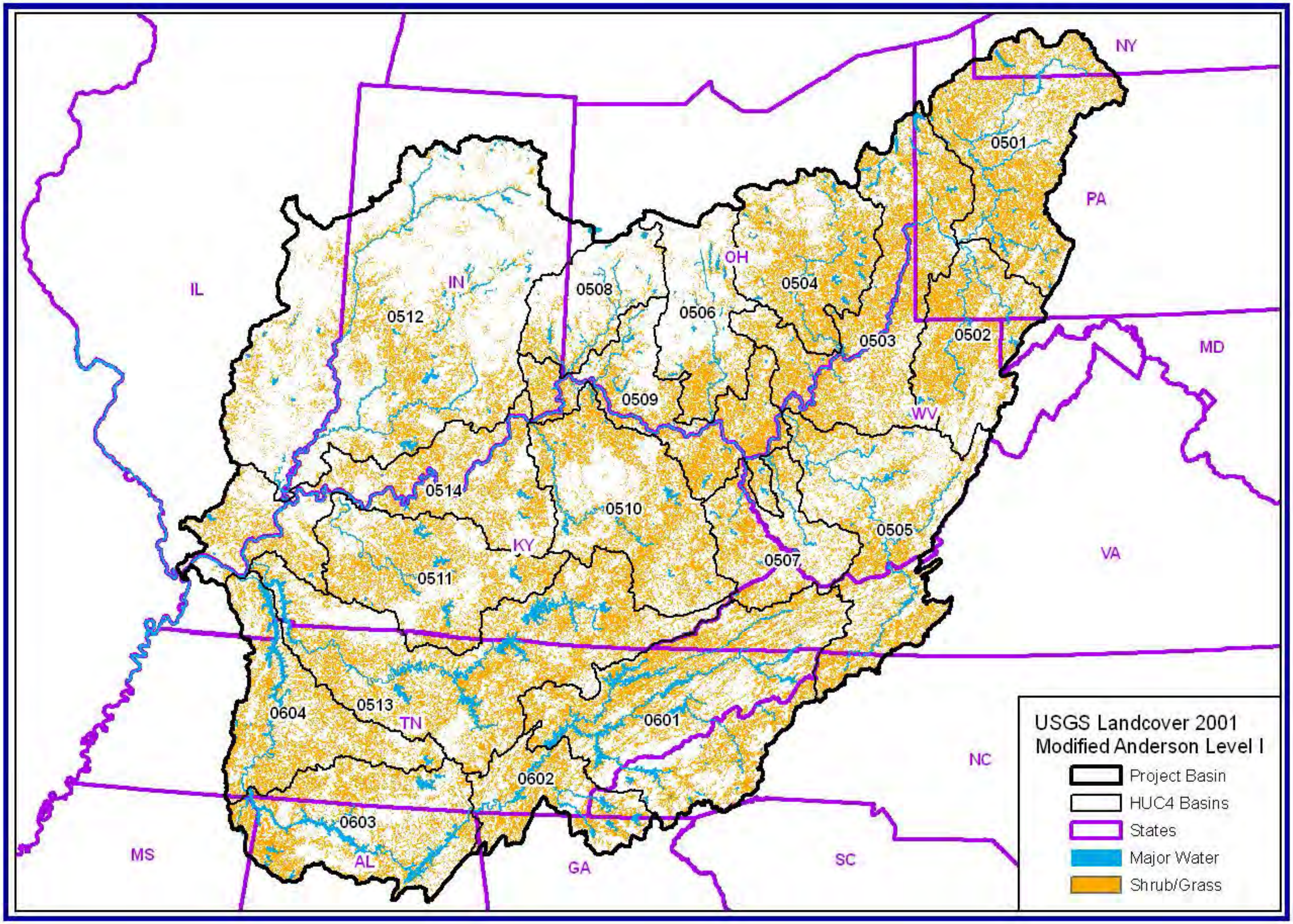
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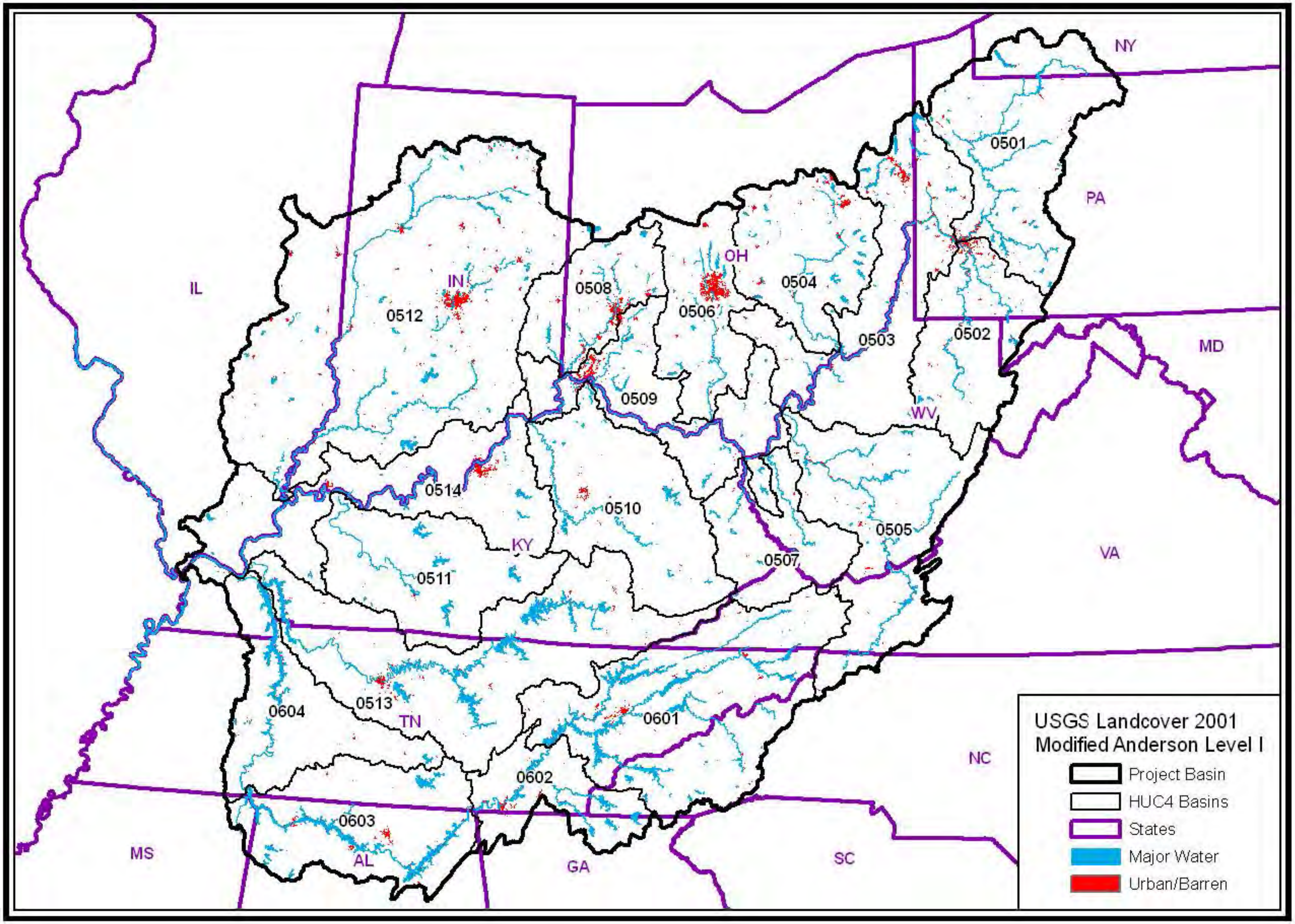
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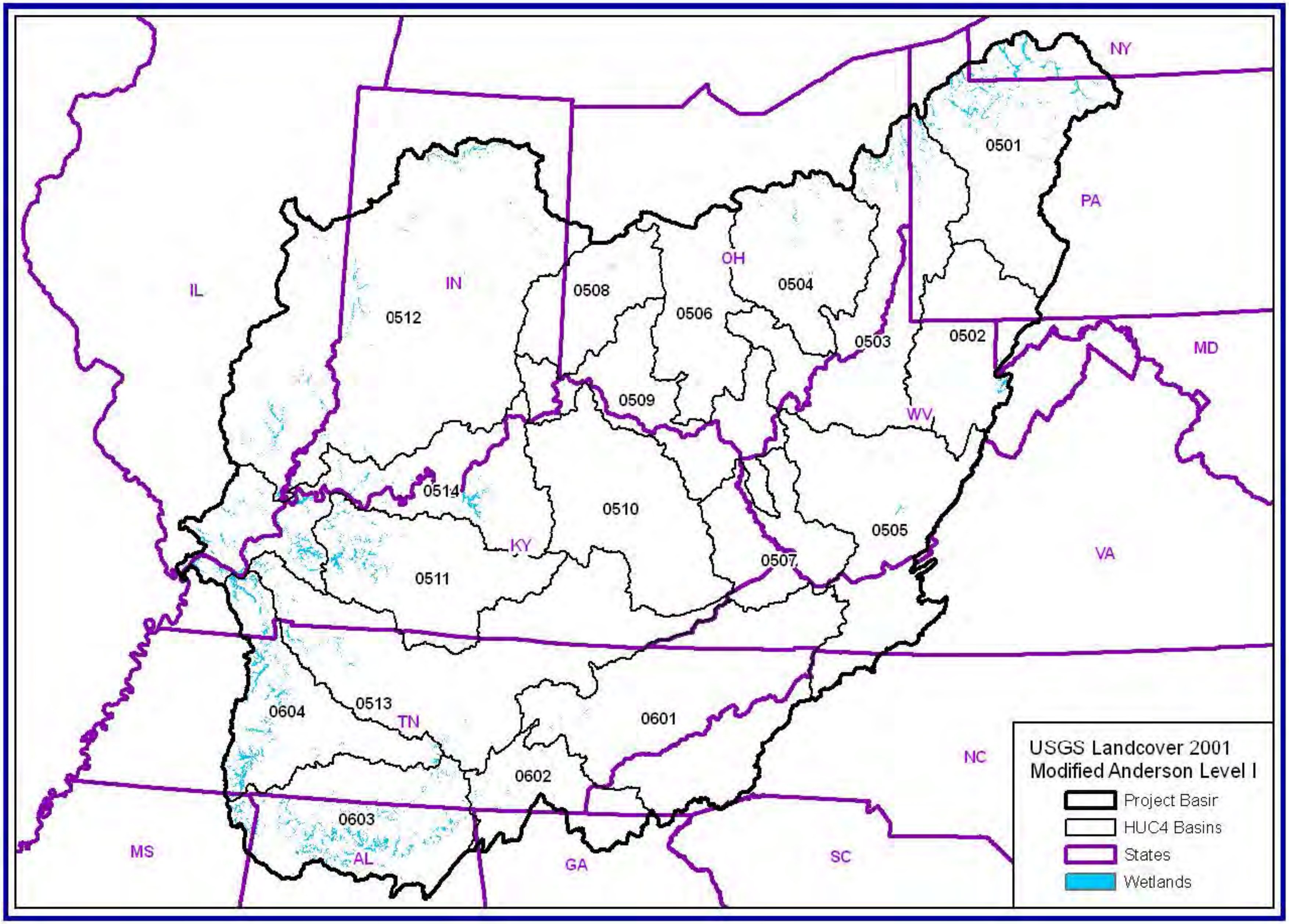
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APPENDIX H – PROTECTED BASIN ASSETS (LPP'S)

Since the late 1930s, USACE has been constructing flood risk reduction infrastructure throughout the Ohio River Basin. A multi-layered system of upstream reservoirs, local protection projects (levees, floodwalls, channels, and diversions), flood warning systems, flood insurance, and nonstructural measures has provided protection for many communities (incorporated and un-incorporated alike).

In all, there have been 83 reservoirs constructed (78 multi-purpose with conservation pools and 5 dry single-purpose reservoirs) and over 100 local protection projects. For the purposes of conducting this analysis of protected assets we have selected 97 LPPs that have been identified in the USACE national database as having been designed by USACE. For this reason, the listing of LPPs for which protected assets have been accumulated in Table 9 below does not match the more extensive listing of LPPs found in Table 8 above.

In addition to the various structural projects, there have been several nonstructural projects implemented featuring elevation of structures above design flood levels and permanent acquisition and relocation of structures in high-hazard floodplain areas. These projects have been authorized and implemented through Section 202 of Public Law 96-367 and subsequent Appropriations Acts in West Virginia, Kentucky and Virginia.

Between the structural and nonstructural measures constructed, hundreds of residences, commercial businesses and institutional structures including schools, churches, city halls, and police and fire stations as well as industrial complexes, transportation routes, and utilities have been protected by these facilities and measures.

Table 9 lists the USACE-designed local protection projects and a summary of the public and private assets protected by those projects. Also shown are the Census estimates of population (normal and night-time) present within these protected areas that depend upon the reliability and security of these facilities. Also included is an estimated value of the protected assets provided for in the US Census and the FEMA HAZUS programs.

Table 9 – Public and Private Assets Protected by USACE Designed LPPs

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Ashland, KY	356.20	1,047	$35,912,100	561	888	853	20	649	1	5	56	0	7
Brewster	263.37	432	$37,653,600	253	653	609	4	397	0	1	75	0	6
Catlettsburg	273.77	562	$25,338,800	394	917	892	3	488	0	2	72	0	12
Ceredo	825.10	2,548	$172,956,800	2,099	4,439	4,280	11	2,357	0	5	299	0	85
Chillicothe	1,052.10	2,258	$135,001,700	2,022	5,019	4,734	0	2,088	0	4	384	0	49
Greenfield	7.96	0	0	0	0	0	0	0	0	0	0	0	0
Guyandotte	560.81	758	$35,881,700	585	1,313	1,270	1	696	0	1	109	0	20
Huntington	3,556.90	11,183	$701,670,500	11,182	25,155	23,734	45	10,084	6	21	1,517	8	2,170
Ironton – North	287.43	783	$57,599,800	693	1,582	1,525	1	763	0	0	118	0	31
Ironton – South	1,208.84	4,286	$270,988,500	3,668	8,333	7,990	13	3,895	0	9	690	3	136
Magnolia Levee	84.90	318	$30,911,600	143	356	335	3	304	0	0	37	0	1
Massillon – East	169.59	282	$15,721,400	217	434	398	1	219	1	0	64	0	2
Massillon – West	58.80	12	$832,800	2	6	6	0	5	0	0	1	0	0
Matewan	22.52	63	$4,101,300	27	51	48	1	56	0	0	4	0	0

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Maysville	367.05	1,131	$61,999,700	848	1,781	1,705	4	1,003	0	1	176	0	21
New Boston – Portsmouth	1,961.24	4,732	$176,490,700	4,069	9,263	8,919	23	4,058	0	14	780	0	249
Newark	103.31	298	$16,302,400	285	757	705	0	278	0	0	71	0	0
Parkersburg	763.34	924	$59,503,600	507	1,186	1,136	23	663	5	1	50	0	4
Pavonia	6.79	0	0	0	0	0	0	0	0	0	0	0	0
Pikeville	389.52	1,003	$102,056,200	691	1,600	1,594	15	832	3	3	87	1	34
Point Pleasant	238.81	688	$37,896,300	583	1,249	1,193	9	577	0	4	97	0	10
Prestonsburg	57.18	163	$16,700,400	76	198	188	4	123	1	2	10	0	1
Roseville	0.00	256	$15,043,400	173	432	401	1	229	0	2	48	0	0
Russell 1	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Russell 2	8.73	7	$309,400	3	6	6	0	6	0	0	0	0	0
Russell 3	8.73	7	$309,400	3	6	6	0	6	0	0	0	0	0
South Williamson	26.77	97	$6,566,900	70	144	138	0	84	0	1	6	0	4
Waldo Levee	0.00	104	$11,752,000	49	102	96	3	84	0	0	14	0	0
West Columbus	2,917.62	4,739	$266,710,300	4,936	13,965	13,408	7	4,185	5	10	1,392	0	156

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
West Williamson	104.83	348	$23,861,200	273	630	590	2	303	1	0	80	0	5
Williamson CBD	77.43	497	$32,386,900	304	515	503	9	371	1	2	19	0	11
Williamson, KY	13.47	17	$1,156,000	12	39	37	0	13	0	0	6	0	0
Zoar Levee	73.50	63	$7,226,100	21	49	45	1	48	0	0	4	0	0
Bardstown FDRP	1.44	0	0	0	0	0	0	0	0	0	0	0	0
Brevoort Levee / Vincennes LFPP	52,988.60	8,845	$506,623,500	6,678	17,031	15,936	19	8,072	12	13	1,262	3	1,770
Brookport LFPP	1,197.24	631	$36,745,000	445	1,038	992	0	607	0	1	111	0	7
Cannelton LFPP	297.15	472	$29,836,000	294	685	647	1	442	0	1	51	0	7
Cincinnati LFPP	2,184.71	1,487	$62,680,300	828	2,538	2,437	18	889	1	2	333	1	32
Covington LFPP	667.50	3,187	$233,312,500	3,474	7,997	7,545	26	2,790	5	8	578	1	116
Dayton LFPP	170.57	799	$44,429,700	784	2,153	2,048	1	738	0	3	231	0	38
Delphi LFPP	344.22	315	$21,760,900	262	607	579	0	283	0	0	53	0	4
England Pond Levee	6,203.50	92	$5,409,600	77	218	201	0	92	0	0	22	0	3
Evansville LFPP	11,581.99	32,493	$2,002,933,600	31,413	74,602	70,301	54	29,731	38	46	6,076	1	1,905
Frankfort LFPP	412.82	668	$48,871,400	436	937	876	26	548	0	0	71	0	7

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Gill Township Levee	12,237.98	91	$5,723,900	56	149	140	0	82	0	0	19	0	0
Golconda LFPP	75.21	198	$8,746,400	100	211	198	1	193	0	0	16	0	0
Hagerstown LFPP	2.58	0	$0	0	0	0	0	0	0	0	0	0	0
Harrisburg LFPP	3,124.69	3,420	$131,879,700	2,335	5,799	5,619	14	3,059	0	5	507	0	75
Hawesville LFPP	60.29	157	$11,103,900	85	182	174	3	133	0	2	27	0	0
Indianapolis LFPP	169.28	111	$12,622,500	135	455	406	1	54	4	3	5	5	139
Jeffersonville-Clarksville LFPP	4,861.89	11,093	$825,085,800	11,007	25,460	24,163	17	10,144	8	14	1,991	1	321
Lawrenceburg LFPP	492.19	1,154	$82,061,800	885	2,172	2,013	8	967	0	5	202	0	2
Lebanon Junction LFPP	255.92	104	$7,545,100	61	180	170	0	93	0	1	19	0	1
Levee Unit No. 5	50,983.70	491	$31,953,800	275	682	661	1	460	0	1	56	0	2
Levee Unit No. 8	16,173.57	153	$10,456,000	70	193	189	1	143	0	1	18	0	0
Louisville LFPP	25,004.45	63,937	$4,078,136,700	68,447	164,271	155,499	118	57,229	65	104	16,628	91	3,576
Lyford Levee	3,606.21	7	$395,500	5	15	14	0	7	0	0	1	0	0
Mason J. Niblack Levee	20,805.09	184	$13,646,000	87	220	207	0	164	0	0	16	0	1
Mount Carmel LFPP	554.75	394	$19,873,800	312	776	695	0	379	0	0	66	0	9

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Muncie LFPP	907.21	2,469	$140,888,000	2,708	6,214	5,601	11	2,265	1	5	350	0	1,078
New Albany LFPP	2,206.98	6,447	$442,858,500	6,243	14,445	13,670	14	5,855	1	9	1,279	0	231
Newport LFPP	440.16	2,124	$103,455,900	2,470	6,232	5,897	9	1,794	0	3	739	0	76
Paducah LFPP	11,194.06	11,033	$510,841,900	8,891	20,204	19,280	24	9,756	4	18	1,800	3	273
Reevesville LFPP	6,726.92	59	$3,999,600	37	97	93	0	56	0	0	7	0	0
Rochester-McCleary's Protected Area	4,862.31	37	$1,750,100	24	70	67	0	35	0	0	5	0	1
Rosiclare LFPP	265.86	196	$7,325,600	124	248	243	2	183	0	1	17	0	0
Rushville LFPP	195.52	413	$34,632,800	264	749	685	3	346	0	2	62	0	1
Shawneetown LFPP	953.25	172	$6,203,800	101	280	265	1	157	0	0	32	0	0
South Frankfort LFPP	90.56	401	$40,273,400	437	837	826	5	337	1	4	73	0	17
Southwest Jefferson County LFPP	16,475.23	17,122	$1,466,085,900	15,988	42,005	39,402	9	16,191	1	20	4,134	0	702
Sturgis LFPP	906.70	1,410	$61,431,900	811	1,925	1,819	2	1,305	0	2	164	0	3
Taylorsville LFPP	175.67	447	$32,809,800	383	814	767	4	400	0	2	72	0	0
Tell City LFPP	185.72	452	$30,018,200	245	543	506	3	361	0	0	67	0	1

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Terre Haute LFPP	125.69	220	$11,582,200	172	509	476	0	199	1	1	29	0	17
Uniontown LFPP	269.70	479	$21,908,700	355	835	784	3	463	0	2	84	0	1
West Terre Haute LFPP	446.17	1,199	$52,818,500	893	2,326	2,175	2	1,130	0	1	252	0	16
Barbourville, KY LPP	664.39	1,097	$84,528,400	898	2,309	2,286	8	917	2	6	134	1	196
Harlan, KY LPP	104.01	415	$33,002,300	268	553	534	5	328	1	3	39	0	9
Loyall, KY LPP	179.36	422	$19,171,400	294	656	635	1	401	0	1	58	0	1
Middlesborough, KY LPP	1,939.46	2,831	$177,528,000	2,130	4,760	4,582	8	2,532	0	7	410	1	74
Pineville, KY LPP	181.80	391	$29,598,700	263	821	799	5	327	0	1	75	1	2
Rio Vista, KY LPP	104.08	154	$8,795,500	134	314	311	0	149	0	0	33	0	3
Wallsend, KY LPP	44.31	228	$9,598,800	180	401	387	4	203	0	1	51	0	0
Williamsburg, KY LPP	81.73	154	$10,758,300	91	228	213	4	115	0	1	9	0	68
Chartiers Creek, James G. Fulton LPP	938.61	1,347	$91,930,100	1,418	2,715	2,595	1	1,201	0	3	173	0	46
Elkins LPP	1,038.23	2,329	$154,304,200	1,778	3,961	3,809	8	2,039	0	7	259	1	178
Etna LPP	34.55	277	$18,365,100	284	629	581	0	264	0	0	37	0	21
Johnsonburg LPP	16.65	34	$1,751,000	23	58	53	0	34	0	0	6	0	0

LPP Name	Acres Protected	Structures Protected	Value of Structures	Households Protected	Population	Nighttime Population	Government Buildings	Residences	Hospitals	K-12 Schools	Enrollment	Colleges	Enrollment
Johnstown LPP	1,526.96	4,105	$153,519,000	4,400	8,835	8,404	16	3,766	29	4	545	1	109
Kittanning LPP	61.96	212	$14,161,600	215	525	480	2	188	0	0	45	0	53
Oil City LPP	44.91	77	$2,171,400	54	92	83	2	47	0	0	10	0	0
Olean LPP	1,799.57	3,153	$178,939,300	3,051	7,484	7,150	8	2,834	0	6	600	0	157
Portville LPP	717.06	524	$32,120,800	429	1,050	995	1	477	0	2	115	0	15
Punxsutawney LPP	278.13	485	$24,046,200	607	1,215	1,150	1	404	0	2	74	0	40
Salamanca LPP	126.93	118	$4,165,900	89	211	205	0	106	0	0	22	0	0
Wellsville LPP	254.35	910	$38,865,900	770	1,956	1,841	0	871	0	2	193	0	19
Wilmore LPP	44.75	54	$4,584,600	54	134	127	0	54	0	0	18	0	1
Totals	*286,913*	*234,086*	*$14,653,466,200*	*220,876*	*526,879*	*498,830*	*679*	*219,253*	*198*	*414*	*46,697*	*123*	*14,438*

APPENDIX I – SUB-BASINS AND WATERSHEDS

The basic geographic framework for the Ohio River Basin Comprehensive Reconnaissance Study was the HUC 8 (eight-digit Hydrologic Unit Code) watershed level established by USGS. Data from various sources (USGS, FEMA, NRCS, US Census, USFWS, HAZUS, etc.) were available at that geospatial level of analysis and using that hydrologic unit made comparison of certain land use, population, flood risk and other watershed attributes possible. This framework also allowed the PDT to essentially "roll up" the HUC 8 data into the larger HUC 4 sub-basin level of analysis. The HUC 4 units being the more commonly known sub-basins of the Ohio River Basin (i.e., Allegheny, Monongahela, Muskingum, Scioto, Green, Wabash, Cumberland and others). Each of the HUC 4 sub-basins is a distinct hydrologic unit with its own characteristics and in many cases, its own issues. Figure 4 shows the four-digit HUC coded sub-basins.

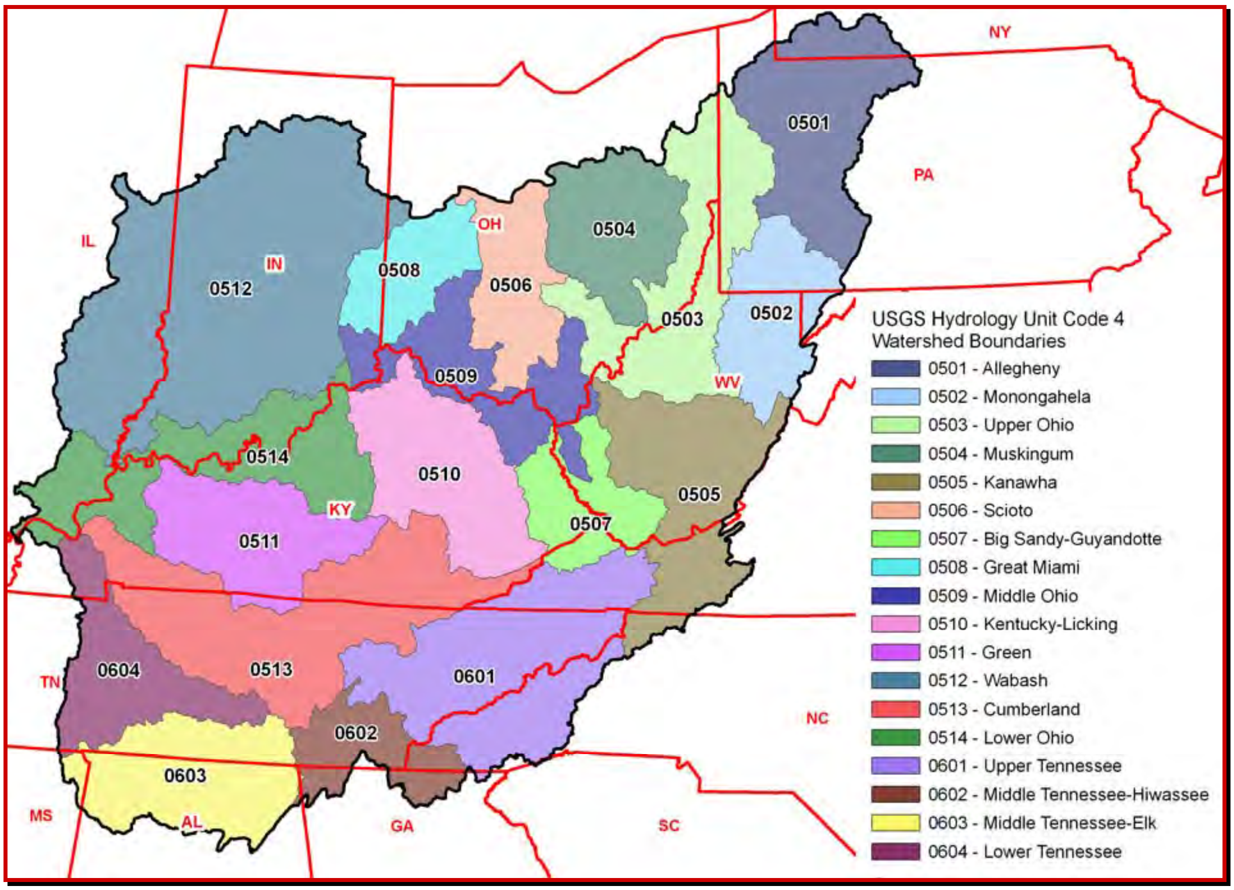

Figure 4 – Four-Digit HUC Coded Sub-basins

At these levels of analyses certain relationships between land use cover, population, impaired waters, T&E species, and other factors could be matched against existing USACE infrastructure, NFIP insurance policies and insurance coverage data to determine where causal relationships existed – relationships that may indicate a problem, need or opportunity that could be addressed through a single or minimum number of alternative actions (synergistic solutions). These causal relationships at the HUC 8 and HUC 4 levels also indicate where sustainability issues may be located and where integrated solutions may be present.

The pages that follow provide information on each of the HUC 4 sub-basins regarding regional context or sub-basin descriptions, information on the most pressing water resources issues, existing USACE projects and opportunities for studies or projects that may be implemented through one of the standing authorities (CAP (Sections 205, 206, or 1135), Section 216 Review of Completed Projects, or Section 22 Planning assistance to States) or through a specially authorized study, program or project. Figures are included for each of the sub-basins.

Table 10 shows the information of all of the HUC 8 level watersheds and HUC 4 sub-basins in the Ohio River Basin HUC 2 region as well as the square miles within each HUC 8 and HUC 4.

1. ALLEGHENY RIVER SUB-BASIN – PENNSYLVANIA, NEW YORK

1.1 REGIONAL CONTEXT

The Allegheny River sub-basin is located primarily within Pennsylvania and New York. This 11,655 square mile region contains a population of approximately 1.4 million residents (density is 121 persons per square mile) and extends northward to the edges of the Lake Erie watershed. Figure 5 shows the extent and location of the sub-basin. The sub-basin contains numerous urban areas including a substantial portion of metropolitan Pittsburgh, PA and all of Johnstown, PA; Jamestown, PA and Baldwin, PA. Predominant land cover types are mixed forest and row crops with hay/pasture and surface mining/quarry cover types following.

1.2 EXISTING USACE PROJECTS

The headwaters of the Allegheny River drain from as far east as Potter County, Pennsylvania northwestward to Salamanca, New York before being controlled by the Kinzua Dam, which creates the huge Allegheny Reservoir, straddling the Pennsylvania/New York state line. There are four local flood reduction projects constructed with Federal assistance in this portion of the Allegheny River basin, and other communities have received state assistance for local flood reduction. Lands of the Seneca Nation are located in this area, as well as large tracts of state land (Allegheny State Park, New York) and Federal land (Allegheny National Forest in Pennsylvania).

The middle Allegheny River includes the stretch of river below Kinzua Dam and above the commercially navigable portion of the river beginning at Lock and Dam 9 near East Brady, Pennsylvania. Three USACE reservoirs are operated in this portion of the Allegheny River's drainage that influence levels and flows in the river. The Nature Conservancy has expressed interest under its Sustainable Rivers initiative to look at this stretch of river for potential aquatic ecosystem enhancement, related to possible modifications to release schedules from these reservoirs.

The Conewango River is a 919 square mile sub-watershed to the Allegheny River, with drainage from Cattaraugus and Chautauqua Counties in New York to its confluence with the Allegheny River at Warren, Pennsylvania. French Creek is a sizable tributary to the Allegheny River, with headwaters in extreme southwestern New York State (Chautauqua County), and joining the Allegheny at Franklin, Pennsylvania. There are two USACE reservoirs within the French Creek drainage. One, Union City, is a dry dam that retains water only seasonally. The other Woodcock Creek Lake, contains water from a relatively small drainage area, and has been briefly considered in the past for the potential to modify its release schedule due to interest from the Nature Conservancy in French Creek under its Sustainable Rivers program.

1.3 WATER RESOURCES ISSUES

In addition to concerns about seasonal flow releases from existing dams, CSOs, invasive species, urban stormwater runoff, nutrient loading, bacterial contamination and other water quality issues brought about by point and non-point sources some of the watersheds contain a high percentage of agriculture land, with concern for improved agricultural land use practices to reduce runoff contributing to sedimentation. The Nature Conservancy is interested in evaluating flow releases from several existing USACE dams in the sub-basin – work that could be accomplished through standing authorities such as the Section 216 Review of Completed Projects program.

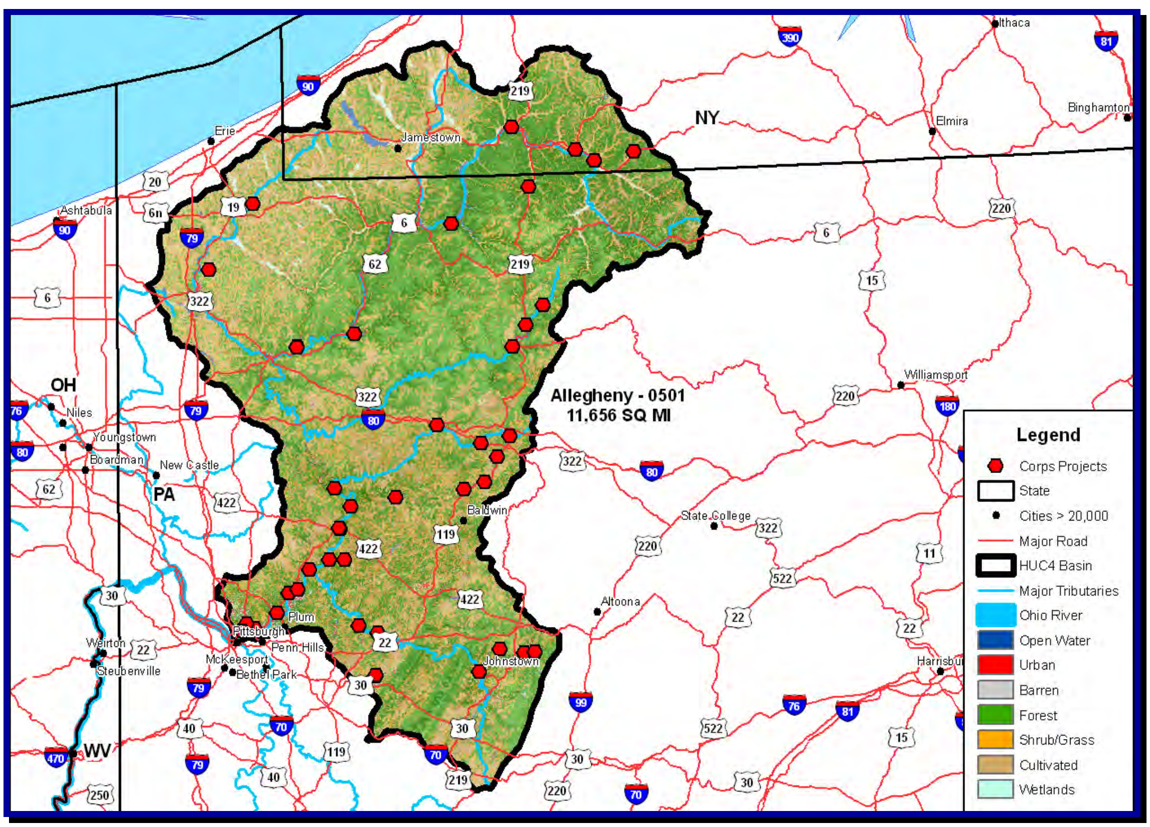

Figure 5 – Allegheny River Sub-basin

1.4 POTENTIAL STUDIES AND PROJECTS THROUGH STANDING AUTHORITIES

Opportunities for USACE to assist with aquatic habitat improvements can be pursued under the Section 206 program (WRDA 1996) for aquatic ecosystem restoration; the Section 216 authority (Flood Control Act of 1970) for Review of Completed Projects due to changed conditions (modified flow regimes); and the Section 1135 program (WRDA 1986) for environmental protection and restoration at completed USACE projects; or evaluated through a watershed assessment as an amendment to Section 5002, Watershed Management, of the Water Resources Development Act of 2007. The interest by the Nature Conservancy in addressing aquatic habitat in the sub-basin shows opportunities to collaborate in multiple studies throughout the region.

2. MONONGAHELA RIVER SUB-BASIN – PENNSYLVANIA, WEST VIRGINIA, MARYLAND

2.1 REGIONAL CONTEXT

The Monongahela River forms from the confluence of the Cheat and West Fork Rivers, both in northern West Virginia. The river then travels 128 miles north to its confluence with the Allegany River to form the Ohio River in Pittsburgh, Pennsylvania. The Cheat and West Fork Rivers as well as the Tygart, Casselman and Youghiogheny Rivers are the tributaries of significance in the Monongahela River basin. Land cover is a mixture of forest, cultivated, shrub/grass and urban types with the more northern portions of the sub-basin being urban and cultivated types and the southern portions in West Virginia being more forest covered. Figure 6 shows the sub-basin land cover types and cultural features.

The City of Pittsburgh and adjacent south hills suburbs and Uniontown comprise the major cities of Pennsylvania in the Monongahela River basin. The major cities of West Virginia in the same river basin are Morgantown and Clarksburg. The sub-basin population is approximately 1.4 million within a land area of 7,370 square miles (density of 194 persons per square mile). Three interstate highways intersect the region and numerous railway lines are located along the main rivers. About 128 miles of the Monongahela River are commercially navigable through USACE maintained locks and dams extending into West Virginia. Health and educational services, public administration, mining and natural resources and retail trade comprise the economic sectors of importance throughout the Monongahela River sub-basin.

2.2 USACE EXISTING PROJECTS

Taking advantage of Stonewall Jackson Dam and Lake is West Virginia's Stonewall Jackson State Park (also known as Stonewall Jackson Resort). The resort managed by, Benchmark Hospitality International, provides a much larger array of services than traditional state park services and is the newest state park in the West Virginia system.

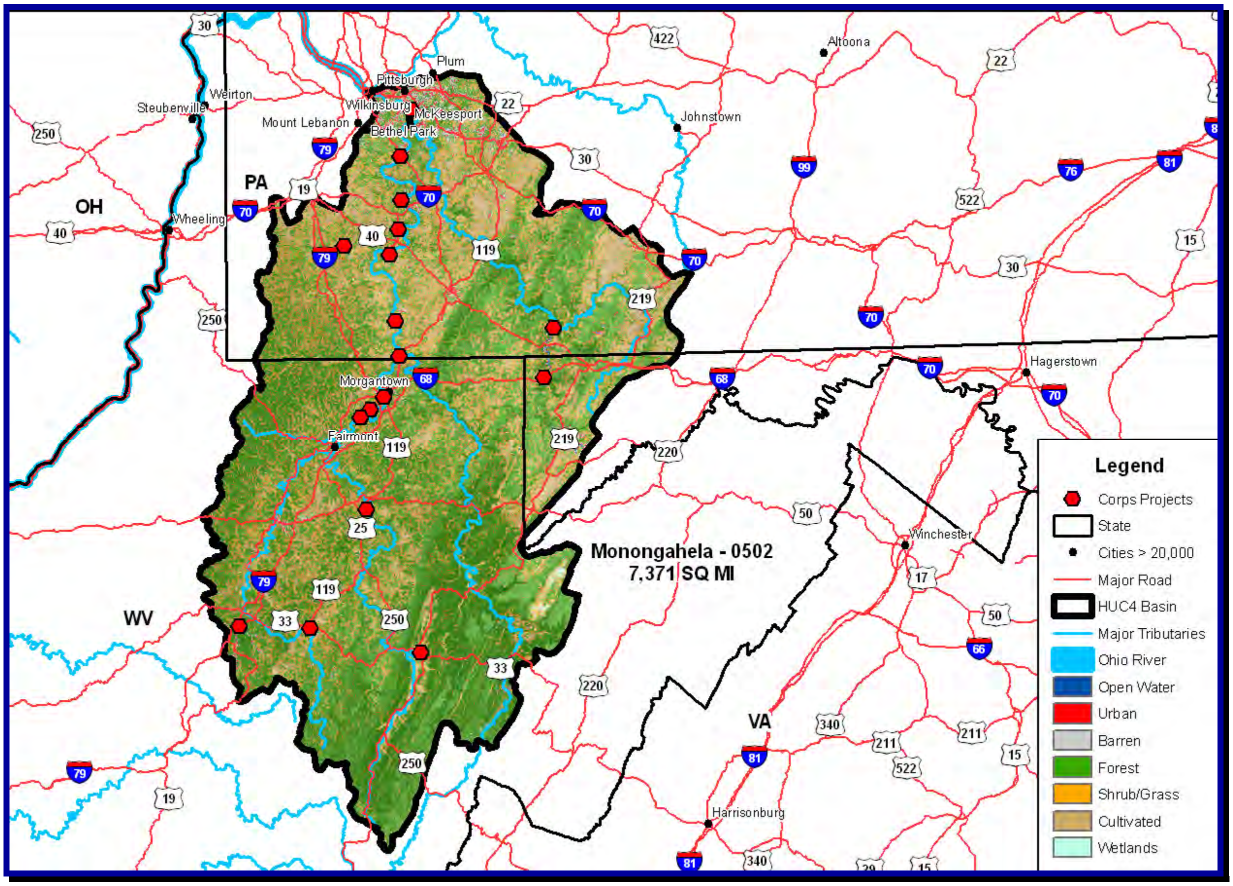

Figure 6 – Monongahela River Sub-basin

USACE operates and maintains 4 flood control reservoirs, 9 locks and dams and 5 local flood protection projects in the Monongahela River Basin. Youghiogheny River Lake features a run-of-reservoir hydropower facility and is the only USACE associated hydropower facility in the Monongahela River basin. In 2008, the Locks and Dams of the Monongahela River basin provided navigable pools that allowed the movement of approximately 28.0 million short tons of commercial traffic. The Lower Monongahela River Project is an ongoing construction project that has replaced the nearly 100-year-old fixed-crest dam at Braddock Locks and Dam with a gated dam, will remove Locks and Dam 3, and construct two new larger locks (Charleroi Locks) at Locks and Dam 4. This effort will lead to improvements for commercial traffic, industrial and municipal water, and recreational boaters.

2.3 WATER RESOURCES ISSUES

Issues particular to the sub-basin include Marcellus shale wastewater, aging river and flood protection infrastructure, acid mine drainage, stormwater runoff, municipal and industrial wastes, combined-sewage overflows, point/non-point source pollution, CSOs, and bacterial contamination.

2.4 POTENTIAL STUDIES OR PROJECTS

Issues having suitability for Section 216 study, CAP 205 and/or 206 or Section PAS study include significant numbers of brownfields (old industrial & manufacturing plants) found throughout the Monongahela River basin. A congressional authority to allow brownfield remediation along stream/riverbanks would provide waterfront development opportunities.

Section 581 of WRDA 1996 authorizes the design and construction of minimum 100-year level of protection for flood control measures in portions of the Monongahela River basin (also in the lower Allegheny River basin). Many communities have expressed interest in pursuing floodwalls and levee construction under Section 581. However, the 100-year stipulation often makes flood control projects too cost prohibitive for smaller communities take advantage of, leaving them flood prone. Reducing the level of protection would allow a level of flood protection to be pursued with cost-sharing partners instead of no action at all.

The recent loss of aquatic life in the Dunkard Creek basin (a multi-state, pristine watershed between West Virginia and Pennsylvania) presents an opportunity to investigate and study, under Section 206, causes that may be related to local Marcellus shale gas activities and restore the aquatic ecosystem in that location as well as provided guidance for future Marcellus shale water issues.

Possible Section 22 Planning Assistance to States may include developing studies and recommendations for water resources used in Marcellus shale operations.

3. UPPER OHIO SUB-BASIN – PENNSYLVANIA, WEST VIRGINIA, OHIO

3.1 REGIONAL CONTEXT

The Upper Ohio Sub-basin covers portions of Ohio, Pennsylvania and West Virginia with numerous direct tributaries of the Ohio River. Chief among those tributaries are the Shenango, Mahoning, Connoquessing, Beaver, Hocking, Little Muskingum and the Little Kanawha rivers. Each of these tributaries and many smaller direct streams drain approximately 13,300 square miles of land cover (a combination of cultivated, forest and urban) into the Ohio River. There are an estimated 2.5 million persons living within this sub-basin area (density of 188 persons per square mile). Several major urban areas populate this sub-basin including western suburbs of Pittsburgh, PA; Youngstown, OH; Weirton, WV; Wheeling, WV; and Athens, OH. Figure 7 shows the combinations of land cover types and cultural features that compose the Upper Ohio Sub-basin.

An extensive network of transportation routes occupies the sub-basin including interstate and federal highways, numerous railways bordering the Ohio River and a number of regional airports. There are a substantial number of heavy industries located along the upper Ohio River mainstem that are so located to take advantage of the inland waterway transportation savings and the abundant water supplies afforded by the Ohio River. These facilities provide a sound economic base for the sub-basin and the region.

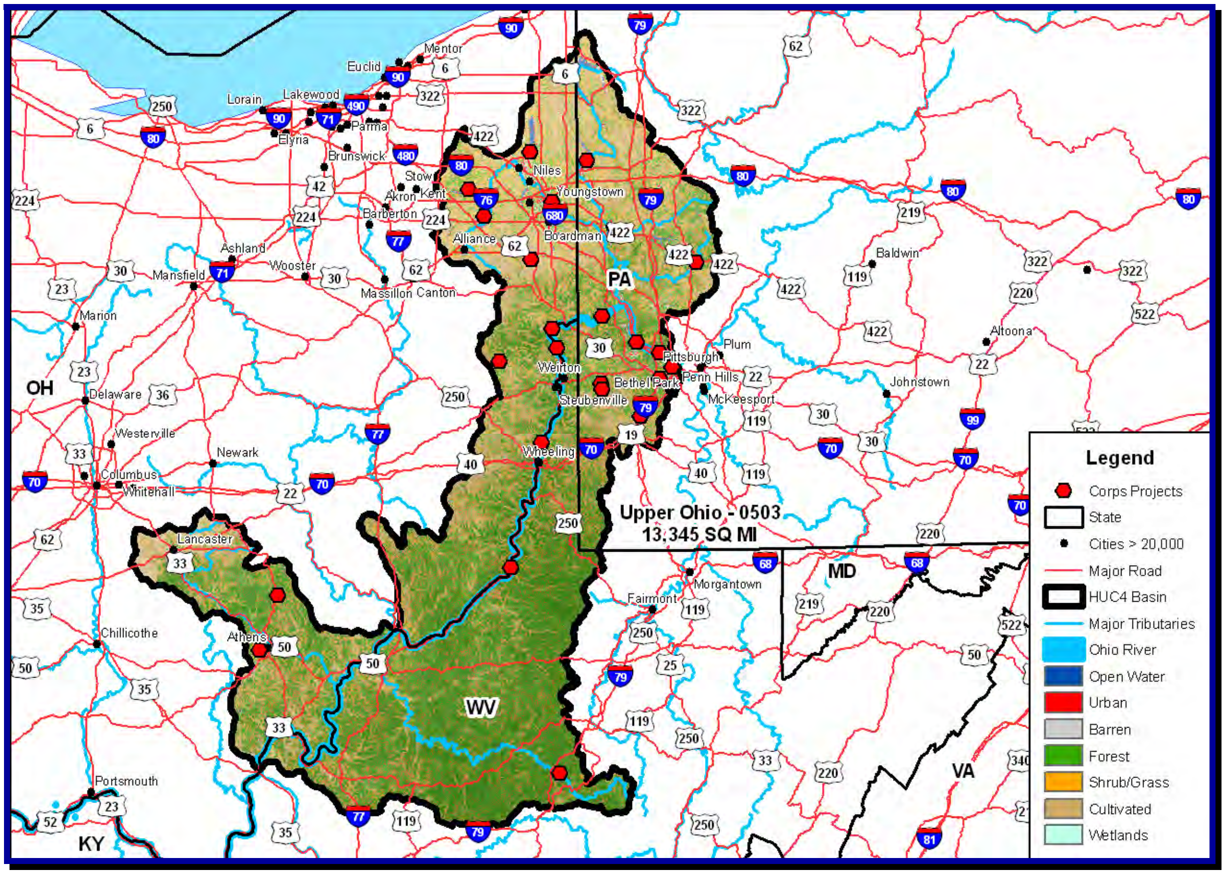

Figure 7 – Upper Ohio Sub-basin

3.2 USACE PROJECTS

As Figure 7 shows (red dots) there are a number of USACE projects in the sub-basin including several navigation locks and dams on the mainstem Ohio River. Several flood risk reduction projects (reservoirs and LPPs) are located within the sub-basin as well.

3.3 WATER RESOURCES ISSUES

The Upper Ohio River sub-basin is a region that historically has seen considerable coal mining activity that has resulted in numerous abandoned mines and incidents of sedimentation and acid-mine drainage. Other areas of the sub-basin have undergone decades of timber harvesting adding to water quality issues. In addition, the presence of major urban areas, several with documented CSOs (see Table 9 in the Main Report) and only limited stormwater management contribute numerous pollutants into the Ohio River. The presence of numerous heavy industries located along the mainstem Ohio River has added to the list of point source pollutants in the river, but cleanup efforts through USEPA and ORSANCO have significantly reduced their numbers. Added to these water quality issues is the ongoing development pressure of an expanding population that has consumed many acres of forest and undisturbed wildlife habitat for residential, commercial and industrial growth.

3.4 OPPORTUNITIES FOR STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

Captina Creek is a tributary to the Ohio River, whose watershed is located largely in Belmont County, Ohio. The endangered Eastern Hellbender, a foot long plus salamander, is found within the watershed, as is Dysart Woods, a rare ancient forest and an endangered ecosystem. The creek has been subjected to a series of coal slurry spills and discharge pipe failures and releases beginning in 1999 and 2000, with litigation and penalties imposed, with more recent events including a large fish kill in August 2005 and another devastating coal slurry discharge in February 2008. Acid mine drainage is another chronic problem in the watershed. Yet the creek retains potential for a quality warm water fishery if protection and restoration efforts are successful. Opportunities for USACE to assist can be pursued under Section 206 program (WRDA 1996) for aquatic ecosystem restoration, or in the conduct of a watershed study, if specifically authorized, for example, as an amendment to Section 5002, Watershed Management, of the Water Resources Development Act of 2007.

4. MUSKINGUM RIVER SUB-BASIN – OHIO

4.1 REGIONAL CONTEXT

The Muskingum River sub-basin is the largest single drainage system in Ohio. At 8,095 square miles, the Muskingum drainage extends from Marietta, Ohio on the Ohio River northward to within 25 miles of the shoreline of Lake Erie. The sub-basin encompasses 5 counties and portions of 22 others. A number of cities and urban areas dot this landscape surrounded by cultivated and forested land covers. The northern and western portions of the region were glaciated featuring rolling hills, deep soils and broad valleys while the southern and eastern sections were spared the advances of glaciers and feature more rugged terrain. The estimated population of this hydrologic region is 1.5 million with projections of 22 percent growth by 2050. Figure 8 shows the extent of the Muskingum River sub-basin in northeastern Ohio.

Due to damaging floods in the 1930s, a system of reservoirs was authorized for construction by USACE. Today there are 14 reservoirs operating in the region thanks to that original authorization. An additional two reservoirs were authorized later and now Dillon (1959) and North Branch Kokosing River (1972) lakes are operated by USACE for flood control purposes as well. Four of the original reservoirs are single-purpose reservoirs for flood control and have no permanent conservation pool (“dry-dams”). Average annual flood damages prevented by this system are estimated at $90.0 million. The original 14 reservoirs were developed in close cooperation with the Muskingum Watershed Conservancy District and the lands acquired for the projects are now operated exclusively by the MWCD for recreation and other purposes; the dams are operated by USACE. Several of the 16 reservoirs provide water supplies for surrounding counties and municipal areas and extensive day-use and overnight recreation facilities including lodging facilities and golf courses are operated by the MWCD. All of the counties and approximately 140 municipal jurisdictions participate in the national flood insurance program (NFIP).

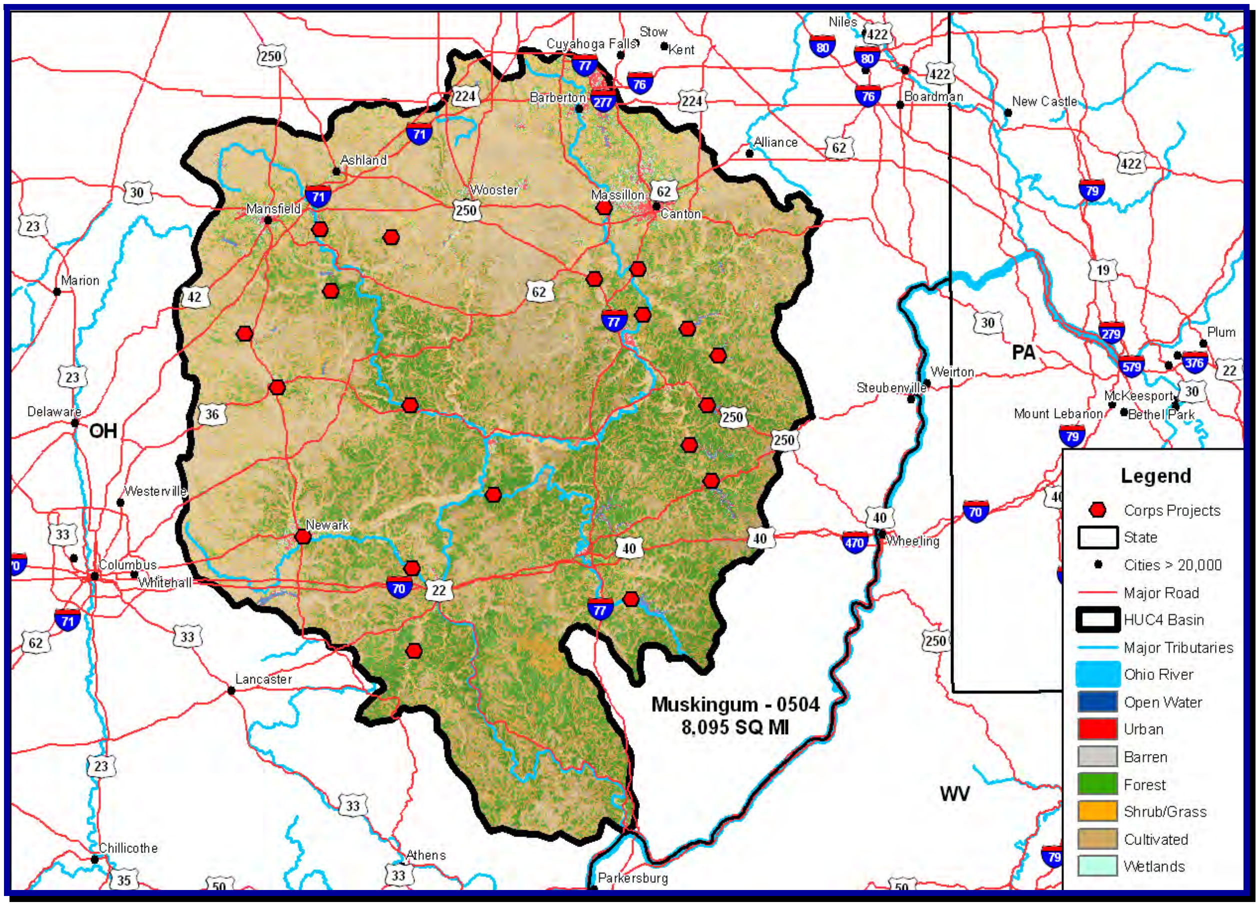

Figure 8 – Muskingum River Sub-basin

4.2 WATER RESOURCES ISSUES

The sub-basin features a combination of cultivated, urban and forested land covers and agriculture is a substantial land use (about 60% of the land cover) in the region. In addition, there has been coal mining in eight counties in the region and those largely "abandoned" facilities continue to contribute to the degradation of water quality through acid-mine drainage. Both of these activities provide employment and their share of impacts. The sub-basin has a number of streams classified by the state and USEPA as "impaired waters" due to sedimentation, nutrient loading and other point and non-point pollution sources. Increased sedimentation has threatened numerous sub-basin reservoirs due to eutrophication and accelerated utilization of sediment storage capacity. The increases in population have resulted in many instances of uncontrolled stormwater runoff (growth of impervious surfaces), degradation of stream and riparian habitat, channel instability and reduced groundwater recharge.

In addition to the issues of water quality the sub-basin, despite the number of operating reservoirs and 5 local protection projects, still is ravaged by flood damages. Average annual flood damages across the region are estimated to be $40.5 million with transportation, residential and commercial uses bearing the brunt of those damages. Major flood events in 1969 and 1998 resulted in substantial damages to small unprotected communities. Heavy rainfall in 2005 resulted in 13 of the 16 reservoirs reaching record flood pools with much concern for the structural stability of several of the aging structures. The aging flood risk reduction structures in the Muskingum sub-basin are of significant concern to USACE. Four of the reservoirs listed as DSAC 2 structures in Table 11 of the main report for rehabilitation under the Dam Safety Program are located in the Muskingum sub-basin (Bolivar, Beach City, Mohawk, and Dover).

4.3 EXISTING USACE PROJECTS

As noted above, there are 16 reservoirs in the sub-basin and five local protection projects. Fourteen of the 16 reservoirs were constructed between 1933 and 1938 with Dillon in 1957 and North Branch of Kokosing River completed in 1972. The five local protection projects (Massillon, Mount Vernon, Newark, Canton and Roseville) are operated by non-Federal local sponsors. Figure 9 shows the locations of the reservoirs and major watersheds of the sub-basin.

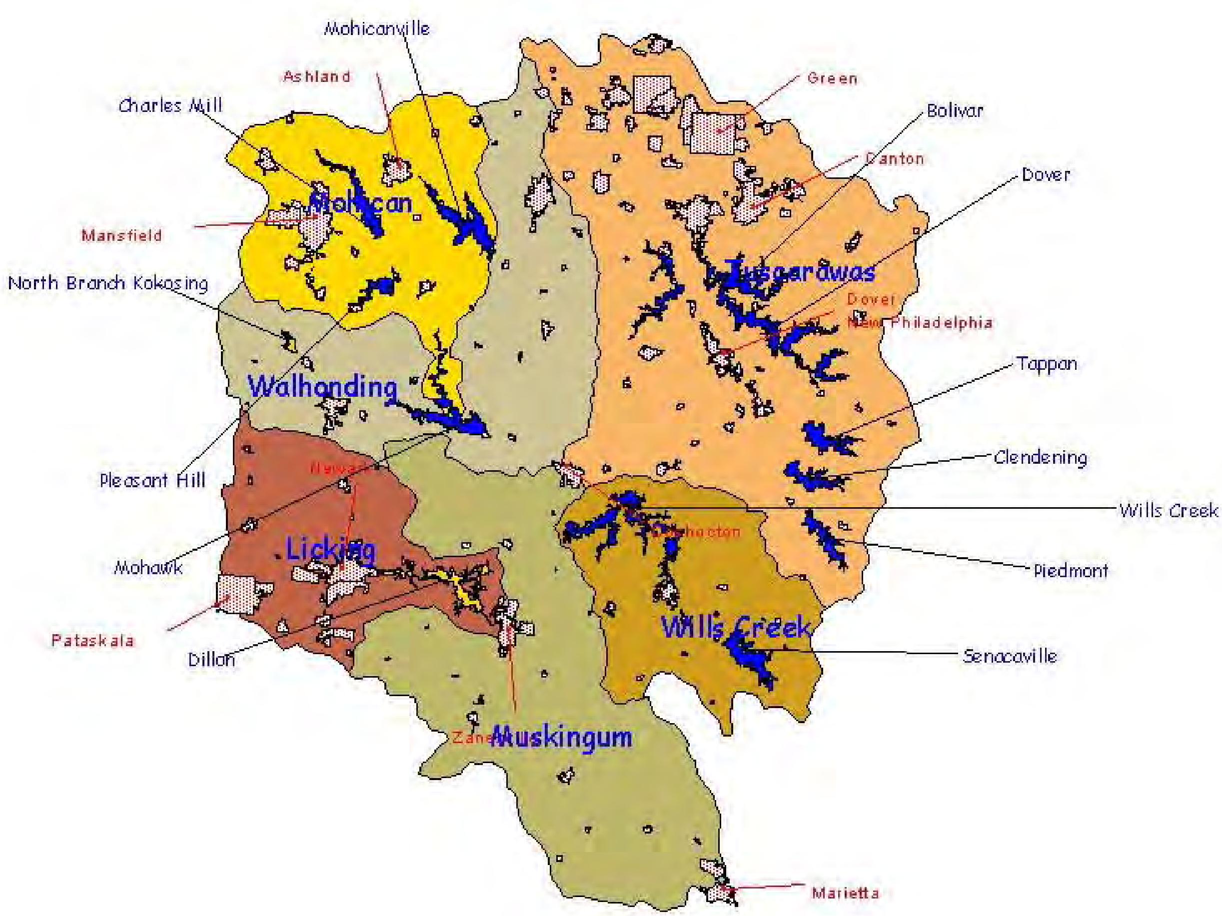

Figure 9 – Muskingum River Sub-basin with Reservoirs

4.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

The presence of many small communities at risk from flood damages indicates the potential for use of the Section 205 Small Flood Control Projects authority under the CAP to implement small structural projects or nonstructural projects such as a flood warning system for the sub-basin. The presence of aquatic habitat degradation through abandoned mines (four specific sites identified) and other sources indicates the potential for use of the Section 206 Aquatic Ecosystem restoration Program or the Section 1135 Environmental Improvement Program under the CAP authority. The downstream water quality issues associated with single port water intakes at older reservoirs (five reservoirs identified) and potential for reallocation of storage among the 14 reservoirs to increase authorized benefits both open the potential for application of the Section 216 Review of Completed Projects authority. Issues of floodplain management and stormwater runoff open the potential for application of the Section 22 Planning Assistance to States authority to locations in the sub-basin.

5. KANAWHA RIVER SUB-BASIN – WEST VIRGINIA, VIRGINIA, NORTH CAROLINA

5.1 REGIONAL CONTEXT

The Kanawha River is about 97 miles long ending near Kanawha Falls of Gauley Bridge, WV at the juncture with the Gauley and New rivers. The New River extends southeast from that point another 320 miles amid mountainous, rugged terrain extending through Virginia into North Carolina. Major cities in the sub-basin include Charleston, WV the state capitol, Nitro, WV and St. Albans. The Kanawha Valley is home to one of the largest concentrations of chemical manufacturing and storage industry in the basin

Major tributaries include Coal River, Elk River, Gauley River, Greenbrier River, and East River. The New River National Park occupies the New River corridor downstream of Bluestone Dam which supports an active whitewater recreation industry. Whitewater rafting is also supported on the Gauley River by releases from Summersville Dam. Figure 10 shows the Kanawha River sub-basin.

5.2 EXISTING USACE PROJECTS

USACE operates three flood control reservoirs in the sub-basin including Sutton Lake, Summersville Lake and Bluestone Lake. Details of their sizes, purposes, lake storage and facilities are shown in Appendix F. Claytor Lake on the New River is a single-purpose hydropower facility constructed in 1939 and owned and operated by Appalachian Power Company with substantial lakeside recreation development. USACE is currently working on a Section 206 Aquatic Ecosystem Restoration project at Claytor Lake through the Continuing Authorities Program. Three USACE Locks and Dams (Winfield, Marmet and London) providing stable pools for commercial navigation – 2008 tonnage approx. 24 million tons.

The Town of Marlinton, WV on the Greenbrier River is the subject of an ongoing flood risk reduction project in the feasibility phase.

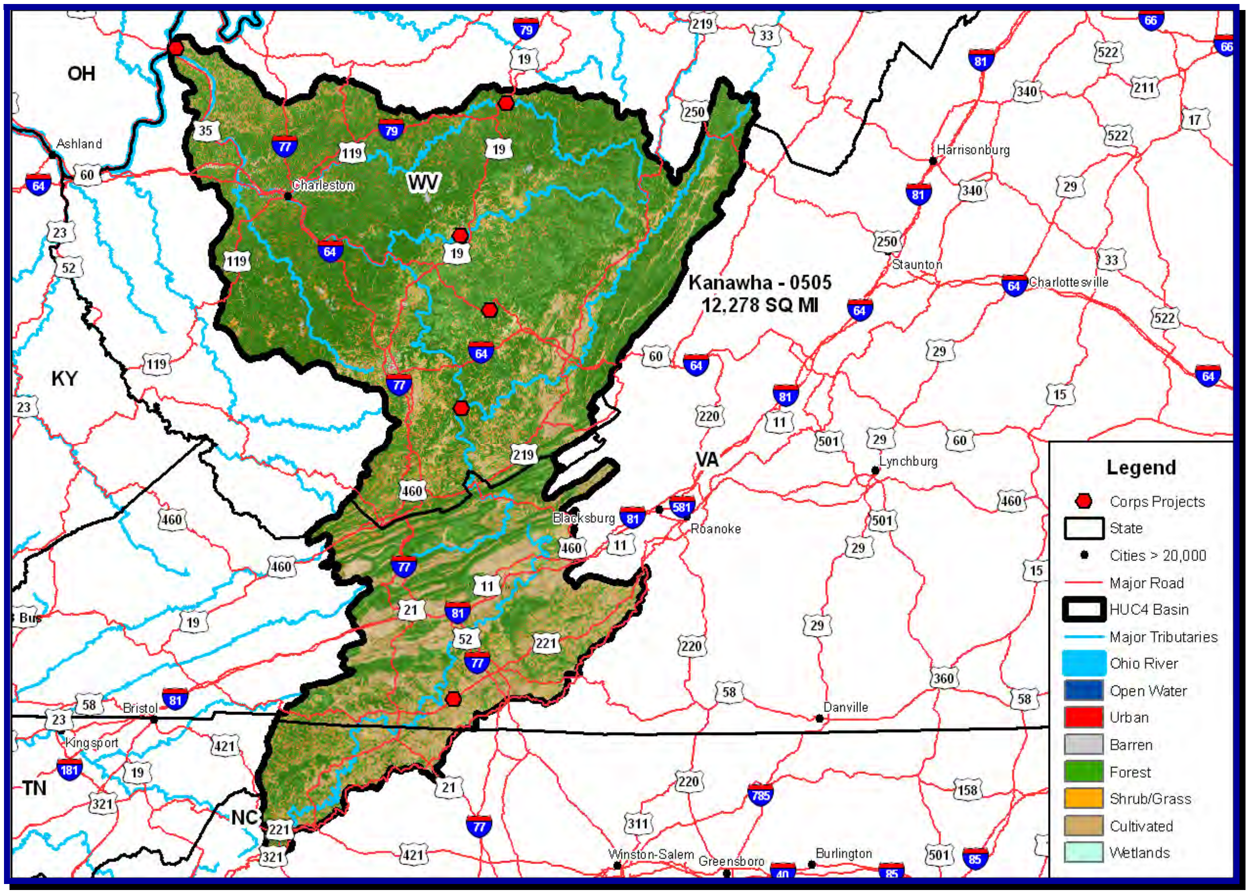

Figure 10 – Kanawha River Sub-basin

5.3 WATER RESOURCES ISSUES

Abandoned mine lands acid-drainage, urban stormwater runoff, sedimentation, point-source pollutants in the Kanawha Valley, municipal and industrial CSOs and some agriculture and livestock water quality issues. Changes in flow regime caused by the presence of USACE reservoirs and other dams impede fish migration and habitat connectivity. There are impaired waters throughout the sub-basin due to numerous pollutants mentioned above.

5.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

Three existing reservoirs have been operated since 1949 (Bluestone Dam) and have yet to be analyzed in terms of allocated storage or downstream flows with regard to ecosystem effects or user needs. Numerous small communities located upstream of the three dams are still subject to flooding and some flooding damages do occur downstream of the dams due to intervening tributaries. Opportunities for Section 205 projects and specially authorized projects to control flood risks are present. The number of aquatic ecosystem issues prevalent in the sub-basin indicates the potential for numerous Section 206 projects. One Section 206 project has been completed in the sub-basin in Boone, NC and one ongoing Section 206 project is occurring at Claytor Lake. One or more Section 22 PAS studies could be completed with state agencies in WV, VA or NC to address floodplain issues, water supply, and other water resources issues not eligible for recommendation.

6. SCIOTO RIVER SUB-BASIN – OHIO

6.1 REGIONAL CONTEXT

The Scioto River sub-basin is located in southern Ohio with the rivers mouth located at Portsmouth, Ohio at river mile 356.6 on the Ohio River. Portions of the lower Scioto River valley are part of the pre-glacial Teays River complex. The sub-basin is about 6,500 square miles in size and is home to several large urban areas, chief of those being the capitol Columbus, Ohio (754,885 – 2008 pop.), as well as Marion, Chillicothe and Portsmouth. An estimated 1.7 million persons live in the 6,506 square mile region (density of 267 persons per square mile).

Other than the urban centers and their expanding suburbs, much of the sub-basin's land cover is classified as cultivated as shown in Figure 11. The terrain is essentially flat to moderately sloped in the middle to northern portions of the sub-basin, but the southern portion of the sub-basin has moderate to steep slopes and much of the steeper terrain near the Ohio River is forested. The floodplain of the lower Scioto River is quite broad and is used extensively for agriculture. The majority of the sub-basin north of Chillicothe was glaciated. The mainstem Scioto River is approximately 230 miles long and is joined in Chillicothe, Ohio by Paint Creek and in downtown Columbus by the Olentangy River.

6.2 EXISTING USACE PROJECTS

There are a number of USACE projects in the sub-basin including Paint Creek Lake, Alum Creek Lake, Delaware Lake, and Deer Creek Lake; all operated and maintained by USACE. There are also three local protection projects in the sub-basin including the West Columbus Floodwall, the Chillicothe Levee Project and the Portsmouth Floodwall and Levee along the Ohio River; each of which is operated by the municipal government. The four USACE reservoirs are multi-purpose structures with Delaware Lake being the oldest constructed in 1951. Delaware Lake, Alum Creek Lake and Paint Creek Lake have storage authorized for regional water supply. Each of the lakes has extensive recreation facilities with state park facilities at Deer Creek Lake.

6.3 WATER RESOURCES ISSUES

Among the many water quality issues in the sub-basin are the introduction of agriculturally generated sediments, agricultural chemicals, nutrients from fertilizers and sewage treatment plants, bacterial loading by livestock, uncontrolled urban stormwater runoff, and CSOs. The Scioto River sub-basin is often targeted as one of the contributors to the nutrient loading linked to the Gulf's hypoxia zone. Added to this insurgence of contaminants in the Scioto is the presence of numerous low-head dams along the Olentangy River and other tributaries (and USACE flood retention structures) that restrict fish passage and aquatic habitat connectivity. Added to these barriers are

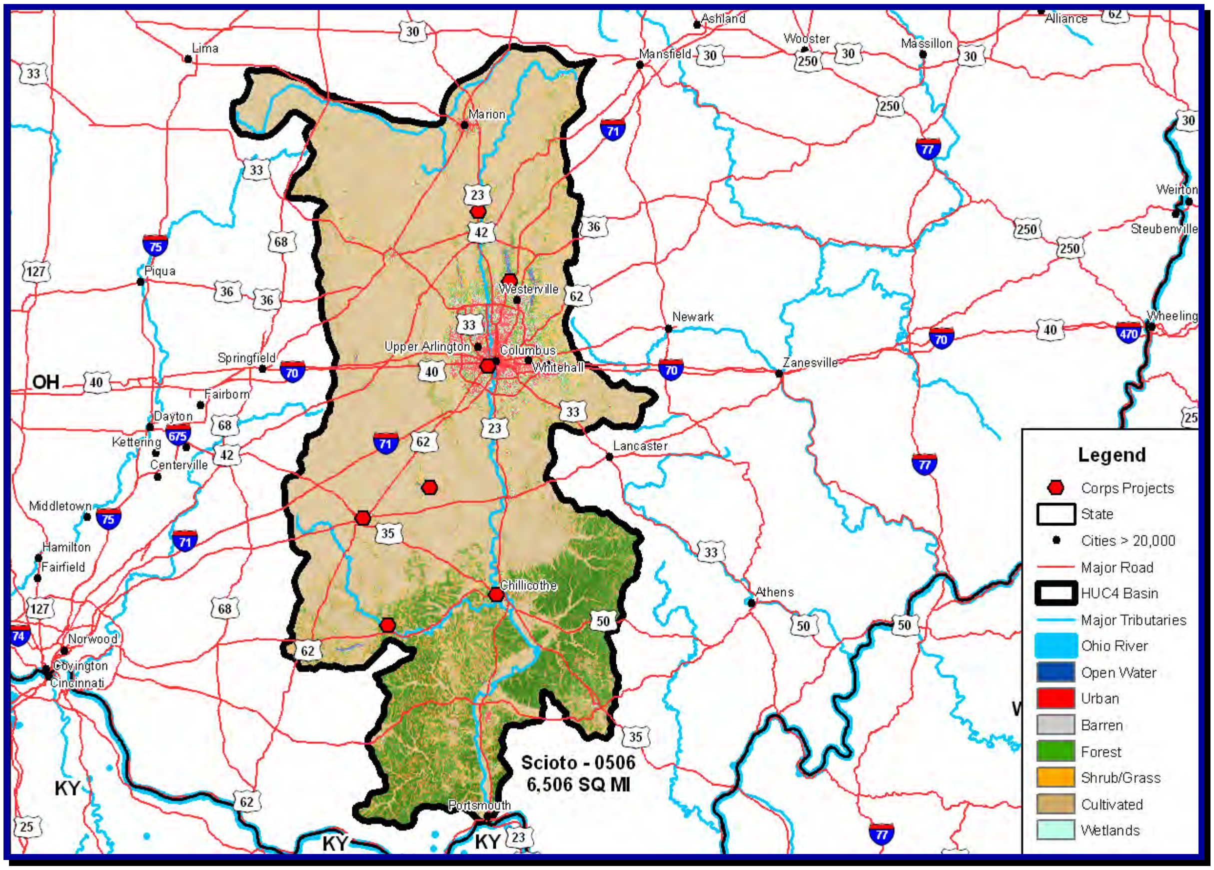

Figure 11 – Scioto River Sub-basin

numerous channel realignments and encroachments into the natural channel for various infrastructure and private developments.

The Scioto River sub-basin is one of several watersheds in Ohio included in the USDA's Conservation Reserve Enhancement Program (CREP) being so designated in 2004. Over 70,000 acres of cultivated land are anticipated to be included in the program as cost-shared, vegetated buffers to protect water quality. This very successful program is a good example of the potential benefits of the Conservation Reserve Program and CREP programs in the basin.

6.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

The Scioto River sub-basin has numerous issues related to management, use and conservation of water resources. The existence of several multi-purpose reservoirs operated by USACE and others points toward the potential for a Section 216 study (Review of Completed Projects) to assess the potential for reallocation of storage within and among the operating USACE reservoirs). Given the growing needs for water supply in the urban areas of this region and potential future needs for agricultural irrigation, such studies may be warranted. Flood damages still occur within the region most notably at North Chillicothe, Ohio and other smaller floodplain communities. Several hundred flood insurance policies are active within the 31 counties of the sub-basin and many more un-insured structures are at risk. Opportunities for flood risk reduction studies under Section 205 of the Continuing Authorities Program as well as separately authorized studies could be initiated in this area.

The number of water quality issues identified by USEPA monitoring stations in the sub-basin point to the likelihood that opportunities for multiple Section 206 (Aquatic Ecosystem Restoration) projects exist in the sub-basin or that a more general aquatic restoration authority for entire sub-basin could be considered. More particularly, the Big Darby Watershed is home to numerous T&E species and species of concern to the State of Ohio. Opportunities for Section 206 projects abound in this and other watersheds of the sub-basin.

Given the numerous references in agency reports and the literature for the Scioto River sub-basin regarding the effects of uncontrolled stormwater on the water quality and in-stream habitat, opportunities for one or more Section 22 Planning Assistance to States studies could be developed to address stormwater issues as well as other issues of floodplain development, floodplain mapping, water supply and others.

7. BIG SANDY/GUYANDOTTE RIVERS SUB-BASIN – WEST VIRGINIA, KENTUCKY, VIRGINIA

7.1 REGIONAL CONTEXT

The Big Sandy River and Guyandotte River sub-basins are unique in their geographic juxtaposition, their land cover characteristics, their histories and the distribution of flood risk reduction projects among them. The sub-basin covers portions of West Virginia, Kentucky and Virginia and as shown on Figure 12 is largely devoid of major interstate highways (only I-64 passes through the sub-basin) and any major urban areas (cities over 20,000 population). Despite the absence of interstate highways, the region has numerous railway lines (NS and CSX) and the lower 8 miles of the Big Sandy River is commercially navigable featuring numerous barge coal-loading facilities.

The sub-basin includes approximately 5,900 square miles. As the displayed land cover indicates, most of the sub-basin is forest cover with limited shrub/grass and barren areas scattered along the tributary valleys. The sub-basins are generally rural in nature with scattered incorporated and unincorporated communities located in narrow floodplains. The major rivers include the Big Sandy River with its major tributaries the Tug and Levisa Forks and the Guyandotte River. The estimated population is about 440,000 persons (density of 74 persons per square mile).

This sub-basin is one of the largest producers of low-sulfur coal and high-quality hardwood timber in the entire basin. These industrial sectors provide a substantial portion of the economic support (employment base and tax/revenue base) for the municipal, county and state governments in the region and nationally significant energy resources both for domestic and foreign uses. Numerous power plants and industrial facilities in the region are dependent upon the ongoing production of these resources.

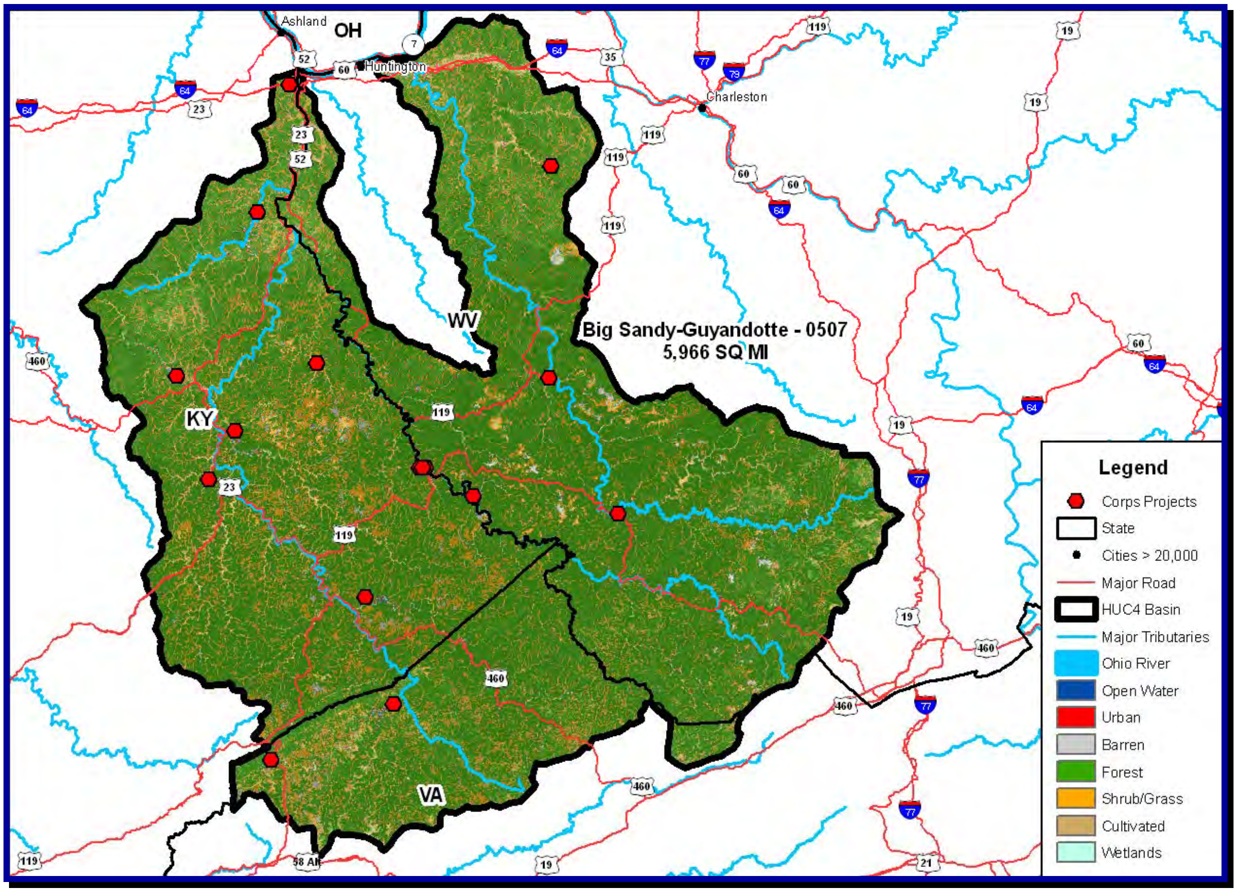

Figure 12 – Big Sandy/Guyandotte Rivers Sub-basin

Due to its rural nature, the region is also popular for tourism and recreation pursuits (hunting and fishing).

7.2 EXISTING USACE PROJECTS

As Figure 12 shows, there are a number of flood risk reduction projects within the two main tributaries of the sub-basin. In addition to several reservoirs, there are many LPPs providing protection to small communities. The reservoir system within the Big Sandy River watershed includes six multi-purpose facilities maintaining storage for several authorized uses including flood protection, recreation, low- flow augmentation, water supply and fish and wildlife habitat. The allocation of reservoir storage in this system has not been analyzed since their initial operation.

7.3 WATER RESOURCES ISSUES

Owing to the abundance of low-sulfur coal and vast hardwood timber resources, this sub-basin has been the center of mining and timber harvesting in the basin since the early 1900s. Although Federal and state efforts to limit sedimentation and acid-mine drainage as a result of mining have been successful in maintaining reasonable water quality throughout the sub-basin, there remain numerous abandoned facilities and instances of point and non-point pollution. With use of BMPs by both the mining and timbering industries and careful inspections by Federal and state agencies, instances of significant pollution have been minimized.

In addition to water quality issues, reliable supplies of potable water in the region are an issue. Most communities use both surface or groundwater supplies in the region, but these are subject to drought conditions and pollutants. Growing reliance on water supplies from constructed reservoirs (USACE and NRCS) point to the need for reliable ad sustainable water management in the sub-basin.

In addition to water quality and water supply issues, the region has suffered decades of flood damages and losses of life due to overbank flooding. The combination of severe terrain, narrow floodplains, and heavy rainfall events has generated numerous damaging flood events. The worst regional event historically was the April 1977 flood that resulted in hundreds of millions of dollars of flood damages and some losses of life. Both the Tug and Levisa Forks of the Big Sandy River were devastated by the 1977 flooding episode. The landmark Congressional legislation referred to as the Section 202 language facilitated the construction of several LPPs and initiation of nonstructural measures that continue on today in Kentucky and Virginia.

Figure 32 in Appendix N shows the preponderance of Federal disaster declarations that have been issued for this sub-basin area. Between 2000 and 2008, the counties within the sub-basin have had as many as nine Federally declared flooding disasters. Most recently in 2009, flood disasters were declared by FEMA for counties in the Big Sandy River sub-basin (see Figure 33 and 34 in Appendix N).

7.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

The presence of so many point and non-point pollutant sources within the sub-basin and their effects on aquatic habitat point to opportunities for the Section 206 Aquatic Habitat Restoration in the CAP program in the region. Other issues such as water supplies, low-flow augmentation and river recreation (whitewater rafting) point to the potential for application of the Section 216 Review of Completed Projects authority to address storage reallocation opportunities in several of the existing multi-purpose reservoirs. Both the Section 205 (Small Flood Protection Projects) authority in CAP and the Section 22 Planning Assistance to States authorities could provide resources for cost sharing flood damage reduction and floodplain information studies in the sub-basin. Opportunities abound for Congressionally authorized projects and programs to address flood damages as evidenced by the ongoing number of federally declared disasters in the sub-basin.

8. GREAT MIAMI RIVER SUB-BASIN – OHIO, INDIANA

8.1 REGIONAL CONTEXT

The Great Miami River sub-basin is located in the southwest portion of Ohio. This system includes the Great Miami, Stillwater, and Mad Rivers. The drainage area of these systems in Ohio is 4,277 square miles. Total drainage area including that portion in Indiana is 5,702 square miles. The Great Miami River sub-basin includes all or part of 15 counties with the headwaters in Hardin and Auglaize counties and the mouth in Hamilton County. Figure 13 shows the sub-basin.

The following table is a summary of land use information for the sub-basin, provided by the Ohio Department of Natural Resources. The data were obtained by scanning satellite imagery.

Land Use	%
Urban	5.0
Agriculture	80.3
Shrub/scrub	1.0
Wooded	11.7
Open Water	1.2
Non-forest Wetlands	0.6
Barren	0.2
Total	*100.0*

Some of the most significant water resource features in the sub-basin are the Stillwater Scenic River, the Great Miami buried valley aquifer, the five major dams (dry) and flood protection system of Miami Conservancy District (MCD), and Indian Lake, a remnant of the Miami-Erie Canal system and one of the largest lakes in Ohio. USACE projects include five multipurpose reservoirs and numerous local flood protection projects.

8.2 COLLABORATIVE ASSESSMENT, TEAM DEVELOPMENT, AND STRATEGIC PLAN

The proposed Great Miami River Sub-Basin Collaborative Assessment will investigate water resources infrastructure, basin hydrology, and problems and opportunities for ecologically and economically sustainable improvements. Assessment teams include planning, engineering, environmental and operations personnel (both lake managers and regulatory staff). Regulatory data (permits, applications, etc), maintained in the District's GIS database, will be accessed to assess both cumulative impacts within the basin and areas of interest for economic development. The USACE Hydrologic Engineering Center (HEC) will lend its national expertise in the technical areas of surface and groundwater hydrology, river hydraulics and sediment transport, reservoir system analysis, planning analysis, real-time water control management, computer modeling such as ecosystem flow management (EFM), and a number of other closely associated technical subjects. The proposed study of this Sub-basin will take a holistic view of the regional demands on water resources. Environmental restoration, flood damage reduction, municipal and industrial water supply, recreation, storm water drainage (of special concern in karsts topography) and other local or regional needs will be identified as will the entities that have potential for addressing same. Environmental sustainability and public support will be the primary guiding principles for both the study and its final report.

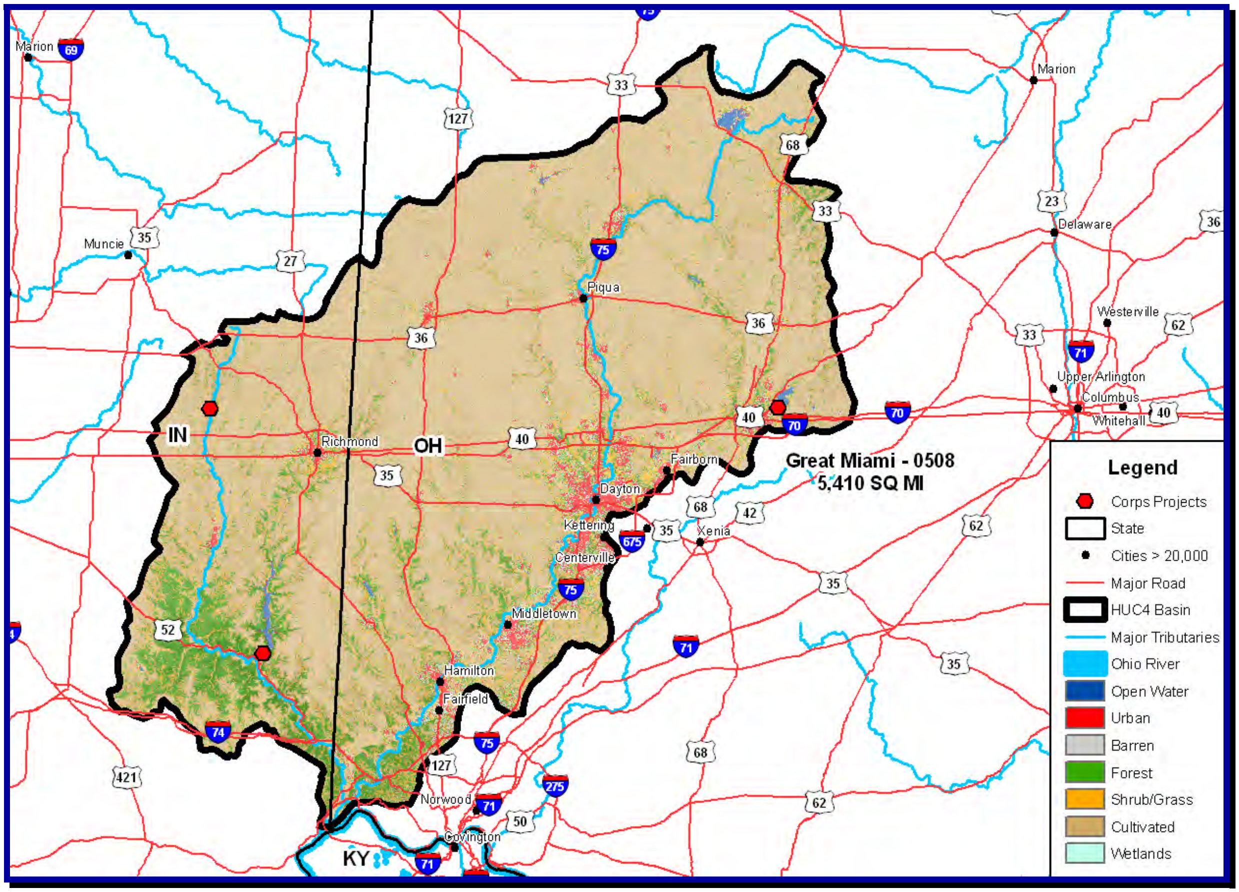

Figure 13 – Great Miami River Sub-basin

8.3 ANTICIPATED OUTPUTS

Outputs will include (1) assessment of water resources infrastructure and identification of responsible parties for each component, (2) identification of issues and resources, including existing or potential partnerships to address local and/or regional issues, (3) infrastructure investment needs, (4) completion of District RES-SIM computer model for basin and HEC-RAS and EFM models to support SRP basin-wide, and (5) strategic planning for both protection and wise use of water resources including review of USACE guidance pertaining to water control plans and manuals to allow greater flexibility in addressing water resources needs on both a project and a regional basis. The review discussed in (5) would apply to ER-1110-2-240 and EM-1110-2-3600. One problem identified while developing Green River Lake, Kentucky, as the pilot project for Sustainable Rivers Project (SRP) is a provision that experimental periods for changes to reservoir guide curves are limited to one three year period. It is very difficult to quantify changes in ecosystems in this short of a period. Consideration of modification of the ER and/or EM to address this issue would be part of the collaborative planning effort with others. Outputs (4) and (5) are of national importance as this basin would be the first where all USACE dams would be operated fully as part of SRP. Environmental benefits from expansion of SRP to all lakes and holistic planning for activities that impact water resources accrue all the way to the Gulf of Mexico through protection and restoration of biodiversity and improvements in the basin's contribution to inland waters feeding the Gulf's anoxic zone. A collaborative review and any subsequent modifications to ER-1110-2-240 and/or EM-1110-2-3600 would apply nationally. All products and report(s) produced will be made available to the public, including HEC models that may be freely downloaded from the HEC web site (www.hec.usace.army.mil).

8.4 ASSESSMENT PDT AND PM

In recognition of the importance of this assessment and the geographic dispersion of the projects, the Assessment PDT will be comprised of experienced planners, engineers, economists, ecologists, and regulatory specialists and operations staff. The Assessment PDT will include several regional technical specialists familiar with water resources and planning. The LRD Centers of Expertise for Flood Damage Reduction (Louisville) and Ecosystem Restoration (Nashville) will be heavily involved in the basin assessment process and collaborative strategy development.

8.5 STUDY SCHEDULE AND BUDGET

Drafts for the five identified outputs will be completed in 18 to 20 months. The five outputs may be presented in one or more documents. The PDT will make this report format decision further into the planning process. Final documents will be completed in 60 to 90 days later. Estimated costs for Outputs (1), (2), and (3) are estimated at $125,000 each. The estimated costs for outputs 4 and 5, each of national importance, impact and transferable to other USACE projects, is $550,000 for (4) including modeling, field surveys and verifications, and coordination with other agencies and $175,000 for (5). The total estimated cost for the five outputs comprising the Green River Collaborative Assessment is $1,100,000 federally funded.

8.6 HQUSACE CIVIL WORKS STRATEGIC PLAN

This proposal clearly supports all five strategic goals in the Civil Works Strategic Plan. It provides for sustainable development and integrated management and repair of past environmental degradation and prevention of future environmental losses through outputs (4) and (5) that extend SRP to four additional lakes and through a review of existing USACE guidance that is not up to date with the Strategic Plan, at least as far as sustainability and restoration goes. Ensure that projects perform and meet evolving conditions is addressed in (1), (2), (4) and (5). Goal 4, reduction of vulnerabilities and losses from disasters, and Goal 5, be a world-class public engineering organization, are encompassed in all five outputs. Nothing proposed, as part of this study is believed to be outside assigned mission authorities.

8.7 STUDY SUPPORT

The proposed sub-basin assessment has previously been discussed with the following listed parties. All have indicated their support and interest in participating in some manner.

Federal

- US Department of Agriculture, Natural Resources Conservation Service
- US Fish and Wildlife Service
- US Geological Survey
- US Geological Survey

State

- Ohio Division of Water
- Ohio Department of Fish and Game

Others

- State Director, Ohio Chapter, The Nature Conservancy

9. MIDDLE OHIO SUB-BASIN – WEST VIRGINIA, OHIO, KENTUCKY, INDIANA

9.1 REGIONAL CONTEXT

The Middle Ohio sub-basin covers a geographic area of 8,941 square miles in West Virginia, Ohio, Kentucky, and Indiana. Approximately 2.1 million residents live in this corridor of the Ohio River mainstem (density of 235 persons per square mile). The sub-basin has numerous sizable tributaries of the Ohio River including the Little Miami, Brush and White Oak Creeks, Little Scioto, Mill Creek, Little Sandy and Twelvepole Creek. A number of significant urban areas occupy the sub-basin including Huntington, WV; Ashland, KY; Portsmouth, OH; Covington, KY; and Cincinnati, OH.

Several interstate highways cross through the sub-basin and railway lines (CSX and NS) occupy one or both sides of the Ohio River mainstem and extend into the major tributary valleys. The entire length of the sub-basin Ohio River mainstem is commercially navigable through the system of locks and dams. Land cover is a mixture of forest, cultivated and urban types. Figure 14 shows the Middle Ohio sub-basin.

9.2 EXISTING USACE PROJECTS

There are a number of multi-purpose reservoirs on the tributaries including Beech Fork, East Lynn Lake, and Grayson Lake. In addition there are several LPPs protecting urban centers such as Huntington, WV; Ashland, KY; Portsmouth, OH; Covington, KY; Maysville, KY; and Cincinnati, OH. USACE Locks and Dams are located along the Ohio River mainstem.

9.3 WATER RESOURCES ISSUES

Each of the urban centers in the corridor has active CSOs discharges containing bacterial contamination and nutrients. In addition, there are issues of uncontrolled stormwater runoff, degradation of aquatic habitat, discharges from industrial plants, hydrothermal heating from power plants and other airborne contaminants. The numerous stream corridor interfaces between municipal areas and rural county suburbs (largely uncontrolled development and stormwater runoff) indicates potential for urban stream habitat degradation and stormwater flooding. The predominance of cultivated land cover in Ohio speaks to the potential presence of nutrients from fertilizers and animal feedlots and sedimentation. This area immediately borders the Scioto River sub-basin also known for its contributions of nutrients and sedimentation into the Ohio River.

In addition to water quality issues, many of the smaller communities along the mainstem Ohio River and its tributaries are subjected to flood damages from the 1% chance flood event as evidenced by the number of insured and possible uninsured structure owners shown in Tables 1 and 2 of Appendix A. The population density and presence of many urban LPPs indicates the potential need for improved navigation pool public access by recreationists (boaters and fishermen) and first responders to address navigation emergencies.

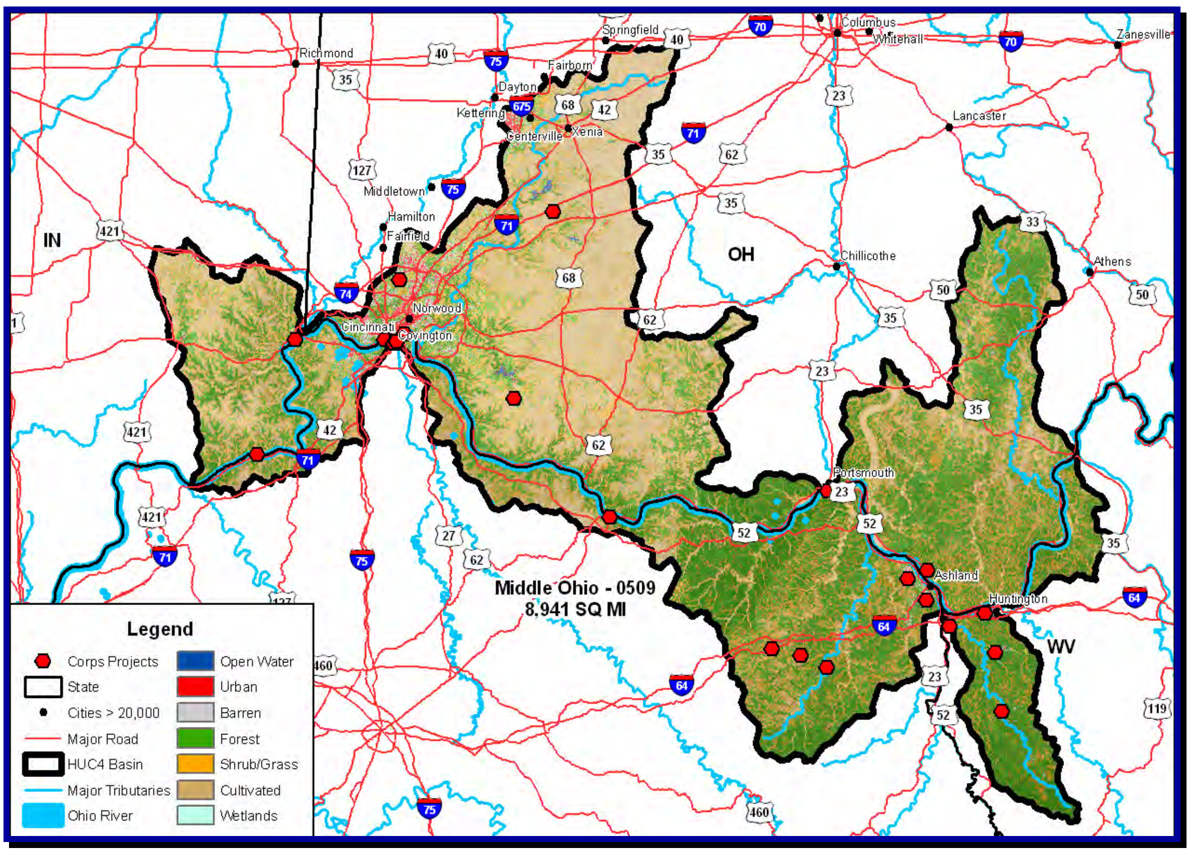

Figure 14 – Middle Ohio Sub-basin

9.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

The presence of aquatic habitat issues shows opportunities for use of the CAP Section 206 Aquatic Ecosystem Restoration authority or application of the Ohio River Ecosystem Restoration Authority to the Ohio River mainstem ecosystem. The location of several existing multi-purpose reservoirs indicates opportunities for application of the Section 216 Review of Completed Projects or the CAP Section 1135 authority to adjust flow releases for downstream aquatic resources and improved recreation access. Opportunities for Section 22 Planning Assistance to States studies of floodplain management, stormwater management, water supply and other water resources issues abound.

10. KENTUCKY/LICKING RIVERS SUB-BASIN – KENTUCKY

10.1 REGIONAL CONTEXT

The basins are located in central Kentucky with a combined drainage area of more than 9,300 square miles. The two rivers flow south to north-northwest. The rivers flow through varied topography beginning in the steep Appalachian mountains to the rugged Cumberland Plateau to the gently rolling Bluegrass region to the Knobs (hilly region) and finally to the Ohio River floodplain. Both begin in the Eastern Kentucky coalfields region. Neither has a wide floodplain as both are entrenched in comparatively deep valleys over most of their length. The Kentucky River joins the Ohio at Carrolton, Kentucky, while the Licking River joins the Ohio at Covington and Newport, Kentucky. Previous water resources developments involving USACE include a largely closed navigation system on the Kentucky, three multipurpose reservoirs on the Kentucky and one on the Licking, and local protection projects. The sub-basin is shown in Figure 15.

Kentucky River is a tributary of the Ohio River and is 259 mi (417 km) long. The river and its tributaries drain much of the central region of the state. The watershed covers about 7,000 sq. mi. Much of the aquatic fauna has been adversely impacted by coal mining, timbering, and waste water discharges from both urban, rural residential, or agricultural uses. Many rare plants and animals do persist within the stretch known as the Pallisades, a canyon environment winding its way through the Bluegrass Region.Licking River, along with some of its tributaries, is a rare example of native muskie streams. The Lower Licking River watershed has a varied geography and a wide range of plant and animal species living in some of the most highly valued habitat in the region. The total project area encompasses more than 1.8 million acres, of which about 60% is open agricultural land and 40% is forested. The Lower Licking River ecosystem project runs along the river from Cave Run Lake Dam to the Ohio River. To the southeast, the Licking River Knobs contain diverse hardwood forested areas as well as open grassy woodlands.

A total of 100 fish species inhabit the region, and the basin also supports several unique fish species including: redside dace, mimic shiner, streamline chub, slender madtom, blue sucker, paddlefish, and eastern sand, tippecanoe and sharpnose darters. There are also more than 50 species of mussels, of which 11 are endangered. The watershed provides respite for about 250 species of migratory birds, an unusually high number.

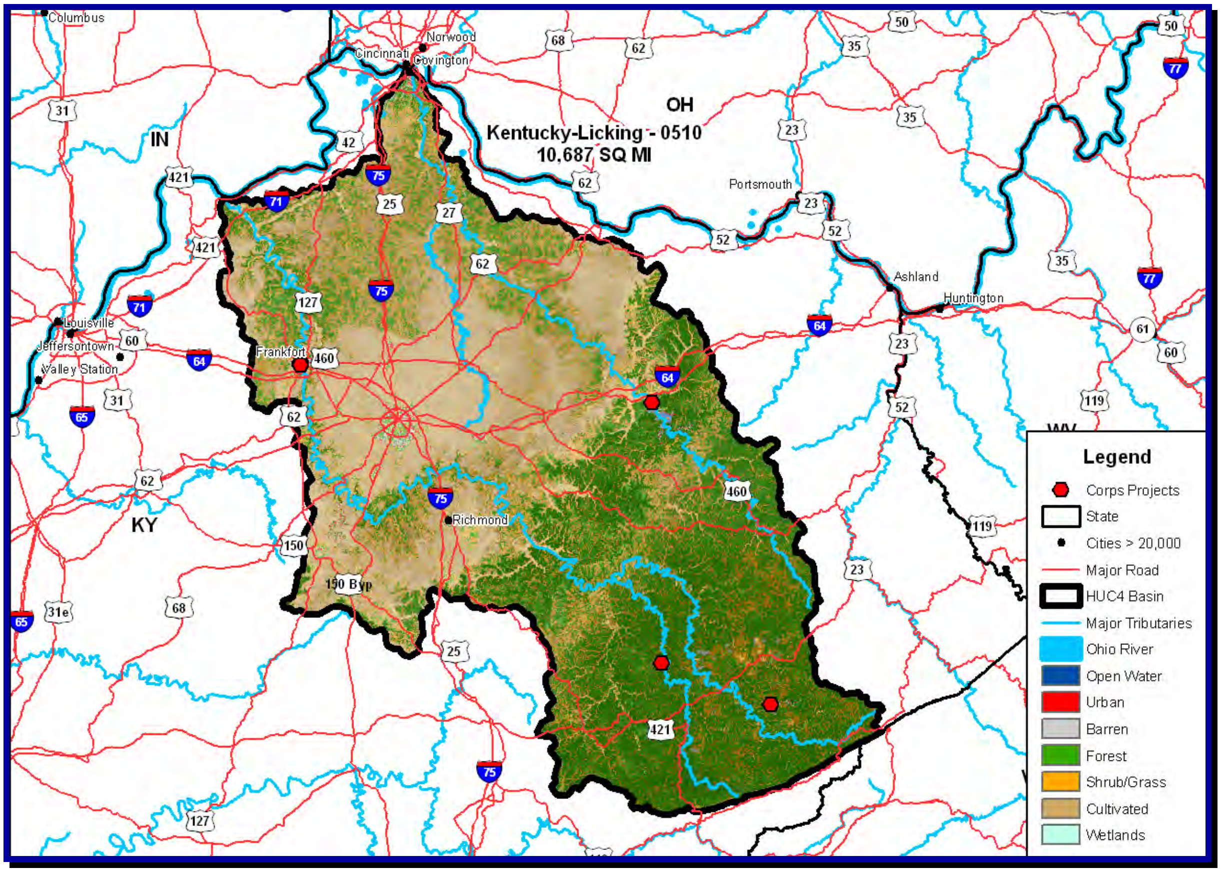

Figure 15 – Kentucky/Licking Rivers Sub-basin

10.2 COLLABORATIVE ASSESSMENT, TEAM DEVELOPMENT, AND STRATEGIC PLAN

The proposed Kentucky/Licking River Sub-Basin Collaborative Assessment will investigate water resources infrastructure, basin hydrology, and problems and opportunities for ecologically and economically sustainable improvements. Assessment teams include planning, engineering, environmental and operations personnel (both lake managers and regulatory staff). Regulatory data (permits, applications, etc), maintained in the District's GIS database, will be accessed to assess both cumulative impacts within the basin and areas of interest for economic development. The USACE Hydrologic Engineering Center (HEC) will lend its national expertise in the technical areas of surface and groundwater hydrology, river hydraulics and sediment transport, reservoir system analysis, planning analysis, real-time water control management, computer modeling such as ecosystem flow management (EFM), and a number of other closely associated technical subjects. The USACE Southwest Division Center of Expertise for Water Supply will provide consultative services, possibly in the area of multiple reservoir outputs to optimize water management as an expansion of the Sustainable Rivers Project basin-wide. The Photogrammetric Mapping Center in St. Louis has also been contacted regarding possible assistance.

The multi-county area development districts (ADDS), who serve as planning agencies for most rural counties in the basin, will be team members. Each ADD has already identified local water issues through their respective Water Management Councils. Local governments, universities, and other interested parties have also expressed interest in team participation. Public forums, local government meetings, and media relations will be used to inform the public citizenry and solicit participation. These would be similar to scoping meetings, i.e.,, held for the purpose of identifying issues, opportunities, and suggestions for resolution of problems affecting water resources. State and federal agencies, especially Kentucky Division of Water and Department of Fish and Wildlife Resources, will also participate as partners or cooperating agencies in these efforts.

The proposed study of this Sub-basin will take a holistic view of the regional demands on water resources. Environmental restoration, flood damage reduction, municipal and industrial water supply, recreation, storm water drainage (of special concern in karsts topography) and other local or regional needs will be identified as will the entities that have potential for addressing same. Environmental sustainability and public support will be the primary guiding principles for both the study and its final report.

10.3 ANTICIPATED OUTPUTS

Outputs will include (1) assessment of water resources infrastructure and identification of responsible parties for each component, (2) identification of issues and resources, including existing or potential partnerships to address local and/or regional issues, (3) infrastructure investment needs, (4) completion of District RES-SIM computer model for basin and HEC-RAS and EFM models to support SRP basin-wide, and (5) strategic planning for both protection and wise use of water resources including review of USACE guidance pertaining to water control plans and manuals to allow greater flexibility in addressing water resources needs on both a project and a regional basis. The review discussed in (5) would apply to ER-1110-2-240 and EM-1110-2-3600. One problem identified while developing Green River Lake, Kentucky, as the pilot project for Sustainable Rivers Project (SRP) is a provision that experimental periods for changes to reservoir guide curves are limited to one three year period. It is very difficult to quantify changes in ecosystems in this short of a period. Consideration of modification of the ER and/or EM to address this issue would be part of the collaborative planning effort with others. Outputs (4) and (5) are of national importance as this basin would be the first where all USACE dams would be operated fully as part of SRP. Environmental benefits from expansion of SRP to all lakes and holistic planning for activities that impact water resources accrue all the way to the Gulf of Mexico through protection and restoration of biodiversity and improvements in the basin's contribution to inland waters feeding the Gulf's anoxic zone. A collaborative review and any subsequent modifications to ER-1110-2-240 and/or EM-1110-2-3600 would apply nationally. All products and report(s) produced will be made available to the public, including HEC models that may be freely downloaded from the HEC web site (www.hec.usace.army.mil).

10.4 ASSESSMENT PDT AND PM

In recognition of the importance of this assessment and the geographic dispersion of the projects, the Assessment PDT will be comprised of experienced planners, engineers, economists, ecologists, and regulatory specialists and operations staff. The Assessment PDT will include several regional technical specialists familiar with water resources and planning. The LRD Centers of Expertise for Flood Damage Reduction (Louisville) and Ecosystem Restoration (Nashville) will be heavily involved in the basin assessment process and collaborative strategy development.

10.5 STUDY SCHEDULE AND BUDGET

Drafts for the five identified outputs will be completed in 18 to 20 months. The five outputs may be presented in one or more documents. The PDT will make this report format decision further into the planning process. Final documents will be completed in 60 to 90 days later. Estimated costs for Outputs (1), (2), and (3) are estimated at $125,000 each. The estimated costs for outputs 4 and 5, each of national importance, impact and transferable to other USACE projects, is $450,000 for (4) including modeling, field surveys and verifications, and coordination with other agencies and $175,000 for (5). The total estimated cost for the five outputs comprising the Green River Collaborative Assessment is $1,000,000 federally funded.

10.6 HQUSACE CIVIL WORKS STRATEGIC PLAN

This proposal clearly supports all five strategic goals in the Civil Works Strategic Plan. It provides for sustainable development and integrated management and repair of past environmental degradation and prevention of future environmental losses through outputs (4) and (5) that extend SRP to four additional lakes and through a review of existing USACE guidance that is not up to date with the Strategic Plan, at least as far as sustainability and restoration goes. Ensure that projects perform and meet evolving conditions is addressed in (1), (2), (4) and (5). Goal 4, reduction of vulnerabilities and losses from disasters, and Goal 5, be a world-class public engineering organization, are encompassed in all five outputs. Nothing proposed, as part of this study is believed to be outside assigned mission authorities.

10.7 STUDY SUPPORT

The proposed sub-basin assessment has previously been discussed with the following listed parties. All have indicated their support and interest in participating in some manner.

Federal

- US Department of Agriculture, Natural Resources Conservation Service
- US Fish and Wildlife Service, Frankfort, KY, Field Office
- US Geological Survey, Kentucky Water Science Center
- US Geological Survey, Tennessee Tech Cooperative Research Unit

State

- Kentucky Environmental Protection Cabinet
- Kentucky Division of Water
- Kentucky Department of Fish and Wildlife Resources

- Kentucky Department of Conservation
- Kentucky State Nature Preserves Commission

Others

- State Director/Vice-President, The Nature Conservancy

11. GREEN RIVER SUB-BASIN – KENTUCKY, TENNESSEE

11.1 REGIONAL CONTEXT

Green River is one of the top four river systems in the United States in terms of its aquatic biodiversity. Few streams rival the 151 species of fishes and 71 species of freshwater mussels in its system. Among these are twelve endemic species (found nowhere else on earth) and more than 35 aquatic species that are considered imperiled. The mineral dissolution of the watershed's underlying lime—stone bedrock makes the Green River a natural companion to nearby Mammoth Cave, the world's largest known underground cave system. Other rare, threatened or endangered plants and animals depend on the river and its tributaries for their survival. Examples include the eastern hellbender, American eel, and gray and Indiana bats.

The basin is located in west central Kentucky and north central Tennessee. It has a drainage area of more than 9,300 square miles in two states, mostly Kentucky. Topography varies from gently rolling in the east to moderately rugged Western Kentucky coalfields region and then into extensive broad and nearly flat alluvial flood plain as the Green joins the Ohio at Henderson, Kentucky. Barren River is the largest tributary followed by the Rough and Nolin rivers. Figure 16 shows the Green River sub-basin.

11.2 USACE PROJECTS

Previous water resources developments involving USACE include a largely closed navigation system, four multipurpose reservoirs, and six local protection projects. Further, TNC and Louisville District jointly constructed the first Section 1135 ecosystem restoration project with TNC as the non-governmental local sponsor restoring and protecting over 2 miles of riparian habitat that had been damaged or lost due to Green River Lake operations. Louisville District actively participates on the oversight committee for USDA/TNC Conservation Reserve Enhancement Program (CREP), operating only in Green River basin, and on the Commonwealth of Kentucky's, Division of Water (DOW), Water Management Councils.

Barren River Area Development District (BRADD) served as lead district for the five ADDs that cover the watershed in an early 1990s USACE study regarding the reestablishment of navigation on the Green and Barren rivers. BRADD continues to work with the Louisville District and other Federal agencies in a variety of water related capacities identified in their letter of support. Each of the five ADDs has established Water Management Councils that deal with multiple water resources issues, particularly those involving supply, treatment, and protection of water quality.

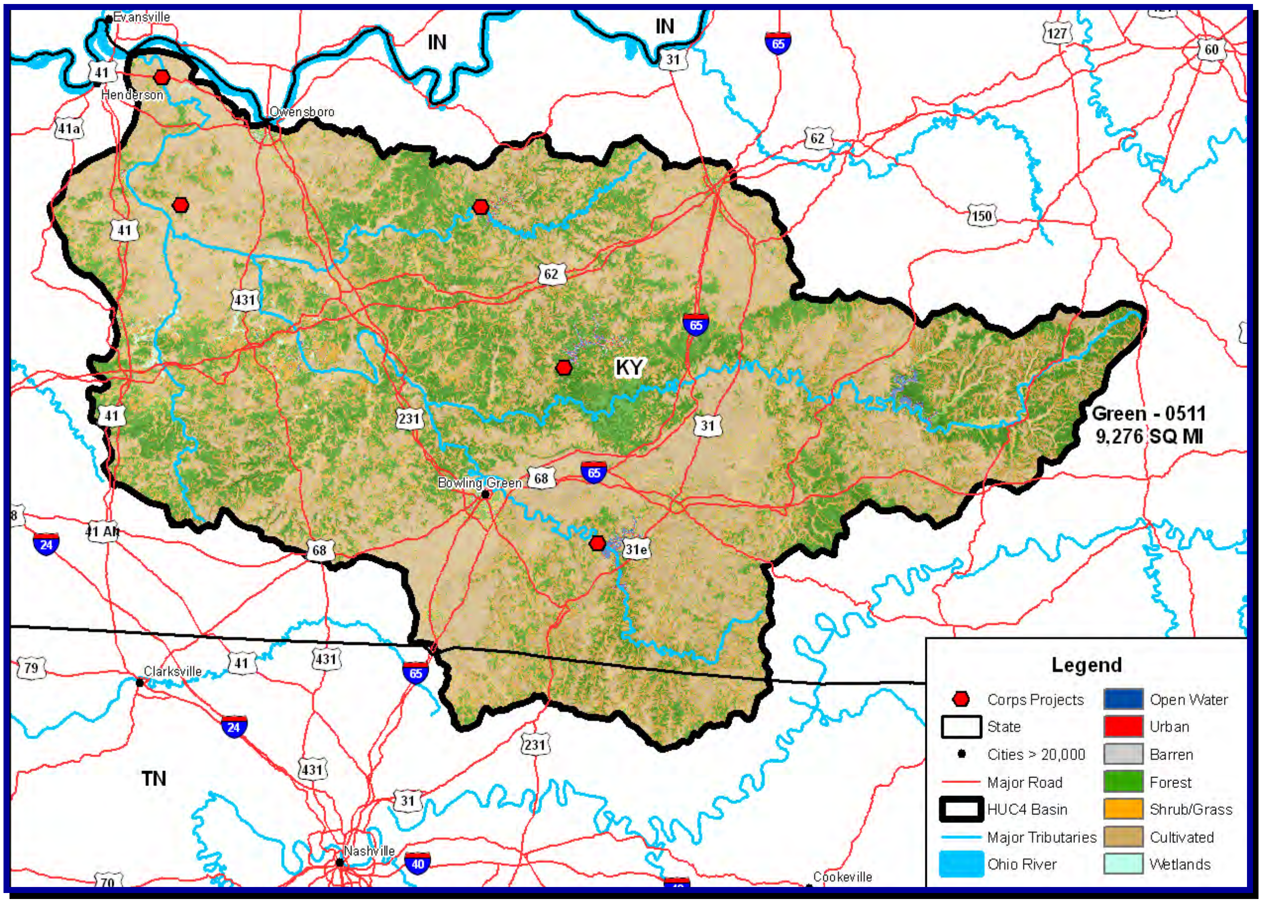

Figure 16 – Green River Sub-basin

11.3 WATER RESOURCES ISSUES

Generally, the lower third of the basin, with both the richest agricultural lands and the most populated, has more flooding problems due to the relatively level flood plain terrain. The middle third, especially tributaries, is greatly impacted by acid mine drainage from orphaned mine lands and by current coal mining and petroleum extraction activities. Threats to the upper third, the area of the Green River Bioreserve, Mammoth Cave National Park and the most pristine stretch of river, include agricultural runoff primarily from beef cattle operations, timbering, and subdivision of family farms into weekend and/or retirement retreats. Barren River is being counted on as the primary source of water supply for Bowling Green, Kentucky, a fast growing urban area on a karsts plain about an hour north of Nashville, Tennessee. Both the river and Barren River Lake are major sources of recreation for the region. Rough River is heavily laden with sediments from runoff from row cropped agricultural lands, as is the smaller Nolin River. The lower half of Rough River is also impacted by past and present strip mining activities. Pond Creek, in the coalfields region, has long-term water quality problems relating to past disposal of polychlorinated biphenyls or PCBS.

11.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

Any proposed studies of the Green River sub-basin would take a holistic view of the regional demands on water resources. Environmental restoration, flood damage reduction, municipal and industrial water supply, recreation, storm water drainage (of special concern in karsts topography) and other local or regional needs will be identified as will the entities that have potential for addressing same. Environmental sustainability and public support will be the primary guiding principles for any studies.

12. WABASH RIVER SUB-BASIN – ILLINOIS, INDIANA, OHIO

12.1 REGIONAL CONTEXT

Identified by the Miami Indians as “Wab-Bah Shik-ki” which means “pure white” for the color of its waters flowing across a bright limestone bed in its upper reaches, the French called it Oubache. Today it is known simply as the Wabash River. Physically the Wabash begins as a drainage ditch near Fort Recovery, Ohio and meanders over 500 miles in length draining two-thirds of the 92 counties in Indiana. In terms of geological history the river is still quite young. When the last glacial ice retreated 25,000 years ago, the flow that would become the Wabash River carried torrents of water from the melting ice which form the Wabash Valley. The sub-basin is shown in Figure 17.

Steeped in history the Wabash River is closely connected to Native American culture. Starting over 12,000 years ago, indigenous people occupied the Wabash Valley for thousands of years. Native Americans living along the river in historical times included groups known today as Miami, Wea, Piankashaw, and later Potawatomi. European contact, spurred by the market for furs, resulted in the Wabash becoming the primary fur trade route between the Great Lakes and the Gulf of Mexico. The ensuing battles for control of the Wabash may be its most famous period. Many of those that participated in these conflicts would become celebrated names in the nation’s history: George Rogers Clark, Little Turtle, Tecumseh, The Prophet, Anthony Wayne, Jean Baptiste Richardville, and William Henry Harrison.

A hundred years later, the Wabash would provide water for the Wabash and Erie Canal stimulating growth in cities along the canal through increased travel and commerce. The river also served communities along its banks as steamboats traveled from the Ohio to the mouth of the Tippecanoe River loaded with corn, wheat, flour, flax, pork, sugar beets, apples, potatoes, and whiskey. The demise of the canal and steamboats was the result of the onset of rail transportation and the storied Wabash Cannonball took its place in American lore. Transportation of merchandise was not the only enterprise the Wabash River supported. The abundance of fresh water mussels in the river would lead to a thriving button industry and later support the Japanese pearl industry. Eventually, over-harvesting would lead to the disappearance of some of the many fresh water mussel species in the Wabash River. Others were reduced in numbers. More recently, protection of this valuable resource has enabled populations to recover somewhat throughout the main stem and its tributaries.

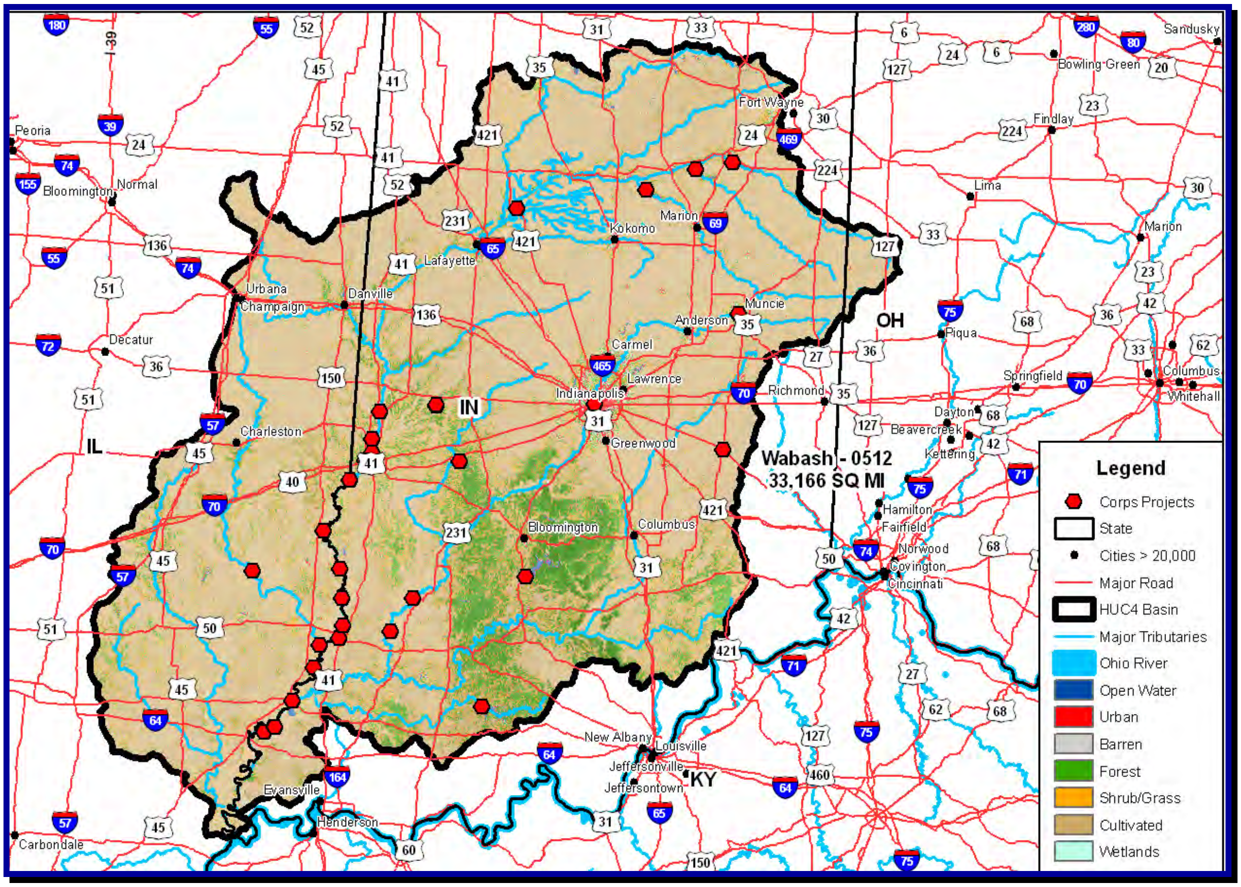

Figure 17 – Wabash River Sub-basin

12.2 COLLABORATIVE ASSESSMENT, TEAM DEVELOPMENT, AND STRATEGIC PLAN

The first Wabash River Corridor Management Plan was developed throughout 1992 and early 1993 by means of regional public planning meetings conducted by Indiana Department of Natural Resources (IDNR) and the National Park Service Rivers, Trails and Conservation Assistance Program (NPS), and meetings of the Commission. The plan recognized the Corridor as a 510-mile, 19-county corridor greenway (a conservation corridor) with cultural and natural resources rivaling those of any in the country. The purpose of creating the plan was to develop a united vision for the future of the Corridor that would serve as a guide for the corridor communities and the Commission.

The vision identified through the planning process was to have: “(1) a river which is attractive and easily usable for fishing, canoeing, and boating; (2) a corridor in which to hike, bike, ride, and drive to enjoy diverse cultural and natural resources; and (3) a greenway cooperatively managed for its maximum benefits, primarily in private ownership yet with ample public use areas and trail connections between those areas where feasible.” As a part of the public process, the following goals were defined for the Commission:

- To promote the improvement of the natural environment of the corridor.
- To promote the improvement of recreational opportunities in the corridor.
- To increase public awareness of the corridor as a whole.
- To encourage that recreational areas and trails are acquired and developed in the corridor without the use of eminent domain.
- To promote the development of a better environmental ethic in the citizens and communities of the corridor.
- To promote better cooperation between all of the groups and individuals with an interest in the corridor.

12.3 ANTICIPATED OUTPUTS

Outputs will include (1) assessment of water resources infrastructure and identification of responsible parties for each component, (2) identification of issues and resources, including existing or potential partnerships to address local and/or regional issues, (3) infrastructure investment needs, (4) completion of District RES-SIM computer model for basin and HEC-RAS and EFM models to support SRP basin-wide, and (5) strategic planning for both protection and wise use of water resources including review of USACE guidance pertaining to water control plans and manuals to allow greater flexibility in addressing water resources needs on both a project and a regional basis. The review discussed in (5) would apply to ER-1110-2-240 and EM-1110-2-3600. One problem identified while developing the Green River Lake in Kentucky as the pilot project for Sustainable Rivers Project (SRP) is a provision that experimental periods for changes to reservoir guide curves are limited to one three year period. It is very difficult to quantify changes in ecosystems in this short of a period. Consideration of modification of the ER and/or EM to address this issue would be part of the collaborative planning effort with others. Outputs (4) and (5) are of national importance as all USACE dams would be operated fully as part of SRP. Environmental benefits from expansion of SRP to all lakes and holistic planning for activities that impact water resources accrue all the way to the Gulf of Mexico through protection and restoration of biodiversity and improvements in the basin's contribution to inland waters feeding the Gulf's anoxic zone. A collaborative review and any subsequent modifications to ER-1110-2-240 and/or EM-1110-2-3600 would apply nationally. All products and report(s) produced will be made available to the public, including the HEC models that may be freely downloaded from the HEC web site (www.hec.usace.army.mil).

12.4 ASSESSMENT PDT AND PM

In recognition of the importance of this assessment and the geographic dispersion of the projects, the Assessment PDT will be comprised of experienced planners, engineers, economists, ecologists, and regulatory specialists and operations staff. The Assessment PDT will include several regional technical specialists familiar with water resources and planning. The Wabash River Heritage Commission, Purdue and Ball State Universities, Indiana Department of Natural Resources and others are expected to be willing and able partners in this study effort.

12.5 STUDY SCHEDULE AND BUDGET

Drafts for the five identified outputs will be completed in 18 to 20 months. The five outputs may be presented in one or more documents. The PDT will make this report format decision further into the planning process. Final documents will be completed in 60 to 90 days later. Estimated costs for Outputs (1), (2), and (3) are estimated at $150,000 each. The estimated costs for outputs 4 and 5, each of national importance, impact and transferable to other USACE projects, is $575,000 for (4) including modeling, field surveys and verifications, and coordination with other agencies and $175,000 for (5). The total estimated cost for the five outputs comprising the Wabash River Collaborative Assessment is $1,200,000 federally funded.

12.6 HQUSACE CIVIL WORKS STRATEGIC PLAN

This proposal clearly supports all five strategic goals in the Civil Works Strategic Plan. It provides for sustainable development and integrated management and repair of past environmental degradation and prevention of future environmental losses through outputs (4) and (5) that extend the Sustainable Rivers Project to three additional lakes and through a review of existing USACE guidance that is not up to date with the Strategic Plan, at least as far as sustainability and restoration goes. Ensure that projects perform and meet evolving conditions is addressed in (1), (2), (4) and (5). Goal 4, reduction of vulnerabilities and losses from disasters, and Goal 5, be a world-class public engineering organization, are encompassed in all five outputs. Nothing proposed, as part of this study is believed to be outside assigned mission authorities.

12.7 STUDY SUPPORT AND LETTERS OF INTENT

The proposed sub-basin assessment has previously been discussed in some form or another with the following listed parties among others.

Federal

- US Department of Agriculture, Natural Resources Conservation Service
- US Fish and Wildlife Service
- US Geological Survey
- National Park Service

State

- Indiana Department of Natural Resources
- Illinois Department of Fish and Wildlife Resources
- Ohio Department of Natural Resources

Others

- The Nature Conservancy
- Wabash River Heritage Commission
- Ball State University
- Purdue University

13. CUMBERLAND RIVER SUB-BASIN – KENTUCKY, TENNESSEE.

13.1 REGIONAL CONTEXT

The Cumberland River is 688 miles (1,107 km) long and its branches and tributaries drain approximately 18,000 square miles of southern Kentucky and northern Tennessee. It starts in Harlan County in eastern Kentucky on the Cumberland Plateau, flows through southeastern Kentucky, crosses into northern Tennessee and then turns back into western Kentucky and flows into the Ohio River at Smithland, Kentucky. There are approximately 10,200 miles of streams in the Upper Cumberland River watershed. The sub-basin is shown in Figure 18.

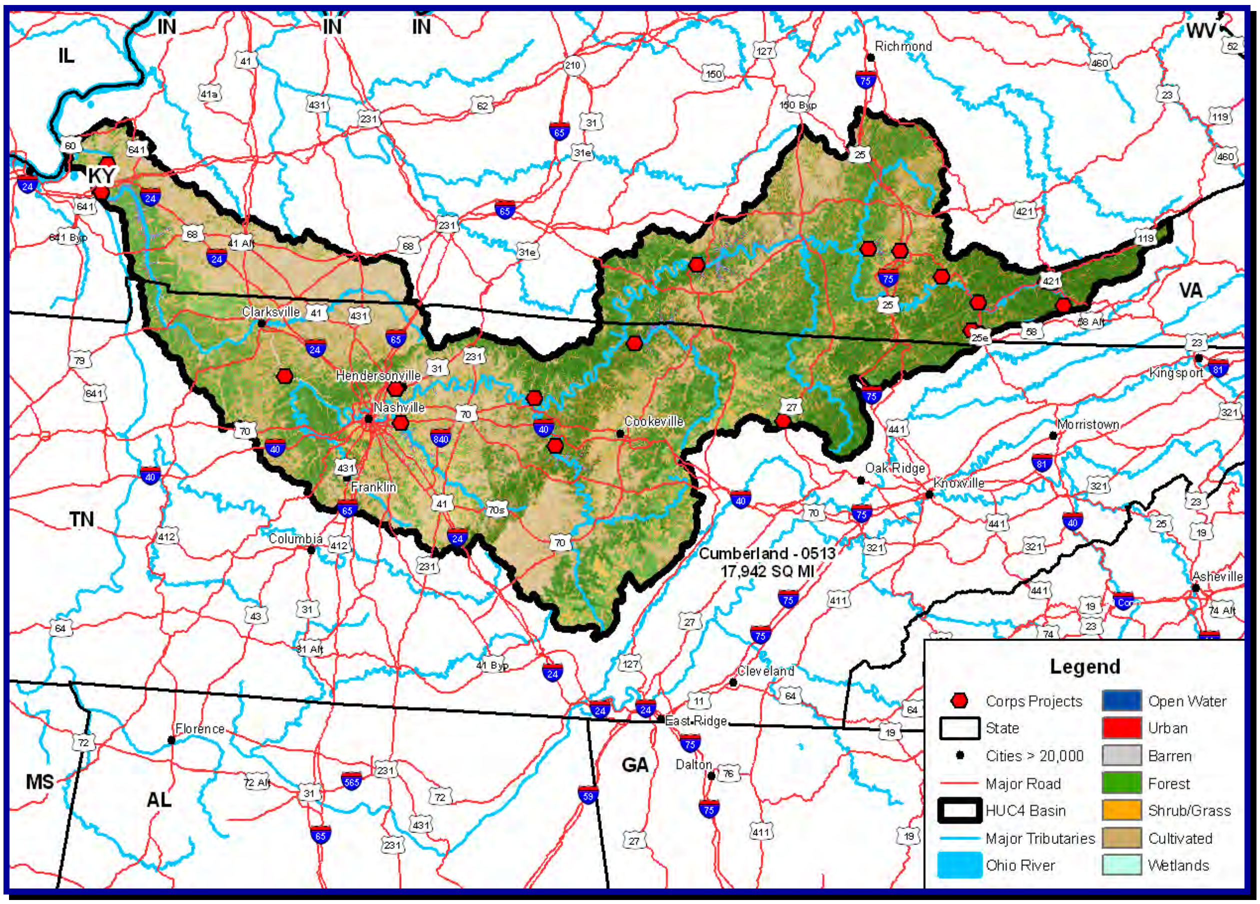

Figure 18– Cumberland River Sub-basin

The Cumberland and Tennessee Rivers are often known as the twin rivers. Their basins include portions of seven states ranging from the mountains of Appalachia to the Mississippi. According to the World Wildlife Fund, “the two closely related basins host the highest number of fish, mussels and crayfish species, and the highest number of endemic freshwater species in North America.” Federal projects built on the Cumberland and Tennessee provide up to 25% of the water in the lower Mississippi during droughts sustaining navigation, water supply, energy production, environmental resources, and recreation for the Ohio and Mississippi Rivers. By storing flood water, the projects prevent millions of dollars in damages annually. Federal water resource infrastructure in the Tennessee and Cumberland River basins has, for the most part, exceeded the original design life.

13.2 WATER RESOURCES ISSUES

Federal projects built on the Cumberland provide water during droughts sustaining navigation, water supply, energy production, environmental resources, and recreation for the Ohio and Mississippi Rivers. By storing flood water, the projects prevent millions of dollars in damages annually. Federal water resource infrastructure in the Cumberland River basin has, for the most part, exceeded the original design life. Issues in the basin include environmental infrastructure needs due to lack of wastewater treatment, straight line pipes, failing home septic systems, etc.; flooding; effects of historical and ongoing surface mining, such as acid mine drainage, valley fills, siltation and loss of riparian area.

Multiple interests have recently converged to express concern about infrastructure and environmental conditions of the Tennessee and Cumberland watersheds. Concerns focus on aging systems and the ability to provide economic and environmental resources for present and future generations in the face of increasing demands. Societal interests are vastly different now than when projects on these rivers were built. These river systems will be expected to continue to support commercial navigation in the context of a multi-modal transportation network and other traditional uses into the future, and they will also be asked to meet ecological demands along with other, as yet unforeseen, needs.

13.3 EXISTING USACE PROJECTS

The *River and Harbor Act of 3 July 1832* authorized the first open-channel work on the Cumberland River. Captains Henry Shreve and Richard Delafield examined the Cumberland River from its mouth to Nashville and devise a plan for its improvement in 1832. In following years its banks and rock obstacles were cleared from Nashville to near the present site of Barkley Dam. Steamboats no longer had to transfer cargo and passengers to smaller boats at Smithland, KY but could then steam all the way to Nashville. The last of the 15 locks and dams built on the Cumberland for navigation was completed in 1924. This established a 6-foot minimum project depth for the Cumberland River.

Comprehensive water management in the Cumberland River system is carried out by a series of multipurpose dams and reservoirs. These consist of a combination of large reservoirs, primarily located on tributaries to the Cumberland River, and navigation projects on the river’s main stem. The exception to this is Lake Cumberland which is on the main-stem of the Cumberland River, but is operated as a tributary type storage project in south central Kentucky.

Dams at various locations of the Cumberland River create large reservoirs for several purposes including: Lake Barkley in western Kentucky; Lake Cumberland in southern

Kentucky, which is the deepest lake in the Tennessee and Cumberland river valleys; Cordell Hull and Old Hickory Lake to the east of Nashville; and Cheatham Lake to the west; Laurel Lake, on the Laurel River in southern Kentucky; the Dale Hollow Reservoir on the Obey River in northeast Middle Tennessee; and J. Percy Priest Lake on the Stones River in Nashville. Each of these is created by dams located just upstream from their respective confluences with the Cumberland River.

The Cumberland River Navigation System is composed of four multi-purpose lock and dam projects and 381.0 miles of maintained open channel on the mainstem Cumberland River. It also shares the 1.5-mile Barkley Canal that connects it with the Tennessee System. The four multi-purpose projects and locations are: Barkley Lock and Dam, Cheatham lock and Dam, Old Hickory Lock and Dam, and Cordell Hull Lock and Dam

13.4 POTENTIAL STUDIES AND PROJECTS THROUGH STANDING AUTHORITIES

Section 5130, East Tennessee Environmental Infrastructure for water related environmental infrastructure and resource protection and development projects. These projects can include wastewater treatment, water supply, environmental restoration and surface water protection and development.

Conduct an assessment of the water resources needs of the southeast at full federal expense through Section 5009. The State of Tennessee is interested in an assessment of the water supply needs of the state. The ongoing drought in the southeast is projected to continue and worsen and Tennessee is one of the hardest hit states with several communities having to truck drinking water to residents in 2007. There are 60 communities on the drought watch list across the state with the southern Cumberland Plateau, Cookeville, Crossville, and northeast Tennessee and along the Tennessee-Alabama state line being the hardest hit. The state is looking for regional water supply solutions including pipeline construction and enlarging existing water treatment plants. The assessment would evaluate existing supply and demand, project future use and include recommendations for specific actions that can be taken by the state and local governments to ensure an adequate supply of drinking water throughout the state. The Nashville District has completed Phase 1 of a study (with Planning Assistance to States funding) in the 2 most critical areas – the southern Cumberland Plateau and Portland/North Central Tennessee. Phase 2 will include population and use projections, critical identification of preliminary alternatives for additional water supply. Phase 3 would include the design and cost of potential solutions a detailed evaluation of the environmental, economic and financial impacts of the measures and recommendations for both areas. When completed, these studies will serve as pilots of regional planning for the Tennessee Department of Economic and Conservation.

Section 2028, Southeastern Water Resources Institute – provides assistance through contracts, cooperative agreements, and grants to the University of Tennessee at Knoxville for the establishment and operation of the Southeastern Water Resources Institute to study sustainable development and the utilization of water resources in the southeastern Unites States.

Section 219, environmental infrastructure project for Cumberland, Lewis, Lawrence, Wayne, Giles County and other counties throughout the Cumberland River basin.

Potential Projects suitable for Section 22 (Planning Assistance to States) and CAP Section 14, 205 and/or 206 can be found throughout the Cumberland River basin.

13.5 POTENTIAL SPONSORS

The following are potential Sponsors of water resources projects in the basin/watershed area:

- Cumberland River Compact
- Duck River Watershed Association
- 7 states each with various departments – Natural Resources, tourism, economic development, planning offices, emergency management and DOT
- Metropolitan Cities in Tennessee, Kentucky and Alabama
- Southeastern Power Administration (SEPA)
- Navigation Industry: shippers/users
- Federal: USFWS, NRCS, EPA, BIA, Coast Guard, Forest Service, FEMA
- Southeast Aquatic Resources Partnership (SARP)
- The Nature Conservancy (TNC)
- World Wildlife Fund (WWF)
- Watershed associations
- Tourism associations
- Utility districts
- Association of Tennessee Valley Governments (ATVG)
- Cumberland Region Tomorrow
- Regional Planning Groups
- Universities

14. LOWER OHIO SUB-BASIN – KENTUCKY, INDIANA, ILLINOIS

14.1 REGIONAL CONTEXT

The Lower Ohio Sub-basin covers portions of Indiana, Illinois and Kentucky spanning 12,698 square miles along the Ohio River mainstem. Approximately 1.8 million residents live within this sub-basin (density of 147 persons per square mile). There are a number of large urban centers in the sub-basin bordering the mainstem Ohio River including Louisville, KY; Evansville, IN/KY; Jeffersonville, IN; Paducah, KY; and Owensboro, KY. Several interstate highways cross through the region and railway lines occupy one or both sides of the Ohio River and extend upstream on the main tributaries.

The Ohio River mainstem is commercially navigable throughout the length of the sub-basin using USACE's locks and dams system. Land cover in the sub-basin is a mixture of cultivated (predominant type), forest and urban types with scattered wetlands along the Ohio River. The primary tributary streams are the Little Kentucky River, Salt River, Saline River, Rolling Fork, and the Tradewater River. Figure No.19 shows the sub-basin area.

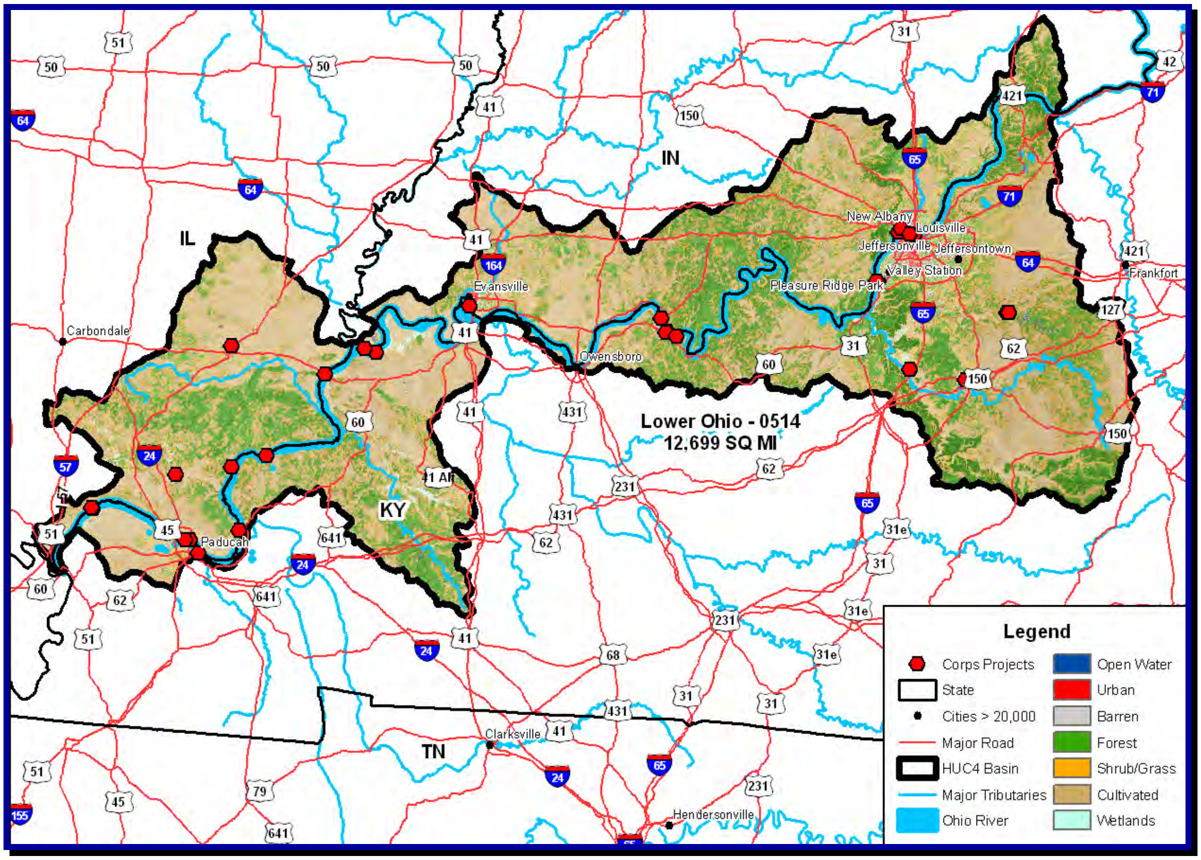

Figure 19 – Lower Ohio Sub-basin

14.2 EXISTING USACE PROJECTS

There are a number of USACE flood risk reduction projects in the sub-basin including reservoirs (Taylorsville Lake) and LPPs at Evansville, Louisville, Jeffersonville and Paducah. In addition, there are several locks and dams on the mainstem Ohio River operated by USACE.

14.3 WATER RESOURCES ISSUES

As with other sub-basins bordering the Ohio River (Upper and Middle Ohio), the Lower Ohio has issues with municipal and corporate CSOs generating bacterial contamination and nutrients. There are multiple CSOs within the major urban centers of this sub-basin (Evansville, Louisville, Owensboro, and Paducah) as shown in Table 9 in the main report. Also there are water quality issues with uncontrolled stormwater runoff, industrial pollutants and both nutrients (nitrogen and phosphorus) and agricultural chemicals such as atrazine from cultivated areas. A number of tributary streams exhibit signs of degraded aquatic habitat due to development pressures and stream encroachments. In addition, there are numerous smaller communities along the Ohio River and its tributaries that are subject to flood damages from the 1% chance flood event as evidenced by the number of flood insurance policies (and indications of un-insured floodplain occupants) shown in Table 2 of Appendix A.

14.4 POTENTIAL STUDIES OR PROJECTS THROUGH STANDING AUTHORITIES

The presence of degraded aquatic ecosystems on the sub-basin's tributary streams indicates the potential for application of the Section 206 Aquatic Ecosystem Restoration authority under the CAP program or application of the Ohio River Ecosystem Restoration authority to address embayment issues. The presence of existing completed projects at which conditions may have changed since initial operation indicates the potential for application of the Section 216 Review of Completed Projects authority to address allocated storage, flow releases, or the ongoing sustainability of LPPs in the face of local fiscal issues. Finally the presence of numerous unprotected communities located within the 1% chance floodplain indicates the potential for application of the Section 205 Small Flood Protection Projects authority under the CAP program to address flood damages and application of the Section 22 Planning Assistance to States authority to study floodplain management issues, and other allied water resources issues in the sub-basin.

15. TENNESSEE RIVER SUB-BASIN – TENNESSEE, MISSISSIPPI, ALABAMA, GEORGIA

15.1 REGIONAL CONTEXT

The Tennessee River Basin encompasses an area of 40,890 square miles, making it the largest tributary to the Ohio River. The Tennessee River flows through portions of seven states: Virginia, North Carolina, Tennessee, Alabama, Georgia, Mississippi, and Kentucky. From its origin high in the Appalachians to the confluence with the Ohio River, the Tennessee River spans more than 850 linear miles. The highest elevation in the basin, located at Mount Mitchell, North Carolina (6,684 feet), is the highest peak east of the Mississippi River. Once a free flowing river, the natural character of the Tennessee River has been significantly altered during the last eighty years. The following four figures (Figure 20–23) show the components of the sub-basin (Lower Tennessee, Middle Tennessee/Elk, Middle Tennessee/Hiwassee and Upper Tennessee).

Between the 1920s and 1960s, 49 dams were constructed along the main stem and tributaries. Dams located along the main stem function as "flow-through" reservoirs that improve river navigation and generate hydroelectric power; whereas dams on the tributaries function as large storage impoundments used primarily for flood control. Other alterations include the merger of the Mobile and Tennessee Rivers via the Tennessee-Tombigbee Waterway, which provides a navigational route between the Mobile and Tennessee Rivers and the Gulf of Mexico.

The aboriginal populations of the Tennessee Valley had extensive populations throughout the Alabama portions of the basin. Evidence of these populations can be dated to 12,000 years ago and lasted until just before the end of the prehistoric era, about 1400–1500 A.D.

The Cherokees referred to the Tennessee River as the "Hogoheegee" or "Big River." (*Paddling the Tennessee River*). During the Civil War the Tennessee River served as a strategic invasion route into the West Confederacy. Its development as one of the

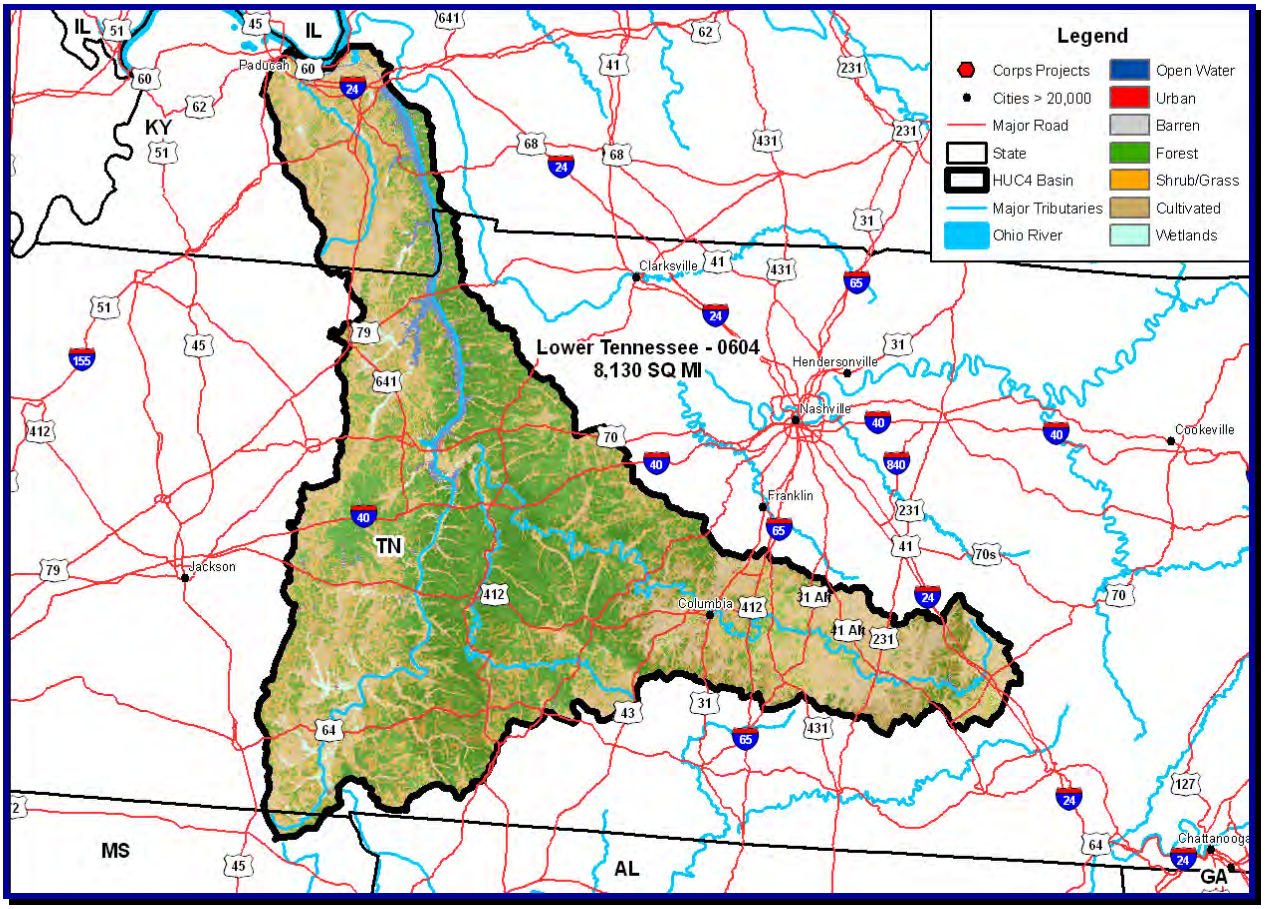

Figure 20 – Lower Tennessee River Component

world's greatest irrigation and hydropower systems began with the establishment in 1933 of the Tennessee Valley Authority.

15.2 NATIVE AMERICANS

The first inhabitants of the Tennessee Basin were Paleo-Indians who were nomadic hunters that used stone tipped spears. They gathered nuts, berries, fruits and roots as well as fish and mussels. They cooked their food in open pits.

The Muscle Shoals area was an early settlement for Paleo-Indians because the Tennessee Valley lays at the southern edge of the hardwood forests where nuts, acorns and game were plentiful and the climate warmer. However the abundance of fish and mussels might have been the most significant factor for their settlement.

When Europeans first began to enter into the Alabama portion of the Tennessee Basin in the 18th century there were three Native American tribes that inhabited the region.

In general, the Tennessee served as the dividing line between the Chickasaws and the Cherokees at Muscle Shoals. *(Lore)*

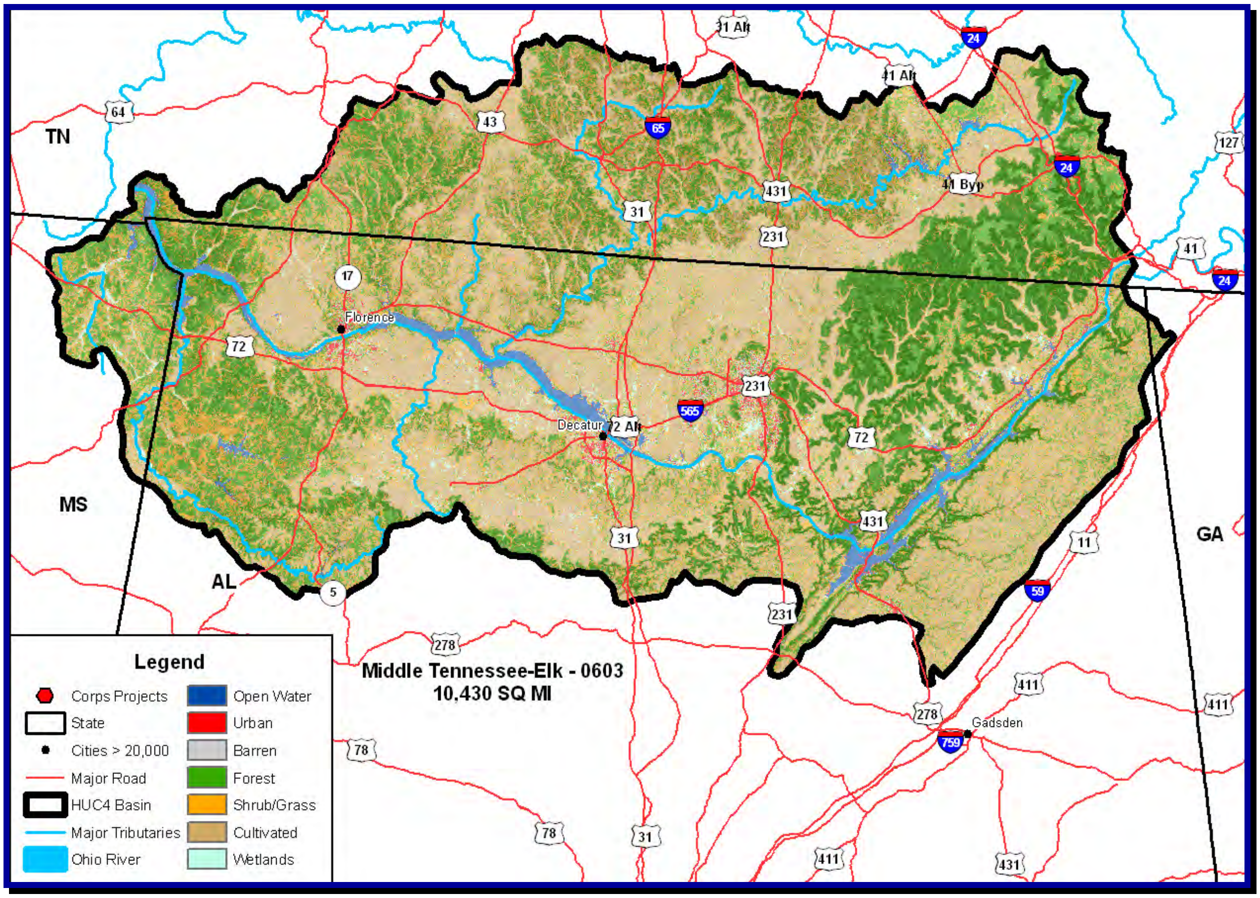

Figure 21 – Middle Tennessee/Elk River Component

The Chickasaws, a relatively small tribe, ranged from north Mississippi, eastern Tennessee, and southwest Kentucky and into northwest Alabama. The Chickasaws were fierce warriors and almost wiped out DeSoto's expedition in Mississippi in 1541 when he tried to enslave 200 Chickasaw warriors to serve as load carriers. They inscribed their bodies with indelible ink.

"It has been said that history records no group of people on any continent at any time who were cleaner than the Chickasaw." They would bathe every day, summer and winter, and were known to break the ice at the river bank so they could enter the water to bathe. Some believe this high regard for cleanliness is one reason the Chickasaws sided with the English traders as opposed to the French and the Spanish.

One of the best known Chickasaw chiefs during the years of European and American occupation was Chief George Colbert ("Kahl-burt") who was half Chickasaw and half Scot. In 1798 he operated a critical ferry across the otherwise uncrossable Tennessee that came to be known as Colbert's Ferry. This ferry, located at the mouth of Bear Creek, was the only crossing for the famed trade route the Natchez Trace, a former buffalo run. His father, James Colbert, was a legend in his own right. A Scotsman who lived amongst the Chickasaws, adopting their ways and even joining them in battle, he

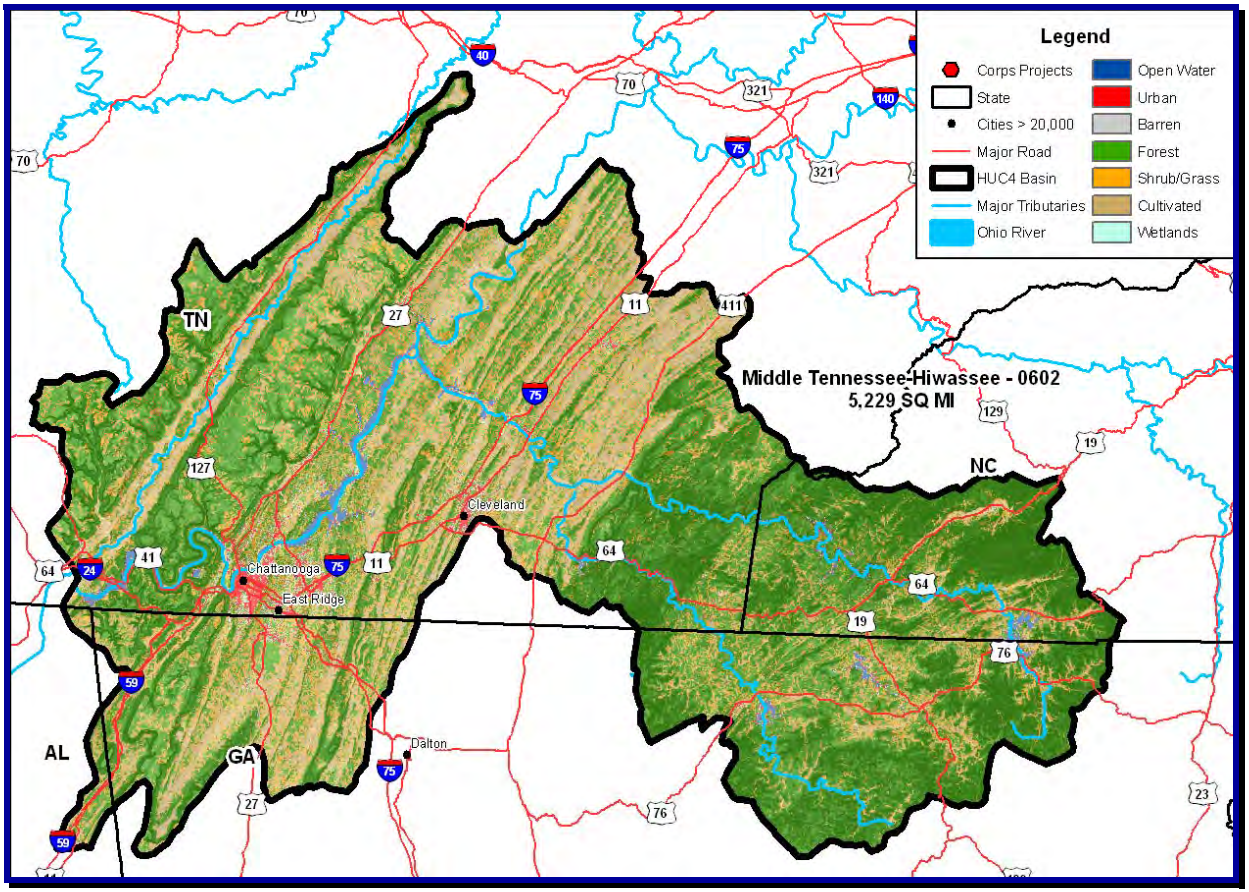

Figure 22 – Middle Tennessee/Hiwassee River Component

took on three Chickasaw brides and fathered eight children, many of whom, like George, gained notoriety amongst the Chickasaws.

George Colbert, who went on to serve as the chief of the Chickasaws for 12 years, and one of his brothers served under General Andrew Jackson during his campaigns against the Creeks. The Chickasaws trusted and admired Andrew Jackson who saw rewarded their loyalty by seeing to it that they were removed from their ancestral home.

In 1774 the Chickasaws refused the Henderson Land Company access to the mouth of Occochapo Creek (present day Bear Creek). After the treaty of 1816, most of the Chickasaws land was ceded to the U.S.

The Cherokees occupied northeast Alabama, and much of Tennessee and northwest Georgia. A few of their villages settled at Muscle Shoals and represented the southwestern tip of their domain. *(Lore)*

Perhaps the most interesting of the Cherokee chiefs in the Tennessee Basin of Alabama was Chief Doublehead or <u>Talo Tiske</u> meaning "two heads." Chief Doublehead established a town on the Tennessee River at the head of Muscle Shoals in 1790. This village sat at the mouth of Blue Water Creek in Lauderdale County.

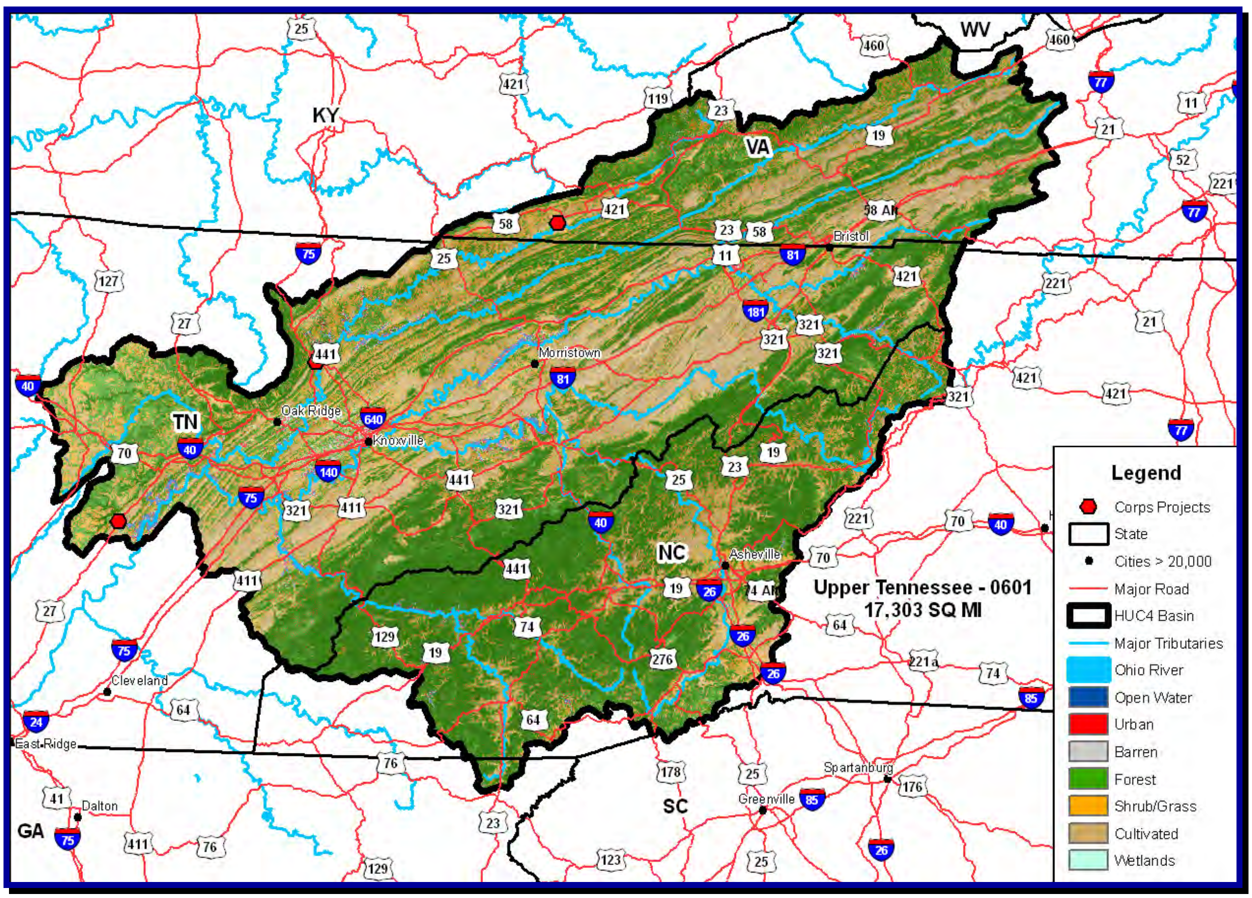

Figure 23 – Upper Tennessee River Component

Muscle Shoals had always been an area of dispute between Chickasaws and Cherokees, though it was known as "Chickasaw Hunting Grounds." When Doublehead's occupation of Muscle Shoals came into question, Chief George Colbert of the Chickasaws confirmed that Doublehead was at Muscle Shoals by his permission. This new agreement seems less unusual considering that Colbert had married two of Doublehead's daughters.

Doublehead's brother was Chief Old Tassel, one of the Cherokees most well-known and beloved chiefs. When he was murdered with the aid of the white mayor James Hubbert, Doublehead went on the rampage, attacking white settlers throughout the Cumberland Mountains of Tennessee. This six year warpath from 1788 to 1794 is well chronicled, and though it was no doubt exaggerated by the afflicted, the chiefs terrible "atrocities" certainly add up to a significant sum. He was even accused of encouraging his warriors to cannibalism of the dead during this escapade.

At the end of his warpath, Doublehead met with President George Washington at the nation's capital, and he returned a changed man. Though he began to mimic the ways of the whites and built a large cabin, he continued to defend the Cherokees land rights in various treaties until his death. This change of heart was characteristic of the Cherokees during this time, many of whom adopted the manners and customs of the whites. He even went as far as forming the Doublehead Company that leased 1,000 acres to more than 50 white settlers between the Elk River and Cypress Creek.

Doublehead was murdered in a savagely interesting tale chronicled by the famous Indian canoe fighter, Sam Dale. On a trip to a ball game on the Hiwasee River, Doublehead engaged in a series of arguments with two Cherokee warriors and a white Indian trader.

The Creek Nation (a confederacy of Musckogean tribes) inhabited parts of present day Colbert and Lauderdale counties for a time during the late 18th century. The Creeks were known for their ruthlessness in battle, mutilating the bodies of fallen enemies by cutting off the arms and the legs and removing the scalp by cutting a circle around the head just above the ears. They adorned their bodies with shell jewelry and freshwater pearls obtained from the large mussel populations of the Tennessee.

In general, the Tennessee basin served as the dividing line between the Chickasaws and the Cherokees at the Muscle Shoals area.

About 1,000 years before the establishment of Florence 1818 (located at the top of the hill); there was a thriving community at the bottom of the hill. The ceremonial mound there was called "Wawmanona" by the Indians and was built between 400 A.D. and 1500 A.D. *(Lore)*

15.3 ANTEBELLUM PERIOD

Small towns slowly became river ports and ferries across the river were quite common. Many of these ferry sites have small histories of their own.

In 1819 Alabama was admitted into the Union as a state and Huntsville was designated as its first capital and seat of the state constitutional convention.

The Moulton Valley was an important southern fruit supplier, and so much grain was produced in this area that it became known as the South's "Cereal Belt."

During the Civil War, many battles were fought throughout Alabama's Tennessee Basin, including many led by Confederate General Nathan Bedford Forrest.

Ulysses S. Grant made his first marks upon the Civil War by understanding the strategic importance of the river at his first victories at Fort Henry and Fort Donelson on the nearby Cumberland tributary to the upper Tennessee.

15.4 TENNESSEE VALLEY AUTHORITY – TVA

The Great Depression of the '30s set the stage for the creation of the Tennessee Valley Authority, an entity that would bring the most rapid and dramatic change the Tennessee had ever experienced. Created in 1933 by Franklin Roosevelt, the Tennessee Valley Authority was a bold and idealistic solution to the poverty and isolation facing inhabitants of the Tennessee Valley. Part of Roosevelt's New Deal, one of the most important short term accomplishments of the TVA was the creation of much needed jobs. Even by Depression standards, the Tennessee Valley was in sad shape in 1933. Much of the land had been farmed too hard for too long, eroding and depleting the soil. Crop yields had fallen along with farm incomes. The best timber had been cut. TVA developed fertilizers, taught farmers how to improve crop yields, and helped replant forests, control forest fires, and improve habitat for wildlife and fish. The most dramatic change in Valley life came from the electricity generated by TVA dams. Electric lights and modern appliances made life easier and farms more productive. Electricity also drew industries into the region, providing desperately needed jobs.

During World War II, the United States needed aluminum to build bombs and airplanes, and aluminum plants required electricity. To provide power for such critical war industries, TVA engaged in one of the largest hydropower construction programs ever undertaken in the United States. Early in 1942, when the effort reached its peak, 12 hydroelectric projects and a steam plant were under construction at the same time, and design and construction employment reached a total of 28,000. By the end of the war, TVA had completed a 650-mile (1,050-kilometer) navigation channel the length of the Tennessee River and had become the nation's largest electricity supplier. Even so, the demand for electricity was outstripping TVA's capacity to produce power from hydroelectric dams. Political interference kept TVA from securing additional federal appropriations to build coal-fired plants, so it sought the authority to issue bonds. Congress passed legislation in 1959 to make the TVA power system self-financing, and from that point on it would pay its own way.

The 1960s were years of unprecedented economic growth in the Tennessee Valley. Farms and forests were in better shape than they had been in generations. Electric rates were among the nation's lowest and stayed low as TVA brought larger, more efficient generating units into service. Expecting the Valley's electric power needs to continue to grow, TVA began building nuclear plants as a new source of economical power. Significant changes occurred in the economy of the Tennessee Valley and the nation, prompted by an international oil embargo in 1973 and accelerating fuel costs later in the decade. The average cost of electricity in the Tennessee Valley increased fivefold from the early 1970s to the early 1980s. With energy demand dropping and construction costs rising, TVA canceled several nuclear plants, as did other utilities around the nation.

To become more competitive, TVA began improving efficiency and productivity while cutting costs. By the late 1980s, TVA had stopped the rise in power rates and paved the way for a period of rate stability that would last for the next decade. As the electric-utility industry moves toward restructuring, TVA is preparing for competition. In recent years it has cut operating costs by nearly $800 million a year, reduced its workforce by more than half, increased the generating capacity of its plants, stopped building nuclear plants, and developed a plan to meet the energy needs of the Tennessee Valley through the year 2020.

Today, as the electric power industry restructures, TVA continues to provide its core product—wholesale electric power—competitively, efficiently and reliably. It sets a standard for public responsibility against which private companies can be measured.

Although TVA's production costs were third-lowest among the nation's 25 largest electric utilities in 1997, according to *Electric Light & Power* magazine, it continues to look for new ways to reduce costs even more and improve efficiency. TVA is on track to align the cost of its power with future competitive rates, in accordance with its 10-year business plan. TVA also has initiated a Business Transformation program to further reduce costs, and is moving to more flexible contracts with its distributor customers to meet their needs in a competitive marketplace.

In 1998 TVA unveiled a new clean-air strategy to reduce the pollutants that cause ozone and smog. The initiative will cut annual nitrogen-oxide emissions from TVA's coal-fired plants by approximately 170,000 tons a year. Modern equipment, representing an investment of $600 million, will help states and cities in the Tennessee Valley meet new, more stringent air-quality standards while providing greater flexibility for industrial and economic growth in the region. TVA earlier invested more than $2 billion to reduce sulfur-dioxide and nitrogen-oxide emissions.

15.5 NATURAL RESOURCES

The Tennessee River Basin is most notable for its abundance and diversity of freshwater fishes. Recognized as one of the most diverse rivers in North America, the Tennessee River supports about 240 fish species. Only the Mobile (236 species), Cumberland (186 species), Roanoke (82 species), and Conasauga (78 species) Rivers compare in numbers of fish species. Along with its unmatched diversity, the Tennessee River Basin also has one of the most imperiled faunas. The U.S. Fish and Wildlife Service currently lists 51 aquatic species (fish and mollusks) as either threatened or endangered.

The Tennessee River also hosts the most diverse mollusk fauna in North America. The town of Muscle Shoals, Alabama, derived its name from a series of islands and shoals created by the mounds of mussel shells deposited by the Cherokee Indians. Approximately 102 native freshwater mussels have been recorded within the Tennessee River Basin. Most of the present-day fauna are confined to the Clinch and Duck Rivers. The diversity of mollusks and fish in the Tennessee River is a reflection of the unique aquatic habitats that exist throughout the Basin.

The Nature Conservancy considers the Tennessee Basin as a whole to be the single most biologically diverse river system for aquatic organisms in the United States. It also harbors the highest number of imperiled species of any large basin in North America with 57 fish species and 47 mussel species considered to be “at risk.” (State of the Rivers) (Masters et al. 1998)

In Alabama, the section of the Tennessee Basin flowing into Wheeler Lake is the most threatened biologically with 23 “at risk” fish and mussel species. Of these 23, nine are federally listed as threatened or endangered. The Pickwick / Wilson Lake watershed is also significant with 15 “at risk” fish and mussel species (four of these are Federally listed as threatened or endangered).

15.6 FISH

176 species of fish are known from the Alabama portions of the Tennessee River Basin. Two of these are believed to be extinct, the harelip sucker (Lagochila lacera) and the whiteline topminnow (Fundulus albollineatus). (State of the Rivers)

High species diversity occurs most prevalently in the free-flowing tributaries of the Paint Rock River (with 98 species) and the Flint River (with 83 species). The main channel of the Tennessee yields a lower diversity due to the impacts from dam construction and maintenance dredging (with 53 species). Other smaller watersheds of interest include Crow Creek (with 56 species), Big Spring–Browns Creek (with 35 species), and Dry Creek (with 32 species).

The Alabama cavefish (Speoplatyihimus poulsoni), an endangered species, is a small, white, and blind fish that exists in only one location; Key Cave in Lauderdale County, Alabama. At one time it may have been present in other caves west of Key Cave, but these caves are now inundated by Pickwick Lake. The Alabama cavefish is considered to be the rarest of all American cavefish, and one of the rarest freshwater fish in the world. The total population of this fish is estimated to be fewer than 100 individuals, with no more than 10 ever observed in a single visit. This fish is threatened by pollutants placed on row crop lands within Key caves recharge area, as well as by competition with the southern cavefish and predation from the Cave crayfish. (See Key Cave National Wildlife Refuge for more information) (US FWS Species Account)

The Boulder darter (Etheostoma wapiti), an endangered species, is found in Shoal Creek and the Elk River.

The Palezone shiner (Notropis albizonatus), an endangered species, is found in the Paint Rock River

The Slackwater darter (Etheostoma boschungi), a threatened species, is found in Swan Creek, Cypress Creek, and the Flint River. It has critical habitat in the basin.

The Snail darter (Percina tanasi), an endangered species, is found in the Paint Rock River.

The Spotfin chub (Cyprinella monacha), an endangered species, is found in Little Bear Creek and Shoal Creek.

The Tuscumbia darter (Etheostoma tuscumbia).

15.7 MUSSELS

In the Guntersville Lake section of the Tennessee 14 species of mussel are considered threatened or endangered by the Alabama Department of Conservation and Natural Resources. Of these only 6 are federally protected and one is being considered as a candidate species.

Mussel species presumed to be extirpated from the Alabama portions of the Tennessee basin include:

- The Oyster mussel (Epioblasma capsaeformis), a federally endangered species, lost its historical habitat within Alabama with the impoundment of the Tennessee River by the Tennessee Valley Authority between the years of 1933 to 1944. This species still maintains very small populations in the tributaries of the Tennessee and Cumberland River basins in Kentucky, Virginia, and Tennessee. (Federal Register)
- The Cumberlandian combshell (Epiblasma brevidans), a federally endangered species, once found in the Alabama portion of the Tennessee Basin, has been extirpated with the advent of locks and dams altering its former habitat. Small populations of this species persist in the Cumberland and Tennessee River basins in Kentucky, Virginia, and Tennessee. (Federal Register)
- Cumberland monkeyface (Quadrula intermedia), an endangered species once known from the Guntersville Lake section of the Tennessee Basin
- Dromedary pearlymussel (Dromus dromas), an endangered species once known from the Guntersville Lake section of the Tennessee Basin
- Orange-foot pimpleback (Plethobasus cooperianus), an endangered species once known from the Guntersville Lake section of the Tennessee Basin
- Pink mucket (Lampsilis ovata), an endangered species once known from the Guntersville Lake section of the Tennessee Basin
- Ring Pink mussel (Obobvaria retusa), an endangered species once known from the Guntersville Lake section of the Tennessee Basin
- Rough pigtoe (Pleurobema plenum), an endangered species once known from the Guntersville Lake section of the Tennessee Basin

Candidate for listing:

- Slabside pearlymussel (Lexingtonia dollabelloides), is currently considered endangered within Alabama and is being considered for federal listing.

15.8 SNAILS

In the Guntersville Lake Section, 3 species of snail are listed as threatened or endangered by the state. One other is listed as endangered federally.

The Tennessee Basin in Alabama is home to one endangered snail species.

Anthony's riversnail (Athearnia anthonyi) is an endangered species known to exist in only two locations, the Sequatchie River in Tennessee and in Limestone Creek in Limestone County, Alabama. It is relatively large in comparison to other aquatic snails (measuring 1 inch in length) and primarily inhabits the shoal areas of large rivers. Most of its historical range has been altered by impoundments. (Fed Register)

The Spiny riversnail is believed to be extirpated from the Tennessee Basin in Alabama. (TVA-Guntersville)

15.9 PLANTS

The Guntersville Reservoir Section of the Tennessee Basin provides habitat for eight federally listed, 43 Tennessee state-listed and 66 Alabama state-listed plant species known from DeKalb, Madison, Marshall and Jackson Counties in Alabama and Marion County in Tennessee. The federally listed species included:

- American Hart's tongue fern, threatened
- Arrowhead, threatened
- Eggert sunflower, threatened
- Price potato-bean, threatened
- Green pitcher plant, endangered
- Harperella, endangered
- Morefield's leather flower, endangered
- Mountain skullcap, endangered

None of these federally listed plants occur on TVA lands within the Basin.

15.10 OTHERS

Four terrestrial species are listed as federally threatened or endangered. They are:

- The bald eagle (threatened), red-cockaded woodpecker (endangered), gray bat and Indiana bat (both endangered).
- The state's largest populations of nesting Bald Eagles and gray bats occur in the Tennessee River Basin.

- Two caves in the Guntersville Lake region, Sauta Cave (formerly Blowing Wind Cave) and Hambrick Cave both have populations of gray bats presumed to exceed 100,000 individuals during the summer months. Numerous other caves had smaller populations. Gray bats can feed up to 32 kilometers from their primary roosting site and depend heavily on emerging aquatic insects for their food supply. (TVA-Guntersville)
- There are many other terrestrial species that are protected under state law or are being tracked as species of special concern.

15.11 WATER RESOURCES ISSUES

The deepest felt and most visible impacts to the watershed are the hydroelectric dams of the Tennessee Valley Authority (TVA). The margins of many of the resulting reservoirs are developed. However, TVA also operates the largest federal watershed assistance and management program in the area.

Mining has also left visible evidence throughout the landscape. Although abandoned miles are still an issue, the newest challenge to the health of the aquatic ecosystem stems from mountain top mining which in effect places excess mountain top materials in a valley and obliterates the stream system that used to flow there. This area, as most of the south, has experienced higher than average growth in population.

Urban and Suburban Sprawl has led to many water quality issues. Rural forested and agricultural lands have become suburbanized at an alarming rate, increasing the amount of impervious surfaces in urbanizing watersheds.

Water Quality Impairment: Nutrient enrichment, sedimentation and pathogens are the leading causes of water quality impairment in the region.

16. DUCK RIVER WATERSHED – TENNESSEE

16.1 REGIONAL CONTEXT

The Duck River is one of Tennessee's most-scenic waterways and the longest river entirely within Tennessee's borders. It is 269 miles long and has only one Tennessee Valley Authority (TVA) Reservoir (Normandy Reservoir at Duck River Mile 248.6). It originates on the Eastern Highland Rim physiographic province, crossing the Central Basin and Western Highland Rim before flowing into the Tennessee River (Kentucky Lake). The Duck River is designated as a State Scenic River within the Central Basin portion. The Duck River has a watershed area of almost 3500 square miles including the tributaries of the Buffalo River (125 miles long) and Piney River. Hydrologic Unit codes for the Duck River watershed include the Lower Duck River (HUC 06040003), Upper Duck River (HUC 06040002) and Buffalo River (HUC 06040004). Figure 24 shows the watershed.

Land Use in the watershed is estimated at 54% forest, 39% pasture, 4% cropland, 1% urban, and 2% water (TVA 1997). The Duck River is the sole source of water for 250,000 people in Middle Tennessee, including the cities of Columbia, Shelbyville,

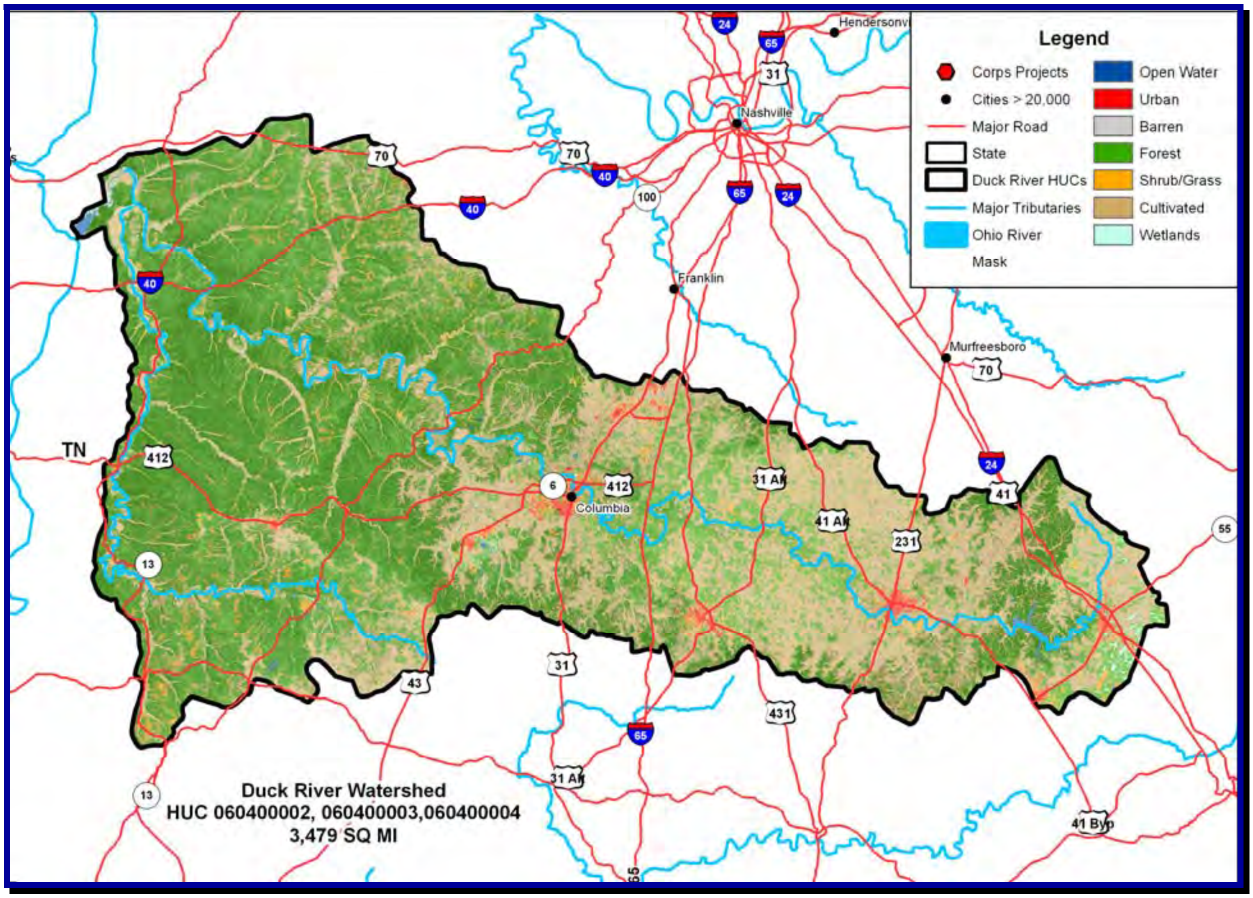

Figure 24 – Duck River Watershed

Manchester, and Tullahoma. The Duck River is considered one of three hot spots for fish and mussel diversity in the entire world. It is generally considered to be the richest river in varieties of freshwater animal on the North American Continent (TNC).

16.2 WATER RESOURCES ISSUES

Water supply and aquatic resources are two key issues are important to water resources planning in the Duck River watershed. Water supplying planning has been a key issue for a number of years. Studies have been performed by numerous parties including TVA, USACE, Tennessee Department of Environment and Conservation (TDEC), the Duck River Development Agency (DRDA), The Nature Conservancy (TNC) and the local water utilities. Minimum flows in the river are a key consideration for planning water supply flows in the Duck River. Past minimum flow requirements at various points have been controlled by releases from TVA's Normandy Dam (TVA 2000). Flows were set to provide both water supply and water quality (waste assimilation) needs. This is subject to an on-going project by TNC and TDEC using the OASIS model to evaluate environmental flow requirements in the Duck River, particularly over sections containing threatened and endangered species. The goal is to optimize use of water for both water supply and seasonal flow requirements for the rich aquatic resources.

Aquatic resources in the Duck River are globally recognized due to the diversity of aquatic species. THC is very active in the basin and has a Duck River coordinator located in Columbia Tennessee. Overall the Duck supports 151 species of fish, 55 freshwater mussel species, and 22 species of aquatic snails. Amount the rare species living in the Duck River are mussels such as the birdwing, pearlymussel and the Tennessee Clubshell and fish such as the barrens topminnow and pygmy madtom. TNC has been working with other partners to provide funds and technical assistance for the Landowner Incentive Program for livestock operations and riparian habitat considerations. The Duck River has served as a refuge for listed mussels relocated from the Clinch River.

Other issues within the Duck River include flooding problems in the cities of Columbia and Shelbyville and water quality issues within Normandy Reservoir. TVA has implemented in-lake oxygenation systems and minimum flow valves to address these water quality issues related to the reservoir.

16.3 EXISTING USACE PROJECTS

There are no USACE facilities in the Duck River basin. TVA operates Normandy Dam and Reservoir, the only large water resource project in the Duck basin. TVA planned the Columbia Dam on the Duck but this was never completed due to economic reasons as well as environmental concerns. The NRCS and Tennessee Department of Agriculture have been active within the Duck River watershed addressing agricultural lands in the basin in conjunction with TNC. There is a local Flood Damage Reduction Project at Shelbyville.

16.4 POTENTIAL STUDIES AND PROJECTS THROUGH STANDING AUTHORITIES

USACE has one Section 206 project under development at Centerville on the lower Duck River. This project would address bank stability and floodplain restoration along a short reach of the river. A USACE reconnaissance study was performed in the late 1990s and identified several aquatic restoration needs for the basin; most would fit the Section 206 program should local sponsor’s interest be confirmed. The Duck River is a highly used recreational (canoeing) stream and encroachment on the floodplain by urban development has been identified as an issue by the NRCS.

Table 10 displays information on all of the sub-basins and watersheds in the basin.

Table 10 – Ohio River Basin – Sub-basins (HUC 4), Watersheds (HUC 8), and USACE Reservoirs

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Allegheny	Conewango. Pennsylvania, New York.	5	501	5010002	0	Pittsburgh	896.3
Ohio Region	Allegheny	Upper Allegheny. Pennsylvania, New York.	5	501	5010001	1	Pittsburgh	2568.7
Ohio Region	Allegheny	French. Pennsylvania, New York.	5	501	5010004	2	Pittsburgh	1221.8
Ohio Region	Allegheny	Middle Allegheny–Tionesta. Pennsylvania.	5	501	5010003	1	Pittsburgh	1688.1
Ohio Region	Allegheny	Clarion. Pennsylvania.	5	501	5010005	1	Pittsburgh	1242
Ohio Region	Allegheny	Middle Allegheny–Redbank. New York.	5	501	5010006	2	Pittsburgh	1703.8
Ohio Region	Allegheny	Lower Allegheny. Pennsylvania.	5	501	5010009	0	Pittsburgh	476.7
Ohio Region	Allegheny	Conemaugh. Pennsylvania.	5	501	5010007	1	Pittsburgh	1361.1
Ohio Region	Allegheny	Kiskiminetas. Pennsylvania.	5	501	5010008	1	Pittsburgh	497.1
Subtotal Area								*11,655.80*
Ohio Region	Monongahela	West Fork. West Virginia.	5	502	5020002	1	Pittsburgh	880.7
Ohio Region	Monongahela	Lower Monongahela. Pennsylvania, West Virginia.	5	502	5020005	0	Pittsburgh	1456.2
Ohio Region	Monongahela	Youghiogheny. Maryland, Pennsylvania, West Virginia.	5	502	5020006	1	Pittsburgh	1771.1
Ohio Region	Monongahela	Cheat. Pennsylvania, West Virginia.	5	502	5020004	1	Pittsburgh	1434.8
Ohio Region	Monongahela	Upper Monongahela. Pennsylvania, West Virginia.	5	502	5020003	0	Pittsburgh	466.2
Ohio Region	Monongahela	Tygart Valley. West Virginia.	5	502	5020001	1	Pittsburgh	1361.6
Subtotal Area								*7,370.60*

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Upper Ohio	Shenango. Ohio, Pennsylvania.	5	503	5030102	1	Pittsburgh	1073.1
Ohio Region	Upper Ohio	Upper Ohio–Shade. Ohio, West Virginia.	5	503	5030202	0	Huntington	1402.9
Ohio Region	Upper Ohio	Mahoning. Ohio, Pennsylvania.	5	503	5030103	3	Pittsburgh	1146.2
Ohio Region	Upper Ohio	Connoquenessing. Pennsylvania.	5	503	5030105	0	Pittsburgh	842.6
Ohio Region	Upper Ohio	Upper Ohio. Ohio, Pennsylvania, West Virginia.	5	503	5030101	0	Pittsburgh	1970.2
Ohio Region	Upper Ohio	Beaver. Pennsylvania.	5	503	5030104	0	Pittsburgh	113.1
Ohio Region	Upper Ohio	Upper Ohio–Wheeling. Ohio, Pennsylvania, West Virginia.	5	503	5030106	0	Pittsburgh	1505.3
Ohio Region	Upper Ohio	Hocking. Ohio.	5	503	5030204	1	Huntington	1185.3
Ohio Region	Upper Ohio	Little Muskingum–Middle Island. Ohio, West Virginia.	5	503	5030201	0	Huntington	1802.8
Ohio Region	Upper Ohio	Little Kanawha. West Virginia.	5	503	5030203	3	Huntington	2303.3
Subtotal Area								*13,344.80*
Ohio Region	Muskingum	Tuscarawas. Ohio.	5	504	5040001	8	Huntington	2612.6
Ohio Region	Muskingum	Walhonding. Ohio.	5	504	5040003	2	Huntington	1267.1
Ohio Region	Muskingum	Mohican. Ohio.	5	504	5040002	3	Huntington	992.8
Ohio Region	Muskingum	Licking. Ohio.	5	504	5040006	2	Huntington	789
Ohio Region	Muskingum	Muskingum. Ohio.	5	504	5040004	0	Huntington	1580.7
Ohio Region	Muskingum	Wills. Ohio.	5	504	5040005	2	Huntington	853.3
Subtotal Area								*8,095.40*

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Kanawha	Lower Kanawha. West Virginia.	5	505	5050008	0	Huntington	945.3
Ohio Region	Kanawha	Greenbrier. West Virginia.	5	505	5050003	0	Huntington	1635.9
Ohio Region	Kanawha	Elk. West Virginia.	5	505	5050007	1	Huntington	1516.2
Ohio Region	Kanawha	Gauley. West Virginia.	5	505	5050005	1	Huntington	1445.5
Ohio Region	Kanawha	Coal. West Virginia.	5	505	5050009	0	Huntington	891.4
Ohio Region	Kanawha	Upper Kanawha. West Virginia.	5	505	5050006	0	Huntington	520.6
Ohio Region	Kanawha	Lower New. West Virginia.	5	505	5050004	0	Huntington	691.6
Ohio Region	Kanawha	Middle New. Virginia, West Virginia.	5	505	5050002	1	Huntington	1696.6
Ohio Region	Kanawha	Upper New. North Carolina, Virginia.	5	505	5050001	0	Huntington	2934.8
Subtotal Area								*12,278.00*
Ohio Region	Scioto	Upper Scioto. Ohio.	5	506	5060001	4	Huntington	3170.2
Ohio Region	Scioto	Lower Scioto. Ohio.	5	506	5060002	1	Huntington	2189.6
Ohio Region	Scioto	Paint. Ohio.	5	506	5060003	1	Huntington	1146.7
Subtotal Area								*6,506.50*
Ohio Region	Big Sandy–Guyandotte	Lower Guyandotte. West Virginia.	5	507	5070102	0	Huntington	741.2
Ohio Region	Big Sandy–Guyandotte	Big Sandy. Kentucky, West Virginia.	5	507	5070204	1	Huntington	418.3
Ohio Region	Big Sandy–Guyandotte	Tug. Kentucky, Virginia, West Virginia.	5	507	5070201	0	Huntington	1560

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Big Sandy–Guyandotte	Lower Levisa. Kentucky.	5	507	5070203	2	Huntington	1107.2
Ohio Region	Big Sandy–Guyandotte	Upper Guyandotte. West Virginia.	5	507	5070101	1	Huntington	949.9
Ohio Region	Big Sandy–Guyandotte	Upper Levisa. Kentucky, Virginia.	5	507	5070202	3	Huntington	1189.2
Subtotal Area								*5,965.80*
Ohio Region	Great Miami	Upper Great Miami, Indiana, Ohio.	5	508	5080001	1	Louisville	2513.3
Ohio Region	Great Miami	Whitewater. Indiana, Ohio.	5	508	5080003	2	Louisville	1480.9
Ohio Region	Great Miami	Lower Great Miami, Indiana, Ohio.	5	508	5080002	0	Louisville	1415.4
Subtotal Area								*5,409.60*
Ohio Region	Middle Ohio	Raccoon-Symmes. Ohio, West Virginia.	5	509	5090101	0	Huntington	1461.4
Ohio Region	Middle Ohio	Little Miami. Ohio.	5	509	5090202	2	Louisville	1745
Ohio Region	Middle Ohio	Middle Ohio–Laughery. Indiana, Kentucky, Ohio.	5	509	5090203	1	Louisville	1406.9
Ohio Region	Middle Ohio	Ohio Brush–Whiteoak. Kentucky, Ohio.	5	509	5090201	0	Huntington	2131
Ohio Region	Middle Ohio	Little Scioto–Tygarts. Kentucky, Ohio.	5	509	5090103	1	Huntington	1032.8
Ohio Region	Middle Ohio	Little Sandy. Kentucky.	5	509	5090104	1	Huntington	720.3
Ohio Region	Middle Ohio	Twelvepole. West Virginia.	5	509	5090102	2	Huntington	443.9
Subtotal Area								*8,941.30*
Ohio Region	Kentucky-Licking	Licking. Kentucky.	5	510	5100101	2	Louisville	2801.7
Ohio Region	Kentucky-Licking	Lower Kentucky. Kentucky.	5	510	5100205	1	Louisville	3228.1

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Kentucky-Licking	South Fork Licking. Kentucky.	5	510	5100102	0	Louisville	933.4
Ohio Region	Kentucky-Licking	Upper Kentucky. Kentucky.	5	510	5100204	1	Louisville	1081.9
Ohio Region	Kentucky-Licking	North Fork Kentucky. Kentucky.	5	510	5100201	1	Louisville	1328.9
Ohio Region	Kentucky-Licking	Middle Fork Kentucky. Kentucky.	5	510	5100202	1	Louisville	568.3
Ohio Region	Kentucky-Licking	South Fork Kentucky. Kentucky.	5	510	5100203	1	Louisville	744.8
Subtotal Area								*10,687.20*
Ohio Region	Green	Lower Green. Kentucky.	5	511	5110005	0	Louisville	924.2
Ohio Region	Green	Rough. Kentucky.	5	511	5110004	1	Louisville	1100.5
Ohio Region	Green	Upper Green. Kentucky.	5	511	5110001	1	Louisville	3181.6
Ohio Region	Green	Pond. Kentucky.	5	511	5110006	0	Louisville	790.6
Ohio Region	Green	Middle Green. Kentucky.	5	511	5110003	1	Louisville	1024
Ohio Region	Green	Barren. Kentucky, Tennessee.	5	511	5110002	1	Louisville	2255.2
Subtotal Area								*9,276.10*
Ohio Region	Wabash	Little Wabash. Illinois.	5	512	5120114	1	Louisville	2148
Ohio Region	Wabash	Lower White. Indiana.	5	512	5120202	0	Louisville	1655.4
Ohio Region	Wabash	Tippecanoe. Indiana.	5	512	5120106	0	Louisville	1956.7
Ohio Region	Wabash	Eel. Indiana.	5	512	5120104	0	Louisville	824
Ohio Region	Wabash	Upper Wabash. Indiana, Ohio.	5	512	5120101	1	Louisville	1578.7
Ohio Region	Wabash	Middle Wabash–Deer. Indiana.	5	512	5120105	0	Louisville	676.1
Ohio Region	Wabash	Salamonie. Indiana.	5	512	5120102	1	Louisville	551.4

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Wabash	Mississinewa. Indiana, Ohio.	5	512	5120103	1	Louisville	838
Ohio Region	Wabash	Middle Wabash–Little Vermilion. Illinois, Indiana.	5	512	5120108	3	Louisville	2283
Ohio Region	Wabash	Vermilion. Illinois, Indiana.	5	512	5120109	0	Louisville	1450.1
Ohio Region	Wabash	Wildcat. Indiana.	5	512	5120107	1	Louisville	806.8
Ohio Region	Wabash	Upper White. Indiana.	5	512	5120201	0	Louisville	2731.9
Ohio Region	Wabash	Sugar. Indiana.	5	512	5120110	0	Louisville	832.9
Ohio Region	Wabash	Embarras. Illinois.	5	512	5120112	1	Louisville	2475.7
Ohio Region	Wabash	Driftwood. Indiana.	5	512	5120204	2	Louisville	1176.6
Ohio Region	Wabash	Eel. Indiana.	5	512	5120203	2	Louisville	1218
Ohio Region	Wabash	Flatrock-Haw. Indiana.	5	512	5120205	1	Louisville	598.9
Ohio Region	Wabash	Middle Wabash–Busseron. Illinois, Indiana.	5	512	5120111	0	Louisville	2067
Ohio Region	Wabash	Upper East Fork White. Indiana.	5	512	5120206	0	Louisville	809.1
Ohio Region	Wabash	Lower East Fork White. Indiana.	5	512	5120208	1	Louisville	2065.3
Ohio Region	Wabash	Muscatatuck. Indiana.	5	512	5120207	0	Louisville	1149
Ohio Region	Wabash	Skillet. Illinois.	5	512	5120115	0	Louisville	1075
Ohio Region	Wabash	Lower Wabash. Illinois, Indiana.	5	512	5120113	0	Louisville	1325.6
Ohio Region	Wabash	Patoka. Indiana.	5	512	5120209	1	Louisville	873
Subtotal Area								*33,166.30*

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Cumberland	Rockcastle. Kentucky.	5	513	5130102	0	Nashville	774
Ohio Region	Cumberland	Upper Cumberland–Lake Cumberland. Kentucky, Tennessee.	5	513	5130103	0	Nashville	1888.9
Ohio Region	Cumberland	Lower Cumberland. Kentucky, Tennessee.	5	513	5130205	1	Nashville	2330
Ohio Region	Cumberland	Upper Cumberland. Kentucky, Tennessee.	5	513	5130101	0	Nashville	2321.5
Ohio Region	Cumberland	South Fork Cumberland. Kentucky, Tennessee.	5	513	5130104	0	Nashville	1351.2
Ohio Region	Cumberland	Red. Kentucky, Tennessee.	5	513	5130206	1	Nashville	1491.3
Ohio Region	Cumberland	Obey. Kentucky, Tennessee.	5	513	5130105	0	Nashville	944.2
Ohio Region	Cumberland	Upper Cumberland–Cordell Hull Reservoir. Tennessee.	5	513	5130106	0	Nashville	788.2
Ohio Region	Cumberland	Lower Cumberland–Old Hickory Lake. Tennessee.	5	513	5130201	0	Nashville	991.3
Ohio Region	Cumberland	Lower Cumberland–Sycamore. Tennessee.	5	513	5130202	0	Nashville	654.6
Ohio Region	Cumberland	Harpeth. Tennessee.	5	513	5130204	0	Nashville	876
Ohio Region	Cumberland	Caney. Tennessee.	5	513	5130108	0	Nashville	1786.1
Ohio Region	Cumberland	Stones. Tennessee.	5	513	5130203	0	Nashville	931.9
Ohio Region	Cumberland	Collins. Tennessee.	5	513	5130107	0	Nashville	812.6
Subtotal Area								*17,941.80*
Ohio Region	Lower Ohio	Silver–Little Kentucky. Indiana, Kentucky.	5	514	5140101	0	Louisville	1256.7
Ohio Region	Lower Ohio	Blue-Sinking. Kentucky, Indiana.	5	514	5140104	0	Louisville	1906
Ohio Region	Lower Ohio	Salt. Kentucky.	5	514	5140102	1	Louisville	1478.8

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Ohio Region	Lower Ohio	Highland-Pigeon. Indiana, Kentucky.	5	514	5140202	0	Louisville	1012.7
Ohio Region	Lower Ohio	Lower Ohio–Little Pigeon. Indiana.	5	514	5140201	0	Louisville	1403
Ohio Region	Lower Ohio	Saline. Illinois.	5	514	5140204	0	Louisville	1193.7
Ohio Region	Lower Ohio	Rolling Fork. Kentucky.	5	514	5140103	1	Louisville	1443.6
Ohio Region	Lower Ohio	Lower Ohio–Bay. Illinois, Kentucky.	5	514	5140203	0	Louisville	1100.6
Ohio Region	Lower Ohio	Tradewater. Kentucky.	5	514	5140205	0	Louisville	957.1
Ohio Region	Lower Ohio	Lower Ohio. Illinois, Kentucky.	5	514	5140206	0	Louisville	946.7
Subtotal Area								*12,698.90*
Tennessee Region	Upper Tennessee	Upper Clinch, Tennessee, Virginia.	6	601	6010205	0	Nashville	2002.3
Tennessee Region	Upper Tennessee	North Fork Holston. Tennessee, Virginia.	6	601	6010101	0	Nashville	697.7
Tennessee Region	Upper Tennessee	Powell. Tennessee, Virginia.	6	601	6010206	0	Nashville	944.3
Tennessee Region	Upper Tennessee	South Fork Holston. Tennessee, Virginia.	6	601	6010102	0	Nashville	1153.6
Tennessee Region	Upper Tennessee	Holston. Tennessee.	6	601	6010104	0	Nashville	1009.9
Tennessee Region	Upper Tennessee	Watauga, North Carolina, Tennessee.	6	601	6010103	0	Nashville	882.3
Tennessee Region	Upper Tennessee	Nolichucky. North Carolina, Tennessee.	6	601	6010108	0	Nashville	1753.5
Tennessee Region	Upper Tennessee	Powell. Tennessee.	6	601	6010207	0	Nashville	627.3
Tennessee Region	Upper Tennessee	Emory. Tennessee.	6	601	6010208	0	Nashville	880.1
Tennessee Region	Upper Tennessee	Lower French Broad. Tennessee.	6	601	6010107	0	Nashville	784.9
Tennessee Region	Upper Tennessee	Watts Bar Lake. Tennessee.	6	601	6010201	0	Nashville	1360.3
Tennessee Region	Upper Tennessee	Upper French Broad. North Carolina, Tennessee.	6	601	6010105	0	Nashville	1886.8

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Tennessee Region	Upper Tennessee	Pigeon. North Carolina, Tennessee.	6	601	6010106	0	Nashville	683.3
Tennessee Region	Upper Tennessee	Lower Little Tennessee. North Carolina, Tennessee.	6	601	6010204	0	Nashville	1047.6
Tennessee Region	Upper Tennessee	Tuckasegee. North Carolina.	6	601	6010203	0	Nashville	730.3
Tennessee Region	Upper Tennessee	Upper Little Tennessee. Georgia, North Carolina.	6	601	6010202	0	Nashville	859.2
Subtotal Area								*17,303.30*
Tennessee Region	Middle Tennessee–Hiwassee	Sequatchie. Tennessee.	6	602	6020004	0	Nashville	589.3
Tennessee Region	Middle Tennessee–Hiwassee	Middle Tennessee–Chickamauga. Alabama, Georgia, Tennessee.	6	602	6020001	0	Nashville	1880.8
Tennessee Region	Middle Tennessee–Hiwassee	Hiwassee. Georgia, North Carolina, Tennessee.	6	602	6020002	0	Nashville	2102.1
Tennessee Region	Middle Tennessee–Hiwassee	Ocoee. Georgia, North Carolina, Tennessee.	6	602	6020003	0	Nashville	656.5
Subtotal Area								*5,228.70*
Tennessee Region	Middle Tennessee–Elk	Upper Elk. Alabama/Tennessee.	6	603	6030003	0	Nashville	1285.8
Tennessee Region	Middle Tennessee–Elk	Lower Elk. Alabama/Tennessee.	6	603	6030004	0	Nashville	973.7
Tennessee Region	Middle Tennessee–Elk	Pickwick Lake. Alabama, Mississippi, Tennessee.	6	603	6030005	0	Nashville	2303.7
Tennessee Region	Middle Tennessee–Elk	Guntersville Lake. Alabama, Georgia, Tennessee.	6	603	6030001	0	Nashville	2019.7

Region Name	Sub-basin Name	Sub-basin Detailed Description	HUC 2 Code	HUC 4 Code	HUC 8 Code	USACE Reservoirs	USACE District	Square Miles
Tennessee Region	Middle Tennessee–Elk	Wheeler Lake. Alabama/Tennessee.	6	603	6030002	0	Nashville	2894.7
Tennessee Region	Middle Tennessee–Elk	Bear. Alabama, Mississippi.	6	603	6030006	0	Nashville	952.4
Subtotal Area								*10,429.90*
Tennessee Region	Lower Tennessee	Lower Tennessee. Kentucky, Tennessee.	6	604	6040006	0	Nashville	697.7
Tennessee Region	Lower Tennessee	Kentucky Lake. Kentucky, Tennessee.	6	604	6040005	0	Nashville	1840.2
Tennessee Region	Lower Tennessee	Lower Duck. Tennessee.	6	604	6040003	0	Nashville	1559
Tennessee Region	Lower Tennessee	Buffalo. Tennessee.	6	604	6040004	0	Nashville	740
Tennessee Region	Lower Tennessee	Lower Tennessee–Beech. Mississippi, Tennessee.	6	604	6040001	0	Nashville	2113.5
Tennessee Region	Lower Tennessee	Upper Duck. Tennessee.	6	604	6040002	0	Nashville	1179.7
Subtotal Area								*8,130.00*
Total HUC 2 Area								*204,429.90*

APPENDIX J – ECONOMICS APPENDIX AND PRELIMINARY EVALUATION OF ALTERNATIVES

1. ENVIRONMENTAL/ECOSYSTEM RESTORATION ALTERNATIVES

1.1 POTENTIAL BENEFITS

The benefits of ecosystem restoration are based upon the measurable enhancement/improvement of existing habitat units (acres, miles, etc.) or creation of additional new units (acres, miles, etc.) of defined habitats (wetlands, bottomland hardwoods, etc.). By statute and regulation either measurable improvement or creation of habitat are regarded as benefits; only the marginal cost per unit of habitat provided or improved is questioned among alternatives. An example would be the proposed modifications of seasonal reservoir operations that would enhance the diversity and/or productivity of downstream aquatic communities. Specific acreages of improved aquatic habitat or miles of enhanced aquatic habitat downstream of a dam (based upon comparative habitat results of reference streams) could be calculated based upon anticipated changes in water temperature, flow volumes and oxygen levels from modified dam operations. Those modifications could be a simple as increasing flows by several cubic feet per second for additional months in the fall season (operational change) or as complicated as adding additional intake portals in the intake structure. Other than potential impacts to other authorized uses (recreation or water supply) in the reservoir from increased flows downstream (negative benefits (costs), the benefits to downstream aquatic ecosystems would be positive.

1.2 POTENTIAL COSTS

Costs for operational changes (notwithstanding any losses of benefits to other authorized uses) at operating reservoirs would be negligible. Costs to modify intake structures for improved downstream water quality that would benefit aquatic species could range in the millions of dollars depending upon the design of the intake facility and the extent of the modification (number of additional ports). Costs for improvement to existing habitat can range between thousands of dollars per acre or mile to hundreds of thousands per acre or mile, but these costs are tempered and contained by the likely marginal benefits to be generated by those actions. Normally costs for ecosystem projects are contained by authority limitations (i.e., Section 206 Aquatic Ecosystem Restoration program) or by the extent of derived benefits generated.

2. WATER QUALITY ALTERNATIVES

2.1 POTENTIAL BENEFITS

The benefits of water quality improvement are produced by the incremental restoration of degraded water quality. Improved water quality provides water that may be chemically and biologically safer for a host of municipal and industrial uses including drinking, cooking, cleaning, and industrial production. Improving the quality of the basic resource in the stream, river or ground results in economic benefits of reduced water treatment costs and fewer health-related costs (hospital costs, lost productivity, loss of life) resulting from contaminated water. Improved water quality provides agricultural benefits through uncontaminated water for livestock and irrigation and improved conditions for swimming, boating, fishing, and other water-based recreation. This includes aesthetic values for activities that are near bodies of water such as picnicking, sightseeing and hiking. Improved water quality additionally has a positive effect on property values of waterfront properties.

2.2 POTENTIAL COSTS

Costs for improving water quality can be generated through treatment of point and non-point sources of pollution through state and local regulatory processes; costs normally absorbed by business and industry or passed on to consumers. Options for establishing water quality credits that can be purchased and traded among landowners and businesses again capture water quality improvement costs into a market system. Costs can also be generated through treatment of contaminated water (sewage and water treatment plants, in-stream filtering systems, etc.) prior to human use. Costs for “end of pipe” treatment solutions can run in the millions of dollars with ongoing O&M requirements for treatment plants.

3. BASINWIDE WATER MANAGEMENT ALTERNATIVES

3.1 POTENTIAL BENEFITS

The primary benefits attributable to the alternatives formulated for basin water management is the capability to operate and managed the storage and flow of water within the basin in a proactive and strategic manner rather than in a reactionary posture. Changing conditions of precipitation (flood or drought conditions) and water availability that may be exacerbated by climate change or other external factors could result in significant losses of water resources benefits or failure to take advantage of heretofore unknown benefit opportunities. The presence of a reliable and proven water management plan that facilitates operation of facilities in a more strategic and sustainable manner enhances the opportunity to take advantage of positive benefit streams and reduce benefit losses. The quantification of those benefits is an amalgamation of the benefit streams listed in the other sub-sections of this Appendix (flood risk reduction, water supply, hydropower, water quality, ecosystem support, etc.).

3.2 POTENTIAL COSTS

Since the development of a water management plan is largely an administrative process involving data collection and computer modeling, the costs can be captured within an agency budget. Estimated costs for development of the Ohio River Basin water management plan are $20.0 million over a 5 year period. Costs for the deployment of the management plan operational procedures are likewise administrative within the operating agency and are costs already experienced for labor.

4. POPULATION GROWTH AND DEVELOPMENT EFFECTS ALTERNATIVES

4.1 POTENTIAL BENEFITS

Benefits accruing to application of alternative measures to reduce damages to ecosystems and to reduce flood damages, loss of life and emergency costs are contingent upon the presence and rate of land use development due to population growth. In the absence of new development, application of new regulations, codes and growth management strategies do not produce benefits and such regulations, codes and strategies are rarely applied to past development retroactively. The incremental summation of all monetary and non-monetary benefits due to application of these strategies (reduced aquatic and terrestrial ecosystem degradation, reduced stormwater runoff, water-harvesting, groundwater recharge, etc.) during development accumulates millions of dollars of savings and avoidance of further damages (flood and or habitat related). The more pronounced the rate of population growth and development, the greater rate of benefit accrual.

4.2 POTENTIAL COSTS

Costs of application of regulations, codes and development strategies are absorbed into the development business process and are many times passed onto the consumer in the price of new housing or the price of goods and services. Some development costs (especially those accruing to the public sector) are defrayed through taxes and user fees. Generally the costs of applying development strategies at the local level do not affect Federal spending (with the exception of Federal development grants). In those cases where watershed studies are conducted through Federal programs (USACE, NRCS, FEMA), costs associated with the studies and any projects emanating from the studies would be cost-shared with local sponsors.

5. WATER SUPPLY ALTERNATIVES

5.1 LIKELY BENEFITS

A main benefit of water supply is having a dependable water source to meet the increasing demand for municipal, industrial, and agriculture water use. Water supply provided by storage in Federal projects is provided at a reduced cost than that of other water supply sources. Water supply storage of Federal reservoirs eliminates or lessens the impacts of severe drought periods. Dependable water supply increases safety by providing water for firefighting and other emergency activities. The average monetary benefit for water supply provided by USACE reservoirs in the Ohio River Basin is estimated to be more than $8.5 million per project (based on water supply yields provided in Appendix G of IWR Report 06-PS-1, Water Supply Database 2005 Update and an average cost of $243 per acre-foot per year, which is based on data from storage reallocation contracts for water supply for USACE reservoirs).

5.2 POTENTIAL COSTS

All costs associate with the development of water supply facilities at USACE projects are the responsibility of a non-Federal sponsor. Costs of all project features (dam and appurtenances, relocations, lands etc.) associated with the water supply element are allocated proportionately to the non-Federal sponsor. In situations where a non-Federal sponsor may request withdrawal of water from an existing reservoir project, all costs associated with construction of pumping stations, treatment facilities and distribution networks are the full responsibility of the non-Federal sponsor requesting the water.

6. FLOOD RISK REDUCTION ALTERNATIVES

6.1 LIKELY BENEFITS

When the risk of flooding is reduced, the threat to human lives from flood events is also reduced. In addition to this reduction of physical damage to structures, contents, vehicles, crops, livestock, roads, bridges, and other infrastructure, there are reduced costs of flood fighting efforts and other emergency costs such as those related to evacuation and reoccupation of homes and facilities. There are reduced clean-up costs and business loss. There are numerous secondary benefits such as elimination of negative impacts on housing prices. A comparison of damages prevented by USACE flood reduction projects to cumulative expenditures (capital investment plus operation and maintenance costs) shows there are average flood reduction benefits of $6.48 for every dollar invested in flood risk reduction projects.

6.2 POTENTIAL COSTS

Costs for flood risk reduction can range between hundreds of thousands of dollars in small projects to hundreds of millions of dollars for major structural or nonstructural projects. Costs are shared with a non-Federal sponsor at a 65%–35% rate and all costs for annual O&M of any project features are 100% non-Federal. Costs to operate existing flood risk reduction projects such as reservoirs are borne by the Federal government while local protection projects are fully supported by local revenues (taxes, assessments and user fees).

7. LOCAL LAND USE DEVELOPMENT ALTERNATIVES

7.1 POTENTIAL BENEFITS

The alternatives targeting local land use development listed in Table 19 of the Main Report generate benefits through reduction of flood risks, reduced damages to ecosystems, reduced stormwater runoff, reduced threats to life and socioeconomic systems, reduced energy costs and reduced transportation costs through densification of development. Generally the strategic application of local development controls generates benefits in proportion to the rate of development or redevelopment; those areas of highest growth rates can exhibit the greatest benefits from application of the described alternatives.

7.2 LIKELY COSTS

Costs associate with instituting local regulatory and development strategies are generally local, administrative and supported by local taxes, user fees, permit fees, and program subsidies. Costs for some strategies for local land development are internalized within existing land market systems (i.e., transfer of development rights).

8. EXISTING FLOOD RISK REDUCTION INFRASTRUCTURE ALTERNATIVES

8.1 POTENTIAL BENEFITS

The benefits associated with the continuance of O&M and rehabilitation of the physical components of the project can be limited to a single purpose (flood risk reduction in the case of USACE projects), or a full spectrum of authorized purposes. Single purpose reservoirs (oft-times dry reservoirs without a summer conservation pool) derive benefits solely from the reduction in downstream flood damages to a variety of land uses. In some limited cases, the project may generate some spin-off benefits from recreation at the dam site and benefits from preservation of terrestrial and aquatic habitat (flowage easements) that may otherwise have been disturbed by private conversion of the land to more intensive uses. In the case of multi-purpose reservoirs, benefits can be generated by any number of authorized purposes such as recreation, water supply, reductions in threats to life and injuries, flood damage reduction, low-flow augmentation, management of fish and wildlife habitat, hydroelectric power generation, and others. Continuing these streams of benefits in the future through rehabilitation of the project components provides justification for planning, design and construction expenditures. Each project generates benefits according to the varying levels of risk of downstream improvements and the anticipated frequency of flooding events. Alternatives that provide for rehabilitation of deteriorated components of a project can be justified through continuance of the various benefit streams. Table 7 in Appendix F shows the average annual flood damages prevented by USACE reservoirs in the basin.

Local protection projects (floodwalls, levees, diversions, etc.) a.k.a. LPPs are primarily single-purpose in their design and operation – that being reduction of flood risks (FRR) and threats to life for those within the protection limits. Many LPPs have incorporated recreation facilities within their alignments as a secondary purpose from which some benefits are generated. Alternatives which provide for rehabilitation of project components can be justified through continuance of those FRR benefits. Table 8 in Appendix F shows the average annual flood damages prevented for some LPPs in the basin.

8.2 POTENTIAL COSTS

Costs for rehabilitation or other renewal strategies for reservoirs and local protection projects can range from thousands of dollars to hundreds of millions of dollars depending upon the scope and complexity of the rehabilitation work. Some of these costs are borne by the Federal government as the sole O&M entity of the project and other costs such as rehabilitation of a LPP could be cost shared under certain circumstances with a non-Federal sponsor.

9. PUBLIC LANDS STEWARDSHIP AND RECREATION ALTERNATIVES

9.1 LIKELY BENEFITS

Water resources projects typically afford many types of water- and land-based recreation activities that people enjoy. These include boating, skiing, fishing, and canoeing, swimming, camping, bicycling, bird watching, sightseeing of flora and fauna, hiking, walking, jogging, picnicking, hunting, and educational activities. It is not possible to adequately estimate the health benefits resulting from recreation at water resource projects. However, current average annual recreation visitation at USACE lakes in the Ohio River Basin indicate there are average annual recreation benefits of $7.6 million, based on an assumed unit day value of $7.

9.2 POTENTIAL COSTS

Potential costs for the Public Land Stewardship and Recreation alternatives displayed in Table 18 of the Main Report would be a mixture of administrative costs for updating land use and recreation master plans and incorporating strategies for addressing T&E species habitat, climate change and new user needs and capital expenses for rehabilitating and expanding recreation facilities on existing USACE projects. Updated master plan costs are estimated to be $250K per project depending upon the geographic size of the project, number of users and stakeholders and the complexity of the land use management and recreation facilities at the project. Capital construction costs for rehabilitation and/or expansion of facilities can reach millions of dollars per project. In most cases those costs would be shared 50%–50% with an eligible non-Federal sponsor.

10. CLIMATE CHANGE ALTERNATIVES

10.1 POTENTIAL BENEFITS

Current studies of climate change in the basin’s region suggest that water resources could be affected by warmer temperatures, increased evaporation, more intense rainfall events, and decreased rainfall. Many of the authorized benefit streams generated by existing projects could be affected adversely by these types of changes. Identifying pre-emptive and adaptive management strategies that could be implemented in relatively short periods of time could preserve the existing streams of public benefits without significant losses.

10.2 POTENTIAL COSTS

The costs for the alternatives described in Table 19 of the Main Report are primarily administrative costs for studies of potential impacts to water resources, ecosystems and various facilities and public uses as a result of a range of anticipated climatic changes. The studies range from basinwide comprehensive studies to sub-basin or state level studies. Use of the Section 22 program would limit the per-state Federal cost to $2.0 million per study.

11. ENVIRONMENTAL INFRASTRUCTURE ALTERNATIVES

11.1 POTENTIAL BENEFITS

The primary purposes of the various environmental infrastructure (or environmental assistance) programs are the provision of funds for design and construction of sewage collection and treatment facilities and water treatment and distribution systems. In some limited cases where the program authorization designates treatment of surface waters, facilities for stormwater retention and management are included. The benefits attributable to the provision of these public services include benefits associated with the differences in customer costs between developing and maintaining reliable on-site water service (well and treatment) and purchasing water from a public service district or municipal utility. Similar benefits can be generated from the landowner cost difference between on site collection and treatment of sewage and paying for similar public services. Other monetary benefits are generated by avoiding health care costs associated with contaminated water, reduction in water treatment costs due to bacterial contamination, and economic development potential facilitated by the provision of reliable public services. Monetary benefits are generated by the provision of stormwater facilities through reduction of flood damages and potential loss of life. Other non-monetary benefits are generated by improvements in water quality that support aquatic and riparian ecosystem health, diversity and productivity.

11.2 POTENTIAL COSTS

Costs attributable to the environmental infrastructure programs range from thousands to millions of dollars depending upon the scope and complexity of the water or sewer system or stormwater facilities being constructed.

12. WATER RESOURCES POLICY ALTERNATIVES

12.1 POTENTIAL BENEFITS

The alternatives included in Table 19 of the Main Report related to the review of water resources policies can generate benefits through increased non-Federal participation in cost-shared projects and programs, increased reinvestment in project recreation facilities, modified calculation of flood damage benefits that lead to greater numbers of economically justified projects, and development of renewable energy facilities on USACE lands among other opportunities. Review and re-evaluation of current policies in view of changed conditions or better information leading to possible modification could generate additional public benefits in excess of costs.

12.2 POTENTIAL COSTS

Costs to review, re-evaluate and possibly modify current policies are largely administrative (internal to USACE). Costs of future actions taken as a result of any policy changes are unknown but existing project economic justification procedures would remain in effect so that future project costs would be tempered by project-generated benefits.

13. HYDROPOWER GENERATION ALTERNATIVES

13.1 POTENTIAL BENEFITS

Hydropower utilizes a renewable energy source to provide electricity in a more efficient manner than other types of generation. Hydropower generation does not generate the pollutants that accompany production by fossil fuels. Hydropower provides dependable, flexible generation capacity. Hydropower plants provide low cost energy that is not affected by increasing prices of fossil fuels. USACE hydropower facilities in the Ohio River Basin generate more than 3 million megawatt hours per year valued at approximately $28.6 billion, based on regional retail prices developed by the Energy Information Administration.

13.2 POTENTIAL COSTS

All costs associated with the installation of hydropower facilities at USACE projects are solely the responsibility of the non-Federal sponsor. Costs of project features (dam and appurtenances, land, relocations, etc.) that support the hydropower purpose are allocated to the non-Federal sponsor. Costs for feasibility studies completed to determine the justification for incorporating hydropower are shared with the non-Federal sponsor.

14. INLAND NAVIGATION ALTERNATIVES

14.1 LIKELY BENEFITS

Transportation of commodities by inland navigation is the most efficient, least cost mode of transportation. Inland waterways transportation reduces highway congestion and deterioration of roadways in the highway system. Reduced rail and highway traffic results in increased safety on roads and highways and reduced carbon dioxide emissions. According to research by the Tennessee Valley Authority, cargo moves at an average transportation savings of $10.67 per ton over the cost of shipping by alternative modes. Total transportation savings provided by the inland waterways in the Ohio River Basin is estimated to be $14.5 billion per year based on 2007 tonnage. In addition to this, the inland navigation system facilitates recreational boating. The stability of the navigation pools support aquatic species (mussels) and M&I water supply intakes that represent significant monetary benefits.

14.2 POTENTIAL COSTS

In accordance with the alternatives displayed in Table 19 of the Main Report to address navigation-related issues, costs would be largely administrative in nature for studies and evaluation of potential new waterway and landside uses (study costs under Section 22 program would be shared with state sponsors). Costs for ongoing maintenance of the stable navigation pools for M&I water supply and aquatic species would be generated through rehabilitation of the existing locks and dams projects; costs which are attributable to the navigation purpose and supported in part by the Inland Waterways Trust Fund.

APPENDIX K – FEDERAL, REGIONAL, STATE, AND AGENCY AUTHORITIES AND PROGRAMS

There are a myriad of Federal, State and Regional agency authorities and programs that either directly affect the development, operation and management of land and water resources in the basin, or are somehow allied with the public's use of those resources. The authorities and programs are provided herein so that basin stakeholders and the public may be able to fully understand both the breath of authorities and programs available and where existing authorities are not currently available to address issues identified in the study. Where these authority "gaps" exist, stakeholders or the public working through their individual Congressional representatives may be able to request an authority to address a particular issue or concern at the basin, watershed, local county or municipal level.

The authorities and programs are listed by Federal Agency, State or Regional Authority or Agency in Table 11.

Table 11 – Federal, State, and Regional Programs

Program Objective(s)
Federal Emergency Management Agency (FEMA)
National Flood Insurance Program (NFIP) (http://www.fema.gov/business/nfip/)
Nearly 20,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes Federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage is reduced by nearly $1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing of flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance. In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and to actuarially rate new construction for flood insurance.
Hazard Mitigation Grant Program (HMGP) (http://www.fema.gov/government/grant/hmgp/index.shtm)
The hazard mitigation grant program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the *Robert t. Stafford Disaster Relief and Emergency Assistance Act.*.
Community Rating System (CRS) (http://www.fema.gov/business/nfip/crs.shtm)
The National Flood Insurance Program's (NFIP's) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: • Reduce flood losses; • Facilitate accurate insurance rating; and • Promote the awareness of flood insurance.

Program Objective(s)
Federal Emergency Management Agency (FEMA) (continued)
Risk Mapping, Assessment and Planning (RISK MAP) (http://www.fema.gov/plan/prevent/fhm/rm_main.shtm#2)
The Federal Emergency Management Agency (FEMA) will collaborate with Federal, state and local stakeholders to achieve goals under risk map: • Flood hazard data. Address gaps in flood hazard data to form a solid foundation for risk assessment, floodplain management, and actuarial soundness of the national flood insurance program (NFIP). • Public awareness/outreach. Ensure that a measurable increase of the public's awareness and understanding of risk results in a measurable reduction of current and future vulnerability. • Hazard mitigation planning. Lead and support states, local, and tribal communities to effectively engage in risk-based mitigation planning resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards. • Enhanced digital platform. Provide an enhanced digital platform that improves management of risk map, stewards information produced by risk map, and improves communication and sharing of risk data and related products to all levels of government and the public. • Alignment and synergies. Align risk analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.
Natural Resources Conservation Agency (NRCS)
P. L. 566 Watershed Protection and Flood Prevention Program (http://www.nrcs.usda.gov/programs/watershed/index.html)
The Watershed Protection and Flood Prevention Act (PL 83-566), August 4, 1954, as amended, authorized NRCS to cooperate with states and local agencies to carry out works of improvement for soil conservation and for other purposes including flood prevention; conservation, development, utilization and disposal of water; and conservation and proper utilization of land. NRCS implements the watershed protection and flood prevention act through three programs: • Watershed surveys and planning, • Watershed protection and flood prevention operations, and • Watershed rehabilitation.
Emergency Watershed Protection Program (http://www.nrcs.usda.gov/programs/ewp/)
The purpose of the Emergency Watershed Protection (EWP) Program is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

Program Objective(s)
Natural Resources Conservation Agency (NRCS) (continued)
Wetlands Conservation Program (WCP) (http://www.nrcs.usda.gov/programs/wrp/)
The Wetlands Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection.
Conservation Reserve Program (CRP) (http://www.nrcs.usda.gov/programs/crp/)
The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, state, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the farm service agency, with NRCS providing technical land eligibility determinations, conservation planning and practice implementation. The Conservation Reserve Program reduces soil erosion, protects the nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter-strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.
Conservation Reserve Enhancement Program (CREP) (http://www.fsa.usda.gov/fsa/webapp?area=home&subject=prod&topic=cep)
The Conservation Reserve Enhancement Program (CREP) is a new state-Federal conservation partnership to address specific state and nationally significant water quality, soil erosion and wildlife habitat issues related to agricultural use. USDA has committed nearly $1.2 billion to the CREP program. CREP uses financial incentives to encourage farmers and ranchers to voluntarily enroll in contracts of 10 to 15 years in duration to remove environmentally sensitive lands from agricultural production. As these agricultural lands are planted in trees, grass and other protective vegetation, soil erosion is reduced, air and water quality improves, and acres of wildlife habitat are established. Currently, six states participate in this innovative and community-based program with its flexible design of conservation practices and financial incentives to address environmental issues.
Community Assistance Program (CAP) (http://www.nrcs.usda.gov/programs/commassistance/index.html)
Community Planning and Farmland Preservation – the Resource Conservation and Development and Rural Lands Division is working to enhance NRCS's ability to deliver technical assistance to communities experiencing development pressure by employing strategic approaches to land use planning and natural resource conservation. Strategic Conservation Planning focuses on the development of a system to support the functions of the natural environment. The support system consists of an interconnected network of natural, working and built-up lands that support the natural ecological processes that contribute to the health and quality of life for America's communities and people.

Program Objective(s)
Natural Resources Conservation Agency (NRCS) (continued)
Conservation Buffers (http://www.nrcs.usda.gov/feature/buffers/)
Conservation Buffers are small areas or strips of land in permanent vegetation, designed to intercept pollutants and manage other environmental concerns. Buffers include: riparian buffers, filter strips, grassed waterways, shelterbelts, windbreaks, living snow fences, contour grass strips, cross-wind trap strips, and shallow water areas for wildlife, field borders, alley cropping, herbaceous wind barriers, and vegetative barriers. Strategically placed buffer strips in the agricultural landscape can effectively mitigate the movement of sediment, nutrients, and pesticides within farm fields and from farm fields. When coupled with appropriate upland treatments, including crop residue management, nutrient management, and integrated pest management, winter cover crops, and similar management practices and technologies, buffer strips allow farmers to achieve a measure of economic and environmental sustainability in their operations. Buffer strips can also enhance wildlife habitat and protect biodiversity.
USACE
General Investigations Program – Reconnaissance and Feasibility Studies
The reconnaissance planning phase is initiated through congressional legislation and is funded 100% by the Federal government. This reconnaissance study phase usually lasts 12 months but can be extended to 18 months. Study expenditures are limited to $100,000, but can be increased with approval for geographically large or very complex studies. The feasibility study phase normally follows the reconnaissance study phase when a feasible project is identified. The feasibility study cost is shared between the Federal government and a project sponsor on a 50%–50% matching basis. The non-Federal sponsor may be a city, county, or state government or an eligible non-profit organization and 100% of the non-Federal costs of the feasibility study may be in the form of contributed work. The purpose of the feasibility study is to identify the optimal plan for construction. The feasibility phase can take 2–3 years to complete depending upon the scope and complexity of the study. The environmental impacts of the project are assessed through the requirements of the *National Environmental Policy Act* (NEPA), as amended.
Continuing Authorities Programs (CAP) – Section 205 Small Flood Protection Projects (http://www.lrh.usace.army.mil/Articles/index.cfm?id=1567&pge_prg_id=4509)
Section 205 of the 1948 *Flood Control Act* provides authority for USACE to develop and construct small flood control projects through a partnership with non-Federal government agencies such as cities, counties, special authorities, or units of state government. Projects are planned and designed under this authority to provide the same complete flood control project that would be provided under specific congressional authorization. The maximum Federal cost for project development and construction of any one project is $7,000,000 and each project must be economically justified, environmentally sound, and technically feasible. Flood control projects are not limited to any particular type of improvement. Levee and channel modifications as well as nonstructural measures (flood warning systems) are examples of flood control projects constructed utilizing the Section 205 authority.

Program Objective(s)
USACE (continued)
Continuing Authorities Program (CAP) – Section 206 Aquatic Ecosystem Restoration Program (http://www.lrh.usace.army.mil/Articles/index.cfm?id=1568&pge_prg_id=4509)
Section 206 of the *Water Resources Development Act* of 1996 authorizes USACE to participate in planning, engineering and design, and construction of projects to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Projects require partnering with a non-Federal sponsor who may be a public agency, state or local government, or a large national non-profit environmental organization. The maximum Federal cost is $5 million.
Continuing Authorities Program (CAP) – Section 1135 Project Modifications for Environmental Improvements (http://www.lrh.usace.army.mil/Articles/index.cfm?id=1570&pge_prg_id=4509)
Section 1135 of the 1986 *Water Resource and Development Act* provides authority for USACE to restore degraded ecosystems through modifications to USACE structures and operations of USACE structures. The maximum Federal cost for project development and construction of any one project is $5,000,000 and each project must be economically justified, environmentally sound, and technically feasible.
Continuing Authorities Program (CAP) – Section 14 Emergency Streambank Protection (http://www.lrh.usace.army.mil/Articles/index.cfm?id=1565&pge_prg_id=4509)
Section 14 of the 1946 *Flood Control Act* provides authority for USACE to prevent erosion damages to public facilities, such as bridges, roads, public buildings, sewage treatment plants, water wells, schools, etc. Private property is not eligible. The maximum Federal cost for project development and construction of any one project is $1,000,000 and each project must be economically justified, environmentally sound, and technically feasible.
Continuing Authorities Program (CAP) – Section 208 Snagging and Clearing for Flood Control (http://www.lrh.usace.army.mil/Articles/index.cfm?id=1569&pge_prg_id=4509)
Section 208 of the 1954 *Flood Control Act* provides authority for USACE for channel clearing and excavation, with limited embankment construction by the use of materials from the clearing operation only. The maximum federal cost for the project development and construction is $500,000 and each project must be economically justified, environmentally sound, and technically feasible.
Section 22 – Planning Assistance to States
Section 22 of the 1974 *Water Resources and Development Act* (WRDA), as amended, authorizes USACE to help states, local governments, and other governmental non-Federal entities with comprehensive planning for the development, use, and conservation of water and related land resources. Projects are generally regional or statewide in scope, but can also be for individual communities as long as the project is compatible with the state water plan. Under this program, USACE may not participate in any formal design or implementation activities. Federal costs are limited to $1.0M per state and planning costs are cost shared 50%–50% with the state.

Program Objective(s)
USACE (continued)
Section 216 – Review of Operating Projects
The Section 216 authority is a standing authority that is used to investigate the modification of existing projects or their operational characteristics when found advisable due to significantly changed physical or economic conditions or for improving the quality of the environment in the overall public interest. The initial project investigations are conducted using 100% Federal funds. The results of the initial investigation can be used to support initiation of a reconnaissance report and following feasibility study to address any necessary modifications to the existing project. This authority can be used to address issues at both operating dams and local protection projects such as levees and floodwalls.
Section 202 of WRDA 2000 – Watershed and River Basin Assessments
The Section 202 authority under WRDA 2000 provides opportunities to conduct Initial Watershed Assessments at 100% Federal cost ($100K study cost limit) and Watershed Assessment Plans at a 75% Federal and 25% non-Federal cost sharing match. In-kind work contributed to the Watershed Assessment Plan is limited to 25% of the non-Federal share. The purposes of the watershed assessments are too foster collaborative and systems-based planning between all levels of government, private citizens, tribes, and corporate entities to formulate watershed management plans and to leverage multiple programs that can address an array of water and land related issues.
United States Geological Service (USGS)
Cooperative Water Program (http://water.usgs.gov/coop/)
The Cooperative Program, a partnership between the USGS and state and local agencies, provides information that forms the foundation for many of the nation's water-resources management and planning activities.
National Streamflow Information Program (NSIP) (http://water.usgs.gov/nsip/)
The National Streamflow Information Program (NSIP) is a conceptual plan developed by the USGS for a new approach to the acquisition and delivery of streamflow information.
National Water Quality Assessment Program (NAWQA) (http://water.usgs.gov/nawqa/)
Since 1991, USGS scientists with the NAWQA program have been collecting and analyzing data and information in more than 50 major river basins and aquifers across the nation. The goal is to develop long-term consistent and comparable information on streams, ground water, and aquatic ecosystems to support sound management and policy decisions.
Ground Water Resources Program (http://water.usgs.gov/ogw/gwrp/)
The Ground-Water Resources Program encompasses regional studies of groundwater systems, multidisciplinary studies of critical groundwater issues, access to groundwater data, and research and methods development. The program provides unbiased scientific information and many of the tools that are used by Federal, state, and local management and regulatory agencies to make important decisions about the nation's groundwater resources.

Program Objective(s)
United States Geological Service (USGS) (continued)
Hydrologic Networks and Analysis (HNA) (http://wa.water.usgs.gov/data/cbr_program.html)
The USGS's Hydrologic Network and Analysis Program, often called the Collection of Basic Record (CBR) Program, is a direct appropriation from Congress.
National Weather Service (NWS)
Storm Ready (http://www.stormready.noaa.gov/index.html)
Stormready, a program started in 1999 in Tulsa, OK, helps arm America's communities with the communication and safety skills needed to save lives and property– before and during the event. Stormready helps community leaders and emergency managers strengthen local safety programs.
IFLOWS – Automated Flood Warning System (AFWS) (http://afws.erh.noaa.gov/afws/national.php)
The concept of the Integrated Flood Observing and Warning System (IFLOWS) has been developed extensively since the creation of the National Flash Flood Program Development Plan in 1978. The goals of the IFLOWS program are to substantially reduce the annual loss of life from flash floods, reduce property damage, and reduce disruption of commerce and human activities. To develop the IFLOWS concept, the National Weather Service (NWS) began a joint effort with selected states in the Appalachian region of the United States to undertake the establishment and development of a flash flood warning system to improve flood warning capabilities in that region.
Turn Around Don't Drown (TADD) (http://www.weather.gov/os/water/tadd/)
TADD is a NOAA National Weather Service campaign to warn people of the hazards of walking or driving a vehicle through flood waters.
US Fish and Wildlife Service (USFWS)
General Agency Mission (http://www.fws.gov/)
The U.S. Fish and Wildlife Service is the premier government agency dedicated to the conservation, protection, and enhancement of fish, wildlife and plants, and their habitats. It is the only agency in the Federal government whose primary responsibility is management of these important natural resources for the American public. The service also helps ensure a healthy environment for people through its work benefiting wildlife, and by providing opportunities for Americans to enjoy the outdoors and our shared natural heritage. The service is responsible for implementing and enforcing some of our nation's most important environmental laws, such as the *Endangered Species Act*, *Migratory Bird Treaty Act*, and *Marine Mammal Protection*.
Ohio River Basin Fish Habitat Partnership (ORBFHP) (http://science.marshall.edu/jonest/ohio%20river%20basin%20habitat/orbmain.htm)
The Ohio River Basin Fish habitat partnership was formed to protect, restore, and enhance priority habitat for fish and mussels in the watersheds of the Ohio River basin. We pursue this mission for the benefit of the public, but what brings us to the table is as diverse as the basin itself. Whether it is sport fish, mussels, imperiled fish, water quality, or one of many other drivers, what bonds us is the basin and our desire to work together to protect, restore, and enhance her aquatic resources. The partnership encompasses the entire 981 miles of the Ohio River mainstem (the second largest river in the U.S. as measured by annual discharge) and 143,550 square miles of the watershed. A decision was made to exclude the Tennessee-Cumberland sub-basin to limit overlap with SARP.

Program Objective(s)
US Fish and Wildlife Service (USFWS) (continued)
Southeast Aquatic Resources Partnership (SARP) (http://southeastaquatics.net/)
The Southeast Aquatic Resources Partnership (SARP) was initiated in 2001 to address the myriad issues related to the management of aquatic resources in the southeastern United States, which includes about 26,000 miles of species-rich aquatic shoreline and over 70 major river basins. The area faces significant threats to its aquatic resources, as illustrated by the fact that 34% of North American fish species and 90% of the native mussel species designated as endangered, threatened or of special concern are found in the southeast.
Endangered Species (http://www.fws.gov/invasives/endangered-species.html)
The ultimate goal of the *Endangered Species Act* (ESA – (16 U.S.C. § 1531 et seq.)) Is the recovery (and long-term sustainability) of endangered and threatened species and the ecosystems on which they depend. Recovery is the process by which the decline of an Endangered or Threatened species is arrested or reversed, and threats removed or reduced so that the species' survival in the wild can be ensured. The goal of the ESA is the recovery of listed species to levels where protection under the ESA is no longer necessary.
Migratory Birds (http://www.fws.gov/migratorybirds/)
Migratory bird program goals: protect, restore, and manage migratory bird populations to: 1) ensure long-term ecological sustainability of all migratory bird populations, 2) increase socioeconomic benefits, 3)improve hunting and bird-watching, other outdoor bird-related experiences, and 4) increase awareness of the value of migratory birds and their habitats or their intrinsic, ecological, recreational and economic significance.
National Wetlands Inventory (http://www.fws.gov/wetlands/)
The US Fish and Wildlife Service is the principal Federal agency that provides information to the public on the extent and status of the nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats. This geospatial information is used by Federal, state, and local agencies, academic institutions, and private industry for management, research, policy development, education and planning activities.
National Refuge System (http://www.fws.gov/refuges/)
The National Wildlife Refuge System, managed by the U.S. Fish and Wildlife Service, is the world's premier system of public lands and waters set aside to conserve America's fish, wildlife and plants. Since President Theodore Roosevelt designated Florida's Pelican Island as the first Wildlife Refuge in 1903, the system has grown to more than 150 million acres, 550 National Wildlife Refuges and other units of the refuge system, plus 37 Wetland Management Districts.
Fish and Wildlife Service Invasive Species Program(s) (http://www.fws.gov/invasives/programs.html)
The U.S. Fish and Wildlife Service is the only agency of the U.S. government whose primary responsibility is the conservation of the nation’s fish, wildlife, and plants. Because of our responsibilities, the service is very concerned about the impacts that invasive species are having across the nation. Invasive plants and animals have many impacts on fish and wildlife resources. Invasive species degrade, change or displace native habitats and compete with our native wildlife and are thus harmful to our fish, wildlife and plant resources.

Program Objective(s)
The Nature Conservancy (TNC)
General Agency Mission
The mission of the Nature Conservancy is to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive.
Freshwater Conservation (http://www.nature.org/initiatives/freshwater/)
Drawing on fifty years of on-the-ground experience, the Conservancy is engaged at 600 water sites in 30 countries, employing rigorous science, business savvy and an unwavering commitment to collaboration – because that's what works. We are focusing on 3 strategies that align with our greatest strengths and that hold the most promise for large-scale, enduring success: 1) protecting land to protect clean water – by preserving the health of land around rivers and lakes – the watershed – we can keep pollution out of our water, 2) keeping rivers flowing in healthy ways – we can preserve the benefits that rivers give us by preserving the patterns of high and low flow that orchestrate life in and along rivers, and 3) averting water scarcity by reducing waste – we can dramatically reduce water waste by giving large users – businesses, farms and cities – tools to use water more wisely.
Appalachian Regional Commission (ARC)
Area Development Program (http://www.arc.gov/index.do?nodeid=8)
ARC's Area Development Program seeks to augment the Highway Program and bring more of Appalachia's people into America's economic mainstream. At least half of ARC's area development grant funding is directed to projects that benefit counties and areas in the Appalachian region designated by arc as economically distressed. The focus of the area development program is on 1) promoting a diversified regional economy through strategies that help communities create and retain businesses and jobs; 2) helping communities develop an educated, skilled workforce and create access to affordable, quality health care; and 3) supporting the development and improvement of infrastructure, including water and sewer services, and the development and use of internet access.
Highway Program (http://www.arc.gov/index.do?nodeid=1006)
In 1964, the president's Appalachian Regional Commission (PARC) reported to congress that economic growth in Appalachia would not be possible until the region's isolation had been overcome. Because the cost of building highways through Appalachia's mountainous terrain was high, the region had never been served by adequate roads. The PARC report and the Appalachian governors placed top priority on a modern highway system as the key to economic development. As a result, congress authorized the construction of the Appalachian Development Highway System (ADHS) in the *Appalachian Development Act* of 1965. The ADHS was designed to generate economic development in previously isolated areas, supplement the interstate system, connect Appalachia to the interstate system, and provide access to areas within the region as well as to markets in the rest of the nation.
Local Development Districts (http://www.arc.gov/index.do?nodeid=20)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.

Program Objective(s)
Appalachian Regional Commission (ARC) (continued)
Top of Alabama Regional Council of Governments (http://www.arc.gov/index.do?nodeid=991)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (lDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Regional Planning and Development Districts in West Virginia (http://www.arc.gov/index.do?nodeid=1003)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Area Development Districts in Kentucky (http://www.arc.gov/index.do?nodeid=993)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Regional Planning and Development Districts in Pennsylvania (http://www.arc.gov/index.do?nodeid=1000)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Development Districts in Tennessee (http://www.arc.gov/index.do?nodeid=1005)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Planning District Commissions in Virginia (http://www.arc.gov/index.do?nodeid=1002)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Regional Planning Development Boards in New York (http://www.arc.gov/index.do?nodeid=996)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Council for Western Maryland (http://www.arc.gov/index.do?nodeid=994)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.

Program Objective(s)
Appalachian Regional Commission (ARC) (continued)
Planning and Development District in Mississippi (http://www.nempdd.com/)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Council of Governments in North Carolina (http://www.regiond.org/)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Regional Development Districts and Commissions in Ohio (http://www.arc.gov/index.do?nodeid=998)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
Regional Commissions in Georgia (http://www.arc.gov/index.do?nodeid=992)
To ensure that funds are used effectively and efficiently, and to strengthen local participation, ARC works with the states to support a network of multicounty planning and development organizations, or local development districts (LDDs), throughout the region. The 73 LDDs cover all 420 counties in the ARC program.
State Of Ohio Conservancy Districts
Programs for flood control, water supply, improving drainage, collecting and disposing of wastes, and providing for irrigation. (http://www.dnr.state.oh.us/tabid/4110/default.aspx)
Conservancy Districts are political subdivisions of the state of Ohio, provided for in the Ohio Revised Code (ORC) under Chapter 6101. The Conservancy Act was enacted less than a year after the devastating 1913 flood as a mechanism for flood prevention and control. It was the first such statute enacted in the United States, and has served as a model for other states. They are formed at the initiative of local landowners or political subdivisions to solve water management problems, most frequently flooding. In addition to controlling floods, other authorized purposes include: conserving and developing water supply, improving drainage, collecting and disposing of waste, providing for irrigation, and arresting erosion on the Lake Erie shoreline. Many Conservancy Districts also provide recreational opportunities in connection with their water management facilities. Of the 57 Conservancy Districts or sub-districts created, 20 are currently active, 22 are inactive, 5 have merged with another, and 10 have been dissolved.

APPENDIX L – USACE AUTHORITIES

This appendix is a compendium of USACE authorities including standing authorities such as the Continuing Authorities Program and specially authorized projects/programs that can be applied to the basin. Table 12 displays the programmatic and project planning, design and construction authorities. Figures 25 through 31 display these authorities graphically.

Table 12 – Current (Active) USACE Planning, Design, and Construction Authorities

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRL	Watershed	Water Resource Development Act	Section 3072 of WRDA 2007	McAlpin Lock & Dam, KY & IN	N	N	N	N	Y	N	N	N
LRL	Reservoir	Water Resource Development Act	Section 4042 of WRDA 2007	Buckhorn Lake, KY	N	N	N	N	N	Y	N	N
LRL	Metropolitan	Water Resource Development Act	Section 4044 of WRDA 2007	Louisville, KY	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 5077 of WRDA 2007	Paducah, KY	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 5079 of WRDA 2007	Winchester, KY	N	N	N	N	N	N	Y	N
LRL	City	Water Resource Development Act	Section 3067 of WRDA 2007	White River, IN	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 4041 of WRDA 2007	Salem, IN	N	N	N	N	N	N	Y	N
LRL	City	Water Resource Development Act	Section 5116 of WRDA 2007	Cincinnati, OH	Y	N	N	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 301 of PL 99-662	Lock & Dam 5-14 Kentucky River, KY	Y	N	N	N	Y	N	N	N
LRL	Metropolitan	Water Resource Development Act	Section 401 of PL 99-662	Louisville, KY	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 401 of PL 99-662	Salyersville, KY	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRL	Reservoir	Water Resource Development Act	Section 855 of PL 99-662	Taylorsville Lake, KY	N	N	N	N	N	Y	N	N
LRL	Watershed	Water Resource Development Act	Section 3 of PL 100-676	Lock & Dam 52 & 53 – KY & IN	N	N	N	N	Y	N	N	N
LRL	Watershed	Water Resource Development Act	Section 101 of PL 101-640	McAlpine Lock &Dam, KY & IN	N	N	N	N	Y	N	N	N
LRL	City	Water Resource Development Act	Section 102 of PL 101-640	South Frankfort, KY	N	N	Y	N	N	N	N	N
LRL	Metropolitan	Water Resource Development Act	Section 101 of PL 104-303	Pond Creek, Jefferson County, KY	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 531 of PL 104-303	Southern & Eastern Kentucky	Y	N	N	N	N	N	N	N
LRL	Metropolitan	Water Resource Development Act	Section 101 of PL 106-53	Beargrass Creek, KY	N	N	Y	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 101 of PL 106-541	John T Myers Lock & Dam	N	N	N	N	Y	N	N	N
LRL	City	EWRDA Appropriations Act	Section 102 of PL 101-541	South Frankfort, KY	N	N	Y	N	N	N	N	N
LRL	Watershed	EWRDA Appropriations Act	Section 202 of PL 101-541	Kentucky River Basin	Y	N	Y	N	Y	Y	Y	N
LRL	County	Water Resource Development Act	Section 401 of PL 99-662	Little Miami River, OH	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 401 of PL 99-662	Miami River, Fairfield, OH	N	N	Y	N	N	N	N	N
LRL	Reservoir	Water Resource Development Act	Section 102 of PL 101-640	Harsha Lake, OH	N	N	Y	N	N	Y	Y	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRL	Reservoir	Water Resource Development Act	Section 116 of PL 101-640	Caesar's Creek Lake, OH	N	N	N	N	N	N	Y	N
LRL	City	Water Resource Development Act	Section 101of PL 104-303	Duck Creek, Cincinnati, OH	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 584 of PL 106-53	Holes Creek, OH	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 331of PL 106-541	Duck Creek, Cincinnati, OH	N	N	Y	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 446 of PL 106-541	Duck Creek Watershed, Ohio	Y	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 1002 of PL 99-662	Anderson, Madison County, IN – Earth Levee	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 102 of PL 101-640	Falls of the Ohio National Wildlife Conservation *	N	N	N	N	N	Y	N	N
LRL	County	Water Resource Development Act	Section 104 of PL 101-640	Old Sulfur Creek, Orleans, IN	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 105 of PL 102-580	Blue River & Brock Creek, Salem, IN	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 105 of PL 102-580	White River, Elnora, IN	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 105 of PL 102-580	White River, Gibson County, IN	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 105 of PL 102-580	White River, Petersburg, IN	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRL	City	Water Resource Development Act	Section 201 of PL 102-580	Feather Creek, Clinton, IN	N	N	Y	N	N	N	N	N
LRL	City	Water Resource Development Act	Section 101 of PL 104-303	New Harmony, IN	Y	N	N	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 323 of PL 104-303	White River, IN	N	N	Y	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 423 of PL 104-303	Tippecanoe River Watershed, IN	Y	N	N	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 559 of PL 104-303	Ohio River Greenway	Y	N	N	N	N	Y	N	N
LRL	Watershed	Water Resource Development Act	Section 322 of PL 106-53	White River, IN	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 427 of PL 106-541	Long Lake, Indiana	Y	N	N	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 603 of PL 99-662	Wabash River, IL	Y	N	N	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 1001 of PL 99-662	Levee Unit 1, Wabash River, IL	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 102 of PL 104-303	Embarras River, Villa Grove, IL	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 102 of PL 104-303	Sumner, Lawrence County, IL	N	N	Y	N	N	N	N	N
LRL	County	Water Resource Development Act	Section 624 of PL 104-303	Twin Lakes, Paris, IL	Y	N	N	N	N	N	N	N
LRL	Watershed	Water Resource Development Act	Section 102 of PL 106-53	Ohio River, IL	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRL	County	Water Resource Development Act	Section 530 of PL 106-53	Georgetown, IL	N	N	N	N	N	N	Y	N
LRL	County	Water Resource Development Act	Section 530 of PL 106-53	Olney, IL	N	N	N	N	N	N	Y	N
LRL	State	Water Resource Development Act	Section 101 of PL 106-541	Ohio River, KY, IL, IN, OH, PA, & WV	Y	N	N	N	N	N	N	Y
LRL	Watershed	Study Resolution	Docket 2484	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRL	Watershed	Study Resolution	Docket 2484	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRL	Watershed	Study Resolution	Docket 2484	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRL	Watershed	Study Resolution	Docket 2563	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRL	State	Study Resolution	105th Congress 1st Session Committee Resolution	Study Resolution	Y	N	N	N	N	N	N	Y
LRL	Watershed	Study Resolution	Docket 2608	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRL	Watershed	Study Resolution	Docket 2719	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 581 of WRDA 1996	Flood Control & Protection	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 581 of WRDA 1996	Flood Control & Protection	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 581 of WRDA 1996	Flood Control & Protection	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	Watershed	Water Resource Development Act	Sec. 581 of WRDA 1996	Flood Control & Protection	N	N	Y	N	N	N	N	N
LRP	State	Water Resource Development Act	Sec. 5117 of WRDA 2007	ORB Environmental Management	Y	N	N	N	N	N	N	Y
LRP	State	Water Resource Development Act	Sec. 5117 of WRDA 2007	ORB Environmental Management	Y	N	N	N	N	N	N	Y
LRP	State	Water Resource Development Act	Sec. 5117 of WRDA 2007	ORB Environmental Management	Y	N	N	N	N	N	N	Y
LRP	State	Water Resource Development Act	Sec. 5117 of WRDA 2007	ORB Environmental Management	Y	N	N	N	N	N	N	Y
LRP	County	Water Resource Development Act	Sec. 5002 of WRDA 2007	Watershed Management	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 5002 of WRDA 2007	Watershed Management	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 5002 of WRDA 2007	Watershed Management	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 5002 of WRDA 2007	Watershed Management	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Sec. 4077 of WRDA 2007	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4070 of WRDA 2007	Flood Damage Reduction Study	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	County	Water Resource Development Act	Sec. 4070 of WRDA 2007	Flood Damage Reduction Study	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4070 of WRDA 2007	Flood Damage Reduction Study	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4070 of WRDA 2007	Flood Damage Reduction Study	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4070 of WRDA 2007	Flood Damage Reduction Study	N	N	Y	N	N	N	N	N
LRP	City	Water Resource Development Act	Sec. 507 of WRDA 1996	Girard Dam Repair & Rehabilitation	N	N	Y	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Sec. 4097 of WRDA 2007	Aquatic Ecosystem Restoration Study	N	Y	N	N	N	N	N	N
LRP	Watershed	Water Resource Development Act	Section 3128 of WRDA 2007	Section 594 Environmental Assistance	Y	N	N	N	N	N	N	Y
LRP	County	Water Resource Development Act	Section 5156 of WRDA 2007	Section 340 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 5155 of WRDA 2007	Section 571 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 5155 of WRDA 2007	Section 571 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 5155 of WRDA 2007	Section 571 Environmental Infrastructure	Y	N	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N
LRP	County	Water Resource Development Act	Section 3143 of WRDA 2007	Section 313 Environmental Improvement	Y	N	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	Borough	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	Township	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	Township	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	Township	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	Township	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	Borough	Water Resource Development Act	Section 502 of WRDA 1999	Section 219 Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRP	River Basin	Continuing Authorities	Section 1135 of WRDA 1986	Environmental Restoration at a USACE project	N	Y	N	N	N	N	N	Y
LRP	Township	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Township	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Township	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRP	Township	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Town	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Borough	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Borough	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Borough	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Borough	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	City	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	City	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	City	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	Town	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRP	county	Continuing Authorities	Section 14 of FCA 1946	Emergency Streambank Protection	N	N	Y	N	N	N	N	Y
LRD	River Basin	Continuing Authorities	Section 205 of FCA 1948	Flood Control	N	N	Y	N	N	N	N	Y

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRN	State	Water Resource Development Act	Sec 5113 of WRDA 2007	Environmental Infrastructure & Restoration	Y	N	N	N	N	N	N	Y
LRD	River Basin	Continuing Authorities	Section 206 of WRDA 1996	Aquatic Ecosystem Restoration	N	Y	N	N	N	N	N	Y
LRH	Congressional District	Water Resource Development Act	Sec 340 of WRDA 1992	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRD	River Basin	Continuing Authorities	Section 208 of FCA of 1954	Clearing & snagging for flood control	N	N	Y	N	N	N	N	Y
LRH & LRL	County	Water Resource Development Act	Sec 531 of WRDA 1996	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRD	River Basin	Continuing Authorities	Section 204 of WRDA 1992	Beneficial Use of Dredged Materials for Habitat	N	Y	N	N	N	N	N	Y
LRH	Congressional District	Water Resource Development Act	Sec 571 of WRDA 1999	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRD	River Basin	Standing Authority	Section 216 of FCA of 1970	Review of Completed Projects	N	Y	Y	Y	Y	Y	Y	N
LRH	State	Water Resource Development Act	Sec 594 of WRDA 1999	Environmental Infrastructure	Y	N	N	N	N	N	N	Y
LRD	River Basin	Standing Authority	Section 22 of WRDA 1974	Planning Assistance to States	N	Y	Y	Y	Y	Y	Y	Y
LRH & LRN	County	Water Resource Development Act	Sec 502 of WRDA 1999	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRL	County	Water Resource Development Act	Sec 5158 (144) of WRDA 2007	Environmental Infrastructure	Y	N	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRH & LRP	County	Water Resource Development Act	Sec 5158 (272) of WRDA 2007	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2800, 24 Sep 2008	Mohican River (Black & Rocky Forks)	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2730, 21 Jul 2004	Cherry River Basin	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2607, 5 Aug 1999	Fourpole Creek	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2472, 7 Mar 1996	Hocking River Basin	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Resolution, 10 May 1962	Kanawha River Basin Study	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	Senate Resolution, 21 Mar 1989	Little Kanawha	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2731, 21 Jul 2004	Meadow River Basin	N	N	Y	N	N	N	N	N
LRH	County	Study Resolution	House Docket 2481, 7 Mar 1996	Mercer County	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2696, 24 Jul 2002	Muskingum River Basin	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2583, 9 Oct 1998	Richland County, Mohican River	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2726, 25 Feb 2004	Upper Guyandotte	N	N	Y	N	N	N	N	N
LRH	Watershed	Study Resolution	House Docket 2809, 24 Sep 2008	Wolf Creek, Barberton OH	N	N	Y	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRH	Watershed	Water Resource Development Act	Sec 579 of WRDA 1996	Flood Damage Reduction on Greenbrier River	N	N	Y	N	N	N	N	N
LRH	Watershed	Water Resource Development Act	Sec 446 of WRDA 2000	Recon for Duck Creek Watershed	N	N	Y	Y	Y	Y	Y	N
LRH	County	Water Resource Development Act	Sec 4070 of WRDA 2007	Recon for Flood Damage Reduction	Y	N	Y	N	N	Y	Y	N
LRH	County	Water Resource Development Act	Sec 4068 of WRDA 2007	Recon for Flood Damage Reduction	Y	N	Y	N	N	Y	Y	N
LRH	Watershed	Water Resource Development Act	Sec 211 of WRDA 1999	Recon for Cabin Creek Watershed	N	N	Y	N	N	N	N	N
LRH	Watershed	EWRDA Appropriations Act	Sec 202 of PL 96-367	Tug & Levisa Forks of Big Sandy River	N	N	Y	N	N	N	N	N
LRH	Watershed	Water Resource Development Act	Sec 5002 of WRDA 2007	Watershed Management &Restoration	Y	N	Y	Y	Y	Y	Y	N
LRN	County	Water Resource Development Act	WRDA 96	Environmental Activities	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	WRDA 96	Ecosystem Restoration at three wetlands & historic*	Y	N	N	N	N	N	N	N
LRN	River	Water Resource Development Act	Section 4087 of WRDA 2007	Recreation, Riverbank Protection, & Environment*	Y	N	N	N	N	Y	N	N
LRN	State	Water Resource Development Act	Section 5113 of WRDA 2007	Environmental	Y	N	N	N	N	N	N	Y

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRN	County	Water Resource Development Act	Section 5130 of WRDA 2007	Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 5158 of WRDA 2007	Section 219 Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	Counties	Water Resource Development Act	Section 531 of WRDA 1996	Environmental Assistance	Y	N	N	N	N	N	N	N
LRN	Counties	Water Resource Development Act	Section 219 (f)(10) of WRDA 1992	Environmental Infrastructure	Y	N	N	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 219 (f)(24) of WRDA 1992	Environmental Infrastructure	Y	N	N	N	N	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRN	City	EWRDA Appropriations Act	Section 202 of PL 96-367	Design & Construction of Flood Control measures	N	N	Y	N	N	N	N	N
LRN	River	Water Resource Development Act	Section 5133 of WRDA 2007	Nashville Riverfront Concept Plan	N	N	N	N	N	Y	N	N
LRN	County	Water Resource Development Act	WRDA 96	Non-structural FDR	N	N	Y	N	N	N	N	N
LRN	County	Water Resource Development Act	WRDA 96	Bank Stabilization	N	N	Y	N	N	N	N	N
LRN	Watershed	Water Resource Development Act	Section 4085 of WRDA 2007	FDR	N	N	Y	N	N	N	N	N
LRN	City	Water Resource Development Act	Section 4086 of WRDA 2007	FDR	N	N	Y	N	N	N	N	N
LRN	County	Water Resource Development Act	Section 4088 of WRDA 2007	Water Supply	N	N	N	N	N	N	Y	N
LRN	County	Water Resource Development Act	Section 4088 of WRDA 2007	Water Supply	N	N	N	N	N	N	Y	N
LRN	County	Water Resource Development Act	Section 4088 of WRDA 2007	Water Supply	N	N	N	N	N	N	Y	N
LRN	City	Water Resource Development Act	Section 5029 of WRDA 2007	Construction of LPP	Y	N	Y	N	N	Y	N	N
LRN	Project	Water Resource Development Act	Section 101 of WRDA 1996	Hydropower Update	N	N	N	Y	N	N	N	N
LRN	Project	Water Resource Development Act	Section 101 of WRDA 1996	Kentucky Lock for Navigation	N	N	N	N	Y	N	N	N
LRN	Project	Omnibus Appropriations Act	Public Law 108-7	Construction of Replacement Lock	N	N	N	N	Y	N	N	N

District	Boundary Type	Authority Type	Authority Citation	Program/Project Description	Environmental Infrastructure	Ecosystem Restoration	Flood Risk Reduction	Hydropower	Navigation	Recreation	Municipal & Industrial Water Supply	Continuing Authorities
LRN	Watershed	Study Resolution	Docket 2746	Flood Control & Protection Study	Y	N	Y	N	N	Y	Y	N
LRN	County	Study Resolution	Docket 2466	Flood Control & Protection Study	Y	N	Y	N	N	Y	N	N
LRN	Watershed	Study Resolution	Docket 2457	Flood Control & Protection Study	Y	N	Y	N	N	N	Y	N
LRN	Watershed	Study Resolution	97th Congress 2nd Session Committee Resolution	Study Resolution	N	N	N	N	Y	N	N	N
LRN	Watershed	Study Resolution	Docket 2692	Flood Control & Protection Study	Y	N	Y	N	N	Y	N	N
LRN	Watershed	Study Resolution	Docket 2506	Flood Control & Protection Study	Y	N	Y	N	N	N	N	N
LRN	County	Study Resolution	53rd Congress 2nd Session	Flood Control & Protection Study	Y	N	Y	N	Y	Y	Y	N
LRN	Watershed	Study Resolution	Docket 2658	Flood Control & Protection Study	Y	N	Y	N	N	N	Y	N
LRN	City	Study Resolution	Docket 2407	Flood Control & Protection Study	N	N	Y	N	N	N	N	N
LRN	Watershed	Study Resolution	Senate Committee on Public Works Resolution	Study Resolution	N	N	N	N	Y	N	N	N

Notes: 1) Repeated citations indicate separate geographic locations of studies/projects authorized under single authority and listed for mapping purposes.

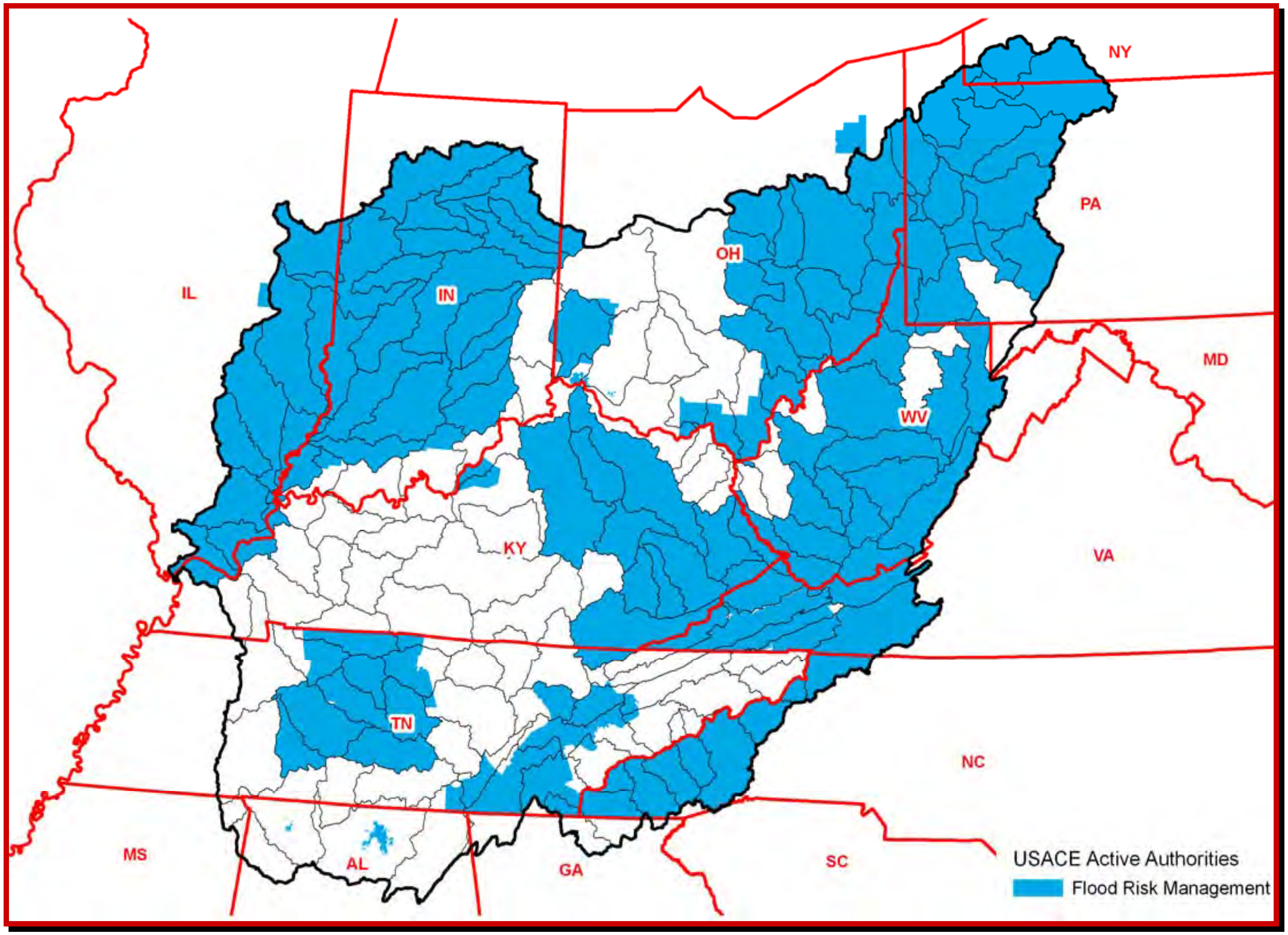

Figure 25 – Flood Risk Reduction

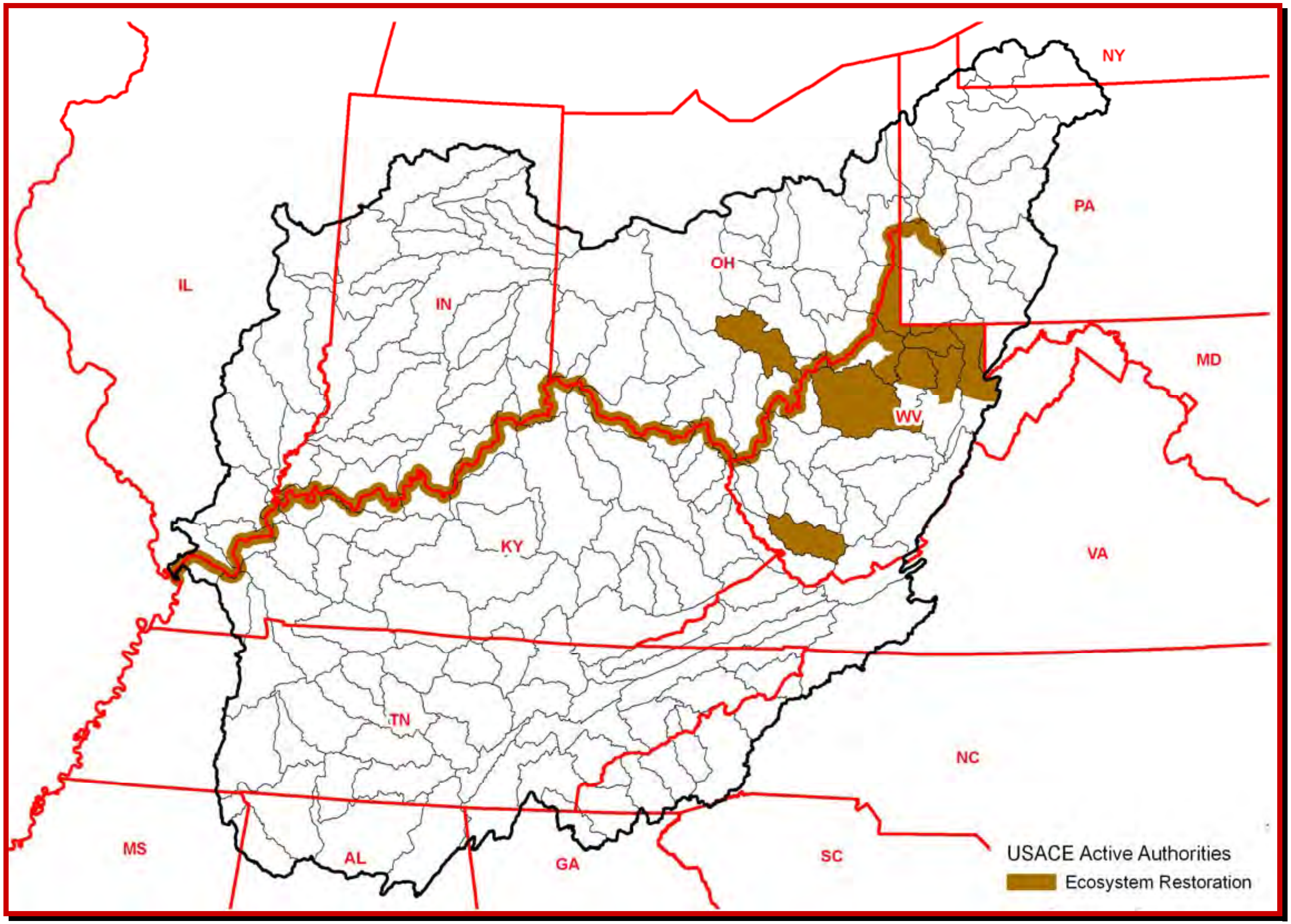

Figure 26 – Ecosystem Restoration

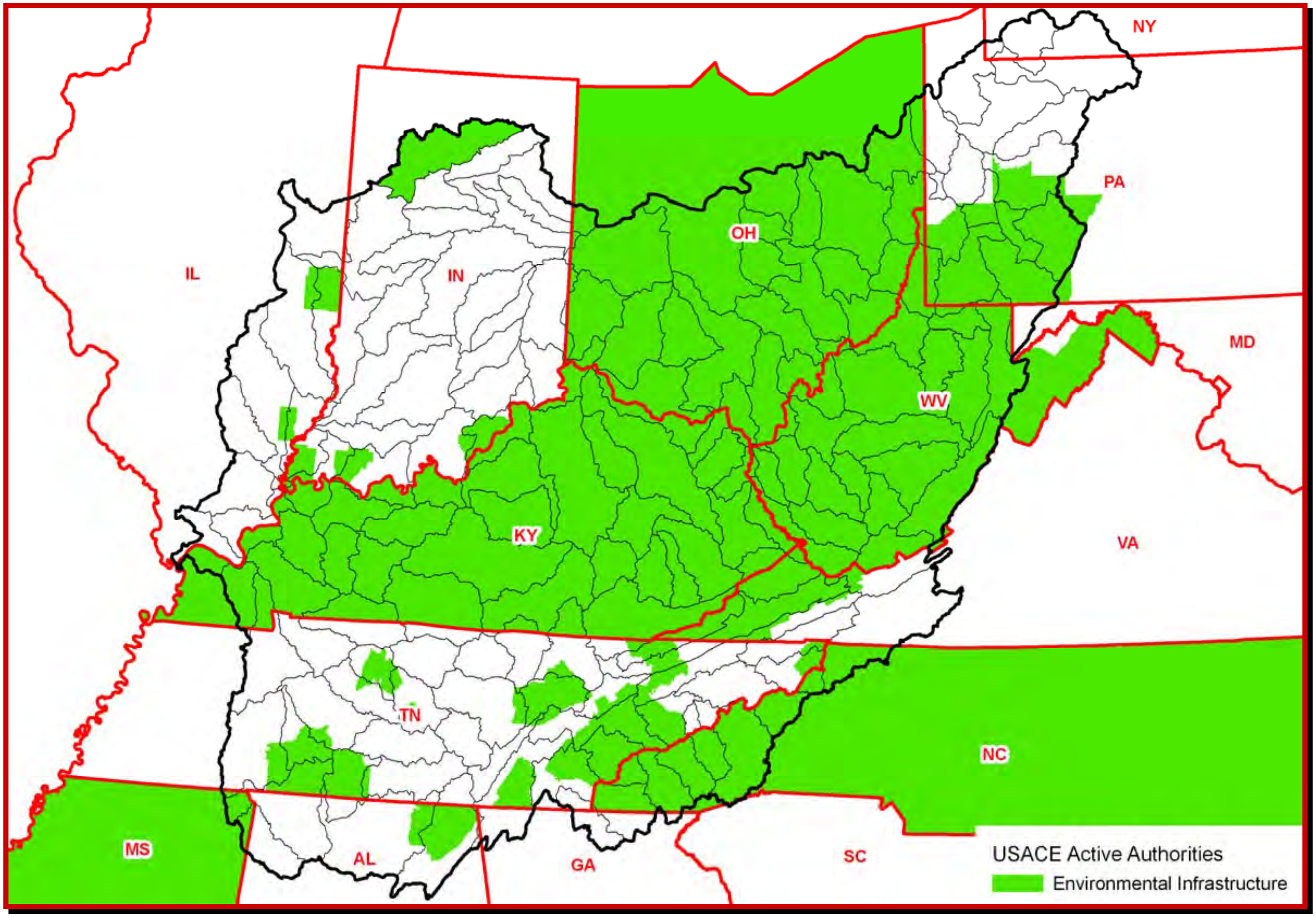

Figure 27 – Environmental Infrastructure

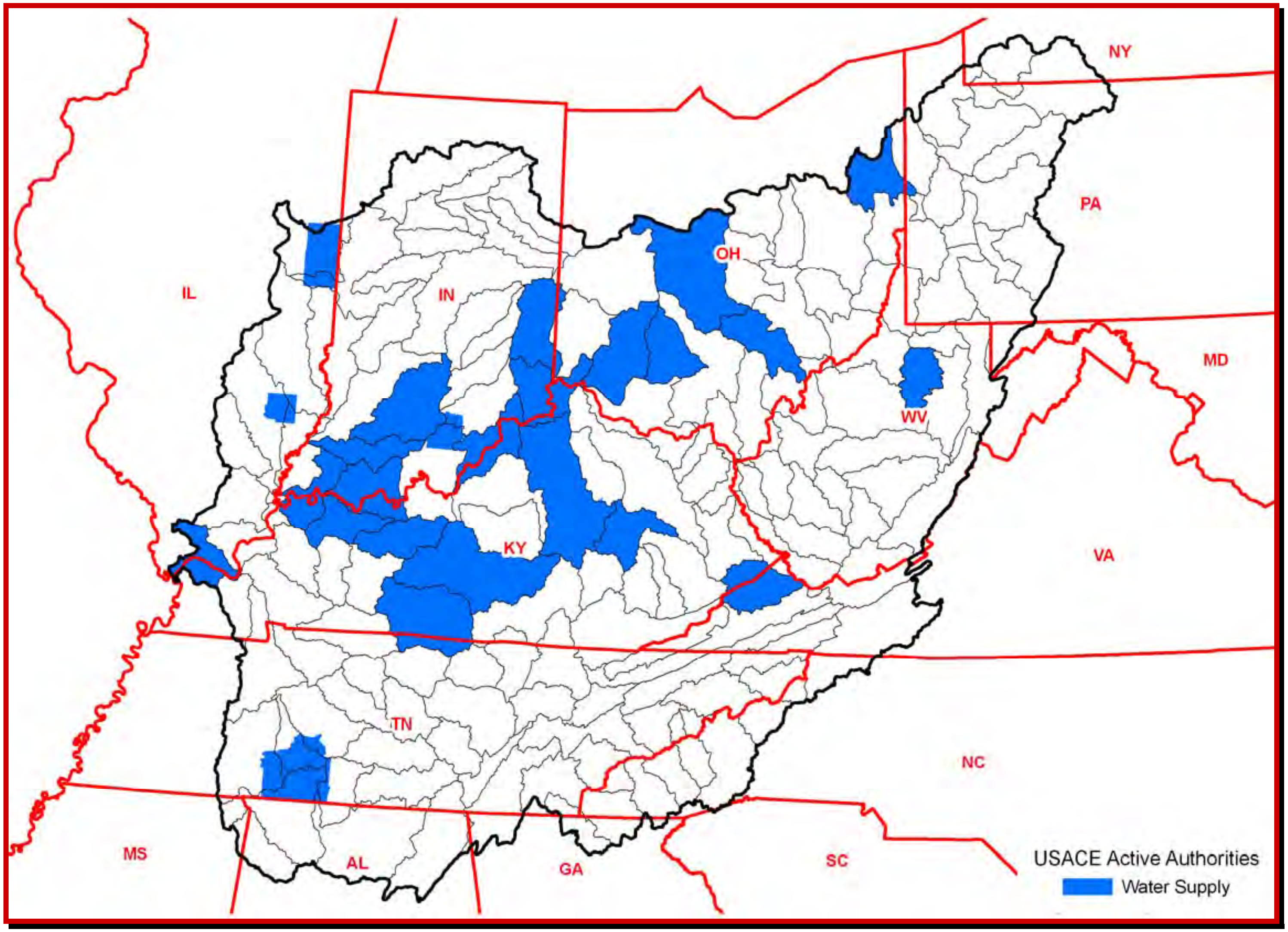

Figure 28 – Water Supply

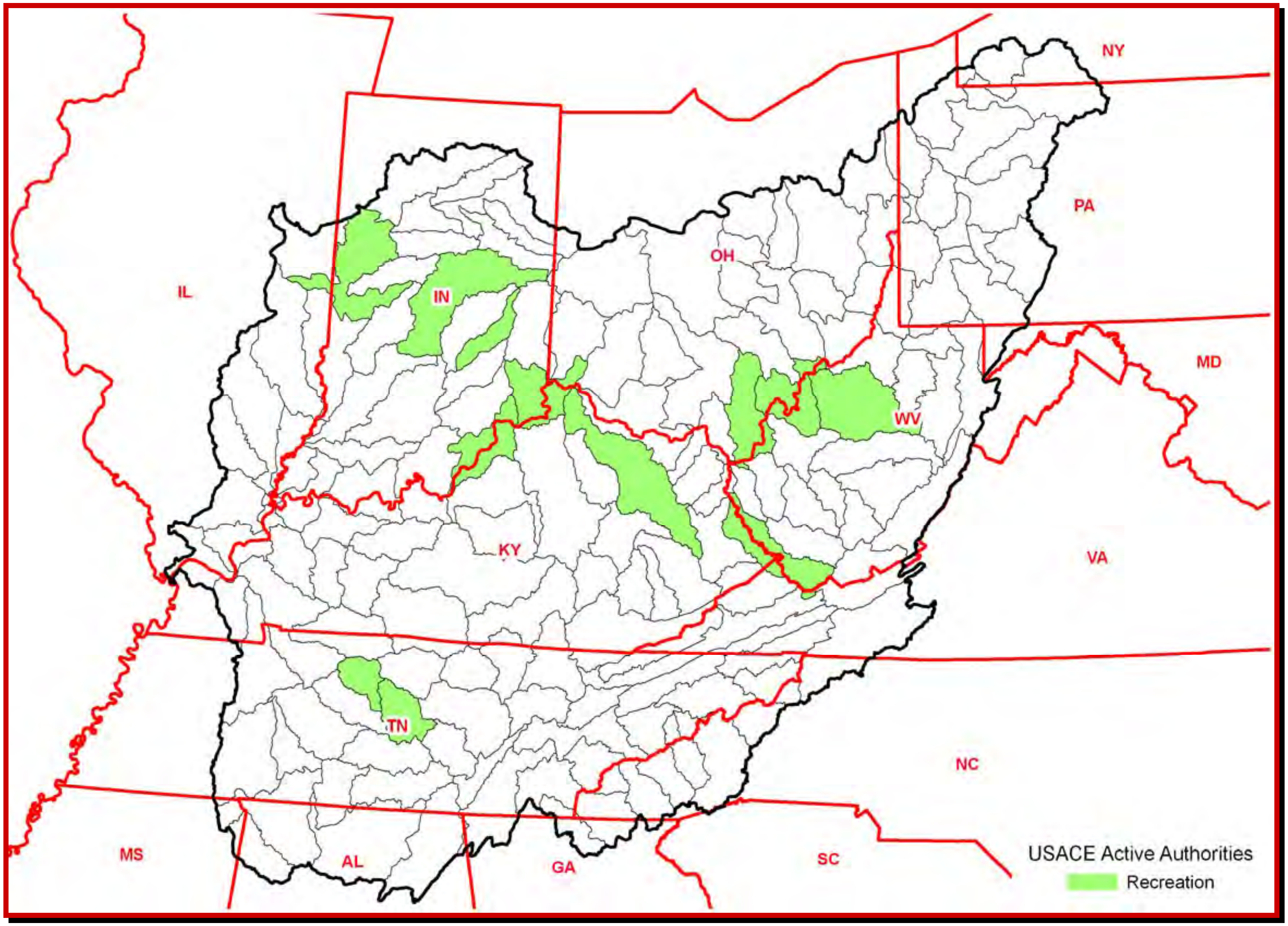

Figure 29 – Recreation (Does Not Include Basinwide Authorities Like P. L. 89-72)

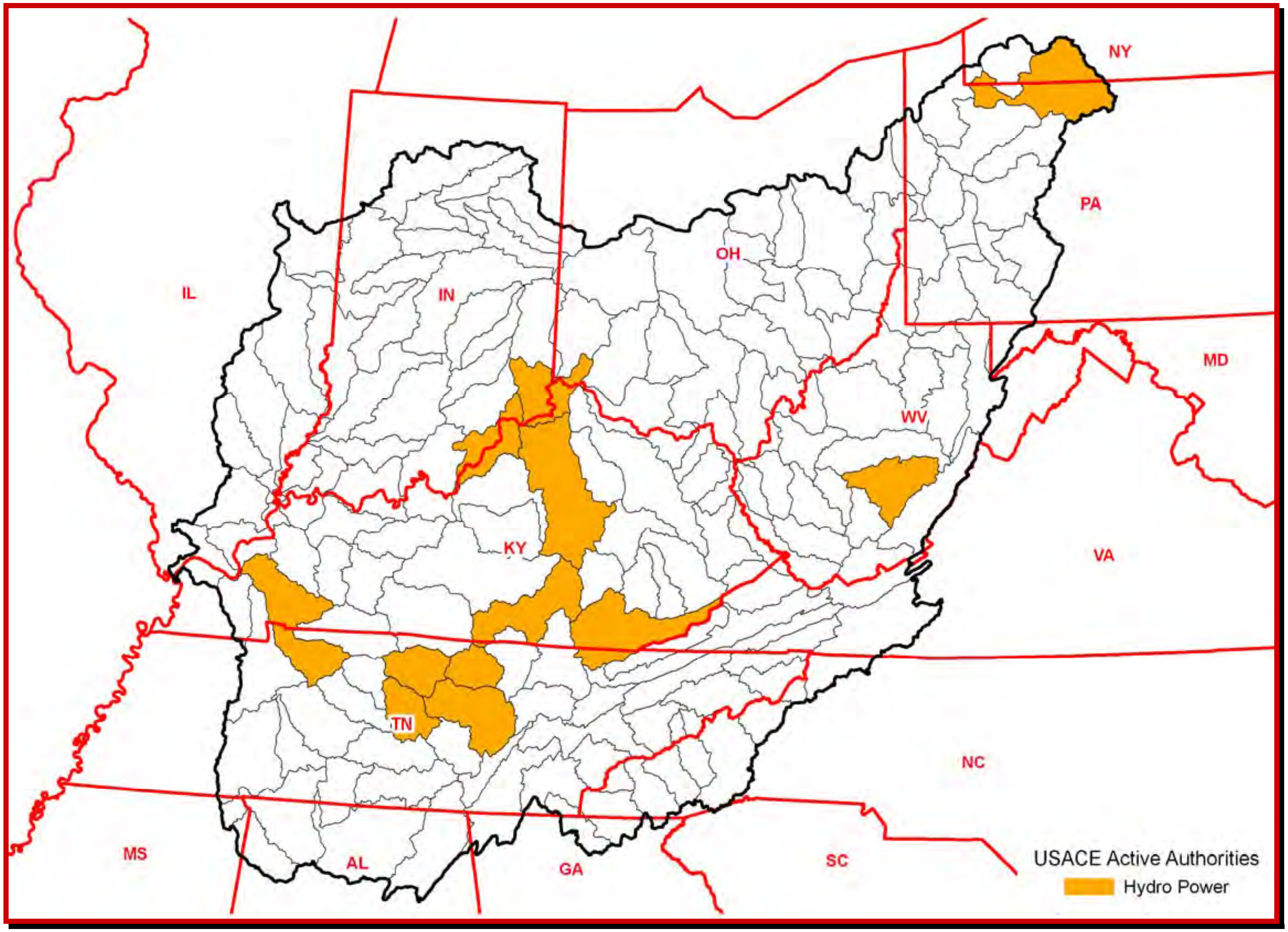

Figure 30 – Hydropower

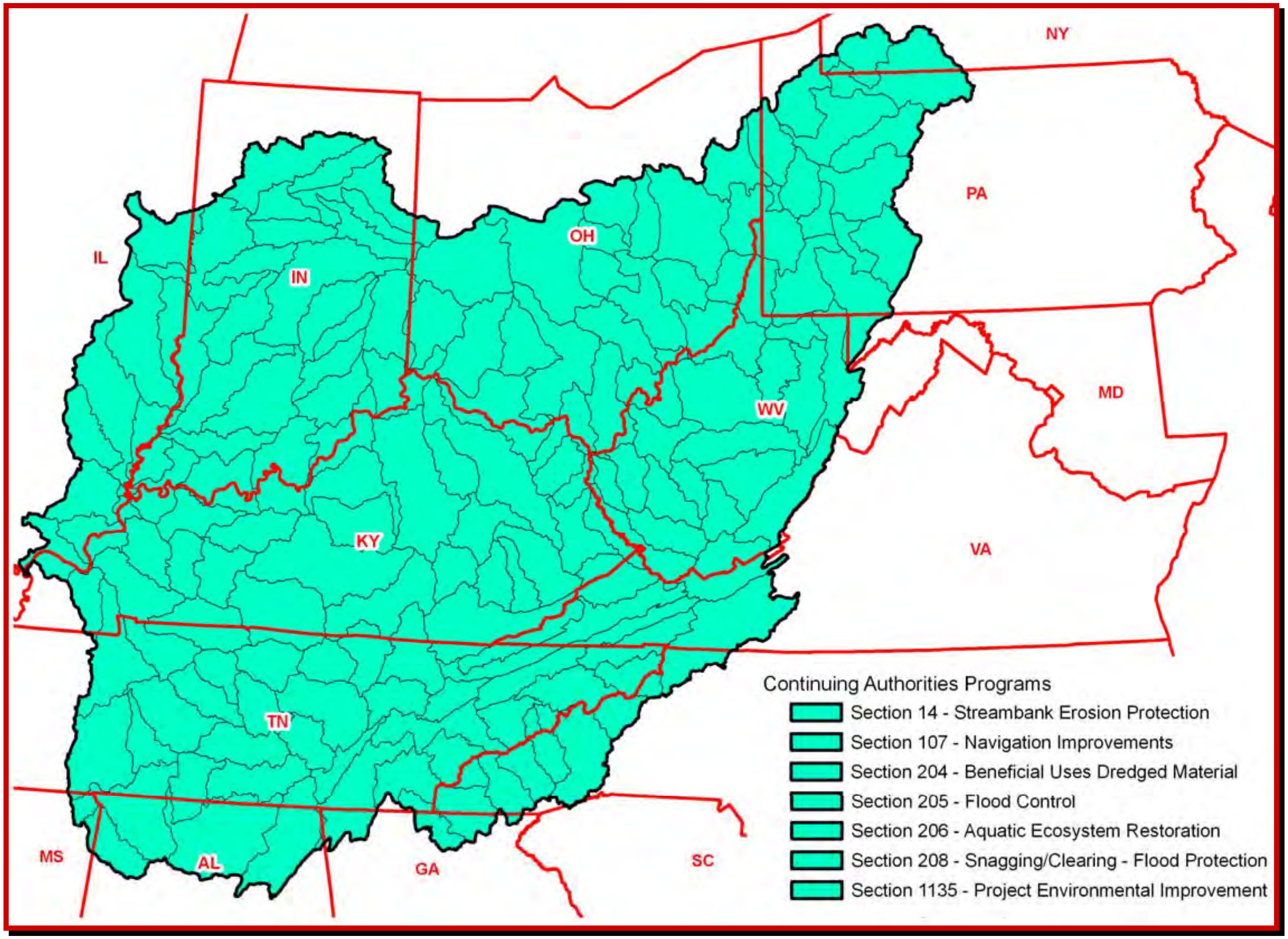

Figure 31 – Continuing Authorities

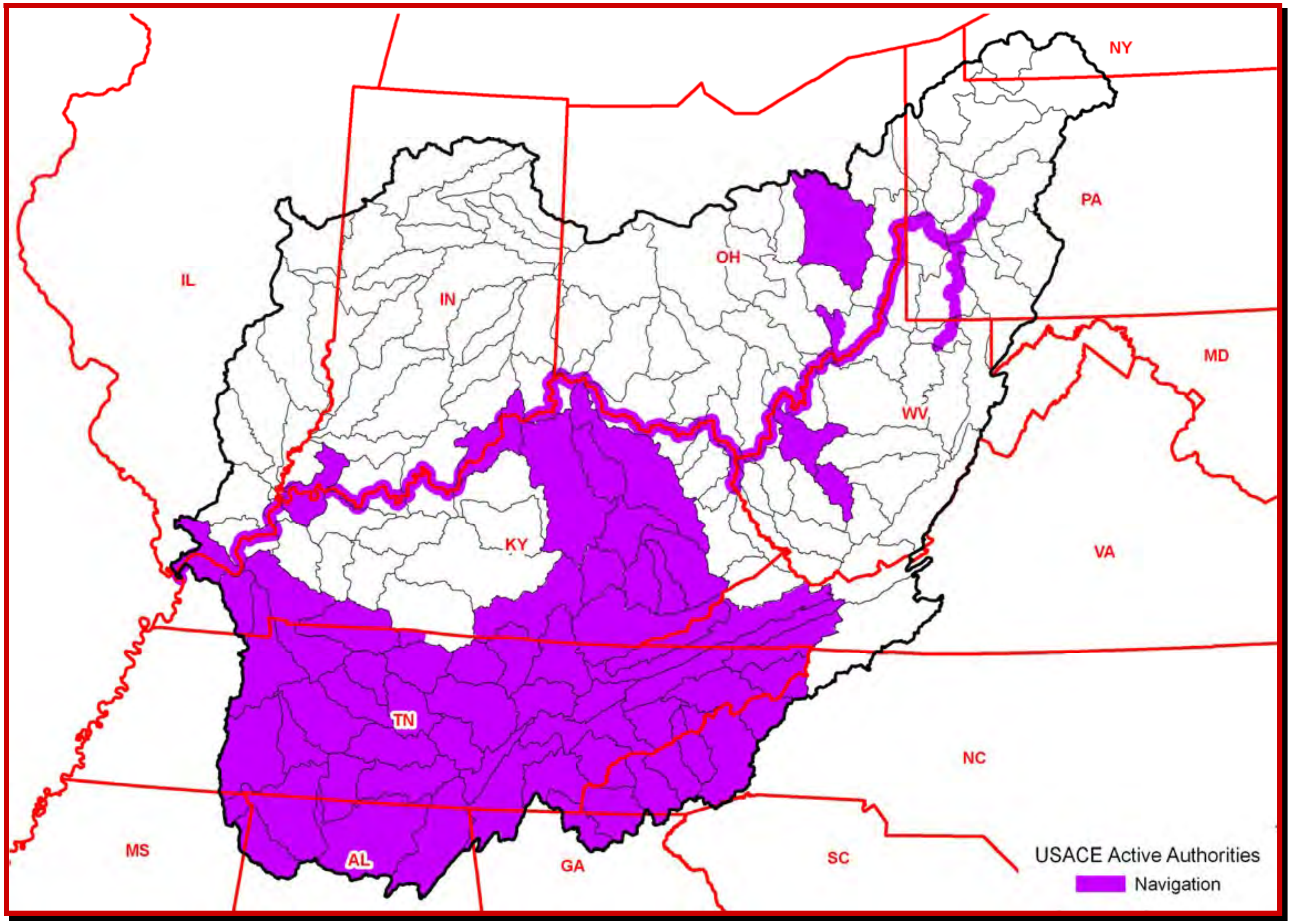

Figure 31b – Navigation

APPENDIX M – ENVIRONMENTAL/ECOSYSTEM SUPPORTING DATA

This appendix includes environmental and ecosystem information accessed or consulted during the reconnaissance study as well as copies of the various agency reports and studies that supported analysis of the issues and development of alternatives for addressing environmental and ecosystem related alternative plans. Agency reports on ecosystem responses to climate change (Thresholds of Climate Change in Ecosystems – January 2009) and water quality monitoring and biological reports on segments of the Ohio River by ORSANCO were used to help characterize existing conditions and to further analyze the aggregated issues. Information contained in reports published by and available on the Internet from the Nature Conservancy, the US Fish and Wildlife Service and other natural resources agencies on the ecosystem resources and services within the Ohio River Basin was also used to support issues analysis and formulation of alternatives.

One of the primary reports regarding ecosystem resources accessed during the reconnaissance study was the Ohio River Basin Fish Habitat Partnership's (ORBFHP) Strategic Plan (see below) that addressed threats to the fish and mussel populations throughout most of the basin and recommended specific actions to address those threats. The Cumberland and Tennessee River basins were not included in that strategic plan since the Southeast Aquatic Resource Partnership (SARP) had already included those two sub-basins in their strategic plan. The SARP strategic plan is also included following the ORBFHP plan.

The ecosystem information, expert analysis of threats and proposed strategic early-action targeted restoration projects for watersheds and sub-basins in ORB found in the ORBFHP plan provided strong support to several of the recon report's recommended actions. Meetings between the ORB PDT members and the ORBFHP membership (represented by USFWS regional offices, national TNC and DNRs of the member states) helped to formulate alternatives for the recon study and to point the pathway forward to cooperation on several potential basin projects involving ecosystem restoration.

THE OHIO RIVER BASIN FISH HABITAT PARTNERSHIP

STRATEGIC PLAN

January 12, 2010

Produced by The Nature Conservancy in Ohio (with funding from USFWS Cooperative Grant # 301818J224)

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Table of Contents

Executive Summary

The Ohio River and its basin are of national significance both in its geographic scope and the fish and mussel resources contained within them. The Ohio River is the second largest river in the United States as measured by its annual discharge (USGS 2009). The basin also contains at least 350 species of fish and more than 120 mussel species, including a number that are federally listed. Sportfishing is a major activity with over 2.5 million angling hours recorded and 2.8 million fish caught within just the main-stem Ohio River during past surveys. It was with these resources in mind, that the Ohio River Basin Fish Habitat Partnership (ORBFHP) coalesced from a meeting of approximately 50 federal, state, NGOs, and academic representatives interested in the aquatic habitat of the Ohio River Basin.

The ORBFHP's focus is embodied in its mission statement: *The Ohio River Basin Fish Habitat Partnership focuses conservation, restoration, and enhancement efforts on priority habitat for fish and mussels in the watersheds of the Ohio River Basin for the benefit of the public.*

Over the course of 3 in-person planning workshops and additional video conferences in 2008-09, the partnership utilized a rigorous open source planning method known as Conservation Action Planning (CAP) to focus on a set of key targets and to develop habitat protection/restoration strategies. Conservation targets selected by the ORBFHP include:

- Large and great rivers (watersheds > 3,681 sq miles) and the signature fish of sauger, paddlefish, sturgeon species, and blue suckers.
- Medium rivers (watersheds 200-3,681 sq miles) and the signature fish of smallmouth and spotted bass, and logperch.
- Headwater and small streams (watersheds < 200 sq miles) and the signature long-ear sunfish, tippacanoe, and orangethroat darters
- Off-channel systems (eg oxbows, sloughs, and other secondary channels) and the signature fish of largemouth bass, and grass pickerel.
- Sensitive mussels (non-pool species)
- Native aquatic vegetation

The key ecological attributes (needs) provided by each habitat type (based on their signature species or biotic group) were identified. Then the root causes of the top threats to each type of habitat type were determined. Threats from individual habitat types were also rolled up to assemble a list of urgent threats that affect all aquatic habitat within the Ohio River basin. Based on these determinations, a set of habitat protection and restoration strategies were developed for each habitat type based on the needs of their signature biota.

Ultimately the ORBFHP also developed a list of crosscutting habitat protection/restoration strategic actions with SMART objectives nested under 6 strategy areas that include the 4 National Fish Habitat Action Plan Board's interim habitat strategies and link well with State Wildlife Action Plans and other planning efforts in the basin. These strategy areas are:

- Identify and protect intact and healthy waters

- Restore natural variability in river and stream flows.

- Reconnect fragmented river and stream habitat, to allow access to historic spawning, nursery and rearing grounds.

- Reduce and maintain sedimentation, phosphorus and nitrogen runoff to river, and stream habitats to a level within 25% of the expected natural variance in these factors or above numeric State Water Quality Criteria

- Reduce other key pollutants or degrading environmental conditions (acid drainage, heavy metals, altered temperatures, or oxygen levels) in degraded priority stream habitat to a level within 25% of natural rates or above numeric Stream Water Quality criteria by 2020.

- Reduce the potential for invasive species impact through prevention and control measures at the basin-level and within priority systems.

During the planning process it was determined the ORBFHP's initial geographic scope would not include the Tennessee River and would be limited to the Ohio River Sub-basin minus its HUC-4 Cumberland watershed (to limit overlap with SARP). The partnership coordination area encompasses the entire 981 miles of the Ohio River main stem and 143,550 square miles of its watershed including tributary streams.

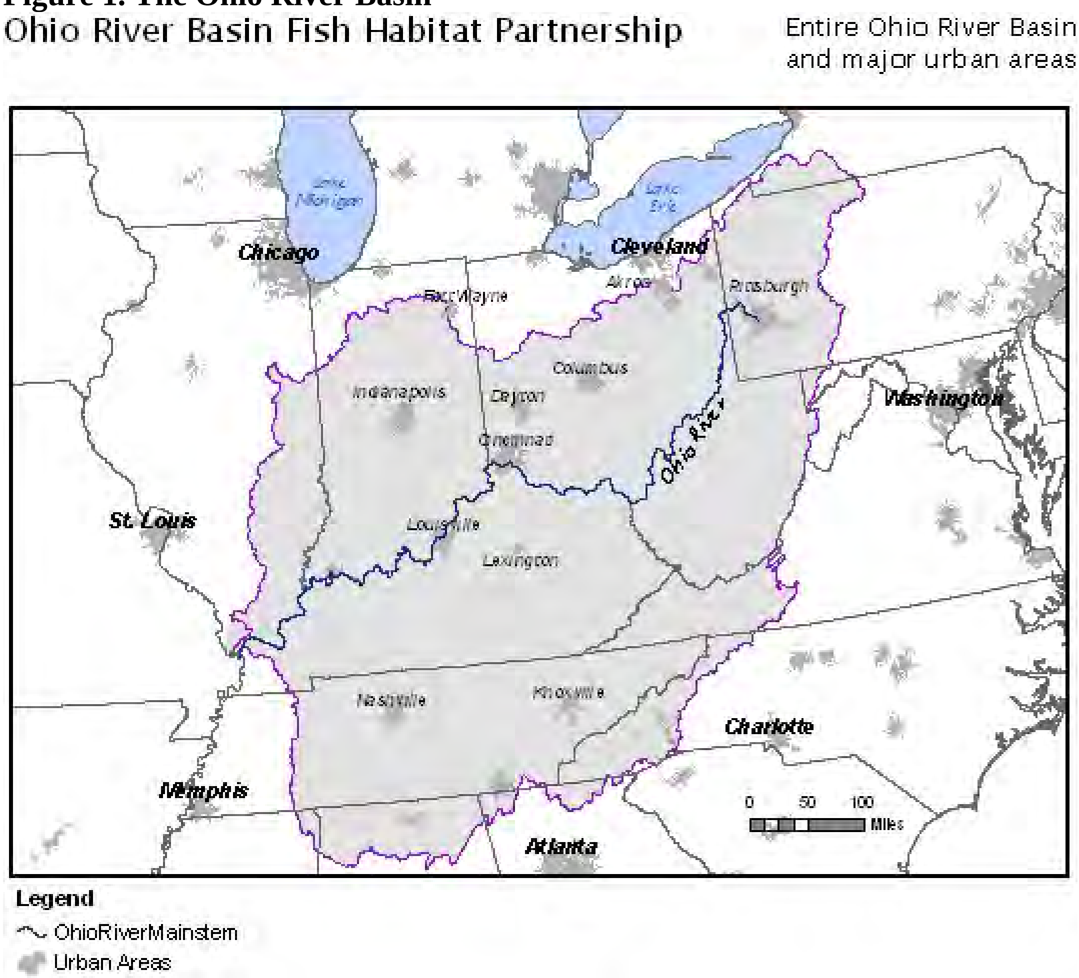
To facilitate immediate progress, ORBFHP planners selected an interim list of early action sites/watersheds based on a combination of outstanding occurrences of conservation targets and state conservation agency priority areas. The ORBFHP will utilize a screening framework based on its mission, guiding principles, core strategic actions, and early action sites to direct funding and other partnership resources initially. In the future, completion of a more rigorous basinwide habitat assessment will allow us to better identify priority areas, help select priority projects, and to track progress on our objectives.

In addition to a basinwide habitat assessment, the partnership has identified a need to conduct sediment and nutrient loading modeling in at least the central and western portion of the basin to determine which lands which are the greatest contributors to water quality stress. An analysis of floodplain connectivity and restoration potential is also needed throughout the ORBFHP area. Finally research into possible invasive species, invasion pathways, and methods of prevention are needed to prevent their introduction or spread.

Introduction

The Ohio River and its basin are of national significance both its geographic scope and the fish and mussel resources contained within them. The Ohio River is the second largest river in the United States as measured by its annual discharge (USGS 2009). In fact, the annual flow of the Ohio River exceeds even that of the Mississippi upstream of their confluence and is a reflection of its approximately 204,000 square mile drainage basin that includes portions of 15 states (Figure 1).

Figure 1. The Ohio River Basin



Of even more importance are the fish and other freshwater biodiversity found within the basin. The Ohio River drainage contains at least 350 species of fish ranging from endemic darters and dace in the headwaters to a suite of great river fish (e.g., paddlefish, blue sucker, lake, and shovelnose sturgeon) and more than 120 mussel species, including a number that are federally listed. These figures approach half of the freshwater fish and over a third of all mussel species found in the United States (NatureServe 2009).

Freshwater mussels as a group are among the most endangered freshwater fauna in the world and it can therefore be argued that conservation of mussels and their habitat in the Ohio River Basin is not just of national significance but of global importance as well.

A number of the fish are also important sport or commercial species. An illustrative example of the Ohio River sportfishery and its economic impact can be found in the results of a 1991-92 creel survey in the West Virginia, Ohio, Kentucky, and Indiana portions of the main stem (Schell et al, 1998). At this time approximately 2.5 million angler hours of effort with a corresponding economic value of 34 million dollars were recorded. The vast productive potential of the Ohio River was evident in the 2.8 million sportfish that were caught even with the dampening effects of continuing habitat threats noted at that time.

Largemouth bass occupy the pools and oxbows of the main stem and the lower reaches of its larger tributaries. A number of the rivers in the Ohio River Basin also contain outstanding smallmouth or spotted bass fisheries, and several main stem tributaries to the Ohio River host a unique riverine subspecies of muskellunge (Trautman 1981, IL Nat History Survey 2003).

The Ohio River and portions of its basin contain viable populations of paddlefish that support a highly valuable commercial fishery (Henley et al, 2001). Reported average annual commercial harvest was 149,764 pounds of flesh and 14,084 pounds of eggs during 1999-2000. The retail value of the 2000 egg harvest *only* was estimated to be 4.3 million dollars.

Fish and mussel habitat within the Ohio River Basin however, is imperiled by a number of historic impacts and continuing threats including mineral extraction, row crop agriculture, and livestock grazing. It was within this context that a group of approximately 50 representatives from state and federal agencies, NGOs and universities within the Ohio River Basin, interested in fish and freshwater mussels, coalesced into the Ohio River Basin Fish Habitat Partnership (ORBFHP) during 2008-09. The forming partnership desired to facilitate and carryout the goals of the National Fish Habitat Action Plan (2006) within the Ohio River Basin by developing a strategic planning framework that would:

- Protect and maintain intact and healthy ecosystems
- Prevent further degradation of fish habitats that have been adversely affected.
- Reverse declines in the quality and quantity of aquatic habitats to improve the overall health of fish and other aquatic organisms.
- Increase the quality and quantity of fish habitats that support a broad natural diversity of fish and other aquatic species.

The subsequent sections of this document summarize the partnership's efforts to develop a strong conservation planning and operational process that complements the national effort to protect and restore fish and mussel habitat.

Mission of the ORBFHP

The first task of the forming fish habitat partnership was to craft a mission statement that reflected the common interests of the partnership members and their desire to achieve the intent of the National Fish Habitat Action Plan within the Ohio River Basin. After careful consideration the following mission statement was developed:

> **The Ohio River Basin Fish Habitat Partnership focuses conservation, restoration, and enhancement efforts on priority habitat for fish and mussels in the watersheds of the Ohio River Basin for the benefit of the public.**

Conservation Planning Process

The ORBFHP undertook a rigorous conservation planning process to determine how to focus existing and future resources for the conservation and restoration of fish and mussel habitat. The partnership utilized an open source planning method utilized by a number of non-profit conservation organizations known as Conservation Action Planning or CAP (TNC 2005).

CAP begins by determining an appropriate conservation project area and then selecting a subset of priority conservation targets within the area (Figure 2). Once the targets have been selected planners determine their key ecological attributes (KEAs) or needs. Current and desired future condition ratings (also known as viability analysis) are developed based on the degree to which target's KEAs are being met.

Figure 2. Visual Representation of the CAP Process

Understanding the KEAs of each target allows a determination of critical threats (key stresses) to each. Once top threats are determined an examination of underlying sources (often called a situation analysis) is undertaken. It is within the situation analysis that conservation objectives and strategic actions are developed to alleviate the top sources of threats.

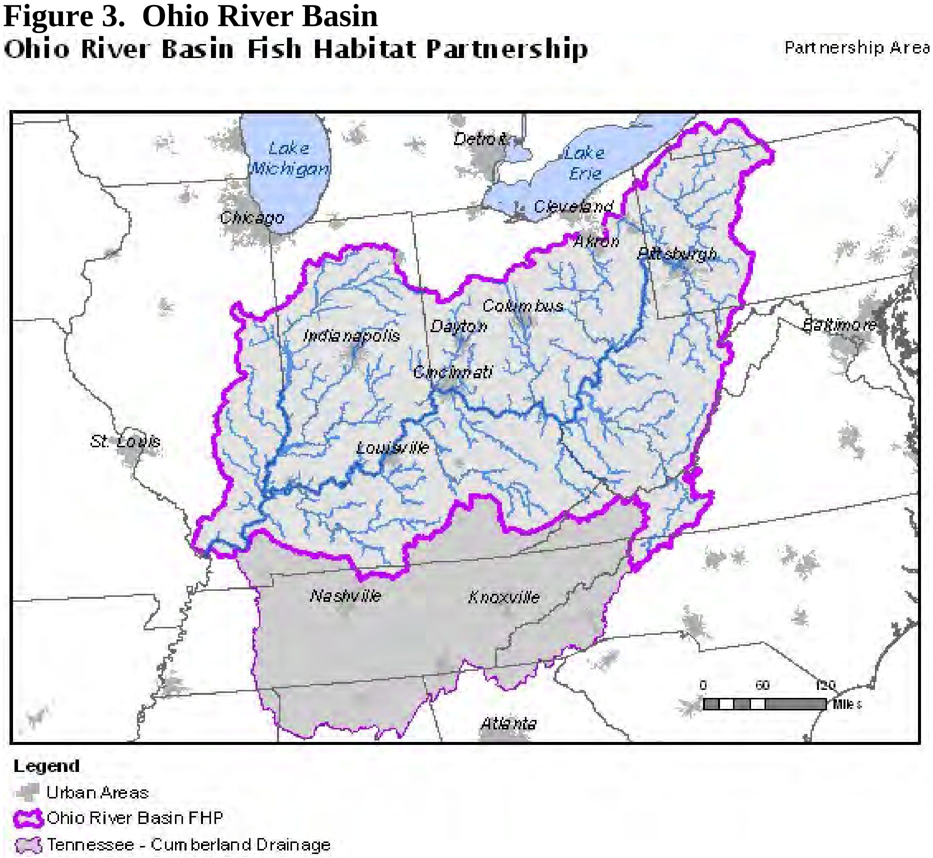
Finally measures are selected to evaluate the impacts of conservation strategies based first on strategy implementation progress and then on the degree to which target KEAs are fulfilled and their status (viability) improves. In true adaptive management fashion effectiveness of selected strategies are evaluated using the selected measures and if necessary, strategies can be changed or refined accordingly.

An assembled group of core conservation experts within the partnership participated in an Ohio River Basin CAP process during 3 in-person workshops in 2008-09. Initial CAP planning was then refined in a series of conference calls and the outcome is presented in subsequent sections of this document.

Project Area Scope

As noted earlier in the document the entire Ohio River Basin is a vast area and it also encompasses two great river basins. The Ohio River and its major tributary (the Tennessee River) comprise the two sub-basin units (Fig 3) within the larger Ohio River Basin.

Figure 3. Ohio River Basin



After careful consideration, the core conservation planning team decided to limit the Ohio River Basin Fish Habitat Partnership's effective administration area to the Ohio River sub-basin excluding its Cumberland HUC-4 (Figure 4).

Figure 4. The Ohio River Basin Fish Habitat Partnership Geographic Boundary

The decision to initially limit the partnership's scope was based primarily on a desire to limit geographic overlap with the Southeastern Aquatic Resources Partnership or SARP (most southern conservation agencies are already affiliated with SARP) as it is SARP's stated intent to work in the Tennessee and Cumberland river systems. The decision to focus on the northern or Ohio River portion of the basin was also driven by a recognition that the prevalence of high dams (and resultant large impoundments) in the excluded areas creates a high degree of system fragmentation that is practically irreversible.

The ORBFHP will therefore initially operate within a geographic area corresponding to a large portion of the Ohio River Basin that extends from the southwestern corner of Maryland and western New York in the east, westward to the confluence of the Ohio River with the Mississippi in Illinois and as far south as portions of Virginia, North Carolina, and Tennessee (Figure 4). Within the bounds of this area are large portions of Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois.

The Ohio River watershed area contained within the ORBFHP encompasses approximately 143,550 square miles (USGS, 2009). A total of 13, HUC-4 units and their streams lie within the bounds of the ORBFHP (Appendix a) as does the entire main stem of the Ohio River stretching 981 miles between Pittsburgh, PA and Cairo, IL.

Conservation Targets

During the conservation planning process, 4 signature groups of fishes representing general habitat types, 1 specific rare habitat type, and a freshwater mussel group were chosen as targets that cover the diversity of aquatic habitat needs within the basin. These targets were:

- Long-ear sunfish, rainbow and orangethroat darters (headwater streams and small rivers)
- Smallmouth bass, spotted bass, logperch and tippacanoe darters (medium rivers)
- Sauger, paddlefish, sturgeon, and blue sucker (large and great rivers)
- Largemouth bass and pickerel (off-channel systems)
- Native aquatic vegetation
- Sensitive mussels (non-pool species)

The key ecological attributes (usually critical habitat needs linked to important life history events) of signature fish or other biotic groupings were examined and are also used to evaluate the current status of their associated habitat types (See Appendix b example). The general distribution of habitat types within the ORB is presented below and includes the KEAs provided by each. Key habitat threats to its signature fish (or other biota) and sources of threats within the basin are also discussed. Finally, the current viability status of signature fish and mussels associated with each habitat type (Table 1) are discussed.

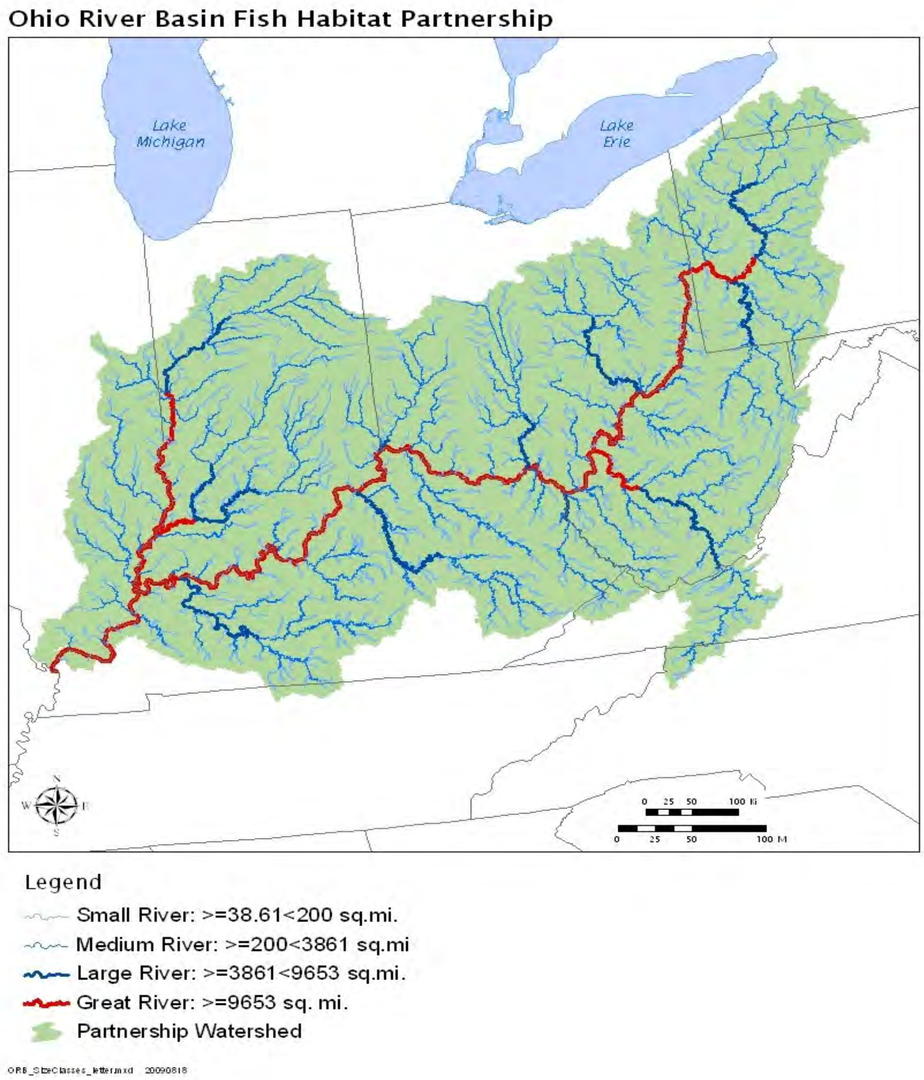
Table 1. Viability Ranking of Conservation Targets

Conservation Target	Very Good	Good	Fair	Poor
Native mussels and hosts		X		
Great and large rivers (signature fish)			X	
Medium rivers (signature fish)		X		
Headwaters and small streams (signature fish)			X	
Native aquatic vegetation				X
Off-channel systems (signature fish)			X	

Headwater and Small Streams

The ORBFHP defined headwater and small streams as having watershed areas less than 200 square miles (Figure 5). This habitat type makes up the majority of stream miles within the basin.

Figure 5. Distribution of stream size classes within the ORBFHP



Long-ear sunfish, rainbow and orange-throat darters were chosen to represent the necessary ecological needs provided by this habitat type. Within the basin, darters are most abundant in the lower gradient headwater and small streams of the basin (Franks 1986) that possess the KEAs of good water quality and physical habitat. Although most are found in warmwater streams a few species can be found in coolwater habitat.

It was determined that additional KEAs of the signature fishes are clean spawning substrates (usually rocks and gravel), and sufficient quantity and composition of invertebrate food sources. Conversely sedimentation from various land uses, barriers (usually road and pipeline crossings at this scale), altered channel morphology (straightening), altered hydrology, and climate change impacts (warmer water temperatures) ranked among the greatest threats to the headwater/small stream fish

(Appendix c). Despite a host of current and potential threats the current viability of the signature fish was assessed to be fair overall within the basin (Table 1).

Medium Rivers

The ORBFHP defined medium rivers as having watershed areas between 200 and 3,861 square miles (Figure 5). Unlike the larger river class there are numerous medium rivers within the Ohio River Basin and therefore they are not listed by name within the current document.

A group of signature fish (smallmouth, spotted bass, logperch, and tippacanoe darter) was chosen to represent the necessary ecological needs provided by the medium rivers habitat type. Within the basin, smallmouth bass are more abundant within the eastern portion of the basin than in the west and are normally found in streams with water temperatures less than 80F. Spotted bass distribution is not as clearly defined as smallmouth bass but they often fill a similar niche in streams or stream segments with warmer water temperatures. Logperch and tippacanoe darter) are typically found in the relatively undisturbed upstream reaches of medium rivers throughout the basin.

It was determined that the KEAs of this group of fish are clean spawning substrates (usually rocks and gravel), good water quality, water temperatures less than 80F and sufficient quantity and composition of invertebrate (darters) as well as sufficient large prey items (smallmouth and spotted bass) Conversely sedimentation from various land uses, dams, altered channel morphology, hydrology, and climate change impacts (warmer water temperatures) ranked among the greatest threats to the medium river fish (Appendix c). Despite a host of current and potential threats the current viability of the signature fish was assessed to be good overall within the basin (Table 1).

Large and Great Rivers

The ORBFHP defined large and great rivers as having watershed areas exceeding 3,861 square miles (Figure 5). Moving generally east to west within the basin these rivers are the Allegheny, Monongahela, Muskingum, Kanawha, Scioto, Big Sandy, Great Miami, Kentucky, Green, Wabash, White, and the Ohio.

A group of signature great river fish (sauger, paddlefish, sturgeon species, and blue suckers) was chosen to represent the necessary ecological needs provided by the large and great rivers habitat type. Sauger are found throughout much of the main stem and are the most highly sought after gamefish of Ohio River anglers (Schell et al 1998, West Virginia DNR 2004). Within the ORBFHP, sturgeon are most abundant in the western portion of the main stem of the Ohio River and the lower reaches of major tributaries in this area and are virtually extirpated in the eastern portion of the basin (*National Paddlefish and Sturgeon Steering Committee 1992*). Paddlefish abundance follows the same trend in the northern portion of the basin (Henley et al, 2001). Blue sucker distribution is relatively unknown but abundance is thought to generally follow that of the sturgeons.

The assembled technical experts determined that the KEAs of this group of fish are suitable spawning areas (shoals of rock and cobble), unimpeded movement within the system at key life history events, and sufficient quantity and quality of planktonic (paddlefish), benthic macroinvertebrate (sturgeon and blue suckers), and piscivorous food sources (sauger). Conversely changes in land use, dams, invasive fish, and flood plain connectivity loss ranked among the greatest threats to the great river fish (Appendix c). It is therefore not surprising that current viability of these fish was assessed at only fair (Table 1) as cobble or larger rock sizes are not abundant in the benthic surface of the Ohio River main stem and many lower tributary reaches. Additionally a system of 20 main stem navigational locks and dams disrupt movement of these highly migratory great river fish (USACE 2010).

Off-Channel Systems

Off channel systems were defined as aquatic habitat not permanently connected to primary stream channels. Examples of this type of habitat include oxbows and sloughs. Off-channel systems are normally found in lower gradient flood plain areas. As a rule of thumb off-channel systems therefore are most prevalent in the floodplain of the lower reaches of larger rivers and generally increase in abundance toward the western side of the basin.

Largemouth bass and pickerel (chain and grass) were chosen to represent the necessary ecological needs provided by the off-channel habitat type. Pickerel are ubiquitous in the remaining off-channel systems within the basin but largemouth bass are generally most abundant in the larger slough and oxbow areas found in the central and western portions of the basin. In naturally functioning stream systems these areas often serve as reproductive and rearing areas and provide an influx of this highly sought after gamefish into stream systems during periodic connections resulting from overflow events. Therefore it was determined that the KEAs of this group of fish were floodplain connectivity, and overflow events of sufficient magnitude at key life cycle stages.

Conversely flood control structures such as dikes/levees, flood plain development, and altered channel morphology (straightening) ranked among the greatest threats to the off-channel fish (Appendix c). As these threats were judged to be impacting much of the basin the viability of the off-channel fish and their habitat was assessed at only a fair level (Table 1).

Native Aquatic Vegetation

Aquatic vegetation, consisting of native species known to occur within the basin, is the final ORBFHP conservation target. Historical accounts of the Ohio River System indicate that aquatic vegetation was once widely distributed (Trautman, 1981). ORBFHP raters, however, have determined that the current viability of this habitat type is poor throughout much of the basin (Table 1).

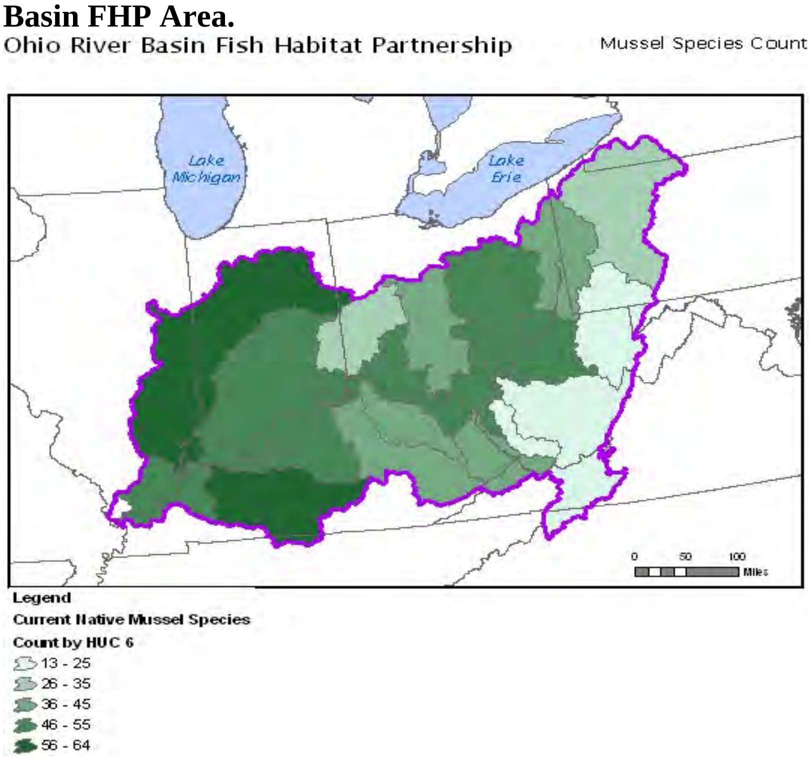
An examination of the assembled rankers' KEAs for this habitat type reveals that the most important ecological needs of the native aquatic vegetation are good water clarity, depositional areas of coarse substrates (rock or sand bars), and relatively shallow water. These KEAS are largely unmet due to numerous top high ranked threats (Appendix c).

Increased sedimentation (as a result of past and current land-use) has greatly reduced water clarity and in some cases covered suitable substrates (ORSANCO). Additionally the series of navigational pools created within the Ohio River main stem and the lower reaches of its major tributaries greatly reduce the amount of shallow water within the system. Likewise past and present dredging for navigational purposes often removes point bars that would create suitable areas for aquatic vegetation growth. Finally, invasive vegetation in some areas of the basin directly competes with native species in suitable growth areas.

<u>Native Mussels</u>

Native mussels that do not colonize pools were defined as a conservation target as these species tend to be indicators of good habitat quality. Conversely, species of mussels found in pools tend to be more tolerant of habitat degredation. The ORBFHP area is a global center for mussel diversity with a number of Ohio River HUC-6 units containing upwards of 45 species (Figure 6).

Figure 6. Distribution of Mussel Diversity (by watershed) within the Ohio River Basin FHP Area.



The middle and lower Ohio River possess outstanding mussel diversity, however, portions of the upper Ohio River remain in an extended recovery phase and currently possess lower mussel diversity from severe environmental degradation prior to 1970

(*Ohio River Basin Comprehensive Reconnaissance Report 2010*). The high mussel diversity found within the Wabash also points out the need to conduct a comprehensive basinwide habitat assessment as soon as possible as that watershed was not identified by experts as an early action site.

ORBFHP conservation planners determined that native mussel KEAs are good water quality (particularly DO, and pH), appropriate stream bed structure (stable and clean gravel substrates with adequate interstitial flow), and presence of suitable host fish during reproductive events. Conversely top ranked threats to native mussels were found to be sedimentation from various land-uses, barriers to host movement (often dams), altered hydrology, channelization, dredging, and non-native invasive mussels (Appendix c). Despite these threats, native mussel viability was ranked as good based on the overall distribution and condition of mussels within the basin (Table 1).

Basinwide Threat Analysis and Habitat Strategy Development

The ORBFHP compiled a list of higher ranked threats that were identified for all or nearly all of the signature conservation targets representing the range of habitat types across the basin (Table 2).

Table 2. Threats across habitat/conservation targets

Threats	Rank
Impervious Surface run-off (CSO and SSO)	High
Class I and II Dams (>40 feet tall)	High
Class III Dams (25 -40 feet high)	High
Class IV (Lowhead) and smaller dams	High
Sediment from Mining (includes coal prep)	High
Sediment from Agriculture	High
Channel Dredging (commercial gravel mining)	Medium
Sediment from Silviculture	Medium
Sediment from Urban Development	Medium
Acid Mine Drainage	Medium
Changing Climates (water temp)	Medium
Atmospheric Deposition	Medium
Invasive Fauna	Medium
Invasive Plants (aquatic)	Medium
Invasive plants (riparian)	Medium
Channelization	Medium
Downcutting	Medium
Flood Control Structures (dikes, levees)	Medium
Development - hydrology impacts	Medium
Development - contaminant runoff	Medium
Endocrine Disruptors/Pharmaceuticals	Medium
Non Point Source Contaminants-Not from Dev.	Medium
Point Source Contaminants-Not from Dev.	Medium
Surface Mining	Medium
Oil and gas explor and extraction	Medium

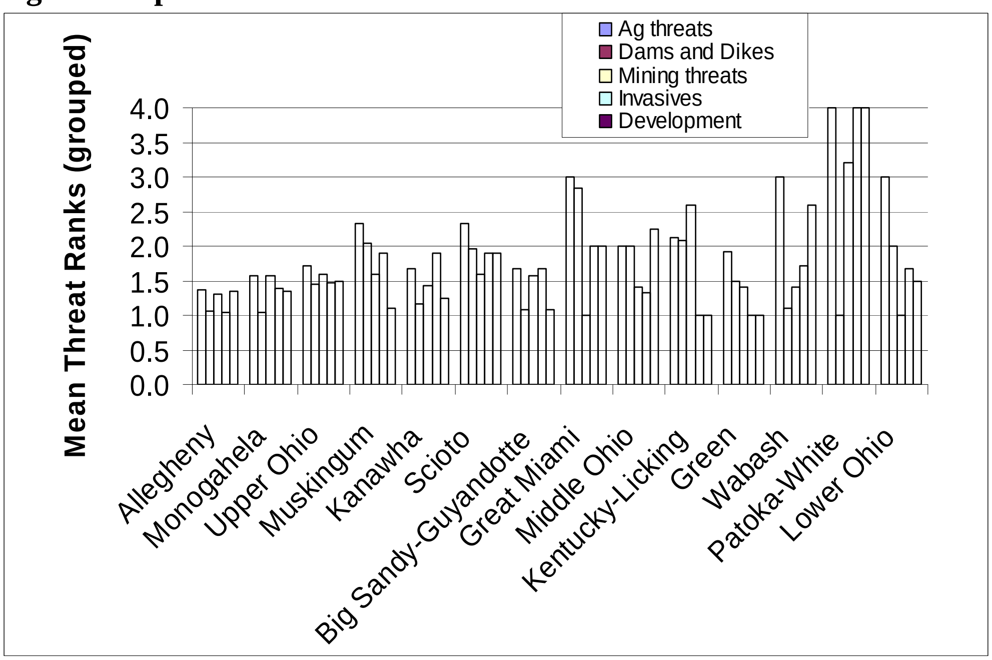
An examination of spatial trends across the basin was then carried out in an effort to better understand the impact of historic impacts and future threats. In order to reduce duplication of effort for this analysis, each stream (or other habitat) type and their signature fish and mussels were considered holistically in the following categories:

- Headwater and small streams and signature fish and mussels
- Medium rivers and signature fish and mussels
- Large rivers and signature fish and mussels
- Off channel systems and signature fish and mussels
- Native aquatic vegetation

Individual raters with knowledge of specific ORBFHP HUC-4 units rated current condition of these conservation targets and the relative severity of the highest ranked threats to these targets both from a legacy standpoint and within the next 10 years to look for trends across the basin.

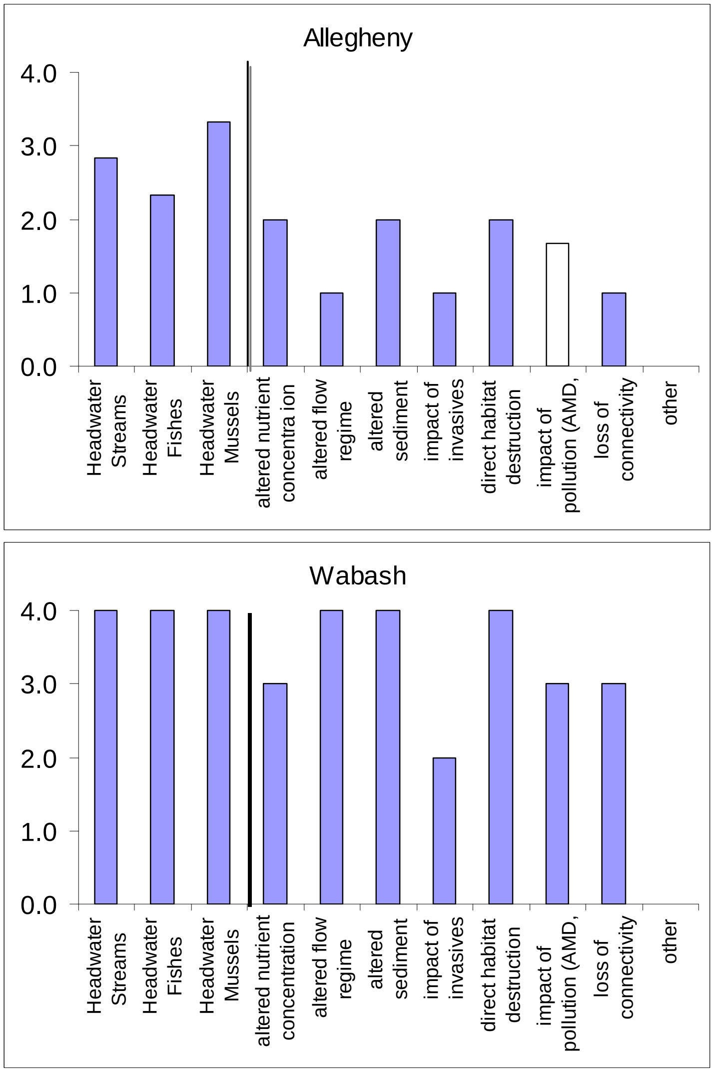
This analysis indicates that although legacy coal mining impacts are greater in the east, the overwhelming legacy and near term threat to the targets in the west stem from agricultural impacts such as sedimentation and altered hydrology (Figure 7).

Figure 7. Spatial differences in threats across the Ohio River Sub-basin



The contrast of the threat posed by agricultural impacts is presented in the example of two extremes from the far eastern and western portions of the basin (Figure 8).

Figure 8. Example of Habitat Condition and Threat Differences across the Ohio River SubBasin



Overall condition rating (left side black line, scaled from 0 (excellent) to 4 (poor) for Headwater Streams, Headwater Fish, and Headwater Mussels, and rating for sources of stress leading to condition rating (right of black line), scaled from 0 (not contributing) to 4 (extremely important contributor) in an eastern HUC (Allegheny, top) and a western HUC (Wabash, bottom). These two systems illustrate some of the general differences among HUCs with altered nutrient and sediment and flow regimes being more prevalent in western HUCs.

These trends also indicate that future work in the western HUCs will often involve habitat restoration strategies geared toward agricultural impact abatement while work in the eastern HUCs generally may involve greater emphasis on protection of higher quality areas or restoration strategies in areas with legacy impacts to abate a variety of often, relatively equally severe threats.

The current conditions of each habitat type and specific protection/restoration strategies developed for them are outlined below based on the previous threat analysis and conservation target situation analysis (See Appendix d example). Also presented are habitat improvement activity indicators and generalized desired biotic outcomes. In each case though, the ORBFHP will need to work with partners in the near term to develop specific desired future conditions (biological outcomes) based on conservation target KEAs and baseline population indicators and cooperative monitoring efforts.

Headwater and Small Streams (Incl. signature fish and mussels)

Despite the overall fair rating of the headwater/small stream fish and mussels (and necessarily their associated habitat) condition of this habitat type varies throughout the basin. In agriculturally or urban dominated areas headwater smaller streams are often ditched and straightened and do not provide suitable habitat quality to support the signature fish and mussel species. Similarly, smaller streams in areas with current or historic mining activities often are heavily impacted in the absence of restorative actions. In less disturbed areas smaller streams possess excellent populations of this habitat type's signature fish and mussels. As a result of this wide range of conditions, a group of strategies were identified from situation analyses (Appendix d as an example) that were a mixture of protection and restoration depending on the localized condition of the target.

These strategies included the utilization of erosion control BMPs (including protection or restoration of riparian zones), removal or replacement of obsolescent road or pipeline crossings with designs that incorporate fish passage, stream channel restoration, flood plain reconnection/restoration, and protection of water quality (particularly as related to water temperature and emerging contaminants such as endocrine disruptors). Prevention/control of riparian invasives was also identified as a protection strategy at this scale.

These strategies link well with a number of watershed-scale conservation efforts by local NGOs. Examples include the recent work of the Muskingum Conservancy to aggressively implement agricultural BMPs and Little Miami, Inc to prevent floodplain development and address barriers.

Future progress indicators include reduction in sedimentation (ultimately to within 10% of natural variability) reduction in the number of barriers, improvement in physical habitat (ie QHEI), benthic indices, number of miles of stream channel restored, and number of acres of flood plain reconnected. The ultimate measure of habitat improvement for this conservation target will be positive changes in IBI (including darter richness) and/or their sampling CPUE.

Medium Rivers (Incl. signature fish and mussels)

Due to the good rating of the medium rivers fish (and necessarily their associated medium river habitat) a group of strategies were identified from situation analyses that were a mixture of protection and restoration strategies depending on the localized condition of the medium river fish. These strategies included the utilization of erosion control best management practices known as BMPs (including protection or restoration of riparian zones), removal or replacement of dam structures with designs that incorporate fish passage, flood plain reconnection/restoration, design and implementation of dam reoperation regimes that mimic the natural hydrograph during key life history events, and protection of water quality (including emerging contaminants such as endocrine disruptors). Prevention/control of aquatic invasive species was identified as a protection strategy and as with the large river fish would possibly include identifying environmental barriers/factors that could be protected or manipulated to provide a competitive advantage for native species.

The preliminary flow, aquatic organism passage, and flood plain connectivity strategies developed by the ORBFHP link well with existing the conservation goals and objectives of the Nature Conservancy's Upper Ohio River Integrated Landscape, and to the Illinois State Wildlife Plan in particular. The envisioned Aquatic Invasive strategy of the ORBFHP is also complementary with the Aquatic Invasive Species prevention/control plans of several basin state conservation agencies.

Future progress indicators include reduction of sedimentation (ultimately to within 10% of natural variability), reduction in the number of barriers, improvement in benthic indices, and number of acres of flood plain reconnected. The ultimate measure of habitat improvement for this conservation target will be positive changes in the percent of signature fish harvested and/or their sampling CPUE.

High value habitat mussel protection or restoration strategies developed from situational analysis include protection of water quality through the application of erosion control BMPs at high value sites, removal of obsolete structures that act as host barriers, development of reoperation regimes at currently utilized locks and dams that promote host passage at key life history events, replacement of road crossing structures, locks, and dams with designs that incorporate fish passage features, development or application of state and local regulations that minimize hydrologic alteration and dredging in high priority watersheds, and prevention or control of non-native mussel species spread.

Future progress indicators include reduction of sedimentation (within 10% of natural variability), reduction in the number of host barriers, miles of streams reconnected and lessened density of non-native mussels. The ultimate measure of habitat improvement for this conservation target will be positive changes in absolute abundance of native mussels, species richness, and percent of monitoring sites with rare species reproduction.

Large Rivers (Incl. signature fish and mussels)
Due to the degraded condition of both the large and a great rivers (and consequently their signature fish) strategies identified from situation analysis are almost exclusively restoration driven. These strategies include the addition of spawning substrates within the tailwaters of locks and dams or creation of spawning shoals in other localities with sufficient flows, removal (where possible) of obsolescent structures, physical or operational modification of current locks and dams for fish passage, and flood plain reconnection/restoration of key flood plain features (particularly important for paddlefish). These strategies link well with the goals and objectives of other planning efforts such as the USFWS range recovery plan for lake sturgeon, the Ohio River Fish Management Team's strategic plan for paddlefish (Henley et al 2001), MICRA and state wildlife action plans in PA, and OH.

A single habitat protection strategy revolving around the prevention/control of asian carp was identified and would include the identification of any potential natural barriers or augmentation of environmental factors that might improve the competitive advantage of the great river fish. While traditional physical barriers have been viewed as control points the ORBFHP is hopeful that possible augmentation of environmental gradients can be used to at least slow the spread of invasive species.

Future progress indicators based on the KEAs of signature fishes and mussels include a reduction in the number of reproductive barriers for these organisms, improvement in benthic and plankton indices, number of acres of flood plain reconnected/number of flood plain features restored. The ultimate outcome of habitat improvement for this conservation target will be positive changes in the percent rock/cobble spawners harvested and/or sampling CPUE.

Off Channel Systems (Incl. signature fish and mussels)
Due to the degraded condition of the off-channel systems strategies identified from situation analysis are almost exclusively restoration driven. High value strategies selected included the removal or alteration of lower value flood control structures, and relocation of floodplain infrastructure to restore flood plain connectivity and improve periodicity of flooding. In off-channel areas with high ecological value, it might also be appropriate to recreate/maintain connections at key lifecycle events through the creation of new hydrologic connections and/or pumping.

Progress indicators include the number of acres of off-channel features reconnected, return frequency and duration of overflow events, and increases in the floodprone width/bankfull width ratio at key localities. The ultimate measure of habitat improvement for this conservation target will be positive changes in the percent of signature fish harvested and/or their sampling CPUE.

Native Aquatic Vegetation
Possible strategies to restore native vegetation includes the development of dredging practices that allow for increased point bar formation, artificial creation of shallow water

zones along the edges of larger pools through the addition of suitable material types, and development and application of techniques to control non-native vegetation.

Indicators of progress will include positive changes in the number of point bars formed, acres of shallow water habitat created, and acres of non-native aquatic vegetation control. Ultimate measures of habitat improvement success will include increased numbers of asexual propagules and % dominance of native species at monitored sites.

Development of Crosscutting Habitat Improvement/Protection Actions

The ORBFHP also developed habitat restoration and protection strategies that addressed the most detrimental (i.e. high ranked) legacy and imminent threats across the spectrum of key habitat types in the basin.

The most urgent individual threats fall into 4 general threat groupings consisting of:

- Direct habitat degradation (channelization, stream bottom removal, stream valley filling, and suitable substrate starvation)
- Altered water quality (toxic pollutants, excess silt and sedimentation, altered temperature regime, and excessive nutrients)
- Altered population dynamics (limited reproduction)
- Altered hydrology (reduced channel/flood plain width, and inappropriate scour)

The larger threat groupings were utilized in a situation diagram that included all 6 of the conservation targets further stratified by condition (good or poor). Essentially the completed situation diagram (Appendix e) and individual threat area breakouts (See Appendix f example) reveal common, underlying causes of the gravest habitat threats across all of the key habitat types of the Ohio River Basin. These "mega" threat *sources* are now being targeted by the ORBFHP by the development and implementation of crosscutting restoration (targeting poor habitat condition due to legacy impacts) or protection (guarding against future degradation of good habitat condition) strategic actions.

Core Habitat Improvement/Restoration Actions

The list of crosscutting habitat improvement or restoration actions developed by the ORBFHP to address Ohio River Basin mega threat sources are nested under 4 broad habitat improvement strategies suggested by the National Fish Habitat Board. The ORBFHP also added 2 additional strategies (other degrading environmental factors and aquatic invasive species prevention/control) based on the unique needs and opportunities present within the Ohio River Basin. These strategy areas with corresponding strategic actions (including SMART objectives) are as follows:

Strategy 1 – Identify and protect intact and healthy waters.

1.1 Identify key lands along priority intact and high quality stream and off-channel systems necessary to maintain the physical and ecological processes needed to sustain the key ecological attributes of selected conservation targets by 2012.

1.2 Work with appropriate state and federal agencies, municipalities, and NGOs to protect lands identified in 1.1 along 1,000 miles of high priority streams and 200 acres of off-channel systems by 2020.

1.3 Identify the key hydrologic parameters needed to sustain the key ecological attributes of conservation targets in priority streams and off channel systems by 2015.

1.4 Work with appropriate governmental agencies, water users and NGOs to prevent future hydrologic alteration within 1,000 miles of high priority streams and 200 acres of off-channel systems identified in 1.3 by 2020.

1.5 Develop guidance on appropriate locations for large water withdrawals and hydropower generation sites that avoid siting within key systems by 2015.

Strategy 2- Restore natural variability in river and stream flows and water surface elevations in natural lakes and reservoirs.

2.1 Identify priority stream and off-channel systems impacted by hydrologic alteration within the Ohio River System by 2012

2.2 Work with dam operators, municipalities, and state agencies on priority *stream systems* to develop and adopt ecologically based flow management regimes that improve the key ecological attributes of selected conservation targets in 1,000 stream miles by 2020.

2.3 Remove or modify (where possible) 20 dams and other structures that significantly alter natural hydrology by 2020.

2.4 Restore 1000 acres of *off-channel systems* impacted by hydrologic alteration within the Ohio River System by 2020.

2.5 Improve system hydrology of 1,000 acres of key floodplain area along priority streams by restoring previous inlets and outlets to these areas by 2020.

Strategy 3 **–** Reconnect fragmented river, stream, reservoir, coastal, and lake habitats to allow access to historic spawning, nursery and rearing grounds.

3.1 Remove or modify (where possible) 30 dams and other barriers that prevent aquatic organism movement by 2020.

3.2 Modify operational regimes to improve fish and aquatic organism passage through 25 locks, dams and other structures by 2020.

3.3 Reconnect 1000 acres of key floodplain areas along priority streams to allow access to key habitat areas for priority conservation targets by 2020.

Strategy 4 **–** Reduce and maintain sedimentation, phosphorus and nitrogen runoff to river, stream, reservoir, coastal, and lake habitats to a level within 25% of the expected natural variance in these factors or above numeric State Water Quality Criteria.

4.1 Within priority stream systems identify those areas which are key contributors to excess nutrification by 2012.

4.2 Within priority stream systems by 2015 determine the appropriate combination of land acreage identified in 4.1 and BMPs needed to reduce nutrification in 1,000 miles of streams.

4.3 Within priority stream systems facilitate the implementation of BMPs on land acreages identified in 4.2 to reduce nutrification in 1,000 miles of streams by 2020.

Strategy 5- Reduce other key pollutants or degrading environmental conditions (acid drainage, heavy metals, altered temperatures, or oxygen levels) in 500 miles of degraded priority stream habitat to a level within 25% of natural rates or above numeric Stream Water Quality criteria by 2020.

5.1 Within priority stream systems identify key sources of pollutants or other environmentally degrading conditions.

5.2 Within priority stream systems identify and facilitate the implementation of BMPs/restoration techniques to reduce degradation from key sources.

Strategy 6- Reduce the potential for invasive species impact through prevention and control measures at the basin-level and within priority systems.

6.1 Identify and prioritize potential sources and associated invasive species by 2011.

6.2 Engage with appropriate agencies and entities to develop prevention programs/measures to stop the introduction/spread of invasive species by 2011.

6.3 Facilitate the implementation of preventionion programs/measures developed in 6.2 with appropriate agencies and entities by 2020 (As an example identify large free-flowing sections or conditions within priority streams that likely serve (or could serve) as barriers for invasives and work with states to develop protection measures to preserve (or augment) these conditions).

6.4 Identify appropriate methods of controlling already present invasive species and implement in at least 100 stream miles by 2020.

Finally, the core list is not meant to exclude potential habitat improvement actions tailored to individual project sites with unique threats. However, it is a guiding framework of high leverage strategies that will be strongly considered when identifying potential projects for funding through the ORBFHP.

Future Information/Research Needs

In addition to a basinwide habitat assessment, the partnership has identified an urgent need to conduct sediment and nutrient loading modelings in at least in the central and western portion of the basin to determine which lands are the greatest contributors to water quality stress. An analysis of floodplain connectivity and restoration potential is also needed throughout the basin. Finally, research into possible invasive species, invasion pathways, and identification of potential environmental barriers is needed to prevent their introduction/spread.

Early Action Sites

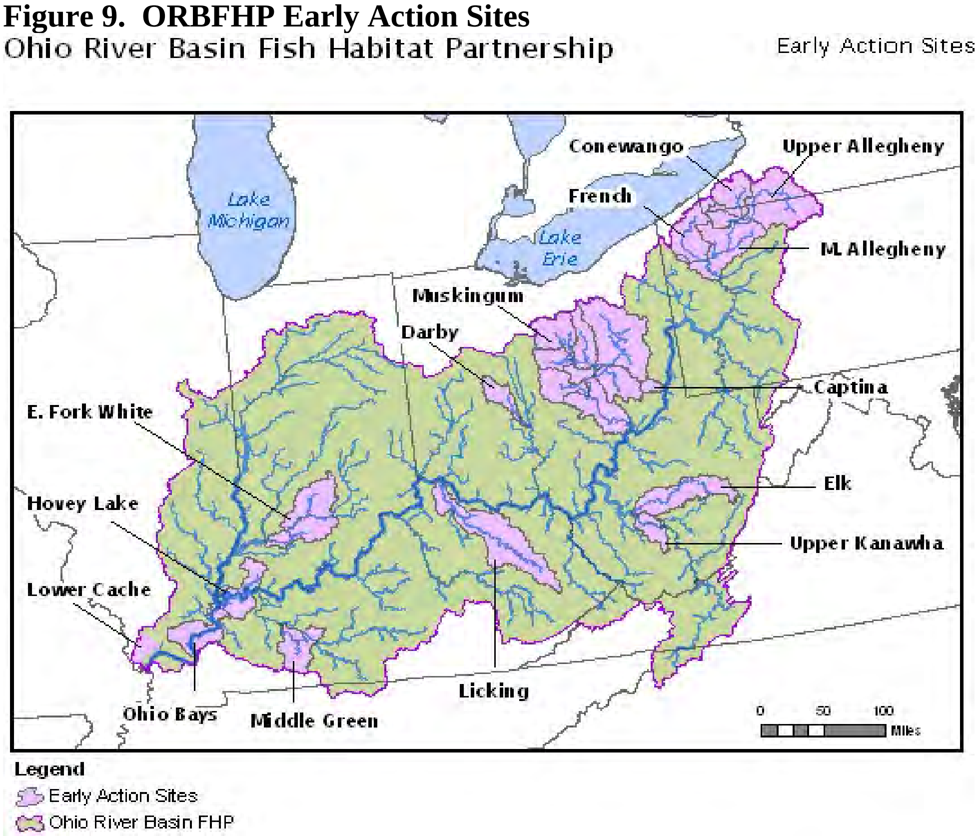
During the conservation planning process participants from across the basin were asked to assemble a list of early action sites (HUC units of varying sizes) that possessed key conservation targets and/or outstanding aquatic biodiversity which were preferably listed as state priority areas. The preliminary list of Early Action Sites includes:

- Conewango River (NY)
- Upper Allegheny River (NY)
- Middle Allegheny River (PA)
- French Creek (NY/PA)
- Elk Fork River (WV)
- Upper Kanawha River (WV)

- Captina Creek (OH)
- Muskingum River (OH)
- Darby Creek (OH)
- Middle Green River (KY)
- Licking River (KY)
- East Fork White River (IN)
- Hovey Lake (IN)
- Cache River (IL)
- Lower OH Bay (KY and IL)
- Ohio River Main stem (PA-IL)

The Early Action Sites are well distributed (Figure 9) and could form the beginning of an interconnected conservation network. These sites will serve as ORBFHP interim focus areas until a comprehensive habitat assessment and fish and mussel population database can be completed and used to identify Priority Areas for the long-term.

Figure 9. ORBFHP Early Action Sites



The ORBFHP intends to use these early action sites and later revisions as priority areas for investment of partnership funding as these areas are thought to contain some of the basin's best aquatic habitat and fish and mussel populations. Application of the partnership's cross cutting habitat protection (or as needed) restoration strategies at these sites will secure the suite of conservation targets with their key ecological attributes intact. Conservation of these areas and their biota will then provide a "bridge" to expand into more restoration driven actions in other interconnected watersheds.

Operational Process

One early task of the forming partnership was to develop a set of guiding principles that embodied the consensus of its member agencies and organizations. Essentially the guiding principles reflect the ORBFHP's "values" and taken together these are a framework for prioritizing commitment of the partnership's resources (financial and time expenditures). The ORBFHP's guiding principles are as follows:

1. **Partnership resources are focused on areas containing both regionally/nationally important fish and mussel species and where there are both angling and species diversity interests.**

2. **Watersheds are treated holistically, realizing that habitats within a watershed are interconnected and must be dealt with accordingly. Reservoirs will not be addressed in and of themselves, but rather as a part of the stream system within which they occur.**

3. **Conservation of the best areas of each type of habitat is prudent, but in addition, appropriate techniques will be applied to areas where restoration of fish and mussel habitats is necessary and positive results can be reasonably expected, particularly when they result in larger contiguous areas of quality habitat.**

4. **Use of sound science and measurement of results are foundational.**

5. **Public support is crucial to generating partnership momentum, securing funding, and ultimately completing on the ground work that will be done by or through local partnerships representing a broad range of interests.**

Partnership Diversity and Governance

The ORBFHP originates from a diverse group of agencies and organizations that have a strong interest in the protection and restoration of fish, mussel, and their associated habitat ranging from the headwaters of the basin to the main stem of the Ohio River.

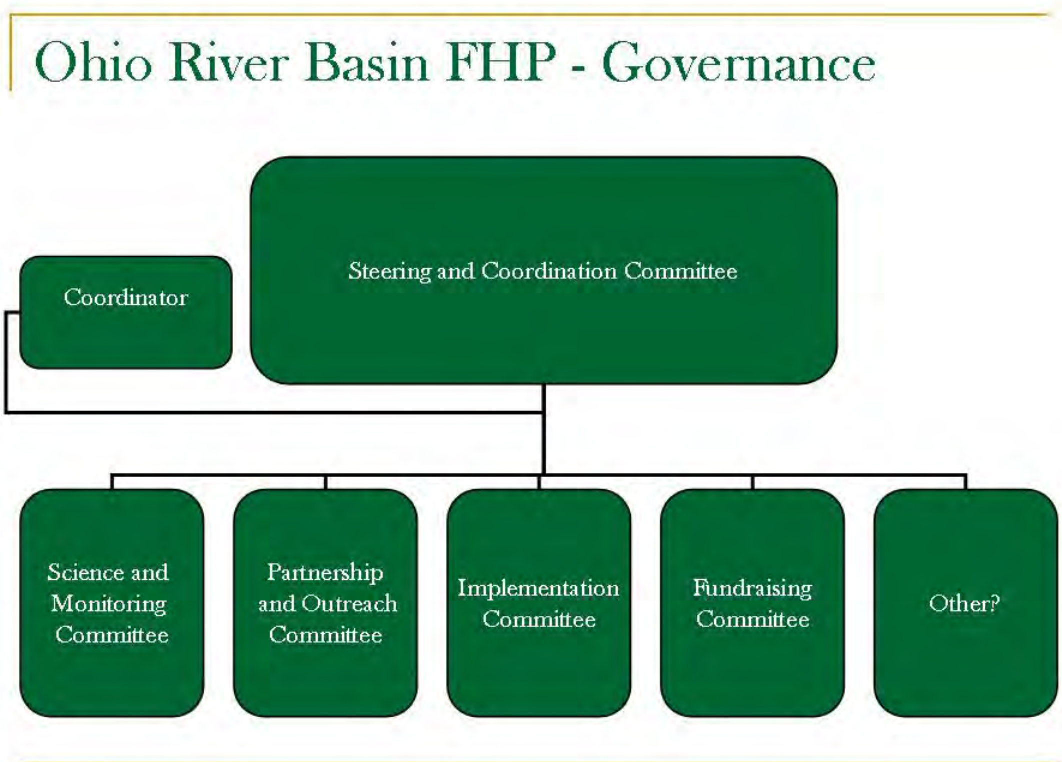
Among the core conservation planning team represented within the ORBFHP are members of the Ohio River Fish Management Team (comprised of representatives of the Ohio River main stem state conservation agencies), the Kentucky State Nature Preserves Commission, federal agencies (e.g., U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers [USACE], U.S. Geological Survey, U.S. Forest Service, U.S. Environmental Protection Agency), unique state-federal partnerships (e.g., Ohio River Valley Water Sanitation Commission), NGOs (e.g., The Nature Conservancy and The Ohio River Foundation), and academic institutions (e.g., Marshall University and the University of Cincinnati).

The partnership entities listed above also have unique interests and associations that strengthen the ORBFHP and provide the foundation for exceptional synergy and management effectiveness. Some of the highlights of partnership strengths and interests are listed in Appendix g.

Partnership Governance Structure

The governance structure will operate with oversight consisting of a Coordinator alongside a Steering and Coordination Committee as well as several working committees to address science and monitoring, partnership and outreach, implementation, fundraising, with possible additions as the partnership develops (Figure 10). Details of committee composition and functions are listed in Appendix h.

Figure 10. ORBFHP Governance Structure



Fish Habitat Partnership Overlap

The ORBFHP area overlaps with the Eastern Brook Trout Joint Venture (EBTJV), Southeastern Aquatic Resources Partnership (SARP), Midwest Glacial Lakes FHP, and Reservoir FHP (Figure 11). The Reservoir FHP, however; is national in scope and therefore not included in figure 11. The ORBFHP has carefully considered this geographic overlap and taken steps to minimize duplication of effort accordingly, while still maintaining meaningful boundaries for our partnership. The reality of the situation is that it is impossible to simultaneously maintain meaningful boundaries and at the same time eliminate overlap between a watershed based partnership, like the ORBFHP, and a state based partnership (e.g., SARP), a system based partnership (e.g., Midwest Glacial Lakes FHP), or a species range based partnership (e.g., EBTJV).

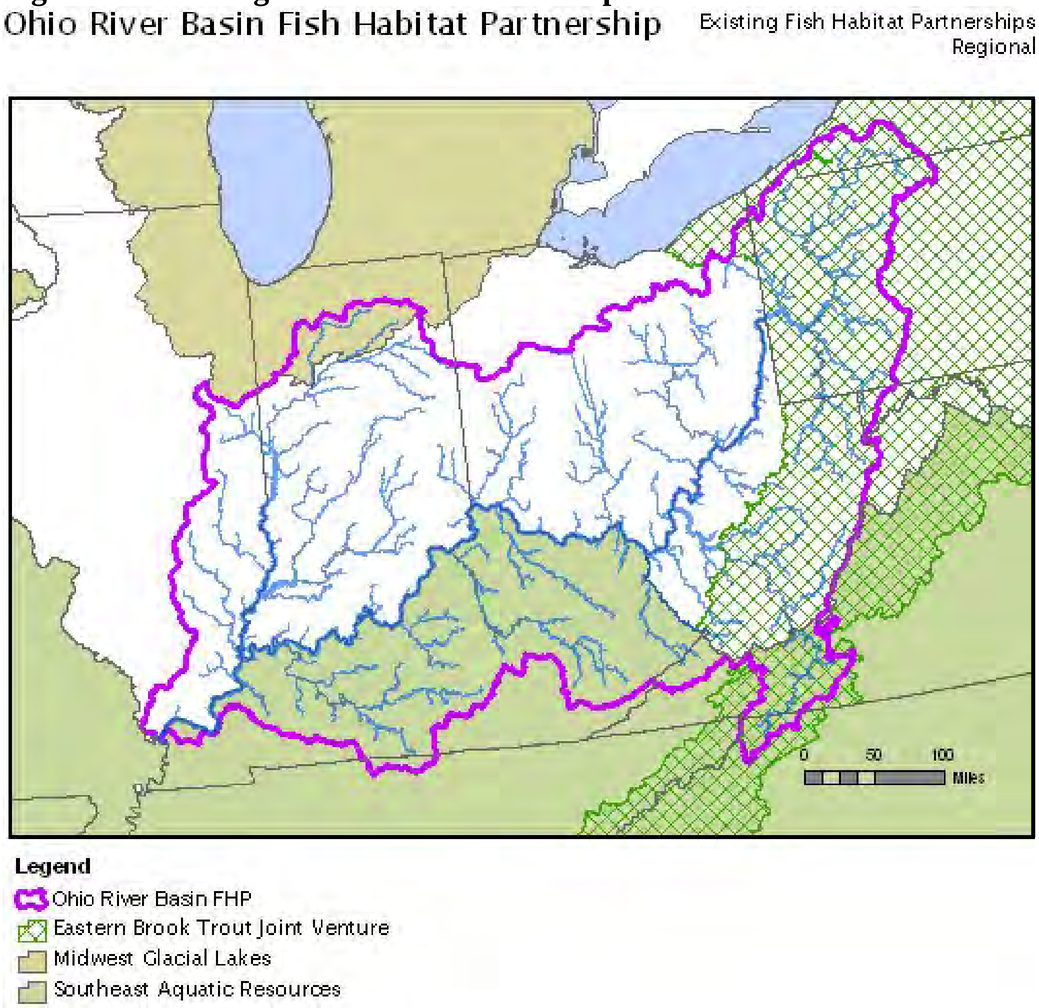
Discussions regarding overlap were extensive. In some cases, solutions were readily apparent, but this was not always the case. In a major step to minimize overlap, the ORBFHP drew the boundaries of our partnership to exclude the Tennessee River and Cumberland River drainages. This reduced the overlap with SARP from 8 to 4 states, with the only significant remaining overlap occurring in Kentucky.

Since then, ORBFHP members have had additional in-depth discussions with the Kentucky Dept. of Fish and Wildlife Resources, SARP, and other overlapping partnerships. The general consensus is that overlap is something that is inherent in the way partnerships were allowed to form. But it is also something that through close communication, the overlapping partnerships can achieve a synergy and strength that results in highly effective coordination and habitat protection/restoration gains.

The ORBFHP will work with SARP in a complementary rather than competitive fashion particularly in areas of mutual interest in Kentucky. We will also do everything we can to minimize redundancy. Currently, the ORBFHP Science and Monitoring Committee is working closely with the SARP Science and Data Committee. Through these and other efforts, the partnership will look for opportunities to collaborate and minimize duplication of effort.

In the case of the Reservoir FHP, we desire overlap because at the time we were establishing our conservation targets, we made a conscious decision not to pursue reservoirs as a target but rather to defer to the Reservoir FHP. We will take advantage of their reservoir assessment efforts as well as their strategies and actions to address reservoir issues.

Figure 11. Existing Fish Habitat Partnerships



Implementation

The partnership has formed a Science and Data Committee to address issues such as prioritization of action areas through a data-based assessment, organization of baseline data, and development of data and metrics to be used to measure long-term successes. This committee was formed by representatives of many of the agencies involved in the partnership. To aid in the accomplishment of the tasks assigned to this committee, several sub-committees have been formed.

A prioritization sub-committee will focus on developing a system to determine the order of importance of planned projects. A GIS sub-committee will be responsible for gathering, creating, and organizing useful shapefiles and datasets to answer geographic questions raised by the partnership. Finally, a habitat assessment sub-committee will be responsible for conducting an initial assessment of the Ohio River basin and providing a means of measuring the success of the partnership.

The partnership has designated a primary GIS expert with the Ohio Chapter of The Nature Conservancy who will act as a clearinghouse for all datasets and shapefiles available to measure baseline conditions and progress in habitat conservation. The partnership has obtained basin specific data sets for the 17 landscape variables used in the Initial Assessment of the Status of Fish Habitat. The ORBFHP will continue to link to the Framework for Assessing the Nation's Fish Habitat by making an assessment of the Ohio River basin using these variables and referencing this initial assessment to document successful habitat protection and restoration. In addition to the national datasets, multiple partners working on relevant projects throughout the basin have shared their information with the partnership's GIS expert.

Technical resources available to the partnership include several up-to-date GIS systems as well as a single, organized set of GIS shapefiles and datasets gathered from various partners and other entities. Financial resources include significant time allotted to data analysis from not only the primary GIS expert, but also multiple other capable GIS users from various partnering entities who will be available to assist with prioritization, assessment, and monitoring tasks as necessary.

Focusing of Partnership Resources

The ORBFHP will evaluate cooperative projects submitted by partnership members or applicants for funding rigorously within the framework of its mission statement and guiding principles. Additionally, priority consideration will be will be given to those projects that address identified data gaps, aspects of the basinwide habitat assessment, and/or directly address the ORBFHP Objectives.

Applicants meeting partnership priorities will be encouraged to implement habitat protection/restoration projects at Early Action Sites or subsequent Priority Areas identified from the basinwide assessment by the allocation of 80% of its funding to these sites. Finally, the ORBFHP intends to achieve maximum conservation leverage of funding and the time commitment of its members by the application of simple benefit-cost ratios (i.e., number of stream miles improved/connected or acres of floodplain restored/connected per dollar/person hours expended) as well as evaluating project feasibility in any review process.

Partnership Coordination Framework

The ORBFHP faces significant coordination workload due to the physical size of the partnership area and the number and severity of threats to its key habitats. It is anticipated that a full-time Coordinator will be needed to provide administrative support to the Steering and Coordination Committee and act as a liaison with the NFHAP Board, and key partners. In addition, there will be a need to coordinate with other major efforts on the Ohio River, such as the USACE's Ohio River Ecosystem Restoration Authorization (WRDA 2000) or any subsequent future authorizations.

In 2000, the Great Lakes and Ohio River Division of the Corps was authorized by Congress to create an Ohio River Ecosystem Restoration Program for the *main stem* of the Ohio River in Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois. This program would restore significant ecosystem function, structure, and dynamic processes (that have been degraded) to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. The program would be initiated and monitored by a partnership of federal and state resource agencies and regional environmental interest groups. The authorization would have provided up to 200 million dollars in federal funding although funds were never appropriated to implement the restoration program beyond an initial $1,000,000 for an ongoing reconnaissance study (and the Ecosystem Restoration Program (ERP) was de-authorized. Within the past month language has been introduced to create a new ERP authorization in what would be the Water Resources Act of 2010. The new authorization would allow the appropriation of up to 250 million dollars in federal funds for restoration within the ORBFHP's portion of the *Ohio River Basin.*

An effort could be made by the ORBFHP to use the lobbying ability of some of its members to secure an appropriation to fund this program if it is adopted in WRDA 2010. In any case, the ORBFHP will have the ability act as an umbrella organization with agreed upon priorities to interact with the USACE in any applicable authorizations. Similar needs/opportunities are envisioned with other sweeping conservation programs including anticipated climate change adaptation funding.

Effective internal and external communication will be needed to accomplish the ambitious role that the ORBFHP envisions. To this end the Partnership and Outreach Committee will maintain a dedicated ORBFHP website for the purposes of external communications (e.g., informational and educational purposes, RFP postings, research, project status updates). A special emphasis will be placed on building relationships with local watershed groups.

Internal communication to partnership members and their representatives will take place through the use of a listserve, videoconferencing, and/or annual meetings. We have also been very effective with and are proud of the fact that our partnership is built primarily by one on one contact with groups and individuals. We believe this will best result in an inclusive and lasting partnership.

Evaluation and Reporting

The ORBFHP will abide by its fourth guiding principle that states *Use of sound science and measurement of results are foundational.* Partners have already donated significant amounts of time preparing an initial assessment of the condition of the major watersheds in the basin as well as ranking the impact of future stressors to those watersheds. The condition assessments and threat rankings were based on expert opinions from throughout the Ohio River basin. These same experts could also grade the watersheds they are familiar with in the context of the Biological Condition Gradient (BCG) developed by the USEPA. On a regular basis throughout the existence of the partnership, local experts could be asked to re-grade these same watersheds. Comparisons of the BCG from different time periods would be one measure of the progress of the partnership.

Other potential metrics used by the partnership to report progress include existing state-developed biological indices using fish and macroinvertebrates. Each state in the basin currently has existing numerical biological criteria in place using one or both of these groups and assessments of watersheds and/or stream reaches have been conducted and reported to the USEPA on a biannual basis in the form of 305b (or integrated) reports. Other metrics include results of periodical national surveys such as USEPA's National Rivers and Streams Assessment or USGS's National Water Quality Assessment.

In addition, raw biological and water quality data collected as part of national surveys and by state agencies for routine assessments are currently being gathered and organized by the partnership. The biological datasets will be assessed using various species diversity metrics and by several diversity indices such as the Modified Index of Centers of Diversity (MICD) which highlights areas that have high abundances of the rarer species in a basin. Finally sufficient hydrologic and morphological data exists throughout much of the ORBFHP area to utilize the Hydro QHEI, (a hydrologic index developed by former Ohio EPA employees now with the Midwest Biodiversity Institute) or the Index of Hydrologic Alteration developed by the Nature Conservancy (Citation).

The ORBFHP will also evaluate progress measures (i.e., comparing on the ground implementation of strategic actions to the expected achievement date). Ultimately though, the success of the ORBFHP will be evaluated against the status of conservation target viability rankings throughout the basin. Continuation of or revisions to cross cutting habitat improvement strategies and their strategic actions will be informed by the response and rate of progress in the viability of conservation targets (as measured by the maintenance and/or improvement of their key ecological attributes).

The partnership will continue to link to the Framework for Assessing the Nation's Fish Habitat by completing an assessment of the Ohio River basin using these variables and referencing subsequent assessments to document successful habitat protection and restoration. The ORBFHP intends to communicate progress measures to the National Fish Habitat Board on an annual basis and conservation target status evaluations at 5 year intervals. Data from and results of comprehensive habitat assessments will be transferred or reported to the National Science and Data Committee within 1 year of completion. GIS files will be maintained by a designated ORBFHP member and available to the Board or its committees upon request.

Revisions

The ORBFHP strategic plan will be revised every 5 years in the absence of a significant need for planning. Significant changes to habitat improvement/protection strategies and/or strategic actions that occur as result of unanticipated threats or changes in severity/scope of known ones would trigger a strategic plan revision. Other causes for revision would include adaptive management changes revealed by habitat assessment information, revision of conservation targets, or significant change in partnership composition.

Appendices

Appendix a. HUC-4 Units of the Ohio River Basin (Excluding the Tennessee River Basin and Cumberland HUC)

HUC Unit Name	States Drained	Watershed Area (Sq mi)
Allegheny	NY and PA	11,600
Monongahela	MD, PA, and WV	7,310
Upper Ohio	WV and OH	13,200
Muskingum	OH	7,980
Kanawha	NC, VA, and WV	12,200
Scioto	OH	6,440
Big Sandy-Guyandotte	VA, WV, and KY	5,900
Great Miami	OH and IN	5,330
Middle Ohio	WV, OH, KY, and IN	8,850
Kentucky-Licking	KY	10,500
Green	TN and KY	9,140
Wabash	OH, IN and IL	32,600
Lower Ohio	KY, IN, and IL	12,500
Total Watershed		143,550

Appendix b. Great River Fish Viability Assessment Example

Viability Assessment

Viability assessment looks at a range of indicators (status of selected KEAs) to determine poor, fair, good, and excellent condition ratings. These are used to classify current status and set objectives to achieve desired future conditions.

Example

Great River Fishes

Landscape Condition-(selected reaches)

- **Number/mi of rock&cobble riffles/bars**

Poor	Fair	Good	Excl
<1	1-2.9	*3-4.9*	>5

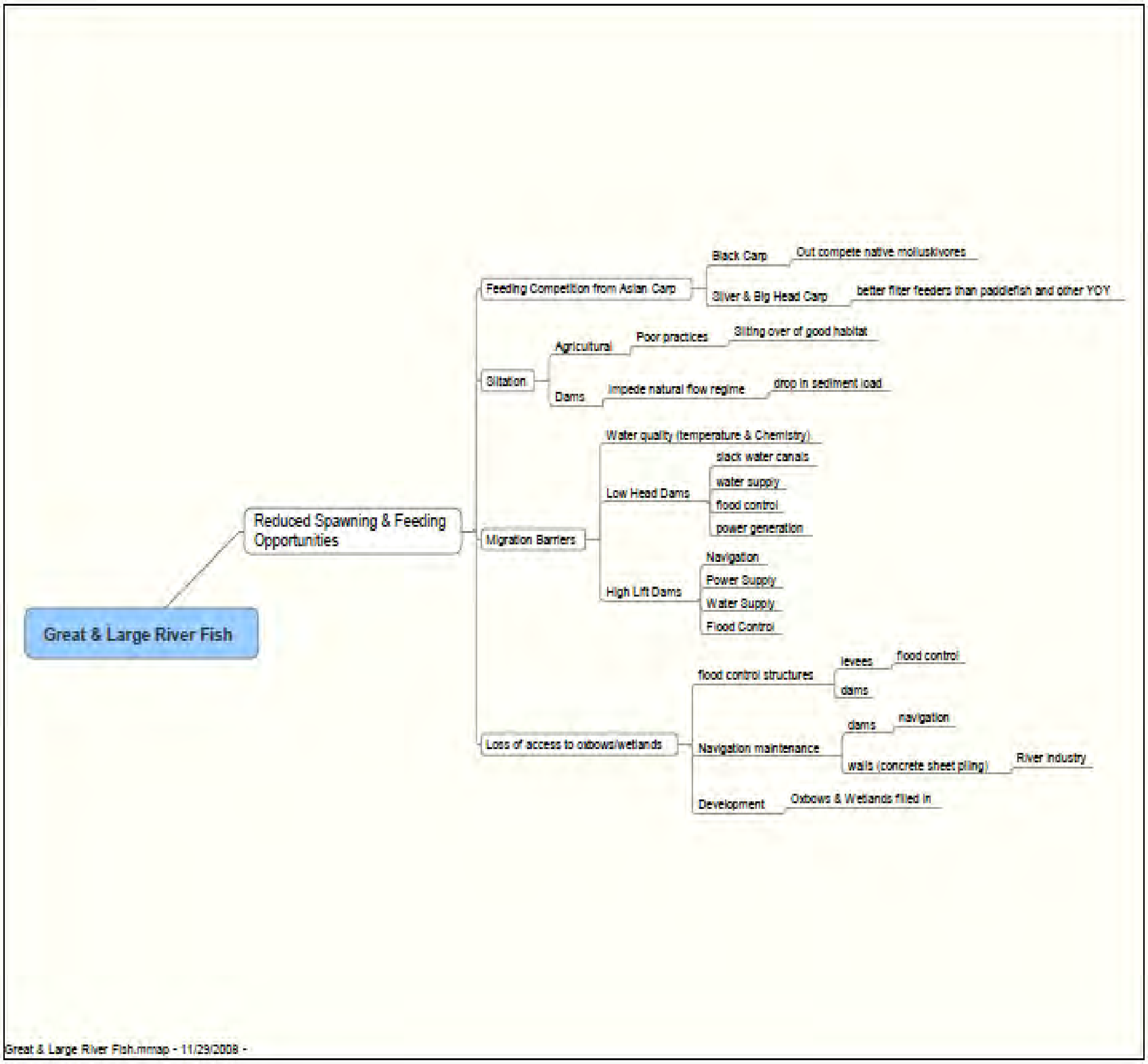
Appendix c. Threats to Conservation Targets

	Threats Across Targets	Native Mussels and Hosts	Great and Large River Fish	Medium Sized River Fish	Headwater/ Small Stream Fish	Off Channel Systems	Native Aquatic Vegetation	Overall Threat Rank
	Project-specific threats	1	2	3	4	6	7	
1	Class III Dams (25 - 40 feet high)	High	High	High				High
2	Impervious Surface run-off (CSO and SSO)	High		Medium	High		Medium	High
3	Agricultural Sedimentation	Medium	-	High	High	Medium	High	High
4	Class IV (Lowhead) and smaller dams	High		High	Medium			High
5	Sediment from mining			High	Low			High
6	Class I and II Dams (>40 feet tall)	High	High					High
7	Invasive Fish Species	Medium	High		Low			Medium
8	Sediment from Urban Development		-	High	Medium			Medium
9	Acid Mine Drainage	Medium					High	Medium
10	Changing Climates (water temp)		Medium	High				Medium
11	Rusty Crayfish		High				Medium	Medium
12	Water Temperature	High		Medium				Medium
13	Zebra Mussels	High	Medium					Medium
14	Atmospheric Deposition			High	Low			Medium
15	Channelization			High	Low	High		High

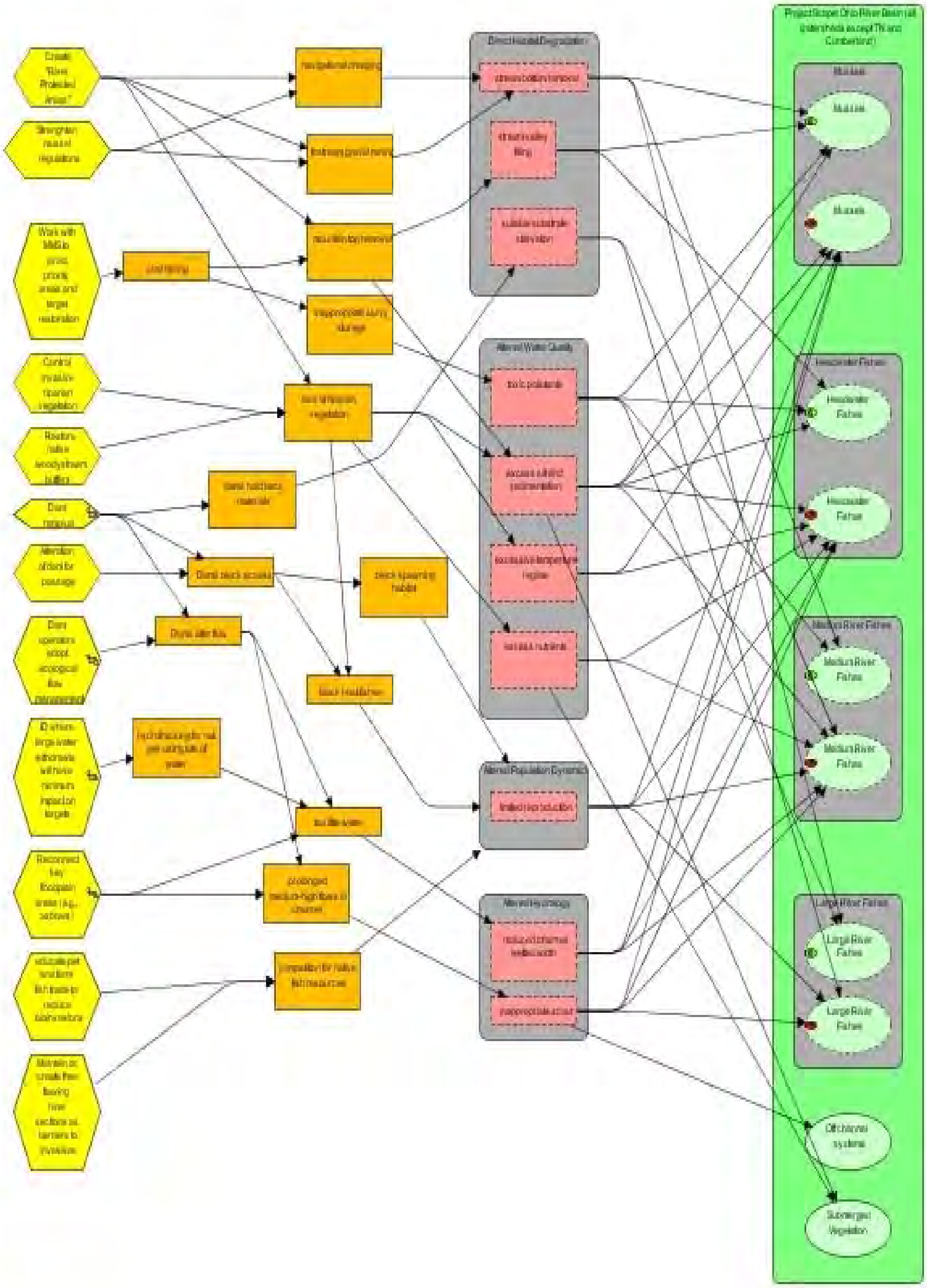
	Threats Across Targets	Native Mussels and Hosts	Great and Large River Fish	Medium Sized River Fish	Headwater/ Small Stream Fish	Off Channel Systems	Native Aquatic Vegetation	Overall Threat Rank
	Project-specific threats	1	2	3	4	6	7	
16	Sediment from Silviculture			High	Low			Medium
17	Culverts and Bridges				High			Medium
18	Flood Control Structures (dikes, levees)		Low	High		High		High
19	Instream Channelization				High			Medium
20	Invasive plants (riparian)				High			Medium
21	Change in Land Use		High					Medium
22	Channel Dredging (commercial gravel mining)	High						Medium
23	Coal prep plants	High						Medium
24	Connectivity Loss		High					Medium
25	Development - land use change	High				High		High
26	Downcutting			High				Medium
27	Endocrine Disruptors		-	High				Medium
28	Established Invasive Competition						High	Medium
29	Invasive Species			High				Medium
30	Lack of Host Fish	High						Medium

	Threats Across Targets	Native Mussels and Hosts	Great and Large River Fish	Medium Sized River Fish	Headwater/ Small Stream Fish	Off Channel Systems	Native Aquatic Vegetation	Overall Threat Rank
	Project-specific threats	1	2	3	4	6	7	
31	Levees - urban			High				Medium
32	Marcellous shale drilling	High						Medium
33	Non Point Source Contaminants			High				Medium
34	Point Source Contaminants			High				Medium
35	Sediment from Livestock			High				Medium
36	Surface Mining	High						Medium
37	Urban Ditching			High				Medium

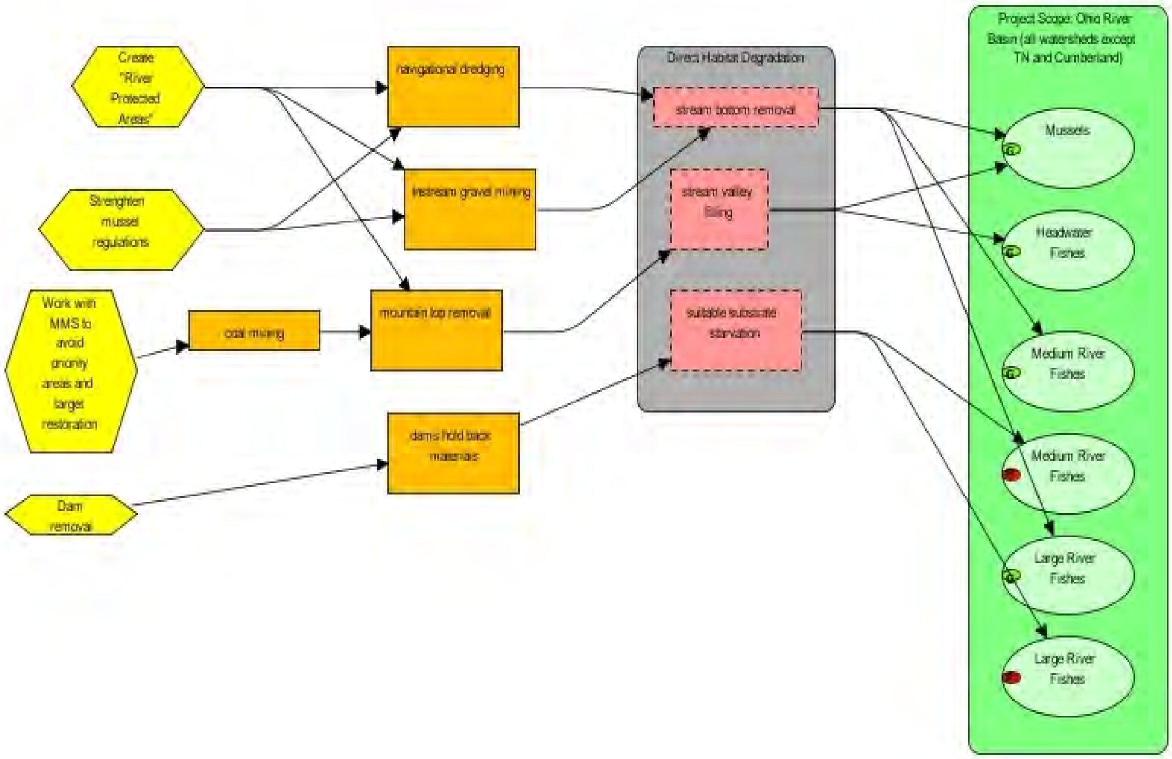
Appendix d. An Example of Situation Analysis Diagram



Appendix e. Situation Analysis of Habitat Type-Mega Threats



Appendix f. Direct Habitat Degradation Threat-Habitat Type Situation Analysis



Appendix g. ORBFHP Partnership Diversity and Strength

Ohio River Fish Management Team

The Ohio River Fish Management Team (ORFMT) was formed in 1990 and consists of state fisheries conservation personnel from the Ohio River main stem states of PA, WV, OH, KY, IN, and IL. The ORFMT works cooperatively to assess the fisheries of the Ohio River and seeks to apply fisheries management techniques in a holistic manner. The ORFMT also serves as the Ohio River sub-basin group within the structure of MICRA, the Mississippi Interstate Cooperative Resource Association that combines the efforts of 28 state natural resource departments to improve interjurisdictional river resource management in the Mississippi River Basin. Population dynamics information collected in the past and future by this group will serve as an important database for evaluating the success of ORBFHP habitat conservation/restoration strategies within the main stem of the Ohio River.

Kentucky Nature Preserves Commission

The Kentucky Nature Preserves Commission protects Kentucky's natural heritage by (1) identifying, acquiring and managing natural areas that represent the best known occurrences of rare native species, natural communities and significant natural features in a statewide nature preserve system; (2) working with others to protect biological diversity; and (3) educating Kentuckians as to the value and purpose of nature preserves and biodiversity conservation (Citation). The current focus on inventorying rare native species (including freshwater mussels) within the state of Kentucky is particularly beneficial to the present and future efforts of the ORBFHP because virtually all of the state drains to the Ohio River and the waters of Kentucky include the highest number of main-stem river miles within the basin.

US Fish and Wildlife Service

The US Fish and Wildlife Service is one of the primary originators and sponsors of the National Fish Habitat Action Plan and plays a major role within the ORBFHP as both a facilitator of this partnership formation process (via a strategic planning grant from the Carterville, Illinois Fisheries Office) and as stakeholder in future work. A key USFWS site within the basin is the Ohio River Islands NWR. This refuge was established in 1990 to protect, conserve, and restore habitat for wildlife native to the river and its floodplain (USFWS cit). Ohio River Islands currently consists of twenty-two islands and three mainland tracts totaling approximately 3,300 acres that are scattered along nearly 400 miles of the Ohio River. Planning is underway to evaluate mainland wetlands and backwater areas for possible inclusion in the refuge. The Ohio Islands NWR is currently authorized to acquire up to 8,000 acres within the main stem and associated corridor of the Ohio River between Pittsburgh, Pennsylvania and Cincinnati, Ohio.

US Army Corps of Engineers

The USACE through its Great Lakes and Ohio River Division (commonly referred to as the Lakes and River Division or LRD) has federal jurisdiction over the navigable waters of the basin and operates and maintains an extensive series of locks and dams for navigation on the main stem and major tributaries to the Ohio River through its Pittsburgh, Huntington, Louisville, and Nashville districts. In regard to its jurisdiction in navigable waters, the LRD also conducts regulatory permitting processes through the Clean Water Act. The LRD also is responsible for flood control within much of the basin. The LRD operates 78 multi-purpose reservoirs (some with associated hydropower production) and 5 single purpose dry dams (flood control only) on a number of tributaries within the basin.

Ohio River Valley Water Sanitation Commission
The Ohio River Valley Water Sanitation Commission (commonly referred to as ORSANCO) is an interstate commission that was created in the 1940s in response to widespread and severe pollution at the time within the main stem of the Ohio River from Pittsburgh, PA to its confluence with the Mississippi River. ORSANCO is responsible for creating and implementing water quality and other environmental health related regulations along the Ohio River main stem.

ORSANCO is a particularly strong partner for not only achieving future success of the ORBFHP but also measuring outcomes as a part of its mission requires monitoring water quality parameters and biological indicators within its purview. To this end, ORSANCO maintains an extensive series of water quality monitoring stations and biological sampling sites and conducts annual fish and macroinvertebrate population sampling at various locations within the Ohio River. Sample data at many sites extends back to the mid 1950s.

US Geological Survey
The US Geological Survey through its Surface Water Division operates the nation's largest network of real-time stream flow gages and is at the forefront of water related science research and application. USGS currently operates an extensive network of stream gages within the Ohio River basin and is engaged in number of cooperative water resource/biological studies with stakeholders.

Within the context of the ORBFHP, the USGS has unique water quality and hydrology modeling expertise that address prima fascia basin threats such as sedimentation (SPARROW) and altered hydrology (IHA equivalent). USGS also possesses extensive groundwater hydrology expertise and modeling ability not found in other partnership team members.

US Forest Service
The US Forest Service is both a stakeholder in the Ohio River basin and a key to the future success of the ORBFHP. The USFS operates a number of forest units within the PA, WV, OH, KY, and IN portions of the watershed that cumulatively exceed X acres. Within these forests the Forest Service regulates timber harvest and road crossings along a large number of headwater stream reaches.

In recent years the USFS has been a national leader in developing timber harvest and unpaved road maintenance BMPs that reduce sedimentation through the use of their WEPP (Watershed Evaluation Prediction Program) model. The Forest Service has also been an innovator in stream crossing design and has recently begun to sponsor a number of workshops on stream crossing designs and techniques that promote aquatic organism passage. In a similar manner, several national forest units within the Ohio River basin have sponsored workshops at the state level to facilitate USFS expertise and technology transfer regarding headwater aquatic organism passage.
US Environmental Protection Agency

The US Environmental Protection Agency is a natural fit within the ORBFHP given its authority under the Clean Water Act to regulate the nation's water quality and provide funding for the restoration of it. EPA's National Exposure Research Laboratory is located nearly in the geographic center of the Ohio River Basin in Cincinnati, OH and includes a focus on aquatic toxicity. Cincinnati based staff have been involved in the ORBFHP from its beginnings contributing greatly to the partnership's water quality expertise.

The Nature Conservancy

The Nature Conservancy (TNC) is an international, non-profit science-driven conservation organization dedicated in part to the preservation of aquatic biodiversity and the lands and waters needed for its survival. As the largest private conservation organization in the world it has well developed conservation planning and stream flow expertise, and GIS analysis capabilities. In the past 2 years the Conservancy has expanded its efforts to conserve and restore functioning of entire aquatic systems such as the lower Great Lakes-St Lawrence River and the Ohio River. The Nature Conservancy in Ohio acts as the Ohio River planning and project lead and coordinates with various state operating units from New York to Illinois to carryout conservation strategies at scale.

Within the scope of the ORBFHP the Conservancy received a grant from the USFWS through the Carterville, IL Fisheries Office to lead the strategic planning process for the candidate partnership and develop a business plan as a part of the application to the National Fish Habitat Board for full partnership status. As a private conservation organization TNC has a track record within the Ohio River Basin of working well at many different scales with private landowners, state and federal conservation agencies, and advocacy groups. A number of ongoing TNC activities such as a developing MOU with the USACE LRD and a GIS based floodplain analysis strengthen the effectiveness of the ORBFHP. Additionally TNC-OH possesses a dedicated GIS position that has contributed to developing preliminary basin-level analysis for the partnership.

Ohio River Foundation

The Ohio River Foundation (ORF) was created in 2000 and is based in Cincinnati, OH. ORF's mission is to protect and restore the water quality and ecology of the Ohio River and its tributaries for the health and enjoyment of present and future generations. As a foundation whose focus is solely on the Ohio River and its basin the ORF adds strength and depth to the resources and connections of the ORBFHP.

Marshall University

Marshall University is located in Huntington, WV in close proximity to the Ohio River and USACE Huntington District Headquarters. The Ohio River and its tributaries have long been of interest to university staff and student and a number of research projects have been conducted including those funded or otherwise facilitated by the Huntington District. Marshall staff have also been of great assistance during the formation of the ORBFHP serving as volunteer hosts and designers for the partnership's web page. University staff and students could serve as a future research source.

University of Cincinnati

The University of Cincinnati also has a strong interest in the Ohio River watershed and has conducted a number of research projects on Ohio River tributaries within Ohio and Kentucky. University staff was of invaluable assistance in providing information on ecological relationships of smaller headwater streams to major tributaries during the ORBFHP strategic planning process and could serve as a future research source.

Appendix h. Composition and Function of ORBFHP Committees

<u>Steering and Coordination Committee:</u>

- **Illinois Division of Fisheries**
- **Indiana Division of Fish and Wildlife**
- **Kentucky Department of Fish and Wildlife Resources**
- **Ohio Division of Wildlife**
- **Pennsylvania Fish and Boat Commission**
- **West Virginia Division of Natural Resources**
- Other states in the basin would have a seat available upon request
    - Maryland Fisheries Service
    - New York Department of Environmental Conservation; Division of Fish, Wildlife and Marine Resources
    - North Carolina Wildlife Resources Commission
    - Tennessee Wildlife Resources Agency
    - Virginia Department of Game and Inland Fisheries
- **USDA-NRCS**
- **USACE**
- **USEPA**
- **USFS**
- **USFWS**
- **USOSM**
- **USGS**
- **ORSANCO**
- **TNC**
- **At large seats** for the following groups to rotate every 2 years.
    - 1 seat for a large environmental NGO (e.g., Sierra Club, Audubon, AFS)
    - 2 seats for universities
    - 2 seats for environmental user businesses (e.g., Bass Pro, Dicks)
    - 2 seats for industries (e.g., utilities, barge companies)
    - 2 seats for environmental user groups (e.g., TU, bass clubs)
    - 2 seats for local/regional government
    - 1 seat for local watershed group or watershed coalition

The primary function of the Steering and Coordination Committee members will be to move the overall partnership in the direction that is most beneficial to meeting our mission and objectives. This group will be co-chaired by a state DNR and the USFWS. Where appropriate, those on the committee should be at a level in their agency/organization to commit resources, whether financial or in kind.

Decisions will be reached by consensus but if needed, a vote will be used. Only decisions with a 3/4 majority vote will be acted upon to help maintain the cooperative nature of the partnership (i.e., only strongly supported decisions, either by consensus or majority vote will move forward). Selections for at large seats will be made by standing members of the Steering and Coordination Committee.

Coordinator:
- USFWS

Coordinator will work with all committees to facilitate and coordinate various aspects of the FHP. The Coordinator role is currently filled by USFWS, but could be filled by other appropriate agencies in the future.

Science and Monitoring Committee:
- BHE Environmental, Inc.
- Marshal University
- ORSANCO
- Pennsylvania Fish and Boat Commission
- The Nature Conservancy
- USEPA
- USGS

This committee works with the Steering and Coordination Committee to determine what data are available and how best to combine them to assess current habitat and how best to measure our future improvements to the basin. Membership is open to interested individuals.

Partnership and Outreach Committee:
- Indiana DNR
- Kentucky State Nature Preserves Commission
- Marshall University
- Ohio River Foundation
- Pennsylvania Fish and Boat Commission
- Sierra Club
- USFWS

This committee will work with the Steering and Coordination Committee to identify and recruit additional people/groups that are beneficial to the ORBFHP. This committee will also to make sure that we have good information and tools to reach out to prospective new members of our group, and that we have long-term capabilities in place for communicating with existing partners and for recruiting new ones. Membership is open to interested individuals.

Implementation Committee:
- USFWS

This committee will grow as implementation grows to help be sure that we are effective in translating planning into action. Membership is open to interested individuals.

Fundraising Committee:

- open

This committee has been formed in concept and is yet to be populated. Its key function is to compile funding opportunities and to match those funding opportunities to funding sources. Membership is open to interested individuals.

Other Committees:

- open

Additional committees will be formed as needs arise and as approved by the Steering and Coordination Committee.

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Appendix V – Southeast Aquatic Resources Partnership Strategic Plan

The Partnership would focus on six key issue areas that encompass those activities that the Service and the States can work in partnership and will provide the greatest benefit to the resources. These issues are not separate or distinct. They should be woven together at every opportunity. Partnership is woven through each issue.

1. Increase recreational fishing and other sustainable uses of aquatic resources by the public. Successful fishery conservation in the United States has always depended upon the significant contributions of recreational anglers and commercial fisherman. Aquatic conservation efforts would not have succeeded without the support of the fishing public. Anglers are the primary catalysts of aquatic resource conservation. Without the recreational anglers and commercial fisherman, State resource agencies, the Fish and Wildlife Service, the National Marine Fisheries Service and the coastal Councils and Commission would be very limited in their scope in addressing fishery resource problems. Successful fishery conservation is a three-way partnership between Federal and States agencies and the public.

Objective 1.1: Increase and improve physical access to aquatic resources for fishing and other recreational related activities.

Objective 1.1.1: Provide appropriate access as identified in assessment/inventory.

Action: Conduct assessment of needs for public access (infrastructure, etc.) as part of coordinated assessment for meeting the goal of increasing recreational fishing and other sustainable uses of aquatic resources by the public.

Objective 1.2: Develop and implement a marketing program to increase participation in recreational fishing and other aquatic related recreation activities.

Objective 1.2.1: Evaluate effectiveness of messages.

Objective 1.2.2: Build messages for identified target groups.

Action: Survey people to market to as an element of coordinated assessment for meeting the goal of increasing recreational fishing and other sustainable uses of aquatic resources by the public..

Objective 1.3: Provide public programs to cultivate fishing and outdoor recreation skills, and promote ethical use of natural resources.

Objective 1.3.1: Incorporate best practices guidelines.

Objective 1.3.2: Evaluate the effectiveness of education programs.

Action: Coordinated assessment for meeting the goal of increasing recreational fishing and other sustainable uses of aquatic resources by the public.

Objective 1.4: Develop and implement management programs for recreational and commercial fisheries.

Objective 1.4.1: Identify management authorities for non-consumptive activities (partners).

Objective 1.4.2: Assure integrated management efforts among regulatory authorites.

Action: Coordinated assessment for meeting the goal of increasing recreational fishing and other sustainable uses of aquatic resources by the public.

2. Provide high quality angling opportunities at water development projects. Fishery mitigation in the Southeast is a joint Federal/State partnership involving the Fish and Wildlife Service and State resource agencies. Although clearly a Federal responsibility, the combined efforts of the Fish and Wildlife Service and the States have been successful in addressing fishery mitigation responsibilities resulting from the construction of numerous Federal water development projects throughout the Southeast. Although the goal is intended to target mitigation at all tailwaters, reservoirs, esturary, and marine environments, the actions address coldwater tailwater (trout) fisheries.

Models: Service's Mitigation Workgroup (ongoing active workgroup);

Objective 2.1: Improve and maintain water quality and quantity to meet state standards, also improve and maintain instream and riparian habitat.

Action: Inventory (cold) tailwaters existing conditions and proposed improvements to maximize angling opportunities in cold tailraces. Future inventories will include both coldwater and warmwater tailwaters.

Objective 2.2: Provide and maintain access to fisheries.

Action: Inventory (cold) tailwaters existing conditions and proposed improvements to maximize angling opportunities in cold tailraces. Future inventories will include both coldwater and warmwater tailwaters.

Objective 2.3: Continue to stock fish necessary to provide high quality fisheries to meet the needs of a diverse angling constituency.

Action: Inventory (cold) tailwaters existing conditions and proposed improvements to maximize angling opportunities in cold tailraces. Future inventories will include both coldwater and warmwater tailwaters.

Objective 2.4: Continuously monitor, evaluate and mange waters impacted by water development projects.

Action: Inventory (cold) tailwaters existing conditions and proposed improvements to maximize angling opportunities in cold tailraces. Future inventories will include both coldwater and warmwater tailwaters.

3. Reduce the numbers of imperiled species in the Southeast. Rapidly expanding human population growth is placing tremendous pressure on this country's aquatic ecosystems. The subsequent decline in the health of these ecosystems has resulted in the escalating imperilment of many of the aquatic species dependant on these ecosystems. It will take a coalition of State/Federal/Tribal/Private partners in order to reverse this trend and accomplish the specific goal of imperiled aquatic species recovery, which is part of the overall charge of ensuring fishable, swimable waters in sufficient quantity to meet the reasonable needs of Americans.

Models: Strategy for the Conservation and Recovery of Southeastern Imperiled Fishes (Southeastern Imperiled Fishes Working Group, 1999);

Objective 3.1: Delisting of currently listed species (State and Federal) through recovery actions.

Objective 3.1.1: Encourage universities to train scientists to address habitat/species issues.

Objective 3.1.2: Outreach and Inreach/Education

Objective 3.1.3: Build and expand partnerships.

Objective 3.1.4: Implement ecosystem-based conservation plans.

Objective 3.1.4.1: Develop ecosystem-based conservation plans.

Objective 3.1.5: Monitoring and assessment of existing projects.

Objective 3.1.6: Protect, conserve and restore aquatic habitat needed by imperiled species.

Objective 3.2: Prevent fish and other aquatic species from being listed.

Objective 3.2.1: Encourage universities to train scientists to address habitat/species issues.

Objective 3.2.2: Outreach and Inreach/Education

Objective 3.2.3: Build and expand partnerships.

Objective 3.2.4: Implement ecosystem-based conservation plans.

Objective 3.2.4.1: Develop ecosystem-based conservation plans.

Objective 3.2.5: Monitoring and assessment of existing projects.

Objective 3.2.6: Protect, conserve and restore aquatic habitat needed by imperiled species.

4. Protect, conserve and restore interjurisdictional fisheries in the Southeast. Interjurisdictional fisheries are defined as those aquatic resource populations that are managed by two or more States, nations, or Native American Tribal governments because of geographic distribution and migratory patterns. Because it is difficult, if not impossible, to impose political or jurisdictional boundaries upon living resources that freely migrate or move across these boundaries during the course of their lives, successful management of interjurisdictional fisheries resources requires a collaborative and coordinated approach between the governmental entities that share them.

Models: Chesapeake Bay Program,

Objective 4.1: Implement fishery management plans for southeast interjurisdictional fisheries.

Objective 4.1.1: Develop fishery management plans for southeast interjurisdictional fisheries.

Objective 4.1.2: Support interjurisdictional fisheries forums such as coastal fishery commission, councils, etc.

Action: Recommend scope (check list) to guide interjurisdictional fisheries management plans.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

Objective 4.1.3: Increase role and participation by U.S. Fish and Wildlife Service in interjurisdeictional forums.

Objective 4.1.4: Interjurisdictional fish priorities determined and recommendations made to the relevant forums.

Action: Population and habitat status review.

Action: Engage critical partners.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

Objective 4.1.5: Establish interjurisdictional fisheries forums by river system/watershed where needed.

Action: Population and habitat status review.

Action: Engage critical partners.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

Objective 4.2: Adaptive management plan for monitoring, evaluating and modifying fishery management plans.

Objective 4.2.1: Develop fishery management plans for southeast interjurisdictional fisheries.

Objective 4.2.2: Support interjurisdictional fisheries forums such as coastal fishery commission, councils, etc.

Action: Recommend scope (check list) to guide interjurisdictional fisheries management plans.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

Objective 4.2.3: Increase role and participation by U.S. Fish and Wildlife Service in interjurisdeictional forums.

Objective 4.2.4: Interjurisdictional fish priorities determined and recommendations made to the relevant forums.

Action: Population and habitat status review.

Action: Engage critical partners.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

Objective 4.2.5: Establish interjurisdictional fisheries forums by river system/watershed where needed.

Action: Population and habitat status review.

Action: Engage critical partners.

Action: Identify by management unit and decide on which interjurisdictional fisheries to work on next.

5. Aquatic habitats have appropriate biological, chemical and physical integrity to support healthy functional communities: The quality and quantity of aquatic habitats in North America and the Southeast, both inland and coastal, has essentially been in decline since European colonization. The bottom line is that past efforts of Federal and State agencies charged with the management of aquatic resources, with minimal notable exceptions involving the restoration of a few individual aquatic species (American alligator, American shad on the Susquehanna River, beaver, river otter, migratory Atlantic Coast striped bass), have been largely ineffective in halting a decline in aquatic habitats and species. Restoration and preservation of aquatic habitats, both in quality and quantity, is the keystone issue underlying the restoration, recovery, and sustainable use of aquatic resources.

One of the key initiatives identified in the "*A Partnership Agenda for Fisheries Conservation: Report of the Fisheries Program Strategic Plan Steering Committee to the Sport Fishing and Boating Partnership Council*" was the development of a National Aquatic Habitat Plan (NAHP). The initiative asks the Fish and Wildlife Service to assume a leadership role in convening a wide array of interests to begin the process to develop a NAHP. The NAHP as envisioned by the Steering Committee of the SFBPC would be an aquatic analog of the North American Waterfowl Management Plan, science-based, landscape-scale, partnership-driven model for habitat conservation. The Report stated " The Steering Committee believes a partnership effort on the scale of the highly successful North American Waterfowl Management Plan is needed to establish and achieve the national conservation goals necessary to rescue imperiled fisheries. As with many natural resource issues, responsibilities for management of aquatic habitats are under the jurisdiction of a wide array of Federal, State and Tribal entities. Thus, management of aquatic habitats is the responsibility of all of them – or none of them.

Models: Lower Mississippi River Conservation Committee (Lower Mississippi River Aquatic Resource Management Plan),

Objective 5.1: Geographical focus

Objective 5.1.1: Conduct geographical assessment

Action: Identify priority areas for restoration.

1. Prioritize areas for restoration
2. Determine restorative actions.
3. Implement actions
4. Monitor and evaluate progress

Action: Identify priority areas for protection

1. Prioritize areas for protection
2. Determine protection actions
3. Implement actions
4. Monitor and evaluate progress

Objective 5.2: Issue focus

Objective 5.2.1: Conduct geographical assessment

Action: Identify issues

1. Prioritize issues
2. Determine actions
3. Implement actions
4. Monitor and evaluate progress

6. Prevent and control the impact of invasive species on the ecological, economic and societal values of the Southeast. Aquatic nuisance species threaten the ecological stability of lakes, rivers and streams and the commercial and recreational activities dependent on these waters. Over 200 aquatic plant and animal species have been introduced into the United States. Approximately half of these are found in the Southeast. Many of these invasive species, such as the Asian carps and the Asian rice eel, can impact both commercial and recreational fishing opportunities.

Models: Great Lakes Aquatic Nuisance Species Panel

Objective 6.1: Prevent new aquatic nuisance species introductions in the Southeast.

Action: Enforce existing laws.

Action: Implement interdiction plan (Interdiction plan – state/regional).

Objective 6.2: Eradicate new aquatic invasive species, when possible.

Action: Rapid response (Rapid response plan – state/regional)

Objective 6.3: Limit the spread of existing aquatic invasive species in the Southeast.

Action: Strategy implementation (Control and management strategy – state/regional)

Objective 6.4: On-going actions crucial to the goal.

Action: Monitor and detect aquatic invasive species.

Action: Data and information management.

Action: Education and outreach

Action: Research and Development.

APPENDIX N – FEDERAL DISASTER DECLARATIONS

The Ohio River Basin has a long history of flood damages and loss of life due to flooding and severe storms that include flooding. Both continental low-pressure systems and tropical cyclones have delivered significant amounts of rainfall to the basin since the 1969 update of the basin plan. Each of these events has affected one or more counties with out of bank riverine flooding, associated flood damages and occasionally losses of life. Unfortunately a great number of structures and facilities remain at risk within the floodplains and floodways as indicated in Appendix A.

The recurrence of basin flooding events is exemplified in Figure 32 showing the distribution of Federally Declared Disasters associated with flooding and severe storms with flooding. As the graphic shows, nearly every basin county has been affected between 2000 and 2008 and in many cases, counties have been affected several times during that time period. Numerous counties in West Virginia, Kentucky, and Indiana have been included in disaster declarations between 7 and 9 times over this 9 year period. Table 13 shows the number of declarations that have been made over this time frame. Information from FEMA databases indicates that many structures in these hard-hit counties have suffered repetitive losses and without intervention through the FEMA HMGP or other agency programs (USACE or NRCS), these structures will remain at risk.

In addition to the string of disaster declarations between 2000 and 2008, there has been a rash of more recent flooding and severe storms with flooding events during 2009. The Figures numbered 33 through 38 show 2009 Federal Disaster Declarations in WV, KY, NY, AL, IN and TN. Both Individual and Public Assistance disaster recovery funds have been provided by FEMA in these six states and in numerous counties.

Exact numbers of affected properties or any losses of life within these declared areas were not available for this report, but disaster funds indicated in FEMA web sites numbered in the tens of millions of dollars. The listing of NFIP policies in force in Appendix A for the highlighted counties on the declaration map(s) indicates the potential numbers of structures that may have been affected during these recent and historical events.

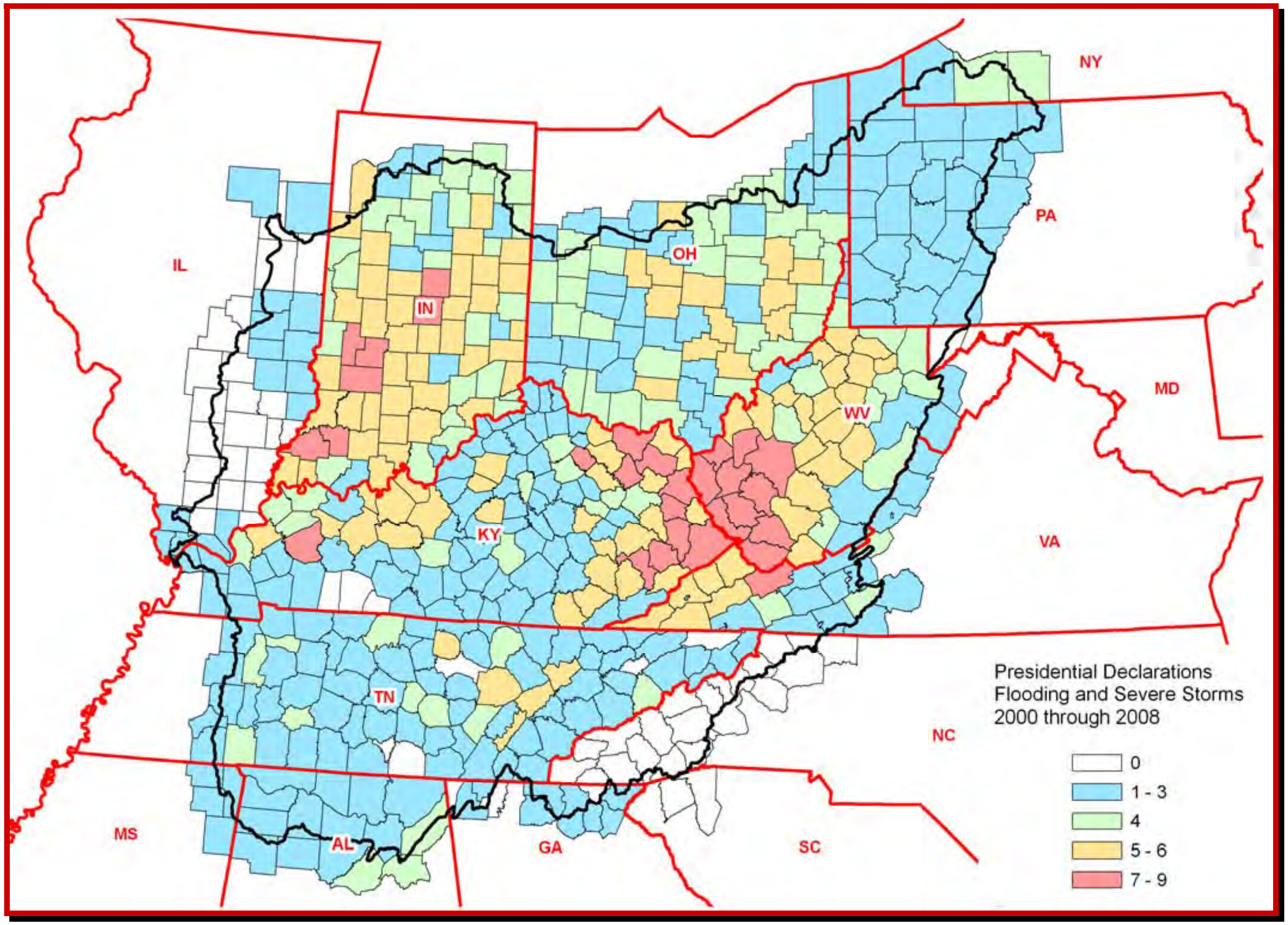

Figure 32 – Federally Declared Disasters (Flooding and Severe Storms with Flooding) 00–08

Table 13 – Federal Declarations for Flooding and Severe Storms with Flooding

State Name	Number of Disaster Declarations* (2000–2009)
West Virginia	11
Kentucky	14
Tennessee	10
New York	4
Pennsylvania	3
Maryland	0
Virginia	6
Illinois	3
Indiana	11
Georgia	1
Mississippi	2
North Carolina	1
Alabama	5
South Carolina	1
Ohio	9
Total	*81*

* *Associated with Flooding and Severe Storms with Flooding*

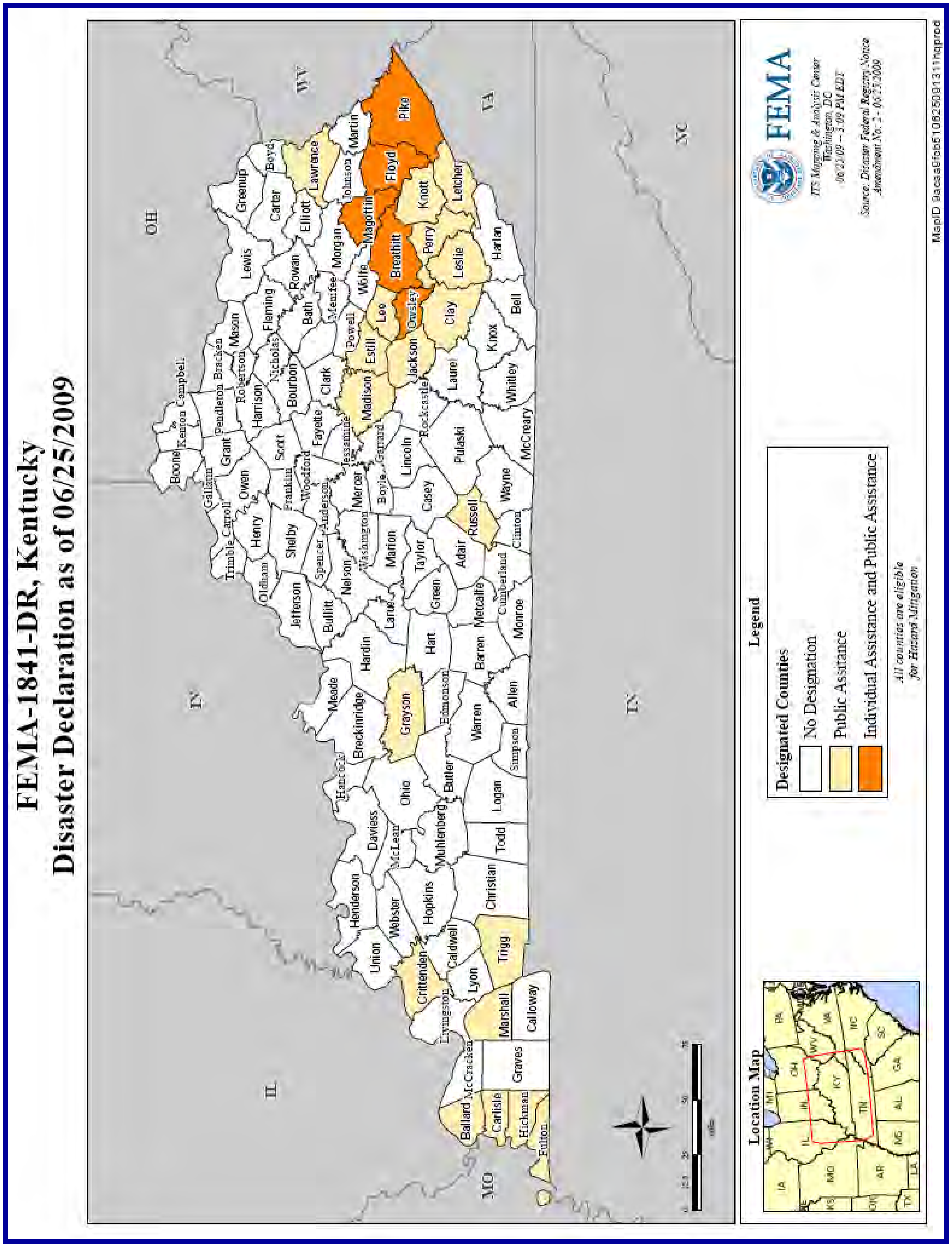

Figure 33 – Disaster Declaration for Kentucky in 2009

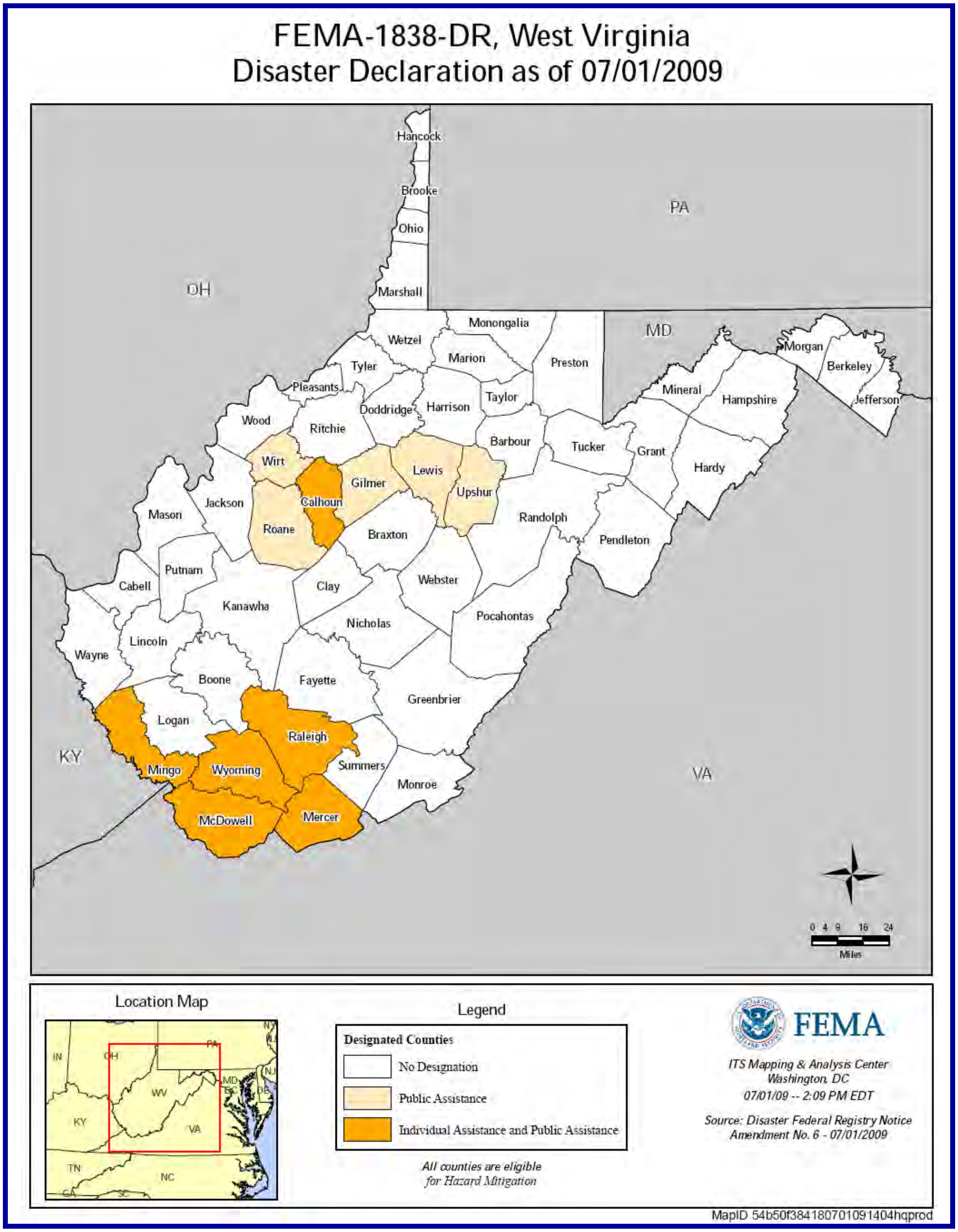

Figure 34 – Disaster Declaration for West Virginia in 2009

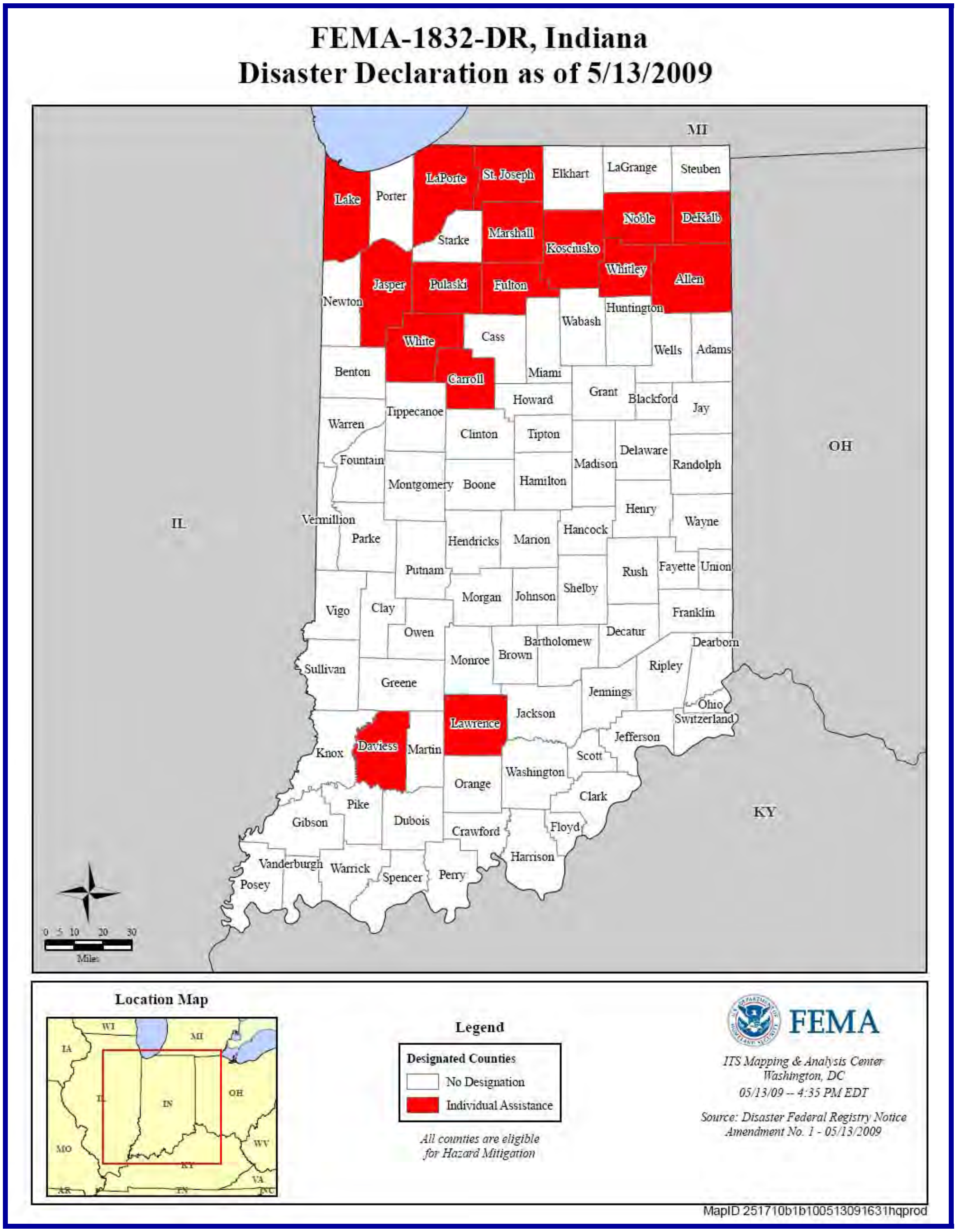

Figure 35 – Disaster Declaration for Indiana in 2009

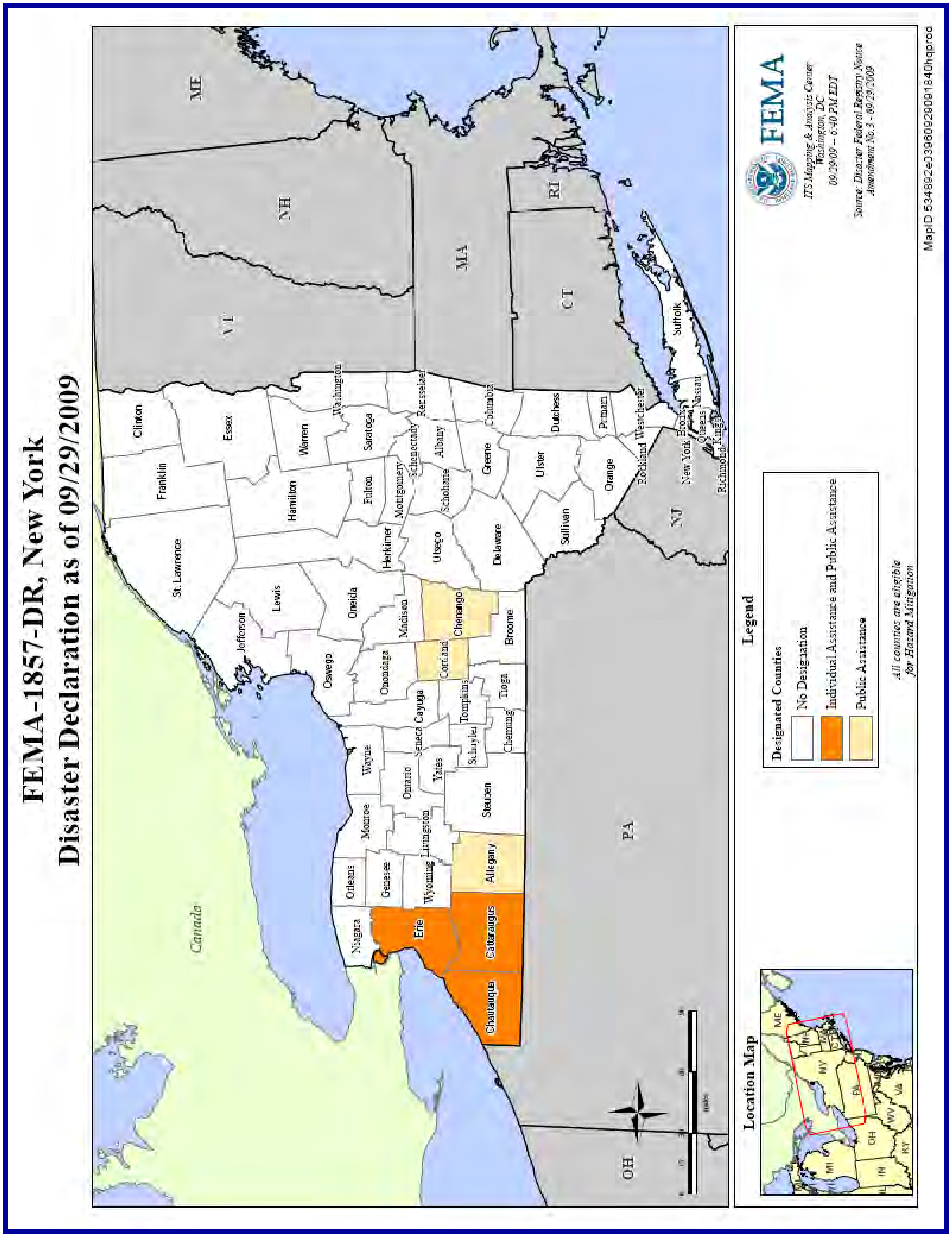

Figure 36 – Disaster Declaration for New York State in 2009

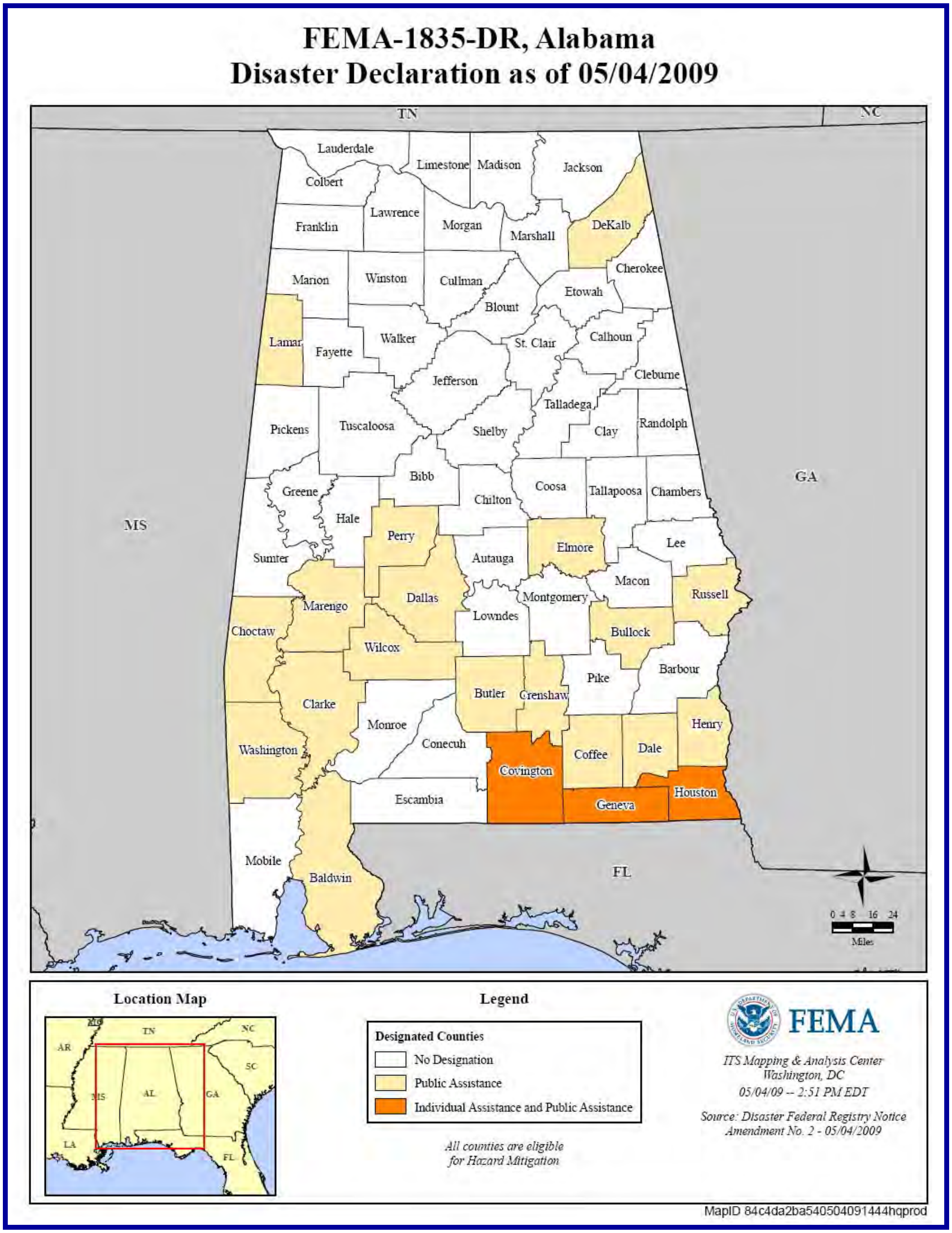

Figure 37 – Disaster Declaration for Alabama in 2009

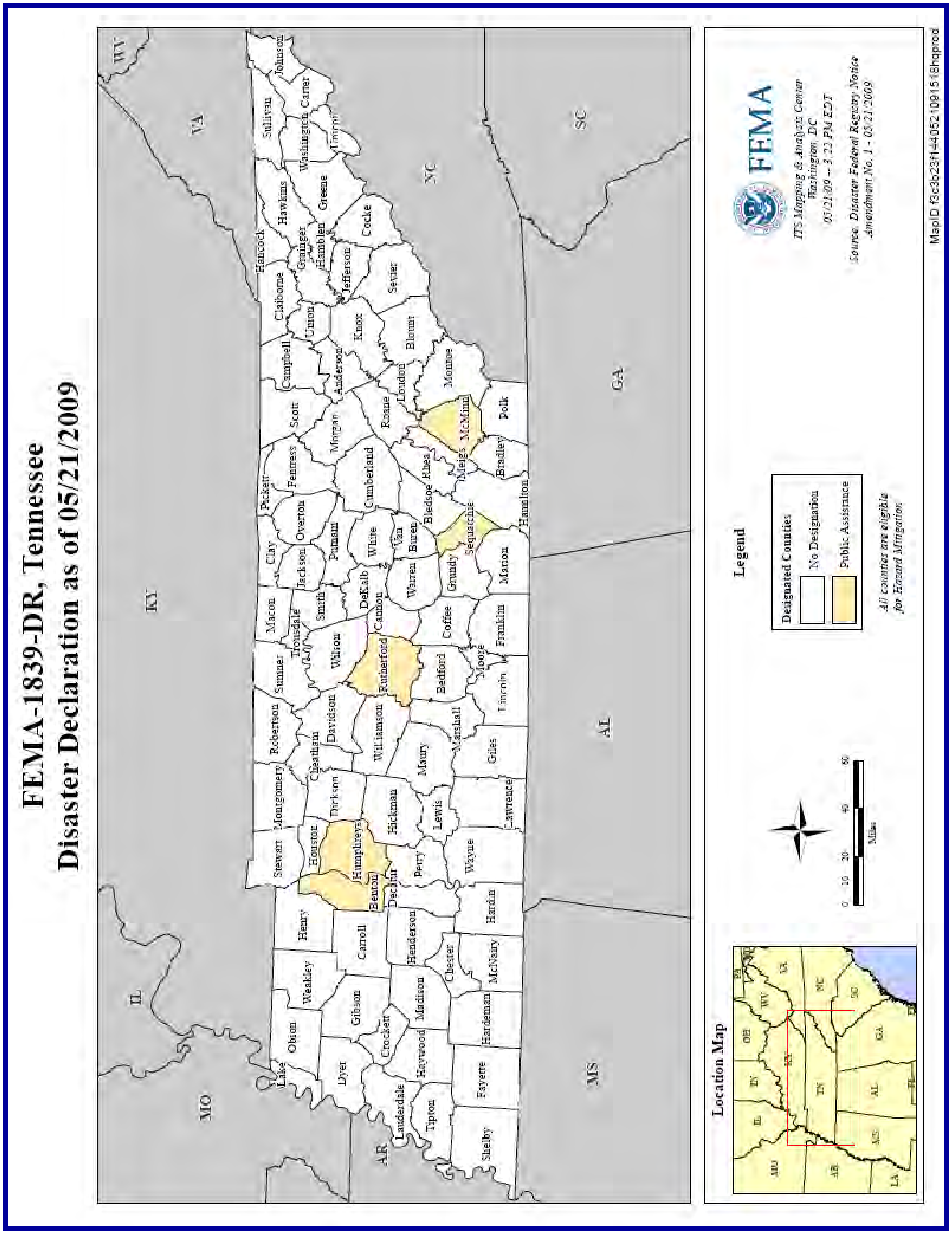

Figure 38 – Disaster Declaration for Tennessee in 2009

APPENDIX O – CONGRESSIONAL REPRESENTATION, GOVERNORS, AND COMMITTEE MEMBERSHIPS

Table 14 displays the array of state Governors and Congressional Interests at work in the 15 states that comprise the Ohio River Basin. This information was taken from the Congressional (THOMAS) web site and the National Governor's Association web site as of October 2009. The Nationalatlas.com web site version of the 110th congressional districts map was matched with the web site versions of the state watersheds to narrow down the House members.

As the table shows, there are 15 Governors of which 10 are Democrats and 5 are Republican. Of the 15 Governors, 10 are up for re-election in 2010. The others are scheduled for re-election in 2011 and 2012. After the upcoming election, the spreadsheet will be revised as needed to reflect any changes in the Governor positions. This array of State chief executives (and their departmental heads, DNRs, DEPs, etc.) represents those persons who may become future supporters/partners of any basin initiatives and these executive office persons are the foundation of any "Basin Coalition" or collaborative structure.

Of the 30 Senators representing the 15 states, 12 are Democrats and 18 are Republicans. Many of these current seats may face re-election challenges in November 2010 and some changes are possible. Of the 178 Representatives within the 15 states, 110 are Democrats and 68 are Republican. Many of these seats are facing re-election challenges in November 2010 as well. Of that total number of House members, only about 66 are located within districts that fall within the basin boundary. Those members are highlighted in yellow in the table. It is possible some of these seats could see a change in November.

The spreadsheet also includes the current committee memberships of the Senators and Congressman listed. In the current political configuration, 5 Senators are on the Authorization Committee (Environment and Public Works) and 9 Senators are on the Appropriations sub or full Committee. Of the House members, 12 are on the House Authorization Committee (Water Resources and Energy or Transportation and Infrastructure subcommittee) and 5 are on the House Appropriations sub or full Committee (based upon information in THOMAS).

Table 14 – Congressional Representation, State Governors, and Committee Memberships

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Alabama					
Governor	Bob Riley (R)	NA			
Senator	Jeff Sessions (R)	NA			
Senator	Richard Shelby (R)	NA			Yes
Representative	Aderholt, Robert	4th	Yes		
Representative	Bachus, Spencer	6th			
Representative	Bonner, Jo	1st			
Representative	Bright, Bobby	2nd			
Representative	Davis, Artur	7th			
Representative	Griffith, Parker	5th	Yes	Yes	
Representative	Rogers, Mike	3rd			
Georgia					
Governor	Sonny Perdue (R)	NA			
Senator	Saxby Chambliss (R)	NA			
Senator	Johnny Isakson (R)	NA			
Representative	Barrow, John	12th			
Representative	Bishop Jr., Sanford D.	2nd			
Representative	Deal, Nathan	9th	Yes		
Representative	Gingrey, Phil	11th	Yes		
Representative	Johnson, Henry C. "Hank" Jr.	4th			
Representative	Kingston, Jack	1st			
Representative	Lewis, John	5th			
Representative	Linder, John	7th			
Representative	Marshall, Jim	8th			
Representative	Broun, Paul C.	10th	Yes		
Representative	Price, Tom	6th			
Representative	Scott, David	13th			
Representative	Westmoreland, Lynn A.	3rd			

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Illinois					
Governor	Pat Quinn (D)	NA			
Senator	Richard Durbin (D)	NA			Yes
Senator	Roland Burris (D)	NA			
Representative	Bean, Melissa L.	8th			
Representative	Biggert, Judy	13th			
Representative	Costello, Jerry	12th	Yes	Yes	
Representative	Davis, Danny K.	7th			
Representative	Gutierrez, Luis	4th			
Representative	Foster, Bill	14th			
Representative	Hare, Phil	17th			
Representative	Halvorson, Deborah "Debbie"	11th			
Representative	Jackson Jr., Jesse L.	2nd			
Representative	Johnson, Timothy V.	15th	Yes	Yes	
Representative	Kirk, Mark	10th			
Representative	Lipinski, Daniel	3rd			
Representative	Manzullo, Donald	16th			
Representative	Quigley, Mike	5th			
Representative	Roskam, Peter J.	6th			
Representative	Rush, Bobby L.	1st			
Representative	Schakowsky, Jan	9th			
Representative	Schock, Aaron	18th			
Representative	Shimkus, John	19th	Yes		
Indiana					
Governor	Mitch Daniels (R)	NA			
Senator	Evan Bayh (D)	NA			
Senator	Richard Lugar (R)	NA			
Representative	Burton, Dan	5th	Yes		
Representative	Buyer, Steve	4th	Yes		
Representative	Carson, André	7th	Yes		

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Indiana (continued)					
Representative	Donnelly, Joe	2nd	Yes		
Representative	Ellsworth, Brad	8th	Yes		
Representative	Hill, Baron	9th	Yes		
Representative	Pence, Mike	6th	Yes		
Representative	Souder, Mark E.	3rd	Yes		
Representative	Visclosky, Peter	1st	Yes		Yes
Kentucky					
Governor	Steven Beshear (D)	NA			
Senator	Jim Bunning (R)	NA			
Senator	Mitch McConnell (R)	NA			Yes
Representative	Chandler, Ben	6th	Yes		
Representative	Davis, Geoff	4th	Yes		
Representative	Guthrie, S. Brett	2nd	Yes	Yes	
Representative	Rogers, Harold	5th	Yes		
Representative	Whitfield, Ed	1st	Yes		
Representative	Yarmuth, John A.	3rd	Yes		
Maryland					
Governor	Martin O' Malley (D)	NA			
Senator	Benjamin Cardin (D)	NA		Yes	
Senator	Barbara Mikulski (D)	NA			Yes
Representative	Bartlett, Roscoe	6th	Yes		
Representative	Cummings, Elijah	7th			
Representative	Edwards, Donna F.	4th			
Representative	Hoyer, Steny H.	5th			
Representative	Kratovil, Jr.	1st			
Representative	Ruppersberger, Dutch	2nd			
Representative	Sarbanes, John P.	3rd			
Representative	Van Hollen, Chris	8th			

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Mississippi					
Governor	Haley Barbour (R)	NA			
Senator	Thad Cochran (R)	NA			Yes
Senator	Roger Wicker (R)	NA			
Representative	Childers, Travis	1st	Yes		
Representative	Harper, Gregg	3rd			
Representative	Taylor, Gene	4th			
Representative	Thompson, Bennie G.	2nd			
New York					
Governor	David Patterson (D)	NA			
Senator	Kirsten Gillibrand (D)	NA		Yes	
Senator	Charles Schumer (D)	NA			
Representative	Ackerman, Gary	5th			
Representative	Arcuri, Michael A.	24th			
Representative	Bishop, Timothy	1st			
Representative	Clarke, Yvette D.	11th			
Representative	Crowley, Joseph	7th			
Representative	Engel, Eliot	17th			
Representative	Hall, John J.	19th			
Representative	Higgins, Brian	27th	Yes		
Representative	Hinchey, Maurice	22nd			
Representative	Israel, Steve	2nd			
Representative	King, Pete	3rd			
Representative	Lee, Christopher J.	26th			
Representative	Lowey, Nita	18th			
Representative	Maffei, Daniel B.	25th			
Representative	Massa, Eric J.J.	29th	Yes		
Representative	McCarthy, Carolyn	4th			
Representative	McHugh, John M.	23rd – Vacancy			
Representative	McMahon, Michael E.	13th			

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
New York (continued)					
Representative	Maloney, Carolyn	14th			
Representative	Meeks, Gregory W.	6th			
Representative	Murphy, Scott	20th			
Representative	Nadler, Jerrold	8th			
Representative	Rangel, Charles B.	15th			
Representative	Serrano, José E.	16th			
Representative	Slaughter, Louise	28th			
Representative	Tonko, Paul D.	21st			
Representative	Towns, Edolphus	10th			
Representative	Velázquez, Nydia M.	12th			
Representative	Weiner, Anthony D.	9th			
North Carolina					
Governor	Michael Easley (D)	NA			
Senator	Richard Burr (R)	NA			
Senator	Elizabeth Dole (R)	NA			
Representative	Butterfield, G.K.	1st			
Representative	Coble, Howard	6th			
Representative	Etheridge, Bob	2nd			
Representative	Foxx, Virginia	5th	Yes		
Representative	Jones, Walter B.	3rd			
Representative	Kissell, Larry	8th			
Representative	McHenry, Patrick T.	10th	Yes		
Representative	McIntyre, Mike	7th			
Representative	Miller, Brad	13th			
Representative	Myrick, Sue	9th			
Representative	Price, David	4th			
Representative	Shuler, Heath	11th			
Representative	Watt, Mel	12th			

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Ohio					
Governor	Ted Strickland (D)	NA			
Senator	Sherrod Brown (D)	NA			
Senator	George Voinovich (R)	NA		Yes	Yes
Representative	Austria, Steve	7th	Yes		
Representative	Boccieri, John A.	16th	Yes	Yes	
Representative	Boehner, John A.	8th	Yes		
Representative	Driehaus, Steve	1st	Yes		
Representative	Fudge, Marcia L.	11th			
Representative	Jordan, Jim	4th	Yes		
Representative	Kaptur, Marcy	9th			
Representative	Kucinich, Dennis J.	10th			
Representative	LaTourette, Steven C.	14th	Yes		Yes
Representative	Latta, Robert E.	5th	Yes	Yes	
Representative	Kilroy, Mary Jo	15th	Yes		
Representative	Ryan, Tim	17th	Yes		
Representative	Schmidt, Jean	2nd	Yes	Yes	
Representative	Space, Zachary T.	18th	Yes		
Representative	Sutton, Betty	13th	Yes		
Representative	Tiberi, Pat	12th	Yes		
Representative	Turner, Michael	3rd	Yes		
Representative	Wilson, Charles A.	6th	Yes		
Pennsylvania					
Governor	Edward Rendell (D)	NA			
Senator	Robert Casey (D)	NA			
Senator	Arlen Specter (D)	NA		Yes	Yes
Representative	Altmire, Jason	4th	Yes		
Representative	Brady, Robert	1st			
Representative	Carney, Christopher P.	10th			
Representative	Dahlkemper, Kathy	3rd	Yes		
Representative	Dent, Charles W.	15th			

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Pennsylvania (continued)					
Representative	Doyle, Mike	14th	Yes		
Representative	Fattah, Chaka	2nd			
Representative	Gerlach, Jim	6th			
Representative	Kanjorski, Paul E.	11th			
Representative	Holden, Tim	17th			
Representative	Murphy, Patrick J.	8th			
Representative	Murphy, Tim	18th	Yes		
Representative	Murtha, John	12th	Yes		Yes
Representative	Pitts, Joseph R.	16th			
Representative	Platts, Todd	19th			
Representative	Schwartz, Allyson Y.	13th			
Representative	Sestak, Joe	7th			
Representative	Shuster, Bill	9th	Yes		
Representative	Thompson, Glenn W.	5th	Yes		
South Carolina					
Governor	Mark Sanford (R)	NA			
Senator	Linsey Graham (R)	NA			
Senator	Jim DeMint (R)	NA			
Representative	Barrett, J. Gresham	3rd			
Representative	Brown, Henry	1st			
Representative	Clyburn, James E.	6th			
Representative	Inglis, Bob	4th	Yes		
Representative	Spratt, John	5th			
Representative	Wilson, Joe	2nd			
Tennessee					
Governor	Phil Bredesen (D)	NA			
Senator	Lamar Alexander (R)	NA		Yes	Yes
Senator	Bob Corker (R)	NA			
Representative	Blackburn, Marsha	7th	Yes		
Representative	Cohen, Steve	9th	Yes	Yes	

Title	Name	District	District in Basin?	Committee Memberships	
				Authorization	Appropriations
Tennessee (continued)					
Representative	Cooper, Jim	5th	Yes		
Representative	Davis, Lincoln	4th	Yes		
Representative	Duncan Jr., John J.	2nd	Yes	Yes	
Representative	Gordon, Bart	6th	Yes		
Representative	Roe, Phil	1st	Yes		
Representative	Tanner, John	8th	Yes		
Representative	Wamp, Zach	3rd	Yes		Yes
Virginia					
Governor	Tim Kaine (D)	NA			
Senator	John Warner (R)	NA			
Senator	Jim Webb (D)	NA			
Representative	Boucher, Rick	9th			
Representative	Cantor, Eric	7th			
Representative	Connolly, Gerald E. "Gerry"	11th			
Representative	Forbes, J. Randy	4th			
Representative	Goodlatte, Bob	6th	Yes		
Representative	Moran, Jim	8th			
Representative	Nye III, Glenn C.	2nd			
Representative	Perriello, Tom	5th	Yes	Yes	
Representative	Scott, Robert C. "Bobby"	3rd			
Representative	Wittman, Robert J.	1st			
Representative	Wolf, Frank	10th			
West Virginia					
Governor	Joe Manchin (D)	NA			
Senator	Robert Byrd (D)	NA			Yes
Senator	John Rockefeller (D)	NA			
Representative	Capito, Shelley Moore	2nd	Yes	Yes	
Representative	Mollohan, Alan B.	1st	Yes		Yes
Representative	Rahall, Nick	3rd	Yes	Yes	

APPENDIX P – POWER PLANTS WITHIN THE OHIO RIVER BASIN (2006 DATA)

Table 15 – Power Plants in the Ohio River Basin

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Mead – Fine Paper Division	OH	Ross	BIO	38
AES Beaver Valley	PA	Beaver	COAL	903008
Albright	WV	Preston	COAL	1000670
Armstrong Power Station	PA	Armstrong	COAL	1796287
Asheville	NC	Buncombe	COAL	2241602
Ashtabula (FIRGEN)	OH	Ashtabula	COAL	1575223
Beckjord	OH	Clermont	COAL	6131507
Big Sandy (KPC)	KY	Lawrence	COAL	7156111
Bowater Newsprint Calhoun Oper	TN	McMinn	COAL	414670
Brown (KUC)	KY	Mercer	COAL	3460777
Brown (SIGE)	IN	Posey	COAL	3353983
Bull Run (TVA)	TN	Anderson	COAL	4677315
Burger	OH	Belmont	COAL	1666218
Cane Run	KY	Jefferson	COAL	3568072
Canton North Carolina	NC	Haywood	COAL	155530
Cardinal	OH	Jefferson	COAL	11454665
Cayuga	IN	Vermillion	COAL	6221816
Cheswick	PA	Allegheny	COAL	2809616
Clifty Creek	IN	Jefferson	COAL	9122736
Clinch River	VA	Russell	COAL	4118417
Colbert	AL	Colbert	COAL	7644226
Coleman (WKEC)	KY	Hancock	COAL	2694202
Colver Power Project	PA	Cambria	COAL	736375
Conemaugh	PA	Indiana	COAL	14280201
Conesville	OH	Coshocton	COAL	9039957
Cooper	KY	Pulaski	COAL	1970455
Culley	IN	Warrick	COAL	2313986
Cumberland (TVA)	TN	Stewart	COAL	18690180
D B Wilson (WKEC)	KY	Ohio	COAL	1710168
Dale (EKPC)	KY	Clark	COAL	1038519
Dunkirk (NRG)	NY	Chautauqua	COAL	3264143
Eagle Valley	IN	Morgan	COAL	1377369

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
East Bend	KY	Boone	COAL	4966967
Edwardsport	IN	Knox	COAL	111447
Elrama	PA	Washington	COAL	2142546
Fort Martin (MONG)	WV	Monongalia	COAL	8030378
Gallagher	IN	Floyd	COAL	2493274
Gallatin (TVA)	TN	Sumner	COAL	7517476
Gavin	OH	Gallia	COAL	16632444
GF Weaton Power Station	PA	Beaver	COAL	532529
Ghent	KY	Carroll	COAL	12190952
Gibson (PSI)	IN	Gibson	COAL	22451271
Glen Lyn	VA	Giles	COAL	1703505
Grant Town Facility (American	WV	Marion	COAL	637899
Green	KY	Webster	COAL	2119372
Green River (KUC)	KY	Muhlenberg	COAL	638122
Harding Street	IN	Marion	COAL	3798751
Harrison	WV	Harrison	COAL	13762948
Hatfields Ferry Power Station	PA	Greene	COAL	9336588
Henderson II	KY	Webster	COAL	1500121
Homer City	PA	Indiana	COAL	12238613
Hutchings	OH	Montgomery	COAL	392951
Hutsonville	IL	Crawford	COAL	727643
John E Amos	WV	Putnam	COAL	20052905
John Sevier	TN	Hawkins	COAL	5042468
Johnsonburg Plant	PA	Elk	COAL	136557
Johnsonville (TVA)	TN	Humphreys	COAL	7572817
Joppa Steam	IL	Massac	COAL	8338903
Kammer	WV	Marshall	COAL	3452794
Kanawha River	WV	Kanawha	COAL	1995027
Keystone (RRI)	PA	Armstrong	COAL	12325241
Killen	OH	Adams	COAL	4145349
Kingston	TN	Roane	COAL	10368053
Kyger Creek	OH	Gallia	COAL	7336698
Mansfield (FIRGEN)	PA	Beaver	COAL	18599842
Marion (SIPC)	IL	Williamson	COAL	1830633
Mead – Fine Paper Division	OH	Ross	COAL	282345
Merom	IN	Sullivan	COAL	6461022
Miami Fort	OH	Hamilton	COAL	6641949
Mill Creek (LGEC)	KY	Jefferson	COAL	9769828

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Mitchell (OPC)	WV	Marshall	COAL	7576850
Mitchell Power Station	PA	Washington	COAL	1658425
Mount Storm (VIEP)	WV	Grant	COAL	11800148
Mountaineer	WV	Mason	COAL	7162930
Muskingum River	OH	Washington	COAL	7478295
Natrium Plant	WV	Wetzel	COAL	489096
New Castle	PA	Lawrence	COAL	1136257
Newton	IL	Jasper	COAL	7169996
Niles (ORION)	OH	Trumbull	COAL	890338
North Branch Project	WV	Grant	COAL	454627
Packaging Corp of America Coun	TN	Hardin	COAL	37691
Paradise (TVA)	KY	Muhlenberg	COAL	14535145
Pete 1 (IP&L)	IN	Pike	COAL	11205353
Picway	OH	Pickaway	COAL	240270
Pleasants	WV	Pleasants	COAL	8639197
Purdue University	IN	Tippecanoe	COAL	111003
Ratts	IN	Pike	COAL	1663436
Reid	KY	Webster	COAL	105999
Richard H. Gorsuch	OH	Washington	COAL	928803
Rockport (INMI)	IN	Spencer	COAL	20325589
Sammis	OH	Jefferson	COAL	15587003
Schahfer	IN	Jasper	COAL	9631894
Seward (RRI)	PA	Indiana	COAL	3236237
Shawnee (TVA)	KY	McCracken	COAL	9500755
Shawville	PA	Clearfield	COAL	3499110
Smith (OMU)	KY	Daviess	COAL	2178709
Sporn	WV	Mason	COAL	5045885
Spurlock	KY	Mason	COAL	7604526
Stuart (DP&L)	OH	Adams	COAL	14661346
Tanners Creek	IN	Dearborn	COAL	5863476
Tennessee Eastman	TN	Sullivan	COAL	1215752
Trimble County (LGEC)	KY	Trimble	COAL	4229643
University of Illinois Abbott	IL	Champaign	COAL	60037
Vanderbilt University Power Pl	TN	Davidson	COAL	33600
Vermilion (DMG)	IL	Vermilion	COAL	748501
W.H. Zimmer	OH	Clermont	COAL	9547198
Wabash River	IN	Vigo	COAL	4231272
Warrick	IN	Warrick	COAL	4441041

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Widows Creek	AL	Jackson	COAL	9629059
Willow Island	WV	Pleasants	COAL	650590
5 AC Station (NOLKEN)	IN	Parke	GAS-O	430607
Clairton Works	PA	Allegheny	GAS-O	110231
Mingo Junction Energy Center	OH	Jefferson	GAS-O	136527
Mon Valley Works	PA	Allegheny	GAS-O	361541
Natrium Plant	WV	Wetzel	GAS-O	52796
Smith (OMU)	KY	Daviess	GAS-O	3836
Tennessee Eastman	TN	Sullivan	GAS-O	0
Weirton Steel Corporation	WV	Hancock	GAS-O	0
Bowater Newsprint Calhoun Oper	TN	McMinn	LIQ-O	104
Canton North Carolina	NC	Haywood	LIQ-O	142779
Courtland Mill	AL	Lawrence	LIQ-O	278736
Hawesville Mill	KY	Hancock	LIQ-O	280209
Johnsonburg Plant	PA	Elk	LIQ-O	177192
Mead – Fine Paper Division	OH	Ross	LIQ-O	155995
Packaging Corp of America Coun	TN	Hardin	LIQ-O	193941
5 AC Station (NOLKEN)	IN	Parke	NG	56526
Allegheny Energy Units 3,4,5	PA	Allegheny	NG	188822
Armstrong Energy LLC	PA	Armstrong	NG	61558
Asheville	NC	Buncombe	NG	136996
Big Sandy (TEPOFU)	WV	Wayne	NG	178182
Bowater Newsprint Calhoun Oper	TN	McMinn	NG	19797
Brown (KUC)	KY	Mercer	NG	331380
Brown (SIGE)	IN	Posey	NG	55195
Brunot Island	PA	Allegheny	NG	5881
Buchanan County (Allegheny)	VA	Buchanan	NG	79684
Cane Run	KY	Jefferson	NG	12990
Cayuga	IN	Vermillion	NG	7000
Ceredo	WV	Wayne	NG	83404
Cheswick	PA	Allegheny	NG	4759
Clairton Works	PA	Allegheny	NG	14360
Colbert	AL	Colbert	NG	1336
Coleman (WKEC)	KY	Hancock	NG	17832
Conemaugh	PA	Indiana	NG	8194

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Courtland Mill	AL	Lawrence	NG	22248
Culley	IN	Warrick	NG	12516
Darby Generating Station	OH	Pickaway	NG	20270
Decatur Energy Center	AL	Morgan	NG	1970760
Dicks Creek	OH	Butler	NG	590
Dynegy – Bluegrass	KY	Oldham	NG	14539
Fayette Energy Facility	PA	Fayette	NG	203309
Frank M Tait	OH	Montgomery	NG	6308
Gallatin (TVA)	TN	Sumner	NG	81685
Georgetown (IP&L)	IN	Marion	NG	7426
GF Weaton Power Station	PA	Beaver	NG	8526
Gibson City (AMGE)	IL	Ford	NG	4877
Grant Town Facility (American	WV	Marion	NG	2505
Greenville Electric Generating	OH	Darke	NG	45472
Handsome Lake Energy	PA	Venango	NG	94410
Hanging Rock Energy Facility	OH	Lawrence	NG	1006760
Harding Street	IN	Marion	NG	60198
Harrison	WV	Harrison	NG	10191
Hawesville Mill	KY	Hancock	NG	9221
Henry County (PSI)	IN	Henry	NG	68652
Holland Energy	IL	Effingham	NG	638564
Hoosier Energy Bedford	IN	Lawrence	NG	37678
Hutchings	OH	Montgomery	NG	13806
Indiana University of Pennsylv	PA	Indiana	NG	142458
J.K. Smith	KY	Clark	NG	199235
Johnsonburg Plant	PA	Elk	NG	2435
Johnsonville (TVA)	TN	Humphreys	NG	68621
Joppa Steam	IL	Massac	NG	11021
Kinmundy	IL	Marion	NG	8399
Lawrenceburg	IN	Dearborn	NG	475562
Madison Generating Station	OH	Butler	NG	172718
Marion (SIPC)	IL	Williamson	NG	6833
Marshall County (CINSOLU)	KY	Marshall	NG	0
Mead – Fine Paper Division	OH	Ross	NG	3399
MEPI GT Facility (MIELPO)	IL	Massac	NG	11388
Mill Creek (LGEC)	KY	Jefferson	NG	35034
Mingo Junction Energy Center	OH	Jefferson	NG	13555
Mitchell Power Station	PA	Washington	NG	3775

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Mon Valley Works	PA	Allegheny	NG	15497
Montpelier Electric Generating	IN	Wells	NG	44647
Morgan Energy Center	AL	Morgan	NG	2286090
Natrium Plant	WV	Wetzel	NG	3464
Noblesville (PSI)	IN	Hamilton	NG	157703
Opryland Usa	TN	Davidson	NG	39670
Packaging Corp of America Coun	TN	Hardin	NG	11688
Paddys Run	KY	Jefferson	NG	90332
Pleasants	WV	Pleasants	NG	15723
Pleasants County	WV	Pleasants	NG	32574
Purdue University	IN	Tippecanoe	NG	657
Raccoon Creek Energy Center	IL	Clay	NG	13673
Reliant Energy Shelby County L	IL	Shelby	NG	24259
Richard H. Gorsuch	OH	Washington	NG	7788
Riverside (DYNOPE)	KY	Lawrence	NG	25452
Rolling Hills	OH	Vinton	NG	17808
Schahfer	IN	Jasper	NG	43937
Sugar Creek	IN	Vigo	NG	215468
Tait Generating Station	OH	Montgomery	NG	11821
Tennessee Eastman	TN	Sullivan	NG	0
Tilton	IL	Vermilion	NG	49313
Trimble County (LGEC)	KY	Trimble	NG	294213
University of Illinois Abbott	IL	Champaign	NG	216161
Vanderbilt University Power Pl	TN	Davidson	NG	34669
Vermilion (DMG)	IL	Vermilion	NG	8002
Vermillion Generating Station,	IN	Vermillion	NG	55106
Wabash River	IN	Vigo	NG	13608
Warrick	IN	Warrick	NG	16477
Washington Energy Facility	OH	Morgan	NG	392833
Waterford Energy Center	OH	Washington	NG	287710
Weirton Steel Corporation	WV	Hancock	NG	24483
Wheatland Generating Facility	IN	Knox	NG	29465
Willow Island	WV	Pleasants	NG	3522
Wolf Hills	VA	Washington	NG	153294
Woodsdale	OH	Butler	NG	24800
Worthington Plant	IN	Greene	NG	16841

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Canton North Carolina	NC	Haywood	OIL-H	2652
Colver Power Project	PA	Cambria	OIL-H	2090
Courtland Mill	AL	Lawrence	OIL-H	214
Packaging Corp of America Coun	TN	Hardin	OIL-H	22153
Weirton Steel Corporation	WV	Hancock	OIL-H	4123
Albright	WV	Preston	OIL-L	3962
Armstrong Energy LLC	PA	Armstrong	OIL-L	911
Armstrong Power Station	PA	Armstrong	OIL-L	3346
Asheville	NC	Buncombe	OIL-L	28782
Ashtabula (FIRGEN)	OH	Ashtabula	OIL-L	1988
Beckjord	OH	Clermont	OIL-L	18489
Big Sandy (KPC)	KY	Lawrence	OIL-L	15394
Brown (KUC)	KY	Mercer	OIL-L	12997
Brunot Island	PA	Allegheny	OIL-L	487
Bull Run (TVA)	TN	Anderson	OIL-L	18826
Burger	OH	Belmont	OIL-L	1084
Cane Run	KY	Jefferson	OIL-L	39
Cardinal	OH	Jefferson	OIL-L	36168
Cayuga	IN	Vermillion	OIL-L	5039
Clifty Creek	IN	Jefferson	OIL-L	5899
Clinch River	VA	Russell	OIL-L	2471
Colbert	AL	Colbert	OIL-L	31320
Conemaugh	PA	Indiana	OIL-L	1611
Conesville	OH	Coshocton	OIL-L	12620
Connersville	IN	Fayette	OIL-L	568
Cooper	KY	Pulaski	OIL-L	2000
Cumberland (TVA)	TN	Stewart	OIL-L	53203
D B Wilson (WKEC)	KY	Ohio	OIL-L	7857
Dale (EKPC)	KY	Clark	OIL-L	1905
Dicks Creek	OH	Butler	OIL-L	0
Dunkirk (NRG)	NY	Chautauqua	OIL-L	8312
Eagle Valley	IN	Morgan	OIL-L	4828
East Bend	KY	Boone	OIL-L	5903
Edwardsport	IN	Knox	OIL-L	517
Elrama	PA	Washington	OIL-L	9348
Fort Martin (MONG)	WV	Monongalia	OIL-L	8466

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Frank M Tait	OH	Montgomery	OIL-L	122
Gallagher	IN	Floyd	OIL-L	23495
Gallatin (TVA)	TN	Sumner	OIL-L	10626
Gavin	OH	Gallia	OIL-L	39225
Ghent	KY	Carroll	OIL-L	16771
Gibson (PSI)	IN	Gibson	OIL-L	14635
Glen Lyn	VA	Giles	OIL-L	10238
Green	KY	Webster	OIL-L	7133
Green River (KUC)	KY	Muhlenberg	OIL-L	1589
Harding Street	IN	Marion	OIL-L	3941
Hatfields Ferry Power Station	PA	Greene	OIL-L	9337
Homer City	PA	Indiana	OIL-L	16613
Hutchings	OH	Montgomery	OIL-L	0
Hutsonville	IL	Crawford	OIL-L	3126
Indiana University of Pennsylv	PA	Indiana	OIL-L	2415
J.K. Smith	KY	Clark	OIL-L	336
John E Amos	WV	Putnam	OIL-L	31002
John Sevier	TN	Hawkins	OIL-L	1109
Johnsonburg Plant	PA	Elk	OIL-L	1502
Johnsonville (TVA)	TN	Humphreys	OIL-L	15599
Kammer	WV	Marshall	OIL-L	3053
Kanawha River	WV	Kanawha	OIL-L	2557
Keystone (RRI)	PA	Armstrong	OIL-L	402292
Killen	OH	Adams	OIL-L	15369
Kingston	TN	Roane	OIL-L	9519
Kyger Creek	OH	Gallia	OIL-L	4010
Low Moor	VA	Alleghany	OIL-L	1117
Mansfield (FIRGEN)	PA	Beaver	OIL-L	28304
Marion (SIPC)	IL	Williamson	OIL-L	2220
Mead – Fine Paper Division	OH	Ross	OIL-L	2910
Merom	IN	Sullivan	OIL-L	9355
Miami Fort	OH	Hamilton	OIL-L	16720
Miami Wabash	IN	Wabash	OIL-L	-179
Mitchell (OPC)	WV	Marshall	OIL-L	32199
Mitchell Power Station	PA	Washington	OIL-L	5595
Mount Storm (VIEP)	WV	Grant	OIL-L	18329
Mountaineer	WV	Mason	OIL-L	10752
Muskingum River	OH	Washington	OIL-L	25630

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
New Castle	PA	Lawrence	OIL-L	2511
Newton	IL	Jasper	OIL-L	9514
Niles (ORION)	OH	Trumbull	OIL-L	694
North Branch Project	WV	Grant	OIL-L	1126
Paradise (TVA)	KY	Muhlenberg	OIL-L	2313
Pete 1 (IP&L)	IN	Pike	OIL-L	12921
Picway	OH	Pickaway	OIL-L	1442
Pleasants County	WV	Pleasants	OIL-L	3188
Purdue University	IN	Tippecanoe	OIL-L	118
Ratts	IN	Pike	OIL-L	1399
Reid	KY	Webster	OIL-L	1349
Rockport (INMI)	IN	Spencer	OIL-L	31305
Sammis	OH	Jefferson	OIL-L	7449
Seward (RRI)	PA	Indiana	OIL-L	14976
Shawnee (TVA)	KY	McCracken	OIL-L	6869
Shawville	PA	Clearfield	OIL-L	9403
Smith (OMU)	KY	Daviess	OIL-L	1572
Sporn	WV	Mason	OIL-L	20248
Spurlock	KY	Mason	OIL-L	5827
Stuart (DP&L)	OH	Adams	OIL-L	32763
Tanners Creek	IN	Dearborn	OIL-L	13893
Trimble County (LGEC)	KY	Trimble	OIL-L	2942
University of Illinois Abbott	IL	Champaign	OIL-L	1276
Vermilion (DMG)	IL	Vermilion	OIL-L	194
W.H. Zimmer	OH	Clermont	OIL-L	40364
Wabash River	IN	Vigo	OIL-L	5976
Weirton Steel Corporation	WV	Hancock	OIL-L	35174
Widows Creek	AL	Jackson	OIL-L	15355
Woodsdale	OH	Butler	OIL-L	467
AES Beaver Valley	PA	Beaver	PC	540
D B Wilson (WKEC)	KY	Ohio	PC	1485608
Green	KY	Webster	PC	1575990
Henderson II	KY	Webster	PC	183441
Marion (SIPC)	IL	Williamson	PC	16374
Bowater Newsprint Calhoun Oper	TN	McMinn	SLD-O	0
Courtland Mill	AL	Lawrence	SLD-O	27082

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Hawesville Mill	KY	Hancock	SLD-O	1690
Mead – Fine Paper Division	OH	Ross	SLD-O	2791
Smith (OMU)	KY	Daviess	SLD-O	21655
Tennessee Eastman	TN	Sullivan	SLD-O	0
Willow Island	WV	Pleasants	SLD-O	6478
Mead – Fine Paper Division	OH	Ross	UNK	24
Tennessee Eastman	TN	Sullivan	UNK	0
Beaver Valley	PA	Beaver	URAN	12135311
Browns Ferry	AL	Limestone	URAN	17871474
Sequoyah (TVA)	TN	Hamilton	URAN	18000679
Watts Bar Nuclear	TN	Rhea	URAN	6678098
Appalachia	NC	Cherokee	WATER	336744
Barkley	KY	Livingston	WATER	641202
Bath County	VA	Bath	WATER	-971725
Blue Ridge (TVA)	GA	Fannin	WATER	28567
Boone (TVA)	TN	Sullivan	WATER	146445
Calderwood	TN	Monroe	WATER	450248
Chatuge	NC	Clay	WATER	18512
Cheatham	TN	Dickson	WATER	189569
Cheoah	NC	Graham	WATER	378315
Cherokee (TVA)	TN	Grainger	WATER	261446
Chickamauga	TN	Hamilton	WATER	641015
Cordell Hull	TN	Smith	WATER	290746
Dale Hollow	TN	Clay	WATER	48342
Douglas (TVA)	TN	Sevier	WATER	343297
Fontana (TVA)	NC	Graham	WATER	732013
Fort Loudoun	TN	Loudon	WATER	672228
Fort Patrick Henry	TN	Sullivan	WATER	99445
Gauley River	WV	Nicholas	WATER	198768
Great Falls (TVA)	TN	Warren	WATER	118930
Greenup Hydro	OH	Scioto	WATER	335283
Guntersville	AL	Marshall	WATER	612670
Hawks Nest Hydro	WV	Fayette	WATER	523966
Hiwassee	NC	Cherokee	WATER	204595
J.P. Priest	TN	Davidson	WATER	46425

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Kentucky (TVA)	KY	Marshall	WATER	1026609
Laurel (USCEND)	KY	Laurel	WATER	26603
Markland	IN	Switzerland	WATER	386485
Marshall (CPLC)	NC	Madison	WATER	5357
Melton Hill	TN	Loudon	WATER	96135
Metropolitan Sewerage District	NC	Buncombe	WATER	8046
New Martinsville Hydroelectric	WV	Wetzel	WATER	277341
Nickajack	TN	Marion	WATER	495539
Norris	TN	Anderson	WATER	340568
Nottely	GA	Union	WATER	21968
Ocoee 1	TN	Polk	WATER	55993
Ocoee 2	TN	Polk	WATER	80334
Ocoee 3	TN	Polk	WATER	126100
Ohio Falls	KY	Jefferson	WATER	239852
Old Hickory	TN	Davidson	WATER	407848
Pickwick	TN	Hardin	WATER	1047950
Raccoon Mountain	TN	Marion	WATER	-667540
Seneca – CEI	PA	Warren	WATER	-244576
South Holston	TN	Sullivan	WATER	109744
Tims Ford	TN	Franklin	WATER	30819
Walters	NC	Haywood	WATER	342431
Watauga	TN	Carter	WATER	110337
Watts Bar Hy	TN	Rhea	WATER	762987
Wheeler (TVA)	AL	Lawrence	WATER	947130
Wilbur	TN	Carter	WATER	15994
Wilson (TVA)	AL	Colbert	WATER	1862191
Wolf Creek (USCEND)	KY	Russell	WATER	610409
Buffalo Mountain	TN	Anderson	WIND	22012
Meyersdale Wind Project	PA	Somerset	WIND	84165
Mill Run Windpower	PA	Fayette	WIND	38306
Mountaineer Wind Energy	WV	Tucker	WIND	173757
Bowater Newsprint Calhoun Oper	TN	McMinn	WOOD	0
Canton North Carolina	NC	Haywood	WOOD	7380
Courtland Mill	AL	Lawrence	WOOD	128674
Hawesville Mill	KY	Hancock	WOOD	76152

Plant Name	Plant State	Plant County	Fuel Type	Annual Kilowatt Hours
Mead – Fine Paper Division	OH	Ross	WOOD	71022
Packaging Corp of America Coun	TN	Hardin	WOOD	81094
Mead – Fine Paper Division	OH	Ross	BIO	38
AES Beaver Valley	PA	Beaver	COAL	903008
Albright	WV	Preston	COAL	1000670
Armstrong Power Station	PA	Armstrong	COAL	1796287
Asheville	NC	Buncombe	COAL	2241602
Ashtabula (FIRGEN)	OH	Ashtabula	COAL	1575223
Beckjord	OH	Clermont	COAL	6131507
Big Sandy (KPC)	KY	Lawrence	COAL	7156111
Bowater Newsprint Calhoun Oper	TN	McMinn	COAL	414670
Brown (KUC)	KY	Mercer	COAL	3460777
Brown (SIGE)	IN	Posey	COAL	3353983
Bull Run (TVA)	TN	Anderson	COAL	4677315
Burger	OH	Belmont	COAL	1666218
Cane Run	KY	Jefferson	COAL	3568072
Canton North Carolina	NC	Haywood	COAL	155530
Cardinal	OH	Jefferson	COAL	11454665
Cayuga	IN	Vermillion	COAL	6221816
Cheswick	PA	Allegheny	COAL	2809616
Clifty Creek	IN	Jefferson	COAL	9122736
Clinch River	VA	Russell	COAL	4,118,417

APPENDIX Q – OCTOBER 2009 OHIO RIVER BASIN SUMMIT SUMMARY

OHIO RIVER BASIN SUMMIT

RISING MOMENTUM IN THE OHIO RIVER BASIN

October 8-9, 2009
Covington, Kentucky

Co-Led by the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Ohio River Valley Water Sanitation Commission, and Ohio River Basin Water Resources Association in cooperation with 39 partner agencies and organizations.

SUMMARY OF PROCEEDINGS

RISING MOMENTUM IN THE OHIO RIVER BASIN

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PREFACE

October 2009 may be a milestone in the history of integrated water resource management within the Ohio River Basin. Approximately 100 representatives from Federal, State, and local government, not-for-profit organizations, industry and academia convened to discuss a shared interest of a healthy and sustainable Ohio River Basin.

Notwithstanding long-standing collaborations in water management in the Ohio Valley, such as the 8-state Ohio River Valley Water Sanitation Commission (ORSANCO) that focuses on abatement of interstate water pollution, the Ohio River Basin is an area that has historically lacked a robust regional collaboration focused on the holistic health of the entire Basin integrating multiple, and often competing, water resource needs such as water quality and quantity, flood risk management, restored and protected ecosystems, and the need for resilient infrastructure.

Historically focused on individual projects, we must now shift our focus to a watershed perspective while working with our partners, stakeholders, and customers. Improving coordination and taking a watershed perspective requires forums for the sharing of information and discussion of collaborative solutions. Such forums may be used to further on-going initiatives, develop strategies for addressing water resource problems, and/or determine who is best positioned to leverage resources to find a solution to a specific problem.

Water resources in the Ohio River Basin provide natural capital which sustains the productivity of 15 States and approximately 10% of the U.S. population. During this Summit participants were actively engaged in dialogue to articulate key challenges, strategies for addressing those challenges, and to determine who can best implement those strategies. Forty-three agencies and organizations contributed to the dialogue and furthered the ability of the Ohio River Basin to speak with a unified voice on the complex water resource challenges and priorities. (See Appendix C for full listing of attendees.)

The outcomes of this Summit and the proposed next steps, contained herein, will be of interest to everyone who has a stake in the sustainability of the Ohio River Basin and its water resources.

SUMMARY OF PROCEEDINGS

RISING MOMENTUM IN THE OHIO RIVER BASIN

I. Introduction

In late August 2005, the Departments of the Interior, Agriculture, Commerce, Defense and the Environmental Protection Agency co-hosted a White House Conference on Cooperative Conservation focusing on, among others, bringing together key stakeholders and decision makers who can advance cooperative conservation and facilitate the exchange of information and advice for successful partnerships.

FY06 Energy and Water Development appropriations included funding for 5 watershed studies across the country. Although the final Ohio River Basin proposal included letters of support from all levels of government, in April 2006, stakeholders learned they were not successful in obtaining that funding. The reason given was in large part due to the lack of any defined regional collaboration that was functionally cross-cutting and geopolitically diverse.

In response, in October 2006, the Ohio Department of Natural Resources and Kentucky Environmental and Public Protection Cabinet hosted an Ohio River Basin Water Resources Partnering Meeting that was titled a “Call to Action”. It was at that meeting that the idea for this Summit was born. There was consensus regarding the value of working toward a more integrated view of water resources management through development of a regional collaboration.

It was clear that States did not support creating a new group or entity to lead this effort. Overhauling and/or expanding the role of the Ohio River Basin Water Resources Association (formerly the Ohio River Basin Commission) and perhaps updating its bylaws to articulate common goals and objectives for the collaboration, and/or modifying the Ohio River Valley Water Sanitation Commission’s compact to include water resources not associated with water quality were both mentioned as possible vehicles for defining a “governing body”.

In October 2009, approximately 100 stakeholders convened in Covington, Kentucky to discuss their shared interest in pursuing a healthy and sustainable Ohio River Basin. Designed to capitalize on the outcomes from the October 2006 multi-state water resources partnering session, the specific objectives of this Summit centered on establishing a dialogue and raising awareness of common issues and priorities. The theme of the Summit was “Rising Momentum in the Ohio River Basin” and included representatives from at least 43 different agencies and organizations including, but not limited to, Federal and State government, non-government organizations (NGOs), industry, academia, and more. Conveners included the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Ohio River Valley Water Sanitation Commission, and the Ohio River Basin Water Resources Association.

While the attendance was diverse, participants recognized the need for broader participation by States, local government, businesses, industry, and charitable organizations. Getting the right people at the table to discuss some of these more challenging issues from every angle will help us to form sustainable solutions, but it is only a part of what we need to do.

This Summit focused specifically on two primary focus areas:

- Identifying key water resources needs,
- Identifying strategies and tools to address those needs.

Dialogue was driven with plenary speakers, panel discussions, breakout sessions and open discussion led by subject matter experts from every stakeholder group. A representative from the Great Lakes Commission shared lessons learned from that collaboration initiative and participants shared information regarding on-going efforts within the Ohio River Basin. Selected themes for more robust discussion included Water Availability and Management, Infrastructure, Restoration and Protection, Watershed Collaboration, and Managing Toward a Sustainable Ohio River Basin.

II. Key Findings and Recommendations

The following summaries of the key findings and recommendations from each of the five breakout sessions were drawn directly from the notes of session facilitators and recorders. They provide a synopsis of the general discussions for each breakout session. While formal consensus was not sought, the statements do reflect the general views expressed by participants in each session, either individually or collectively. This information is presented to the community of Ohio River Basin interests for the purpose of informing discussions and actions toward advancing development and application of sustainability principles within the Ohio River Basin.

To help focus the discussions, a question was posed to each of the five breakout sessions. Potential actions to address needs for research, data and information, planning and policy improvements, and other recommendations are given in a bulleted format.

Common themes for water resource needs included the need to involve the Basin's Governors early and the need to share information more broadly between various groups dedicated to managing water resources within the Basin. Primary obstacles identified in the groups included a lack of public awareness and a lack of effective communication at all levels. A few of the strategies identified that could overcome these obstacles included routine communication between the right people to share information and perhaps combining efforts throughout the Basin, selecting or forming a steering committee for water management that can lead development of common perspectives and would include a cross-section of stakeholders, including industry, development of interagency teams to identify funding sources, and development of a basin wide plan,. Other strategies included broader outreach that could serve to create and maintain a basin identity and development of incentives for public participation in the improvement of the health of the Ohio River Basin.

A. Water Availability and Management

Charge Question: *Water quality is often impacted by water quantity and both have far-reaching impacts on health and human safety. What are the current major uses of water in the Ohio River Basin? How will water use in the Ohio River Basin likely change in the next 50 years? How will decisions be adapted to address supply and demand?*

Session participants heralded the need for renewed commitment to data collection and analysis as necessary to inform collective understanding of interactions within the Basin (e.g. Stream Flow (Real Time), Water Quality, Groundwater, and Precipitation). Defining water uses with a focus on the relation to quality and quantity measures and the surrounding ecology will promote more efficient and effective management of water throughout the Basin. An improved understanding of demand drivers, better forecasting (customized), a better understanding of the relationship between water quantity and quality, improved protection of riparian habitats, floodplain management, and future water transfers were identified as key challenges within the Ohio River Basin. One example of the changing mindset within the scientific community is demonstrated by hydrologists who have historically been interested in flood forecasting but have recently expanded their scope into secondary impacts to water resources.

Also discussed was the need for more robust adaptive water management and failing infrastructure. The Ohio River Basin's infrastructure was developed for conditions 60-70 years ago. Infrastructure is deteriorating simply due to age in many cases and there is a serious problem with loss of water through conveyance. It does not begin to address current conditions, let alone future needs.

A few of the obstacles to resolving these concerns included the lack of a political will to change, competing water uses, funding, complexity, lack of authorities to address these looming issues, and a lack of watershed approach. Authorities and responsibilities are fragmented and that lack of continuity fosters an inherent problem with decisions being made based on misperceptions.

The Ohio River Valley Water Sanitation Commission (ORSANCO) has historically been positioned to focus on water quality along the mainstem of the Ohio River. Their area of responsibility does not cover the upper reaches of the watershed nor the Tennessee and Cumberland River basins. However, in recent years, ORSANCO has become more interested in integrating water quality and water quantity needs. ORSANCO has worked to capitalize upon existing relationships and maintain long-standing collaborations with State and Federal partners to address the relationship of water quality and quantity in a more holistic manner.

Future actions that can be taken include:

Research, Data, and Information

- Educate other agencies and the public about technology breakthroughs with the Integrated Water Resources Information System (IWRIS), a data management tool. http://www.water.ca.gov/iwris/

- Develop a common framework for integrating existing water resource information systems.

Planning and Policy

- Take an adaptive management approach. Focusing on long-range management will enhance capacity to predict events months in the future. Adaptive management is a general strategy for the future.

B. Infrastructure

Charge Question: *Much of the infrastructure in the Ohio River Basin has exceeded its design life and values for services provided continue to change. Assuming the design life of the replacement infrastructure will be between 50-100 years, who are the current stakeholders with respect to Ohio River Basin infrastructure and what functions do they value? Also, there has been a major increase in the number of applications for hydropower in the Basin. What are the opportunities for green infrastructure?*

Key identified resource needs regarding infrastructure within the Ohio River Basin included the need for public education and more specifically, an increased awareness of the value of infrastructure to each individual. This education would conceivably foster collaboration and dispel individually focused perspectives that do not consider regional or national impacts.

Infrastructure needs within the basin span water supply, water quality, flood control, and navigation. Infrastructure is aging and innovative approaches are necessary to address recapitalization of that infrastructure with a focus on life-cycle management.

Future actions that can be taken include:

Research, Data, and Information

- Increase the involvement of end users.
- Establish awareness among users so that they understand they are users and solicit their support to assist in mitigating challenges in the management of our infrastructure needs.
- Engage and garner lessons learned from similar groups across the Nation to maximize the efficacy of collaborative efforts. Simply understanding what efforts have been tried and what efforts are underway will assist in more efficient use of limited resources.
- Fully utilize all available technological advances to save energy and support industrial infrastructure.

Planning and Policy

- Streamline licensure process to foster building new plants that are more efficient and produce more power from less fuel.

- Recognition of the importance of waterways in transportation is crucial. We must have the ability to compete with other countries through efficient distribution of our manufactured products and agricultural goods. Also, low cost domestic distribution is enjoyed by many industries on the river system. Marine transport offers advantages in safety, emissions, and lessening oil dependence.

C. Restoration and Protection

Charge Question: *Urban exodus and economic downturn has freed up much of urban areas for reuse. How can we make use of this opportunity to restore important hydro-ecological functions to the sensitive areas where we have traditionally build our urban centers? Rural population growth is driving the continued development of green areas in our watersheds. What can be done to minimize environmental footprints? What can be done to preserve sensitive areas in rural settings? How do we better ecologically connect the rivers and floodplains? How can we reduce the impacts of invasive species on indigenous aquatic and terrestrial species?*

Of all of the functional water resource issues within the Ohio River Basin, restoration and protection may be characterized as "low-hanging fruit", an area where there may be less dispute or contention on the purpose, need, and way forward. As is illustrated by the efforts of the Great Lakes Commission, their rallying point and center of focus has been restoration of the Great Lakes and it is around this resource need that they have realized significant support from the public and all levels of government. A lack of information has been a major inhibitor to furthering restoration and protection efforts within the Ohio River Basin.

The Ohio River Ecosystem Restoration Program, authorized in the Water Resources Development Act of 2000, is an example of a regional authority that lacks funding. The Clean Water Act was authorized in 1975 and is likely the easiest example of outdated laws and regulations that prevent effective management of ecosystems within the Ohio River Basin. These challenges must be addressed in a comprehensive manner. However, deriving sustainable solutions, rather than short-term gains, takes more time and resources when compared to executing individual projects with primarily local benefits and limited regional benefits.

Disruption and/or degradation of environmental flows due to large and small dams, contaminated sediment, gravel dredging, large sewer overflows, development in the floodplain altering bankfull flows, water quality and temperature issues further inhibits the ability to proactively and efficiently plan and manage restoration and protection efforts within the Basin. Land use impacts are partly characterized by the lack of adequate coal mine reclamation and lack of riparian buffers.

Future actions that can be taken include:

Research, Data, and Information

- Increase understanding of the land use impacts through the Basin.
- Update outdated water quality data.
- Improve monitoring to enable clearer future projections.
- Develop a central databank into which the diverse array of stakeholders and users can deposit information with an emphasis on any available baseline (prior to development) habitat data that can be used as a benchmark.
- List challenges with fish populations and connectivity with the rest of the Basin.

Planning and Policy

- Educate advocates of the importance of management of water resources by ecological (watershed) boundaries given that jurisdictional boundaries are typically based on political boundaries and promote consistency between those jurisdictions.
- Identify a regional authority to restore and protect ecological resources empowering the ability of stakeholders to maximize the use of finite funding for the benefit of the entire Basin.
- Energize local planning and zoning efforts in the context of the Basin's needs to minimize contributions to regional pollution and flooding.

D. Watershed Collaboration

Charge Question: *What can be accomplished with successful watershed collaboration in the Ohio River Basin? How can communications be improved and activities coordinated with and between existing sub-watershed groups and specific functional groups (e.g. water quality, navigation, ecosystem restoration)? Can we develop short-, medium- and long-term plans for actions? What opportunities exist for resourcing collaboration efforts?*

A successful regional collaboration initiative in the Ohio River Basin can foster information exchange, leverage knowledge of others' skills and resources, facilitate partnering on missions and tasks, promote development of agreed upon priorities, enable advocacy for those priorities, reduce redundancy, define a shared vision, and ultimately enhance and protect important water resources.

Historically focused on individual projects, we must shift our focus to a watershed perspective while working with our partners, stakeholders, and customers. We are looking toward the future and the impact what we do now will have on future generations. Improving coordination and taking a watershed perspective requires forums for sharing information and discussion of collaborative solutions. This ensures the watersheds are managed with a holistic perspective on the inter-relatedness of multiple objectives, and competing interests and resources of the various watershed systems. As such, it is important that any regional collaboration represent a balanced partnership between Federal, State, and Local stakeholders.

Primary concerns in regard to watershed collaboration within the Ohio River Basin include sufficient financial support, high level political support, better knowledge and ability to leverage regional strengths, common goals, and means by which to measure success.

Watershed collaboration within the Ohio River Basin has not garnered strong legislative support presumably due to the lack of a national issue around which to rally, lack of an identifiable basin-wide initiative that would define the basin's identity, and subsequently, an ease in pursuing individual projects in an effort to take some positive action. Lacking regional leadership or a regional forum to promote common goals, legislative authorities and agenda policies have resulted in turfism". One example might be the U.S. Fish & Wildlife Service and American Electric Power collaborating on innovative ways to help improve habitats around river facilities.

Decision Support Systems

- Develop a "steering committee" to assimilate and guide forward movement of regional collaboration efforts through routine contact and communication. Formulation of this committee would add structure to carry the regional collaboration's momentum from meeting to meeting.
- Leverage existing partnerships and relationships such as the Ohio River Valley Water Sanitation Commission, the Ohio River Basin Water Resources Association, the Ohio River Basin Fish Habitat Partnership, the Sustainable Rivers Program, and many others that can readily serve to assist in defining a regional collaboration for the Ohio River Basin.
- Develop working groups focused on specific functions:

    - The Ohio River Valley Water Sanitation Commission will continue to pursue expansion of current compact to more robustly integrate water quality and quantity.
    - The U.S. Fish and Wildlife Service will serve to lead the Ohio River Basin Fish Habitat Parternship
    - The Nature Conservancy will continue to lead the Sustainable Rivers Program.
    - The Ohio River Basin Consortium for Research and Education, the Ohio River Foundation, and other established groups with a Basin focus will continue to lead efforts in their specific focus areas and do so in a synchronized fashion.

- Populate a matrix capitalizing on the framework of the Susquehanna River Basin Commission crosswalk.
- Develop a reference of capabilities within the collaboration that can be used to leverage our limited resources to address our complex water resource challenges.
- Participate in February 2010 themed "Vision to Action" focusing on developing a shared vision for the Ohio River Basin and more specifically on actions that are, and will be, taken in search of sustainability. This conference will encourage broader participation to include congressional staff, gubernatorial and State agencies, municipalities and other

local governments, Brookings Institution and other private foundations, Departments of Economic Development, Universities/Researchers, Industry, Regional Councils of Government, Public-private-NGOs, etc.
- Share results and recommendations of the Ohio River Basin Comprehensive Study.
- Provide an economic rationale for funding integrated water resource management within the Ohio River Basin as the stakeholders within the basin begin to speak with a unified voice

Adopt tools and metrics for policy assessment

E. E. Managing Toward a Sustainable Ohio River Basin

<u>Charge Question</u>: *The regional economy will undergo major transitions as traditional industries decline and new, more sustainable industries emerge. Demographic and land use patterns will be transformed by shifts in industrial activities and lifestyles. Possible changes include exploitation of brownfields, increased use of agricultural feedstocks for manufacturing, reduced dependence on highway transportation, and pressure for development of green spaces. What are the possible future scenarios, and in the face of such changes how can we ensure the protection and resilience of important hydro-ecological functions in sensitive areas?*

Essential needs for a sustainable Ohio River Basin include identification and understanding of an economic value proposition where natural capital protection is weighted alongside workforce attraction. Market-based approaches are waiting to be explored. Predictive capacity and forward-looking, adaptive management strategies must be developed with a regional scope. It is important to develop a well-defined, cohesive purpose and sustainability vision for the Ohio River Basin. With that purpose and vision, responsible urban development and responsible agricultural practices can flourish.

However, public expectations for such approaches are low, and many seem resigned to having poor water quality. Inadequate resources further stymie the ability to develop a coordinated voice and decisive regulatory and legislative action. There is no sense of urgency given the lack of a “burning platform”, although Dunkard Creek, a tributary to the Monongahela River, just experienced the largest fish kill in our Nation’s history. The hypoxia zone in the Gulf of Mexico cries for attention and much of the excess nutrient loading comes from the Ohio River Basin.

Improved communication is critical for taking action on improving sustainability within the Basin. Leveraging existing studies and available information rather than starting new studies and finding common ground on shared objectives will enable a change in the public’s perceptions and expectations regarding the health of their environment. Exposing the public to the value of comprehensive water resources management and the impact that management can have on their quality of life and the health of their communities will be a start. Responsible use of our water resources can be fostered with education, and technological innovations can be leveraged to further enable that responsible use. The value of our water resources can be enhanced and viewed as a true asset with public understanding and leadership from a functionally cross-cutting regional collaboration initiative.

Analyzing the success of collaborations in other parts of the country and garnering lessons learned will enable more expeditious growth and development of the regional collaboration within the Ohio River Basin that will be required to further the dialogue on sustainability.

Water resource managers may have a good grasp of water resources issues, but when we talk to the public they have different priorities. We are worried about aging infrastructure such as pumping stations and levees, and assume that others are worried about it post-Katrina, but the public at large thinks these issues are already being addressed. Unless one is very involved with operation of flood systems, the situation is not well understood. There is connectivity between rivers and flood systems. The environmental baseline of river systems is different due to dams on rivers and fish populations have adjusted in response. Fisheries want to sustain trout fishing, while resource agencies want us to go back to historical populations. These are differing resource perspectives that appear to be in conflict.

The economic downturn in our Nation presents both a challenge and an opportunity. The Ohio River Basin is a water-rich region. Therein lay marketing opportunities for industry and the potential for economic development. The following summarizes key steps on the path forward. Future actions that can be taken include:

<u>Engage the public as part of the solution.</u>

- Establish a shared vision for the Ohio River Basin that can inform and guide unified policy approaches. Re-envision this resource in the context of improvement, not maintenance. This vision must balance our past, present, and future as well as our urban and rural needs.
- Develop a cohesive identity and purpose for management of water resources within the Basin that can be communicated to all stakeholders.
- Promote better management practices by looking at nutrients and sedimentation from agricultural lands as well as residential. Communicate with farmers and get a 5-10 year contract to help nurture those partnerships, encouraging farmers to go to no-till, cover crops, nutrient management, and filter strips.
- Think globally but act locally.
- Educate ourselves and then public officials so that they can create jobs, pursue development, and balance needs of the environment more effectively. Specifically focus on construction in the floodplain and destruction of riparian corridors. How do we determine the positive impacts of nutrient reduction? How do we get connectivity between these farms and tie in ecological understanding with ecosystems? How do we quantify both ecological benefits and financial benefits?
- Develop tools to illustrate the value of water to the public. We need to develop the concept that the river margin serves all of us, and we should encourage watershed protection with better riparian zones at the top of banks. The challenge is to connect watershed values and the values of the people who drive these changes.

Smart Growth and Innovation

- Promote new technology, such as groundwater source geothermal, to industry.
- Leverage the Miami River Corridor and bike trails as an example of sustainable development.
- Explore natural gas resource opportunities and impacts on water resources.
- Identify and promote low-cost practices that can be employed by users struggling to make ends meet.

Policy Approaches

- Investigate opportunities for the Ohio River Basin Water Resources Association to serve as the umbrella organization for establishment of a functionally cross-cutting Ohio River Basin partnership focused on integrated management of water resources for the entire Basin.
- Build collaboration around "low-hanging fruit" or more readily achievable actions; perhaps an Ohio River basin wide training program.
- Examine the ability of Ohio River Valley Water Sanitation Commission to lead regional collaboration efforts in areas of water quality and quantity.
- Develop an official Ohio River Basin strategic plan that sets forth a core set of priorities, incorporating the results and recommendations of the Ohio River Basin Comprehensive Study, and identifies measurable outputs.
- Develop a sense of urgency or a sense of a major opportunity. Perhaps this needs to be approached from an economic standpoint because of the current focus on economic recovery.
- Get marketing departments involved and develop a good communications strategy. For example, explore the economics of shipping food around the world versus growing locally.

III. Conclusions and Next Steps

Summit participants did not need to be convinced that gathering together to roundtable on water resource issues within the Ohio River Basin is necessary to promote a sustainable water resources future. Partnerships are a driving force to national recognition of basin initiatives such as the Chesapeake Bay, Great Lakes, and Columbia River as unique areas deserving of national attention. A robust collaboration in the Ohio River Basin is anticipated to derive the following expected outcomes:

- Meaningful stakeholder relationships,
- Shared vision of a healthy, sustainable Ohio River Basin,
- Unified regional voice for goals and priorities,
- Synergistic public-private partnerships,
- Understanding of regional needs & trends,
- Ability to share resources and work regionally,

- Deployment of innovative solutions,
- Evidence of measurable progress,
- Improved service to the public,
- Long-term economic and ecological resilience.

We are looking toward the future and seeking actions that will be beneficial to both present and future generations. Comprehensive watershed planning and systems-based approaches for the Ohio River Basin are absolutely essential in such a resource-constrained environment. This type of forum enables a shift from a tactical project focus to a strategic watershed perspective. Having a strengthened regional identity for the Ohio River Basin and a forum for basin-wide communication and information sharing will help us to reduce duplication of effort and leverage limited resources. A genuine regional collaboration will enable development of effective communication and outreach, attention to priorities such as runoff and infrastructure, and anticipation of changes due to urban development or climate fluctuations, thereby improving timeliness and quality of responses. This kind of effort can integrate regional and local issues and promote integrated and sustainable solutions to our most difficult water resource challenges.

Development of a unified voice among the states and proposing a more comprehensive and integrated approach will help in their state-wide planning and will help your congressional delegation to support regional initiatives that provide the greatest local benefit. It is clear that this event alone will not serve as a "silver bullet", but great things can be accomplished through the cooperation of all stakeholders interested in a more sustainable water resources future. Policy can be influenced through a consensus among a variety of stakeholders pursuing a common goal. This will ensure that watersheds are managed with a holistic perspective on the inter-relatedness of multiple objectives, as well as the competing interests and resources of the various watershed systems. A balanced strategy will involve integrating functions that normally compete for scarce resources such as navigation and ecosystem restoration. The proposed collaboration will help all groups involved achieve more effective objectives, better balanced solutions, and wiser and more sustainable use of resources.

The next meeting of the Ohio River Basin Collaboration will be in Columbus, Ohio in the last week of February 2010.

APPENDIX A
PARTICIPATING AGENCIES AND ORGANIZATIONS

American Electric Power

Battelle

Duke Energy

Fishbeck, Thompson, Carr & Huber Inc.

Fort Thomas Forest Conservancy

Hamilton County Soil & Water Conservation District, Ohio

Keiser & Assoc., LLC

Kentucky Division of Water

KY State Nature Preserves Commission

KY Transportation Cabinet

Miami Conservancy District

Midwest Great Lakes Society

Muskingum Watershed Conservancy District

National Association of Flood and Stormwater Management Agencies

National Oceanic and Atmospheric Administration, National Weather Service

National Park Service

National Science Foundation

Ohio Department of Natural Resources

Office of Surface Mining

Ohio Environmental Protection Agency

Ohio River Foundation

Ohio University

Ohio-Kentucky-Indiana Regional Council of Governments

Ohio River Valley Water Sanitation Commission

Ohio State University

Pennsylvania Department of Environmental Protection

Pennsylvania Fish & Boat Commission

Restoration Foundation

Thomas More College

The Nature Conservancy

Trust for Public Land

Tennessee Valley Authority

University of Cincinnati

United States Maritime Administration

United States Army Corps of Engineers

United States Coast Guard, Ohio Valley

United States Department of Agriculture, Natural Resources Conservation Service

United States Environmental Protection Agency

United States Fish and Wildlife Service

United States Geological Society

West Virginia Bureau of Public Health

West Virginia Waste and Water Management

West Virginia Department of Health and Human Resources

APPENDIX B

Ohio River Basin Water Resources Summit

October 8-9, 2009

Cincinnati Marriott RiverCenter, Covington, KY

Final Agenda

Purpose: A next step intended to foster necessary dialogue on diverse water resource challenges and development of a regional collaborative initiative within the Ohio River Basin that can move the notion of "sustainability" from concept to application

Wednesday, October 7

5:00 pm – 7:00 pm **Informal Social (Hofbrauhaus Newport)**
America's first authentic Hofbrauhaus featuring genuine Bavarian cuisine

Thursday, October 8

7:00 am – 5:00 pm **Registration (Covington Ballroom)**

7:30 am – 10:00 am **Continental Breakfast**

8:00 am – 8:30 am **Opening Keynote**
Mr. Patrick Jaynes, State Director and Deputy Chief of Staff, U.S. Senator Lamar Alexander, Tennessee, Committee on Environment and Public Works and Energy and Water Appropriations Subcommittee

8:30 am – 9:10 am **Conference Welcome**
Ms. Sally Gutierrez, Director, National Risk and Research Laboratory; U.S. Environmental Protection Agency (USEPA)

Major General John W. Peabody, Commander, Great Lakes & Ohio River Division; U.S. Army Corps of Engineers (USACE)

Mr. Jeff Eger, Chairman, Ohio River Sanitation Commission (ORSANCO)

Mr. John Hines, Chairman, Ohio River Basin Water Resources Association (ORBWRA), Pennsylvania Department of Environmental Protection

9:10 am – 9:40 am **Lessons Learned from a Successful Collaboration**
Mr. Matt Doss, Great Lakes Commission

9:40 am - 10:10 am **Break**

10:10 am – 10:30 am **Ohio River Basin Comprehensive Study**
Mr. Mike Worley, Project Manager, USACE

10:30 am – Noon **Panel: Rising Momentum in the Ohio River Basin**

Moderator: Dr. Paul Bishop, Program Director, National Science Foundation
Panel Members
Mr. Terry Cook, The Nature Conservancy (TNC), Director, Kentucky Chapter
Mr. Charlie Wooley, U.S. Fish and Wildlife Service (USFWS), Deputy Regional Director
Ms. Jane Hardisty, Natural Resources Conservation Service, Indiana State Conservationist
Mr. Alan Vicory, Executive Director, ORSANCO

Noon – 1:15 pm **Lunch and Luncheon Keynote Address**
Mr. Geoff Reed, Field Director and Senior Policy Advisor, U.S. Representative Ben Chandler, Kentucky (6th District)

1:15 pm – 1:30 pm **Aministrative Remarks**

1:30 pm – 3:00 pm **Concurrent Sessions**
See Attached Charge Questions for each Session

Session A: Water Availability and Management

Facilitator: Mr. Jim Morris, U.S. Geological Survey, Ohio Water Center
Panel Members
Mr. James Noel, National Oceanic and Atmospheric Administration
Mr. David Hanselman, Ohio Department of Natural Resources

Session B: Infrastructure

Facilitator: Mr. Sammy Sweetland, Tennessee Valley Authority

Panel Members

Ms. Debbie Nispel, Duke Energy
Mr. Derek Guthrie, Past-President, NAFSMA, Former Director of Engineering/Operations and Chief Engineer Louisville and Jefferson County, KY Metropolitan Sewer District
Mr. Floyd Miras, U.S. Maritime Administration

Session C: Restoration and Protection

Facilitator: Ms. Mary Jennings, USFWS, Tennessee Field Office

Panel Members

Ms. Amy Yersavich, Director, Ohio Brownfields Program
Dr. Paul Bishop, Program Director, National Science Foundation
Mr. Terry Cook, TNC (Representing Green River, Sustainable Rivers Program)

Session D: Watershed Collaboration

Facilitator: Mr. Rory Robinson, National Park Service

Panel Members

Mr. John Hoopingarner, Muskingum Watershed Conservancy District
Mr. Charles Duritsa, Former Director, Pennsylvania DEP, Southwest Region
Dr. Terry Chang, Ohio River Basin Consortium for Research & Education
Mr. John Stark, TNC

Session E: Managing Toward a Sustainable Ohio River Basin

Facilitator: Dr. Joseph Fiksel, Executive Director, Center for Resilience, Ohio State University

Panel Members

Mr. Dusty Hall, Miami Conservancy District
Mr. Mike Fremont, Rivers Unlimited and Restoration Foundation
Dr. Tim Lohner, American Electric Power, Environmental Services Division

3:00 pm – 3:30 pm **Break**

3:30 pm – 5:00 pm **Repeat Concurrent Sessions**

5:00 pm **Evening River Boat Tour aboard the P.A. Denny Sternwheeler (Sponsored by ORSANCO and the Foundation for Ohio River Education)**

Friday, October 9

7:30 am – 10:00 am	**Continental Breakfast**
8:30 am – 10:30 am	**Breakout Session Out Briefs**
10:30 am – 11:00 am	**Putting Ideas into Action** Dr. Joseph Fiksel, Executive Director, Center for Resilience, Ohio State University
11:00 am – 11:30 am	**Plenary Discussion/Next Steps**
11:30 am – 12:00 am	**Closing Remarks**
12:00 am	**Adjourn**

APPENDIX C

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Natural Resources Conservation Service
US Department of Agriculture

Louis Aspey
Acting State Conservationist
Natural Resources Conservation Service
US Department of Agriculture

Paul L. Bishop
Program Director for Environmental Engineering
National Science Foundation

Brian Bohl
Stream Specialist
Hamilton County Soil & Water Conservation District

Sharon M. Bond
Chief, Planning Branch
US Army Corps of Engineers, Louisville

Astor Boozer
State Conservationist
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US Department of Agriculture

Jeff Boyle
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Fishbeck, Thompson, Carr & Huber Inc.

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Environmental Protection Assistant
US Environmental Protection Agency, National Risk Management Research Laboratory

Kevin Brown
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Natural Resources Conservation Service
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Outreach Coordinator
US Army Corps of Engineers, Louisville

Beth Cade
Community Planner
US Army Corps of Engineers, Huntington

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Environmental Scientist
Kentucky Division of Water

Bill Carroll
Ohio State Director
The Trust for Public Land

Tiao J. Chang
Executive Director and Professor
Ohio River Basin Consortium for Research & Education
Ohio University

Jean Chruscicki
Environmental Scientist, TMDL Specialist
US Environmental Protection Agency

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Supervising District Engineer,
Philippi District Office
WV Bureau for Public Health,
Environmental Engineering Division

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Executive Director
Ohio River Foundation

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Kentucky State Director
The Nature Conservancy

David Dale
Deputy District Engineer/Chief, PMD
US Army Corps of Engineers, Louisville

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Director
Kentucky State Nature Preserves
Commission

Charles Duritsa
Pennsylvania Commissioner
Ohio River Valley Water Sanitation
Commission

Jeff Eger
Chairman
Ohio River Valley Water Sanitation
Commission

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Assistant Director, USGS West Virginia
Water Science Center
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USEPA, National Risk Management
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Mike Fremont
President
Restoration Foundation

Timothy C. Fudge
Deputy Chief, Operations
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William Guertal
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U.S. Geological Survey

Sally Gutierrez
Director
U.S. Environmental Protection Agency
ORD, National Risk Management Research
Laboratory

Derek Guthrie
Past President
National Association of Flood and
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Program Development Manager
The Miami Conservancy District

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State Conservationist
Natural Resources Conservation Service
US Department of Agriculture

Dave Harmon
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Kentucky Transportation Cabinet

Laura Hill
Assistant Field Supervisor
U.S. Fish & Wildlife Service

John Hines
Deputy Secretary, Office of Water Management
PA Department of Environmental Protection

Tim Hoeflich
Railroad & Government Permit Administrator
Duke Energy, Inc.

John Hoopingarner
Executive Director
Muskingum Watershed Conservancy District

Deborah Hopkinson
Chief Appraiser, Real Estate
U.S. Army Corps of Engineers, Cincinnati

Craig S. Hunter
Hydrologist in Charge
NOAA - National Weather Service - Ohio River Forecast Center

Andrea Irland
Outdoor Recreation Planner
National Park Service - Rivers, Trails and Conservation Assistance

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Jim Morris
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APPENDIX D
FEEDBACK

(Circle one with 5 being highest value)	5	4	3	2	1	No response
Did you find the Summit to be productive?	21	20	4	1		
Did you feel the right people were in attendance?	9	27	7	3		
Would you like to continue to participate in the future?	37	7	1			1
Was there enough time in the breakout sessions?	17	9	12	7	1	
Were the speakers relevant and informative?	30	13	3			
Was the location convenient?	32	12	1	1		
Did this event meet your expectations?	28	14	4			

Comments:

Expand Participation at next meeting

Need to invite additional reps from Universities, Cities, Chambers of Commerce, Industry, State Water Resource Institutes, Rahall Maritime Institute, Corps Flood Risk Management Program Managers and State Silver Jackets lead (great opportunity to promote collaboration after the Summit), additional State USGS reps, Key state legislative reps, additional reps from Conservancy Districts. Want to add this was a great first start.

Need to incorporate municipalities and State reps to include all stakeholders and get buy in.

Need more folks from the southern part of the district and more navigation/flood control interests (and I am a conservationist)

Good start - need additional partners at the table - local government, industry, etc.

Missing - water supply, non government, industry

This summit was a good start to addressing the basin through collaboration. Future sessions must include representation from the local level, municipalities, local government, and perhaps locally elected officials would provide perspective and assist with directing future efforts.

Perhaps there is reluctance to expand the scope of the summit, but if collaboration is to remain a focus, more effort should be made to involve business and state agency groups. Otherwise, a very informative meeting! Great job!

My concern is about the continuing the momentum. Event needs to continue - at least annually. Possibly have a standing interagency team to handle logistics and issues from year to year. Suggestion to add more local governments, private citizens' organizations and governors' offices.

Others that should be included - resource economists, academics - especially biologists, resource practitioners. Group weighted toward those in agencies but not necessarily "on-the-ground" "doers".

There is an unlimited array of people who could have been invited, but I think it was about right for the first meeting.

Very well done. Good facilitators. The right content. Would also suggest the Public Owned Treatment Works (POTW) group should be included.

Invite foundation/funding representatives into the process

Municipalities and regional agencies should be brought into the effort. That could include the cities of Cincinnati, Pittsburgh, Louisville, Huntington, Regional and Watershed Groups (Miami Valley Watershed Conservation Agency and Ohio, Kentucky, Indiana Regional Council of Governments.

A bit more local/regional and private sector representation

Breakout Sessions

Great meeting, very good discussions, got to where we needed to go Friday morning. Dr. Fiksel will be an excellent advisor for the process. Breakout sessions did not have enough time.

Breakout sessions - too much briefing and not enough discussion in water collaboration and the infrastructure was too focused on navigation.

Breakouts - opening speakers seemed unclear on their roles; some took too much time which detracted from discussions

Future meetings should include more time in breakout sessions. This is a valuable format for idea exchange.

The breakouts were too slow to start but ended up lacking time - thus, the lesson here was that we had the right people who were ready to talk and work but we didn't get to exhaust the potential.

We could have had more time in the breakouts, but I realize we could have talked for days.

For our breakout session, our charge questions weren't as helpful as you may have hoped. One panelist didn't have them when preparing his talk.

Need more time for discussion at breakouts - Keep all questions/decision points visible

Confusion in difference in charge questions all participants received and the questions the session facilitators were given. Sessions needed time for discussion and less time for presentations.

Recommend limiting presentation of panel members to 5 minutes so that the group can discuss issues and mind map recommendations and way ahead.

Presentations/Panel/Speakers

Dr. Fiksel did a great job of bringing everything together.

Can provide data support to vision team based upon recon report results.

Great first step and meeting; Lessons learned from the Great Lakes was very informative; Presentations from John Hines and Mike Worley were great!

The prepared presentations by the panel members took too much time and left little time for group interaction.

Some of the speakers were too preachy - the audience consisted of folks with knowledge, aka, the choir.

Impressive line up of speakers and knowledge; Glad to see much enthusiasm and energy for collaboration

The opening session was a bit dry until Hines spoke and hit a homerun.   All in all a good start - peaked interest, started dialogue, and most important, driving action. Thanks for pulling it all together!

Excellent starting point. Impressive collection of representatives and expertise.

Recommendations

Recommend developing a pamphlet with 1 page summaries of each agency/org missions/charter for better understanding by all

Employ ORSANCO to develop an ORB staff person in near future, independent, but under ORSANCO umbrella. Keep the process going.

Highly recommend steering committee include a good unbiased facilitator. A good facilitator can really make the difference between failure and success of the mission. I was most impressed with Dr. Fiksel's presentation/facilitation - perhaps he would be willing to take that role on?! Good conference!

The working group should probably have members from USACE, USGS, NOAA, but only 1.

We need to concentrate on new dollars and not redirect current appropriations.

Great meeting to get interest started. I especially applaud the efforts to keep momentum moving and emphasis on next steps. Need to find a way to get out information from this meeting to stakeholders not in attendance.

Next meeting should be in TN or Upper Basin if we want it to be ORB-wide

The first steps would be to have a lead agency to head the effort. Then develop a science based, practical plan.

Next time I would suggest we have a discussion concerned with the environmental regulations. The Clean Water Act is integral in any discussion, as well as the Safe Drinking Water Act.

General

Superb event - well organized, Robust discussion - well thought out - good start for Ohio River Basin discussion!

Of course the proof will be in the follow-up. There is such potential, I would hate for the momentum to slow down.

Excellent meeting, well organized.

A great start! A daunting concept but it needed to start somewhere. Excellent job of getting a diverse group together to begin the discussion on a relatively short time frame. Excellent opportunity to meet the many players, learn what organizations are doing and make connections for the benefit of the ORB.

I hope the momentum initiated through this Summit will continue. Great job!

The Summit exceeded my expectations by a long shot. I felt energized and filled with new ideas, especially at the end of the break out sessions. The opportunities to see colleagues I don't always see was excellent. Overall, the conference was extremely well organized and the hotel was very comfortable. I for one certainly hope we will have a follow up meeting/conference in the near future to capitalize on our success.

Kieser & Associates is developing the first multi-state trading program with the electric power industry and ORSANCO. This will require multi-state policy for agriculture, industry, POTWs, etc.

#1 Priority:

Aquatic habitat on the entire basin capable of supporting healthy populations of fish and other aquatic life. The Endangered Species Act listed species (and other indicators) demonstrate we're not there yet.

Aquatic habitat/Conservation and Restoration

Sustainable resilience governance to move issues, themes, and strategies toward greater public education and resolution.

Aging infrastructure

Protect, sustain, and enhance water quality (This is an URGENT matter in the Monongahela River Basin currently! 30 mile fish kill in Dunkard Creek last month straddling PA & WV state line. Marcellus Shale gas drilling and water quality and water quantity concerns are immense in the Basin and elsewhere in the Upper Ohio basin.

Water quality, especially nutrient load/CSOs

Increasing collaboration between water quality and water quantity in managing the basin's water resources

Water Management

Water uses (withdrawals vs. consumption)

Drinking Water

Long-term environmental monitoring, river gauges, etc.

Water Resources Hydrologic forecasts to improve situational awareness and decision support by using short-term and long-term forecasts.

Flow regimes

Research and Education

Information sharing between agencies - what is important and what are they working on

Lack of system connectivity (both in terms of stream reach connectivity and flood plain connection)

Incorporate agricultural needs and land use within the basin, and include rural resource concerns voiced by conservation districts, into a basin-wide effort.

Protection of resource through work on private lands, particularly agricultural lands.
Improve navigation
Improving biodiversity of the river and watershed
Ecological Integrity of system, particularly as it relates to threatened/endangered/rare species
Innovative partnerships with industry to conserve endangered species.
Identify which issues are cumulative in nature versus which issues are individual watershed management integrates common minor stressors to solve big problems. Turf battles do not exist in individual acute stressors. Let's ID problems with multiple sources of contributors to the problem and to the solution as a basis to identify common goals.
Investigate the adoption and implementation of an educational curriculum - ~1990 USEPA produced a K-12 curriculum called "Always A River" which focused on the significance of rivers. This could be used as a starting point for primary and secondary education.
Education of the public
Collaboration of many groups for a unified voice in a shared vision
Marketing region, in a way that builds support, understanding, vision
Increased focus on funding for the Ohio River Basin
An organization to champion the Basin
Bring a "fair share" of Federal and State monies into the Basin to address watershed related issues.

APPENDIX R – BASIN GAGING SYSTEM: STREAM PEAK DISCHARGE, STAGE, QUALITY, AND GROUNDWATER

There is an extensive basinwide gaging system that collects both surface water and groundwater data. Stream discharge (peak flow), stage (water elevation based upon a standard datum), and water quality are collected for surface waters. Both water volume and water quality are collected for groundwater through wellhead monitoring.

Table 16 shows the distribution of the IFLOWS stream stage and precipitation gaging networks in tabular form. Figure 39 and 40 display the distribution of the IFLOWS gages across the HUC 8 watersheds.

The USGS gaging system covers both surface and groundwater resources. Stream discharge, stage and water quality gages operated by USGS cover most of the region. Table 17 shows the distribution of the USGS gages among the HUC 4 sub-basins. Figure 41 through 45 show the distribution of the USGS gages by type across the HUC 8 watersheds.

Other surface water gages are operated and maintained by USACE and State agencies to support operation of flood risk reduction structures and to monitor water quality.

Table 16 – IFLOWS Stream Stage and Precipitation Gages by Sub-basin

State	Type	HUC 4 Sub-basins														*Totals*
		0501	0502	0503	0504	0505	0506	0507	0508	0509	0510	0511	0513	0601	0602	
KY	Precip.	0	0	0	0	0	0	41	0	21	87	1	27	1	0	*178*
	Stage	0	0	0	0	0	0	14	0	0	8	1	3	0	0	*26*
NC	Precip.	0	0	0	0	2	0	0	0	0	0	0	0	83	4	*89*
	Stage	0	0	0	0	1	0	0	0	0	0	0	0	15	0	*16*
OH	Precip.	0	0	47	59	0	30	0	16	58	0	0	0	0	0	*210*
	Stage	0	0	0	1	0	4	0	0	0	0	0	0	0	0	*5*
PA	Precip.	56	19	12	0	0	0	0	0	0	0	0	0	0	0	*87*
	Stage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*0*
TN	Precip.	0	0	0	0	0	0	0	0	0	0	0	4	40	0	*44*
	Stage	0	0	0	0	0	0	0	0	0	0	0	0	4	0	*4*
VA	Precip.	0	0	0	0	35	0	30	0	0	0	0	0	48	0	*113*
	Stage	0	0	0	0	2	0	7	0	0	0	0	0	10	0	*19*
WV	Precip.	0	97	35	0	61	0	32	0	2	0	0	0	0	0	*227*
	Stage	0	21	4	0	11	0	6	0	0	0	0	0	0	0	*42*
Totals		*56*	*137*	*98*	*60*	*112*	*34*	*130*	*16*	*81*	*95*	*2*	*34*	*201*	*4*	*1060*

Table 17 – Ohio River Basin USGS Gages (Surface and Groundwater)

Data Description	Real Time	0501	0502	0503	0504	0505	0506	0507	0508	0509	0510	0511	0512	0513	0514	0601	0602	0603	0604	*Grand Total*
Ground Water	N	3,683	2,064	3,235	200	1,105	374	162	948	568	1,086	1,547	507	600	1,948	992	118	573	823	*20,533*
Ground Water Total		*3,683*	*2,064*	*3,235*	*200*	*1,105*	*374*	*162*	*948*	*568*	*1,086*	*1,547*	*507*	*600*	*1,948*	*992*	*118*	*573*	*823*	*20,533*
Peak Flow	N	25	22	43	33	60	23	6	20	38	26	30	113	105	38	119	57	29	46	*833*
	Y	7	12	11	7	2	3	2	2	15	16		34	2	5	8	1	11	1	*139*
Peak Flow Total		*32*	*34*	*54*	*40*	*62*	*26*	*8*	*22*	*53*	*42*	*30*	*147*	*107*	*43*	*127*	*58*	*40*	*47*	*972*
Peak Flow & Water Quality	N	27	41	38	21	35	16	25	15	31	21	17	52	101	18	158	37	46	39	*738*
	Y	45	38	44	31	38	26	21	26	22	36	17	88	37	48	53	9	18	20	*617*
Peak Flow & Water Quality Total		*72*	*79*	*82*	*52*	*73*	*42*	*46*	*41*	*53*	*57*	*34*	*140*	*138*	*66*	*211*	*46*	*64*	*59*	*1,355*
Water Quality	N	1,498	879	1,241	651	1,237	215	1,245	440	525	475	695	3,693	1,490	731	783	319	682	773	*17,572*
	Y		1	1		1		1			1		6	13	7				4	*35*
Water Quality Total		*1,498*	*880*	*1,242*	*651*	*1,238*	*215*	*1,246*	*440*	*525*	*476*	*695*	*3,699*	*1,503*	*738*	*783*	*319*	*682*	*777*	*17,607*
Water Quality & Ground Water	N	787	262	517	256	663	234	378	476	207	459	432	503	158	687	170	54	276	290	*6,809*
Water Quality & Ground Water Total		*787*	*262*	*517*	*256*	*663*	*234*	*378*	*476*	*207*	*459*	*432*	*503*	*158*	*687*	*170*	*54*	*276*	*290*	*6,809*
(blank)	N	1,608	2,773	3,624	581	3,269	471	751	444	692	470	834	1,224	1,090	1,093	1,766	384	1,071	632	*22,777*
	Y	4	2	8	5	6		1		8	8	3	22	1	7	1		1	2	*79*
(blank) Total		*1,612*	*2,775*	*3,632*	*586*	*3,275*	*471*	*752*	*444*	*700*	*478*	*837*	*1,246*	*1,091*	*1,100*	*1,767*	*384*	*1,072*	*634*	*22,856*
Grand Total		*7,684*	*6,094*	*8,762*	*1,785*	*6,416*	*1,362*	*2,592*	*2,371*	*2,106*	*2,598*	*3,575*	*6,242*	*3,597*	*4,582*	*4,050*	*979*	*2,707*	*2,630*	*70,132*

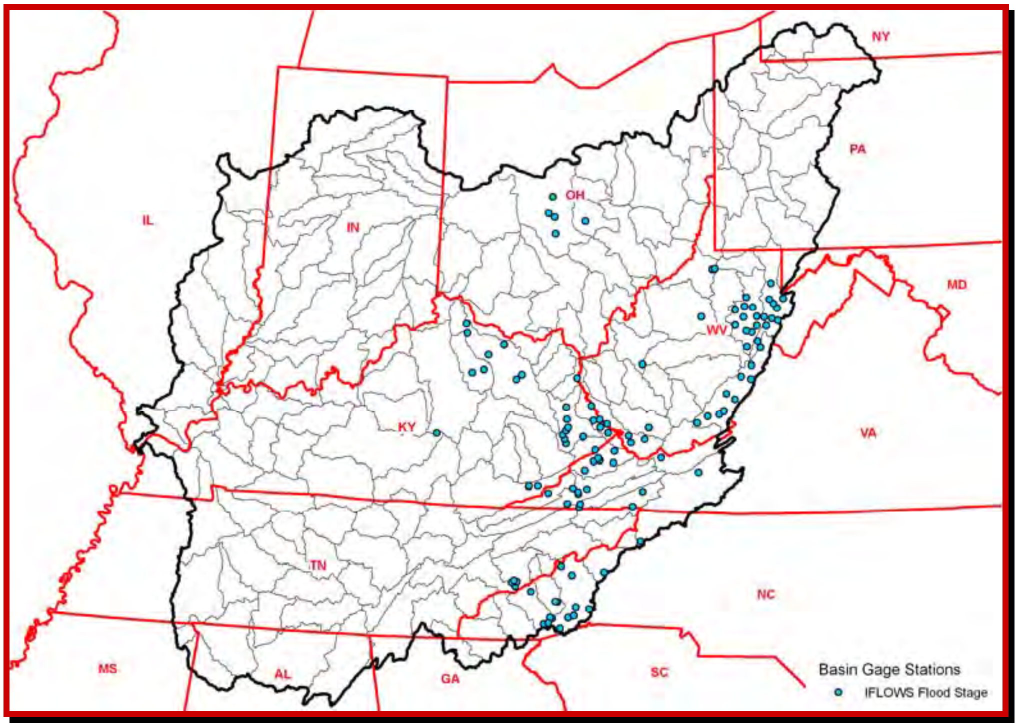

Figure 39 – IFLOWS Streamgages (Stage)

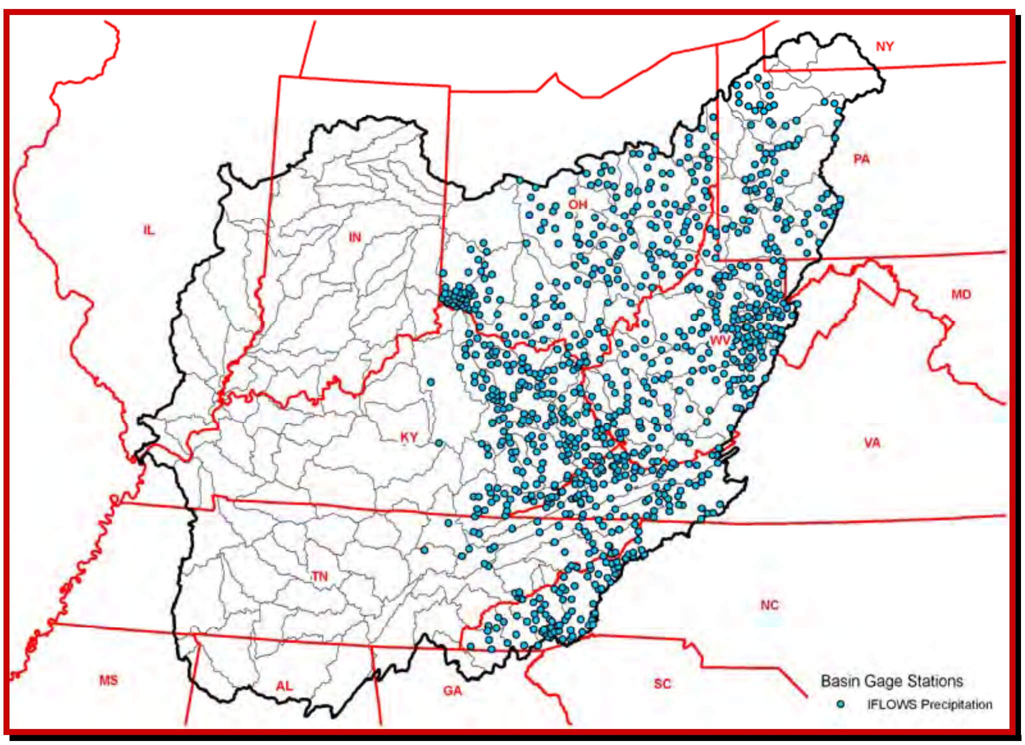

Figure 40 – IFLOWS Precipitation Gages

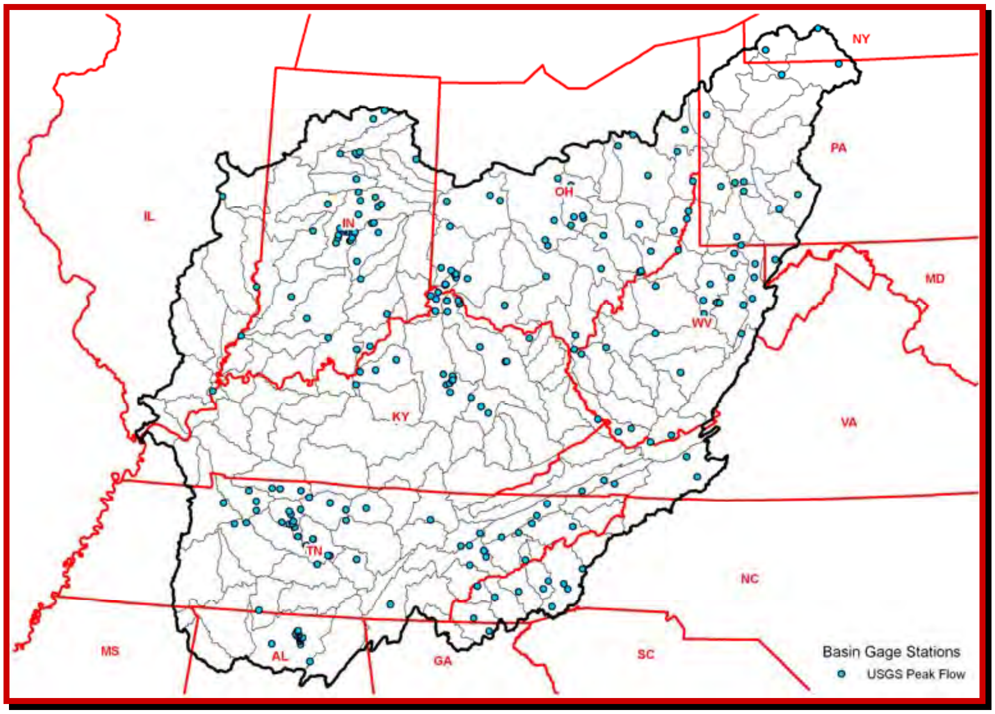

Figure 41 – USGS Gage Stations (Peak Flow)

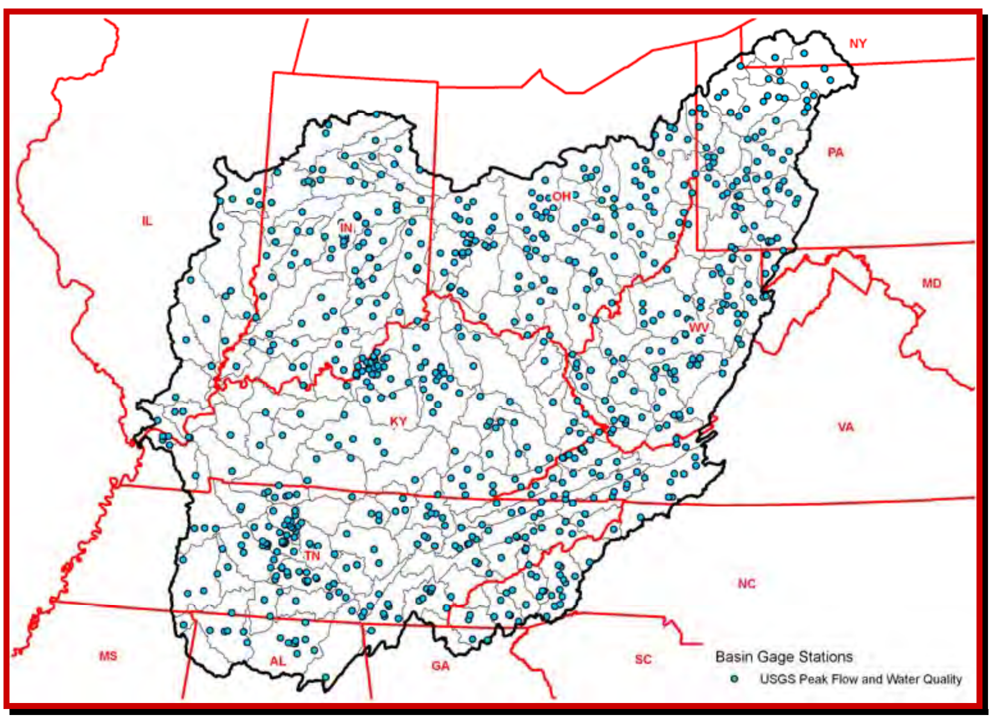

Figure 42 – USGS Gage Stations (Peak Flow and Water Quality)

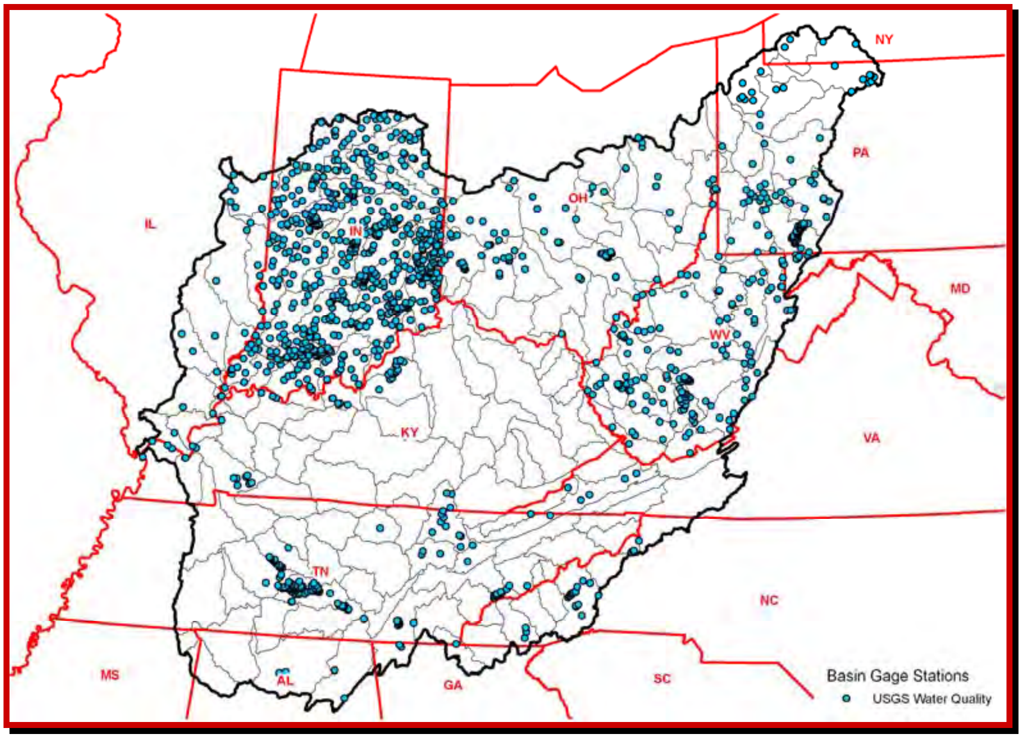

Figure 43 – USGS Gage Stations (Water Quality)

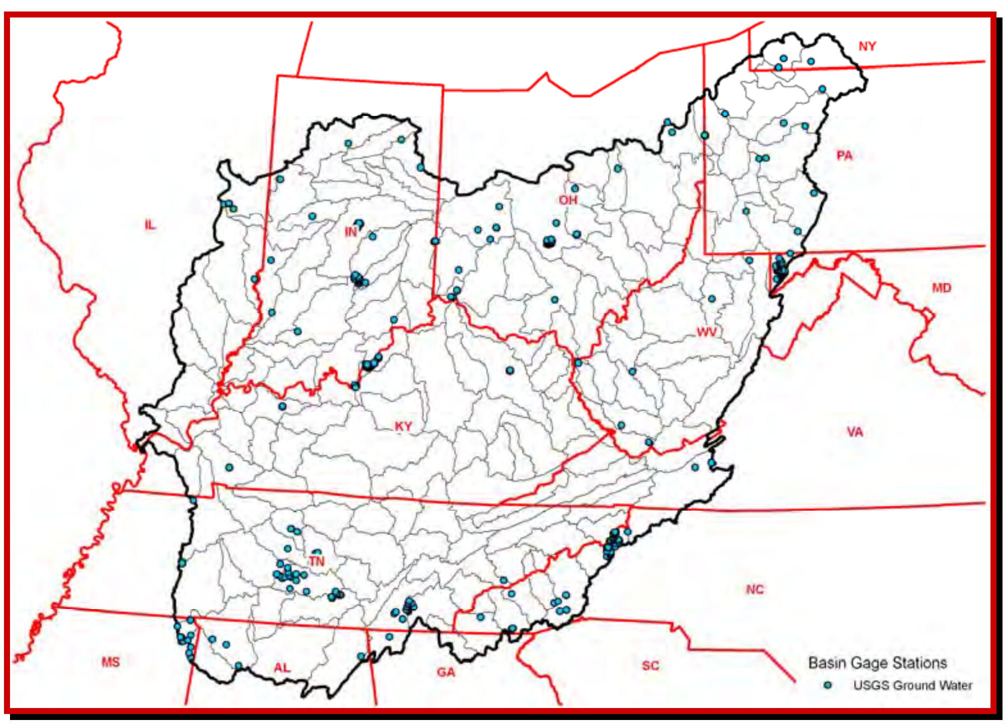

Figure 44 – USGS Gage Stations (Groundwater Volume)

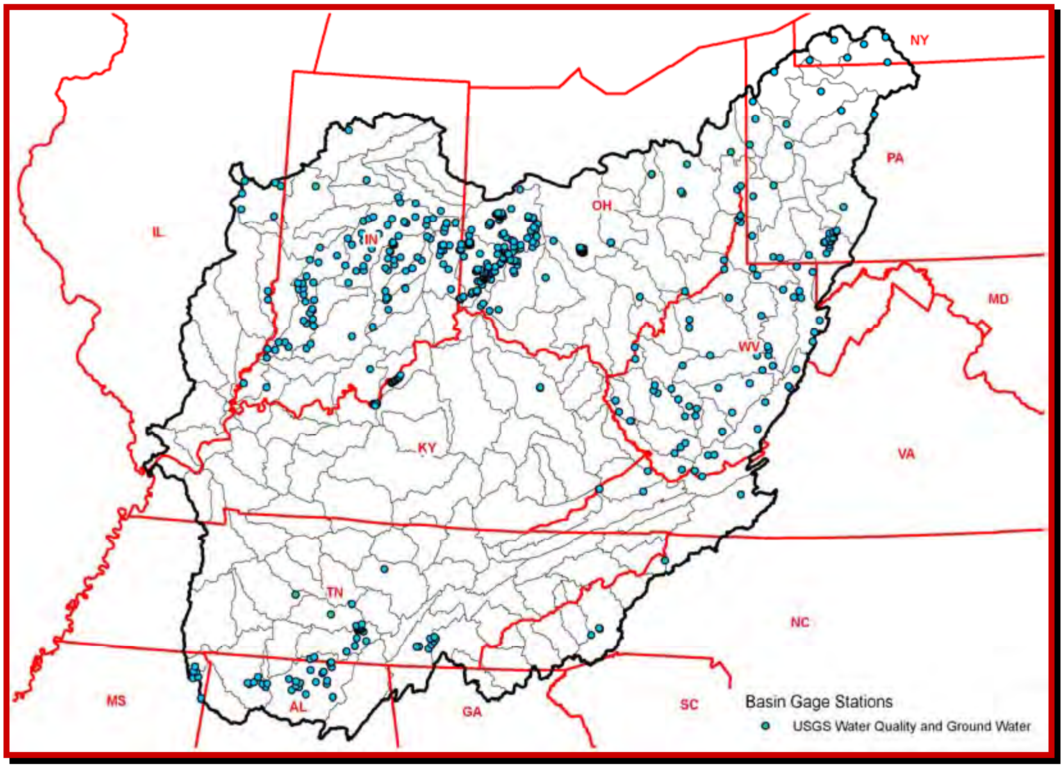

Figure 45 – USGS Gage Stations (Groundwater and Water Quality)