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Appendix A

USGS Watersheds

Missouri Department of Natural Resources

Missouri Watersheds based on their USGS basin name, HUC 8, and Missouri basin name.

HUC 8	USGS Basin Name	Missouri Basin Name
07100009	Lower Des Moines	Des Moines Basin
07110001	Bear-Wyaconda	Wyaconda - Fox Rivers
07110002	North Fabius	North Fabius River Basin
07110003	South Fabius	South Fabius River Basin
07110004	The Sny	North River - Bobs Creek
07110005	North Fork Salt	North Salt River Basin
07110006	South Fork Salt	Middle-South Forks of the Salt River
07110007	Salt	Lower Salt River Basin
07110008	Cuivre	Cuivre River Basin
07110009	Peruque-Piasa	Peruque-Dardenne Creeks
07140101	Cahokia-Joachim	Mississippi River Tribs - St. L-Ste. Gen
07140102	Meramec	Meramec River Basin
07140103	Bourbeuse	Bourbeuse River Basin
07140104	Big	Big River Basin
07140105	Upper Mississippi-Cape Girardeau	Mississippi River Tribs - Ste. Gen-Cape Gir.
07140107	Whitewater	Castor-Whitewater Rivers Basin
08010100	Lower Mississippi-Memphis	Mississippi River Mainstem Below Ohio River
08020201	New Madrid-St. Johns	St. Johns Bayou
08020202	Upper St. Francis	Upper St. Francis Basin
08020203	Lower St. Francis	Lower St. Francis Basin
08020204	Little River Ditches	Little River Ditches
08020302	Cache	Cache River Basin
10240001	Keg-Weeping Water	Missouri River Bottom
10240004	Nishnabotna	Nishnabotna River Basin
10240005	Tarkio-Wolf	Tarkio-Squaw Tributaries Basin
10240010	Nodaway	Nodaway River Basin
10240011	Independence-Sugar	Missouri River Mainstem
10240012	Platte	Platte River Basin
10240013	One Hundred and Two	102 River Basin
10270104	Lower Kansas	Kansas River Basin
10280101	Upper Grand	Upper Grand River Basin
10280102	Thompson	Thompson River Basin
10280103	Lower Grand	Middle Grand River Basin
10280201	Upper Chariton	Upper Chariton River Basin
10280202	Lower Chariton	Lower Chariton River Basin
10280203	Little Chariton	Little Chariton River Basin
10290102	Lower Marais Des Cygnes	Maries des Cygnes River Basin
10290103	Little Osage	Little Osage River Basin
10290104	Marmaton	Marmaton River Basin
10290105	Harry S. Truman Reservoir	Upper Osage River Basin
10290106	Sac	Sac River Basin
10290107	Pomme De Terre	Pomme de Terre River Basin
10290108	South Grand	South Grand River Basin
10290109	Lake of the Ozarks	Lake of Ozarks Basin
10290110	Niangua	Niangua River Basin
10290111	Lower Osage	Lower Osage River Basin
10290201	Upper Gasconade	Upper Gasconade River Basin
10290202	Big Piney	Big Piney River Basin
10290203	Lower Gasconade	Lower Gasconade River Basin

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HUC 8	USGS Basin Name	Missouri Basin Name
10300101	Lower Missouri-Crooked	Missouri River Mainstem- KC to Glasgow
10300102	Lower Missouri-Moreau	Missouri River Mainstem- Glasqow to Hermann
10300103	Lamine	Lamine River Basin
10300104	Blackwater	Blackwater River Basin
10300200	Lower Missouri	Missouri River Mainstem- Hermann to St.L
11010001	Beaver Reservoir	Table Rock Lake Basin
11010002	James	James River Basin
11010003	Bull Shoals Lake	Bull Shoals Lake Basin
11010006	North Fork White	North Fork White River Basin
11010007	Upper Black	Black River Basin
11010008	Current	Current River Basin
11010009	Lower Black	Fourche Creek Basin
11010010	Spring	Spring River Basin (Howell/Oreg counties)
11010011	Eleven Point	Eleven Point River Basin
11070206	Lake O' the Cherokees	Cherokees Lake Basin
11070207	Spring	Spring River Basin
11070208	Elk	Elk River Basin

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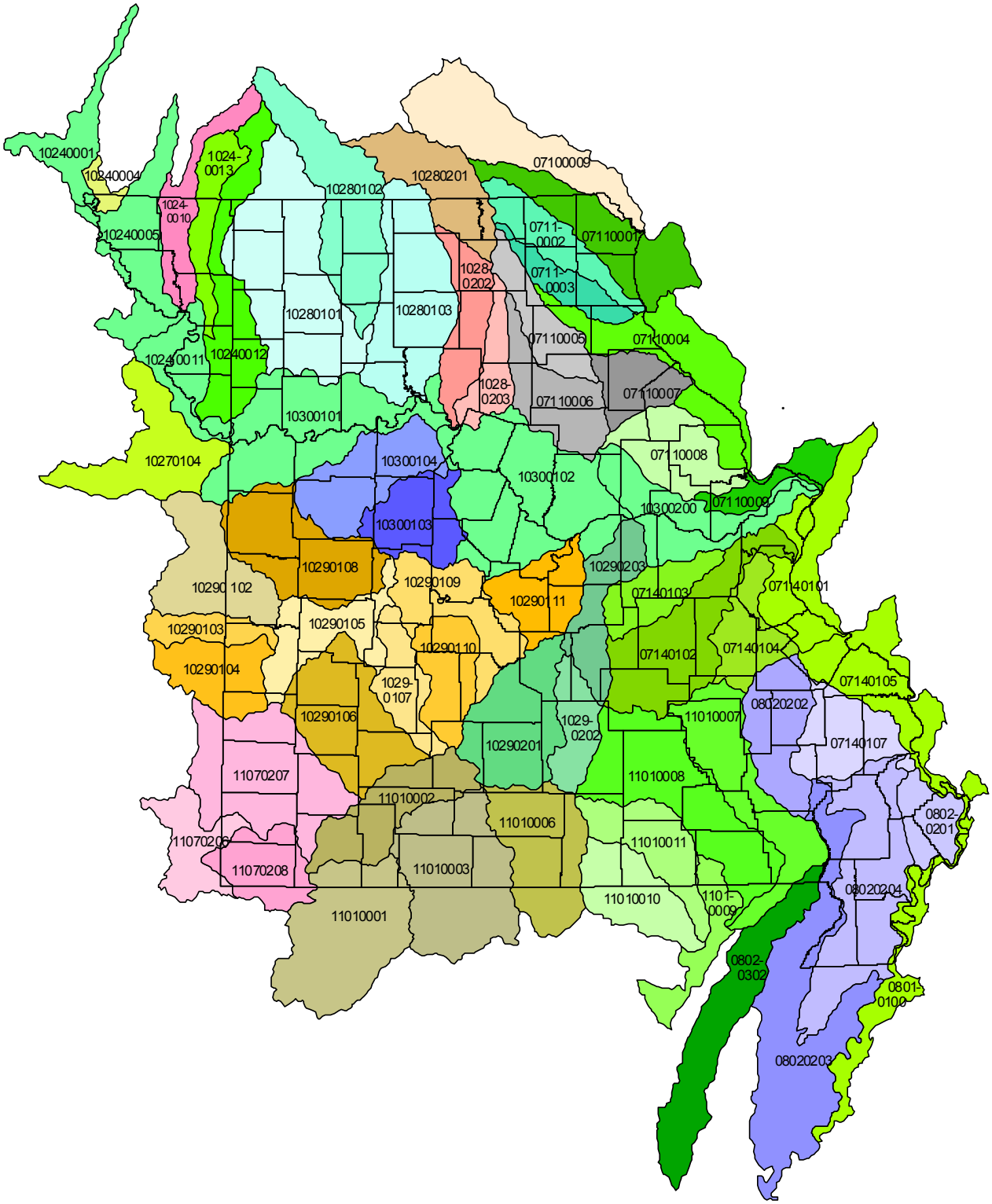
Missouri Hydrologic Unit Delineations by 8-digit Hydrologic Unit Code.



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Appendix B

Our Missouri Waters Initiative

List of 12-Digit HUC Numbers and Names

Spring_12digit_Export_Output_8

HUC_8	HUC_12	ACRES	HU_12_NAME
11070207	110702070101	26455	Headwaters Spring River
11070207	110702070102	32872	Headwaters Honey Creek
11070207	110702070103	10370	Honey Creek
11070207	110702070104	19781	Hillhouse Branch-Spring River
11070207	110702070105	34867	Williams Creek
11070207	110702070106	20484	Stahl Creek
11070207	110702070107	16075	Town of Freistatt-Spring River
11070207	110702070201	33307	Headwaters North Fork Spring River
11070207	110702070202	29731	Kyle Creek-North Fork Spring River
11070207	110702070203	31036	Elm Branch-North Fork Spring River
11070207	110702070204	24183	Pettis Creek
11070207	110702070205	34157	West Fork Spring River
11070207	110702070206	13292	Lamar Lake-North Fork Spring River
11070207	110702070301	36799	Coon Creek
11070207	110702070302	12682	Community of Boston-North Fork Spring River
11070207	110702070303	21070	Deer Creek
11070207	110702070304	22914	Headwaters Dry Fork
11070207	110702070305	17230	Dry Fork

HUC_8	HUC_12	ACRES	HU_12_NAME
11070207	110702070306	24593	Opossum Creek-North Fork Spring River
11070207	110702070307	28364	Buck Branch-North Fork Spring River
11070207	110702070308	26836	Glendale Fork
11070207	110702070309	14953	Headwaters Little North Fork
11070207	110702070310	16115	Little North Fork
11070207	110702070311	23423	North Fork Spring River
11070207	110702070401	41127	Second Cow Creek
11070207	110702070402	26077	First Cow Creek
11070207	110702070403	35046	East Cow Creek-Cow Creek
11070207	110702070404	38359	Brush Creek-Cow Creek
11070207	110702070405	24231	Long Branch-Cow Creek
11070207	110702070501	15334	Cave Spring Branch
11070207	110702070502	23196	Headwaters White Oak Creek
11070207	110702070503	17253	White Oak Creek
11070207	110702070504	42496	Dry Hollow-Spring River
11070207	110702070505	35640	City of Carthage-Spring River
11070207	110702070506	15954	Town of Alba-Spring River
11070207	110702070507	13835	Blackberry Creek
11070207	110702070508	20660	Town of Waco-Spring River
11070207	110702070601	14603	Dry Valley Branch

HUC_8	HUC_12	ACRES	HU_12_NAME
11070207	110702070602	28089	Headwaters Center Creek
11070207	110702070603	23296	Jenkins Creek
11070207	110702070604	22194	Jones Creek
11070207	110702070605	34848	City of Sarcoxie-Center Creek
11070207	110702070606	22185	Grove Creek-Center Creek
11070207	110702070607	28367	Webb City-Center Creek
11070207	110702070608	18480	Center Creek
11070207	110702070701	9930	Joyce Creek
11070207	110702070702	30484	Headwaters Shoal Creek
11070207	110702070703	29255	Capps Creek
11070207	110702070704	22803	Headwaters Clear Creek
11070207	110702070705	24995	Clear Creek
11070207	110702070706	21412	Zerbert Branch-Shoal Creek
11070207	110702070801	19166	Spencer Branch-Shoal Creek
11070207	110702070802	24301	Hickory Creek
11070207	110702070803	30537	Dry Branch-Shoal Creek
11070207	110702070804	31684	Baynham Branch-Shoal Creek
11070207	110702070805	35021	Thurman Creek-Shoal Creek
11070207	110702070806	20071	Shoal Creek

HUC_8	HUC_12	ACRES	HU_12_NAME
11070207	110702070901	29752	Turkey Creek
11070207	110702070902	38834	Shawnee Creek
11070207	110702070903	37103	Brush Creek
11070207	110702070904	32074	Short Creek-Spring River
11070207	110702071001	21822	Fivemile Creek
11070207	110702071002	23543	Willow Creek-Spring River
11070207	110702071003	16388	Warren Branch
11070207	110702071004	23247	Devils Hollow-Spring River
11070207	110702071005	22237	Flint Branch-Spring River

Big_12digit_Export_Output_9

HUC_8	HUC_12	ACRES	HU_12_NAME
07140104	071401040101	26034	Headwaters Big River
07140104	071401040102	17345	Saline Creek
07140104	071401040103	17183	Headwaters Cedar Creek
07140104	071401040104	15858	Cedar Creek
07140104	071401040105	32491	Clear Creek-Big River
07140104	071401040106	26777	Wallen Creek-Big River
07140104	071401040107	17099	Blay Creek-Big River
07140104	071401040108	30437	Flat River
07140104	071401040109	17582	Headwaters Terre Bleue Creek
07140104	071401040110	24834	Terre Bleue Creek
07140104	071401040111	23009	Owl Creek-Big River
07140104	071401040201	30546	Mine a Breton Creek
07140104	071401040202	17011	Sunnen Lake-Fourche a Renault
07140104	071401040203	24872	Fourche a Renault
07140104	071401040204	24422	Clear Creek-Mineral Fork
07140104	071401040205	11883	Old Mines Creek
07140104	071401040206	12721	Mineral Fork
07140104	071401040301	32820	Mill Creek
07140104	071401040302	36944	Three Hill Creek-Big River
07140104	071401040303	21115	Tiff Creek-Big River
07140104	071401040401	20378	Calico Creek-Big River
07140104	071401040402	18890	Dry Creek
07140104	071401040403	36060	Ditch Creek-Big River
07140104	071401040404	16539	Belew Creek

HUC_8	HUC_12	ACRES	HU_12_NAME
07140104	071401040405	14645	Jones Creek-Big River
07140104	071401040406	20459	Heads Creek
07140104	071401040407	32961	Big River

Lower_Grand_12digit_Export_Output_10

HUC_8	HUC_12	ACRES	HU_12_NAME
10280103	102801030101	33215	Upper Little Medicine Creek
10280103	102801030102	17379	Middle Little Medicine Creek
10280103	102801030103	18329	Lower Little Medicine Creek
10280103	102801030201	20007	West Fork Medicine Creek
10280103	102801030202	32385	Headwaters Medicine Creek
10280103	102801030203	10142	Elm Branch
10280103	102801030204	23014	Buckworth Creek-Medicine Creek
10280103	102801030205	15271	Barber Creek
10280103	102801030206	10703	Long Branch-Medicine Creek
10280103	102801030207	39214	Hooton Creek-Medicine Creek
10280103	102801030301	21732	Black Oak Branch-Medicine Creek
10280103	102801030302	21941	Sapp Branch-Medicine Creek
10280103	102801030303	12120	Medicine Creek
10280103	102801030401	16127	Upper Muddy Creek
10280103	102801030402	24807	Middle Muddy Creek
10280103	102801030403	18225	Lower Muddy Creek
10280103	102801030501	25731	Headwaters Parson Creek
10280103	102801030502	12476	Little Parson Creek
10280103	102801030503	32561	Parson Creek
10280103	102801030601	31585	Headwaters East Locust Creek
10280103	102801030602	25799	Little East Locust Creek
10280103	102801030603	22170	East Locust Creek
10280103	102801030701	12165	East Fork Locust Creek
10280103	102801030702	28771	Headwaters Locust Creek

HUC_8	HUC_12	ACRES	HU_12_NAME
10280103	102801030703	34873	West Locust Creek
10280103	102801030704	26867	Watkins Creek-Locust Creek
10280103	102801030705	34433	Rooks Branch-Locust Creek
10280103	102801030706	26560	Community of Reger-Locust Creek
10280103	102801030801	15986	Upper West Locust Creek
10280103	102801030802	26926	Middle West Locust Creek
10280103	102801030803	39361	Lower West Locust Creek
10280103	102801030901	18255	Lowes Branch-Locust Creek
10280103	102801030902	17388	Muddy Creek
10280103	102801030903	32250	Kemper Branch-Locust Creek
10280103	102801030904	20954	Locust Creek
10280103	102801031001	16698	Roach Lake-Grand River
10280103	102801031002	25090	Johnson Creek-Grand River
10280103	102801031003	21684	Campbell Creek-Grand River
10280103	102801031101	26365	Winigan Creek
10280103	102801031102	34244	Upper East Yellow Creek
10280103	102801031103	35339	Middle East Yellow Creek
10280103	102801031104	22554	Lower East Yellow Creek
10280103	102801031201	25322	Headwaters West Yellow Creek
10280103	102801031202	22759	Town of Sorrell-West Yellow Creek
10280103	102801031203	36134	Bear Creek-West Yellow Creek
10280103	102801031204	30668	Long Branch
10280103	102801031205	9832	Bear Creek-West Yellow Branch
10280103	102801031206	13999	Goose Lake-West Yellow Creek
10280103	102801031301	33770	Turkey Creek
10280103	102801031302	20455	Spring Branch-Elk Creek

HUC_8	HUC_12	ACRES	HU_12_NAME
10280103	102801031303	19627	Elk Creek
10280103	102801031401	26487	Yellow Creek
10280103	102801031501	19367	Tater Hill Creek
10280103	102801031502	30241	Bridge Creek
10280103	102801031503	19099	Headwaters Big Creek
10280103	102801031504	11379	Shootman Creek
10280103	102801031505	16535	Wolf Branch-Big Creek
10280103	102801031506	35950	Big Creek
10280103	102801031601	10490	Towstring Creek
10280103	102801031602	22777	City of Sumner-Grand River
10280103	102801031603	26188	Hurricane Creek
10280103	102801031604	24113	Potter Slough-Grand River
10280103	102801031701	38193	Salt Creek
10280103	102801032303	15805	Grand River

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Appendix C

Department Initiatives

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FY 2012 Missouri Mississippi River Basin Healthy Watersheds Initiative Projects

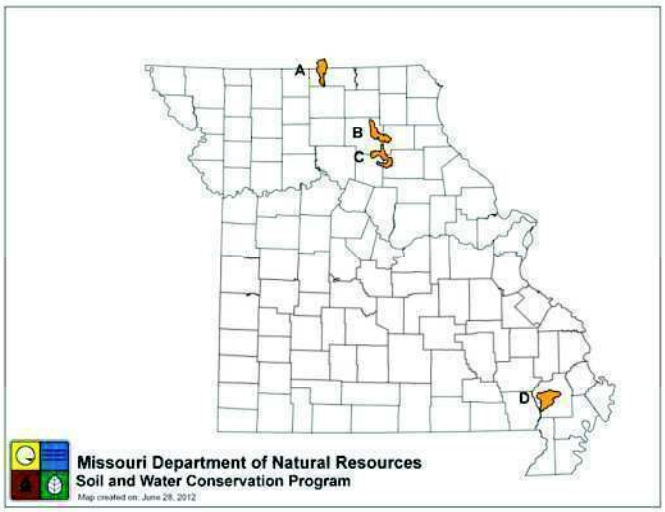
- **In June 2012, Missouri was awarded Mississippi River Basin Healthy Watersheds Initiative (MRBI) - Cooperative Conservation Partnership Initiative (CCPI) funding for all four of the MRBI-CCPI project proposals that were submitted. These proposals were developed by the Missouri Department of Natural Resources Soil and Water Conservation Program and sponsored by the Putnam, Macon, Randolph, and Stoddard County Soil and Water Conservation Districts.**

- **Arkansas had the most MRBI-CCPI projects (9) funded in 2012, followed by Missouri and Iowa with four each, among the 13 states that were eligible for MRBI funding.**

- **If Missouri's 2012 projects are fully funded, they will receive a total of $7.58 million in federal cost-share funding during the 4-year project periods (2012-2016). The table below shows the amounts of funding requested for each of the 2012 Missouri MRBI project proposals. All of these projects were fully funded for the first year.**

2012 MISSOURI MRBI PROJECTS	Amount
(A) Putnam County – Lower Grand	$1,450,000
(B) Macon County – North and South Fork Salt	$1,700,000
(C) Randolph County – South Fork Salt	$2,180,203
(D) Stoddard – Lower St. Francis	$2,251,711
Totals	$7,581,914

- **The locations of the four Missouri MRBI projects that were awarded funding in 2012 are shown in the map below. The letters on the map refer to the projects listed in the table above.**



- **During the first three years of the MRBI program, Missouri has been awarded more MRBI-CCPI funding than any other state (up to $45.6 million from 2010-2016 if all projects are fully funded). Missouri has also received funding for more MRBI-CCPI projects (22) than any other state.**

- **The primary agricultural conservation practices that will be implemented in Stoddard County (Bootheel area of Missouri) are irrigation land leveling, irrigation pipeline, nutrient management, fence, pasture and hayland planting, cover crops, shallow water development and management for wildlife, irrigation water development, edge-of-field monitoring, and watering facility.**

- **The primary agricultural conservation practices that will be implemented in Putnam, Macon, and Randolph counties in north central Missouri are underground outlet, terrace, cover crops, edge-of-field monitoring, residue and tillage management (no-till), nutrient management, pasture and hayland planting, and grassed waterway.**

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Background

- **The Mississippi River Basin Healthy Watersheds Initiative (MRBI) is a targeted U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) program that was initiated in 2010 to improve the health of watersheds in the Mississippi River Basin.**

- **MRBI promotes voluntary implementation of 41 core and supporting conservation practices that avoid, control, and trap nutrient and sediment runoff, improve wildlife habitat, restore wetlands, and maintain agricultural productivity.**

- **NRCS is providing up to $80 million in MRBI funding annually from 2010 through 2013.**

- **MRBI encourages implementation of "conservation systems" involving multiple core and supporting conservation practices.**

- **MRBI is not a grant program. Cost-share funds are paid directly to eligible producers for implementing conservation practices in approved MRBI project areas.**

- **A total of 54 8-digit HUC watershed focus areas in 13 states (Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, South Dakota, Tennessee, and Wisconsin) are eligible for MRBI funding.**

- **Six 8-digit HUC watersheds in Missouri are eligible for MRBI funding (Lower Grand, North Fork Salt, South Fork Salt, Little River Ditches, Lower St. Francis, and Cache Creek).**

- **Funding is provided through the Cooperative Conservation Partnership Initiative (CCPI), which includes the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentive Program (WHIP), and the Conservation Stewardship Program (CSP), and the Wetlands Reserve Enhancement Program (WREP), which includes the Wetlands Reserve Program (WRP).**

- **The Missouri Department of Natural Resources Soil and Water Conservation Program developed MRBI project proposals for eligible Missouri soil and water conservation districts and assisted them in applying for MRBI funding in 2010-2012. Nonfederal matching funds provided by SWCP through state cost-share payments to agricultural producers and state funds provided for edge-of-field and in-field monitoring have been important in making Missouri's MRBI project proposals more competitive.**

- **In 2010, Missouri was awarded MRBI-CCPI funding for 12 MRBI projects, the most of any eligible state. If these 12 projects are fully funded, Missouri will receive a total of $28.3 million in additional federal cost-share funding from 2010-2015.**

- **In 2011, Missouri was awarded MRBI-CCPI funding for six MRBI projects, the most of any eligible state. If these six projects are fully funded, Missouri will receive a total of $9.7 million in additional federal cost-share funding from 2011-2015.**

- **In 2012, Missouri was awarded MRBI-CCPI funding for 4 MRBI projects, which tied with Iowa for the second-most projects funded. Arkansas had the most MRBI-CCPI projects funded (9) in 2012. If Missouri's four projects are fully funded, Missouri will receive a total of $7.6 million in additional federal cost-share funding from 2012-2016.**

Missouri Nutrient Reduction Strategy

In 2008, after several years of reassessment and planning activities, the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (Hypoxia Task Force) released the Gulf Hypoxia Action Plan 2008. Among the 11 action items listed in this plan, the Hypoxia Task Force recognized the importance of developing state-level nutrient reduction strategies by making it Action Item #1. The 12 states in the Mississippi/Atchafalaya River Basin (MARB), which include Arkansas, Indiana, Iowa, Illinois, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin, agreed that state nutrient reduction strategies should be completed as soon as possible, and implemented as soon practicable, but no later than 2013. Recognizing the heterogeneity of soils, hydrology, land use, and cropping practices, as well as legal, legislative, and administrative framework variances across MARB states, the Hypoxia Task Force acknowledged that no single approach to nutrient reduction would be effective in every state. However, use of a common approach among the MARB states in developing state nutrient reduction strategies, including use of similar critical elements, was encouraged to increase the likelihood of the states moving forward toward attaining the "Coastal Goal" of the Hypoxia Action Plan. The Coastal Goal calls for a reduction in the five-year running average areal extent of the Gulf of Mexico hypoxic (dead) zone to less than 5,000 square kilometers by the year 2015.

Development of the Missouri Nutrient Reduction Strategy began in October 2011. However, in May 2012, the Missouri Department of Natural Resources was awarded a Section 104(b)(3) grant for $118,530 in financial assistance, which will be used to help develop the Missouri Nutrient Reduction Strategy. The EPA grant project period will extend from June 1, 2012, until December 31, 2013. The target date for completing and beginning implementation of the Strategy is September 30, 2013. This grant will be used to hire a contractor(s) over the 1 ½ year project period to hire contractors (two temporary employees) to draft portions of the state nutrient reduction strategy, compile information on the effectiveness and costs of BMPs, develop tables and figures, identify critical treatment areas, and assist with drafting of two or more watershed management plans. The Missouri Nutrient Reduction Strategy will be developed through a diverse committee that is currently composed of more than 90 participants from 38 different organizations, including state and federal agencies, municipal and county governments, nongovernmental organizations, watershed groups, private industry, universities, agricultural producers, private citizens, and planning commissions. Expected outcomes associated with completion of the Missouri Nutrient Reduction Strategy are a comprehensive list of recommendations and action items, which when implemented, should significantly reduce nutrient loads within the Missouri watersheds with the greatest amounts of nutrient pollution.

Our Missouri Waters Initiative

The *Our Missouri Waters Initiative* is an effort to move Missouri towards watershed-based management – making decisions while looking at an entire watershed, and not just parts of it. The initiative is also going to bring the diverse parts of the Missouri Department of Natural Resources together to maximize resources and approaches.

The three pilot watersheds were selected to demonstrate and evaluate the feasibility of water resource management on a targeted basis. The pilots will help the department develop the necessary infrastructure, policies and procedures to implement this approach across all 66 of the state's HUC-8 level watersheds.

For additional information reference: http://dnr.mo.gov/omwi.htm

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Appendix D

Framework Schedule

04/04/12

2011-2014 BASINWIDE Plans Schedule

Basin - *colors indicate planner*	Last EMC plan	2008	2009	2010	2011	2012	2013	2014
FRENCH BROAD	2007	A	P		D F		A	
NEW	2005		A		P D F			A
TAR-PAMLICO	2004	A		P D	F		A	
ROANOKE	2006		A		I P D F			
CAPE FEAR	2005		A		I P D F			A
WHITE OAK	2007				A I P D F			
SAVANNAH	2007				A I P D F			
WATAUGA	2007				A I P D F			
HIWASSEE	2007				A I P D F			
LITTLE TENNESSEE	2007				A I P D F			
PASQUOTANK	2007				A I P D F			
CHOWAN	2007				A I P D F			
BROAD	2008	D P F			A	I P D F		
YADKIN-PEE DEE	2008	D P F				A I P D F		
NEUSE	2009	D P	F		A			
LUMBER	2010		P D	F		A I P D F		
CATAWBA	2010	A		P D F		A I P D F		
Integrated Report to EPA		I R		I R		I R		I R

2012 IR - 1/1/2006 thru 12/31/2010

2014 IR - 1/1/2008 thru 12/31/20012

	Biological & Lake Sampling
A	ESS Reports
I	Schedule Presentation of Internal Draft, & mtgs w/ NPDES & ROs
	Initial Review (Draft Done)
P	Public Review
D	Final Draft Basin Plan Approved by WQC
F	Final Basin Plan Approved by EMC
	NPDES Permits Issued

	Nora Deamer
	Heather Patt
	Melanie Williams
	Paul Clark/Ed Williams

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Appendix E

Permit Synchronization Draft

Initial Transition to Watershed Based Management – Permit Synchronization and Inspections

Contents Page Number

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Section 2 – Grouping of Permits to be Synchronized 1

Section 3 – Transitioning to Permit Synchronization 3

Section 4 – Inspections During and After Permit Synchronization 6

Section 5 – Figures and Tables 8

Appendix A – Permits to be Synchronized, Permit Writer Instructions, and Inspection Years

Figures and Tables Page Number

Figure 1 - The five groups of HUC8 watersheds 8

Table 1 – HUC8 Group 1 9

Table 2 – HUC8 Group 2 9

Table 3 – HUC8 Group 3 10

Table 4 – HUC8 Group 4 10

Table 5 – HUC 8 Group 5 11

Table 6 – Permit Synchronization Table 11

Table 7 – Inspection per fiscal year by permit category by region and statewide 12

DRAFT

Section 1 - Introduction

Currently, a major priority of the Department is the transition from the traditional methods with which Missouri's water resources have been managed to a Watershed Based Management (WBM) approach. This approach involves coordination and collaboration between programs and divisions within the department, other state, federal, and local government agencies, and stakeholders of all kinds. At the regional office (RO) level, staff will play a prominent role in monitoring, compliance assistance, and overall planning and coordination between many of the involved entities. Within the Water Protection Program (WPP) this shift involves reevaluating and reorganizing many of the routine duties that are performed such that activities within a watershed are more directed and focused. The WBM strategy that is proposed for the WPP consists of grouping watersheds together into five groups and moving each group sequentially through a cycle of five phases. The cycle will last five years and will involve assessment and prioritization of watersheds, targeting of certain areas for focused data collection, and development of watershed management plans. The cycle culminates in phase five with the execution of the management plan, including issuance of all permits in the watershed and implementation of all other watershed-specific activities deemed necessary to meet the determined goals. Each year, a new group of watersheds will begin the five year cycle and the cycle will begin again after the fifth year; creating a continuous and predictable cycle of duties that will lay the groundwork for a more consistent and goal-oriented program.

As the idea of moving to the WBM approach has been discussed over the past few months, the notion that permit issuance should be synchronized within watersheds has become a prevailing sentiment both within the Department and among stakeholders. Permit synchronization has become a key element in the draft framework that is being developed for the WBM approach to WPP functions.

The immediate goals of the permit synchronization include the following:

- The administrative and technical streamlining of WPP and RO activities such as permitting, inspections, and water quality monitoring.
- Providing the basis for future watershed permitting.
- Beginning to further examine Missouri's water resources on a watershed basis.

In the long term, permit synchronization will provide the framework for enacting and attaining measureable water quality improvements and will aid in a potential future move to water quality trading if it proves feasible.

Section 2 - Grouping of permits to be synchronized

The WBM approach will manage watersheds on the eight-digit Hydrological Unit Code (HUC8) scale. As permitting and permit synchronization is a key aspect of successful implementation of a Watershed Management Plan (WMP), the same HUC8 groups that will move through the WBM cycle will have their permit expirations and issuances synchronized in the same fiscal year. The typical five-year term of permit issuances aligns with the proposed five-year WBM cycle and the two processes will be intimately tied together.

The State of Missouri has 66 HUC8s many of which are bound entirely within Missouri's borders. Some HUC8s, however, are shared somewhat evenly with neighboring states and some have only a small area that lie in Missouri. As the WBM cycle lasts five years, these 66 HUC8s must be divided into five groups that evenly divides the workload year to year. An important component of the WBM cycle that must be considered in making the HUC8 groupings are the synchronization of renewals of site specific domestic permits with a design flow of 50,000 gallons per day (GPD) or more as well as all other site specific permits within HUC8s. Domestic permits with a design flow of less than 50,000 GPD are excluded from consideration as the WPP is considering a general permit for these types of facilities. The chosen HUC8 grouping must ensure that the permit renewal workload is relatively consistent every year. Related to the permit workload is the inspection workload for the regions. The WBM cycle specifies that each of the applicable permitted facilities in a HUC will receive a compliance inspection as close to permit renewal as feasible and no more than three years before renewal. When choosing the HUC8s that will be grouped together, this must be taken into account to ensure that regions are not overwhelmed with inspections in certain years.

As of May 2012, the number of site specific permits meeting the above stated criteria is 1,036. Rounding down to the nearest hundred, the ideal HUC8 grouping would have around 200 permits to be renewed per year and 40 inspections per region per year. In reality, however, the geographic dispersion or density of permitted facilities throughout the state makes it difficult to reach those ideals. Some HUC8s have few or no facilities meeting the criteria and many have more than 40; up to 87 in one circumstance. As such, grouping the 66 HUC8s with permit renewals per year and inspections per region per year as close as possible to the targets became a painstaking process that, even after many adjustments, still falls short of the goal in a couple cases. The following steps are what were ultimately used in the grouping process:

- The three HUC8s in the Our Missouri Waters Initiative were placed in the first group of HUC8s.
- Two HUC8s with very large applicable permit numbers, one primarily in KCRO with 87 permits and on in NERO with 62 permits were placed in groups under the assumption that the other HUCs in those groups would have very little or no more permitted facilities for that region.
- SLRO was specifically addressed next. This region contains the fewest number of HUC8s; however, most of them contain high numbers of applicable facilities. The HUC8s were distributed amongst the groups to come up with a fairly even number of facilities per year for SLRO.
- SWRO has more HUC8s than SLRO but also has several HUC8s with relatively high numbers of applicable permits. These were distributed similarly to SLRO.
- All other HUC8s with moderate numbers of permits were then distributed amongst groups where they fit in without skewing any region's permit numbers.
- At this point the remaining HUC8s with low permit numbers or no permits were used to fill in any gaps in the five groups. Special care was taken to ensure that HUC8s in the same groups were as geographically dispersed throughout the region as possible to ensure that no part of the region would have the perception of being neglected at any given time. HUC8s with no permits were added to groups that already had permit numbers far in

excess of 40 for a given region. This provides similar numbers of HUC8s to manage annually for the region but does not increase the workload.

Figure 1 is a map of Missouri that displays the five HUC8 groups that resulted from this process. It is apparent from this map that many HUC8s cross regional boundaries and have permitted facilities that lie in two or three different regions. In these situations the watershed management responsibilities for that HUC8 will fall onto the region with the majority of the land mass. Inspections and other regional office responsibilities for facilities falling in the minority land mass areas will remain with the regional office covering that county. With this arrangement there will need to be close cooperation between the regional watershed coordinators and compliance and enforcement staff between regions.

Tables 1 through 5 contain details of the HUC8s that belong to the five management groups. Note that the total number of permits per group is as close to 200 as is possible using the above described scheme. In groups containing the densely permitted HUC8s in KCRO and NERO, it appears that those regions would have peaks of high workloads every five years. However, given the lower numbers of permits for those regions in the groups before and after, the inspections should be able to be distributed fairly evenly over a couple years.

Section 3 - Transitioning to Permit Synchronization

Since permits are issued on a five-year term, to achieve synchronization many permits will need to be issued for less than the full five years allowed by regulation. The intent is that all permits within a HUC8 and within the larger group of HUC8s moving through the WBM cycle together will all expire in the same fiscal year. Expirations will be staggered throughout the year to allow permit staff to keep up with the work load. If possible, permits within the twelve-digit HUC scale should all expire and be reissued at the same time. This will allow further streamlining by placing multiple permits within a smaller geographic area on public notice simultaneously, thereby reducing repeated administrative efforts.

The task of getting all permits in the groups of HUC8s synchronized will be a five-year task at its core with a small amount of synchronization work extending past that mark. During that time, there will be a larger than usual workload for permit writers. The increase will not be doubled but, since some permits would need to be issued twice in less than ten years, staff will see noticeably more renewals in the first five years. Fortunately, much of workload increase will be offset with the move of smaller facilities to general permit coverage. Careful planning will be needed to ensure that the expiration dates of all permits within a HUC8 are aligned.

The proposed WBM cycle is a five year process in which the implementation phase is year five. Part of the implementation phase is the issuance of all permits in the HUC8. In order to ensure that all permits in Group 1 of HUC8s are fully synchronized and ready for reissuance during the fifth year of the WBM cycle, the synchronization process must begin one full year prior to implementation of the WBM planning process. For the purpose of this proposal, assume that statewide implementation of WBM planning will be effective July 1, 2013 (FY14). If Group 1 permits are to be synchronized by FY18 (year five or implementation phase) then the process must begin July 1, 2012 (FY13). Table 6 displays the five HUC8 groups that will have their

permits synchronized. The table shows that each group has an initial and a final permit synchronization year. In an ideal situation, all permits would be issued for a full five years in the initial synchronization year such that they would expire and be renewed again during the fifth year (implementation phase) of the WBM cycle. The reality is that many permits are effective until several years after the initial synchronization year, thus a second synchronization year is necessary.

A plan has been developed that provides permit staff with specific instructions on when to renew every permit and for how long it should be issued (Appendix A). The plan was developed using a series of specific logic functions in Microsoft Excel that, given the current permit expiration, the initial and final permit synchronization periods, and the proximity of expiration to synchronization time, produces an instruction to either renew the permit for five years, allow it to remain expired for up to two years and then renew it for five years in one of the synchronization years, or to renew it for a period of less than five years to expire in one of the synchronization years. Allowing permits to remain expired for up to two years will alleviate some of the duplicate permit work inherent in the synchronization process.

To distribute the permit workload evenly throughout the fiscal year all permits in a group were sorted by their HUC8 and then by the sub-watershed (HUC12). In that order, each HUC12 was alternately assigned a quarter in the fiscal year. If, after assignment, any quarter had more or less permits than the others, adjustments were made to make them equal. The assignments were then used to determine during which quarter in the initial and final permit synchronization years the permits would be renewed.

The logic functions in Excel used the following criteria to determine the instruction to the permit writer:

- If a permit expires 2 years or less before the initial or final synchronization quarter it will remain expired until that quarter comes.
- If a permit expires more than two years before the initial permit synchronization quarter it will be renewed for a period of less than five years such that it expires in the initial synchronization quarter. It will then be renewed for a full five years, expiring in the final synchronization quarter.
- If a permit expires after the initial synchronization quarter but more than two years from the final synchronization quarter it will be renewed for a period of less than five years, expiring in the final synchronization quarter.

Group 1 and Group 2 permits will be slightly different from the others. For Group 1, the initial sync year begins FY13 so there is no time to allow permits to be expired for a time before the initial sync quarter. For Group 2 some permits have been expired some time already and, according to the logic should be renewed; however these permits will remain expired until the initial sync year.

It should be emphasized that the synchronization plan is only a guide for permit writers and there will certainly be many exceptions. Some of these are listed as follows:

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- Many permits are on hold for affordability analyses. The instructions may tell a permit writer to allow the permit to remain expired for some time. If there are no objections within the Department or from the facility, the permit should remain expired until the prescribed time. If the permit issuance cannot wait for any reason there are two options. It can be renewed for a short time period to expire during the initial permit synchronization or it can be renewed for five years. If the latter is the case, special instructions should be added to the fact sheet and to the facility file detailing to the next permit writer how long the next permit should be issued for.
- If the permit writer instructions say to issue a permit for less than five years but the permit contains a schedule of compliance (SOC) or other conditions that prevent it from being issued for the prescribe time period it may be renewed for the full five years and the same instructions as above should be followed.
- If a permit is issued to a new facility or an initial permit is issued to an existing facility, the synchronization quarter for the other permits in its HUC12 should be identified and the permit should be issued for a period up to five years with expiration corresponding to that quarter.
- The permit synchronization scheme has excluded all domestic wastewater treatment facilities with a design flow under 50,000 GPD under the assumption that general permits will be developed for these facilities. If a facility is determined to be ineligible for the general permit then the same instructions as immediately above should be followed.
- It is feasible that, with staff turnover, and other unforeseen circumstances, permit staff may get behind on the synchronization schedule. If this were to happen, however, it would not completely derail the process. The permit synchronization scheme does not specify the term that a permit should be issued but rather specifies only when it should expire to line up with the synchronization quarters. If permits do not get renewed as scheduled in their respective initial or final synchronization quarters, they will simply be renewed at the earliest time for a period of less than five years.

<u>Challenges to permit synchronization</u>

As mentioned previously, it will be a challenge for permit staff to keep up with the increased workload during the synchronization phase. The number of employees dedicated to permit writing is based on the workload as it currently stands. With more renewals taking place, the permit writing process will need to be streamlined as much as possible, both through the consolidation and delegation of administrative tasks and through strong leadership in the Permits Section.

It is anticipated that some permittees may be opposed to receiving a permit that is good for less than the full five years they are used to. Permittees perceive that each permit renewal will bring tighter limits and conditions. If their next renewal is less than five years away, they may be upset in anticipation of repeated facility upgrades. Moreover, they may not like the additional work of renewing it more frequently. Conversely, some permittees may look favorably on the department allowing their permit to remain expired until the synchronization year under the perception that it gives them more time until limits and conditions

Section 4 - Inspections during and after Permit Synchronization

The ideal situation for inspections of permitted facilities is that each would be inspected at least once every five years, preferably within one year prior to permit renewal. Each year, regional staff members develop inspection work plans with this in mind; however, due to the large number of facilities and the negotiated targets with the EPA for different types of facilities, the Department does not always accomplish this ideal. The WBM cycle takes this into account and prescribes that inspections be conducted for all applicable facilities in a HUC8 group in years two, three, or four (preferably three or four) to ensure that reports are finalized and available to permit staff during year five.

Once permits are synchronized and the WBM cycle has been fully implemented, the annual inspections lists for these applicable facilities will be fairly constant and predictable; paralleling the HUC8 group management cycle. During the transition period, however, permit expirations are not on the predictable cycle and many permits will remain expired for some time or be renewed for shorter time periods. The long term and seemingly sporadic expiration and renewal schedule of this transition makes it difficult to plan inspections over the coming fiscal years to ensure that permit staff has recent inspection reports in hand during permit drafting. Fortunately, the detailed permit synchronization plan described in the previous section provides an opportunity to develop a parallel inspection plan for the synchronization phase.

The inspection plan that has been developed (Appendix A) follows the same assumptions as permit synchronization; that full implementation of the WBM cycle will begin in FY14 and that the WPP will begin to plan inspections in FY13 based on that implementation date. As with permit synchronization, beginning inspections based on the WBM cycle a full year prior to WBM implementation is necessary to ensure the goals are met and will provide some room for adjustment and adaptation as the program and regions learn to adjust. Similar to the permit synchronization plan, the inspection plan was developed using a series of logic functions in Excel, building from the initial and final permit synchronization periods already established.

The logic functions in Excel used the following criteria to determine the instruction to the permit writer:

- If a permit is already expired or will be expiring in the first two quarters of FY13 and will be renewed in FY13 there is no time to finalize an inspection prior to renewal. These facilities will be inspected during the fiscal years leading up to their final synchronization year. The plan does not specify a single year that the inspection will occur prior to final permit synchronization. Instead a range of years is provided; allowing for flexibility in the planning process.
- If a permit is expiring in the second or third quarters of FY13, an inspection will be finalized in the first two quarters of FY13.
- For all other facilities, the plan prescribes that an inspection takes place in the fiscal year prior to the permit expiration.

In addition to the first round of inspections, if a facility is initially inspected more than three years before the final permit synchronization year, the plan lays out a general time that a second inspection should occur. This will ensure that, at the next permit renewal, a recent inspection report will be available as well. As with permit synchronization, this plan is not a mandate, but rather a guide that should be used for planning purposes for the next few years through the permit synchronization process. After each group passes the final synchronization year, the inspections schedule will be dictated by the WBM cycle. Deviations from the plan are to be expected and some of the circumstances warranting a deviation are described as follows:

- Each year in the work planning stage, regional staff will compare this plan to a list of recently inspected facilities. In the first couple years many facilities will have already been inspected in the previous year or two. These facilities do not necessarily need to be inspected again if it is close enough to permit renewal.
- Many facilities will need to be inspected during unscheduled year because of issues or concerns as they arise.
- There is potential that the inspection plan will not satisfy all of the inspection goals negotiated with the EPA. If that is the case, inspections may need to be moved up a year or two to accommodate those requirements.

Tables 7 displays the number of inspections per region and statewide by type of facility that the plan prescribes. These numbers take into account the initial inspections from the plan only. For facilities that do not have a single specified year, but rather a range of years that the inspection may occur, the first year of that range was used. Note that for some regions it appears that as the years progress the number of inspections tapers off. That is not necessarily so in that, as the years progress, HUC8 groups will be passing their initial synchronization year. These numbers do not take into account the second inspections from the plan.

This plan alone will not meet the inspection goals negotiated with the EPA since it does not include domestic wastewater permits less than 50,000 GPD, land disturbance permits, or any other general permits. Regions will still need to proceed with work planning as traditionally done for these types of facilities.

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Section 5 - Figures and Tables

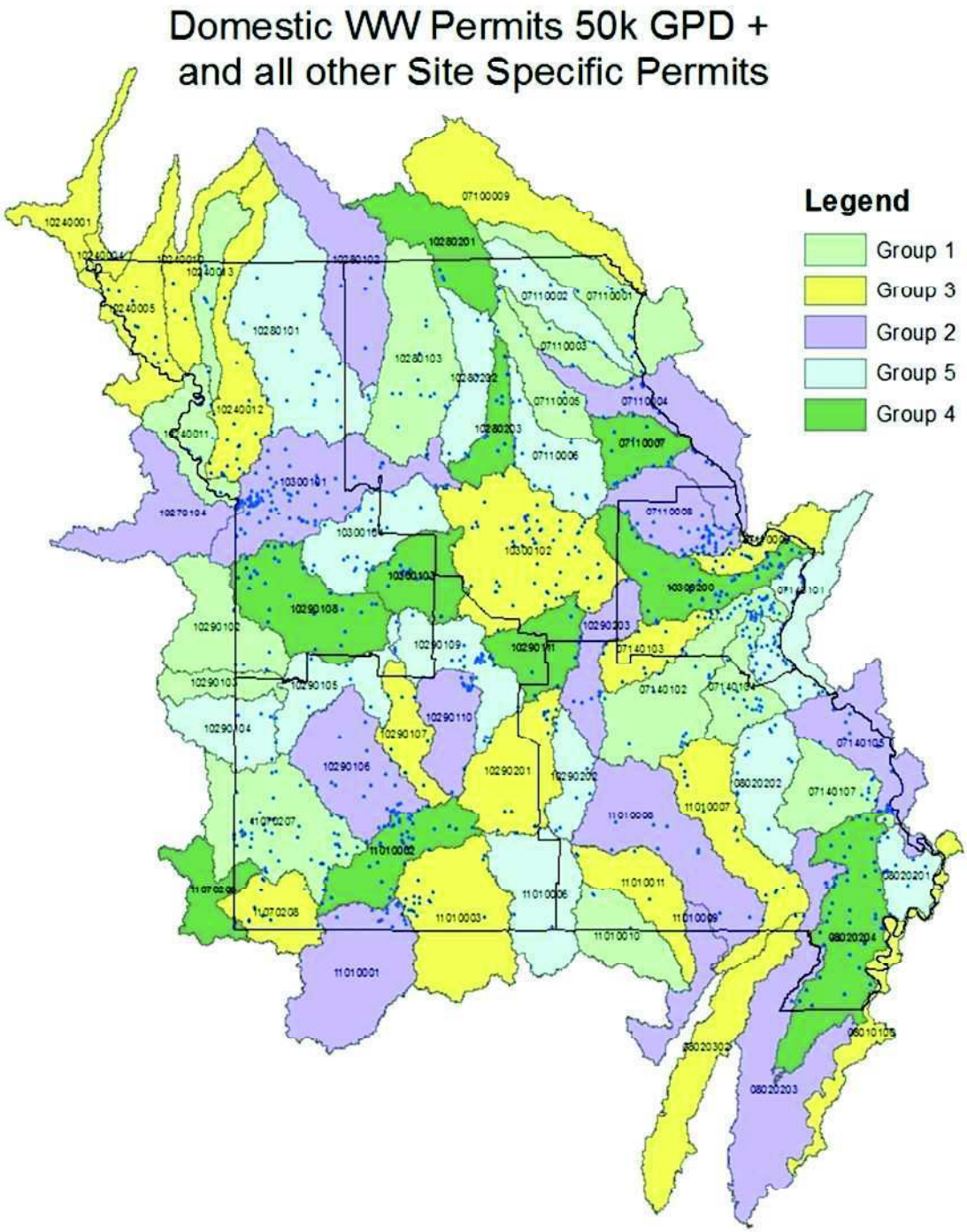

Figure 1 The five groups of HUC8 watersheds denoted by different colors with all domestic wastewater permits with a design flow of 50,000 GPD or more and all other site specific permits denoted by dots.

HUC-8 Group Number One										
HUC-8	HUC-8 Name	Square Miles	Permit Count	NERO	SERO	SLRO	SWRO	KCRO	State 2	State 3
07140104	Big (OMW)	970.4	29		15	14				
10280103	Lower Grand (OMW)	2358.8	12	12					Iowa	
11070207	Spring (OMW)	2588.8	*53*				53		Kansas	Oklahoma
07140102	Meramec	2149.6	41		12	29				
10240011	Independence-Sugar	1042.1	20					20	Kansas	
07110001	Wyaconda - Fox Rivers	1725.5	10	10					Iowa	Illinois
07140107	Whitewater	1193.5	9		9					
11010010	Spring	1214.5	3		3				Arkansas	
07110005	North Fork Salt	893	6	6						
07110003	South Fabius	619.4	4	4						
10290102	Lower Marais Des Cygnes	1575.9	6					6	Kansas	
10290103	Little Osage	580.7	0				0	0	Kansas	
10240013	One Hundred and two	776.4	5					5	Iowa	
		Totals	**198**	**32**	**39**	**43**	**53**	**31**		

Table 1 HUC8 Group 1 showing the number of permits in a region for each watershed and indicating the region with the majority of land mass by grey shading.

HUC-8 Group Number Two									
HUC-8	HUC-8 Name	Square Miles	Permit Count	NERO	SERO	SLRO	SWRO	KCRO	State 2
10300101	Lower Missouri-Crooked	2697.6	87	6				81	Kansas
10270104	Lower Kansas, Kansas*	1655.6	0					0	Kansas
07110008	Cuivre	1261.5	36	2		33	1		
10290106	Sac	1969.3	24				24		
07110004	The Sny	1986.8	20	16		4			Illinois
07140105	Upper Mississippi-Cape Girardeau	1729.3	16		16				Illinois
08020203	Lower St. Francis*	3581.3	7		7				Arkansas
10290203	Lower Gasconade	1032.5	6	1	4	1			
11010008	Current	2618.3	9		9				Arkansas
11010009	Lower Black*	818.5	0		0				Arkansas
10280102	Thompson	2199.6	5	3				2	Iowa
10290110	Niangua	1028.5	14				14		
11010001	Beaver Reservoir	2552.8	12				12		Arkansas
		Totals	**236**	**28**	**36**	**38**	**51**	**83**	

Table 2 HUC8 Group 2 showing the number of permits in a region for each watershed and indicating the region with the majority of land mass by grey shading. * Denotes watersheds with only a small portion lying in Missouri.

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HUC-8 Group Number Three											
HUC-8	HUC-8 Name	Square Miles	Permit Count	NERO	SERO	SLRO	SWRO	KCRO	State 2	State 3	State 4
10300102	Lower Missouri-Moreau	3398.3	64	62		0	2				
07140103	Bourbeuse	843.4	18		7	11					
07110009	Peruque-Piasa	669.2	15			15			Illinois		
10240012	Platte	1663.6	20					20	Iowa		
11010007	Upper Black	1925	16		16				Arkansas		
10290107	Pomme De Terre	845.2	9				9	0			
10290201	Upper Casconade	1786.4	14		8		6				
11010003	Bull Shoals Lake	2604.5	19				19		Arkansas		
11010011	Eleven Point	1202.3	4		4				Arkansas		
08020302	Cache*	2007.5	1		1				Arkansas		
8010100	Lower Mississippi-Memphis*	1098.9	1		1				Illinois	Tennessee	Arkansas
10240010	Nowaway	999.2	3					3	Iowa		
10240005	Tarkio-Wolf	1701.1	10					10	Kansas	Nebraska	Iowa
10240004	Nishnabotna*	175.1	0					0	Nebraska	Iowa	
10240001	Keg-Weeping Water*	838.5	0					0	Iowa		
07100009	Lower Des Moines*	2140.1	0	0							
11070208	Elk	1025	10				10		Arkansas	Oklahoma	
		Totals	**204**	**62**	**37**	**26**	**46**	**33**			

Table 3 HUC8 Group 3 showing the number of permits in a region for each watershed and indicating the region with the majority of land mass by grey shading. * Denotes watersheds with only a small portion lying in Missouri.

HUC-8 Group Number Four											
HUC-8	HUC-8 Name	Square Miles	Permit Count	NERO	SERO	SLRO	SWRO	KCRO	State 2	State 3	State 4
10300200	Lower Missouri	1590.4	42	0		42					
08020204	Little River Ditches	2608.1	43		43				Arkansas		
10290108	South Grand	2046	29				0	29	Kansas		
07110007	Salt	793.7	14	14							
10280203	Little Chariton	698	11	11							
11010002	James	1455.5	41				41				
10300103	Lamine	1110.9	16	0			2	14			
10290111	Lower Osage**	1077	7	1	4		2				
10280201	Upper Chariton	1351.1	3	3					Iowa		
11070206	Lake O Cherokees*	909.2	2				2		Oklahoma	Kansas	Arkansas
		Totals	**208**	**29**	**47**	**42**	**47**	**43**			

Table 4 HUC8 Group 4 showing the number of permits in a region for each watershed and indicating the region with the majority of land mass by grey shading. * Denotes watersheds with only a small portion lying in Missouri. ** Denotes a watershed where the region with the majority of land mass is up for further review.

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HUC-8 Group Number Five									
HUC-8	**HUC-8 Name**	**Square Miles**	**Permit Count**	**NERO**	**SERO**	**SLRO**	**SWRO**	**KCRO**	**State 2**
07140101	Cahokia-Joachim	1647	47		8	39			Illinois
10290109	Lake of the Ozarks	1385.5	29		1		25	3	
10280101	Upper Grand	3324.1	21	2				19	Iowa
10300104	Blackwater	1543.1	21	5				16	
07110006	South Fork Salt	1213	12	12					
10280202	Lower Chariton	1018.7	7	7					
08020201	New Madrid-St. Johns	689.5	11		11				
08020202	Upper St. Francis	1298.5	12		12				
11010006	North Fork White	1830.1	3		0		3		
10290104	Marmaton	1140.9	5				5		Kansas
10290202	Big Piney	754.7	7		7				
07110002	North Fabius	915.2	6	6					Iowa
10290105	Harry S	1202.8	9				8	1	
		Totals	**190**	**32**	**39**	**39**	**41**	**39**	

Table 5 HUC8 Group 4 showing the number of permits in a region for each watershed and indicating the region with the majority of land mass by grey shading.

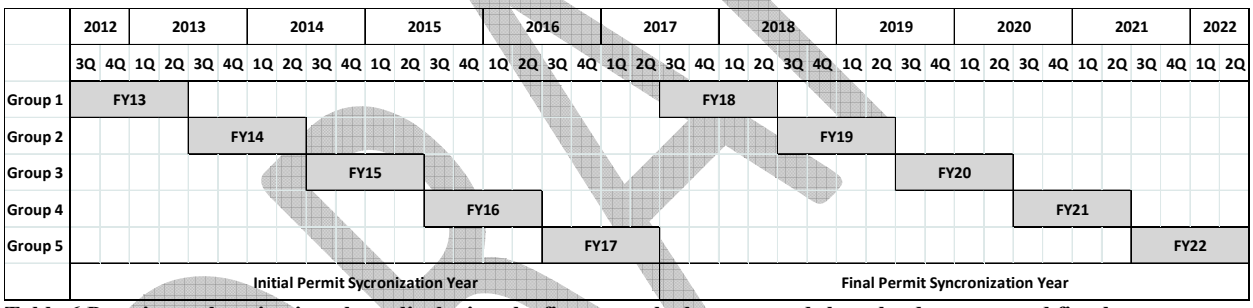

Table 6 Permit synchronization chart displaying the five watershed groups and the calendar years and fiscal year quarters where initial and final permit synchronization will occur.

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	Inspection Types	FY13	FY14	FY15	FY16
KCRO	Major Municipal	10	3	7	6
	Minor 92-500	15	7	10	6
	Minor Municipal	17	23	9	11
	Minor Non-Municipal	13	11	7	11
	SS Industrial SW	15	15	10	10
	Major Federal	1	0	0	0
	Minor Federal	1	0	0	1
	Minor State	0	0	1	0
	Major Non-Municipal	2	1	2	4
	Totals	**74**	**60**	**46**	**49**

	Inspection Types	FY13	FY14	FY15	FY16
NERO	Major Municipal	2	4	3	6
	Minor 92-500	15	12	11	9
	Minor Municipal	12	17	12	5
	Minor Non-Municipal	8	14	5	6
	SS Industrial SW	9	7	6	7
	Major Federal	0	0	0	0
	Minor Federal	1	0	0	0
	Minor State	0	2	0	1
	Major Non-Municipal	1	1	2	3
	Totals	**48**	**57**	**39**	**37**

	Inspection Types	FY13	FY14	FY15	FY16
SERO	Major Municipal	3	4	11	3
	Minor 92-500	21	8	19	13
	Minor Municipal	13	9	7	3
	Minor Non-Municipal	7	8	14	9
	SS Industrial SW	9	4	5	7
	Major Federal	0	0	0	1
	Minor Federal	0	0	1	1
	Minor State	0	0	0	0
	Major Non-Municipal	2	6	4	6
	Totals	**55**	**39**	**61**	**43**

	Inspection Types	FY13	FY14	FY15	FY16
SLRO	Major Municipal	9	4	7	9
	Minor 92-500	5	4	2	2
	Minor Municipal	14	16	10	6
	Minor Non-Municipal	11	19	22	20
	SS Industrial SW	3	3	5	9
	Major Federal	0	0	0	0
	Minor Federal	2	0	0	0
	Minor State	0	1	0	0
	Major Non-Municipal	0	1	2	2
	Totals	**44**	**48**	**48**	**48**

	Inspection Types	FY13	FY14	FY15	FY16
SWRO	Major Municipal	4	5	10	6
	Minor 92-500	22	6	11	7
	Minor Municipal	15	8	12	3
	Minor Non-Municipal	30	14	13	18
	SS Industrial SW	12	16	8	3
	Major Federal	0	0	0	0
	Minor Federal	1	0	1	0
	Minor State	2	1	0	1
	Major Non-Municipal	2	0	6	0
	Totals	**88**	**50**	**61**	**38**

	Inspection Types	FY13	FY14	FY15	FY16
State-wide	Major Municipal	28	20	38	30
	Minor 92-500	78	37	53	37
	Minor Municipal	71	73	50	28
	Minor Non-Municipal	69	66	61	64
	SS Industrial SW	48	45	34	36
	Major Federal	1	0	0	1
	Minor Federal	5	0	2	2
	Minor State	2	4	1	2
	Major Non-Municipal	7	9	16	15
	Totals	**309**	**254**	**255**	**215**

Table 7 Numbers of inspections of Domestic WW facilities with a design flow of 50,000 GPD or more as well as all other site specific permits grouped by regional office and total statewide for FY13 – FY17 and broken down by permit category type.

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Appendix F

Example Water Quality Plan

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DRAFT 2012 Hiwassee River Basinwide Water Quality Plan

Entire Document

Plan By Chapter

- Chapter 1: Hiwassee Plan Summary

10-Digit Watershed Chapters

- Chapter 2: Shooting Creek Watershed (HUC 0602000201)
- Chapter 3: Tusquitee Creek Watershed (HUC 0602000202)
- Chapter 4: Brasstown Creek Watershed (HUC 0602000203)
- Chapter 5: Vally River Watershed (HUC 0602000204)
- Chapter 6: Nottely River Watershed (HUC 0602000206)
- Chapter 7: Hiwassee Lake Watershed (HUC 0602000207)
- Chapter 8: Apalachia Lake Watershed (HUC 0602000209)
- Chapter 9: Ocoee River Watershed (HUC 0602000302)

General Basin Information Chapters

- Chapter 10: Local Conservation Initiatives
- Chapter 11: Forestry & Water Quality
- Chapter 12: References & Websites

Appendices

- Appendix A: Use Support Ratings for All onitored Waterbodies in the Hiwassee River Basin
- Appendix B: Biological Assessment (Macroinvertebrate & Fish Site Sample Results)
- Appendix C: Maps
- Appendix D: Ambient Monitoring Station Data Summary Sheets

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Appendix G

EPA Review of States Best Plans

Watershed Based Plan Review

Final Report

July 2011

U.S. Environmental Protection Agency
Office of Wetlands, Oceans, & Watersheds
Assessment & Watershed Protection Division
Nonpoint Source Control Branch

Introduction & Purpose

In 2006, the Non Point Source Control Branch (NPSCB) of the EPA Office of Wetlands, Oceans, and Watersheds completed a review of the "best" watershed plans from each state. The purpose of the review was to evaluate how well stakeholders were meeting the challenge of developing high-quality watershed-based plans in accordance with the 9 essential components outlined in the October 2003 "Nonpoint Source Program & Grants Guidelines for States and Territories". The 2006 review found that while some states were able to develop high quality watershed-based plans, many plans were still not sufficiently well designed or did not contain sufficient information to support a fully successful implementation effort that would lead to the attainment of water quality standards in the waterbodies identified.

Recommendations from the 2006 review included:

- Greater oversight by EPA Regions to assure watershed-based plans are adequate
- Developing a guidance document providing "best" examples for each of the 9 components
- Providing better training and guidance that demonstrates the level of detail needed to assure water quality standards are achieved in a watershed
- Distributing the "best" plans to the Regions as examples of the level of detail required for a good watershed-based plan.

Since the 2006 review, EPA Headquarters has taken action to provide guidance for developing effective watershed based plans, including publishing the Watershed Planning Handbook; releasing the best plans from the last review; posting additional exemplary plans on the EPA nonpoint source website; and convening workshops addressing watershed-based plan issues such as modeling.

In 2008, EPA Headquarters decided to conduct a second review of state watershed-based plans to determine the level of progress that states and their stakeholders have made in addressing the nine essential components of watershed-based plans. In September of 2008, the NPSCB again asked each of the regional offices to coordinate with their states and territories to identify and submit the "best" watershed-based plan from each state. A total of 49 plans were reviewed during the period 2008 – 2010.

Purposes of this review included:

- Improving our understanding of States' ongoing efforts to develop watershed based plans and identifying needs for improvement.
- Identifying effective and innovative approaches to watershed planning and management that can be shared with states, tribes, and local partners.
- Help guide future activities to promote improved watershed planning and management.

Evaluation Method

EPA developed scoring criteria based on the nine components of a watershed based plan, as identified in the October 2003 Federal Register notice. There are several critical elements identified for each criterion. In order for a plan to meet a criterion, it should contain each of its corresponding elements. Upon the review of each plan, each criterion was given a score of 0-3, 3 being the highest score. Scoring is further explained in **Table 1**

Table 1: Criterion Scoring

3	Excellent – Criterion was met at a level that goes above and beyond the minimum and/or included especially effective approaches to addressing the criterion.
2	Good - Criterion met an adequate level of detail; i.e. information provided was adequate to support successful implementation.
1	Fair – Information provided addressed some aspects of the criterion, but failed to fully address it.
0	Poor - Criterion was not adequately addressed

The overall score for each plan was based on a maximum score of 100. Each criterion was assigned a percent weight, and the weight of each criterion was based upon its relative level of importance in assuring that implementation of the plan would attain water quality standards. In particular, 54% of the final score is focused on the first three criteria.

A criterion's score of 0-3 was converted to a percentage, which was multiplied by the weight to determine how many of the possible percentage points were earned for each criterion. For example, a plan that achieves a 2 for all criteria would have a total score of 67% and would be considered by the scoring system to be adequate to support successful implementation. The overall score was not used to assign a particular "rating" to each watershed plan, or declare that a plan "passed" or "failed". Rather, it was used to rank all of the watershed plans; i.e. the higher the score, the higher the rank. This information has been used to identify the merits of those plans that appear to be of high quality – providing excellent models that states, local governments, watershed groups can review and learn from and to assess the overall quality of all of the plans.

The criteria that were used to evaluate the plans are listed in **Table 2**.

Table 2. Numerical Criteria

A. CAUSES/SOURCES OF POLLUTION ARE IDENTIFIED		
Goals for restoration & protection are clearly defined, quantified & thoroughly explained		8.0%
	Impaired, partially impaired, and/or threatened water bodies on the 303(d) list are identified	
	Goals are clearly defined, and quantified (if applicable)	
Causes/sources of pollution that need to be controlled to meet goals are identified as it applies to areas for restoration and protection		14.0%
	Sources of pollution, both point and non point, are mapped/causes identified	
	Loads from identified sources are quantified	
	Watershed sufficiently subdivided by landuse type, cover or other characteristics to enhance the assessment of sources and strategic placement of BMP's	
	Data sources, estimates and assumptions are cited & documented	
	Data Gaps Identified if they exist, but data gaps not significant enough to delay implementation	
B. EXPECTED LOAD REDUCTIONS FOR SOLUTIONS IDENTIFIED		18.0%
	Expected load reductions are linked to a pollution cause/source identified in (A)	
	Expected load reductions are analyzed to ensure water quality criteria, and/or other goals will be achieved	
	Basis of load reduction effectiveness estimates is thoroughly explained	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	
C. NONPOINT SOURCE MANAGEMENT MEASURES IDENTIFIED		14.0%
	Management measures needed to address causes/sources of pollution identified in (A) are listed, described, and mapped (if known)	
	Explanation for the selection of measures is included to ensure they are applicable to the pollutant causes/sources and are feasible and acceptable	
	Management measures are prioritized based on critical pollutant causes/sources, type, and location as well as compatibility with landowner operations	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	
D. ESTIMATE OF TECHNICAL & FINANCIAL ASSISTANCE		
Estimate of Technical Assistance needed		4.0%
	Significant existing sources of technical assistance that may be needed to implement the plan are accounted for.	
	Additional technical assistance needs are identified, and referenced back to the solutions	

Estimate of Financial Assistance Needed		4.0%
	General cost estimate is included by task (project work plans should have more detailed cost information)	
	Multiple funding sources are listed, as well as an estimated contribution from each source	
E. EDUCATION/OUTREACH		8.0%
	Reaches out to the appropriate sectors of the population in the watershed	
	Both educates public and encourages participation	
	Encourages the implementation of BMP's necessary to fulfill the plan requirements	
F. IMPLEMENTATION SCHEDULE		6.0%
	Timeline presents projected dates for the development and implementation of the actions needed to meet the goals of the plan and includes information on how implementation will be tracked	
	Implementation of point source and regulatory activities are coordinated with nonpoint source actions and other watershed implementation activities	
G. MILESTONES IDENTIFIED		6.0%
	Milestones are measureable and attainable	
	Includes expected completion dates to ensure the continuous implementation of plan	
H. SHORT TERM CRITERIA TO ENSURE PROGRESS IS BEING MADE TOWARDS ATTAINING WATER QUALITY STANDARDS		9.0%
	Interim numerical criteria present	
	Expected dates of achievement identified.	
	Includes a review process to determine if the reductions are being met	
	Includes criteria to determine whether the watershed based plan needs to be revised based upon failure to make adequate progress in accordance with the implementation schedule	
I. MONITORING COMPONENT		9.0%
	Includes description of how monitoring will be used to evaluate the effectiveness of the implementation efforts	
	There is a routine recording element in which progress and methodology are evaluated.	
	Monitoring is tied to a quality assurance plan	
	Parties responsible for monitoring are identified	

Additional details were recorded for each plan to assess any trends across plans. These included:

- Organization(s) authoring the document
- Predominant pollutants addressed in plans
- Watershed size, to determine if there was any correlation between the quality of the plan and the size of the watershed.

- Model used, if applicable, to get a better idea of the models that are being most commonly used and where.

General Results

Based on the above described scoring system, the average score for all of the plans was 56%. Figure 1 presents the average score for each of the 9 watershed based plan components required in 319 plans.

The majority of reviewed plans have done very well with respect to the following components:

- Identifying causes and sources of pollution that need to be controlled to achieve watershed goals (Component A);
- Describing the NPS management measures that need to be implemented to achieve watershed goals (Component C);
- Developing an information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing NPS management measures (Component E); and
- Including a monitoring component to evaluate the effectiveness of the implementation efforts over time (Element I)

However, many states continue to struggle with estimating load reductions expected for the management measures selected, and setting criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards (components B and H). Components B and H were found to be problematic in the 2006 review and again were often addressed inadequately in the plans reviewed for this study. These two components go hand in hand; without adequate load reduction estimates, a state cannot develop criteria that can be used to determine whether load reductions are being achieved at an adequate rate over time.

While plans in small watersheds were usually easiest to review, there appeared to be no correlation between size of watershed and overall quality of the plans (Figure 2). However, 40 of the 49 plans submitted were less than 1000 square miles and most of these were significantly smaller than that. Table 3 lists which models were used for components A-C. 13 of the plans reviewed relied solely on monitoring data, and used no formal model for estimating pollutant sources or reductions expected from management practices. Where a model was used, the model used was as varied as the plans themselves.

It is notable that the average score of the plans that used some kind of model (61%) was substantially higher than the average score of those plans that did not use a model (44%).

FIGURE 1

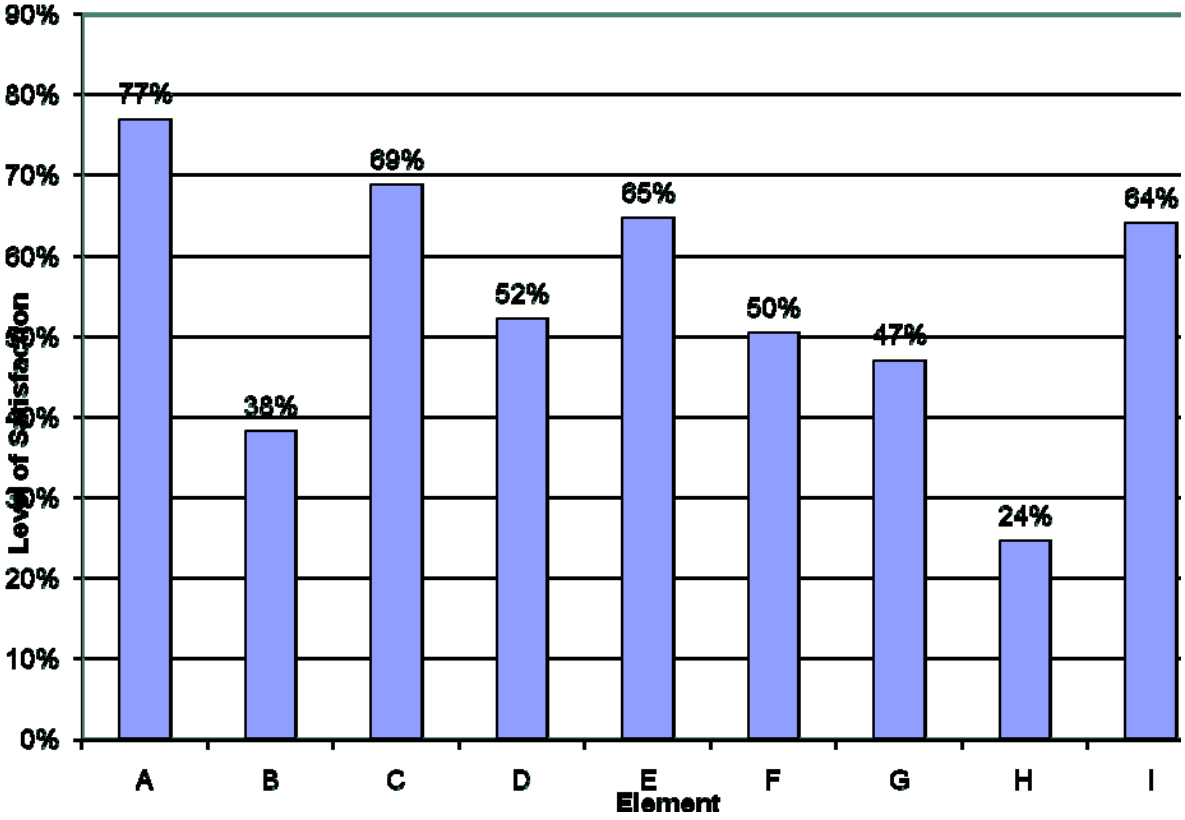
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FIGURE 2

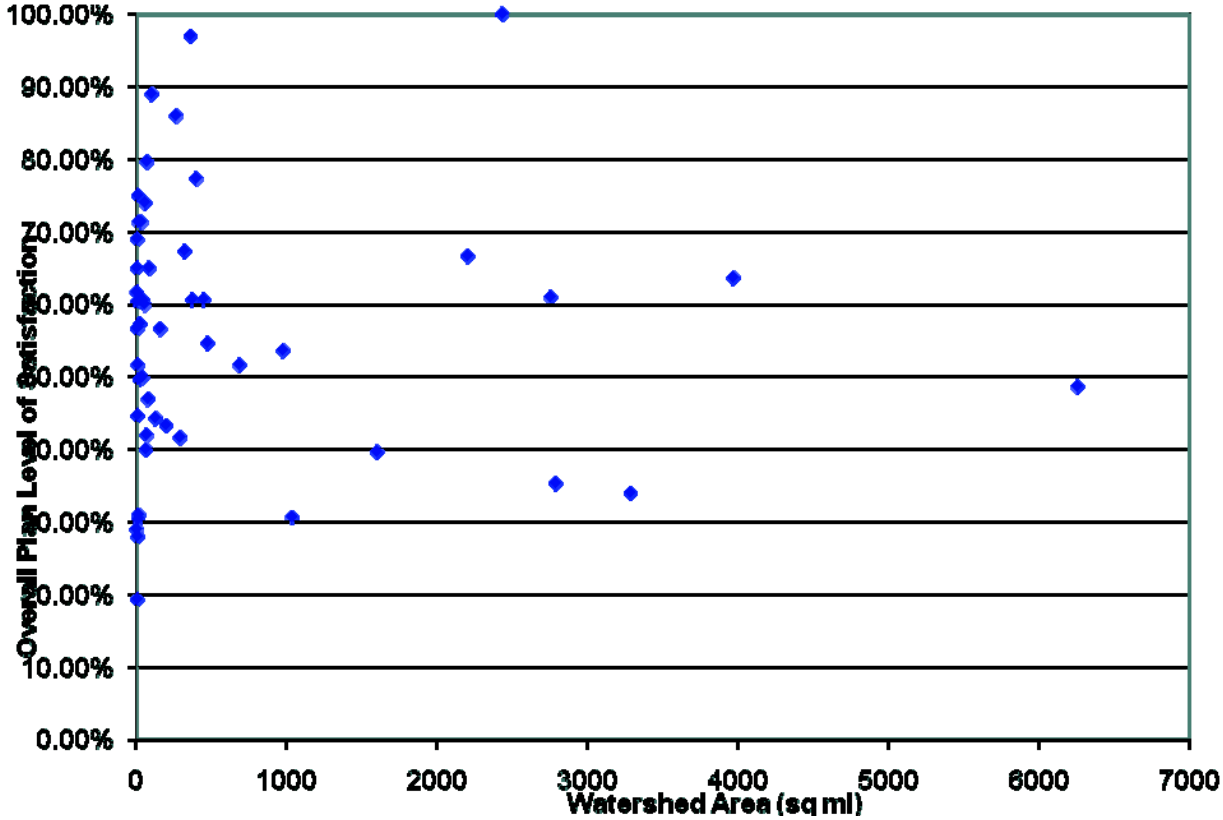

Table 3: Models used in Watershed Based Plans

Model Name	Use
[No Model]	13
Soil & Water Assessment Tool (SWAT)	4
[Revised] Universal Soil Loss Equation ([R]USLE)	3
ArcView Generalized Loading Function (AVGWLF)	3
Loading Simulation Program in C++ (LSPC)	3
Speadsheet Tool for Estimating Pollutant Loads (STEPL)	3
Stormwater Management Model (SWMM)	3
Automated Geospatial Watershed Tool (AGWA, uses Kinematic Runoff and Erosion Model (KINEROS2) and SWAT)	2
Hydrologic Simulation Program Fortran (HSPF)	2
Long Term Hydrologic Impact Assessment (L-THIA)	2
Pollution Reduction Impact Comparison Tool (PreDICT)	2
Annualized Agricultural Non-Point Source Pollution Model (Ann AGNPS)	1
AVNPS	1

Bacteria Indicator Tool	1
Bacteria Source Load Calculator	1
BATHTUB	1
Environmental Fluid Dynamics Code (EFDC)	1
FLUX	1
Impervious Cover Model	1
Integrated Pollutant Source Identification Pollutant Loading Model (IPSI/PLM, from TVA)	1
Method for Assessment, Nutrient-loading and Geographic Evaluation of watersheds (MANAGE)	1
BASINS Nonpoint Source Model (NPSM)	1
Nonpoint-Source Pollution and Erosion Comparison Tool (NSPECT)	1
PLAT/NLEW	1
Pollutant Load Screening Model (PLSM)	1
QUAL2E	1
R5 Pollutant Control Model	1
SELECT	1
Site Evaluation Tool (SET)	1
Stream Network Temperature model (SNTEMP)	1
Watershed Management Model	1
Watershed Treatment Model	1
Delaware Inland Bays Model (Based on CB Model)	1
Sediment Delivery Calculator	1
CE-QUAL-ICM	1

Sediment, bacteria, and nutrients were the most common pollutants addressed in the plans (Table 4).

Table 4: Pollutants Addressed in Watershed Based Plans

Pollutant	# Addressed
Sediment	24
Bacteria (Fecal Coliform & E.Coli)	19
Nutrients (Both Nitrogen & Phosphorus)	16
Phosphorus	8
Metals (Cadmium, Zinc, Lead, Mercury, Copper)	8
Temperature	7
DO	6
Impaired Aquatic Communities	5
Herbicides/Pesticides (including Atrazine, DDT)	4
BOD	3
pH	3
Nitrogen	2
Water Quantity	2
Aromatic Hydrocarbons	1
Oil & Grease	1

Trash	1
Salinity	1
Selenium	1
Noxious Aquatics/Exotic Species	1

While many plans were developed under the supervision of a technical committee, the "author" is the person or group that is named as the actual writer of the plan. As seen in Table 5, private consultants, hired by local watershed groups, states, and other stakeholders authored a greater number of plans than other groups, followed closely by state environmental agencies and miscellaneous entities, such as local planning commissions, large nonprofits, and other state agencies.

Table 5: Watershed Based Plan Authors

Author	# Addressed
Consultant	11
State Environmental Agencies	10
Etc (Incl. State NRCS, Area Planning Commissions and Environmental Councils)	7
Multiple Authors	6
Local Watershed Group	6
SWCD	4
Extension	3
Local Government (city or county)	2

Summary of Findings for Each Component

Component A

An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed based plan (and to achieve any other watershed goals identified in the watershed-based plan). Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed.

It is difficult to remediate an impaired waterbody without first identifying the causes and sources of impairment. Identification of pollutant sources and reductions needed to meet water quality standards (component A) are the essence of TMDL's; in a number of cases, TMDL's had already addressed this component to a significant extent, thereby setting a foundation for the plan. In the few plans that did not satisfy this component, load estimates from significant source categories were absent, or the sources of pollution that need to be controlled were not quantified at a level that is useful for waterbody remediation.

Component B

An estimate of the load reductions expected for the management measures selected

Without load reduction estimates, it is not possible to determine whether or not the proposed management measures are sufficient to meet the water quality goals set in component A. As

mentioned previously, many states had difficulty addressing component B. Many plans simply did not provide any load reduction estimates. Others provided estimates, but made no attempt to show that the management measures chosen would lead to meeting the overall goals described in component A.

Quantifying expected load reductions is difficult, requiring both sufficient data and an analysis leading to a judgment as to what assumptions are appropriate to make for the situation. The processes that planners need to take into account are complex, and therefore difficult to translate to a simple numerical endpoint. While there are a myriad of tools available, from complex to simple spreadsheets, as EPA discusses in considerable detail in the "Handbook for Developing Watershed Plans to Restore and Protect Our Water" (2008), it requires considerable analysis supported by experience and training to determine which one will suit the needs of a specific watershed.

However, the watershed planning process isn't necessarily about getting exactly the right answer the first time. Rather, it is about successfully employing an adaptive management approach in which available information and analytical tools are used to support the best planning decisions that can be made. The best plans were not necessarily relying on the most sophisticated watershed models or making any claims that their load estimates are 100% correct. In fact, some plans contained explicit discussions stating factors that may lead to errors in the estimates. However, it is critical that the best effort be made to develop good estimates; set a bar to measure whether or not the proposed measures are adequate; and establish a feedback loop to determine if there are additional issues in the watershed that may have been missed when the plan was first written.

Component C

A description of the NPS management measures that will need to be implemented to achieve the load reduction estimated in component B, and an identification of the critical areas in which those measures will need to be implemented

After the causes and sources of pollution are identified, the next step is to identify management measures that will reduce the pollutant loads from these sources to the extent necessary to meet water quality goals. Most states were able to do this without significant difficulties. However, some states failed to adequately explain why certain management measures were chosen over similar alternatives.

The discrepancy between the level of satisfaction in components B and C suggests plan writers can successfully identify best management practices to address pollutants, but many are having a difficult time quantifying the expected load reduction from these practices.

Component D

An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the plan.

Component D was met with a moderate degree of success. The best plans were able to list the partners that would be called upon to complete each action in the plan, and included a full cost estimate, including possible sources of funding. Other plans were commonly missing one or more of these pieces of information or included all of this information at a level of detail that was much lower than the best plans.

Component E

An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

Actions to reduce nonpoint sources of pollution are usually voluntary; therefore, effective education campaigns are extremely important to watershed based plans. A good educational campaign helps to ensure that needed management measures will actually be implemented. Most of the time, some kind of education campaign was included (passing out flyers, PSA's etc) but an explanation of how these campaigns would enhance public understanding or encourage involvement was absent. In these cases, there is a serious question whether adequate community understanding of and support for the watershed plan and its implementation have been established.

Component F

A schedule for implementing the NPS management measures identified in the plan that is reasonable expeditious.

A schedule helps ensure that the plan's developers have thought about the feasibility of their plan in relation to its objectives and available resources. It also helps to ensure the continuous implementation of the plan. In many cases, plans failed to include a schedule beyond a year of implementation, or had a much less detailed schedule compared to the best plans reviewed.

Component G

A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

Component F and G are closely related. Most states received the same scores for both components, and had the same issues with component G as they did with component F, namely, one, or in some cases, no interim milestones, and a lesser level of detail than the best plans reviewed.

Component H

A set of criteria that can be used to determine whether load reductions are being achieved over time and substantial progress is being made towards attaining water quality standards, and, if not, the criteria for determining whether the watershed based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.

Components B and H go hand in hand; without adequate load reduction estimates, a state cannot develop criteria that can be used to determine whether load reductions are being achieved at an adequate rate over time. Therefore, it is unsurprising that states which are struggling with Component B are also struggling with Component H. Most of the time, Component B was not mentioned in the context of Component H, or there seemed to be confusion between what was required with respect to components G and H. Many times, the criteria that would be used to determine whether loading reductions were being achieved were actually milestones; this indicates that there was confusion surrounding the difference between the two. The criteria should be expected levels of pollutants of concern in the waterbody at different points in time, whereas milestones indicate achievement of implementation steps like the number of BMP's that will be installed in a certain year. Many plans also failed to identify how often progress would be reviewed, and who would actually be responsible for reviewing the plan to determine this information. This would likely result in a lack of implementation of this important step and perhaps lead to continued implementation along a path that needs to be modified.

Component I

A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under component H.

Most plans were relying on the implementation of existing state monitoring programs, which have well established procedures, so component I is relatively straightforward. In a very small number of plans, responsibility for monitoring was unclear, as well as how often monitoring would take place.

Best Watershed Plans

These are the plans the received the highest scores of all rated plans. EPA recommends that state and EPA nonpoint source staff review these plans to gather some ideas regarding effective ways to address watershed based plan development. None of these plans is perfect, yet each represents a concerted effort to understand and address information and factors that affect the watershed's problems.

Kansas: Lower Big Blue/Lower Little Blue River

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http://www.kcare.ksu.edu/DesktopModules/ViewDocument.aspx?DocumentID=4055

The Lower Big Blue/Lower Little Blue River watershed is a transboundary watershed (Only ~ 25% of watershed is in Kansas, the rest is in Nebraska) and drains into Tuttle Creek Lake, a flood control reservoir in Kansas. The lake is impaired by phosphorus, total suspended solids, and atrazine. While the plan only addresses Kansas portion of the watershed, it is overall an excellent watershed-based plan. Every required component was fully addressed, and the information for components B-I were presented in an especially effective manner. The tables and maps made the information easy to read and digest and all of the information was tied back to meeting the goals of the plan; there was little extraneous information. It was also one of the few plans that included a brief explanation of the model used in the analysis, including why the model was selected, major assumptions, and data sources used. Specific highlights include:

- The Soil and Water Assessment Tool (SWAT) was used to determine loading rates and locations of pollutant causes and sources. Pollutant source analysis is further explored pollutant by pollutant in the critical areas identified in the modeling process.

- The plan explicitly compares load reductions expected from management measures with load reductions prescribed in the TMDL, to ensure that management measures chosen will meet the goals of the plan. Also, there is a section that clearly explains the load reduction estimate methodology.

- Using the model with some ground-truthing, the plan identifies "areas or subwatersheds with the top 20-30% of the highest loads among all areas within the watershed" as critical (targeted) areas for BMP implementation.

- The plan broke cost estimates down to BMP's per year; provided the source of information for these costs; and also included the estimated cost of technical assistance.

- Target audiences are identified for different education/outreach activities, and the plan includes an outline for evaluating these activities.

- The implementation schedule covered the entire life of the plan, and included milestones (# of acres of BMP, miles of streambank stabilization, etc) and interim water quality milestones.

- The plan includes a strategy for reviewing the plan over time, complete with a schedule, delegation of responsible parties, and a list of indicator and parameter criteria and data sources that will be used to assess progress.

Overall, the Lower Big Blue/Lower Little Blue River plan was one of the best reviewed, and it provides an excellent example of how to develop and write a watershed based plan.

Oklahoma: Lake Eucha/Spavinaw

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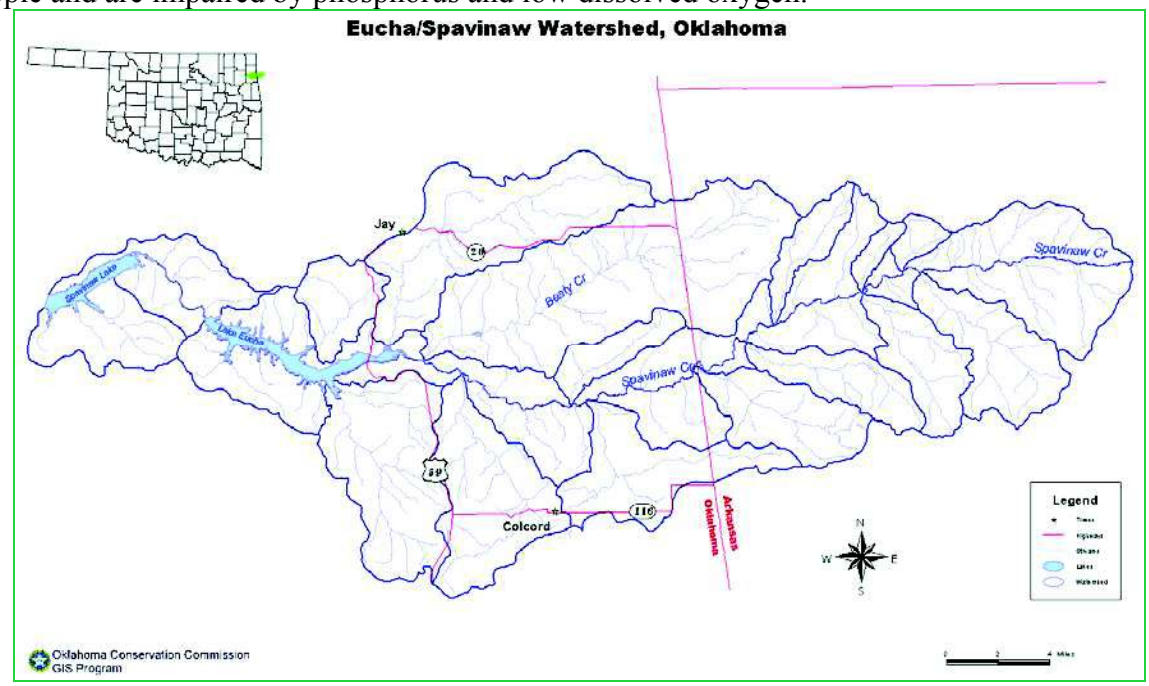
http://www.environment.ok.gov/documents/CWA/GrantWorkplans/Eucha-Spavinaw%20Watershed%20Riparian%20Protection%20Initiative/EuchaSpavWBPRev2-07.pdf

The Lake Eucha/Spavinaw watershed is a transboundary watershed (60% in OK, the rest in AR, see figure) and has been the subject of conflict, including litigation, regarding its many point and nonpoint sources of pollution. The lakes supply drinking water to approximately 1 million people and are impaired by phosphorus and low dissolved oxygen.



The watershed based plan addresses each of the 9 components and includes adequate specifics for each. In particular:

- The plan contains clear quantitative goals complete with an explanation for choosing those goals and how the goals correspond to the load reduction goals and interim water quality criteria.

- All of the information in the plan was tied back to the goals of the plan, so there was very little extraneous information which made the plan very easy to read and comprehend.

- SWAT was used to determine sources of phosphorus, including point sources of phosphorus, and was calibrated with soil test phosphorus results. The model was also used to identify critical areas in the watershed to target implementation.

- Information used for the SWAT analysis was clearly documented, and information not crucial to the WBP was included in a separate report of the modeling efforts. Results were summarized in an easy to understand table in the report, with references to a separate report if more detail is needed.

- Assumptions of the analysis are clearly stated and explained.

- Barriers to attainment of goals are discussed (for example, soils supersaturated with phosphorus may take decades to deplete) but these barriers are not presented as an excuse for inability to attain standards, rather as something to be aware of throughout the implementation of the plan.

- Reasoning for the selection of BMP's is included with the corresponding estimated load reduction. In addition, several simulations were performed to see which practices might have the greatest impact on water quality.

- The cost estimate included BMP's, education, and monitoring, and included the responsible parties for each task. The delegation of work is particularly well explained in the educational activities, which lists each group involved and clearly states what the group will be doing.

- The implementation schedule includes load reduction goals associated with planned activities and a schedule for evaluating the actions to determine if any adjustments need to be made.

- One possible improvement for the plan would be to include more interim water quality criteria.

- The monitoring plan lists what parameters will be measured and who will be responsible for which monitoring activities, as well as a map where monitoring will take place.

Overall, the Lake Spavinaw/Eucha plan was one of the best reviewed, and should be shared as another example of an excellent watershed based plan.

Virginia: Hawksbill & Mill Creek

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http://www.deq.state.va.us/export/sites/default/tmdl/implans/hksmillip.pdf (Does not include the technical report)

Hawksbill & Mill Creek are tributaries of the South Fork of the Shenandoah River, located in the northern part of Virginia. Both waterbodies are impaired due to violations of the State's water quality criteria for fecal coliform and E. Coli. In Virginia, TMDL Implementation plans are required to be written for each TMDL and this plan was written under that requirement, taking into account watershed plan requirements from other programs, such as 319. The watershed plan for remediating Hawksbill & Mill Creek satisfies all 9 components of a watershed based plan. Highlights of the plan include:

- Several stakeholders in the watershed were involved in developing this plan. In addition to general public meetings, 3 specialized working groups (agricultural, residential, and government) were assembled to seek public input from specific stakeholders and a steering committee collected information from the different groups and guided the overall development of the plan. Throughout the rest of the plan it was clear that these groups were all very involved in the process.

- The assumptions of pollutant source analysis are clearly stated and discussed.

- Selection of management measures needed to control sources of pollution was well explained, and the public was included in selection of management measures to ensure implementation.

- The quantity of management measures needed to meet water quality goals was estimated using modeling, spatial analysis, and input from the public, and possible locations for these measures were identified in the plan.

- Education strategies that proved successful in other watersheds, which were identified by the working groups involved in plan development, were used in the implementation plan.

- This is one of the few plans that included a cost efficiency analysis of the BMP's selected; which consisted of a breakdown of pollutant removed per $1000 spent, as well as an explanation of the non-monetary benefits of the selected BMP's. This information, along with information gathered from a land use analysis, was used to prioritize implementation.

- All information, from pollutant reduction of BMP's to costs of implementation, was clearly referenced.

- A suggestion for improvement to this plan is to explain how this plan will be reviewed over time, specifically, who will be responsible for reviewing the plan to determine whether or not changes need to be made?

Hawksbill & Mill Creek plan is another excellent example of a watershed based plan.

Maryland: Lower Monocacy River

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http://www.watershed-alliance.com/mcwa_pubsWRASsupplement.html

The Lower Monocacy River plan is a supplement to the original Watershed Plan completed in May 2004. The Lower Monocacy River and its subwatersheds are listed as impaired for: fecal coliform (2002), nutrients (1996), sediment (1996), and impacts to biological communities (2002, 2004, and 2006). However, there is only 1 TMDL that has been approved and adopted in the watershed (Phosphorus & Sediments in Lake Liganore, an impoundment within the watershed). One TMDL has been submitted but has not been approved, and the rest were scheduled for development in 2008 and 2009. In the absence of completed TMDL's, the plan developers used stream corridor assessments and the Impervious Cover Model to identify causes and sources of pollution and estimate loads. This illustrates that an excellent plan can still be written with simpler models. Additional highlights of the plan include:

- The plan was successfully able to integrate information from several sources (such as TMDL's and Tributary strategies from the 2000 Chesapeake Bay agreement). The plan contained a lot of information, but it was easy to read because everything was summarized well and contained clear references to other documents.

- The chosen management measures were adequately described, and included assumptions about their operation and effectiveness.

- This was another one of the few plans that included a benefit cost ratio of pollutant removal to aid in prioritizing implementation actions.

- A responsible party is identified for each implementation action, and all actions are clearly tied back to the goals of the plan.

- Education and outreach efforts are linked to implementation actions and goals, and each activity has measureable outcomes.

- The watershed has an extensive and well organized network of watershed groups. Plan includes a list of all groups with contact information and a summary of the type of assistance each group can provide.

- Implementation schedule reports the status of implementation, as well as the schedule for future implementation.

- The County has an electronic implementation database to track the progress of the plan. The database also calculates expected pollutant removal for each BMP entered.

- The monitoring plan includes project level and watershed level monitoring. All monitoring efforts list who is responsible, and the monitoring parameters that will be measured at each monitoring location.

- The plan includes a section dedicated to discussing issues requiring further study, and strategies for resolving these issues in the future.

This plan would benefit from additional details on the implementation of agricultural BMP's, but it is mentioned that new goals are being adopted by the Tributary Strategy program and this information will be included in the next revision of the plan. Also, there is no explicit plan for reviewing and revising the watershed based plan, but considering this is a supplement of the original plan, it is clear that this work is being done.

Overall, the Lower Monocacy River plan provides an excellent example of a watershed based plan.

Best Examples for Individual Plan Components

Several plans reviewed, while not overall "the best", did excellent jobs addressing some of the required components of a watershed based plan. Appendix B lists these examples by plan component, and hopefully can be used by plan writers in the future.

Plans In Need of Some Improvement

The purpose of this report is to provide information that can be used to help move State watershed planning and implementation programs in the right direction. Identifying and describing some of the chief deficiencies found in some plans helps to achieve this purpose. In contrast, identifying specific States' plans as having specific deficiencies would not help achieve this purpose. Therefore, the discussion in this section and the following section does not provide names of specific States but does provide descriptions of shortcomings that should be avoided by all States.

Overall, one plan suffers from a lack of detail in certain components, but contains an excellent example of how to identify the causes and sources of pollution (component A of the 319 requirements.) The plan contains an excellent summery of existing data, and a great summary of management measures and why they are chosen. However, more information is needed to determine if the management measures chosen will achieve the pollutant reduction goals. There are no interim water quality goals, or any details on how the implementation of this plan will be assured, although the plan refers to several data sets that would be useful for further efforts.

A second plan was very easy to read because it was well laid out. For example, the 9 components of the plan are summarized in the appendix, and the plan includes a "using this document" section with summaries of each part of the plan right up front. However, there are several major flaws. While the whole plan is focused on future growth and how it will impact the stream, there doesn't seem to be any mention of revisiting the plan once it is implemented to make sure the

plan is adequately meeting the water quality goals. There is no detail on reducing the impact of agriculture on water quality, even though it is a significant portion of the watershed.

A third plan suffers most from a lack of quantitative data. The plan does not include load estimates for identified sources of pollution, or load reduction estimates for the nonpoint source management measures selected to address pollutant sources. This might be because there is no TMDL in place. The state provides the option of a locally led watershed management planning effort in place of a full TMDL. However, while specific interim numerical water quality criteria were absent, there is a clear procedure for periodically reviewing plan progress. The implementation plan was very strong, and the management measures were listed with the specific overall goals, funding mechanisms, responsible parties, and information/education activities that would be used to promote the adoption of the measure. This made it very clear how every action proposed in the plan fit together. The monitoring plan was also very clear.

Plans in Need of Significant Improvement

One plan suffers from a lack of quantitative detail, especially regarding the expected pollutant-reduction benefits from management measures. There is also very little detail in terms of implementation. The evaluation of the plan that was conducted by the state DEQ, which was included with the plan, summarizes the issues best: "The TMDL provides specific numbers and pollutant reductions targets for the general basin. The (plan) provides information on general BMP's that will address pollutants in the TMDL, but they don't link specifically to load reductions or water quality numbers"

A second plan is missing several critical pieces of information required of a watershed-based plan, most notably the extent of management measures implementation needed to meet the goals of the plan, and load reduction estimates for the management measures that are identified. Without this information, there is no way to tell whether or not the proposed management measures are sufficient to meet the goals of the plan. There is also very limited implementation detail.

A third plan provided very little information, and the state supplemented this through a web- link to the statewide watershed based plan website to find any information missing from plan submitted. Few of the data gaps in the submitted plan were addressed in the documents on the website, since those documents focused on a much larger spatial scale (HUC 12 level) and none of them discussed the watershed in the submitted plan. Thus no information is provided in the plan regarding the watershed's water quality impairments, the types and quantities of sources, and all other similar relevant information. After reviewing the grant application and the other documents provided, an overall plan for addressing the water quality impairments in the watershed could not be determined. Actions are proposed in a grant application to address the water quality issues in the pond, but the expected impact is not. The amount or percentage of water quality impairment of this pond to be addressed by these projects is unstated. In addition, there is no discussion of a feedback loop and relevant monitoring related to this watershed.

Conclusions & Recommendations

This review of watershed plans from around the country indicated that while it is possible to meet the challenge of developing high quality watershed based plans, many plans fail to rise to that level. There is not a single clear reason for this; some plan developers may lack the expertise needed to develop a high quality plan, while others may be suffering from the lack of availability to sufficient information and resources. In some cases it may simply be the lack of sufficient effort or resources devoted to the development of the plan. It is clear that more needs to be done so all plans are of a quality that will support a successful implementation effort to restore impaired waterbodies. Specific recommendations are listed below:

- EPA Regional offices should use the results of this review to discuss with States the specific components that the states are struggling with, and to also share information from States that have successfully addressed those components.

- EPA Regions should work more closely with the States to assure that the States and their watershed partners have sufficient technical capacity and are investing sufficient funds to develop robust watershed-based plans that will lay a good foundation for a successful implementation effort that will restore the waterbodies being addressed to meet water quality standards.

- States' should take greater care in their development of watershed-based plans to assure that the plans truly address all nine components of EPA's guidelines and provide as good and specific a guidepost to future actions in the watershed as reasonably possible. The Section 319 program and grants guidelines allow each State to use up to 20% of its "incremental" watershed-based plan implementation funds to develop watershed-based plans. States should dedicate sufficient funds to the development of each watershed-based plan to assure that they will successfully address all nine components of these plans in a thoughtful and useful manner that will support successful implementation.

- EPA should follow up with the developers of the best watershed plans. Interviewing writers of successful plans would provide insight from those "on the ground" as to what resources contribute most to a successful plan. This information can in turn be used by EPA to prioritize training and tool development.

- EPA should make the best watershed plans, as well as the best examples of different components of watershed based plans, available online and in tools such as EPA Plan Builder. Overall, there seems to be confusion on "how much is enough". Several plans included extraneous information that made the plan hard to review and, most likely, less useful to those using the plan. Providing more examples of what is considered adequate will clarify what an excellent WBP should look like. EPA should also take actions to promote the resources available for WBP's.

- States should focus on developing plans at a scale that allows for the development of the right level of detail. This means, for example, that even if a State develops an integrated

watershed plan at an 8-digit HUC level, it may, and likely will, need to develop a more detailed watershed-based plan at a smaller scale (e.g., HUC-12).

Appendix A: List of Watershed Based Plans Reviewed

Region 1

State	*Contact*	*Watershed*
CT	Steve Winnett	Coginchaug River
MA	Warren Howard	Martins Pond
ME	Warren Howard	Spruce Creek
NH	Warren Howard	Webster-Highland Lake
RI	Margherita Pryor	Green Hill & Ninigret Ponds
VT	Warren Howard	Lake Carmi

Region 2

State	*Contact*	*Watershed*
NJ	Donna Somboonlakana	Mulhockaway Creek
NY	Richard Balla	Chemung & Upper Susquehanna River
PR	Nesamarie Negron	Rio Grande De Loiza
VI	Donna Somboonlakana	Coral Bay

Region 3

State	*Contact*	*Watershed*
DC		
DE	Fred Suffian	Indian River, and Indian River, Rehoboth and Little Assawoman Bay
MD	Fred Suffian	Lower Monocacy River
PA	Fred Suffian	Mill Creek
VA	Fred Suffian	Hawksbill & Mill Creek
WV	Fred Suffian	Martin Creek

Region 4

State	*Contact*	*Watershed*
AL	Yolanda Brown	Indian Creek
FL	Yolanda Brown	Lower St. Johns River
GA	Yolanda Brown	Two Mile Branch
KY	Yolanda Brown	Corbin City Reservoir
MS	Yolanda Brown	Bee Lake
NC	Yolanda Brown	Smith Creek
SC	Yolanda Brown	May River
TN	Yolanda Brown	Oostanaula Creek

Region 5

State	*Contact*	*Watershed*
IL	Amy Walkenbach (IL)	Bull Creek/Bull's Brook
IN	Andrew Pelloso (IDEM)	Salt Creek
MI	Robert Day (MDEQ)	Paw Paw River
MN	Thomas Davenport	Lake Independence
OH	Russ Gibson (OH EPA)	Bokes/Mill Creek

WI		

State	Contact	Watershed
AR	Brad Lamb	Bayou Bartholomew
LA	Brad Lamb	Bayou Plaquemine Brule
NM	Brad Lamb	Jemez River
OK	Brad Lamb	Lake Eucha/Lake Spavinaw
TX	Brad Lamb	Plum Creek

Region 7

State	Contact	Watershed
IA	Suzanne Hall	Lake Hendricks
KS	Steve Schaff	Lower Big Blue River & Lower Little Blue River
MO	Peter Davis	Brush Creek
NE	Peter Davis	Carter Lake

Region 8

State	Contact	Watershed
CO	Marcella Hutchinson	Coal Creek
MT	Peter Monahan	Ruby River
ND	Peter Monahan	Beaver Creek and Seven Mile Coulee
SD	Peter Monahan	Belle Fourche River
UT	Peter Monahan	San Pitch
WY	Peter Monahan	Flat Creek

Region 9

State	Contact	Watershed
AS		
AZ	Jared Vollmer	Agua Fria
CA	Tina Yin	Agua Hedionda
Guam		
HI	Audrey Shileikis	Ko'olaupoko Moku
NMI		
NV	Stephanie L. Wilson	Carson River
TT		

Region 10

State	Contact	Watershed
AK	Rick Seaborne	Lower Kenai River
ID	Rick Seaborne	Pack River
OR	Rick Seaborne	Willamette River Basin: City of Lowell
WA	Rick Seaborne	Stillaguamish River

Appendix B: Best Component Examples from Watershed Plans

Puerto Rico's plan provides an excellent example of an approach to successfully implementing **component A**. Unlike most plans, model selection criteria are identified to guide model selection. Model input assumptions are clearly explained, and assumptions are supported with appropriate references. Explanation of the calibration process clearly lays out what information was used and data gaps that limited the analysis. The modeling results are presented by subwatershed, and each section includes a pollutant source assessment, priority ranking (with explanation), a breakdown of loading by source, and an analysis of seasonal variations or other critical factors that may exacerbate pollution issues. *Link: Rio Grande De Loiza, pp. IV-1 – IV-2; IV-18 – IV-28, V-2 – V-164*

The New Hampshire plan provides great examples for **components A-C**. The New Hampshire plan outlines different pollutant estimate approaches that apply to their watershed, clearly stating the limitations and assumptions of each. The pollutant source analysis begins with an in-depth study of the watershed completed several years ago using one of the more complicated approaches. Simplified approaches were then used to assess how conditions may have changed since the original study was completed.

STEPL was used to estimate the loads from individual sources of pollution in the watershed. All of the sources for information used in the modeling are listed, and while the model was not fully calibrated, an attempt was made to compare how the model results differed from monitoring results. Each possible pollutant source is further explored in the following sections, including relevant studies and visual evidence of problems that could not be taken into account using STEPL. Also included are measures to control the individual sources of pollution and estimated load reductions, explicitly linking pollutant control measures to specific sources of pollution. The information about pollutant source loads and control measures are summarized in a table as an easy reference. *Link: Coginchaug River, p. 7 – 47*

The Mill Creek plan from Pennsylvania does a good job of identifying NPS management measures that need to be implemented to meet the goals of the plan. Plan writers not only have an idea for which BMP's to install (**component C**), but where they should be installed and to what extent (acres treated by a cover crop, length of fencing, etc). This level of specificity suggests that plan writers are intimately involved in this watershed and provides confidence that the plan, once it is implemented, will succeed. The Mill Creek plan also provides a detailed cost estimate for each proposed BMP (**component D**). .Potential funding sources are also identified for the different types of BMP's. *Link: Mill Creek, p. 24 – 46*

The Coal Creek plan from Colorado addresses **component C** with a short table that summarizes the appropriate management measures and how those measures work to reduce pollution. The Coal Creek plan also uses a summary table to illustrate gaps in the monitoring data used for quantifying the causes and sources of pollution. *Link: Coal Creek, pp. 8 – 9; 49*

The Washington State Stillaguamish plan follows a similar format as New Hampshire to address **component C**, providing a section to discuss each source of pollution, specific problem areas and the management measures that should be used to address each source. The watershed characterization in this plan is very thorough and allows for the ability to very specifically target sources of pollution with management measures. This is also one of the few plans that addresses temperature, and does a great job explaining suspected causes of impairment and targeting specific areas for management actions.

The plan also does an excellent job identifying sources of technical assistance, which is part of addressing **component D**. Partners are identified from the federal to the local level and specific actions are identified for each partner. These expectations are described in text, and then summarized in an "Implementation Tracking Sheet" to easily keep track of the tasks that need to be accomplished by which partner. This differs from most of the plans reviewed; most identified partners but did not specify what these partners were expected to contribute. *Link: Stillaguamish River, pp. 14 – 87; D-3 – D-7*

The Agua Hedionda watershed plan from California does an excellent job describing the NPS management measures that will need to be implemented to meet the goals of the plan (**component C**). Each management measure includes a detailed explanation for why it was chosen and where exactly it would be implemented, and most measures also include a strategy for prioritizing implementation. Maps of critical implementation areas enhance the presentation of this information, and cost estimates are included. A discussion of potential funding sources is also included (**component D**). The education/information component identifies target audiences and activities to reach these audiences, and it outlines specific goals for outreach activities (**component E**). The monitoring component of this plan is very clear (**component I**). Monitoring indicators are specifically linked to plan objectives. The plan also lays out the groups responsible for the different pieces of the monitoring plan and recommends specific monitoring locations that would enhance the ability of watershed managers to determine if the implementation efforts are working over time. *Link: Agua Hedionda, see Chapter 6*

The implementation piece of Wyoming's plan for Flat Creek is very strong. The management measures are broken down by the goal the measure is meant to address along with cost estimates, possible funding sources, responsible parties and information/education activities that would be used to promote the adoption of the measure **(components D, E, F, G)** This made it very clear how every action proposed in the plan fit together. The implementation summary table also makes clear how the monitoring efforts will be used to ensure goals are being reached (**component I**). Many of the plans reviewed contained a lot of information, and it was not always clear how the information would be used to implement the watershed plan. By summarizing information in this way, it is clear how each and every piece of information in the plan fits into the overall watershed goals. The Flat Creek Plan also outlines a clear procedure periodically reviewing the plan to ensure progress is being made and that the plan is revised as new information is collected. *Link: Flat Creek p. 30 – 37*

The education/information section (**component E**) in the Lake Hendricks plan from Iowa is presented in a question and answer format that clearly illustrates the decision process the plan writers followed to choose information/education activities that would be effective. Unlike most

other plans, barriers to practice adoption are identified in advance along with strategies to overcome those barriers. Also, plan writers interviewed landowners in person to get a better idea of how to target the information/education campaign. *Link: Lake Hendricks See Information & Education Section.*

The education and outreach strategy (**component E**) in the Bee Lake watershed plan from Missouri includes indicators for success, which is not present in other plans. The plan also assigns responsibility for each education/information activity to a specific party, and provides a detailed cost estimate for each activity. The Bee Lake plan also includes a good summary of data used for quantifying causes and sources of pollution. *Link: Bee Lake pp. 11 – 13; 40 – 51*

Tennessee's watershed plan for Oostanaula has a clear implementation schedule (**component F**) and does a good job describing measurable, interim milestones in addition to the implementation schedule and setting criteria that can be used to determine whether loading reductions are being met over time (**components G, and H**). *Link: Oostanaula Creek pp. 55 – 57; 60 – 62*

The Lower St. John's River Basin watershed plan from Florida contains one of the most detailed sections on how the monitoring component would be used to evaluate effectiveness of the plan over time (**component I**). An explanation why different modeling stations and parameters were chosen is included, in addition to a map of monitoring stations (that also illustrated which subbasins the stations corresponded to). Most other plans reviewed did not go very far beyond a map of stations, if a map was included at all. The monitoring efforts are summarized in a table that listed the monitoring stations, what parameters would be monitored at each station and how often, and who would be responsible for carrying out the monitoring. The plan also explains how the monitoring database would be managed, which is another factor missing from most other plans. The plan also includes a thorough discussion of the assumptions made in the analysis of causes and sources of pollution. *Link: Lower St. Johns River, pp. 8 – 12; 80 - 90*

Indiana presents its causes and sources of pollution in a table, complete with an explanation for suspecting each source. It is very clear what previous monitoring was used to verify/quantify each pollutant source. *Link: Salt Creek, p. 97 – 101.*

Hawaii developed a unique way to prioritize project implementation in the Koolaupoko watershed plan that takes into account factors such as landowner support, as well as factors such as BMP efficiency. This plan also includes a really good discussion of the model used for watershed analysis that includes assumptions and limitations. *Link: Ko'olaupoko Moku, p 3-7 – 3-11; Appendix B*

The Carter Lake plan from Nebraska is one of the only plans that included an economic valuation of the waterbody. *Link: Carter Lake, p. 8 – 11*

The Chesapeake Bay Tributary strategy from New York has a very detailed section discussing the information needed to refine the plan in future iterations. *Link: Chemung & Upper Susquehanna River , p. 76 – 83*