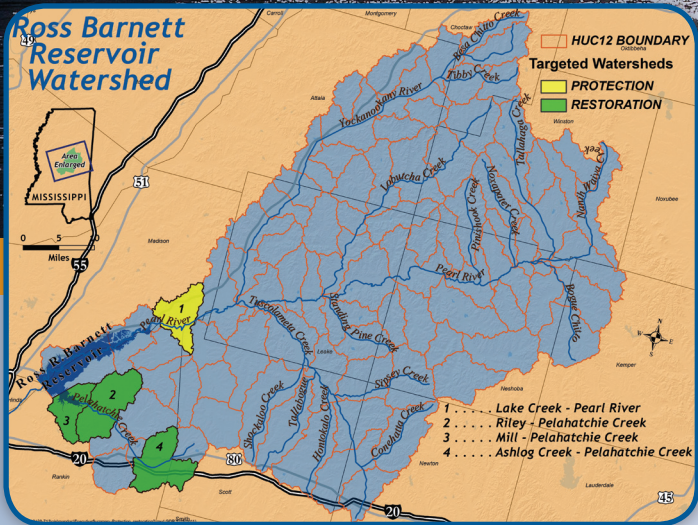
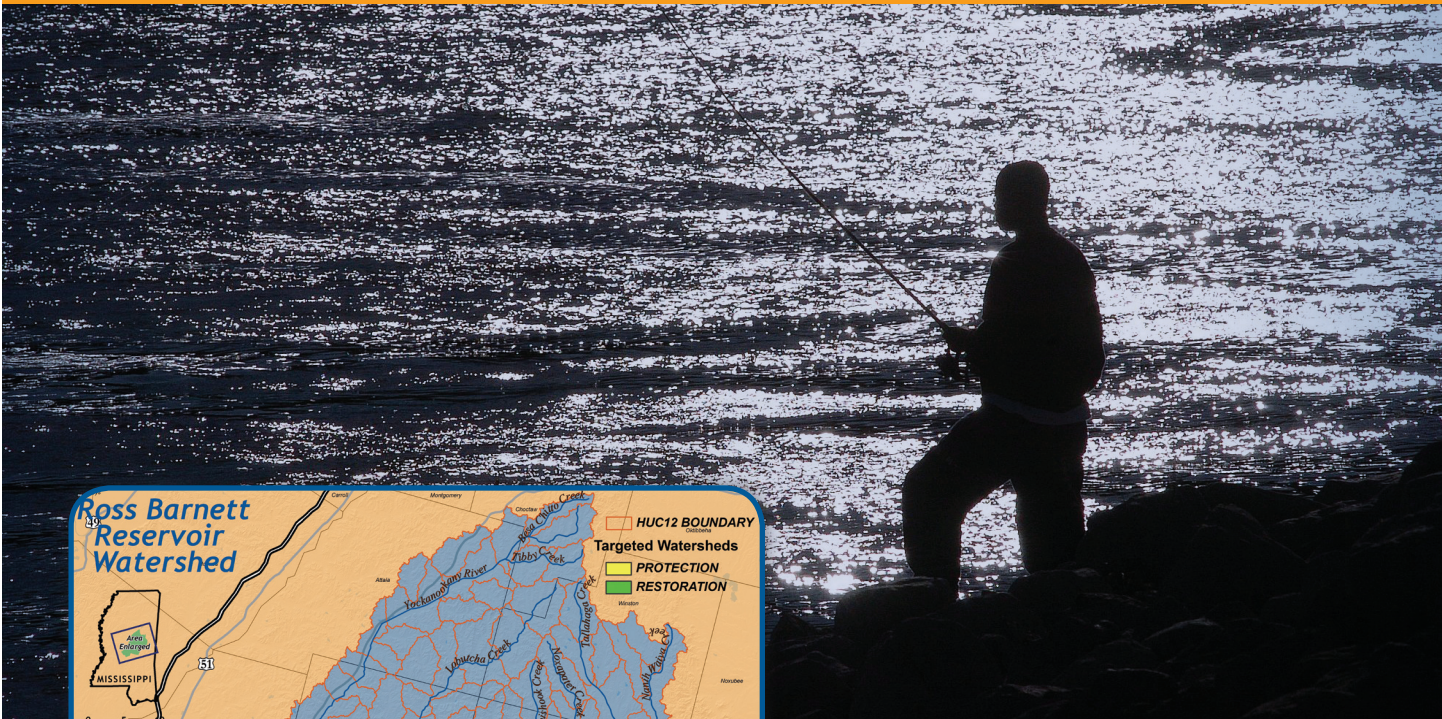




SOURCE WATER PROTECTION PLAN
for the
O.B. CURTIS DRINKING WATER INTAKE



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EXECUTIVE SUMMARY

In 1959, the Mississippi Board of Water Commissioners approved a request by the Pearl River Valley Water Supply District (PRVWSD) to construct a dam and reservoir on the channel of the Pearl River, just upstream of Jackson, Mississippi, for the purposes of recreation and water supply (Permit Application No. 01120). That same year, an agreement was reached between PRVWSD and the City of Jackson for the purpose of providing water from the reservoir to the City of Jackson for use as drinking water. Construction of the reservoir began in 1960 and the Ross Barnett Reservoir was completed and filled to normal pool elevation in 1965. Today, the designated uses of the Reservoir include recreation, fish and wildlife support, fishing, and drinking water supply. PRVWSD manages the Reservoir for these uses.

The Ross Barnett Reservoir is an exceptional surface water resource. The Reservoir provides residents and visitors alike with an abundant assortment of recreational opportunities. It provides habitat for fish and wildlife, and plays a prominent role in the economic health and development of the surrounding area. Most importantly, the Reservoir supplies the O.B. Curtis Water Treatment Plant with an average of 20 million gallons of water per day for the potable water needs of more than 175,000 people and several industries in the Jackson area.

PRVWSD, the Mississippi Department of Environmental Quality (MDEQ), the Mississippi State Department of Health (MSDH), and the City of Jackson, as well as many other resource agencies and local stakeholders, have long recognized the importance of the Reservoir and are committed to preserving the Reservoir for future generations. The US Environmental Protection Agency (EPA) has designated the Reservoir's drainage area as a Priority Watershed. As a result, EPA and its partners have agreed to focus their resources on protecting and restoring the Reservoir and waters draining into the Reservoir.

The Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 104-182) required the state to develop and implement a Source Water Assessment Program (SWAP) and to prepare a Source Water Assessment (SWA) for each of the state's surface water intakes used for potable water supply. In 1998, MSDH contracted with MDEQ to develop and administer the Mississippi Source Water Assessment Program. EPA approved the state's SWAP Plan in November 1999, after which implementation of the SWAP was initiated. At MDEQ's request,

the Tennessee Valley Authority (TVA) prepared the SWA for the O.B. Curtis Water Treatment Plant surface water intake in 2004. In 2010, FTN Associates, Ltd. (FTN) updated the SWA for MDEQ as part of the Ross Barnett Reservoir Initiative. The updated SWA, included as Appendix A, fully satisfies the regulatory requirements of the SDWA.

While not required by the SDWA, the development and implementation of a source water protection plan is essential for protecting and preserving a high-quality water supply for the City of Jackson. The recently published report by the Water Research Foundation (WRF), *Developing a Roadmap and Vision for Source Water Protection for U.S. Drinking Water Utilities*, noted that pollution prevention is far preferable to the remediation or treatment of a contaminated source (WRF 2010).

Recently, MDEQ and PRVWSD, as project co-leads, initiated a comprehensive effort to protect and restore water quality in the Ross Barnett Reservoir. This undertaking is called the Ross Barnett Reservoir Initiative, or *Rezonate*. As part of *Rezonate*, MDEQ and PRVWSD have developed a number of plans aimed at addressing water quality. These include:

- *Comprehensive Protection and Restoration Plan for the Ross Barnett Reservoir Watershed, Mississippi;*
- *Water Quality Monitoring Plan for the Ross Barnett Reservoir and its Watershed;*
- *Comprehensive Education and Outreach Plan for Rezonate!;*
- *Pathogen Source Assessment and Wastewater Management Plan* (CDM 2010);
and
- *Source Water Protection Plan for the O.B. Curtis Drinking Water Intake*
(including the 2010 Source Water Assessment).

This *Source Water Protection Plan* was developed by a work group consisting of representatives from MSDH, PRVWSD, City of Jackson, MDEQ, EPA, and the Mississippi Emergency Management Agency (MEMA). The missions of these agencies and their roles on the work group are provided in Appendix B. In developing the *Source Water Protection Plan*, the work group chose to use the elements recommended by the American Water Works Association (AWWA). The AWWA recommends the following elements:

1. Source water protection program vision statement and goals;
2. Source water characterization;
3. Source water protection action plan;
4. Implementation of the action plan, including periodic evaluation and revision of the entire program.

Each of these elements is discussed further in this *Source Water Protection Plan*.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFO	animal feeding operation
AST	aboveground storage tank
AWWA	American Water Works Association
BMP	best management practice
CAFO	confined animal feeding operation
CCR	Consumer Confidence Report
CDL	Cropland Data Layer
CERLCA	Comprehensive Environmental Response, Compensation, & Liability Act
CRP	Conservation Reserve Program (NRCS)
CWA	Clean Water Act
DBP	disinfection byproduct
EAP	Emergency Action Plan
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EQIP	Environmental Quality Incentives Program (NRCS)
ERP	Emergency Response Plan
ESD	Emergency Services Division (MDEQ)
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study (FEMA)
FLP	Forest Legacy Program (MFC)
FRDP	Forest Resource Development Program (MFC)
FSA	Farm Service Agency
FSP	Forest Stewardship Program (MFC)
GI	green infrastructure
HAAs	haloacetic acids
HOA	homeowner association
LID	low-impact design
MCI	Mississippi Conservation Initiative
MCL	maximum contaminant level
MDAC	Mississippi Department of Agriculture and Commerce
MDEQ	Mississippi Department of Environmental Quality
MDMR	Mississippi Department of Marine Resources
MDWFP	Mississippi Department of Wildlife, Fisheries & Parks
MEMA	Mississippi Emergency Management Agency

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

MFC	Mississippi Forestry Commission
MS4	municipal separate storm sewer system
MSDH	Mississippi State Department of Health
MSOGB	Mississippi State Oil & Gas Board
MSWCC	Mississippi Soil & Water Conservation Commission
NASS	National Agricultural Statistics Service (USDA)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NRCS	Natural Resources Conservation Service
PCS	potential contaminant source
PPA	primary protection area
POR	period of record
ppm	parts per million
PRVWSD	Pearl River Valley Water Supply District
RCRA	Resource Conservation and Recovery Act
SDWA	Safe Drinking Water Act
SMCL	secondary maximum contaminant level
SOP	standard operating procedure
SWA	Source Water Assessment
SWAP	Source Water Assessment Program
SWP	Source Water Protection
SWPA	Source Water Protection Area
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
TOC	total organic carbon
TRI	Toxics Release Inventory
TTHM	total trihalomethanes
TVA	Tennessee Valley Authority
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UST	underground storage tank
WRF	Water Research Foundation

1.0 SOURCE WATER PROTECTION VISION AND GOALS

A group of agency representatives and local stakeholders responsible for various resource management activities and economic interests for the Reservoir and its watershed developed a vision statement for *Rezonate*. This vision statement was provided to the Source Water Protection Work Group (WG), who in turn developed a specific vision statement for the *Source Water Protection Plan* that builds on the *Rezonate* vision. The vision for source water protection (SWP) for the Ross Barnett Reservoir is as follows:

“The Ross Barnett Reservoir provides a safe and reliable supply of drinking water at a reasonable cost for water customers. Ross Barnett Reservoir is protected by a highly motivated, enlightened citizenry of central Mississippi who have a passion for the sustainability of this valuable resource and its contribution to their quality of life.”

The WG developed four program goals for the *Source Water Protection Plan* based on the vision statement. These goals intentionally parallel the goals for the *Comprehensive Watershed Protection and Restoration Plan*, so that similar and overlapping strategies can be used to realize the vision of both plans. The program goals are:

1. Manage the land of the watershed using responsible land stewardship practices and sound planning decisions.
2. Restore or improve those areas of the watershed that are contributing to drinking water quantity and quality problems.
3. Sustain the Reservoir so that a safe and reliable source of drinking water will meet the demands of a growing population.
4. Maintain a healthy watershed to protect the quantity, quality, and cost of the drinking water.

These program goals have been used to develop strategies for the Action Plan described in Section 3.0. Also, these program goals reflect stakeholder priorities and are consistent with goals of programs already in place and managed by the represented agencies.

2.0 SOURCE WATER CHARACTERIZATION

Source water characterization addresses the Reservoir and the land area where the source water originates. It identifies the designated uses and current water quality of the Reservoir and describes the land use and contaminant sources in the surrounding watershed. It also addresses water quantity and the current emergency/security plan. The characterization is consistent with the Source Water Protection Area (SWPA) delineation and the inventory of potential contaminant sources (PCSs) discussed in the 2010 Source Water Assessment (SWA) included in Appendix A.

2.1 General Description of the Reservoir and Watershed

The Ross Barnett Reservoir's impounded area at summer normal pool is approximately 33,000 acres, and is located in Hinds, Madison, and Rankin counties. The upstream drainage area of the Reservoir is approximately 3,050 square miles and includes portions of twelve counties: Attala, Choctaw, Hinds, Kemper, Leake, Madison, Neshoba, Newton, Noxubee, Rankin, Scott, and Winston. Municipalities that border the Reservoir include Madison, Ridgeland, and Flowood. The City of Jackson is located southwest of the Reservoir, downstream of its watershed.

In addition to its designated uses of public water supply, recreation, and fish and wildlife support, the Ross Barnett Reservoir has many other desired uses including economic growth, scenic beauty, fishing and residential development. All of these uses of the Reservoir affect the economy of central Mississippi. In recent years, real estate development in the shoreline areas of the Reservoir has grown at a rapid pace. Development of businesses that serve the growing community has accompanied the residential growth. Water supply provided by the Reservoir has also allowed the development of industries in central Mississippi.

The current land use information available for the watershed (i.e., Secondary Protection Area) is based on the US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) from 2008, and is summarized in Table 2.1. Additional discussion of the land use and land cover is also presented in greater detail in Section 2.2 of the *Comprehensive Watershed Protection and Restoration Plan* (FTN 2011b). The

Comprehensive Watershed Protection and Restoration Plan also includes a comprehensive watershed description, including geography, soils, climate, and geology.

Table 2.1. Land use in the Ross Barnett Reservoir watershed.

Land Use*	Percentage of Watershed
Forest/Woodland	50.4%
Pasture/Grassland	18.9%
Shrubland	12.6%
Wetlands	8.9%
Developed	6.3%
Open Water	1.8%
Agricultural Crops	1.1%
TOTAL	100.0%

* USDA NASS Cropland Data Layer (CDL) 2008

2.2 Water Quality in the Reservoir and its Watershed

Water quality monitoring in Ross Barnett Reservoir and its watershed has been conducted since the Reservoir was filled in 1965. Several agencies have been involved in various efforts to collect chemical, physical, and biological data in the Reservoir, including the Mississippi Department of Environmental Quality (MDEQ), the US Environmental Protection Agency (EPA), the Mississippi State Department of Health (MSDH), the US Geological Survey (USGS), the City of Jackson, and the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP). The *Water Quality Monitoring Plan for the Ross Barnett Reservoir and its Watershed* was developed as part of *Rezonate*. The plan includes a summary of the monitoring activities that have occurred in the Reservoir and its watershed, an inventory of all available data for the Reservoir, and ongoing data collection efforts (FTN 2011b).

Surface water quality is dictated by Section 314 of the Clean Water Act (CWA) and is based on the designated uses of the waterbody being maintained and supported. EPA has authorized MDEQ as the administrator of the CWA in the state of Mississippi. The current condition of the Reservoir using the Carlson Trophic State Index is “eutrophic,” meaning there is high primary productivity. Eutrophication in surface waters occurs when elevated levels of nutrients lead to changes in the aquatic ecosystem, resulting in increased primary production and

decreased dissolved oxygen levels. However, assessments of trophic state index do not reflect whether a waterbody supports its designated use. MDEQ noted that trophic state is not synonymous with water quality (MDEQ 2010b). In fact, the Reservoir is not included on Mississippi's 303(d) list as impaired, and is presently meeting the established water quality standards for aquatic life support (MDEQ 2010a, 2010b). Section 2.4 and Appendices C, D, and E of the *Comprehensive Watershed Protection and Restoration Plan* include an in-depth review of the water quality data available in the watershed, including the Reservoir. The available water quality data do indicate that some waterbodies located in the Ross Barnett Reservoir watershed are impaired. Total maximum daily loads (TMDLs) have been calculated for these waterbodies and recommend reductions in pollutant loads. See Appendix G for more information.

Drinking water quality is dictated by the Safe Drinking Water Act (SDWA) and is administered through MSDH. The requirements and monitoring set forth by the SDWA are to ensure the national health-based standards are met.

The drinking water goals of the *Water Quality Monitoring Plan* are to track water quality constituents related to drinking water treatment issues identified by the City of Jackson O.B. Curtis Water Treatment Plant and to assess the status and trends in levels of suspended sediments, dissolved oxygen, algae, and total organic carbon (TOC). The plan recommends routine sampling for these parameters at multiple locations in the Reservoir, including a site near the O.B. Curtis Water Treatment Plant's intake. Sampling for pesticides and other organic contaminants applied in early spring is also planned near the O.B. Curtis Water Treatment Plant's intake.

The Water Research Foundation (WRF) noted that one of the known challenges in a Source Water Protection Program is the interagency coordination between those with oversight for the SDWA and CWA, because they typically fall under different agencies (WRF 2010). It is important to note that the numerical values of drinking water criteria can differ from the values of surface water quality criteria.

2.3 Quality of Intake Water, Raw Water, and Finished Water

EPA's National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations and the State of Mississippi Drinking Water Regulations set forth the monitoring and sampling routines performed by the O.B. Curtis Water Treatment Plant and MSDH. This sampling is intended to ensure that the source water is treated to the appropriate level, and that the treated water meets the established drinking water standards. A complete listing of these standards and regulations is included in Appendix C.

The monitoring frequency required by the Primary Drinking Water Regulations for the O.B. Curtis Water Treatment Plant is generally dictated by previous monitoring results (and is also summarized in Appendix C). All parameters are measured twice per shift, 7 days per week. The treatment plant currently has an "A" classification, which requires them to be in operation 24 hours per day, 7 days per week, with a certified operator on each shift. For the Secondary Drinking Water Regulations, staff at the O.B. Curtis Plant measure constituents on regular business days at three locations in the treatment process.

- Intake water or source water is collected at or near the intake to the O.B. Curtis Water Treatment Plant prior to any treatment or chemical addition.
- Raw water is collected at the treatment plant after the addition of approximately 0.3 parts per million (ppm) of potassium permanganate (KMnO₄). KMnO₄ is used to prevent clams from clogging the intake line.
- Finished water is collected after the treatment process at the plant and from within water distribution lines.

The City of Jackson operates the O.B. Curtis Water Treatment Plant using two treatment trains: a conventional treatment process and a recently upgraded ZeeWeed ultrafiltration treatment process. The conventional process proceeds as follows:

1. Intake located in the Reservoir,
2. Raw water received at O.B. Curtis Treatment Plant,
3. Pre-oxidation (to address taste, odor, manganese removal, and pH adjustments as needed),
4. Rapid mix,

5. Flocculation,
6. Settling basins,
7. Ultraviolet disinfection and filters (to address log 4 removal, which means achieving a 99.99% reduction of biological contaminants), and
8. Onsite storage and distribution.

The newer ultrafiltration technology provides additional water treatment capacity with improved technology, and works in parallel with the conventional water treatment process. The upgraded ultrafiltration treatment process also proceeds through steps 1 through 3 described above; however, during rapid mixing, the processes differ. The ultrafiltration treatment train proceeds through the rapid mix process to flocculation in a covered contact chamber and through one of six membrane filters to the clearwell. Two separate clearwells are connected by a pipe that could allow the treated water from the separate treatment trains to mix; however, the water from each treatment train typically arrives in the clearwell at separate times, so mixing does not occur. In the clearwells, the water is treated with chloramines, fluoride, and lime as needed to adjust the pH for the finished water.

The recent upgrade at the water treatment plant did not directly result from a single water quality issue within the Reservoir, but from a combination of considerations that were influenced by the changing conditions of the source water (personal communication, City of Jackson, 2010). One issue was detection of cryptosporidium in 1 out of 24 samples tested in 1998. The upgraded ultrafiltration treatment process decreases the potential for cryptosporidium in the finished water.

Sampling data for raw and finished water are documented in several reports. MSDH performs annual treatment plant inspections and prepares comprehensive biennial reports. The biennial reports dated 2005, 2007, and 2009 have not identified any deficiencies at the O.B. Curtis Water Treatment Plant. The 2005 report included a reminder to the plant staff that monthly bacteriologic samples should be collected in accordance with the approved sampling plan, and requested that plant staff improve their documentation of the location of sampling sites. No additional comments were recorded on subsequent inspection reports.

The City of Jackson prepares an annual Consumer Confidence Report (CCR) for their customers. The CCR documents the quality of the drinking water from both the O.B. Curtis and

J.H. Fewel water treatment plants. The CCR provides the results of the entire year of water quality testing for the contaminants that are routinely monitored as required by federal and state laws. The 2010 CCR, which is the most current report available, does not indicate any violations except for turbidity. In January 2010, the limits of turbidity were exceeded. Although turbidity has no significant health effects, it can interfere with disinfection and provide a medium for microbial growth. The problem was addressed with corrective actions that including training personnel. The 2010 CCR Report is included in its entirety in Appendix D.

Secondary Drinking Water Regulations are a set of non-enforceable water quality standards that include the parameters that primarily affect the aesthetic qualities of the drinking water, such as color, pH, iron, and total and dissolved manganese. The City of Jackson performs analyses for these parameters in order to effectively treat their raw water. The City also measures alkalinity and TOC in the raw water. EPA does not enforce these secondary maximum contaminant levels (SMCLs) because they are not considered to present a health risk at the SMCL.

Raw water data provided by the City of Jackson were statistically analyzed for seasonal trends. The analyses show that iron, color, and alkalinity appear to have similar seasonal patterns over the period from 2004 through 2009. A complete discussion of the analyses performed is included in Appendix E. In summary, the results of the analyses suggest the following:

- Parameters measured exhibit seasonal variability, except pH.
 - Highest levels of alkalinity occur during the summer.
 - Highest levels of color, iron, manganese, and turbidity occur during the winter and/or spring.
 - Seasonal variability of turbidity is not as apparent as exhibited in the other parameters.
- Iron may contribute to both color and turbidity.
- Iron and manganese may be influenced by water buffering capacity.

Recent samples of source water and finished water showed that levels of 137 compounds classified as either pesticides or pesticide degradates were present at concentrations below the EPA maximum contaminant level (MCL) (Rose et al. 2009). EPA has established criteria for

many pesticides based on protection of aquatic life and human health. MDEQ uses these criteria in its surface water quality standards (MDEQ 2007). The water quality reports from the O.B. Curtis Water Treatment Plant show that water samples routinely satisfy these standards.

2.4 Current Issues and Concerns of Reservoir Water Quality

Rezonate identifies sediments/turbidity and pathogens/bacteria as the top two priority issues affecting water quality in the Reservoir. Additional issues include nutrients, currently used pesticides, trash, and invasive aquatic plant species. The O.B. Curtis Water Treatment Plant operators have reported concerns related to elevated turbidity, nutrients, iron, and manganese. These issues must be considered when treating the intake water to produce finished water. The intake line is designed so that plant operators can adjust the depth of the water-intake opening to withdraw water from the Reservoir at an optimum location at any given time. The optimum location has the lowest levels of the parameters of concern (i.e., is of the highest available water quality). The optimum level is most commonly the upper elevation, which is near the surface. The depth of the intake is adjusted infrequently (personal communication, City of Jackson, 2010).

The quality of the source water affects the degree and cost of treatment required to satisfy the drinking water standards. High levels of suspended sediments in the source water can potentially increase maintenance and energy costs and require the increased use of coagulants and polymers. Ultimately, this creates additional residual solids that require disposal. Residual solids must be loaded into trucks and disposed of at a local landfill. The current cost per truck load is \$495 (City of Jackson 2011). Sediment can also foul the raw water screens and filters, requiring the plant to run its centrifuges more often. The presence of sediment and suspended solids requires more frequent backwashing of conventional filters and performing more cleaning of the membrane filters. The costs associated with these operations at the O.B. Curtis Water Treatment Plant are not known but can be inferred based upon other data. For example, a study was conducted in Texas to estimate the costs of municipal water treatment as a function of source water quality. The researchers determined that with every 1% increase in turbidity, there was a 0.25% increase in treatment chemical costs (Dearmont et al. 1998).

The presence of nutrients in the source water cause additional challenges to water treatment. Abundant nutrients lead to algal growth in settled water launders and filters in the treatment plant. Increased algal production can in turn cause objectionable taste and odor in drinking water. Organic material resulting from the presence of algae in source water can form disinfection byproducts (DBPs) when chlorine reacts with organic material during the treatment process.

DBPs, specifically total trihalomethanes (TTHMs) and haloacetic acids (HAAs) are the byproducts of the disinfection process and pose potential health risks when present in levels greater than the MCL. The amount of TTHMs and HAAs present in treated drinking water can change from day to day, depending on the season, water temperature, amount of chlorine added, amount of organic material in the water, and a variety of other factors. The primary strategy for reducing DBPs is to reduce the amount of organic carbon in the source water (National Research Council [NRC] 2000). The O.B. Curtis Water Treatment Plant samples for DBPs on a quarterly basis and maintains a running annual average of the measured data. Quarterly records on file with MSDH dating back to the first quarter of 2004 consistently report TTHMs and HAAs below the MCL.

The City of Jackson is concerned about manganese remaining in the finished water staining clothes when laundered. In most cases, iron and manganese are removed during water treatment, but under certain conditions (reducing conditions), manganese is slower to precipitate during the treatment process and can become present in the distribution pipelines and home plumbing. Iron and manganese may be found in source water from the Reservoir during anoxic conditions in the hypolimnion near the intake point. Under these conditions, water pH is typically low and carbon dioxide levels increase, causing iron and manganese in sediments to dissolve into the water column.

Manganese levels in raw water are summarized in Table 2.2. Naturally occurring dissolved concentrations of 0.1 to 1.0 mg/L are common at low or neutral pH waters. The secondary MCL for manganese in finished water is 0.05 mg/L, above which the noticeable effects are black- to brown-colored water, black staining, and a bitter metallic taste (EPA 1992). On occasion, elevated levels of manganese have occurred in the finished water. During the period of record (POR) of January 1, 2004, through October 4, 2009, the secondary MCL was

exceeded on 59 occasions in finished water at the O.B. Curtis Water Treatment Plant and five measurements were at the secondary MCL. The majority of these exceedances occurred in 2006 and 2009 (22 and 23 exceedances, respectively). The majority of these exceedances (37) occurred in the winter or spring (December through April). The remainder occurred during the summer (May through September). The only year during this period with no measured manganese concentrations above the secondary MCL was 2004.

Table 2.2. Raw water manganese samples collected January 1, 2004, through October 4, 2009.

Parameter	Minimum (mg/L)	Maximum (mg/L)	Median (mg/L)
Total Manganese	0.017	1.276	0.117
Dissolved Manganese	0.000	0.912	0.086

Iron levels in raw water are summarized in Table 2.3. The secondary MCL for iron in finished water is 0.3 mg/L, above which a rusty color, staining, and/or a metallic taste may be noticed (EPA 1992). Iron concentrations measured in finished water at the O.B. Curtis Water Treatment Plant did not exceed the secondary MCL during the POR.

Table 2.3. Raw water iron samples collected January 1, 2004, through October 4, 2009.

Parameter	Minimum (mg/L)	Maximum (mg/L)	Median (mg/L)
Total Iron	0.00	1.80	0.16

Color is used as an indicator of organic materials in the water. The presence of iron and/or manganese may also influence color. Data for color measured in raw water are summarized in Table 2.4. According to EPA, consumer complaints typically occur when the finished water is over 15 color units. Also, rapid changes in color are more likely to provoke complaints (EPA 1992). There are no documented complaints from O.B. Curtis Water Treatment Plant consumers with regard to the color of their drinking water.

Table 2.4. Color measured January 1, 2004, through October 4, 2009.

Parameter	Minimum (color units)	Maximum (color units)	Median (color units)
Color	4	520	80

2.5 Water Quantity

At present there are no issues related to water quantity at the O.B. Curtis Water Treatment Plant intake. A long-term concern for the Reservoir is the gradual loss of capacity due to sedimentation. Reservoirs that are relatively shallow and have a drainage area (DA) to surface area (SA) ratio of 50 or more can have a significant loss of capacity within a matter of several decades (Kitchell 2001). The DA/SA ratio for the Ross Barnett Reservoir is 61.

2.6 Contaminant Sources

The contributing watershed of the Reservoir is divided into two areas, the primary protection area (PPA) and the secondary protection area. The PPA includes open water and the adjacent land, from which a contaminant could reach the drinking water intake within 24 hours of a spill. Contaminant sources in this area pose an immediate threat to the drinking water supply. The secondary protection area includes the remainder of the watershed, for which a contaminant spill is more likely able to be contained and/or treated prior to reaching the water supply intake.

In both the primary and secondary protection areas, the following issues exist and pose a potential threat the drinking water supply:

1. Direct spill of hazardous materials,
2. Permitted discharges from regulated facilities/sources, and
3. Nonpoint source discharge of pollutants.

2.6.1 Direct Spill

Any significant direct spill into the Reservoir within the PPA warrants an immediate response to protect the drinking water supply. A direct spill into the Reservoir could occur at/on bridges or at marinas and boat ramps. The probable cause of a spill of a hazardous nature is a

vehicle or boating accident or a malicious act. A current inventory of the bridges, marinas and public boat ramps within the PPA are included geographically and in a tabular form in the 2010 SWA (Appendix A). Walk-in access point locations are too numerous to be identified independently.

A direct spill into the Reservoir could also occur anywhere along the shoreline where there is human activity or anywhere within the Reservoir where there is boating activities. The entire shoreline and the Reservoir surface area are included in the PPA.

The potential pollutants from a direct spill include petroleum products and chemicals being transported on the roadways, leaked from automobiles and boats, and/or spilled as a result of an accident. Potential pollutants also include de-icing chemicals and/or salts applied directly to the roads and bridges.

The MDEQ Office of Pollution Control's Emergency Services Division (MDEQ-ESD), has responded to at least one boating accident where a spill containment and cleanup contractor was dispatched to the Reservoir. MDEQ-ESD will respond to an incident at the Reservoir if requested by MEMA or the location authorities. When called, MDEQ-ESD will assess the situation and determine the severity. Response actions are determined on a case-by-case basis. MDEQ-ESD recommends that the local authorities and/or property owners contact a contractor trained and equipped to contain and/or clean up the accident. Emergency response procedures, emergency protocol, and/or standard operating procedures (SOPs) seem to exist and be utilized, but supporting documentation is not readily available for review. Consideration should be given to documenting the emergency SOPs in the event of a spill and making the emergency SOPs available to businesses and first responders in the immediate vicinity of the Reservoir so that if there is a potential threat to the public water intake, immediate and routine responses will be available and executed.

2.6.2 Regulated Sources and Facilities

There are numerous facilities and businesses located with the Ross Barnett Reservoir watershed that have obtained permits through MDEQ, EPA, the Mississippi State Oil and Gas Board (MSOGB), and county and city governments. The accidental discharge of a pollutant from

a permitted facility in the PPA is not expected but should be considered a potential threat and prepared for nonetheless.

Permitted facilities under the regulatory control of EPA and MDEQ include municipal, commercial, and industrial wastewater treatment plants, stormwater from urban areas, large construction sites (i.e., sites 5 acres or larger), surface mines, animal growing operations, underground storage tanks (USTs). Aboveground storage tanks (ASTs) are not currently regulated by MDEQ or EPA. County and city governments issue small construction stormwater permits (i.e., 1- to 5-acre sites) and manage municipal separate storm sewer system (MS4) programs. All currently known permitted facilities within the PPA have been identified in the updated PCS inventory (Appendix A). A summary of the types of regulated facilities and their potential pollutant(s) are summarized in Table 2.5.

Table 2.5. Regulated sources, their potential pollutants, and related concerns.

Regulated Facility/Source	Potential Pollutant(s)	Concerns
UST	Petroleum products	Leaching of pollutants into groundwater, accidental spills
AST	Petroleum products	Accidental spills
Wastewater discharges permitted under the National Pollutant Discharge Elimination System (NPDES) program	Nutrients, pathogens, and organic material	Water quality issues in source water (eutrophication, pathogen levels, increased organics)
Construction stormwater discharges permitted under the NPDES program	Sediments oil and grease	Water quality issues in source water (elevated turbidity)
Urban stormwater (MS4) discharges permitted under the NPDES program	Sediments, nutrients, pathogens, oil and grease, fertilizers and pesticides	Water quality issues in source water (elevated turbidity, eutrophication, pathogen levels, increased organics)
Gas pipeline, gas & carbon dioxide wells	No significant pollutants identified	Transmission of pollutants to surface water
Solid waste	Pathogens, stormwater containing leachate	Transmission of pollutants to surface water
Hazardous waste (Resource Conservation and Recovery Act [RCRA], Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], and Toxics Release Inventory [TRI])	Pollutants vary according to permit conditions	Transmission of pollutants to surface water, accidental spills
Animal growing operations / Confined animal feeding operations (CAFOs) and animal feeding operations (AFOs)	Pathogens, nutrients, and organic material	Water quality issues in source water (eutrophication, pathogen levels, increased organics)

2.6.3 Nonpoint Sources of Pollutants

Nonpoint source pollutants account for the majority of issues of concern cited in *Rezonate*. Nonpoint sources cannot be specifically located, but can be described based on anthropogenic activities, land use types, and other watershed characteristics, and are summarized in Table 2.6. The *Comprehensive Watershed Protection and Restoration Plan* includes an extensive discussion of nonpoint sources.

Table 2.6. Nonpoint sources, their potential pollutants, and related concerns.

Nonpoint Source	Potential Pollutant(s)	Concerns
Residential	Herbicide, pesticides, fertilizers, petroleum products, bacteria from pet waste, soil erosion.	Water quality issues in source water (increased turbidity, eutrophication, pathogen levels, increased organics); transmission of pollutants into source water.
Agriculture	Herbicide, pesticide, bacteria from animal waste, soil erosion.	Water quality issues in source water (increased turbidity, eutrophication, pathogen levels, increased organics); transmission of pollutants into source water.
Commercial business	Herbicide, pesticide, fertilizer, petroleum products, litter.	Water quality issues in source water (pathogen levels, increased organics); transmission of pollutants into source water.
Forestry practices	Soil erosion, petroleum products.	Increased turbidity; transmission of pollutants into source water.
Internal loading	Sediments resuspended during wind/wave action; nutrients, iron, and manganese released from sediments.	Increased turbidity and levels of manganese and iron.
Wildlife	Bacteria.	Elevated pathogen levels.
Boats	Boat gas and oil; sediments resuspended due to wave action.	Transmission of pollutants into source water; accidental spills; increased turbidity due to wave action.

The developed and landscaped areas of the Reservoir shoreline are especially vulnerable to nonpoint source pollution. Removal and alteration of the natural vegetation of the shoreline can diminish the natural ability of riparian areas to filter and remove pollutants from water draining from the watershed. Based on a review of 2005 aerial imagery of the Reservoir shoreline, approximately 26% of the shoreline contained no visible riparian cover while 74% of the shoreline included a visible riparian cover. Continuous lengths of the shoreline with no

apparent effective riparian cover are concentrated around the dam, residential areas on Pelahatchie Bay, and locations where roads make up the bulk of the shoreline.

2.7 Emergency Preparedness and Security Plan

Under the guidance of EPA and in compliance with Section 1433 of the SDWA and the Emergency Planning and Community Right-to-Know Act (EPCRA), an Emergency Response Plan (ERP) has been prepared by the City of Jackson. This document is made available to employees of the water system to use as a guide in the event of a natural disaster or other emergency. The ERP identifies the appropriate contacts in the event of an emergency. The ERP is reviewed each year and updated as necessary. For security reasons, the ERP is a confidential document and is not available for public release.

An Emergency Action Plan (EAP) for the Ross Barnett Reservoir and its dam was prepared by the US Army Corps of Engineers (USACE) in August 2009 for the Pearl River Valley Water Supply District (PRVWSD). The EAP identifies the area of impact in the unlikely event of a dam failure (USACE 2009). The report includes sample news releases and an emergency notification process that can be used to develop ERPs in the event of other emergencies at the dam and Reservoir.

3.0 ACTION PLAN

Because the Reservoir drains a large watershed with diffuse pollutant sources, a watershed-wide action plan is necessary to protect and preserve its ability to serve as a source of drinking water. This section presents the activities and management practices currently in place along with additional recommended actions intended to mitigate the identified threats (existing and anticipated) to the Reservoir. The work group recommended the following strategies to achieve the goals and realize the vision given in Section 1.0.

1. Create a committed work group under the leadership of MDEQ's Basin Management Branch that includes other state agencies, local government, and stakeholders to promote and administer the Source Water Protection Program for the Reservoir watershed.
2. Encourage cooperation and coordination among state agencies, local government, and the planning and development community to implement land management practices throughout the watershed that are consistent with stormwater management plans, ordinances, and zoning codes resulting in overall improved health of the watershed.
3. Educate the public about drinking water; where it comes from, the treatment process, and why and how the Reservoir should be protected. Foster an appreciation of the Reservoir as a source of drinking water, in addition to the other natural amenities it offers.
4. Develop guidance for effective best management practices (BMPs) for use within the PPA and the watershed as a whole. Educate the public about the BMPs that can be implemented at their homes or work places to improve the water quality of the Reservoir.
5. Implement an ongoing water quality monitoring plan for the Reservoir and its watershed.
6. Promote legislation establishing enforceable mechanisms that will promote implementation of appropriate BMPs and result in reduced transmission of pollutants.
7. Encourage Emergency Management Offices to incorporate routine training for first responders involved in the response to a spill or threat to the Reservoir.

Table 3.1 includes a summary of the strategies and the actions needed to achieve each strategy. The summary table includes only the new/expanded activities recommended for

implementation of this *Source Water Protection Plan*. The text in this section gives a detailed description of the new/expanded activities along with ongoing watershed programs (both regulatory and non-regulatory programs) that are relevant to source water protection.

Table 3.1. Action plan summary.

Strategy	Action	Resources	Obstacles	Timetable
Administration of the Source Water Protection Plan by Work Group (WG) (details included in Section 3.1).	Prepare and make available public notices of the updated SWA and Source Water Protection Plan using local printed and digital media available.	MDEQ Basin Team and WG members	Lack of interest among the general public	Fall 2011
	Annual meeting to review and evaluate program goals and strategies.	MDEQ Basin Team and WG members	No specific budget allocated to source water protection activities	Annually
	Update the PCS inventory.	MDEQ Basin Team and WG members	No specific budget allocated to source water protection activities	Annually
	Annual outreach/education newsletter for the identified PCS businesses located in the PPA The newsletter would include emergency contact information in the event of a spill and promote BMPs specific to minimizing the risk of the release of pollutants.	MDEQ Basin Team and WG members	No specific budget allocated to source water protection activities	Annually
Encourage and promote coordination with existing local, state, and federal programs (details included in Section 3.2).	Maintain an inventory of regulatory programs applicable to source water protection.	WG, MDEQ Basin Team, local communities	Changing regulatory programs.	Annually
	Update comprehensive plans to incorporate goals that specifically identify source water protection.	Madison and Rankin counties, WG members, MDEQ Basin Team.	Coordination of source water protection policies across political jurisdictions.	2012-2013 (or at next complete plan update)
	Consider adding restrictions on impervious surface areas into selected zoning requirements and including incentives for use of low-impact design (LID) and green infrastructure (GI) practices.	Local communities, county government, WG, MDEQ Basin Team	Coordination of consistent zoning restrictions across political jurisdictions; adoption of additional regulatory practices.	2013-2014
	Consider developing an overlay zoning district for the PPA.	Local communities, county government, WG, MDEQ Basin Team	Coordination of consistent zoning restrictions across political jurisdictions; adoption of additional regulatory practices.	2013-2014
	Consider developing a shoreline/streamside protection ordinance that limits disturbance of riparian buffer zones in the PPA or a larger drainage area.	Local communities, county government, WG, MDEQ Basin Team	Adoption of additional regulatory practices.	2015
	Form partnerships with homeowner associations (HOAs) to promote the use of green infrastructure practices.	Local communities	Few cost-share programs available to individual homeowners and lack of interest.	Starting in 2012
	Consider update to regulatory policy for ASTs to increase containment capacity (current policy requires 20% containment).	EPA, MDEQ, Mississippi Department of Agriculture and Commerce (MDAC)	Adopting increased regulatory policy. No single agency is responsible for ASTs.	2013
	Develop AST inventory program for the PPA	EPA, MDEQ, MDAC	Non-permitted ASTs are difficult to identify; no single responsible agency.	Prior to PCS inventory update (2016)
	Enhance the monitoring SOPs at the O.B. Curtis Treatment Plant to better utilize measured data.	City of Jackson, MSDH, MDEQ Basin Team	May require additional funding for equipment maintenance.	2011-2012
	Update forestry management plan to specifically target source water protection.	PRVWSD	None anticipated	2010
Develop education/ outreach actions specific to the benefits of the TMDLs completed within the watershed.	MDEQ Basin Team	None anticipated	2011-2012	
Education and appreciation of drinking water (details included in Section 3.3).	Implementation of the <i>Comprehensive Education and Outreach Plan</i> .	MDEQ Basin Team	None anticipated	2011-2015
Implementation of BMPs (details included in Section 3.4).	Prepare and distribute BMP information (fact sheets) that specifically targets the PPA.	WG, MDEQ Basin Team, local communities	Lack of interest among the general public.	Ongoing
	Encourage adoption of BMPs within municipal codes, ordinances.	Local communities, WG, MDEQ Basin Team	Coordination of consistent zoning restrictions across political jurisdictions; adoption of additional regulatory practices.	2012 – 2014

Table 3.1. Action plan summary (continued).

Strategy	Action	Resources	Obstacles	Timetable
	Implementation of the management strategies identified in the <i>Comprehensive Watershed Protection and Restoration Plan</i> for targeted watersheds.	MDEQ Basin Team, WG, local communities	Funding and landowner willingness	Ongoing after 2012
Water quality monitoring (details included in Section 3.5).	Implementation of the <i>Water Quality Monitoring Plan</i> .	MDEQ Basin Team	Funding	Ongoing after 2012
Promote legislation for source water protection (details included in Section 3.6).	Evaluate the effectiveness of this plan to determine if additional enforceable mechanisms are needed.	WG, MDEQ Basin Team	Adoption of additional regulatory practices.	2015 or later
Emergency contingency/ notification plan (details included in Section 3.7).	Heighten awareness of the community of the Reservoir being a drinking water source.	WG, MDEQ Basin Team	Lack of interest among the general public.	Starting in 2011-2012
	Prepare and distributed Education and Emergency Procedure kit to businesses located within the PPA (including an emergency contact notification tree).	WG, MDEQ Basin Team, local communities and emergency management	Cost of kit	2013
	Develop first responder training.	WG, MDEQ Basin Team, MEMA, local communities and emergency management	None anticipated	2011-2012
	Develop a Spill Response Plan	PRVWSD, WG, MDEQ Basin Team, MSDH, City of Jackson	No funding allocated at this time.	2012
	Obtain and install signage within the PPA indicating the presence of a drinking water source.	WG, MDEQ Basin Team, local communities	Cost	2011-2013

3.1 Work Group

A Source Water Work Group will be created to promote and administer the Source Water Protection Program for the Reservoir watershed. This work group will be under the leadership of MDEQ's Basin Management Branch and will include other state agencies, local government, and stakeholders. The WG that developed this *Source Water Protection Plan* will serve as the nucleus for the new Source Water WG.

The Source Water WG will engage the public in order to create interest and participation in source water protection. This will be done through notifying the public of the availability of the 2010 SWA and the newly developed *Source Water Protection Plan*. The Source Water WG will also have a role in implementing the objectives specified in the *Comprehensive Education and Outreach Plan* (FTN and the Cirlot Agency 2011).

The Source Water WG will convene annually to review program goals and strategies, and to review the activities of the previous year. The WG will also decide upon activities with accompanying milestones for the coming year. The WG will discuss the successes, challenges, and obstacles experienced throughout the previous year. More information about the Source Water WG participants and roles and responsibilities are included in the Appendix B.

3.2 Coordination with Existing Programs

A successful Source Water Protection Program must encourage cooperation and promote coordination among state and federal agencies, local governments, the planning and development community, and the stakeholders located in the SWPA. Cooperation and coordination are necessary to implement land management practices (BMPs) throughout the watershed that are consistent with existing stormwater management plans, ordinances, and zoning codes, and result in the overall improved water quality within the watershed.

Such cross-jurisdictional partnerships are essential for meeting the goals of public agencies and municipalities along with the priorities of landowners, drinking water customers, and the general public recreating on the Reservoir. In the Reservoir watershed, the water utility (i.e., the City of Jackson) is responsible for meeting the drinking water standards, while PRVWSD and local governments are responsible for regulating land use in the watershed. Thus,

it is important for the local governments and City of Jackson to closely coordinate efforts to promote water quality.

Members of the Source Water WG will work within their respective agencies and organizations to maintain a current inventory of the regulatory programs that benefit and/or encourage watershed protection, water conservation, water quality improvements, and the protection of the drinking water supply. The existing local, state, and federal programs are discussed below.

3.2.1 Local Programs

Local governments within the Reservoir's watershed regulate management and modification of land within their political boundaries. Regulatory mechanisms currently in place to protect source water include zoning ordinances, landscaping ordinances, and subdivision / stormwater ordinances. PRVWSD also enforces policies that require sound land development in the area immediately surrounding the Reservoir.

Local governments in the area immediately surrounding the Reservoir include Madison, Rankin, and Hinds counties, and the cities of Flowood, Madison, and Ridgeland. Both Rankin and Madison counties have developed comprehensive plans to guide community development.

Rankin County's comprehensive plan includes long-range goals and objectives as well as plans for land use, transportation, and community facilities. The plan has several goals relevant to source water protection including recognizing and considering environmental constraints in the establishment of land use patterns and reducing the effects of stormwater. The land use component of the comprehensive plan includes a current and future (next 25 years) land use map for the county. The most common change seen in future land use patterns is the conversion of agricultural lands to residential estates and low-density residential development.

The goals and objectives of the Madison County comprehensive plan are intended to reflect community issues and community values. Citizen input was solicited in the fall of 2001 to obtain the public's priorities for development in the county. Local priorities include political and business leaders working collaboratively to solve community problems, and involving the private sector in the implementation of the comprehensive plan. The comprehensive plan requires

improvements in stormwater drainage in areas prone to flooding, and stormwater retention/detention facilities, and measures intended to reduce pollutants in stormwater.

Madison and Rankin counties should be encouraged to incorporate goals that specifically target source water protection into their comprehensive plans. Optimally, the plans should indicate specific actions that will be taken in order to achieve source water protection. Future land use forecasting maps should identify portions of the Reservoir's PPA where expected land use changes may result in increased population and development.

The county governments administer zoning ordinances based on their comprehensive plans. Zoning plans include maps of zoning districts with specific requirements for each district. Zoning requirements for open spaces are relevant to source water protection. Zoning plans for Rankin and Madison counties require a portion of all developed zones to be set aside as open space. The amount of open space varies in each zone, but generally ranges from 10% to 30% of the developed area. Restrictions on the amount of impervious surfaces can reduce the quantity of stormwater produced and protect downstream channels. The current zoning plans do not address impervious surfaces. It may be beneficial to limit impervious area in future developments to reduce the quantity of stormwater generated from developed areas.

Maintaining vegetated buffer zones along drainage channels and streams are one of the most effective ways to remove pollutants from stormwater entering the Reservoir. Maintaining buffer zones is a highly cost-efficient BMP when disturbance of the buffer zone is avoided to begin with. Regulatory controls to prevent disturbance of riparian buffer zones in new developments should be considered for the shoreline, drainage channels and tributaries located within the PPA.

Local governments often designate special and unique areas as an overlay type of district, such as an historical district or downtown district. Overlay districts often have specific architectural requirements that are usually more stringent than other zones. Overlay districts have been used within the United States to designate specific zoning requirements in source water protection areas. In a national survey of 22 representative water supply reservoir watersheds, 60% considered overlay districts as a preferred mechanism to guide and regulate land use in drinking-water reservoir watersheds, and about one third of the watersheds emphasized

stormwater runoff treatment over land use control as the major thrust of their watershed protection strategy (Kitchell 2001; van der Leeden et al. 1990).

Overlay districts for source water protection typically have stricter controls for activities that may impact water quality, such as landfills, septic systems, hazardous waste storage, gas stations, car washes, and dry cleaning facilities. They also may require additional treatment of stormwater through more effective stormwater controls on developed sites to reduce the quantity and pollutant content of stormwater. Requirements or recommendations for developers to use LID and incorporate GI principles into new development or retrofitting projects would reduce nonpoint source pollutant loads in stormwater. An overlay district in Rankin and Madison counties could be considered as an action to enhance pollution control requirements within the PPA.

Stormwater/subdivision ordinances in Rankin and Madison counties regulate quantity and quality of stormwater generated within developed areas. The stormwater ordinances in all areas require control of post-construction stormwater such that flow rates during certain sized storms (typically 2-year, 24-hour storm) are less than pre-development rates. Some ordinances also regulate the flow regime of stormwater exiting developed sites (i.e., sheet flow versus concentrated flow). The cities of Flowood, Madison, and Ridgeland have additional ordinances that specify requirements for tree preservation and land grading.

Protective covenants developed by local homeowner associations (HOAs) may also serve as local mechanisms to improve water quality through introducing requirements for maintenance of open space, stormwater management structures, and landscaping. Partnerships formed through HOAs are a proven method to promote green infrastructure practices such as rain barrels, rain gardens, and reduced use of fertilizers and pesticides.

3.2.2 State Programs

Activities to protect drinking water are carried out through a number of programs and partnerships at the state level. These programs can be regulatory or voluntary in nature.

3.2.2.1 Regulatory State Programs

Permitting programs managed by the state of Mississippi are generally specific to point source discharges and require compliance with federal laws, such as the SDWA and CWA. The authority to implement many of these programs has been delegated to the state.

MSDH is responsible for implementation of those components of the SDWA related to the regulation of public water systems in Mississippi. Regulations under SDWA include:

- National Primary and Secondary Drinking Water Regulations (Title 40 Code of Federal Regulations [CFR] Sections 141, 142, 143),
- National Primary Drinking Water Regulations; Long Term 2 Enhanced Surface Water Treatment Rule,
- Stage 2 Disinfectants and Disinfection Byproducts Rule,
- Mississippi Safe Drinking Water Act of 1997, and
- Mississippi Primary Drinking Water Regulations.

MSDH's Office of Health Protection has established regulations governing residential individual onsite waste water disposal systems to protect from improper design and or installation. Certification is required for design, construction, installation, and repair of onsite systems. Improperly installed or maintained septic systems are a source of potential contamination of ground and surface waters. Routine maintenance of any individual onsite waste water disposal unit is the responsibility of the owner and is not regulated by MSDH.

Other state agencies also handle some components of the SDWA. For example, MDEQ has partial primacy over the Underground Injection Control (UIC) Program, and MSOGB has primacy over other issues.

The O.B. Curtis Water Treatment Plant complies with the monitoring and reporting requirements as stipulated by the National Primary Drinking Water Regulations, under the authority of MSDH. A discussion of ongoing monitoring is included in Sections 2.2 and 2.3, and summarized in Appendices E and F. The reporting routine includes monthly operating reports, biennial inspection reports, CCRs, as well as other routine operating reports.

MDEQ administers CWA permitting programs. Permit programs relevant to source water protection include commercial, municipal, and industrial wastewater treatment, MS4,

construction and surface mining sites, and animal growing operations. An inventory of CWA permits within the PPA is included in the 2010 SWA (Appendix A). Descriptions of the permitting programs and an inventory of facilities in the entire SWPA are included in Appendix F (and Figures F.1 and F.2) of the *Comprehensive Watershed Protection and Restoration Plan*.

MDEQ is working with local governments near the Reservoir to reduce stormwater pollution resulting from construction and mining sites. This program, called the Ross Barnett Reservoir Stormwater Compliance Initiative, involves state and local agencies. Both MDEQ and local agencies share responsibility to enforce construction stormwater management regulations. Recent efforts have included increased frequency of inspections and enforcement actions. Local agencies are working closely with developers to ensure that management practices are installed and maintained in accordance with stormwater pollution prevention plans (SWPPPs).

The UST program is administered by MDEQ, although it is a component of RCRA and CERCLA, both of which are federal programs.

There is not currently a state or local program that administers registration of ASTs in Mississippi. Federal requirements for ASTs storing petroleum products are provided in 40 CFR Part 112 and administered by EPA. The WG will investigate a mechanism to develop and maintain an inventory of ASTs located within the PPA as part of the PCS inventory.

2.2.2.2 Voluntary State Programs

There are several state agencies that administer voluntary conservation programs or education programs that are relevant to source water protection. The Mississippi Department of Marine Resources (MDMR) and MDWFP developed the official boating safety course to educate and promote Mississippi boaters. An online boat safety course introduces the legal requirements of boaters, including the proper disposal of sewage and waste.

The Mississippi Soil & Water Conservation Commission (MSWCC) works in conjunction with county conservation districts to administer conservation projects in rural areas and to promote educational opportunities related to conservation. MSWCC was one of several partners in the Mill Creek and Fannegusha Creek Watersheds Nonpoint Source Pollution Projects.

Presently more than 50% of the source water protection area is forested land. Forest lands perform many functions that are vital to maintaining the health of the Reservoir watershed. Forest lands naturally intercept stormwater and filter water through soil and wetland areas to remove pollutants and provide soil and bank stabilization along streams. Riparian forests have been found to be effective filters for nutrients, including nitrogen, phosphorus, calcium, potassium, sulfur, and magnesium (Lowrance et al. 1984). A 2002 study by the Trust for Public Land and American Water Works Association (AWWA) found that for every 10% increase in forest cover in the watershed, the water treatment chemical costs decreased approximately 20%, up to 60% forest cover (Ernst 2004).

Proper management of the forested land within the PPA is vital to maintaining the Reservoir as a source of drinking water. Much of the forest land in the PPA is owned and managed by PRVWSD. PRVWSD has developed a forestry management plan for its forest land. The current plan was developed for the years 2000 through 2010. The forestry management plan includes detailed descriptions of each compartment of forest land. Management practices are prescribed for each compartment in order to maintain healthy forest areas. Timber harvesting is conducted according to the management plan upon approval from the PRVWSD Board of Directors. A new plan for 2011 through 2020 is currently in development.

The Mississippi Forestry Commission (MFC) provides educational material and administers programs to promote proper management of forest land and administers the state Forest Stewardship Program (FSP). This program provides assistance to private landowners of nonindustrial lands to manage natural resources on forest land to improve water quality, air quality, wildlife, and recreational benefits of forest lands. Forest conservation programs that may provide funding for private landowners implementing conservation programs in the Reservoir watershed include the Forest Resource Development Program (FRDP) and Forest Legacy Program (FLP). These programs are described in detail in Appendix M of the *Comprehensive Watershed Protection and Restoration Plan*.

3.2.3 Federal Programs

Federal programs can provide grants and technical resources to improve and restore areas of the watershed that are contributing to drinking water quality problems. The Source Water

Protection WG will make program details available so that the citizens of the Ross Barnett Reservoir understand and have access to these programs. Successful projects will be highlighted through implementation of the *Comprehensive Education and Outreach Plan* to demonstrate the positive impact of cooperative efforts in the watershed.

The August 1996 amendments to the SDWA directed EPA to support the protection of all public drinking water sources. Building on previous wellhead protection programs, EPA is working with states, tribes and communities to develop the Source Water Assessment Program (SWAP). These programs address potential contamination of both surface and subsurface water sources.

EPA's Office of Water has numerous programs that focus on watershed protection under the CWA. The CWA includes programs such as the Nonpoint Source Program, National Estuary Program, the TMDL Program, and the NPDES program. Each of these programs encourages states to develop programs to promote watershed-based protection, and they have elements that support watershed-based planning and implementation. The federal programs are generally implemented at the state level.

The benefits that EPA and other federal programs can provide to state and local source water assessment and protection efforts are potentially very large. These include information, technical and financial resources, and communication networks and enforcement authorities (EPA 2011).

3.2.3.1 Regulatory Federal Programs

The TMDL program is a component of the CWA that regulates waterbodies not attaining surface water quality criteria for their designated use(s). A TMDL report describes the maximum amount of a pollutant (i.e., sediment, nutrients, pathogens, toxics, etc.) that a waterbody can receive and still meet water quality standards. TMDL reports have been completed for several tributaries of the Reservoir. The Reservoir itself, however, is presently supporting its designated uses and is not considered impaired. Currently, there are no TMDL reports for the Reservoir.

Although TMDL reports exist for tributaries of the Reservoir, water quality issues in the tributaries are not considered a significant threat to water quality in the Reservoir. In many cases, the presence of pollutants in these tributaries has not been substantiated through monitoring data

collection. Rather, pollutants are considered potentially present based on anecdotal evidence or biological monitoring. Pollutants present in the upstream waterbodies would likely be attenuated through biological transformation and settling before they reach the Reservoir. Ongoing monitoring conducted by the City of Jackson at the O.B. Curtis Water Treatment Plant confirms that upstream pollutants are not present in treated water in amounts exceeding National Primary Drinking Water Regulations (see Appendix F). A complete list of TMDLs in the Reservoir watershed is included in Appendix G. WRF noted that TMDLs and associated programs are often poorly understood outside of the regulatory circle, so that whatever benefits they may provide to the watershed or the quality of the Reservoir may not be understood locally. The Source Water Protection WG should consider including education and outreach activities specific to the benefits of the TMDLs completed within the watershed.

The Ross Barnett Reservoir is considered a navigable body of water by USACE and is subject to regulations under the Section 10 of the Rivers and Harbor Act of 1889 and Section 404 of the CWA amendments of 1977. Any work on, in, or over water or wetlands requires a Section 10 permit and any deposition of dredged or fill material into waters or wetlands of the United States requires a Section 404 permit, both of which issued by USACE.

PRVWSD maintains navigational channels throughout the Reservoir. The deposition of the dredged material requires an individual permit from USACE. PRVWSD will continue dredging operations under a general permit with USACE and will ensure that any future deposition site for the dredged material will be placed in the least environmentally damaging location.

3.2.3.2 Voluntary Federal Programs

The Natural Resources Conservation Service (NRCS) provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. NRCS administers numerous conservation programs in Mississippi as funding is made available. These programs are listed in Appendix H. Several of these programs are currently funding activities in the Reservoir watershed and are discussed in the *Comprehensive Watershed Protection and Restoration Plan*. One example is the Conservation Reserve Program (CRP). CRP is administered by the Farm Service Agency (FSA), with NRCS providing technical

land eligibility determinations, conservation planning, and practice implementation. The program aims for a reduction of sedimentation in stream and lakes, improved water quality, and enhanced forest and wetland resources. As of March 2010, the acreage enrolled in the CRP in the counties that make up the Ross Barnett Reservoir, with the exception of Noxubee, totals approximately 127,924 acres.

The Environmental Quality Incentives Program (EQIP), managed by NRCS, is also active in the watershed. EQIP provides incentive payments to encourage farmers to adopt land management practices such as nutrient management, manure management, integrated pest management, and wildlife habitat management. Any farmer engaged in livestock or crop production on eligible land may apply for EQIP. The Mississippi Conservation Initiative (MCI) is another cost-share program administered by NRCS. MCI was recently used to assist Rankin County with bank stabilization efforts in Mill Creek.

3.3 Education About and Appreciation of Drinking Water

The *Comprehensive Education and Outreach Plan* focuses on educating the public about the importance of water quality and seeks to involve stakeholders in restoration and protection activities within the watershed. Activities of the *Comprehensive Education and Outreach Plan* are consistent with the educational strategy for source water protection, which includes educating the public about drinking water, where drinking water comes from, how the water is treated, and why and how the Reservoir should be protected. The strategy is also intended to foster an appreciation of the Reservoir as a source of drinking water in addition to the other natural amenities it offers.

The *Comprehensive Education and Outreach Plan* identifies six target audiences: the general public, educators and students, homeowner associations, area civic and recreational organizations, decision-makers, and developers/contractors. Educational goals and objectives have been established for each target audience. Table 3.2 summarizes the objectives that relate specifically to source water protection. The objective numbers included in the table refer to the objective's respective section in the *Comprehensive Education and Outreach Plan* (FTN and the Cirlot Agency 2011).

Table 3.2. Education and outreach objectives for source water protection.

Audience	Objective	Relevance to Source Water Protection
General Public	Plan and conduct WaterFest (Objective 1.1.13).	Builds awareness of the concept of a watershed, that the Ross Barnett Reservoir is primary drinking water source for the City of Jackson, and how to protect and improve the water quality of the Reservoir.
	Develop PSAs and public relations materials (Objective 1.2.1).	Raises awareness of how to reduce nonpoint source pollutants and control trash and invasive species.
	Place storm drain markers in the Reservoir watershed (Objective 1.2.2).	Raises awareness that storm drains carry water and material to streams that flow to the Reservoir.
	Establish a Watershed Team with defined roles and responsibilities of recruited stakeholders and decision makers (Objectives 1.3.1 and 1.3.2).	Increases participation in <i>Rezonate</i> and informs citizens about how to become involved in the Watershed Team.
	Road signs (Objective 1.1.6).	Informs motorists that they are in the Reservoir watershed by the installation of road signs in the watershed.
Educators and Students	Support and implement curriculum, resource kits, follow-up (Objective 2.1.3).	Increases knowledge of nonpoint source pollution and their impact on water quality.
Homeowner Associations	Develop a homeowner recognition program similar to Maine's Lakesmart Program (Objective 3.1.4).	Educates and encourages homeowners to use best management practices when caring for their lawns.
Area Civic and Recreational Organizations	Install pet waste stations at parks and walking trails located near the Reservoir (Objective 4.1.4).	Decreases the chance of pathogen contamination in streams that flow into the Reservoir.
Decision-Makers	Locate and install model locations for rain barrels and rain gardens (Objective 5.3.2).	Raises awareness and acceptance of green infrastructure techniques.
Developers and Contractors	Develop a contractor and inspector training and certification program for the Reservoir watershed (Objective 6.2.1).	Encourages contractors to meet or exceed performance standards for stormwater management during construction.
	Develop enforceable mechanisms for discouraging littering (Objective 6.2.2).	Discourages litter.

Additional educational activities could be implemented at the discretion of the source water work group. Direct notification of homeowners and businesses located in the primary protection area is critical to source water protection. Landowners in this area need to be informed that any pollutant present on their property has the potential to wash into the Reservoir during

rain events. They also need to know how to contact local authorities in the event of a pollutant spill.

3.4 Best Management Practices

BMPs for source water protection can be a device or a management practice that is intended to reduce the threat of pollutants or contaminants reaching the water supply. BMPs include land use management and controls, regulations and permits, and public education. BMPs also include engineered devices such as wet ponds, bioretention areas, vegetated swales, and buffer strips. Development policies such as low-impact development are also considered BMPs.

The following BMPs are recommended for source water protection. Fact sheets describing these practices are included in Appendix N of the *Comprehensive Watershed Protection and Restoration Plan*:

- Incorporate GI practices in retrofitting and future development
- Encourage vegetated areas for discharging generated wash-water onsite, such as at car washes located in the PPA.
- Incorporate constructed wetlands/filters strips for stormwater that is discharged in the PPA.
- Encourage aesthetically pleasing BMPs: wetlands, rain gardens, grassy swales, tree plantings, vegetated buffer strips, within the residential developments that border the Reservoir.
- Incorporate permeable pavement or pavers where appropriate within the PPA.
- Encourage riparian buffer conservation or restoration.
- Install signage at marinas and boat launches for litter prevention and invasive species control (i.e., remove plant materials from boats and trailers to prevent spread of aquatic invasive plants)

BMPs specifically recommended for the PPA are listed below. Fact sheets for these practices are included in Appendix I.

- Preserve and restore vegetated riparian buffer zones along the Reservoir and its tributaries.
- Include secondary containment structures such as oil retaining catch basins, containment berm for above ground storage tanks, or impervious surfaces for tank placement at appropriate PCS locations.
- Install oil/water separators (parking lots/gas stations) at locations in the PPA.
- Provide hazardous (household) waste collection sites.
- Perform routine street sweeping, especially along the road and bridges located within PPA.
- Provide and maintain pet waste receptacles at public boat ramps, parks, and walking trails within the PPA.

3.5 Water Quality Monitoring

The *Water Quality Monitoring Plan* includes goals and recommendations specific to source water protection. The plan includes a recommendation for additional monitoring at the O.B. Curtis Water Treatment Plant.

3.6 Promote Legislation for Source Water Protection

Implementation of the management practices recommended in this plan is voluntary, but essential to ensure a safe and reliable supply of drinking water. The Source Work Protection WG will evaluate the effectiveness of this plan to determine if additional enforceable mechanisms are needed to adequately protect source water. Legislative actions are expected if the WG determines that voluntary programs and incentives are insufficient to protect the Reservoir.

3.7 Emergency Contingency/Notification Plan

The ERP prepared by the City of Jackson satisfies the requirements of Section 1433 of the SDWA, but for security reasons, the ERP is a confidential document and is not available for public release. Additional measures should be encouraged and made public in order to provide additional levels of emergency response in the event of an accident that could compromise the

drinking water supply. The WG will consider developing ways to promote a heightened awareness and response from the public and emergency personnel in the event of an accident or hazardous spill that could introduce contaminants in to the Reservoir. Activities for consideration are described below:

- Prepare and distribute an Education and Emergency Procedure kit to the businesses located within the PPA that will include a notification tree in the event of an accident on/near their property.
- Develop signage for bridges to alert that it is a link to source water and assist in alerting first responders.
- Develop a Spill Response Plan that will lay out the procedures for managing a significant spill of contaminants in the Reservoir.
- Obtain grants to construct extra protection for the Reservoir (i.e., improved guard rails and spill containment equipment).

4.0 PROGRAM IMPLEMENTATION

Implementation of the *Source Water Protection Plan* will require coordination of regulatory and volunteer programs and responding to the challenges that may arise. The program implementation will identify barriers that exist preventing the success of the programs identified/proposed in the action plan. Addressing these barriers through program modification and assessment of the action plan will make it possible to meet the goals established for the *Source Water Protection Plan*.

Rezonate will ultimately drive the successful implementation of the programs to improve the water quality of the Reservoir, thereby protecting the source water. The *Comprehensive Watershed Protection and Restoration Plan* includes general recommendations for management measures for the Reservoir watershed and specific recommendations for measures in targeted subwatersheds. Two of the targeted subwatersheds are located within or near the primary protection area: the Mill-Pelahatchie Creek subwatershed and the Riley-Pelahatchie Creek subwatersheds. Recommendations for these subwatersheds are listed below and discussed in detail in the *Comprehensive Watershed Protection and Restoration Plan*.

4.1 Recommendations for Targeted Subwatersheds

4.1.1 Mill-Pelahatchie Creek Subwatershed

- Incorporate green infrastructure stormwater management measures in new construction and retrofits;
- Coordinate with Rankin County officials in matters related to stormwater management in developed areas;
- Improve stormwater controls for construction on individual lots that are within a larger common plan of development;
- Stabilize disturbed soils on construction sites and surface mines by quickly replanting with native grasses and other vegetation;
- Identify and restore shoreline and streamside buffer zones and banks in needed areas, and repair eroding gullies; and
- Leave undisturbed vegetated areas (green space) and shoreline/streamside buffer zones within new developments.

- Develop an incentive program to encourage use of green infrastructure management practices.

4.1.2 Riley-Pelahatchie Creek Subwatershed

- Address compliance issues at the Reservoir East publicly owned treatment works (POTW) and encourage all new homes and buildings to connect to a central sewer system (most soils are not suitable for septic tanks),
- Incorporate green infrastructure stormwater management measures in new construction,
- Preserve streamside buffers and green space as new development expands to this area,
- Stabilize disturbed soils on construction and surface mining sites by quickly replanting with native grasses and other vegetation,
- Implement pasture management measures on all areas with willing landowners, and
- Encourage participation in forestry stewardship programs.

4.2 Evaluation and Revision

The Source Water Protection WG will establish a reasonable schedule for periodic reviews and subsequent updates of the *Source Water Protection Plan*. A small team will be established to periodically review the *Source Water Protection Plan* and convene the WG and responsible agencies when an update in the *Source Water Protection Plan* is deemed necessary.

The source water protection programs include performance measures. The Source Water Protection WG review team will perform the scheduled reviews to evaluate the program success as prescribed in the program implementation plan. After their review, actions may be recommended to make adjustments, and/or updates to achieve success.

The Source Water Protection WG will convene yearly to evaluate the relevance and effectiveness of the vision statement, goals, and strategies for the *Source Water Protection Plan*. Revisions will be addressed accordingly.

The Source Water Protection WG, in coordination with MDEQ's Basin Management Team for the Pearl River Basin, will publish a yearly review of the Source Water Protection

Program vision, goals, and strategies. The yearly review will be based on a set of performance measures established by the group to review and report on progress, successes and barriers.

4.3 Performance Measures

The following list includes the proposed list of performance measures for the *Source Water Protection Plan*. This list may be modified and appended based on recommendations and future needs of the WG.

- MDEQ's Basin Management Branch will initiate a routine update of this PCS Inventory once every 5 years.
- The updated (2010) SWA will be made available to the public upon its completion.
- Prepare and distribute an annual outreach/education newsletter for the identified PCS businesses located in the PPA that identifies the Reservoir as the drinking water source for the City of Jackson. The newsletter would include emergency contact information in the event of a spill and promote BMPs specific to minimizing the risk of the release of pollutants.
- The number of and/or areas where recommended management measures are implemented. (Note: The *Comprehensive Watershed Protection and Restoration Plan* will include provisions to track progress on implementation of specific management practices.)
- Public complaints about the Reservoir related to water quality for recreational use and drinking water.
- Number of people participating in outreach/educational activities.
- Updates to local ordinances zoning regulations, and land-use policies.
- Monitoring data results and annual reports required by the CWA and the SDWA.
- Progress reports related to implementation of the *Comprehensive Watershed Protection and Restoration Plan*, the *Comprehensive Education and Outreach Plan*, and the *Water Quality Monitoring Plan*.
- Progress on each action item listed in Table 3.1.

4.4 Funding

The successful implementation of any program requires funding for the needed staff and resources. The primary source of funding for this program will be MDEQ and PRVWSD

operating budgets for staff. Additional funding opportunities may be available through grants and nonprofit groups.

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APPENDIX A

Source Water Assessment, 2010

SOURCE WATER ASSESSMENT (2010)

The Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 104-182) mandated that states implement Source Water Assessment Programs (SWAPs). The Mississippi State Department of Health (MSDH) has primacy for the Public Water Supply Supervision Program and is recognized as the lead agency having program oversight for the state's SWAP. In 1997, MSDH asked the Mississippi Department of Environmental Quality (MDEQ) to help with the development and implementation of the SWAP.

The two agencies understood that the 1996 SDWA amendments placed a strong emphasis on Congress' intent to incorporate public awareness and involvement in the state's SWAP. As a result, a public advisory committee was formed in 1998 to assist the state with SWAP development by providing a public perspective. The SWAP Advisory Committee was made up of a broad range of groups who are identified in the state's SWAP document. It was intended that the SWAP Advisory Committee would function even after the US Environmental Protection Agency (EPA) approved the state's SWAP in November 1999. The SWAP Advisory Committee was expected to meet once every 1 to 2 years to review the SWAP's status and implementation with regard to program goals and timelines. In addition to creating the advisory committee, public hearings were used to encourage public participation in the SWAP decision-making process. The state's commitment to include the public was demonstrated by holding three public hearings to present the proposed plan and encourage public review and comment. MDEQ also provided key stakeholders with a copy of the plan, and made the plan available to any citizen requesting the document.

While the SWAP Advisory Committee is no longer in place, newer programs present opportunities for increased public participation in ways that can strengthen the SWAP. One of these programs is the Statewide Basin Management Approach. The Basin Management Approach includes watershed-based teams that work through collaborative watershed planning, education, protection, and restoration initiatives to protect the State's water resources. Each team includes state and federal agencies and local organizations. Together, basin team members help assess water quality, determine causes and sources of problems, and prioritize watersheds for water quality restoration and protection activities. The Basin Management Approach encourages

public participation in the teams and with the programs and activities organized in support of the respective basin.

The 1996 SDWA amendments include the requirement that a source water assessment (SWA) be completed for each public water system. The initial SWA for the Ross Barnett Reservoir was completed in 2004 by the Tennessee Valley Authority (TVA) in support of the state's SWAP. This document is titled *City of Jackson – Pearl Intake, Jackson, Mississippi, Source Water Assessment* (TVA 2004a).

The 2004 SWA contains valuable information about the Pearl River watershed as it relates to the Ross Barnett Reservoir Source Water Protection Area (SWPA). The SWA provides an overview of river basin characteristics, including hydrology, flood potential, and basin uses, as well as information on water quality, physiography, land use and soils. The information has been updated and expanded upon in this appendix and in the *Source Water Protection Plan* and the *Comprehensive Watershed Protection and Restoration Plan for the Ross Barnett Reservoir Watershed, Mississippi*.

This SWA will update the four elements of a SWA required by the SDWA amendments and EPA, and as required in the Mississippi SWAP Plan (MDEQ 1999). The four required elements are:

1. Delineation of the SWPA;
2. Potential Contaminant Source (PCS) inventory;
3. Susceptibility analysis; and
4. Making assessments available to the public (MDEQ 1999).

The SWAP guidance prepared by EPA identified additional program elements that should be addressed by the State, namely, public participation and the development of program deadlines. These additional elements were adopted as required program elements by MDEQ and placed in the SWAP Plan (1999).

The Source Water Protection Work Group of the Ross Barnett Reservoir Initiative, known as *Rezonate*, reviewed, provided input, and concurred with this updated SWA.

Delineation of Source Water Protection Areas (SWPA)

It is important that this updated SWA, as well as the *Source Water Protection Plan*, clearly define the SWPA in a manner that is easily understood and applied. According to the state's SWAP Plan (MDEQ 1999), the Ross Barnett Reservoir SWPA is the entire watershed area upstream of the intake that falls within the hydrologic boundaries of the drainage area as determined using US Geological Survey 8-digit hydrologic unit code (HUC) boundaries. The SWPA is then subdivided into more manageable units defined as the primary protection area (PPA), the secondary protection area, and protection strips (MDEQ 1999). The PPA, as defined by MDEQ, includes the entire surface area of the Reservoir and a 24-hour time of-travel distance (at flood stage) from the headwaters of all major streams and tributaries entering the Reservoir (MDEQ 1999).

The 2004 SWA (TVA 2004a) delineates a "critical area" of the entire SWPA rather than establish a PPA, as referred to by MDEQ. The 2004 SWA defined the "critical area" of the SWPA as a zone extending 0.25 mile downstream of the O.B. Curtis Water Treatment Plant intake to 15 miles upstream of the O.B. Curtis Water Treatment Plant intake, and extending 1,000 ft outward from the shoreline of the Reservoir and along both sides of major tributaries for a distance of 1 mile up such tributaries from their confluence with the Reservoir. To delineate the "critical area," TVA performed a contaminant travel-time analysis on the Ross Barnett Reservoir using a series of inflows/outflows representing low- and high-flow scenarios (TVA 2004b and TVA 2004c).

As part of this updated SWA, the 24-hour time-of-travel zone was developed using the data from the contaminant travel-time analysis prepared by TVA, but incorporating flows representative of flood stage on the Reservoir (elevation 299 ft mean sea level) and for the Pearl River and Pelahatchie Creek. The updated 24-hour time-of-travel zone is shown on Figure A.1.

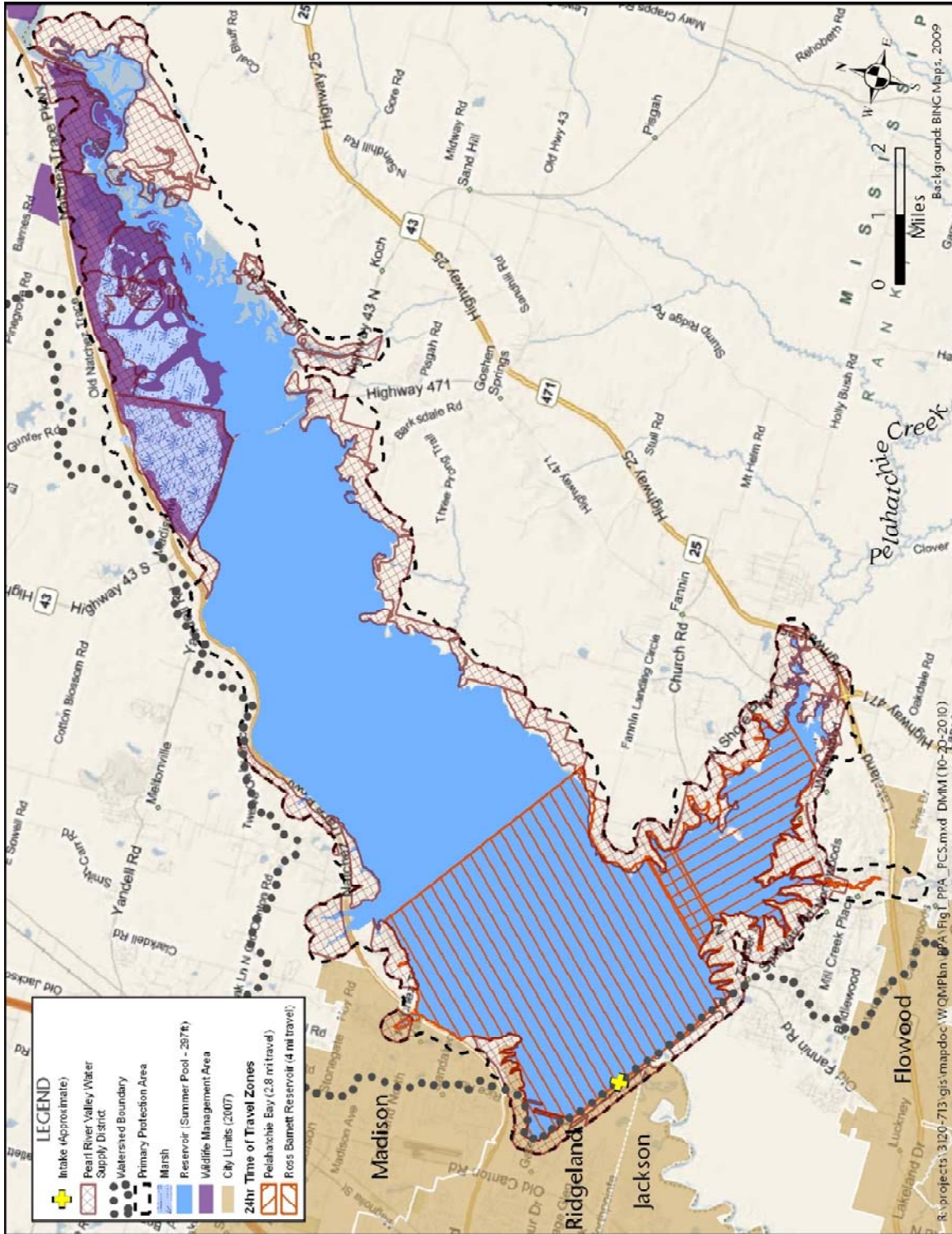


Figure A.1. 24-hr Time of Travel in Primary Protection Area.

In summary, the updated delineation of the PPA of the SWPA incorporates the TVA 24-hour time-of-travel analysis, updated to account for flood stage conditions, from the intake upstream into the Reservoir and upstream into Pelahatchie Bay, and incorporates the additional “protection areas” designations included in the Mississippi SWAP Plan (1999). It is recommended by the Source Water Protection Work Group that the updated plan read as follows:

The Primary Protection Area includes the surface area of the Reservoir, when the Reservoir is at flood stage, and the 24-hour travel zone in the Reservoir from the intake upstream along the Pearl River channel and upstream along the Pelahatchie Creek channel through the embayment, using flows representative of flood stage. An additional protection strip that is a 1,000-ft buffer around the entire Reservoir at flood stage (299 ft MSL) is incorporated as part of the Primary Protection Area.

The Secondary Protection Area is the remainder of the Source Water Protection Area that is upstream of the Primary Protection Area. This includes all of the subwatersheds within the 8-digit HUC, beyond the boundary of the Primary Protection Area. A 250-ft protection strip is included along the water bodies in the Secondary Protection Area as measured from the top of left and right banks of each water body.

The PPA is delineated on Figure A.1. The entire SWPA is delineated on Figure A.2.

Potential Contaminant Source Inventory

The initial Potential Contaminant Source (PCS) inventory was developed for the 2004 SWA by TVA. For this current SWA, the PCS inventory includes all of the identified potential contaminant point sources located in the updated Primary Protection Area. The inventory is a geospatial point file with a corresponding database populated with the descriptive attributes specific to each individual source identified. As of this SWA update, the inventory includes 127 sites. The location and PCS type are provided on Figure A.3. A condensed version of the database table is found in Table A.1. The inventory includes the potential contaminant sources identified in the 2004 SWA that are located in the Primary Protection Area. The PCS inventory also includes state and federally permitted point sources, underground storage tank (UST) and above ground storage tank (AST) sites, transportation features, such as bridges and boat ramps, gas wells and pipelines, unsewered subdivisions, and other potential point sources.

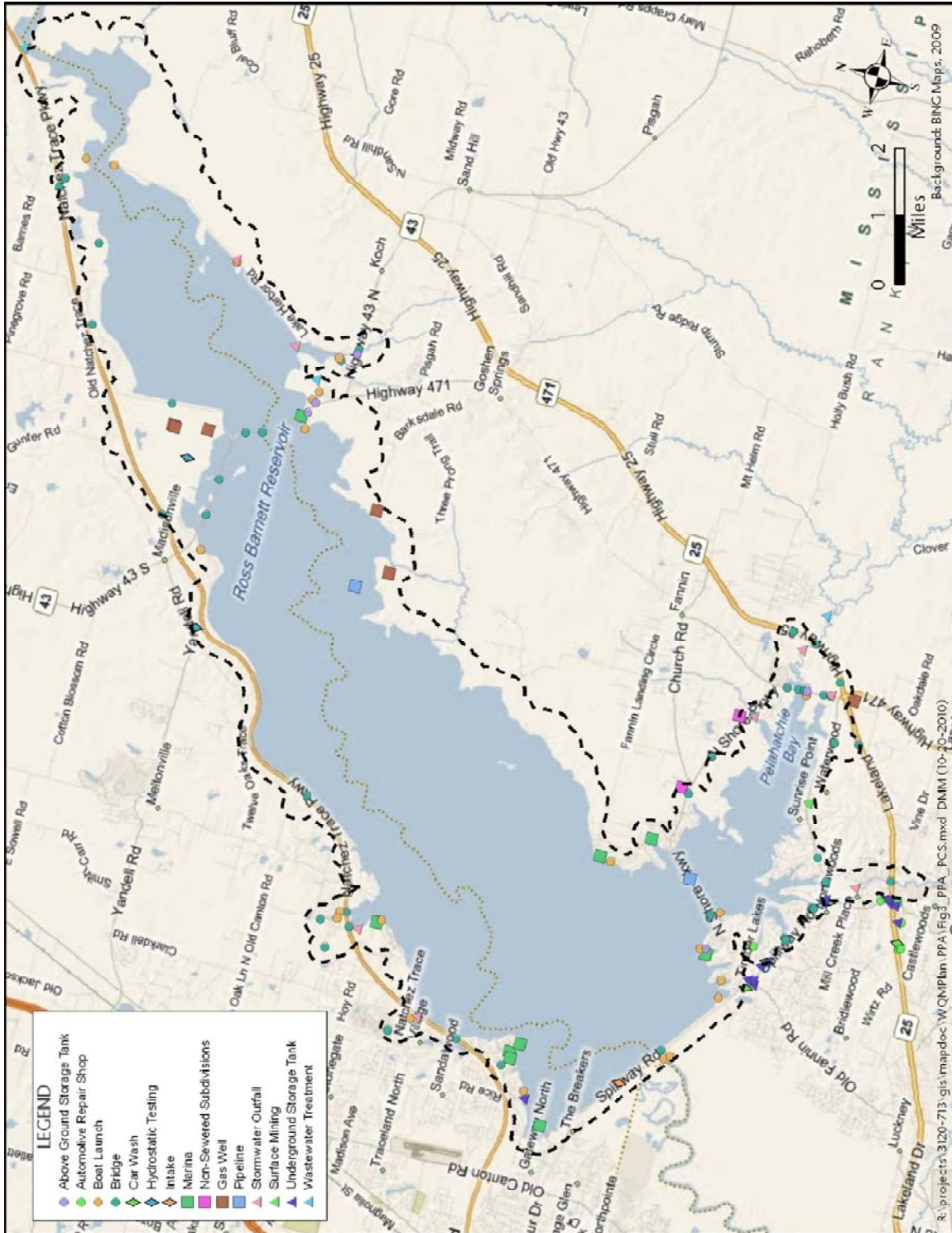


Figure A.3. PPA and PCS inventory.

Table A.1. PPA PCS inventory.

PCS ID	SITE NAME	PCS TYPE (LEGEND)
AST_115	Pelahatchie Bay Trading Post	Above Ground Storage Tank
AST_133	Chevron (Cefco #527)	Above Ground Storage Tank
AST_203	Sportsman's Marina	Above Ground Storage Tank
AST_322	Safe Harbor Marina	Above Ground Storage Tank
AST_401	Tommy's Trading Post	Above Ground Storage Tank
AST_421	Lake Harbor Trading Post	Above Ground Storage Tank
AUTO_128	Versatile Oil Change and Quick Lube LLC	Automotive Repair Shop
AUTO_146	Penzoil Oil Change Center	Automotive Repair Shop
AUTO_147	Valvoline Oil Change	Automotive Repair Shop
AUTO_152	Meinike Car Care Center	Automotive Repair Shop
AUTO_154	Upton Tire Pros and Oil Change	Automotive Repair Shop
AUTO_155	WalMart Quick Lube	Automotive Repair Shop
BOAT_117	Pelahatchie Shore Park Landing	Boat Launch
BOAT_119	Pelahatchie Bay	Boat Launch
BOAT_204	Madison Landing	Boat Launch
BOAT_206	Fannin Landing	Boat Launch
BOAT_207	Timber Lake Boat Ramp	Boat Launch
BOAT_208	Rankin Boat Landing	Boat Launch
BOAT_209	Spillway Boat Ramp West	Boat Launch
BOAT_217	Downstream of Spillway East	Boat Launch
BOAT_219	Sportsman's Marina - Boat Launch	Boat Launch
BOAT_225	Northbay Boat Launch	Boat Launch
BOAT_308	Lost Rabbit Boat Ramp	Boat Launch
BOAT_312	Safe Harbor	Boat Launch
BOAT_314	Brown's Landing	Boat Launch
BOAT_319	Twin Harbors East Boat Launch	Boat Launch
BOAT_320	Twin Harbors West Boat Launch	Boat Launch
BOAT_402	Goshen Springs Boat Launch	Boat Launch
BOAT_403	Boat Launch at Hwy 43 and Tommy's Trading Post	Boat Launch
BOAT_404	Boat Launch	Boat Launch
BOAT_405	Walk-in Site Boat Launch	Boat Launch
BOAT_406	PRVWSD Boat Launch	Boat Launch
BOAT_420	Cane Creek	Boat Launch
BRIDGE_101	Northshore Parkway	Bridge
BRIDGE_102	Northshore Parkway	Bridge
BRIDGE_103	Highway 471	Bridge
BRIDGE_104	Highway 471	Bridge

Table A.1. PPA PCS inventory (continued).

PCS ID	SITE NAME	PCS TYPE (LEGEND)
BRIDGE_105	Highway 471	Bridge
BRIDGE_106	Highway 471	Bridge
BRIDGE_107	Highway 471	Bridge
BRIDGE_108	Highway 25	Bridge
BRIDGE_109	Spillway Road - Trib to Pelahatchie Ck	Bridge
BRIDGE_110	Spillway Road - Pelahatchie Bay	Bridge
BRIDGE_111	Spillway Road over Mill Creek	Bridge
BRIDGE_112	Scenic Drive - Pelahatchie Bay	Bridge
BRIDGE_113	Scenic Drive - Pelahatchie Bay	Bridge
BRIDGE_114	Northshore Parkway	Bridge
BRIDGE_122	Highway 25	Bridge
BRIDGE_123	HWY 25 at Mill Creek	Bridge
BRIDGE_124	Northshore Pkwy at Trib to Pelahatchie Bay	Bridge
BRIDGE_125	HWY 25 at Trib to Pelahatchie Ck	Bridge
BRIDGE_126	Highway 25 Southbound	Bridge
BRIDGE_150	Spillway Road - Pelahatchie Bay	Bridge
BRIDGE_151	Spillway Road - Pelahatchie Bay	Bridge
BRIDGE_201	North Bay Drive Over Hearn Creek	Bridge
BRIDGE_202	Spillway Road - Spillway	Bridge
BRIDGE_212	Natchez Trace at Hearn Creek	Bridge
BRIDGE_213	Natchez Trace South of Hearn Creek	Bridge
BRIDGE_214	Post Rd at Reservoir	Bridge
BRIDGE_301	Old Rice Road over Haley Creek	Bridge
BRIDGE_302	Old Rice Road	Bridge
BRIDGE_303	Highway 43	Bridge
BRIDGE_304	Highway 43	Bridge
BRIDGE_305	Highway 43	Bridge
BRIDGE_306	Highway 43	Bridge
BRIDGE_309	Natchez Trace Parkway	Bridge
BRIDGE_310	Natchez Trace Parkway	Bridge
BRIDGE_311	Natchez Trace Parkway	Bridge
BRIDGE_407	Natchez Trace at Trib to Rez	Bridge
BRIDGE_408	Pipeline Road in WMA	Bridge
BRIDGE_409	Pipeline Road in WMA	Bridge
BRIDGE_410	Pipeline Road in WMA	Bridge
BRIDGE_411	Harbor Lane nr Cane Creek	Bridge

Table A.1. PPA PCS inventory (continued).

PCS ID	SITE NAME	PCS TYPE (LEGEND)
BRIDGE_412	Natchez Trace Pkwy to Upper Rez	Bridge
BRIDGE_413	Pipeline Road to Upper Rez	Bridge
BRIDGE_414	Highway 43	Bridge
CWASH_121	Macs Gas Inc, Macs Gas Number 23	Car Wash
CWASH_127	Super Stop Car Wash	Car Wash
CWASH_129	BP Oil Site Number 24774	Car Wash
CWASH_153	5 Minute Car Wash	Car Wash
CWASH_224	Checkered Flag Car Wash	Car Wash
GWELL_130	Natural Gas Production	Gas Well
GWELL_316	Carbon Dioxide Production	Gas Well
GWELL_317	Carbon Dioxide Production	Gas Well
GWELL_417	Carbon Dioxide Production	Gas Well
GWELL_418	Carbon Dioxide Production	Gas Well
GWELL_419	Carbon Dioxide Production	Gas Well
HYDT_315	CO2 Gas Pipeline	Hydrostatic Testing
HYDT_416	PRVA 13-10 to Trace Dehy	Hydrostatic Testing
INTAK_210	OB Curtis Intake	Intake
MARN_205	Jackson Yacht Club	Marina
MARN_215	Jackson Yacht Club	Marina
MARN_216	Main Harbor Marina	Marina
MARN_218	Sportsman's Marina	Marina
MARN_220	Bridgepoint Marina	Marina
MARN_221	Edgewater Cove	Marina
MARN_223	Arbor Landing	Marina
MARN_313	Safe Harbor Marina	Marina
MARN_321	Lost Rabbit Marina	Marina
NSSUB_131	The Fountains	Non-Sewered Subdivisions
NSSUB_132	Countryside Estates	Non-Sewered Subdivisions
PIPE_116	Koch Gateway Pipeline Company	Pipeline
PIPE_307	Pennzoil Producing Company	Pipeline
SMINE_139	PRVWSD sand pit	Surface Mining
STORM_134	Stormwater Outfall Pelahatchie Creek	Stormwater Outfall
STORM_135	Stormwater Outfall Mill Creek	Stormwater Outfall
STORM_136	Stormwater Outfall Spring Branch	Stormwater Outfall
STORM_137	Stormwater Outfall Plummer Slough	Stormwater Outfall
STORM_222	Stormwater Outfall Hearn Creek	Stormwater Outfall

Table A.1. PPA PCS inventory (continued).

PCS ID	SITE NAME	PCS TYPE (LEGEND)
STORM_318	Stormwater Outfall Haley Creek	Stormwater Outfall
STORM_422	Stormwater Outfall Cane Creek	Stormwater Outfall
STORM_423	Stormwater Outfall Spring Lake Slough	Stormwater Outfall
UST_118	Pantry Number 3433	Underground Storage Tank
UST_120	Chevron (Cefco #527)	Underground Storage Tank
UST_138	Pump & Save Number 1381	Underground Storage Tank
UST_141	Macs Gas Inc, Macs Gas Number 23	Underground Storage Tank
UST_142	Exxon Gas Station	Underground Storage Tank
UST_143	Chevron Gas Station + Car Wash	Underground Storage Tank
UST_144	Polk's Discount Drug - Texaco Gas Station	Underground Storage Tank
UST_145	Kroger Gas Station	Underground Storage Tank
UST_148	Texaco Gas Station	Underground Storage Tank
UST_149	BP Gas Station (Store No. 1032)	Underground Storage Tank
UST_156	Chevron (CEFCO#532)	Underground Storage Tank
UST_211	Harbor Walk Marina	Underground Storage Tank
WWTP_140	Reservoir East Subdivision	Wastewater Treatment
WWTP_415	River Bend Comfort Station	Wastewater Treatment
WWTP_424	PRVWSD, Lake Harbor	Wastewater Treatment

Multiple data sources were used in the compilation of the updated PCS inventory, including the 2004 SWA (TVA 2004a), MDEQ’s electronic environmental Site Information System (enSite), Mississippi Automated Resource Information System (MARIS), Mississippi State Oil and Gas Board (MSOGB), EPA, MSDH, Pearl River Valley Water Supply District, and local residents.

The updated PCS inventory resulted in the removal of the 11 previously listed PCS sites shown in Table A.2. The updated PCS inventory includes 21 PCS sites that are located outside the PPA. Some of these sites were identified in the 2004 SWA and some were constructed after 2004. These PCS sites were included if they were no greater than approximately 1,000 ft from the boundary of the PPA, were located in an area of the watershed that has and continues to experience rapid commercial development, and identified by stakeholders in the watershed as sites of concern. These PCS sites are identified in Table A.3.

Table A.2. 2004 SWA sites removed from the PPA PCS inventory.

TVA Site No.	Facility Name	Reason for Removal
1	PRVWSD/Twin Harbor POTW	No longer in operation
4	MMC Materials Incorporated	Outside PPA ~ 3,200 ft
5	Noranco Utilities Incorporated	Outside PPA ~3,900 ft
9	Old Canton Road bridge	Outside PPA ~4,400 ft
43	Pantry #3423	Outside PPA – Outside Watershed
44	Q & M Shell	Outside PPA – Outside Watershed
45	BP Shop #9	Outside PPA – Outside Watershed
46	Dynamic Minute Mart (FFP #312)	Outside PPA – Outside Watershed
47	Rice Road Chevron	Outside PPA – Outside Watershed
52	Pump & Save #1368	UST Removed
67	Noranco Utilities Inc./Mill Creek Subdivision	Facility Closed

Table A.3. PCS sites included in the PCS inventory outside the PPA.

PCS ID No.	Facility Name
AST-133	Chevron (CEFCO #527)
AUTO-146	Penzoil Oil Change
AUTO-147	Valvoline Oil Change
AUTO-152	Meinike Car Care Center
AUTO-154	Upton Tire Pros and Oil Change
AUTO-155	WalMart Quick Lube
CWASH-127	Super Stop Car Wash
CWASH-129	BP Oil Site Number 24774
CWASH-224	Checkered Flag Car Wash
CWASH-153	5 Minute Car Wash
GWELL-130	Natural Gas Production
UST-120	Chevron (CEFCO #527)
UST-138	Pump & Save Number 1381
UST-142	Exxon Gas Station
UST-143	Chevron Gas Station + Car Wash
UST-144	Polk's Discount Drug – Texaco Gas Station
UST-145	Kroger Gas Station
UST-148	Texaco Gas Station
UST-149	BP Gas Station (Store No. 1032)
UST-156	Chevron (CEFCO #532)
WWTP-140	Reservoir East Subdivision

A total of eight gas wells were identified within the PPA through the MSOGB database and are summarized in Table A.4. Two of the identified gas wells were removed from the PCS inventory upon receipt of MSOGB's Form 7 – Plugging Record. The well records obtained are included in Appendix J of the *Source Water Protection Plan*.

Table A.4. PPA gas well status (per MSOGB database, 2010).

PCS ID No.	Site Name – API Well No.	Status
GWELL_417	Carbon Dioxide Production API # 2308920130	CO2EX – Expired Permit
GWELL_316	Carbon Dioxide Production API # 2312120177	CO2PR - Producing
GWELL_317	Carbon Dioxide Production API # 2312120182	CO2PR - Producing
GWELL_130	Natural Gas Production API # 2308920141	GASDG - Producing
GWELL_418	Carbon Dioxide Production API # 2308920129	CO2PR - Producing
GWELL_419	Carbon Dioxide Production API # 2308920133	CO2CPL - Completed
N/A	Dry Hole API # 2312100040	DHPA – Dry Hole Plugged and Abandoned (Form 7 Filed)
N/A	Dry Hole API # 2312100032	DHPA – Dry Hole Plugged and Abandoned (Form 7 Filed)

The Clean Water Act requires the control of wastewater discharges to surface waters under the National Pollutant Discharge Elimination System (NPDES) program. MDEQ has the delegated authority to administer the NPDES program in Mississippi. The Mississippi Commission on Environmental Quality (MCEQ) oversees MDEQ’s administration of the NPDES program on the state level, while EPA provides oversight at the federal level.

Under delegated authority, MDEQ issues NPDES permits for several types of wastewater discharges including treated domestic and industrial wastewater and stormwater. There are currently 3 facilities permitted to discharge treated wastewater within the PPA. These facilities are Reservoir East subdivision, Natchez Trace Parkway River Bend Comfort Station, and PRVWSD, Lake Harbor. Each facility is issued “Effluent Limitations and Monitoring Requirements” as part of their official permit. Table A.5 is a summary of the permit limits issued for the three NPDES permits located with the PPA. The Lake Harbor facility is currently required to meet Phase I permit limits for BOD5 and is required to develop a schedule for upgrades required to meet Phase II limits by December 2011. The permits are available to the public through MDEQ’s enSearch Online website or by contacting MDEQ.

Table A.5. Wastewater permit limits.

Facility Name	Permit No.	Permit Limits			
		Flow (MGD)	BOD5, Daily Average (mg/L)	TSS (mg/L)	Fecal Coliform Bacteria, Avg/Max (cfu/100 mL)
PRVWSD Lake Harbor	MS0035327	0.25	30 (Phase I) 10 (Phase II)	30	200/400 colonies
Reservoir East Subdivision	MS0035327	0.175	30	60	200/400 colonies
River Bend Comfort Station	MS0025003	0.002	30	30	200/400 colonies

The potential contaminant sources included in the PPA inventory could pose an immediate threat to public safety in the event of a spill. The operator(s) at the O.B. Curtis intake should be notified immediately when there is an incident at a PCS site since the source water is under an immediate threat.

Additional threats to the quality of the source water in the Reservoir lie beyond the PPA in the secondary protection area. These threats include the same sources as identified in the inventory as well as others, such as septic systems, agricultural practices, lawn maintenance, forestry practices, underground and above ground storage tanks, illegal dumping, and other point and nonpoint sources of pollution. Contaminants introduced in areas beyond the PPA will incur long travel distances which should allow for the occurrence of volatilization, dilution, and attenuation of concentrated constituents (MDEQ 1999).

The updated land use for the PPA, which includes approximately 42,971 acres, is based on the USDA NASS Cropland Data Layer (CDL) from 2008. The land use in the PPA is included on Figure A.4 and is distributed as shown in Table A.6. Additional land use classifications for the SWPA are discussed in the *Source Water Protection Plan* and the *Comprehensive Watershed Protection and Restoration Plan*.

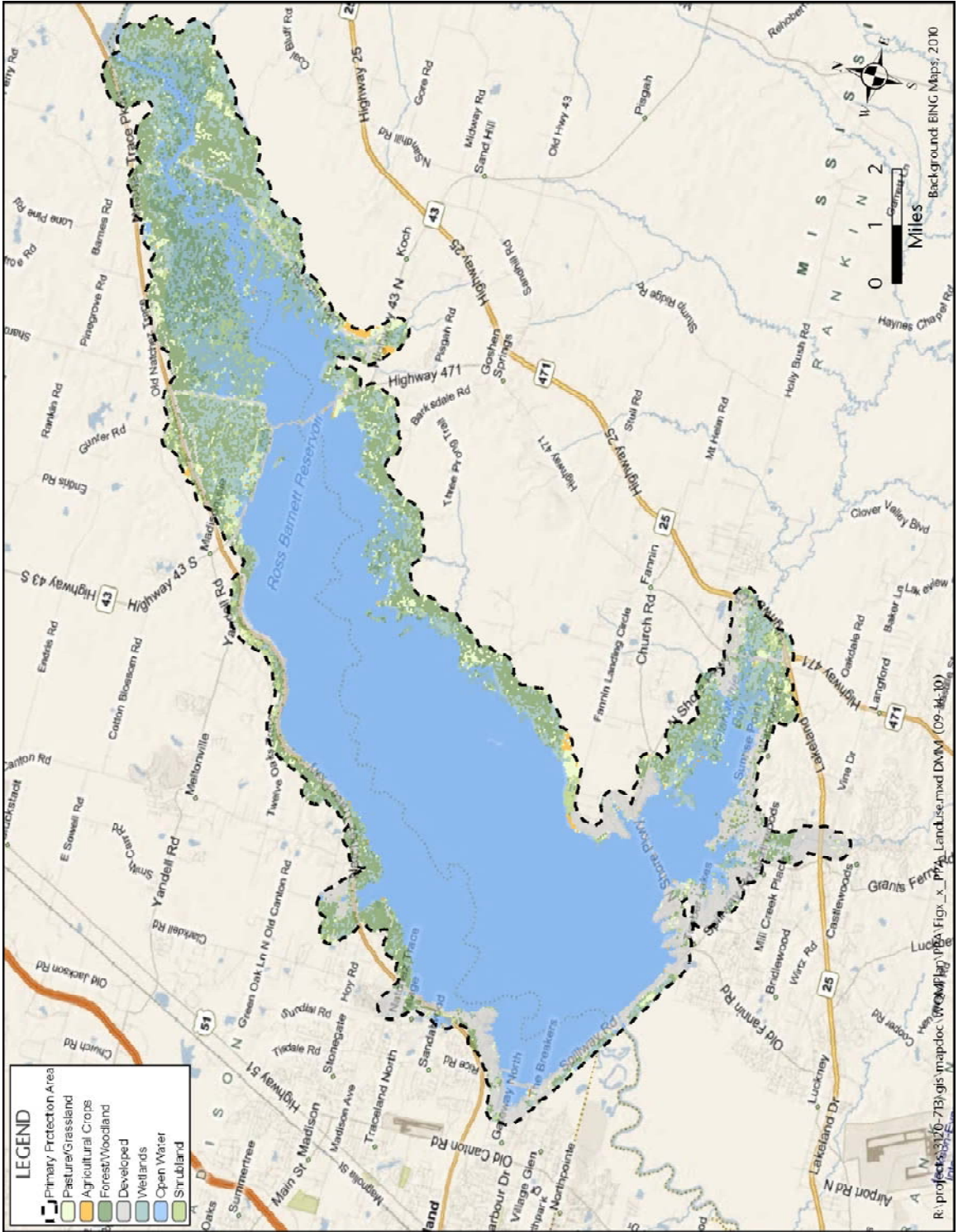


Figure A.4. Landuse (2008) within the PPA.

Table A.6. Land use in the PPA.

Land Use*	Percentage of PPA
Open Water	56.6%
Forest/Woodland	14.5%
Wetland	13.0%
Developed	9.0%
Shrubland	3.6%
Pasture/Grassland	2.9%
Agriculture	0.3%

* USDA NASS Cropland Data Layer (CDL) 2008

The land use within the “critical area” of the SWPA defined in the 2004 SWA, which includes approximately 34,034 acres, is based on 2002 Land Use Coverage (TVA 2004) and is distributed as shown in Table A.7. The land use classifications between 2002 and 2008 have changed slightly; however, a generalized comparison of the land use indicates modest increases have occurred in the forested and developed areas with decreases in agriculture and the areas designated as open water/wetland areas.

Table A.7. Land use in the critical area of the SWPA (TVA 2004).

Land Use*	Percentage of “critical area”
Open Water	72%
Forest/Woodland	10%
Wetland	9%
Developed	7%
Shrubland	N/A
Right of Way	1%
Cropland/Pasture	1%

* TVA 2004; Land Use Coverage 2002

Susceptibility Analysis

During the development of the SWAP Plan, the state elected to adopt the susceptibility analysis methodology that focuses on the elements that individually or collectively determine the ability of a public water supply to resist becoming contaminated from the inventoried PCSs (MDEQ 1999). The methodology uses three susceptibility rankings: (1) higher, (2) moderate,

and (3) lower. These rankings are not intended to indicate that a water source is unsafe if it has a “higher” ranking, or that it is not subject to contamination with a “lower” ranking. Rather, the susceptibility rankings are intended to assist the State in determining which water systems are more susceptible to contamination. This allows the State to focus its limited resources on the appropriate areas where PCSs may be of concern.

The susceptibility criteria and the determination of susceptibility flow chart are included as extracted from the MDEQ SWAP Plan, “Table 5.2: Criteria for Determination of PWS Surface Water Intake Susceptibility” (Figure A.5), and “Figure 5-2: Determination of PWS Surface Water Intake Susceptibility” (Figure A.6) (MDEQ 1999). The initial susceptibility ranking for the Ross Barnett Reservoir was higher due to the presence of major transportation corridors and potential contaminant sources within the PPA, and that ranking remains unchanged.

Public Notification Assessment

In 2004 MDEQ provided the SWA for the Ross Barnett Reservoir to the City of Jackson. The City was responsible for notifying its customers that a SWA report was available for review upon request. Additionally, EPA required that the annual Consumer Confidence Report (CCR) prepared by the City for its water system reference the SWA report and provide a brief summary of the assessment’s findings (MDEQ 2009).

A review of the City of Jackson’s website confirms that their Annual Drinking Water Quality Report includes the following statement: “The Mississippi Department of Environmental Quality has completed their SWA report which is available for review by appointment at the Water / Sewer Utilities Division Office, 200 S. President Street, Room 405, between the hours of 8:00 AM and 5:00 PM Monday through Friday. Call 601-960-2090 for appointment” (<http://www.jacksonms.gov/downloads/2009ccr.pdf>). These same procedures will be followed for this and subsequent official SWA updates.

Table 5-2 Criteria for Determination of PWS Surface Water Intake Susceptibility	
1.	MSDH Detects -- Concentrations of detected contaminants in raw water samples ($\geq 50\%$ of MCL or $< 50\%$ of MCL).
2.	Intake in Stream -- Is the PWS intake located in a stream (i.e., creek, river, etc.) versus a reservoir or lake?
3.	303(d) List -- Is the water body included on the Clean Water Act 303(d) list of impaired waters in the state?
4.	Transportation Corridor -- Is the water body used for barge trafficking and/or are major highways, pipelines, railroads located within the delineated SWPA?
5.	PCSs in Primary Protection Areas -- Are significant PCSs located within the 1,000 foot buffer zone for the area included in the Primary Protection Area (24-hour time of travel)?
6.	PCS Concerns -- Were material storage and/or operating concerns (i.e., poor management practices) found to exist at inventoried PCS sites?
7.	Non-Point Pollution Sources -- Do non-point sources of pollution (e.g., agricultural and silvacultural activities) exist within the 250 foot buffer zone in the Secondary Protection Area?

The same **Criterion #1** is used to determine the susceptibility for both ground water and surface water PWSs. **Criteria #5 and #6** in Table 5-2 are similar to the ground water

Figure A.5. "Table 5.2: Criteria for Determination of PWS Surface Water Intake Susceptibility," as extracted from the MDEQ SWAP Plan (MDEQ 1999).

Figure 5-2 DETERMINATION OF PWS SURFACE WATER INTAKE SUSCEPTIBILITY

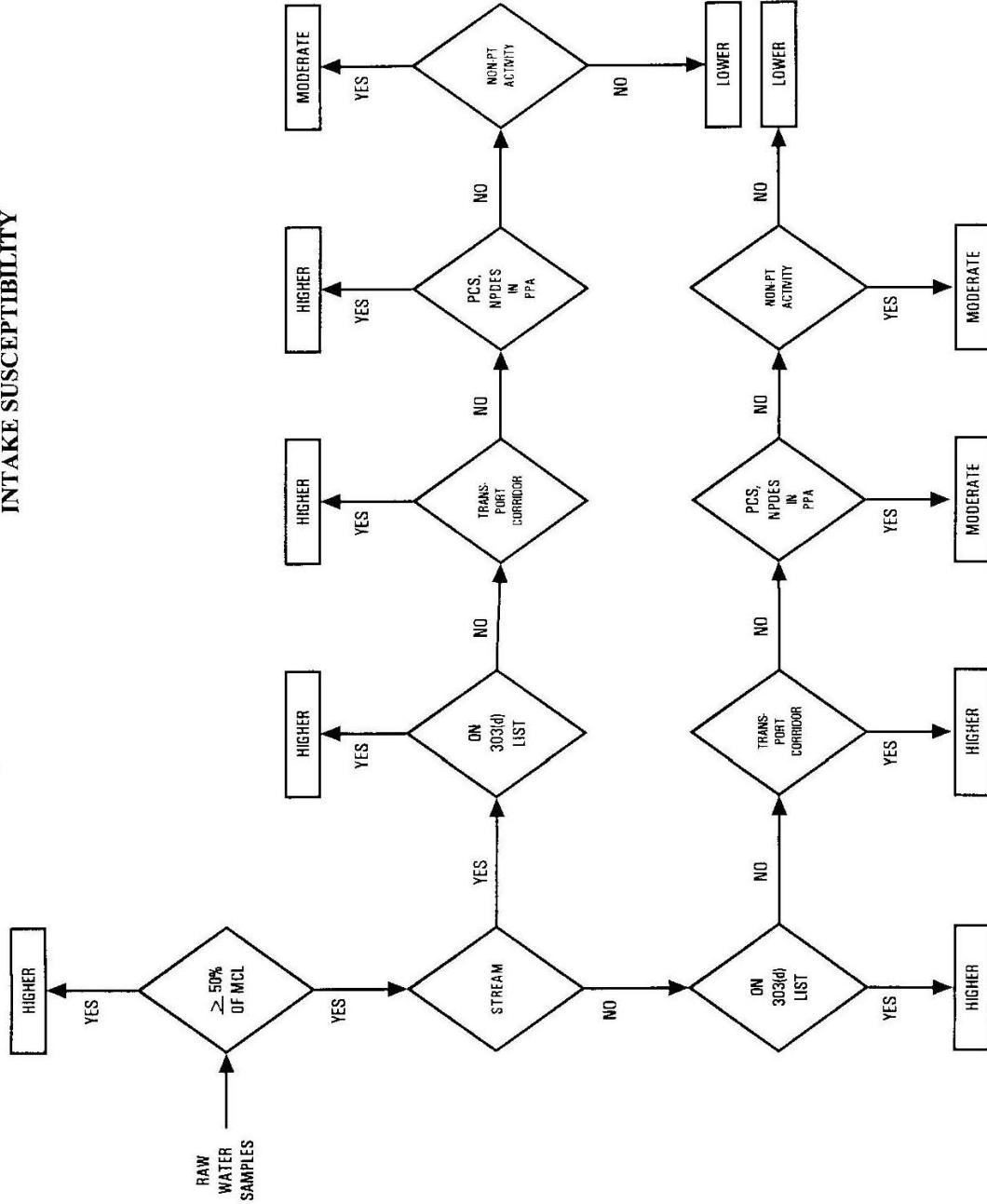


Figure A.6. Determination of PWS Surface Water Intake Susceptibility as extracted from the MDEQ SWAP Plan.

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APPENDIX B

Source Water Protection Work Group

SOURCE WATER PROTECTION WORK GROUP

Six agencies/partners collaborated in the development of this *Source Water Protection Plan* for the Reservoir. The agencies and their roles are as follows:

Mississippi Department of Environmental Quality (MDEQ)

Lead agency for the Source Water Assessment Program (SWAP), the development and implementation of the *Source Water Protection Plan* and the implementation of the Source Water Protection Program.

Mississippi State Department of Health (MSDH)

Lead agency responsible for implementing the Safe Drinking Water Act and assisting in implementation of the Source Water Protection Program.

City of Jackson

Responsible for the treatment and delivery of drinking water to the public.

Pearl River Valley Water Supply District (PRVWSD)

Maintains the 33,000-acre Ross Barnett Reservoir and the Reservoir's dam; manages the lands adjacent to the Reservoir, including 17,000 acres of lease lands and numerous parks and campgrounds; and provides the Reservoir Patrol.

US Environmental Protection Agency (EPA), Region 4

Will provide technical assistance for developing the updated Source Water Assessment and Source Water Protection Plan.

Mississippi Emergency Management Agency (MEMA)

Emergency preparedness and contingency planning.

Representatives from each of these entities formed the Source Water Protection Group. Table B.1 lists the participating individuals.

Table B.1. Participants in the Source Water Protection Work Group.

Participant	Agency
Donetta McCullum-Weatherspoon	MDEQ
John Sigman	PRVWSD
Kay Whittington	MDEQ
Greg Burgess	PRVWSD
Darion Warren	City of Jackson
Dan Gaillet	City of Jackson
David Willis	City of Jackson
Amy McLeod	MSDH
Nick Hatten	MDEQ
Kirsten Sorrell	MDEQ
Janet Chapman	MDEQ
Charles Smith	MDEQ
Jamie Crawford	MDEQ
Larry Cole	EPA

As necessary, the Work Group called on the following entities for input and/or expertise:

- Mississippi Department of Wildlife, Fisheries and Parks (MDWFP),
- Mississippi Forestry Commission (MFC),
- Mississippi Soil & Water Conservation Commission (MSWCC),
- Mississippi Department of Marine Resources (MDMR),
- Mississippi Oil & Gas Board (MSOGB),
- US Geological Survey (USGS),
- US Fish & Wildlife Service (USFWS),
- Natural Resources and Conservation Service (NRCS),
- Rankin, Scott, Madison, Leake, and Hinds counties,
- Property and business owners,
- Economic development agencies and planners,
- Local politicians, and
- Watershed groups.

These agencies or groups were vital for their individual program knowledge and knowledge of the local concerns that are important to the success of a Source Water Protection

Plan and Program. Many of these supporting entities are already participating in components of the *Comprehensive Watershed Protection and Restoration Plan*.

The initial meeting of the Source Water Protection Work Group was held in Jackson, Mississippi, on July 15, 2010, and was successful in defining the roles and responsibilities of the members of the Source Water Protection Work Group, as given below:

1. Actively participate in the Source Water Work Group.
2. Review Work Group Representation for the comprehensive Source Water Protection Program of the Ross Barnett Reservoir to identify and fill any gaps.
3. Define the roles and responsibilities of each agency included in the Source Water Protection Work Group. Identify the key personnel for providing pertinent information for the plan development.
4. Participate in the development of the Source Water Protection Plan vision and goals.
5. Provide oversight, review, and guidance in the Source Water Assessment update.
6. Provide oversight, review, and guidance in the development of the *Source Water Protection Plan*.
7. Serve as a liaison between the Work Group, your respective agency, and the public, in the implementation of the Source Water Protection Program.

Subsequent meetings of the Source Water Protection Work Group were successful in defining the vision, goals, and strategies for the *Source Water Protection Plan*. The group also reviewed and assisted in developing the updated Source Water Assessment and *Source Water Protection Plan*. The meeting was held on September 22, 2010.

The Source Water Protection Work Group is a committed work group intended to demonstrate strong leadership, assist in identifying opportunities for educating the consumers, and promote local involvement in source water protection in order to have and maintain clean water and a healthy watershed. The Source Water Protection Work Group will ensure that the *Source Water Protection Plan* references and is compatible and consistent with any existing emergency contingency/notification plans for the protection of the drinking water source.

Upon completion of the *Source Water Protection Plan*, the Source Water Protection Work Group, under the direction of the Pearl River Basin Management Team, will implement

the *Source Water Protection Plan*. The ongoing commitment and the performance measures of the Source Water Protection Work Group are discussed in Section 3.0, Action Plan, and Section 4.0, Program Implementation, of the *Source Water Protection Plan*.

APPENDIX C

**EPA Drinking Water Standards (Primary & Secondary)
Stage 2 DBPR Fact Sheet**



National Primary Drinking Water Regulations

Contaminant	MCL or TT ¹ (mg/L) ²	Potential health effects from long-term ³ exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L) ²
OC Acrylamide	TT ⁴	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment	zero
OC Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R Alpha/photon emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	0
IOC Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
OC Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
IOC Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2
OC Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	zero
OC Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	zero
IOC Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	0.004
R Beta photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	zero
DBP Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	zero
IOC Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	0.005
OC Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	0.04
OC Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	zero
D Chloramines (as Cl ₂)	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort; anemia	Water additive used to control microbes	MRDL=4 ¹
OC Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	zero
D Chlorine (as Cl ₂)	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	MRDL=4 ¹
D Chlorine dioxide (as ClO ₂)	MRDL=0.8 ¹	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Water additive used to control microbes	MRDL=0.8 ¹
DBP Chlorite	1.0	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Byproduct of drinking water disinfection	0.8
OC Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	0.1
IOC Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	0.1
IOC Copper	TT ⁵ ; Action Level = 1.3	Short-term exposure: Gastrointestinal distress. Long-term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	1.3
M <i>Cryptosporidium</i>	TT ⁷	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero

LEGEND

D Disinfectant	IOC Inorganic Chemical	OC Organic Chemical
DBP Disinfection Byproduct	M Microorganism	R Radionuclides

Contaminant	MCL or TT ¹ (mg/L) ²	Potential health effects from long-term ³ exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L) ²
IOC Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	0.2
OC 2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	0.07
OC Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	0.2
OC 1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	zero
OC o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	0.6
OC p-Dichlorobenzene	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories	0.075
OC 1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC 1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	0.007
OC cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	0.07
OC trans-1,2-Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	0.1
OC Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories	zero
OC 1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC Di(2-ethylhexyl) adipate	0.4	Weight loss, liver problems, or possible reproductive difficulties	Discharge from chemical factories	0.4
OC Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	zero
OC Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	0.007
OC Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	zero
OC Diquat	0.02	Cataracts	Runoff from herbicide use	0.02
OC Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	0.1
OC Endrin	0.002	Liver problems	Residue of banned insecticide	0.002
OC Epichlorohydrin	TT ⁴	Increased cancer risk; stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	zero
OC Ethylbenzene	0.7	Liver or kidney problems	Discharge from petroleum refineries	0.7
OC Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	zero
M Fecal coliform and <i>E. coli</i>	MCL ⁵	Fecal coliforms and <i>E. coli</i> are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes may cause short term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.	Human and animal fecal waste	zero ⁶
IOC Fluoride	4.0	Bone disease (pain and tenderness of the bones); children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	4.0
M <i>Giardia lamblia</i>	TT ⁷	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	0.7
DBP Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	n/a ⁹
OC Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	zero
OC Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	zero
M Heterotrophic plate count (HPC)	TT ⁷	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	n/a

LEGEND

D Disinfectant	IOC Inorganic Chemical	OC Organic Chemical
DBP Disinfection Byproduct	M Microorganism	R Radionuclides

Contaminant	MCL or TT ¹ (mg/L) ²	Potential health effects from long-term ³ exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L) ²
OC Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	zero
OC Hexachlorocyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	0.05
IOC Lead	TT5; Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	zero
M <i>Legionella</i>	TT7	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	zero
OC Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens	0.0002
IOC Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	0.002
OC Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock	0.04
IOC Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	10
IOC Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	1
OC Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	0.2
OC Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood-preserving factories	zero
OC Picloram	0.5	Liver problems	Herbicide runoff	0.5
OC Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	zero
R Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	zero
IOC Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum and metal refineries; erosion of natural deposits; discharge from mines	0.05
OC Simazine	0.004	Problems with blood	Herbicide runoff	0.004
OC Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	0.1
OC Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	zero
IOC Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	0.0005
OC Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	1
M Total Coliforms	5.0 percent ⁸	Coliforms are bacteria that indicate that other, potentially harmful bacteria may be present. See fecal coliforms and <i>E. coli</i>	Naturally present in the environment	zero
DBP Total Trihalomethanes (TTHMs)	0.080	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	n/a ⁹
OC Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	zero
OC 2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	0.05
OC 1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	0.07
OC 1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	0.2
OC 1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	0.003
OC Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	zero

LEGEND

D Disinfectant	IOC Inorganic Chemical	OC Organic Chemical
DBP Disinfection Byproduct	M Microorganism	R Radionuclides

Contaminant	MCL or TT ¹ (mg/L) ²	Potential health effects from long-term ³ exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L) ²
M Turbidity	TT ⁷	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause short term symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
R Uranium	30µg/L	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero
OC Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
M Viruses (enteric)	TT ⁷	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

LEGEND

D Disinfectant	IOC Inorganic Chemical	OC Organic Chemical
DBP Disinfection Byproduct	M Microorganism	R Radionuclides

NOTES

1 Definitions

- Maximum Contaminant Level Goal (MCLG)—The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
 - Maximum Contaminant Level (MCL)—The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
 - Maximum Residual Disinfectant Level Goal (MRDLG)—The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
 - Maximum Residual Disinfectant Level (MRDL)—The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
 - Treatment Technique (TT)—A required process intended to reduce the level of a contaminant in drinking water.
- 2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).
- 3 Health effects are from long-term exposure unless specified as short-term exposure.
- 4 Each water system must certify annually, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05 percent dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01 percent dosed at 20 mg/L (or equivalent).
- 5 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10 percent of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.
- 6 A routine sample that is fecal coliform-positive or *E. coli*-positive triggers repeat samples—if any repeat sample is total coliform-positive, the system has an acute MCL violation. A routine sample that is total coliform-positive and fecal coliform-negative or *E. coli*-negative triggers repeat samples—if any repeat sample is fecal coliform-positive or *E. coli*-positive, the system has an acute MCL violation. See also Total Coliforms.
- 7 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:
- *Cryptosporidium*: 99 percent removal for systems that filter. Unfiltered systems are required to include *Cryptosporidium* in their existing watershed control provisions.
 - *Giardia lamblia*: 99.9 percent removal/inactivation
 - Viruses: 99.99 percent removal/inactivation
 - *Legionella*: No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated according to the treatment techniques in the surface water treatment rule, *Legionella* will also be controlled.
 - Turbidity: For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelometric turbidity unit (NTU), and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
 - HPC: No more than 500 bacterial colonies per milliliter
 - Long Term 1 Enhanced Surface Water Treatment; Surface water systems or ground water systems under the direct influence of surface water serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
 - Long Term 2 Enhanced Surface Water Treatment; This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional *Cryptosporidium* treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storage facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts. (Monitoring start dates are staggered by system size. The largest systems (serving at least 100,000 people) will begin monitoring in October 2006 and the smallest systems (serving fewer than 10,000 people) will not begin monitoring until October 2008. After completing monitoring and determining their treatment bin, systems generally have three years to comply with any additional treatment requirements.)
 - Filter Backwash Recycling: The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.
- 8 No more than 5.0 percent samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli*. If two consecutive TC-positive samples, and one is also positive for *E. coli* or fecal coliforms, system has an acute MCL violation.
- 9 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
 - Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L)

National Secondary Drinking Water Regulation

National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, some states may choose to adopt them as enforceable standards.

Contaminant	Secondary Maximum Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

For More Information

EPA's Safe Drinking Water Web site:
<http://www.epa.gov/safewater/>

EPA's Safe Drinking Water Hotline:
(800) 426-4791

To order additional posters or other ground water and drinking water publications, please contact the National Service Center for Environmental Publications at :
(800) 490-9198, or
email: nscep@bps-lmit.com.

Title 15 - Mississippi Department of Health

Part III – Office of Health Protection

Subpart 72 – Bureau of Public Water Supply

CHAPTER 01 MISSISSIPPI PRIMARY DRINKING WATER REGULATION

100 GENERAL PROVISIONS

100.01 **Legal Authority.** This regulation has been promulgated under the authority of and pursuant to the Mississippi Safe Drinking Water Act of 1997 (Section 41-26-1 through Section 41-26-101, Mississippi Code of 1972, Annotated).

100.02 **Definitions.**

1. **Department** shall mean the Mississippi State Department of Health.
2. **Director** shall mean the Executive Officer of the Mississippi State Department of Health or his authorized agent.
3. **Municipality** shall mean a city, town, village, or other public body created by state law, or an Indian tribal organization authorized by law.
4. **Federal Agency** shall mean any department, agency, or instrumentality of the United States.
5. **Administrator** shall mean the Administrator of the U.S. Environmental Protection Agency or his authorized representative.
6. **Federal Act** shall mean the Safe Drinking Water Act of 1974, cited as Public Law 93-523, or any subsequent revisions thereto.
7. **Regulations** shall mean primary drinking water regulations promulgated by the administrator pursuant to the federal act.
8. **Backflow** shall mean the reversal of normal flow direction where water flows from the intended point of delivery towards the public water supply.
9. **Cross Connection** shall mean any direct interconnection between a public water system and a non-public water system or other source which may result in the contamination of the drinking water provided by the public water system. This definition includes any arrangement of piping where a potable water line is connected to non potable water; it may be a pipe-to-pipe connection where potable and non potable water lines are directly connected or a pipe-to-water connection where the potable water outlet is submerged in non potable water. If the potable and non-potable source are

separated by gate valves, check valves or devices other than the appropriate backflow preventer as outlined by this regulation, a cross connection exists. By-pass arrangements, jumper connections, swivel or change over assemblies, or other temporary or permanent assemblies through which, or because of which, backflow may occur are considered to be cross connections.

10. **Public water system** means a system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes: Any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. Such term does not include any “special irrigation district.” Service connection, as used in the definition of public water system, does not include a connection to a system that delivers water by a constructed conveyance other than a pipe if:
- a. The water is used exclusively for purposes other than residential uses (consisting of drinking, bathing, cooking, or other similar uses);
 - b. The Director or Administrator determines that alternative water to achieve the equivalent level of public health protection provided by the applicable national primary drinking water regulation is provided for residential or similar uses for drinking and cooking; or
 - c. The Director or Administrator determines that the water provided for residential or similar uses for drinking, cooking, and bathing is centrally treated or treated at the point of entry by the provider, a pass-through entity, or the user to achieve the equivalent level of protection provided by the applicable national primary drinking water regulation.

Special irrigation district means an irrigation district in existence prior to May 18, 1994, that provides primarily agricultural service through a piped water system with only incidental residential or similar use where the system or the residential or similar users of the system comply with the exclusion provisions in Section 1401(4)(B)(i)(II) or (III) of the Federal Safe Drinking Water Act.

11. **Professionally installed** shall mean installed in a workmanlike manner with no apparent errors in installation.
12. The definitions as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.2 are hereby adopted.

100.03 **Coverage.** This regulation shall apply to each public water system in the State, except that it shall not apply to a public water system:

1. Which consists only of distribution and storage facilities which does not have any collection and treatment facilities; and
2. Which obtains all of its water from, but is not owned or operated by, a public water system to which such regulation applies; and
3. Which does not sell water to any person; and
4. Which is not a carrier which conveys passengers in interstate or intrastate commerce.

100.04 **Variances and Exemptions.** Variances and exemptions may be issued by the Director in accordance with Sections 1415 and 1416 of the federal act. Treatment utilizing best available technology, as stipulated in Title 40 Code of Federal Regulations, Part 142, Subparts F and G, may be required in order to grant variances and exemptions under this regulation. Variances and exemptions shall not be issued if not allowed by the National Primary Drinking Water Regulations.

100.05 **Preconstruction and Treatment Requirements.**

1. **Siting Requirements.** Before a person may initiate construction of a new community or non-transient non-community public water system or increase the capacity of an existing community or non-transient non-community public water system, he shall submit sufficient information to the Director for evaluation of the proposed site, to determine whether the site and design of the proposed construction or modification will enable the system to comply with this regulation.
2. **Plans and Specifications Approval.** Prior to advertising for bids and/or initiating construction of a new community or non-transient non-community public water system or making significant extensions or alterations to an existing community or non-transient non-community public water system which may effect the operation of that system, plans and specifications for the proposed construction shall be approved by the Director. Plans and specifications submitted to the Director for approval shall be prepared by a professional engineer licensed to practice in the State of Mississippi.
3. **Operation and Maintenance Plans.** Each applicant for a new community or non-transient non-community public water system shall submit an operation and maintenance plan for review and approval by the Director. The plan must be approved by the Director prior to beginning construction.
4. **Financial and Managerial Viability.** Each applicant for a new community or non-transient non-community public water system shall submit financial

and managerial information as required by the Public Utilities Staff. Plans and specifications shall not be approved by the Director until written certification of the financial and managerial viability of the new water system is received from the Executive Director of the Public Utilities Staff.

5. **Changes to Existing Public Water Systems.** Plans and specification for changes to an existing community or non-transient non-community public water systems shall not be approved if the Director determines the changes would threaten the viability of the water system or if the changes may overload the operational capabilities of the water system.
6. **Non-Centralized Treatment Devices.** Public water systems may utilize point-of-entry devices to comply with maximum contaminant levels as stipulated in the National Primary Drinking Water regulations as published at Title 40 Code of Federal Regulations Sections 141.100 and 141.101.
7. **Ban of Use of Lead Products.** Any pipe, solder, or flux used in the installation or repair of any public water system, or any plumbing in a residential or nonresidential facility providing water for human consumption which is connected to a public water system shall be lead free. Solders and flux are defined as "lead free" when they contain not more than 0.2 percent lead. Pipes and pipe fittings are defined as "lead free" when they contain not more than 8.0 percent lead. Plumbing fittings and fixtures intended by the manufacturer to dispense water for human ingestion are defined as "lead free" when they comply with standards established in accordance with 42 U.S.C. 300g-6(e).
8. **Lead Service Line Replacement.** It shall be the responsibility of each supplier of water to comply with the lead service line replacement requirements and lead service line reporting requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.84 and 141.90.
9. **Overloaded Public Water Systems.** Public water systems that are serving customers in excess of the design capacity as determined by the Director shall be identified as overloaded and shall immediately, upon written notification by the Director, cease adding new customers. Public water systems identified as overloaded shall not add new customers until notified, in writing, by the Director that the system's design capacity has been increased and that the water system can resume adding new customers.

101 MAXIMUM CONTAMINANT LEVELS

- 101.01 **Microbiological**. All microbiological maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.52 and 141.63.
- 101.02 **Inorganic Chemicals**. All inorganic chemical maximum contaminant levels and action levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.11, 141.23 (d & e), 141.51, 141.60, 141.62 (b, c & d) and 141.80.
- 101.03 **Organic Chemicals**. All organic chemical maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.50, 141.60 and 141.61.
- 101.04 **Turbidity**. The maximum contaminant levels for turbidity shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.13, 141.73, 141.173 and Appendix B to Subpart Q of Part 141.
- 101.05 **Radionuclides**. All radionuclide maximum contaminant levels and maximum contaminant level goals shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.15, 141.16, 141.55 and 141.66.
- 101.06 **Disinfectant Residuals**, Disinfection Byproducts, and Disinfection Byproduct Precursors. All disinfectant residuals, disinfection byproduct and disinfection byproduct precursor maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.130, 141.53, 141.54, 141.64 and 141.65.
- 101.07 **Total Trihalomethanes**. All total trihalomethane maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.12 and 141.64.
- 101.08 **Miscellaneous Contaminants**. All maximum contaminant levels not previously referenced in this regulation shall apply to public water systems as stipulated in the latest revision of the National Primary Drinking Water Regulations including Appendix B to Subpart Q of Part 141.

102 **MONITORING, ANALYTICAL, AND TREATMENT TECHNIQUE REQUIREMENTS**

102.01 **Coliform Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the Coliform Monitoring and Analytical Requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.21 or any subsequent revisions thereto except that the following optional provisions of Title 40 Code of Federal Regulations Section 141.21 are not adopted:

1. The provision of Title 40 Code of Federal Regulations Section 141.21 (a)(2) concerning the reduction of the monitoring frequency for community water systems serving 1,000 or fewer persons;
2. The provision of Title 40 Code of Federal Regulations Section 141.21 (a)(5) concerning waiver of the time limit for sampling after a turbidity sampling result exceeds 1 NTU;
3. The provision of Title 40 Code of Federal Regulations Section 141.21 (b)(1) concerning waiver of the time limit for repeat samples;
4. The provision of Title 40 Code of Federal Regulations Section 141.21 (b)(3) concerning collection of large volume repeat samples in containers of any size;
5. The provision of Title 40 Code of Federal Regulations Section 141.21 (b) (5) concerning waiver of the requirement to take five routine samples the month after a public water system has a total coliform positive sample;
6. The provision of Title 40 Code of Federal Regulations Section 141.21 (c) (1) (ii) and Section 141.21 (c) (1) (iii) with respect to invalidation of total coliform positive samples;
7. The provision of Title 40 Code of Federal Regulations Section 141.21 (d) concerning agents other than State personnel conducting sanitary surveys;
8. The provisions of Title 40 Code of Federal Regulations Section 141.21 (e)(2) with respect to waiver of fecal coliform or E. Coli testing on a total coliform positive sample;

102.02 **Inorganic Chemical Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the inorganic chemical sampling/analysis requirements, analytical techniques, and water quality parameters as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.23, 141.86, 141.87, 141.88 and 141.89 except that the following optional provisions of Title 40 Code of Federal Regulations are not adopted: Section 141.23 (a)(4) and Section 141.88(a)(1)(iv) which allow compositing of samples.

- 102.03 **Organic Chemical Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the organic chemical sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.24, 141.30 and 141.40 except that the following optional provisions of Title 40 Code of Federal Regulations are not adopted: Sections 141.24 (f) (14) and (h) (10) and Section 141.40 (n)(9) which allow compositing of samples.
- 102.04 **Total Trihalomethane Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the total trihalomethane sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.30, 141.130, 141.131, 141.132, and 141.531.
- 102.05 **Radionuclides.** It shall be the responsibility of each supplier of water to comply with the radionuclide sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.25 and 141.26.
- 102.06 **Turbidity Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the turbidity sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.22, 141.174 and Appendix B to Subpart Q of Part 41.
- 102.07 **Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the disinfection byproduct sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.130, 141.131, 141.132, and 141.531. Compliance with this section shall be determined as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.133.
- 102.08 **Filtration and Disinfection.** It shall be the responsibility of each supplier of water to comply with the filtration and disinfection analytical and monitoring requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.74, 141.174, 141.70, and 141.73.
- 102.09 **Miscellaneous Contaminants.** It shall be the responsibility of the supplier of water to comply with the special monitoring requirements of the National Primary Drinking Water Regulation Title 40 Code of Federal Regulations Section 141.41 (special monitoring for sodium) and Section 141.42 (special monitoring for corrosivity characteristics). It shall also be the responsibility of the supplier of water to comply with all other monitoring and analysis

requirements not previously addressed in this regulation as stipulated in the National Primary Drinking Water Regulations.

102.10 **Sanitary Surveys**. The Mississippi State Department of Health shall make periodic on-site surveys of each public water system for the purpose of determining the adequacy of the water source, facilities, equipment, watershed control program, and operation and maintenance procedures as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.522. These surveys include the right to inspect all records, take water quality samples, or verify procedures, to determine compliance with this regulation. Significant deficiencies, as determined by the Department utilizing current EPA guidance manuals, shall be identified by Department staff during the conduct of sanitary surveys. Public water systems shall, upon receipt of the sanitary survey report, provide a written response to all significant deficiencies identified in the report to the Department within 45 days of receipt of the report. In this written response, the public water system shall outline its plan to correct the significant deficiencies identified in the survey report. After reviewing the public water system's written response, the Director shall require, by means of a written order, that the public water system correct the significant deficiencies within a reasonable period of time as determined by the Department.

102.11 **Treatment Techniques**. It shall be the responsibility of each supplier of water to comply with the treatment techniques as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.76, 141.81, 141.82, 141.83, 141.110, 141.111, 141.135, and Appendix A to Subpart Q of Part 141.

103 REPORTING, RECORDS, AND PUBLIC NOTIFICATION

103.01 **Reporting Requirements**.

1. The supplier of water shall provide the results of all water quality analyses to be utilized for compliance with this regulation to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31, 141.35, 141.73, 141.75, 141.76, 141.90, 141.134, 141.173, 141.175, and 141.570.
2. The supplier of water shall report to the Director the failure to comply with these regulations, including failure to comply with monitoring and analytical requirements, and failure to meet maximum contaminant levels as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31, 141.35, 141.73, 141.75, 141.76, 141.173 and 141.175.

3. The supplier of water shall provide proof of public notification to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31(d), 141.32 and 141.90(f).
4. The supplier of water shall maintain records and submit to the Director copies of all required records as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31 (e), 141.91, 141.75, 141.76 and 141.175.
5. The state shall be responsible for submitting to the Administrator all information stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 142.15.

103.02 **Public Notification and Education.** Each supplier of water shall provide public notification or education as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.32, 141.35, 141.85, 141.90(f), 141.201, 141.202, 141.203, 141.204, 141.205, 141.206, 141.207, 141.208, 141.209, 141.210, 141.71, 141.73, 141.74, 141.170-141.174, 141.500-141.553, and 141.560-141.564. Public notification of fluoride content is required of all public water suppliers as stipulated in Title 40 Code of Federal Regulations Section 143.5.

103.03 **Record Maintenance.** Each supplier of water shall retain records and make such records available to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.33, 141.35, 141.75, 141.76, 141.134, 141.155, 141.175 and 142.62.

103.04 **Records Kept by States.** Records of tests, measurements, analyses, decisions, and determinations performed on each public water system to determine compliance with applicable provisions of the Mississippi Primary Drinking Water Regulations will be maintained in accordance with the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 142.14.

103.05 **Laboratory Certification.**

1. The Director may prescribe minimum requirements for a laboratory to be certified by the Mississippi State Department of Health to perform water quality analyses required under this regulation.
2. Each supplier of water must utilize the services of certified laboratory to complete all water quality analyses required by this regulation.

103.06 **Filtration and Disinfection - Surface Water Treatment Rule.**

1. **General Requirements:** Each public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the treatment technique requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.70.
2. **Criteria for Avoiding Filtration:** In order to avoid filtration, a public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the criteria for avoiding filtration as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.71.
3. **Disinfection:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the disinfection requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.72.
4. **Filtration:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water and does not meet all of the criteria in Title 40 Code of Federal Regulations Section 141.71 for avoiding filtration must comply with the treatment requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.73.
5. **Recycle Provisions:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the recycle provisions as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.76.

103.07 **Enhanced Filtration and Disinfection - Surface Water Treatment Rule.**

1. **General Requirements:** Each public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the treatment technique requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.170, 141.500-141.503, 141.510-141.511, and 141.520.
2. **Criteria for Avoiding Filtration:** In order to avoid filtration, a public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the criteria for avoiding filtration as stipulated in the National Primary Drinking

Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.171 and 141.521.

3. **Disinfection:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the disinfection, profiling and benchmarking requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.172, 141.530-141.536, 141.540-141.544.
4. **Filtration:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water and does not meet all of the criteria in Title 40 Code of Federal Regulations Section 141.171 for avoiding filtration must comply with the treatment requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.173, 141.550-141.553, and 141.560-141.564. A public water system that uses a surface water source or a ground water source under the influence of surface water shall arrange for the conduct of a comprehensive performance evaluation by the Department or a third party approved by the Department within 30 days of exceeding the filter performance triggers stipulated by the National Primary Drinking Water Regulations published under Title 40 Code of Federal Regulations Section 141.175 (b)(4). Based upon the results of this comprehensive performance evaluation, the public water system shall arrange for the completion of a composite correction program developed in accordance with current EPA guidance documents. This composite correction program shall be submitted to the Department for review and approval prior to actual implementation. The Director, after reviewing and approving the composite correction program, shall, by means of a written order, require the public water system to implement the approved composite correction program on a time schedule approved by the Department as stipulated in Title 40 Code of Federal Regulations Section 142.16(g)(1) and 142.16(j)(1).

104 CROSS CONNECTIONS

104.01 **Cross Connections Prohibited.** No person shall install, permit to be installed or maintain any cross connection between a public water system and any other non-public water system or a line from any container of liquids or other substances, except as specifically authorized by this regulation, unless a backflow prevention assembly is installed between the public water system and the source of contamination. Direct connections between a public water supply and sewer or storm sewer are prohibited.

104.02 **Low Hazard Cross Connection.**

1. A connection between a public water system and a service or other water system not hazardous to health but not meeting established water quality standards for public water systems and not cross connected within its system with a potentially dangerous substance shall be considered a low hazard category cross connection. An appropriate backflow prevention assembly or device recommended by the Department for low hazard cross connections shall be installed except as provided in section 104.02(2).
2. Pursuant to Section 41-26-14(2)(b) of the Mississippi Code of 1972, as amended, the following cross connections shall be considered as low hazard posing a very low risk and shall not be required to have a backflow preventer device:
 - a. Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and was professionally installed regardless of whether the system is underground or above ground or whether the system has pop-up sprinkler heads.
 - b. Any swimming pool that is connected to a public water system and was professionally installed or any swimming pool that is connected to a public water system and has a fill line with an anti-siphon air gap.
 - c. Any water fountain or cooler that provides drinking water for human consumption that is connected to a public water system and was professionally installed.
 - d. Any fire sprinkler system that contains only water or a dry pipe and no chemicals that is connected to a public water system and was professionally installed.
 - e. Any commercial establishment that is connected to a public water system that contains no cross connections directly with a dangerous or hazardous substance or material.

104.03 **High Hazard Cross Connection.**

1. A connection between a public water system and a non-public water system or other source of contamination which has or may have any material in the water dangerous to health, or connected to any material dangerous to health, that is or may be handled under pressure, or subject to negative pressure, shall be considered a high hazard category cross connection. The cross connection shall be eliminated by air gap separation or shall be protected by the installation of an appropriate backflow prevention assembly or device recommended by the Department for high hazard cross connections.
2. Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and either injects or stores lawn chemicals or is

connected to a wastewater supply shall be considered a high hazard cross connection and shall be protected by the installation of a backflow prevention assembly or device.

3. Additional backflow prevention assemblies or devices shall not be required for carbonated beverage dispensers if 1) the water supply connection to the carbonated beverage dispenser is protected against backflow by a backflow prevention assembly or device that conforms to ASSE 1022 or by an air gap, and 2) the backflow prevention assembly or device and the piping downstream from the device are not affected by carbon dioxide gas.

104.04 **Distinction Between Low and High Hazard Cross Connection.** The distinction between low hazard cross connection and high hazard cross connections shall be made by an authorized representative of the public water system subject to review by the Department.

105 **RESPONSIBILITY OF PUBLIC WATER SYSTEMS TO ESTABLISH CROSS CONNECTION CONTROL PROGRAMS**

105.01 **Cross Connection Control Program.** All public water supplies shall adopt and enforce a cross connection control policy or ordinance that is no less stringent than the provisions of this regulation; however, the adopted policy or ordinance shall not be more stringent than the provisions of House Bill 692 enacted by the 2001 Mississippi Legislature, as codified in Section 41-26-14 et. seq. of the Mississippi Code of 1972, Annotated. This policy or ordinance shall establish a cross connection control program consisting of the following:

1. Locating and eliminating unprotected cross connections.
2. Preventing the occurrence of new cross connections with the public water system.
3. Maintaining records pertaining to the location of existing backflow prevention assemblies, type and size of each assembly and results of all tests of backflow prevention assemblies by a tester certified by the Department.

105.02 **Cross Connection Surveys.** It shall be the responsibility of each public water system to conduct surveys and on-site visits as necessary to locate existing cross connections. Single family dwellings and multi-family dwellings shall not be included in this survey unless the officials of the public water system have reason to believe that a cross connection exists. This survey shall be performed by an authorized representative of the public water system utilizing established written guidelines as published by the Department.

1. Each public water system shall complete an initial cross connection survey by December 31, 2000.

2. Upon completion of the required cross connection survey, the responsible official of each public water system shall certify to the Department, on forms provided by the Department, that the required survey has been properly completed in accordance with the written guidelines published by the Department.

105.03 **Installation of Backflow Preventers.** When a cross connection is identified, the public water system shall require that the property owner eliminate the cross connection or install the proper type backflow prevention assembly.

1. When a cross connection is identified, the public water system shall notify the property owner, in writing and within ten (10) days, of the existence of the cross connection and that the cross connection must be eliminated or protected.
2. If the public water system determines that the cross connection is a high hazard category cross connection, it shall be eliminated or protected by the appropriate backflow preventer by June 30, 2001. If a public water system identifies an existing high hazard cross connection after June 30, 2001, the high hazard cross connection shall be eliminated or protected by the property owner within ninety (90) days of written notification by the public water system. If the property owner has an existing backflow preventer, the public water system shall allow the backflow preventer to remain in place until it fails to function properly.
3. If the public water system determines that the cross connection is a low hazard cross connection, it shall be eliminated or protected by the property owner by installing an appropriate backflow preventer by June 30, 2004. If an existing low hazard cross connection is identified by a public water system after June 30, 2004, the cross connection shall be eliminated or protected by the property owner by installing an approved backflow preventer within one (1) year of written notification by the public water system. If the property owner has an existing backflow preventer, the public water system shall consider the backflow preventer approved and shall allow the installed backflow preventer to remain in place until the backflow preventer fails to function properly.

105.04 **Public Water System Enforcement Actions.** In the event a customer refuses to comply with the cross connection control provisions of this regulation, the public water system is authorized to discontinue water service to the customer until such time as the customer complies with this regulation.

106 RECOMMENDED BACKFLOW PREVENTERS

106.01 **List of Recommended Backflow Preventers.** The Department shall prepare and publish a list of backflow prevention assemblies recommended for use in the

State of Mississippi. The Department shall routinely update this list as necessary.

1. Recommended Devices for High Hazard Cross Connections.

- a. Reduced Pressure Principle Backflow Prevention Assemblies. Backflow prevention assemblies recommended to protect high hazard cross connections shall include reduced pressure principle backflow prevention assemblies.
 - b. Pressure Vacuum Breaker Assemblies. Backflow prevention assemblies recommended to protect high hazard cross connections shall include pressure vacuum breaker assemblies. Pressure vacuum breaker assemblies shall not be used in locations where the vacuum breaker may be subject to back pressure and shall not be used in locations where the vacuum breaker is not higher than all downstream connections.
 - c. Atmospheric Vacuum Breakers. Backflow prevention devices recommended to protect high hazard cross connections shall include atmospheric vacuum breakers. Atmospheric vacuum breakers shall not be installed in locations that may be subject to back pressure, shall not be installed in locations where the vacuum breaker is not higher than all downstream locations, shall not be installed in locations with valves downstream and shall not be installed in locations of continuous use.
- 2. Low Hazard Cross Connections.** Backflow prevention assemblies recommended to protect low hazard cross connections shall include reduced pressure principle assemblies, pressure vacuum breaker assemblies, atmospheric vacuum breaker assemblies, and double check valve assemblies. Pressure vacuum breaker assemblies shall not be used in locations where the vacuum breaker may be subject to back pressure and shall not be used in locations where the vacuum breaker is not higher than all downstream connections. Atmospheric vacuum breakers shall not be installed in locations that may be subject to back pressure, shall not be installed in locations where the vacuum breaker is not higher than all downstream locations, shall not be installed in locations with valves downstream and shall not be installed in locations of continuous use.

106.02 Installation Requirements.

1. Reduced pressure principle backflow prevention assemblies, double check valve assemblies, and pressure vacuum breaker assemblies shall be installed in a location that provides adequate access for testing and repair of the assembly.

2. Reduced pressure principle backflow prevention assemblies and double check valve assemblies shall not be subject to possible flooding. Reduced pressure principle backflow prevention assemblies and double check valve assemblies shall not be located in a pit below ground level.

107 TESTING OF BACKFLOW PREVENTION ASSEMBLIES

107.01 **Testing By Certified Tester.** When a reduced pressure principle backflow prevention assembly, double check valve assembly, or pressure vacuum breaker assembly is installed to protect a public water system against the possibility of a backflow from a customer's water service, inspection and testing of the assembly, where required by this regulation, shall be performed by an individual who has been licensed as a Certified Tester by the Department.

1. Each backflow prevention assembly shall be inspected and tested by a Certified Tester after installation and before use by the customer. Reduced pressure principle backflow prevention assemblies and pressure vacuum breakers shall be inspected and tested at least once a year by a Certified Tester.
2. The Certified Tester shall provide the property owner and the public water system with a written report of the inspection and test results on each assembly tested. This written report shall be on a form provided by the Department. The report shall be prepared and submitted by the Certified Tester making the inspection and test. The Certified Tester and the public water system shall retain all backflow prevention assembly test and inspection results for at least five (5) years from the date of test and inspection.
3. Reduced pressure principle backflow prevention assemblies and pressure vacuum breaker assemblies that fail to function properly or fail the routine required test shall be repaired or replaced within thirty (30) days of identification of the failure. Double check valves that fail to function properly shall be repaired or replaced within ninety (90) days of identification of the failure.

107.02 **Licensing of Certified Testers.** Each Certified Tester shall be licensed by the Department. All tester training shall be submitted to the Department for approval at least 45 days prior to the scheduled date of training. The Department shall review the instructors and course curriculum for all proposed tester training. The Department shall approve proposed tester training if it determines that the proposed training program and instructor(s) meets the Department's minimum guidelines. The Department shall develop and administer the backflow tester certification test at the conclusion of each approved tester training program. A minimum score of 70% on the Department's written examination and successful performance of prescribed tests on a reduced pressure principle backflow prevention assembly, double

check valve assembly, and pressure vacuum breaker assembly will be required for certification. Any applicant not successfully completing both the written and performance tests must attend a Department approved tester training program before taking the certification tests again. Under special circumstances and upon receipt of a written request by the applicant, the Department may allow an applicant to take the written and performance tests without attending a Department approved tester training program.

1. The Department may issue, solely at its discretion and without testing, certification to a Tester possessing certification from a nationally recognized backflow prevention assembly tester certification program.
2. Each Tester's certification will expire three (3) years from the date issued. To become re-certified, the Tester must successfully complete a recertification examination developed by the Department and administered by the Department or an authorized representative of the Department.
3. The Certified Tester shall maintain the accuracy of the testing equipment to be used to test backflow prevention devices. The testing equipment shall be checked for proper calibration and shall be recalibrated, as needed, in accordance with the recommendations of the manufacturer. Only properly trained individuals shall perform calibration adjustments or repair or testing equipment. Calibration standards utilized in the testing or repair of this testing equipment shall have their accuracy checked and adjusted to within allowable tolerances against standard instruments traceable to the National Institute for Standards and Technology (NIST).

107.03 **Suspension or Revocation of Tester's Certificate.**

1. A Tester's Certificate may be revoked or suspended by the Department for just cause. Causes include, but are not limited to, the following:
 - a. Fraud, deception, or misrepresentation of a material fact to either the public or the Department ;
 - b. Misfeasance, malfeasance or nonfeasance;
 - c. Failure to file any official reports required by the Department;
 - d. Failure to maintain all official records required by the Department;
 - e. Failure to respond to any official correspondence from the Department;
 - f. Failure to obey a lawful order of the Director or any duly appointed Administrative Hearing Officer of the Department;

- g. Failure to exercise reasonable care or judgment in the testing of backflow prevention devices;
 - h. Failure to comply with the terms of a suspension of a certificate issued by the Department;
2. No Tester's Certificate will be suspended or revoked without notice to the Certificate holder and an opportunity for a hearing. Hearings shall be held in conformity with Sections 41-26-17 and 41-26-21 Mississippi Code of 1972 Annotated.
 3. Notwithstanding the requirement for a hearing, the Director may, if he determines that public health is threatened, issue any such orders as are deemed necessary to protect the public health, including, but not limited to, orders to individual(s) to cease all actions as a Certified Tester of backflow prevention devices in the State of Mississippi.

108 CROSS CONNECTION CONTROL WAIVERS

- 108.01 **Waivers.** The Director may issue a waiver to a public water system to any part or parts of the cross connection control provisions of this regulation if the Department deems such waiver to be appropriate and will not potentially jeopardize public health.

109 APPLICATION AND FEES FOR CERTIFIED TESTER

109.01 **Filing Application.**

1. A tester desiring certification shall file an application with the Department on forms provided by the Department.
2. The Department shall review the application and supporting documents, determine the eligibility of the applicant, and issue a certificate when the minimum requirements are met.

109.02 **Backflow Prevention Assembly Tester Certification Fees.**

1. An initial fee of fifty dollars (\$50.00) shall be charged for certification as a Backflow Prevention Assembly Tester. The Department shall invoice each applicant for the \$50 fee and the certificate will not be issued until the fee is received by the Department.
2. A fee of thirty dollars (\$30.00) shall be charged for the renewal of a certificate. The Department shall invoice each applicant for the \$30 fee and the renewal certificate will not be issued until the fee is received by the Department.

110 CONSUMER CONFIDENCE REPORTS

110.01 **Purpose and Applicability.** Each community public water system shall prepare and deliver to their customers an annual consumer confidence report as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.151.

1. **Effective Dates.** The effective dates for community public water supplies to prepare and deliver annual consumer confidence reports shall be as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.152.
2. **Content of the Reports.** The content of the Consumer Confidence Reports prepared by community public water supplies shall be as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.153.
3. **Required Additional Health Information.** It shall be the responsibility of each community public water supply preparing a consumer confidence report to include the required additional health information as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.154.
4. **Report Delivery.** Delivery of Consumer Confidence Reports prepared by community public water supplies shall be as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.155.

111 EMERGENCY CONDITIONS AND ENFORCEMENT

111.01 **Emergency Conditions.** The Director is authorized to develop and implement a plan for the provision of safe drinking water in emergency circumstances for any public water system.

111.02 **Enforcement.** Violations of any requirement of this regulation shall be subject to the enforcement provisions of the Mississippi Safe Drinking Water Act of 1997 as found at Sections 41-26-1 through 41-26-101, Mississippi Code of 1972, Annotated.



Fact Sheet: Stage 2 Disinfectants and Disinfection Byproducts Rule

In the past 30 years, the Safe Drinking Water Act (SDWA) has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water. Disinfection of drinking water is one of the major public health advances in the 20th century. One hundred years ago, typhoid and cholera epidemics were common through American cities; disinfection was a major factor in reducing these epidemics.

However, the disinfectants themselves can react with naturally-occurring materials in the water to form byproducts, which may pose health risks. In addition, in the past 10 years, we have learned that there are specific microbial pathogens, such as *Cryptosporidium*, which can cause illness, and are highly resistant to traditional disinfection practices.

Amendments to the SDWA in 1996 require EPA to develop rules to balance the risks between microbial pathogens and disinfection byproducts (DBPs). The Stage 1 Disinfectants and Disinfection Byproducts Rule and Interim Enhanced Surface Water Treatment Rule, promulgated in December 1998, were the first phase in a rulemaking strategy required by Congress as part of the 1996 Amendments to the Safe Drinking Water Act.

The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) builds upon the Stage 1 DBPR to address higher risk public water systems for protection measures beyond those required for existing regulations.

The Stage 2 DBPR and the Long Term 2 Enhanced Surface Water Treatment Rule are the second phase of rules required by Congress. These rules strengthen protection against microbial contaminants, especially *Cryptosporidium*, and at the same time, reduce potential health risks of DBPs.

Questions and Answers

What is the Stage 2 DBPR?

The Stage 2 Disinfection Byproducts Rule will reduce potential cancer and reproductive and developmental health risks from disinfection byproducts (DBPs) in drinking water, which form when disinfectants are used to control microbial pathogens. Over 260 million individuals are exposed to DBPs.

This final rule strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5). The rule targets systems with the greatest risk and builds incrementally on existing rules. This regulation will reduce DBP exposure and related potential health risks and provide more equitable public health protection.

The Stage 2 DBPR is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs.

What does the rule require?

Under the Stage 2 DBPR, systems will conduct an evaluation of their distribution systems, known as an Initial Distribution System Evaluation (IDSE), to identify the locations with high disinfection byproduct concentrations. These locations will then be used by the systems as the sampling sites for Stage 2 DBPR compliance monitoring.

Compliance with the maximum contaminant levels for two groups of disinfection byproducts (TTHM and HAA5) will be calculated for each monitoring location in the distribution system. This approach, referred to as the locational running annual average (LRAA), differs from current requirements, which determine compliance by calculating the running annual average of samples from all monitoring locations across the system.

The Stage 2 DBPR also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results. The operational evaluation level provides an early warning of possible future MCL violations, which allows the system to take proactive steps to remain in compliance. A system that exceeds an operational evaluation level is required to review their operational practices and submit a report to their state that identifies actions that may be taken to mitigate future high DBP levels, particularly those that may jeopardize their compliance with the DBP MCLs.

Who must comply with the rule?

Entities potentially regulated by the Stage 2 DBPR are community and nontransient noncommunity water systems that produce and/or deliver water that is treated with a primary or residual disinfectant other than ultraviolet light.

A community water system (CWS) is a public water system that serves year-round residents of a community, subdivision, or mobile home park that has at least 15 service connections or an average of at least 25 residents.

A nontransient noncommunity water system (NTNCWS) is a water system that serves at least 25 of the same people more than six months of the year, but not as primary residence, such as schools, businesses, and day care facilities.

What are disinfection byproducts (DBPs)?

Disinfectants are an essential element of drinking water treatment because of the barrier they provide against waterborne disease-causing microorganisms. Disinfection byproducts (DBPs) form when disinfectants used to treat drinking water react with naturally occurring materials in the water (e.g., decomposing plant material).

Total trihalomethanes (TTHM - chloroform, bromoform, bromodichloromethane, and dibromochloromethane) and haloacetic acids (HAA5 - monochloro-, dichloro-, trichloro-, monobromo-, dibromo-) are widely occurring classes of DBPs formed during disinfection with chlorine and chloramine. The amount of trihalomethanes and haloacetic acids in drinking water can change from day to day, depending on the season, water temperature, amount of disinfectant added, the amount of plant material in the water, and a variety of other factors.

Are THMs and HAAs the only disinfection byproducts?

No. The four THMs (TTHM) and five HAAs (HAA5) measured and regulated in the Stage 2 DBPR act as indicators for DBP occurrence. There are many other known DBPs, in addition to the possibility of unidentified DBPs present in disinfected water. THMs and HAAs typically occur at higher levels than other known and unknown DBPs. The presence of TTHM and HAA5 is representative of the occurrence of many other chlorination DBPs; thus, a reduction in the TTHM and HAA5 generally indicates a reduction of DBPs from chlorination.

What are the costs and benefits of the rule?

Quantified benefits estimates for the Stage 2 DBPR are based on reductions in fatal and non-fatal bladder cancer cases. EPA has projected that the rule will prevent approximately 280 bladder cancer cases per year. Of these cases, 26% are estimated to be fatal. Based on bladder cancer alone, the rule is estimated to provide annualized monetized benefit of \$763 million to \$1.5 billion.

The rule applies to approximately 75,000 systems; a small subset of these (about 4%) will be required to make treatment changes. The mean cost of the rule is \$79 million annually. Annual household cost increases in the subset of plants adding treatment are estimated at an average of \$5.53, with 95 percent paying less than \$22.40.

What are the compliance deadlines?

Compliance deadlines are based on the sizes of the public water systems (PWSs). Wholesale and consecutive systems of any size must comply with the requirements of the Stage 2 DBPR on the same schedule as required for the largest system in the combined distribution system (defined as the interconnected distribution system consisting of wholesale systems and consecutive systems that receive finished water). Compliance activities are outlined in the following table.

PUBLIC WATER SYSTEMS	ACTIONS			
	Submit IDSE monitoring plan, system specific study plan, or 40/30 certification	Complete an initial distribution system evaluation (IDSE)	Submit IDSE Report	Begin subpart V (Stage 2) compliance monitoring
CWSs and NTNCWSs serving at least 100,000	October 1, 2006	September 30, 2008	January 1, 2009	April 1, 2012
CWSs and NTNCWSs serving 50,000 - 99,999	April 1, 2007	March 31, 2009	July 1, 2009	October 1, 2012
CWSs and NTNCWSs serving 10,000 - 49,999	October 1, 2007	September 30, 2009	January 1, 2010	October 1, 2013
CWSs serving fewer than 10,000	April 1, 2008	March 31, 2010	July 1, 2010	October 1, 2013
NTNCWSs serving fewer than 10,000	NA	NA	NA	October 1, 2013

*States may grant up to an additional two years for systems making capital improvements.

What technical information will be available on the rule?

The following Guidance Documents will be available:

- Initial Distribution System Evaluation (IDSE) Guidance Manual
- Operational Evaluation Guidance Manual
- Consecutive Systems Guidance Manual
- Small Systems (SBREFA) Guidance Manual
- Simultaneous Compliance Guidance Manual

Where can I find more information about this notice and the Stage 2 DBPR?

For general information on the rule, please visit the EPA Safewater website at <http://www.epa.gov/safewater/disinfection/stage2> or contact the Safe Drinking Water Hotline at 1-800-426-4791. The Safe Drinking Water Hotline is open Monday through Friday, excluding legal holidays, from 10:00 a.m. to 4:00 p.m., Eastern Time. For technical inquiries, email stage2mdbp@epa.gov.

APPENDIX D

Consumer Confidence Report, 2010

2010 Annual Drinking Water Quality Report
 City of Jackson Surface Water System
 Public Water Supply Identification Number MS0250008
 June 17, 2011

We're pleased to present to you the 2010 Annual Water Quality Report. This report is designed to inform you about the quality water and services we deliver to you every day. Our constant goal is to provide you with a safe and dependable supply of drinking water. We want you to understand the efforts we make to continually improve the water treatment process and protect our water resources. We are committed to ensuring the quality of your water. Our water sources are the Ross Barnett Reservoir and the Pearl River (surface water).

The Mississippi Department of Environmental Quality has completed their source water assessment report which is available for review by appointment at the Water / Sewer Utilities Division Office, 200 S. President Street, Room 405, between the hours of 8:00 AM and 5:00 PM Monday through Friday. Call 601-960-1007 for appointment.

This report shows our water quality and what it means.

If you have any questions about this report or concerning your water utility, please contact Don Bach, P.E. at 601-960-1007. We want our valued customers to be informed about their water utility. To participate in decisions that may affect the quality of the water, please attend any of our regularly scheduled City Council meetings. They are held every other Tuesday at either 6:00 PM or 10:00 AM within City Hall.

The City of Jackson Surface Water System routinely monitors for constituents in your drinking water according to Federal and State laws. This table shows the results of our monitoring for the period beginning January 1, 2010 and ending December 31, 2010. As water travels over the land or underground, it can pick up substances or contaminants such as microbes, inorganic and organic chemicals, and radioactive substances. All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents. It's important to remember that the presence of these constituents does not

necessarily pose a health risk. In this table you will find many terms and abbreviations you might not be familiar with. To help you better understand these terms we've provided the following definitions:

Non-Detects (ND) - laboratory analysis indicates that the constituent is not present. The test result table does not list non-detected contaminants.

Parts per million (ppm) or Milligrams per liter (mg/l) - one part per million corresponds to one minute in two years or a single penny in \$10,000.

Parts per billion (ppb) or Micrograms per liter - one part per billion corresponds to one minute in 2,000 years, or a single penny in \$10,000,000.

Picocuries per liter (pCi/L) - picocuries per liter is a measure of the radioactivity in water.

Millirems per year (mrem/yr) - measure of radiation absorbed by the body.

Nephelometric Turbidity Unit (NTU) - nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Action Level - the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

Treatment Technique (TT) - A treatment technique is a required process intended to reduce the level of a contaminant in drinking water.

Maximum Contaminant Level - The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal - The "Goal"(MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

TEST RESULTS								
Contaminant	Violation Y/N	Date Collected	Level Detected	Range of Detects or # of Samples Exceeding MCL/ACL	Unit Measurement	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants								
Total Coliform Bacteria	N	2010		0.0%		0	Presence of coliform bacteria in 5% of monthly samples	Naturally present in the environment
Fecal coliform and E. coli.	N	2010		0		0	0	Human and animal fecal waste
Total Organic Carbon (TOC)	N	2010	2.88	Removal percentage within limits	ppm	n/a	TT - 35% to 50% removal based upon untreated water TOC concentration	Naturally present in the environment
Turbidity	Y	2010	1.55 maximum	Lowest monthly percentage below 0.3 = 92.6	NTU	n/a	TT - for conventional filtration, 0.3 NTU in 95% of samples collected, 1 NTU maximum	Soil runoff
Inorganic Contaminants								
Arsenic	N	2010	0.634	0.567-0.701	ppb	0	10	Erosion of natural deposits; runoff from orchards; runoff from glass and electronics production wastes
Barium	N	2010	0.016	0.014-0.018	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium	N	2010	1.546	1.484-1.607	ppb	100	100	Discharge from steel and pulp mills; erosion of natural deposits
Copper	N	2008	0 (90 th percentile)	0	ppm	1.3	AL=1.3	Corrosion of household plumbing systems; erosion of natural deposits
Fluoride	N	2010	0.555	ND-1.86	ppm	4	4	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories
Lead	N	2008	5 (90 th percentile)	0	ppb	0	AL=15	Corrosion of household plumbing systems, erosion of natural deposits

TEST RESULTS

Contaminant	Violation Y/N	Date Collected	Level Detected	Range of Detects or # of Samples Exceeding MCL/ACL	Unit Measurement	MCLG	MCL	Likely Source of Contamination
Nitrate	N	2010	0.09	ND-0.18	ppn	1	1	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Synthetic Organic Contaminants including Pesticides and Herbicides								
Atrazine	N	2007	0.0675	0.06-0.08	ppb	3	3	Runoff from herbicide used on row crops
Disinfection Byproducts								
chloramines	N	2010	2.400	2.5-5.9	ppm	4	4	Water additive used to control microbes
Chlorine Dioxide	N	2010	35.7	ND-380	ppb	800	800	Water additive used to control microbes
Chlorite	N	2010	0.078	ND-0.86	ppm	0.8	1.0	By-product of drinking water disinfection
HAA5 (sum of 5 Haloacetic Acids)	N	2009	23.0	ND-30.0	ppb	N/A	60	By-product of drinking water chlorination
TTHM (Total trihalomethanes)	N	2009	28.0	3.4-38.6	ppb	N/A	80	By-product of drinking water chlorination

*N/A indicates that chemical is monitored for but not regulated.

All sources of drinking water are subject to potential contamination by substances that are naturally occurring or man made. These substances can be microbes, inorganic or organic chemicals and radioactive substances. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791.

Additional Information for Lead:

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Jackson is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at <http://www.epa.gov/safewater/lead>. The Mississippi State Department of Health Public Health Laboratory offers lead and copper testing for \$20 per sample. Please contact 601-576-7582 if you want to have your water tested.

Our system had some problems during 2010:

During January 2010, we exceeded the limits on turbidity. Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea and associated headaches. We have corrected this problem with better maintenance of analytical equipment and training our personnel to better respond to analytical data.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care

providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

Please call our office if you have questions.

We ask that all our customers help us protect our water sources, which are the heart of our community, our way of life and our children's future.

Water System User Charge Notification

Your water use charge is \$2.48/100 cubic feet if you are within the City Limits, \$4.96/100 cubic feet if you are outside the City Limits but within 1 mile of the City Limits and \$1.48/100 cubic feet if you are more than 1 mile outside of the City Limits. 65% of this charge is used for operations and maintenance of the water system. 35% of this charge is used for debt retirement.

Water Conservation Tips

Water conservation measures are an important first step in protecting our water supply. Such measures not only save the supply of our source water, but can also save you money by reducing your water bill. There are a few suggestions:

Conservation measures you can use inside your home include:

- Fix leaking faucets, pipes, toilets, etc.
- Replace old fixtures and install water -saving devices in faucets, toilets and appliances.
- Wash only full loads of laundry.
- Do not use the toilet for trash disposal.
- Take shorter showers.
- Do not let the water run while shaving or brushing teeth.
- Soak dishes before washing.
- Run the dishwasher only when full.

You can conserve outdoors as well:

- Water the lawn and garden in the early morning or evening.
- Use mulch around plants and shrubs.
- Repair leaks in faucets and hoses.
- Use water from a bucket to wash your car and save the hose for rinsing.

Information on other ways you can help conserve water can be found at www.epa.gov/safewater/publicoutreach.

APPENDIX E

O.B. Curtis Water Treatment Plant Lab Data Summary, 2007-2010

SUMMARY OF O.B. CURTIS WATER TREATMENT PLANT LABORATORY DATA

Water quality data for the O.B. Curtis Water Treatment Plant were collected and recorded on lab sheets. These data were reviewed and the results are displayed on the following plots, with the exception of total organic carbon (TOC). Results of the analyses show what appears to be a change in the character of the data (from January 2004 through October 2009) beginning in early 2007. Therefore, data from prior to 2007 were excluded from analysis. Time-series plots of turbidity, color, alkalinity, iron, total manganese, and dissolved manganese exhibit apparent seasonal patterns. The time-series plot of pH does not appear to exhibit a strong seasonal pattern.

A tree analysis process was used to identify the months with water quality that was most similar, and the results are summarized in Table E.1. Iron and color appear to have similar seasonal patterns, and alkalinity has a seasonal pattern that is the inverse of the pattern for iron and color. These patterns are different from the patterns of manganese and turbidity, which are also different from each other.

Table E.1. Results of tree analyses.

Parameter	Months	Number of Values	Mean Value
Alkalinity	Jan – May	195	15.4
	Jun – Dec	288	21.0
Color	Jan – May	197	202.5
	Jun – Dec	289	81.9
Iron	Jan – May	180	0.08
	Jun – Dec	282	0.03
Dissolved Manganese	Sep – Feb	192	0.060
	Mar – Aug	281	0.165
Total Manganese	Sep – Feb	192	0.138
	Mar – Aug	289	0.266
Turbidity	Jan – Feb	74	17.1
	Mar – Apr	83	28.7
	May – Dec	325	7.4

Plotting the parameters against each other indicated that there are strong correlations between several of the parameters, including a seasonal component. These correlations were investigated using multiple linear regression analysis, which confirmed the existence of

statistically significant relationships among the parameters. Results of the regression analyses are summarized in Table E.2. The plots used in the analysis have been included as Figures E.1 through E.3. In an attempt to characterize the seasonality of the data, the data were also plotted by Julian day (see Figure E.2), and as box-and-whisker plots by month (see Figure E.3).

Table E.2. Results of multiple linear regression analyses.

Dependent	Independent	Coefficient	p value	R Squared
Color	Turbidity	2.1	0.000	0.622
	Alkalinity	-9.2	0.000	
	pH	-0.7	0.862	
	Iron	418.9	0.000	
	Month	-2.9	0.025	
	Constant	285.6	0.000	
Iron	Turbidity	0.001	0.000	0.363
	Alkalinity	-0.001	0.001	
	Total Manganese	0.033	0.001	
	Month	-0.004	0.000	
	Constant	0.08	0.000	
Total Manganese	pH	0.041	0.000	0.729
	Dissolved Manganese	1.234	0.000	
	Month	0.003	0.032	
	Iron	0.401	0.003	
	Constant	-0.266	0.000	
Turbidity	Alkalinity	-1.011	0.000	0.376
	pH	2.705	0.000	
	Iron	123.0	0.000	
	Constant	6.787	0.199	

The results of the regression analyses suggest the following:

- Iron appears to contribute to both color and turbidity, while manganese does not.
- Iron and manganese are related, suggesting that they respond similarly to water conditions.
- Buffering capacity, alkalinity and pH, appear to influence iron and manganese.
- Seasonality influences color, iron, and manganese, but not so much turbidity.

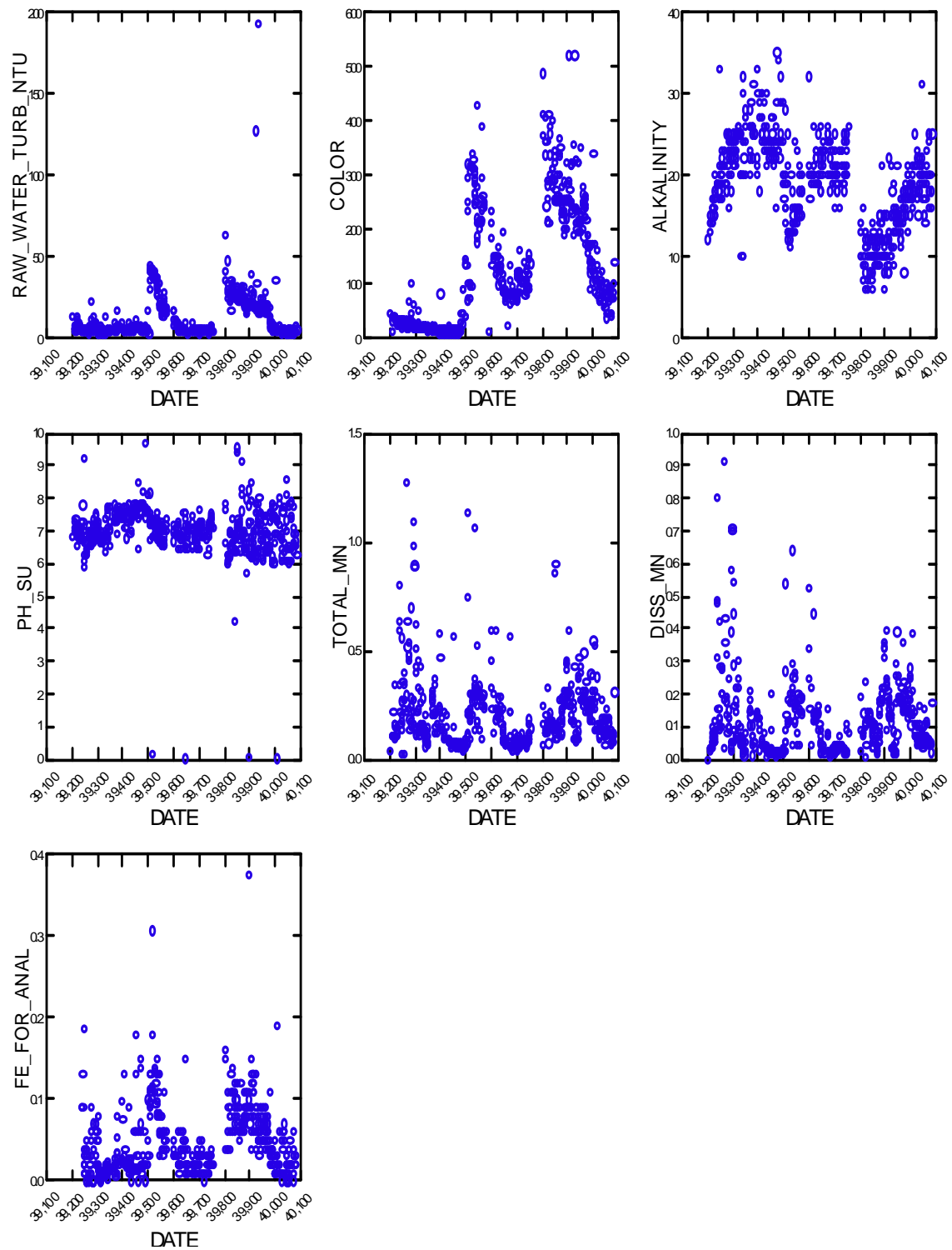


Figure E.1. Time-series plots of data from O.B. Curtis Water Treatment Plant lab sheets from 2007 through 2009.

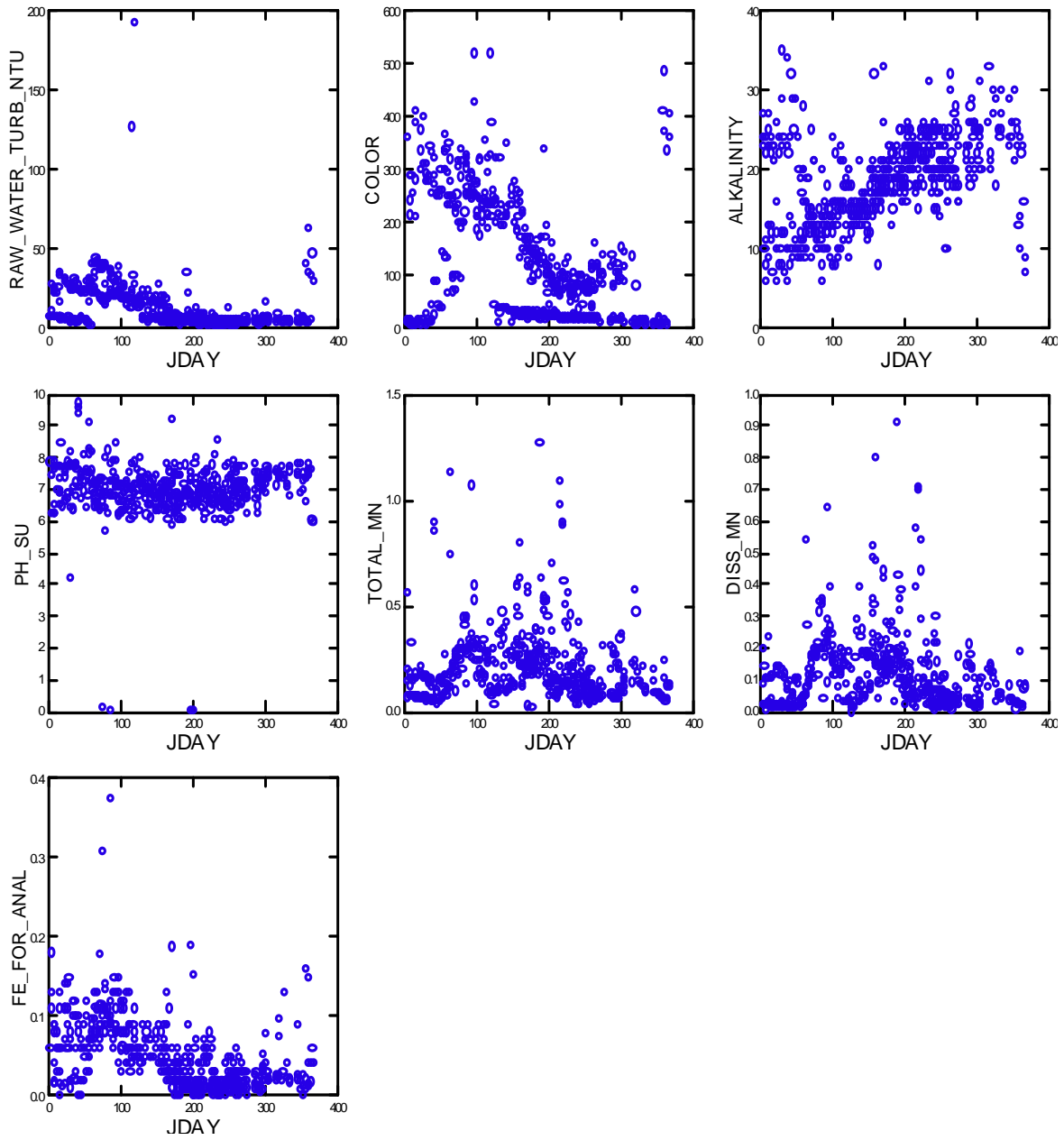


Figure E.2. Data from O.B. Curtis Water Treatment Plant lab sheets, plotted by Julian Day.

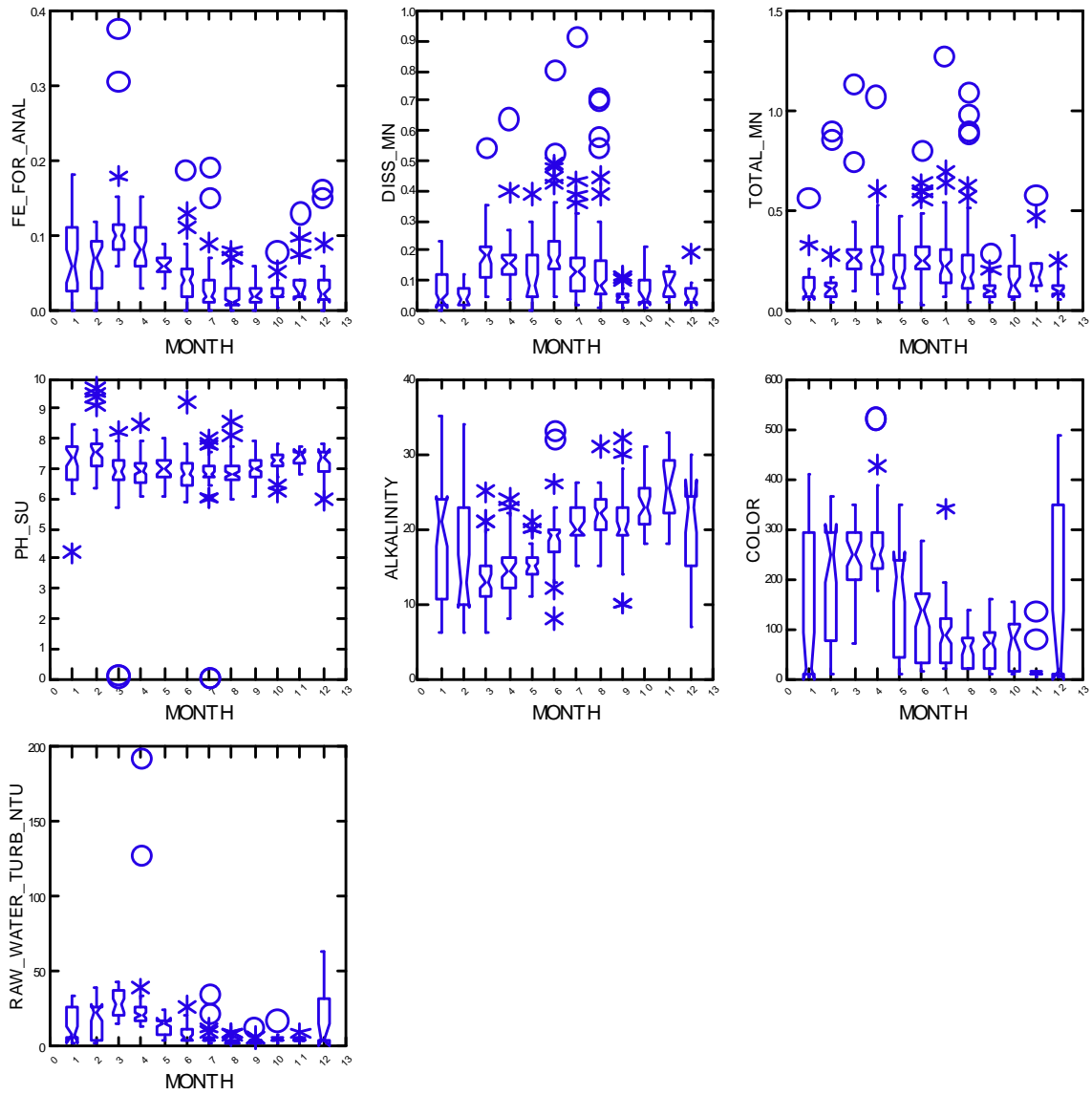


Figure E.3. Box-and-whisker plots of the data from the O.B. Curtis Water Treatment Plant lab sheets.

In summary:

- The raw water quality has changed over the period from 2004 through 2009.
- The parameters measured exhibit seasonal variability, except pH.
 - For alkalinity and manganese, highest concentrations occur during the summer.
 - For color, iron, and turbidity, highest levels occur during the winter and/or spring.
 - Seasonal variability of turbidity is less strong than that for the other parameters.
- Iron may contribute to both color and turbidity.
- Iron and manganese appear to respond similarly to water conditions.
- Iron and manganese may be influenced by water buffering capacity.

A comprehensive summary of the monitoring activities that have occurred in the Reservoir and its watershed is provided in the *Water Quality Monitoring Plan for the Ross Barnett Reservoir and its Watershed*. The drinking water goals of the Water Quality Monitoring Plan are to track water quality constituents related to drinking water treatment issues identified by the City of Jackson O.B. Curtis Water Treatment Plant, and be able assess the status and trends over space and time in the Reservoir of suspended sediment, anoxia, algae, and total organic carbon (TOC). A recommendation for annual late spring water quality sampling at the OB Curtis Intake for the parameters associated with pre-emergent and emergent herbicides is presented in Section 4.7 of the Water Quality Monitoring Plan. Additional goals and performance measures that would also have a beneficial impact on the Reservoir are discussed in the Water Quality Monitoring Plan.

APPENDIX F

**Summary of O.B. Curtis Water Treatment Plant
Reporting Routine and Results**

SUMMARY OF O.B. CURTIS WATER TREATMENT PLANT MONITORING AND REPORTING REQUIREMENTS

The City of Jackson O.B. Curtis Water Treatment Plant complies with the monitoring and reporting requirements as stipulated by the US Environmental Protection Agency's (EPA's) National Primary Drinking Water Regulations, under the authority of the Mississippi State Department of Health (MSDH). The reporting routine includes monthly operating reports, biennial inspection reports, and Consumer Confidence Reports (CCRs), as well as a laundry list of routine operating reports. The following list of reports must be maintained onsite and made available to MSDH personnel upon request:

- Bacti site plan with map & bacteriological sampling results,
- Policy and procedures for operating the system,
- Other water quality analyses,
- Approved lead and copper site plan,
- Inspection reports,
- Annual operating agreement,
- Annual report,
- Operator's log book,
- Monthly operating reports,
- Actions taken by system to correct violations, and
- All MSDH correspondence.

A summary of the monitoring requirements currently in place is included below.

Table F.1. Monitoring routine.

No. of Samples	Frequency	Type	Location	Purpose
3	Monthly	Chlorite	Distribution system	SDWA
8	Quarterly	Disinfection and disinfection byproducts	Distribution system	SDWA, plant operators
50	Every 3 years	Lead/copper	Distribution system and at residences	SDWA

No. of Samples	Frequency	Type	Location	Purpose
1	Monthly	Total organic carbon (TOC), alkalinity	Intake	SDWA, plant operators
1	Year ¹	Cyanide	Finished water prior to distribution	SDWA
1	Monthly	TOC	Finished water prior to distribution	SDWA
1	Year ¹	Inorganic chemicals (IOCs)	Finished water prior to distribution	SDWA
1	Year ¹	Nitrate	Finished water prior to distribution	SDWA
1	Every 6 years	Volatile organic chemicals (VOCs)	Finished water prior to distribution	SDWA
1	Every 3 years ²	Synthetic organic chemicals (SOCs)	Finished water prior to distribution	N/A
120	Monthly ³	Bacteria	Distribution system	SDWA, plant operators
1	Every 6 years ¹	Radionuclides	Finished water prior to distribution	SDWA
Continuous	Continuous	Turbidity	Source water through finished water	Plant operators

Notes:

- (1) Based on previous monitoring results, decreased frequency is required.
- (2) City monitors every 3 years for all SDWA chemicals, but it is not required.
- (3) Total coliform requirements are based on population; turbidity measured beyond filters indicates removal of cryptosporidium.

APPENDIX G

Total Maximum Daily Load Reports

TOTAL MAXIMUM DAILY LOAD REPORTS IN THE ROSS BARNETT RESERVOIR WATERSHED

Total maximum daily load (TMDL) reports have been completed for several waterbodies in the watershed. Table G.1 lists the TMDLs in the Reservoir watershed, including the waterbody and the pollutant. With the exception of Pelahatchie Creek, Fannegusha Creek, and Cane Creek, the identified waterbodies are not located within the primary protection area (PPA), but are located in the secondary protection area of the Source Water Protection Area (SWPA). The presence of these TMDLs indicates water quality issues in the watershed that warrant consideration in source water protection.

The Mississippi Department of Environmental Quality (MDEQ) developed TMDLs for pathogens, nutrients, and sediment for Pelahatchie Creek. The pathogen TMDL was developed based on fecal coliform sampling data, and specifies 30% reductions in the summer months (May – October) and 27% reductions (November – April) in the winter. The TMDL cites wastewater treatment facilities permitted under the National Pollutant Discharge Elimination System (NPDES), grazing cattle, application of poultry litter to pasture land, failing septic systems, urban areas, and wildlife as potential sources of the pollutants (MDEQ 2009a). The nutrient TMDL for Pelahatchie Creek calls for a 60% reduction in total phosphorus from nonpoint sources. The TMDL suggests that the specified reduction in total phosphorus could be achieved through reduction in point sources of total phosphorus and implementation of best management practices (BMPs) to reduce nonpoint sources. MDEQ also recommends quarterly monitoring of total nitrogen levels from NPDES permitted point sources that discharge into Pelahatchie Creek (MDEQ 2009b).

Table G.1. TMDLs in the Ross Barnett Reservoir watershed.

Waterbody	Pollutant	Approval Date
Bogue Chitto Creek	Organic enrichment/low DO	Nutrients: December 18, 2008
	Sediment	March 25, 2009
	Legacy pesticides	January 4, 2007
Cane Creek	Sediment	March 25, 2009
Coffee Bogue Creek	Pathogens	December 18, 2008
	Organic enrichment/low DO and nutrients	March 25, 2009
	Sediment	March 25, 2009
Conehatta Creek	Sediment	March 25, 2009
Conehoma Creek	PCBs	January 13, 2004
Eutacutachee Creek	Sediment	March 25, 2009
	Organic enrichment/low DO and nutrients	June 2009
Fannegusha Creek	Sediment	June 28, 2004
	Pathogens	March 2009
Hughes Creek	Sediment	March 2009
Hughes Creek	Nutrients, ammonia toxicity, organic enrichment/low DO	June 2009
Hurricane Creek	Sediment	June 28, 2004
Lobutchka Creek (upper and lower)	Pathogens	December 15, 1999
Lobutchka Creek	Sediment	March 25, 2009
Nanah Waiya Creek	Organic enrichment/low DO and nutrients	December 18, 2008
	Legacy pesticides	December 18, 2008
	Pathogens	December 15, 1999
	Sediment	March 25, 2009
Noxapater Creek	Organic enrichment/low DO and nutrients	December 18, 2008
	Legacy pesticides	January 4, 2007
	Sediment	March 25, 2009
Pearl River	Nutrients	June 29, 2009
	Pathogens	December 15, 1999
	Sediment	March 25, 2009
Pearl River (Copiah, Hinds, Rankin, and Simpson)	Legacy pesticides	January 4, 2007
Pearl River (Leake and Neshoba)	Legacy pesticides	January 4, 2007
Pearl River (Leake, Madison, Rankin, and Scott)	Legacy pesticides	January 4, 2007
Pearl River	Mercury	January 12, 2004
Pelahatchie Creek	Pathogens	March 2009
	Legacy pesticides	January 4, 2007
	Sediment	March 25, 2009
	Nutrients	June 2009

Table G.1. TMDLs in the Ross Barnett Reservoir watershed (continued).

Waterbody	Pollutant	Approval Date
Pinishook Creek	Pathogens	December 15, 1999
	Sediment	March 25, 2009
Red Cane Creek	Sediment	June 28, 2004
Shockaloo Creek	Organic enrichment/low DO and nutrients	June 29, 2009
	Pathogens	December 18, 2008
	Sediment	March 25, 2009
Standing Pine Creek	Pathogens	December 15, 1999
Tallabogue Creek	Organic enrichment/low DO and nutrients	June 29, 2009
	Sediment	March 25, 2009
Tallahaga Creek	Sediment	March 25, 2009
	Pathogens	December 15, 1999
Tibby Creek	Pathogens	December 18, 2008
Tuscolameta Creek	Organic enrichment/low DO and nutrients	June 29, 2009
	Sediment	March 25, 2009
Yockanookany River	Mercury	January 12, 2004
	Polychlorinated biphenyls (PCBs)	January 13, 2004

The sediment TMDL developed for Pelahatchie Creek and Cane Creek specifies a target sediment load for stable streams at the 1.5-year peak flow (effective discharge) in the Southeastern Plains ecoregion. The allowable load is specified as a range of allowable yields (tons per acre per day) at the effective discharge. Sources of sediment include upland sources from activities such as land development in urban (MS4-regulated) areas, forest harvesting, and stream-channel processes such as bank failure. The TMDL recommends reductions in sediment loads from MS4 regulated urban areas and construction sites through the use of BMPs (MDEQ 2009c). Similarly, the sediment TMDL for Fannegusha Creek specifies an allowable sediment yield at the effective discharge. Sediment sources in Fannegusha Creek include runoff from agricultural and silvicultural activities, as well as from stream-channel processes (MDEQ 2004).

The pathogen TMDL for Fannegusha Creek specifies pathogen reductions of 73% in the summer months and 44% in the winter. The TMDL cites NPDES-permitted wastewater treatment facilities, grazing cattle, poultry litter, failing septic systems, urban areas, and wildlife as potential sources (MDEQ 2009d).

APPENDIX H

Summary of Natural Resources Conservation Service Programs in Mississippi

SUMMARY OF NATURAL RESOURCES CONSERVATION SERVICE PROGRAMS IN MISSISSIPPI

The following is a listing of Natural Resources Conservation Service (NRCS) programs¹ in Mississippi:

- Agricultural Water Enhancement Program,
- Grassland Reserve Program,
- Conservation Innovation (CIG) Grants,
- Grazing Lands Conservation Initiative,
- Conservation of Private Grazing Lands,
- Healthy Forests Reserve Program,
- Conservation Reserve Program (CRP) (with the Farm Service Agency),
- Mississippi Outreach Initiative,
- Conservation Stewardship Program(CSP),
- Mississippi Organic Growers Program,
- Conservation Technical Assistance ,
- Resource Conservation and Development Program,
- Emergency Watershed Protection,
- Soil Survey Programs,
- Environmental Quality Incentives Program (EQIP),
- Watershed Protection and Flood Prevention,
- Farm and Ranch Lands Protection Program,
- Wetlands Reserve Program,
- Floodplain Easement Program, and
- Wildlife Habitat Incentives Program.

¹ <http://www.ms.nrcs.usda.gov/programs/>

Table H.1. Acres subject to active CRP contracts in March 2010.

County	Total Acres Under Active CRP Contract March 2010
Attala	14,516
Choctaw	7,345
Hinds	28,250
Kemper	8,763
Leake	6,988
Madison	32,309
Neshoba	4,307
Newton	7,515
Scott	9,838
Winston	8,094
Total	127,924

Source: <http://www.fsa.usda.gov/>

Table H.2. EQIP funding priorities for 2010.

County	Resource Concerns and Percent EQIP Funds					TOTAL
	Forestry	Grazing	Water Quantity	Sedimentation	Animal Waste	
Attala	20.0	40.0	5.0	30.0	5.0	100%
Choctaw	24.0	30.0	20.0	16.0	10.0	100%
Hinds	5.0	30.0	0.0	60.0	5.0	100%
Kemper	40.0	50.0	0.0	5.0	5.0	100%
Leake	10.0	25.0	0.0	10.0	55.0	100%
Madison	10.0	40.0	0.0	45.0	5.0	100%
Neshoba	20.0	40.0	0.0	5.0	35.0	100%
Newton	20.0	30.0	0.0	10.0	40.0	100%
Rankin	25.0	30.0	0.0	5.0	40.0	100%
Scott	20.0	30.0	0.0	10.0	40.0	100%
Winston	25.0	35.0	5.0	5.0	30.0	100%

Source: <http://www.ms.nrcs.usda.gov/programs/2010StatewideEQIPProgram.html>

APPENDIX I

Fact Sheets for Selected Best Management Practices

Riparian Buffer/ Vegetated Buffer



Description

Riparian buffers are natural or constructed low-maintenance ecosystems adjacent to surface waterbodies, where trees, grasses, shrubs, and herbaceous plants function as a filter to remove pollutants from overland stormwater flow and shallow groundwater flow prior to discharge to receiving waters. Maintaining a vegetated buffer along creeks, streams, and rivers provides an attractive landscape and can improve water quality by removing sediment and chemicals before they reach the waterway. In addition, buffers provide flood control, help recharge groundwater, prevent soil erosion, and preserve or improve certain types of wildlife habitat.

The primary objective of the buffer strip should be determined prior to design. Various objectives might include protection of water quality, streambank stabilization, downstream flood attenuation, or provision of wildlife habitat or movement corridors.

Design Considerations

- The width, length, and plant composition of a buffer will determine its effectiveness, and should be based on the objective of the buffer strip.
- Stormwater flow to buffer should generally enter as sheet flow.
- Slope of buffer should not be greater than 6%.
- Level spreaders are required if flow to buffer is concentrated.
- An effective urban riparian buffer design consists of three preservation zones. Zone 1 is on the stream or shoreline side and includes undisturbed forest to provide shade and stabilize banks. Zone 2 is the middle zone and should also be forested, but limited clearing is acceptable as well as passive recreational uses. Zone 3 is the outer zone, which is the buffer between the forested zones and development. This zone provides initial removal of pollutants.
- Establishing continuous riparian forest buffers in the landscape should be given a higher priority than establishing fragmented buffers. Continuous buffers provide better stream shading and water quality protection, as well as corridors for the movement of wildlife.
- Detailed design information and requirements for riparian/vegetated buffers are available in the *Planning and Design Manual for the Control of Erosion, Sediment, and Storm Water*, Volume 2: Stormwater Runoff Management Manual. This



Source: Paxton Creek Watershed & Education Association

publication is available from the Mississippi Department of Environmental Quality and online at <http://www.deq.state.ms.us>.

Implementation

- Urban retrofit.
- New development (preservation of existing buffers).
- Pasture and row-crop areas that border perennial streams or drainage channels.

Revegetated riparian buffers can be installed along the bank of any stream, creek, or waterbody within the watershed. The plantings should be native species that will thrive in the local climate where installed.

Pollutant Removal Efficiency

Placement of the buffer strip within the watershed will determine its effectiveness. Buffers installed higher within the watershed are more effective at removing pollutants. The efficiencies given in the table are considered “average” values of efficiency.

Pollutant	Efficiency
Total Suspended Solids (TSS)	60%
Total Nitrogen	30%
Total Phosphorus	35%

Riparian Vegetation for the Reservoir Watershed

Native species of shrubs, trees, and grasses should be used for revegetation of riparian buffers. Native vegetation is adapted to survive in the climate and soil conditions of Mississippi and requires less maintenance (fertilizer, watering, etc). Recommended vegetative plantings for the areas nearest to streams (Zone 1) include the following non-woody species: switchgrass (*Panicum virgatum*), soft rush (*Juncus effusus* and *Juncus* spp.), soft stem bulrush (*Scirpus validus*), maidencane (*Panicum hemitomom*), and water willow (*Dianthera americana*). Suitable woody trees and shrubs are numerous and include willow (*Salix* spp.), cypress (*Taxodium distichum*), overcup oak (*Quercus lyrata*), pin oak (*Quercus palustris*), Nuttall oak (*Quercus texana*), red maple (*Acer rubrum*), sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), water tupelo (*Nyssa aquatica*), green ash (*Fraxinus pennsylvanica*), and sweetbay magnolia (*Magnolia virginiana*). Suitable shrub species include buttonbush (*Cephalanthus occidentalis*), common alder (*Alnus serrulata*), elderberry (*Sambucus canadensis*), red chokeberry (*Aronia arbutifolia*), Virginia sweetspire (*Itea virginica*), deciduous holly (*Ilex decidua*), and nonflowering dogwood (*Cornus amomum* and *C. foemina*). Rose mallow (*Hibiscus moscheutos*) is a non-woody perennial that is shrub-like in appearance and provides large colorful flowers. Trees for areas farther away from the shoreline include all of those listed above; these tree species are especially tolerant of root flooding for long periods but will also thrive further from the shoreline. The Mississippi State University Extension Service has developed the following excellent guides for selecting appropriate native vegetation: *Native Trees for Mississippi Landscapes* and *Native Shrubs for Mississippi Landscapes* (Brzuszek 2007a, 2007b). The University of Georgia

Marine Extension Service has developed a list of plants appropriate for riparian buffer restoration. Many of the trees, shrubs, and grasses listed in this publication (University of Georgia Marine Extension Service, no date) will most likely be effective for the Reservoir watershed.

Whether riparian buffers should be revegetated with trees or grasses is a question of ongoing discussion. Both grass and forest buffers can reduce levels of nutrients and sediments from surface runoff, and reduce levels of nitrates from subsurface flows. Grass buffers are more quickly established, and in terms of sediment removal, may offer greater stem density to decrease the velocity of water flow and provide greater surface area for sediments to be deposited. Forested buffers, though, offer the advantage that the woody debris and stems may offer greater resistance and are not as easily inundated, especially during heavy floods (US Environmental Protection Agency [EPA] Chesapeake Bay Program Forestry Work Group 1993). Higher rates of denitrification are often observed in forested buffers, presumably due to the greater availability of organic carbon and interactions which occur between the forest vegetation and the soil environment (Lowrance et al. 1995; Correll 1997).

Cost

Planting costs depend on geographic location, number of acres planted, number of trees planted per acre, species of trees, and whether or not the trees are from bare root or container stock. Grass buffers tend to cost less than forest buffers to plant and maintain.

Cost-share and incentive programs exist for the preservation of riparian buffers, for the removal of riparian areas from agriculture production, and for riparian restoration. The US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) is usually the lead federal agency. The programs are typically available in agricultural areas; there are no known cost-share programs in urban areas. Known cost-share/incentive programs include Conservation Reserve Program, the Wetland Reserve Program, and the US Fish and Wildlife Service's Partners for Fish and Wildlife Program.

Benefits

- Offers numerous aesthetic and passive recreational benefits.
 - Provides water quality treatment, erosion control, and water temperature benefits.
 - Builds support for greenways within riparian buffers in urban and suburban watersheds by maintenance of trails that are well-constructed, well-marked, and well-signed.
 - Creates shade, which improves the habitat for aquatic organisms.
 - Stabilizes the shoreline and eroding stream banks.
 - Has low maintenance requirements once established.
 - Can increase property values.
 - Provides food and habitat for wildlife.
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Limitations

- Sometimes seen as unkempt public areas.
- Can be perceived as interfering with views of streams, especially with shrubby bank-side vegetation.
- In the worst cases, can be abused as places for dumping trash and litter.
- May require development and adoption of an ordinance for urban application.
- Will not repair damaged shorelines.
- May obstruct views of the Reservoir.
- Urban runoff can concentrate rapidly from paved areas and cut across the buffer as channel flow, eliminating the intended function of passing through the buffer.

Maintenance

- Inspect buffer at least annually for signs of erosion, sediment buildup, or vegetation loss.
- If a meadow buffer, provide periodic mowing as needed to maintain a healthy stand of herbaceous vegetation.
- If a forested buffer, then the buffer should be maintained in an undisturbed condition, unless erosion occurs.
- If erosion of the buffer occurs, eroded areas should be repaired and replanted with vegetation similar to the remaining buffer. Corrective action should include eliminating the source of the erosion problem, and may require retrofit with a level spreader.
- Remove debris and accumulated sediment, based on inspection.

Education and Outreach

The target audience for this practice is developers and decision-makers involved with landscape-scale stormwater issues. Developers should be encouraged to include riparian buffers in the design for retrofit projects as well as to maintain existing buffers in undeveloped areas. Opportunities to present information about this practice include collaborative training and workshops and the green infrastructure (GI) incentive program. Decision-makers include city and county government officials who approve stormwater management plans. This group will be educated about riparian buffers through participation in the watershed team and stormwater management training. Education of officials is vital to preventing delays or difficulties in the permit approval process that may occur when GI practices are used in place of conventional practices. Property owners will be encouraged to use restored riparian buffers in model retrofit projects.

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Source Water Protection Overlay District

Description

Source Water Protection Overlay Districts are intended to provide protection to public water supply reservoirs through regulation of land uses and development within the designated Primary Protection Area of the drainage area.

Design Considerations for Overlay District

- Consider water quality attributes for planned developments
- Consider / encourage green infrastructure and low impact developments
- Consider innovative development designs such as mixed uses and compacted communities

Considerations for Exclusions from Overlay District

- New point source discharges
- Commercial or industrial development (i.e. service stations, junkyards, dry-cleaning)
- Commercial or industrial land uses that generate, store, or dispose of hazardous wastes
- Above ground or underground petroleum storage tanks
- Solid waste disposal facilities
- Confined animal feeding operations
- Golf course
- Cemeteries
- Individual on-site waste disposal systems

Implementation

- Adoption by all municipal governments within the designated Primary Protection Area.
- Incorporation into permitting, planning, development review policies.

Pollutant Removal Efficiency

- Restricted uses in the Overlay District will prevent potential contaminants from reaching the Reservoir without adequate time to protect the water supply.
 - An Overlay District will also reduce the risk of accidental spills.
-

Cost

- The cost of developing an Overlay District is dependent on many factors such as the size of the area and the extent of the restrictions. Costs would include development and consultant costs for coordination and implementation and cost for enforcing restrictions.

Benefits

- Reduces potential contaminant spills in the immediate area of the Reservoir.
- Protects the drinking water supply.

Limitations

- Multiple municipal governments must cooperate.
- Additional level of regulatory measures must be adopted and applied to the development review processes in place.

Maintenance

- Unique design elements may require adjustments to routine maintenance policies and procedures.

References

Information in the factsheet is adapted from:

EPA Stormwater Menu of BMPs. Development Districts. January 2008.

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/>

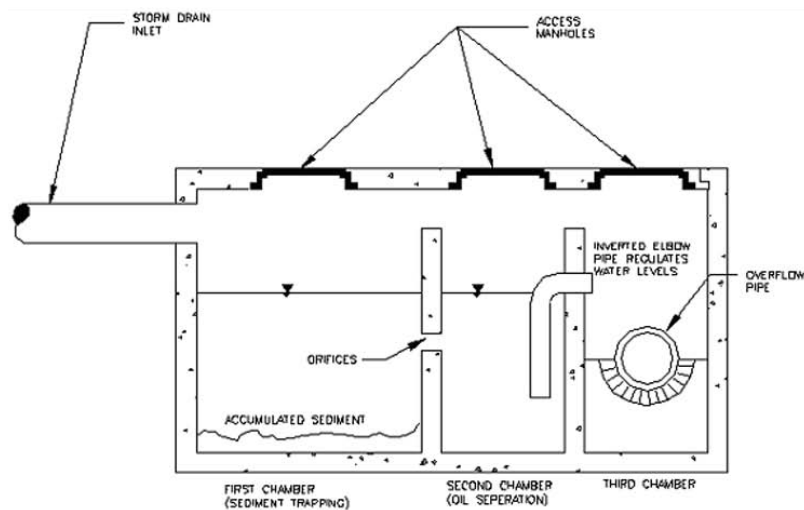
EPA Model Surface Water Ordinance.

http://www.stormwatercenter.net/Model%20Ordinances/Surface_water_%20Protection/Model%20Surface%20Water%20Ordinance.htm

Secondary Containment Structures

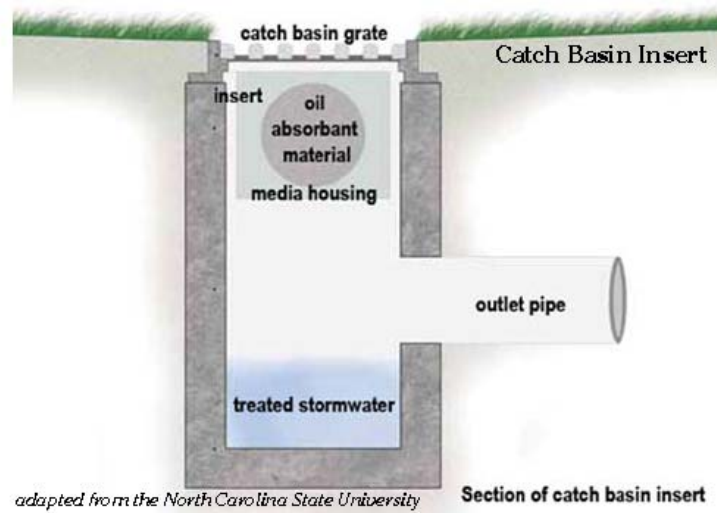
Description

Secondary containment refers to a risk management measure that provides a secondary container as a backup to a primary container for the purpose of providing adequate volume capacity to contain a spill from the primary container. Examples of secondary containment structures are oil retaining catch basins, containment dikes, berms, or curbing for above ground storage tanks, or impervious surfaces for tank placement.¹

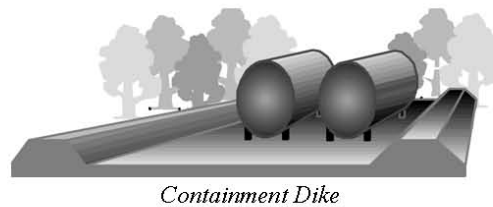
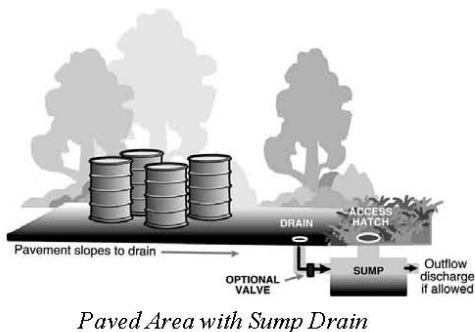


Oil-Sediment Removal System. Source: Massachusetts Stormwater Handbook.

¹ Note: This fact sheet does not address Federal Oil Pollution Prevention Regulation, Title 40 Code of Federal Regulations (CFR) Part 112, which includes the Spill Prevention Control and Countermeasure (SPCC) Plan requirements and the Facility Response Plan (FRP) requirements.



Catch Basin Insert. Source: Massachusetts Stormwater Handbook



Source: King County, WA, Stormwater Pollution Prevention Manual

Design Considerations

- Secondary containment areas should be designed, maintained and constructed in accordance with sound engineering practices.
- Containment structures should be designed and constructed to provide adequate storage to contain a spill from a primary container and provide a barrier.
- Containment structures should be designed with impermeable materials, or if an earthen dike is used it may require special maintenance of vegetation.

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- Oil-retaining catch basins or oil/grit separators should be utilized where space is limited.
 - Most containment structures are suitable for urban, commercial, and transportation areas.
 - Paving materials used in containment should be considered with regard to how they react to the contaminant stored.

Implementation

Secondary containment is a management practice to be considered where above ground storage tanks are in place, or proposed, and in parking areas where oil and grease is likely to be transported by stormwater.

- Urban/commercial retrofit
- New commercial development

Pollutant Removal Efficiency*

Total Suspended Solids (TSS)	25% - 50%
Total Nitrogen	5%
Total Phosphorus	5%
Metals	Insufficient data
Pathogens (coliform, e coli)	Insufficient data

*Oil/Grit Separator

Cost

The cost of constructing containment structures varies greatly due to the type of structure and the size requirements of the structures.

Benefits

- Applicable to small drainage areas.
- Good for highly impervious areas, particularly parking lots.
- Good retrofit capability.
- Curbing and catch basins have relatively low installation costs.

Limitations

- Regular and routine maintenance is required.
 - Poor maintenance can render the secondary containment useless.
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- Proper disposal of collected pollutants is required.
 - Not suitable for large drainage areas.
 - Earthen berms used for containment are subject to erosion and may require frequent rebuilding.
 - Evidence suggests the Oil/Grit separator pollutant removal performance is extremely limited and susceptible to flushing during large storm events.

Maintenance

- Systems should be inspected regularly, and following rainfall events, with maintenance or rehabilitation conducted as warranted by such inspection.
- Trash and debris should be removed at each inspection and disposed of properly.

Education and Outreach

The target audience for this practice is commercial developers and property owners with existing above ground storage tanks. Developers should be encouraged to include containment structures into their design for retrofit and new projects. Opportunities to present information about this practice include collaborative training and workshops discussed in the Watershed Restoration and Protection Plan.

Documentation about this BMP should be provided to above ground storage tank (AST) owners. Owners and current locations of ASTs were identified in the Source Water Assessment.

References

Information in the fact sheet is adapted from:

King County Stormwater Pollution Prevention Manual, Chapter V: BMP Info Sheets.
January 2009

Massachusetts Stormwater Handbook, Volume 2, Chapter 2: Stormwater Best Management Practices (BMPs). February 2008.

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EPA NPDES Stormwater BMPs:

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=77&minmeasure=5

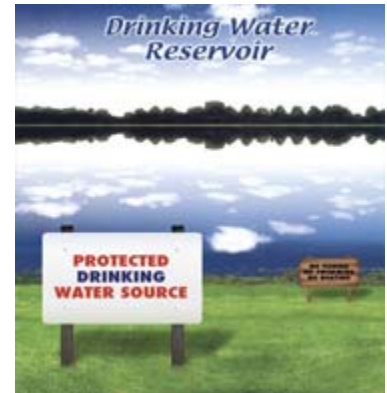
Source Water Protection Education

Description

Protecting drinking water sources is a shared responsibility and requires cooperation of all people living within the watershed. Education is needed to provide a general understanding of the need for source water protection and educate citizens about how to identify potential contaminant sources that could impact the Reservoir.

Educational Focus

- **Be Informed:** Read the annual Consumer Confidence Report, the Source Water Assessment to identify the potential threats to the water source water and to understand the role of the Primary Protection Area and its location.
- **Be Observant:** Review local media for activities that may pollute your drinking water. Know your local utility vehicles, routines, personnel. Report suspicious vehicles, activity to the law enforcement personnel.
- **Be Involved:** Attend public meetings, ask questions, and volunteer. Form/participate in a watershed group or a citizens watch network.
- **Don't Contaminate:** Participate in recycling programs where available, reduce pesticide use, keep pollutants away from the boat marinas, do not litter.



Source: EPA Source Water Protection

Implementation

All affected governmental entities in the watershed must collaborate with the local citizens and businesses, especially in the Primary Protection Area, to make them aware, to make information available, and to encourage participation and involvement in addressing water quality and actively protecting the Reservoir. Educational opportunities can include conferences, seminars, outdoor events (such as WaterFest), displays at public facilities, pamphlets, mailings, billboards and signs.

Cost

The cost of media campaigns and education/outreach materials will vary depending on the type of program to be developed.

Benefits

- Create educated citizens that will lead Reservoir protection opportunities within the location communities.
- Improve water quality and the health of the watershed.
- Education and collaboration can reduce conflicts.

Limitations

- Messages must be developed carefully so that they are clearly understood by the targeted audience.
- Establishing local partnerships and leadership can be a slow process.

References

Information in the factsheet is adapted from:

EPA NPDES Menu of BMPs. Educational Displays, Pamphlets, Booklets, and Bill Inserts. May 2006. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/>

EPA NPDES Menu of BMPs. Municipal Employee Training and Education. October 2008. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/>

EPA NPDES Menu of BMPs. Using the Media. May 2006. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/>

EPA Source Water Protection, Source Water Protection. October 2006. <http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/index.cfm>

EPA Source Water Protection, Citizen Involvement in Source Water Protection. January 2011. <http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/citizeninvolvementinsourcewaterprotection.cfm>

Street Cleaning

Description

Roads can accumulate significant amounts of pollutants that can directly reach streams and reservoirs through direct runoff and storm drain systems. Pollutants include sediment, debris, trash, road salt, and trace metals. Street sweeping improves the aesthetics of roadways and well as decreasing accumulation and transport of pollutants.

Design Considerations

There are 3 types of street sweepers and each has its own advantages and disadvantages, price and personal preference are the primary selection criteria.



Source: Center for Sustainable Design, Mississippi State University

- Mechanical: rotating brooms force debris from street into hoppers. Effective on coarse particles.
- Regenerative Air: rotating brooms with forced air and a high-power vacuum. Effective in removing fine particles and the associated pollutants attached.
- Vacuum Filter: high powered vacuum combined with rotating brooms. Effective on fine particles. Some use water to control dust and others include dry continuous filtration system.

Implementation

An effective street sweeping program should be developed incorporate a reasonable schedule and to consider the effectiveness.

Pollutant Removal Efficiency

Street sweeping can be an effective measure in reducing pollutants in stormwater runoff. During the year 2000, the Department of Highway Services and Bethesda Urban Partnership in Montgomery County, Maryland swept approximately 14,373 miles of roadways and removed 2,464 tons of materials (Curtis, 2002). Decreasing the amount of pollutants in roads before they are picked up by stormwater runoff reduces pollutants in surface waters.

Pollutant	Efficiency*
Total Suspended Solids (TSS)	5% - 79%
Total Nitrogen	4% - 62%
Metals	Insufficient data

*Depending on Sweeper Equipment Used

Applicability in the Primary Protection Area

Decreasing the amount of pollutants in roads before they are transported by stormwater runoff reduces pollutants entering the surface waters.

Cost

Street sweeping programs are limited by costs. The largest expenditures include staffing and equipment (CASQA, 2003). The capital cost for a conventional street sweeper is between \$60,000 and \$120,000 with newer technologies approaching \$180,000 (CASQA, 2003).

Table 1. Estimated costs for two types of street sweepers

Sweeper Type	Purchase Price (\$)	Life (Years)	O&M Cost (\$/curb mile)	Sources
Mechanical	75,000	5	30	Finley, 1996, SWRPC, 1991
Vacuum-assisted	150,000	8	15	Finley, 1996 Satterfield, 1991

Benefits

- Reduce pollutants, including sediment, collecting in roadways and destined for surface water.
- Aesthetic benefits.
- May reduce need for structural stormwater controls, such as catch basin inserts or trash racks and may prevent clogging of downstream detention basins.

Limitations

- Cost of equipment.
- Labor Costs.

Maintenance

- Equipment maintenance as dictated by manufacturer.

References

Information in the factsheet is adapted from:

EPA NPDES BMP Stormwater Manual of BMPs. May 2006.

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=99&minmeasure=6

New Hampshire Stormwater Manual, Volume 2 Post-Construction Best Management Practices Selection & Design, December 2008.

Center for Sustainable Design, Mississippi State University, December 1999. Water Related Best Management Practices in the Landscape.

The Low Impact Development Center, Inc.; Fairfax County, VA LID BMP Fact Sheet, Street Sweeping, February 2005.

http://www.lowimpactdevelopment.org/fairfax.htm#ffx_factsheet

Pennsylvania Stormwater Best Management Practices Manual, Chapter 5 Non Structural BMPs, December 2006

http://www.elibrary.dep.state.pa.us/dsweb/Get/Version-48476/06_Chapter_5.pdf

Pet Waste Management

Description

Pet waste left improperly disposed of can be transported by storm water runoff directly into nearby water bodies. Decaying pet waste contributes bacteria and organic matter in storm water runoff, which can damage the health of fish and other aquatic life. Pet waste also carries viruses and parasites that can threaten human health and the health of wildlife. Pet waste also contains nutrients that promote weed and algae growth (eutrophication). Cloudy and green, Eutrophic water makes swimming and recreation unappealing or even unhealthy.

Program Considerations

Pet waste management can be controlled through adopting local ordinances, but requires the cooperation of pet owners and must be enforced.

Implementation

An effective pet waste management program should start with public education. Posting signs and installing pet waste disposal stations in public parks and trails is a common outreach strategy.



Applicability in the Primary Protection Area

Pet waste stations should be installed at PRVWSD Parks (Lakeshore Park, Old Trace, boat launches (Madison Landing, Rankin Landing, and Pelahatchie Shore Park), and access points to walking trails in Ridgeland and near Pelahatchie Bay.

Cost

Program costs are dependent on the levels of public outreach and materials produced. Education and outreach materials have been developed and are readily available which can decrease costs.

Benefits

- Reduce nutrients, bacteria, viruses, and parasites destined for surface water.
 - Aesthetic benefits.
-

Limitations

- Requires participation and cooperation of pet owners.
- Ordinance adoption and enforcement required.

Maintenance

- Maintenance of disposal receptacles and signage.

References

Information in the factsheet is adapted from:

EPA NPDES BMP Stormwater Manual of BMPs. May 2006.

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=4&minmeasure=1

Center for Sustainable Design, Mississippi State University, December 1999. Water Related Best Management Practices in the Landscape.

Reducing Bacteria with Best Management Practices, Delaware Department of Natural Resources and Environmental Control.

City of Marysville, WA, Pet Waste Management

http://marysvillewa.gov/PublicWorks/swm/programs/pet_waste.htm

Household Hazardous Waste Collection

Description:

Many common household products, such as oven cleaners, paint removers, bug killer, and drain cleaners contain chemicals potentially harmful to people and the environment. In 1976, legislators passed the Resource Conservation and Recovery Act (RCRA) to regulate the procedures governing the generation, storage, transport, treatment, and disposal of hazardous materials. Although this legislation has mitigated some of the problems associated with commercial hazardous material disposal, more needs to be done to reduce and properly dispose of home hazardous wastes, which are exempt from RCRA regulations.

Implementation

MDEQ has a recycling and solid waste reduction program and has developed a Consumer's Guide to Hazardous Household Waste (MDEQ, no date). The guide provides information about proper disposal of common household wastes. The MDEQ website includes a listing of community programs that help citizens properly dispose of wastes. Programs in the Reservoir watershed include Brandon, Madison/Madison County, and Ridgeland.



Source: EPA

Project managers should work to coordinate with these existing programs to inform residents how to properly handle and disposal of hazardous materials and prevent contamination of water supplies. Project managers should consider partnering with solid waste disposal services or service stations in the communities for assistance in implementing and administering programs within the source water protection area.

Pollutant Removal Efficiency

Effectiveness can only be measured by the amount of materials collected.

Applicability in Primary Protection Area (PPA)

Reduces the potential for occurrences of illegal dumping of hazardous chemicals and removes the potential pollutants from the PPA.

Cost

Costs for household hazardous waste programs can be high. The Small Business and Household Pollution Prevention Act provides 80-percent grants to counties to develop and implement pollution prevention education programs for households and small businesses, even if conducted in the absence of a collection program. Municipalities should check with their state environmental agencies to identify grant programs they can use for household hazardous waste programs. To lessen hazardous waste disposal costs, recycling programs can reuse some chemicals.

Limitations

- Can be a costly program.
- Municipal resources are often limiting.

References

Information in the factsheet is adapted from:

US EPA, National Pollutant Discharge Elimination System, May 2006.

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=3&minmeasure=1

APPENDIX J

Well Permits in the Primary Protection Area of the Ross Barnett Reservoir

PLUGGING RECORD

Operator THE CALIFORNIA COMPANY, A Division of California Oil Company		Address Box 713, Brookhaven, Mississippi	
Name of Lease M. M. Hunt et al 5 Unit 1	Well No 1	Field & Reservoir Pearl River Reservoir Area, Smackover	
Location of Well 1660.6' N of S Line, 1006.6' W of E Line		Sec-Top-Rce or Block & Survey 34 8N 3E	County Rankin
Application to drill this well was filed in name of W. M. Hunt et al 5 Unit 1-1	Has this well ever produced oil or gas --	Character of well at completion (initial production): Oil (bbls/day) -- Gas (MCF/day) -- Dry? --	
Date plugged 10-7-63	Total depth 14,925	Amount well producing when plugged: Oil (bbls/day) -- Gas (MCF/day) -- Water (bbls/day) --	

Name of each formation containing oil or gas indicate which formation open to well-bore at time of plugging

Fluid content of each formation

Depth interval of each formation

Size, size & depth of plugs used indicate cases where cemented, giving amount cement.

Fish left in hole consists of bit, drill collars, stabilizers, jars, and drill pipe.

Top @ 5900'. Bottom @ 14820'. Laid 2900 ex cement plug in annulus (from 12700-8940').

Laid 200 ex cement plug in drill pipe from 12700-11190 and 9200-7800' (top of DP @ 5900').

Laid 130 ex cement plug in 10-3/4" casing from 5400' to 49700'.

Set cast iron bridge plug at 4420'. Laid 50 ex cement plug from 4420-4316'. Laid 15 ex Ont plug from 80'-surface. (over)

CASING RECORD

Size pipe	Put in well (ft.)	Pulled out (ft.)	Left in well (ft.)	Give depth and method of parting casing (shot, ripped etc)	Packers and shoes
16"	341	0	341		
10-3/4"	5578	0	5578		

Was well filled with mud-taken fluid, according to regulations? **Yes**

Indicate deepest formation containing fresh water. **--**

NAMES AND ADDRESSES OF ADJACENT LEASE OPERATORS OR OWNERS OF THE SURFACE

Name	Address	Direction from this well:
Not required by State Oil & Gas Board (Exploratory)		

In addition to other information required on this form, if this well was plugged back for use as a fresh water well, give all pertinent details of plugging operations to base of fresh water sand, perforated interval to fresh water sand, name and address of surface owner, and attach letter from surface owner authorizing completion of this well as a water well and agreeing to assume full liability for any subsequent plugging which might be required.

Does not apply

Use reverse side for additional detail
 Via this form in duplicate with _____

Executed into the 18th day of October 1963

Date of Mississippi
 County of Lincoln

Before me, the undersigned authority, on this day personally appeared J. L. Phillips known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn an oath states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Subscribed and sworn to before me this 18th day of October 1963

Notary Public in and for Lincoln County, Mississippi

By commission expires June 27, 1966

MISSISSIPPI STATE OIL AND GAS BOARD

Plugging Record
 FORM 7 - 10CC P-10

Authorized by Order No. 118-63 Effective November 1, 1958

23-121-00032

PLUGGING RECORD

Operator CHEVRON OIL COMPANY		Address Box 713, Brookhaven, Mississippi		
Name of Lease Ben Archie		Well No. 1	Field & Reservoir Coshen Springs Area	
Location of Well 612.9' W of E Line, 665.3' N of S Line		Sec-Twp-Rng or Block & Survey 36 8N 3E		County Rankin
Applicating to drill this well was filed in name of Ben Archie #1	Has this well ever produced oil or gas No	Character of well at completion (initial production): Oil (bbbls/day) 0 Gas (MCF/day) 0 Dry? Yes		
Date plugged: 10-12-65	Total depth 10,512	Amount well producing when plugged: Oil (bbbls/day) 0 Gas (MCF/day) 0 Water (bbbls/day) 0		
Name of each formation containing oil or gas. Indicate which formation open to well-bore at time of plugging		Field content of each formation		Depth interval of each formation
1. Ran DP open ended				
2. Laid 50 sk Cmt Plug 2000-2110'				7. Laid 15 sk cement plug 0-36'
3. Laid 50 sk Cmt plug 1275-1390'				8. Welded 1/2" steel plate & bleeder valve on top.
4. POOH				
5. Salvaged wellhead equipment				9. Well P&A 10-12-65
6. Cut off pipe 3' below ground level.				10. Rig released @ 6 PM 10-12-65.

CASING RECORD

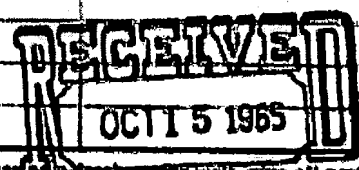
Size pipe	Put in well (ft.)	Pulled out (ft.)	Left in well (ft.)	Clog depth and method of parting casing (shot, ripped etc)	Packers and chases
16	50	0	50		
9-5/8	1326	0	1326		

Was well filled with mud-taken fluid, according to regulations? **Yes**

Indicate deepest formation containing fresh water. **1980'**

NAMES AND ADDRESSES OF ADJACENT LEASE OPERATORS OR OWNERS OF THE SURFACE

Name	Address	Direction from this well:
Unknown		



In addition to other information required on this form, if this well was plugged back for use as a fresh water well, give all pertinent details of plugging operations to base of fresh water sand, perforated interval to fresh water sand, name and address of surface owner, and attach letter from surface owner authorizing completion of this well as a water well and agreeing to subsequent plugging which might be required.

Use reverse side for additional detail. File this form in duplicate with _____

Executed this the 14th day of October 1965
 State of Mississippi
 County of Lincoln

Before me, the undersigned authority, on this day personally appeared L. L. Fisher known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Subscribed and sworn to before me this 14th day of October 1965
Notary Public in and for Lincoln County, Mississippi
 My commission expires June 27, 1966

**MISSISSIPPI STATE OIL & GAS BOARD
ORIGINAL WELL COMPLETION AND/OR RECOMPLETION REPORT AND WELL LOG**



INDICATE TYPE OF COMPLETION											
NEW WELL	REENTRY	WORKOVER	DEEPEN	PLUG BACK	SAME RESERVOIR	DIFFERENT RESERVOIR	OIL	GAS	INJECTOR	DRY	
X								X			
DESCRIPTION OF WELL AND LEASE											
OPERATOR Denbury Onshore, LLC				ADDRESS 5100 Tennyson Parkway, Plano, TX 75024							
LEASE NAME PEARL RIVER VALLEY AUTHORITY 13-10				WELL NUMBER 1				FIELD & RESERVOIR MONROE/NORPHLET			
LOCATION Surf: 575' FSL & 2336' FEL BHL: 2206' FSL & 758' FEL of Sec. 13				SEC - TWN - RGE, LAT AND LONG 13-8N-3E 32.53250 89.94375		API NO 23089201290000		DIRECTIONAL, VERTICAL OR HORIZONTAL Directional			
COUNTY Madison		PERMIT NUMBER 2007-OPD-134		DATE ISSUED 5/21/07 (amend)		PREVIOUS PERMIT NUMBER 2007-OPD-134		DATE ISSUED 2/20/07			
DATE SPUNDED 3/15/07		DATE TOTAL DEPTH REACHE 7/22/07		DATE OF THIS COMPLETION 8/21/07		ELEVATION (DF, RKB, RT or GR) 297.2' GR		ELEVATION OF CASING HD FLANGE			
TOTAL DEPTH 16873'		P B T D		SINGLE, DUAL OR TRIPLE COMPLETION? Single		IF THIS IS A DUAL OR TRIPLE COMPLETION, FURNISH SEPARATE REPORT FOR EACH COMPLETION.					
PERFORATIONS FOR THIS COMPLETION, FORMATION Norphlet 15964'-16204'						DRILLING CONTRACTOR Grey Wolf					
WAS THIS WELL DIRECTIONALLY DRILLED? YES		WAS DIRECTIONAL SURVEY MADE? YES		WAS COPY OF DIRECTIONAL SURVEY FILED? YES		DATE FILED 10/29/07					
LIST ALL ELECTRICAL LOGS RUN FOR THIS COMPLETION, SERVICE COMPANY AND DATES FILED											
ARRAY RESISTIVITY/SPECTRAL DENSITY/DUAL SPACED NEUTRON; ARRAY RESISITIVITY TVD; ARRAY RESISTIVITY/ARRAY SONIC; ARRAY SONIC TVD 10/29/07											
CASING RECORD											
CASING (Report All Strings Set in Well - Conductor, Surface, Intermediate, Producing, etc.)											
PURPOSE	SIZE HOLE DRILLED	SIZE CASING SET	WEIGHT (lb/ft)	DEPTH SET	SACKS CEMENT	AMOUNT PULLED					
Conductor		20"		65'	DRIVEN						
Surface	17-1/2"	13-3/8"	68#	5875'	4510 SX	NONE					
INTERMEDIATE	12-1/4"	9-5/8"	53.5#	11676'	1210 SX	NONE					
Production	8-1/2"	4-1/2"	13.5#	16852'	620 SX	NONE					
TUBING RECORD				LINER RECORD							
SIZE	DEPTH SET	PACKER SET AT	SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN				
IN.	FT.		IN.	FT.	FT.		FT.				
PERFORATION RECORD THIS COMPLETION				ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD							
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	AMOUNT & KIND OF MATERIAL USED				DEPTH INTERVAL			
6	3-1/8"	15964'-16064'	Black Warrior								
6	3-1/8"	16154'-16204'	Black Warrior								
LIST ALL OTHER PERFORATIONS RECORDS AND TEST RESULTS CONT ON BACK											
PERFORATION RECORD THIS COMPLETION				ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD							
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	AMOUNT & KIND OF MATERIAL USED				DEPTH INTERVAL			
INITIAL PRODUCTION											
DATE OF FIRST PRODUCTION/INJECTION 1/25/2010			PRODUCING METHOD (Indicate if Flowing, Gas Lift or Pumping - If Pumping, Indicate Size & Type of Pump) Flowing								
DATE OF TEST 2/1/10	HOURS TESTED 24	CHCKE SIZE 32/64	OIL PRODUCED DURING TEST 0	GAS PRODUCED DURING TEST 31856	WATER PRODUCED DURING TEST 0	OIL GRAVITY -----	*API				
TUBING PRESSURE 2800	CASING PRESSURE	CALCULATED RATE OF PRODUCTION PER 24 HRS.		OIL 0	GAS 31856 MCF	WATER 0	GAS - OIL RATIO ----				
DISPOSITION OF GAS (State Whether Ventd, Used for Fuel or Sold)				SOUR GAS OR OIL							
Sold				AMOUNT H ₂ S:				AMOUNT CO ₂ : 100%			

Executed this the 9th day of February, 2010
 State of Texas
 County of Collin
 Before me, the undersigned authority, on this day personally appeared Linda Gruver known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.
 Subscribed and sworn to before me this 9th day of February, 2010
 SEAL
 Notary Public in and for Collin County, Texas
 My commission expires August 08, 2012
 Signature: Kathleen Mays
 MISSISSIPPI STATE OIL AND GAS BOARD
 FORM NO 3
 A.P.I. WELL NUMBER
 STATE COUNTY WELL
 23 089 2012900000

CASING TESTS, REQUIRED BY STATEWIDE RULES 11 AND 12, MUST BE MADE.
 Effective Jan. 1, 2007, no authorization to transport Oil or Gas from location will be approved until a completed form 3 and all electrical surveys have been filed with the Mississippi Oil and Gas Board.

RECEIVED
 FEB 10 2010
 STATE OIL & GAS BOARD

DETAIL OF FORMATIONS PENETRATED			
FORMATION	TOP	BOTTOM	DESCRIPTION REQUIRED*
HOSSTON	10300' MD		
BOSSIER	14550' MD		
HAYNESVILLE	14760' MD		
BUCKNER ANHYDRITE SMACKOVER	15000' MD 15412' MD		
NORPHLETT	15960' MD		
LIST ALL PERFORATIONS WITH TEST DATA, ACID, FRACTURE, SQUEEZE, PLUGS			
CORE RECORD			
DIAMOND CORE INTERVAL		LIST ALL SIDEWALL CORES	
OPEN HOLE TESTS DRILL STEM TEST INTERVAL DEPTHS		RECOVERY	PRESSURES

* Show all important zones of porosity; detail of all cores; and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures, and recoveries.

INSTRUCTIONS

Attach all Well Logs.

This well completion or recompletion report and well log shall be filed with the Mississippi State Oil and Gas Board no later than thirty (30) days after project completion.

0000 01 0000

**MISSISSIPPI STATE OIL & GAS BOARD
ORIGINAL WELL COMPLETION AND/OR RECOMPLETION REPORT AND WELL LOG**



FORM 3

INDICATE TYPE OF COMPLETION										
NEW WELL	REENTRY	WORKOVER	DEEPEN	PLUG BACK	SAME RESERVOIR	DIFFERENT RESERVOIR	OIL	GAS	INJECTOR	DRY
X								X		
DESCRIPTION OF WELL AND LEASE										
OPERATOR Denbury Onshore, LLC					ADDRESS 5100 Tennyson Parkway, Plano, TX 75024					
LEASE NAME PEARL RIVER VALLEY AUTHORITY 13-161					FIELD & RESERVOIR MONROE/NORPHLET					
LOCATION SL: 459' FSL & 2404' FEL BHL: 606' FSL & 139' FEL					SEC. - TWN. - RGE, LAT AND LONG 13-8N-3E 32.53218 89.94397		API NO. 23089201330100		DIRECTIONAL, VERTICAL OR HORIZONTAL Directional	
COUNTY Madison		PERMIT NUMBER 2008-OPD-255		DATE ISSUED 1/16/08		PREVIOUS PERMIT NUMBER		DATE ISSUED		
DATE SPUNDED 2/10/08		DATE TOTAL DEPTH REACHED 5/17/08		DATE OF THIS COMPLETION 11/25/08		ELEVATION (DF, RKB, RT or GR) 297' GR		ELEVATION OF CASING HD. FLANGE		
TOTAL DEPTH 16745		P.B.T.D.		SINGLE, DUAL OR TRIPLE COMPLETION? Single		IF THIS IS A DUAL OR TRIPLE COMPLETION, FURNISH SEPARATE REPORT FOR EACH COMPLETION.				
PERFORATIONS FOR THIS COMPLETION, FORMATION Norphlet (15850-16140)							DRILLING CONTRACTOR Grey Wolf			
WAS THIS WELL DIRECTIONALLY DRILLED?		WAS DIRECTIONAL SURVEY MADE?		WAS COPY OF DIRECTIONAL SURVEY FILED?		DATE FILED				
YES		YES		YES		2/9/09				
LIST ALL ELECTRICAL LOGS RUN FOR THIS COMPLETION, SERVICE COMPANY AND DATES FILED										
ARRAY RESISTIVITY/SPECTRAL DENSITY/DUAL SPACED NEUTRON; ARRAY RESISTIVITY TVD; ARRAY RESISTIVITY/ARRAY SONIC; ARRAY SONIC TVD 2/9/09										
CASING RECORD							LINER RECORD			
CASING (Report All Strings Set In Well - Conductor, Surface, Intermediate, Producing, etc.)										
PURPOSE	SIZE HOLE DRILLED	SIZE CASING SET	WEIGHT (lb./ft.)	DEPTH SET	SACKS CEMENT	AMOUNT PULLED				
Conductor	20"	20"	94#	104'	DRIVEN					
Surface	17-1/2"	13-3/8"	72#	5867'	4470 sx	NONE				
INTERMEDIATE	12-1/4"	9-7/8"	53.5#	14570'	1210 sx	NONE				
Production	8-1/2"	4-1/2"	13.5#	16736'	775 sx	NONE				
TUBING RECORD				LINER RECORD						
SIZE	DEPTH SET	PACKER SET AT	SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN			
IN.	FT.		IN.	FT.	FT.		FT.			
PERFORATION RECORD THIS COMPLETION				ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD						
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	AMOUNT & KIND OF MATERIAL USED		DEPTH INTERVAL				
6	2-1/8"	15850-15970	Halliburton							
6	2-1/8"	16010-16050	Halliburton							
LIST ALL OTHER PERFORATIONS RECORDS AND TEST RESULTS CONT ON BACK				ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD						
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	AMOUNT & KIND OF MATERIAL USED		DEPTH INTERVAL				
6	2-1/8"	16080-16140	Halliburton							
INITIAL PRODUCTION										
DATE OF FIRST PRODUCTION/INJECTION 1/25/2010			PRODUCING METHOD (Indicate if Flowing, Gas Lift or Pumping - If Pumping, Indicate Size & Type of Pump) Flowing							
DATE OF TEST 2/1/10	HOURS TESTED 24	CHOKED SIZE 40/64	OIL PRODUCED DURING TEST 0	GAS PRODUCED DURING TEST 48450	WATER PRODUCED DURING TEST 0	OIL GRAVITY ----	*API			
TUBING PRESSURE 2425	CASING PRESSURE	CALCULATED RATE OF PRODUCTION PER 24 HRS.		OIL 0 BBLs	GAS 48450 MCF	WATER 0 BBLs	GAS - OIL RATIO ----			
DISPOSITION OF GAS (State Whether Vented, Used for Fuel or Sold) Sold				SOUR GAS OR OIL AMOUNT H ₂ S: AMOUNT CO ₂ : 100%						

Executed this the 9th day of February, 2010
State of Texas

County of Collin

Linda Gruver
Signature of Affiant
Linda Gruver

Before me, the undersigned authority, on this day personally appeared Linda Gruver known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Subscribed and sworn to before me this 9th day of February, 2010

SEAL
KATHLEEN MAYS
Notary Public, State of Texas
My Commission Expires
August 08, 2012

Signature *Kathleen Mays*
2010

MISSISSIPPI STATE OIL AND GAS BOARD
FORM NO 3
A.P.I. WELL NUMBER
STATE COUNTY WELL
23 089 2013301000

CASING TESTS, REQUIRED BY STATEWIDE RULES 11 AND 12, MUST BE MADE.

Effective Jan. 1, 2007, no authorization to transport Oil or Gas from location will be approved until a completed form 3 and all electrical surveys have been filed with the Mississippi Oil and Gas Board.

RECEIVED
FEB 10 2010
STATE OIL & GAS BOARD

DETAIL OF FORMATIONS PENETRATED			
FORMATION	TOP	BOTTOM	DESCRIPTION REQUIRED*
MIDWAY	3910		
SELMA	4795		
EUTAW	5920		
TUSCALOOSA	6400		
BOSSIER	14540		
HAYNESVILLE	14685		
BUCKNER	14950		
SMACKOVER	15340		
NORPHLET	15852		
LIST ALL PERFORATIONS WITH TEST DATA, ACID, FRACTURE, SQUEEZE, PLUGS			
CORE RECORD			
DIAMOND CORE INTERVAL		LIST ALL SIDEWALL CORES	
OPEN HOLE TESTS			
DRILL STEM TEST		RECOVERY	
INTERVAL DEPTHS		PRESSURES	

* Show all important zones of porosity; detail of all cores; and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures, and recoveries.

INSTRUCTIONS

Attach all Well Logs.

This well completion or recompletion report and well log shall be filed with the Mississippi State Oil and Gas Board no later than thirty (30) days after project completion.

MSRB 01 000

**MISSISSIPPI STATE OIL & GAS BOARD
ORIGINAL WELL COMPLETION AND/OR RECOMPLETION REPORT AND WELL LOG**



FORM 3

NEW WELL X		REENTRY	WORKOVER	DEEPEN	PLUG BACK	INDICATE TYPE OF COMPLETION SAME RESERVOIR		DIFFERENT RESERVOIR	OIL	GAS X	INJECTOR	DRY
OPERATOR Denbury Onshore, LLC						DESCRIPTION OF WELL AND LEASE ADDRESS 5100 Tennyson Parkway, Plano, TX 75024						
LEASE NAME Pearl River 3-8						WELL NUMBER 1	FIELD & RESERVOIR DRI Ice / Norphlet CO2 Gas Pool					
LOCATION Surf: 2677 FSL & 4141 FEL; BHL: 1944 FNL & 257 FEL						SEC. - TWN. - RGE. LAT AND LONG Surf: Sec 2; BHL: Sec 3-7N-3E	API NO. 23121201770100	DIRECTIONAL, VERTICAL OR HORIZONTAL Directional				
COUNTY Rankin	PERMIT NUMBER 2006-OPD-268	DATE ISSUED 2/15/06		PREVIOUS PERMIT NUMBER		DATE ISSUED						
DATE SPUDDED 4/30/06	DATE TOTAL DEPTH REACHED 11/6/06	DATE OF THIS COMPLETION 1/29/07		ELEVATION (DF, RKB, RT or GR) 301.3 GL		ELEVATION OF CASING HD. FLANGE						
TOTAL DEPTH 16777 MD	P.B.T.D 16665	SINGLE, DUAL OR TRIPLE COMPLETION? Single		IF THIS IS A DUAL OR TRIPLE COMPLETION, FURNISH SEPARATE REPORT FOR EACH COMPLETION.								
PERFORMATIONS FOR THIS COMPLETION, FORMATION 16557 - 16607'										DRILLING CONTRACTOR Grey Wolf		
WAS THIS WELL DIRECTIONALLY DRILLED? Yes		WAS DIRECTIONAL SURVEY MADE? Yes		WAS COPY OF DIRECTIONAL SURVEY FILED? Yes		DATE FILED 9/11/07						
LIST ALL ELECTRICAL LOGS RUN FOR THIS COMPLETION, SERVICE COMPANY AND DATES FILED 1", 2" & 5" High Resolution/Induction/Spectral Density/LSS												
CASING RECORD Casing (Report All Strings Set in Well - Conductor, Surface, Intermediate, Producing, etc.)												
PURPOSE	SIZE HOLE DRILLED	SIZE CASING SET	WEIGHT (lb./ft.)	DEPTH SET	SACKS CEMENT	AMOUNT PULLED						
Surface	14-3/4"	10-3/4"		5,868'	3,615	None						
Intermediate	9-7/8"	7-5/8"	39#	15,300'		None						
Production	6-1/2"	5-1/2"	20 & 23#	16,777'	185	None						
TUBING RECORD												
SIZE	DEPTH SET	PACKER SET AT	SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN					
IN.	FT.		IN.	FT.	FT.		FT.					
PERFORATION RECORD THIS COMPLETION												
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD		AMOUNT & KIND OF MATERIAL USED						
6	3-3/8"	16557 - 16607				DEPTH INTERVAL						
LIST ALL OTHER PERFORATIONS RECORDS AND TEST RESULTS CONT ON BACK												
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD		AMOUNT & KIND OF MATERIAL USED						
						DEPTH INTERVAL						
INITIAL PRODUCTION												
DATE OF FIRST PRODUCTION/INJECTION 2/23/07			PRODUCING METHOD (Indicate if Flowing, Gas Lift or Pumping - If Pumping, Indicate Size & Type of Pump) Flowing									
DATE OF TEST 3/6/07	HOURS TESTED 24	CHOKE SIZE Open	OIL PRODUCED DURING TEST 0	GAS PRODUCED DURING TEST 42,583	WATER PRODUCED DURING TEST 304	OIL GRAVITY						
TUBING PRESSURE 15	CASING PRESSURE 43,583	CALCULATED RATE OF PRODUCTION PER 24 HRS.		OIL 0	GAS 43583	WATER 304	GAS - OIL RATIO					
DISPOSITION OF GAS (State Whether Ventted, Used for Fuel or Sold) Sold				SOUR GAS OR OIL		AMOUNT H ₂ S:		AMOUNT CO ₂ : 100%				

Executed this the 11th day of September, 2007
State of Texas

County of Collin

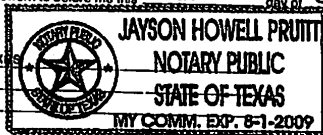
Brenda Borden
Signature of Affiant
Brenda Borden

Before me, the undersigned authority, on this day personally appeared Brenda Borden known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Subscribed and sworn to before me this 11th day of September, 2007

SEAL

Notary Public in and for Texas
County Collin
My commission expires:



Signature Jayson Pruitt

MISSISSIPPI STATE OIL AND GAS BOARD		
FORM NO. 3		
A.P.I. WELL NUMBER		
STATE	COUNTY	WELL
23	121	201770100

CASING TESTS, REQUIRED BY STATEWIDE RULES 11 AND 12, MUST BE MADE.

Effective Jan. 1, 2007, no authorization to transport Oil or Gas from location will be approved until a completed form 3 and all electrical surveys have been filed with the Mississippi Oil and Gas Board.

RECEIVED

SEP 20 2007

STATE OIL & GAS BOARD

DETAIL OF FORMATIONS PENETRATED			
FORMATION	TOP	BOTTOM	DESCRIPTION REQUIRED*
Bossier	14,604' MD		
Haynesville	14,752' MD		
Buckner	14,957' MD		
Smackover	15,347' MD		
Norphlet	15,759' MD		
LIST ALL PERFORATIONS WITH TEST DATA, ACID, FRACTURE, SQUEEZE, PLUGS			
CORE RECORD			
DIAMOND CORE INTERVAL		LIST ALL SIDEWALL CORES	
OPEN HOLE TESTS		RECOVERY	
DRILL STEM TEST		PRESSURES	
INTERVAL DEPTHS			

* Show all important zones of porosity; detail of all cores; and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures, and recoveries.

INSTRUCTIONS

Attach all Well Logs.

This well completion or recompletion report and well log shall be filed with the Mississippi State Oil and Gas Board no later than thirty (30) days after project completion.



MISSISSIPPI STATE OIL & GAS BOARD ORIGINAL WELL COMPLETION AND/OR RECOMPLETION REPORT AND WELL LOG

FORM 3

INDICATE TYPE OF COMPLETION: NEW WELL, REENTRY, WORKOVER (X), DEEPEN, PLUG BACK, SAME RESERVOIR (X), DIFFERENT RESERVOIR, OIL, GAS (X), INJECTOR, DRY. OPERATOR: Denbury Onshore, LLC. LEASE NAME: PEARL RIVER 1-4. LOCATION: SL: 529' FNL & 361' FWL BHL: 415' FNL & 97' FWL. WELL NUMBER: 1. FIELD & RESERVOIR: DRI ICE/NORPHLET. DATE ISSUED: 4/18/08. DATE OF THIS COMPLETION: 4/23/08. DRILLING CONTRACTOR: Grey Wolf. PERFORMATIONS FOR THIS COMPLETION, FORMATION: Open Hole. LIST ALL ELECTRICAL LOGS RUN FOR THIS COMPLETION, SERVICE COMPANY AND DATES FILED: ARRAY INDUCTION DUAL SPACED NEUTRON SPECTRAL DENSITY (OPEN HOLE & SIDETRACK); ARRAY INDUCTION DSN/SDL; ARRAY INDUCTION (OPEN HOLE & SIDETRACK); MUDLOG 10/31/07. CASING RECORD table with columns: PURPOSE, SIZE HOLE DRILLED, SIZE CASING SET, WEIGHT (lb ft), DEPTH SET, SACKS CEMENT, AMOUNT PULLED. TUBING RECORD table with columns: SIZE, DEPTH SET, PACKER SET AT, SIZE, TOP, BOTTOM, SACKS CEMENT, SCREEN. PERFORATION RECORD THIS COMPLETION table with columns: NUMBER PER FEET, SIZE & TYPE, DEPTH INTERVAL, SERVICE COMPANY, AMOUNT & KIND OF MATERIAL USED, DEPTH INTERVAL. INITIAL PRODUCTION: DATE OF FIRST PRODUCTION/INJECTION: 4/25/08. PRODUCING METHOD: Flowing; Clean out barite; fishing job. DATE OF TEST: 5/4/08. CHOKESIZE: 48/64". OIL PRODUCED DURING TEST: 0. GAS PRODUCED DURING TEST: 21927. WATER PRODUCED DURING TEST: 0. TUBING PRESSURE: 2050. CASING PRESSURE: 1700. CALCULATED RATE OF PRODUCTION PER 24 HRS: OIL 0, GAS 21927 MCF, WATER 0. DISPOSITION OF GAS: SOLD. AMOUNT H2S: 0. AMOUNT CO2: 100%.

Executed this the 7th day of May State of Texas

Signature of Linda Gruver, 2008

County of Collin

Before me, the undersigned authority, on this day personally appeared Linda Gruver known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Subscribed and sworn to before me this 7th day of May

Signature of Carolyn A. Babb, 2008

SEAL: CAROLYN A. BABB My Commission Expires December 10, 2011

MISSISSIPPI STATE OIL AND GAS BOARD FORM NO. 3 A.P.I. WELL NUMBER STATE COUNTY WELL 23 121 201820100

CASING TESTS, REQUIRED BY STATEWIDE RULES 11 AND 12, MUST BE MADE.

Effective Jan. 1, 2007, no authorization to transport Oil or Gas from location will be approved until a completed form 3 and all electrical surveys have been filed with the Mississippi Oil and Gas Board.

RECEIVED

MAY 09 2008

STATE OIL & GAS BOARD

DETAIL OF FORMATIONS PENETRATED			
FORMATION	TOP	BOTTOM	DESCRIPTION REQUIRED*
BOSSIER	14455' MD		
HAYNESVILLE	14665' MD		
BUCKNER	14984' MD		
SMACKOVER	15747' MD		
NORPHLET	16146' MD		
LIST ALL PERFORATIONS WITH TEST DATA, ACID, FRACTURE, SQUEEZE, PLUGS			
CORE RECORD			
DIAMOND CORE INTERVAL		LIST ALL SIDEWALL CORES	
OPEN HOLE TESTS			
DRILL STEM TEST		PRESSURES	
INTERVAL DEPTHS		RECOVERY	

* Show all important zones of porosity; detail of all cores; and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures, and recoveries.

INSTRUCTIONS

Attach all Well Logs.

This well completion or recompletion report and well log shall be filed with the Mississippi State Oil and Gas Board no later than thirty (30) days after project completion.

**MISSISSIPPI STATE OIL & GAS BOARD
ORIGINAL WELL COMPLETION AND/OR RECOMPLETION REPORT AND WELL LOG**



FORM 3

INDICATE TYPE OF COMPLETION															
NEW WELL X	REENTRY	WORKOVER	DEEPEN	PLUG BACK	SAME RESERVOIR	DIFFERENT RESERVOIR	OIL	GAS X	INJECTOR	DRY					
DESCRIPTION OF WELL AND LEASE															
OPERATOR Denbury Onshore, LLC				ADDRESS 5100 Tennyson Parkway, Plano, TX 75024											
LEASE NAME PEARL RIVER 1-4				WELL NUMBER 1				FIELD & RESERVOIR DRI ICE/NORPHLET							
LOCATION SL: 529' FNL & 361' FWL BHL:415' FNL & 97' FWL				SEC. - TWN. - RGE, LAT AND LONG 1-7N-3E 32.48572 89.95113				API NO. 23121201820100		DIRECTIONAL, VERTICAL OR HORIZONTAL Directional					
COUNTY RANKIN		PERMIT NUMBER 2007-OPD-038		DATE ISSUED 2/2/07 (amend)		PREVIOUS PERMIT NUMBER 2007-OPD-038		DATE ISSUED 7/31/06							
DATE SPUNDED 10/28/06		DATE TOTAL DEPTH REACHE 2/25/07		DATE OF THIS COMPLETION 7/28/07		ELEVATION (OF RKB, RT or GR) 300' GL		ELEVATION OF CASING HD. FLANGE							
TOTAL DEPTH 16546'		P B T O		SINGLE, DUAL OR TRIPLE COMPLETION? Single		IF THIS IS A DUAL OR TRIPLE COMPLETION, FURNISH SEPARATE REPORT FOR EACH COMPLETION.									
PERFORATIONS FOR THIS COMPLETION, FORMATION Open Hole						DRILLING CONTRACTOR Grey Wolf									
WAS THIS WELL DIRECTIONALLY DRILLED? YES		WAS DIRECTIONAL SURVEY MADE? YES		WAS COPY OF DIRECTIONAL SURVEY FILED? YES		DATE FILED with Form 3									
LIST ALL ELECTRICAL LOGS RUN FOR THIS COMPLETION, SERVICE COMPANY AND DATES FILED															
ARRAY INDUCTION DUAL SPACED NEUTRON SPECTRAL DENSITY (OPEN HOLE & SIDETRACK); ARRAY INDUCTION DSN/SDL; ARRAY INDUCTION (OPEN HOLE & SIDETRACK); MUDLOG															
CASING RECORD															
CASING (Report All Strings Set in Well - Conductor, Surface, Intermediate, Producing, etc.)															
PURPOSE	SIZE HOLE DRILLED	SIZE CASING SET	WEIGHT (lb/ft)	DEPTH SET	SACKS CEMENT	AMOUNT PULLED									
Conductor		20"	94#	76'		Driven									
Surface	17-1/2"	13-3/8"	68#	5890'	4530	NONE									
INTERMEDIATE	12-1/4"	9-5/8"	53.5#	15037	1190	NONE									
Production	8-1/2"	5-1/2"	20 & 23#	16150	350	NONE									
TUBING RECORD				LINER RECORD											
SIZE	DEPTH SET	PACKER SET AT	SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN								
NONE															
PERFORATION RECORD THIS COMPLETION				ACID, SHOT, FRACTURE, CEMENT SQUEEZE RECORD											
NUMBER PER FEET	SIZE & TYPE	DEPTH INTERVAL	SERVICE COMPANY	AMOUNT & KIND OF MATERIAL USED				DEPTH INTERVAL							
Open Hole		16150-16546'													
LIST ALL OTHER PERFORATIONS RECORDS AND TEST RESULTS CONT ON BACK															
NUMBER PER FEET				SIZE & TYPE				DEPTH INTERVAL				SERVICE COMPANY			
INITIAL PRODUCTION															
DATE OF FIRST PRODUCTION/INJECTION 8/28/07				PRODUCING METHOD (Indicate if Flowing, Gas Lift or Pumping - If Pumping, Indicate Size & Type of Pump) Flowing											
DATE OF TEST 9/24/07	HOURS TESTED 24	CHOKE SIZE 0	OIL PRODUCED DURING TEST			GAS PRODUCED DURING TEST 21563			WATER PRODUCED DURING TEST 120			OIL GRAVITY ---			
TUBING PRESSURE 3600		CASING PRESSURE 2600		CALCULATED RATE OF PRODUCTION PER 24 HRS				OIL 0	GAS 21563	WATER 120	GAS - OIL RATIO ---				
DISPOSITION OF GAS (State Whether Vented, Used for Fuel or Sold) SOLD						SOUR GAS OR OIL									
						AMOUNT H ₂ S		AMOUNT CO ₂ : 100%							

Executed this the 31st day of October 2007
 State of Texas
 County of Collin
 Before me, the undersigned authority, on this day personally appeared Linda Gruver known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.
 Subscribed and sworn to before me this 31st day of October 2007

SEAL
 Notary Public in and for Texas
 County _____
 My commission expires: DECEMBER 10, 2007

Signature Carolyn A. Babb
 MISSISSIPPI STATE OIL AND GAS BOARD
 FORM NO. 3
 A.P.I. WELL NUMBER
 STATE COUNTY WELL
 23 121 201820100

CASING TESTS, REQUIRED BY STATEWIDE RULES 11 AND 12, MUST BE MADE.
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DIAMOND CORE INTERVAL		LIST ALL SIDEWALL CORES	
OPEN HOLE TESTS			
DRILL STEM TEST		RECOVERY	
INTERVAL DEPTHS		PRESSURES	

* Show all important zones of porosity; detail of all cores; and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures, and recoveries.

INSTRUCTIONS

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MISSISSIPPI OIL AND GAS BOARD

INSPECTOR'S VERIFICATION OF WELL SPUDDING

FIELD: Wildcat INSPECTOR: Seben

OPERATOR: Jellus INSPECTION DATE: 7-21-10

WELL NAME & NO.: Emerson Crossed Unit 1 API #: 23-089-20141

COUNTY: Madison SEC: 23 TWN: 10N RANGE: 4E

LATITUDE 32.37679

LONGITUDE 89.86266

WELL SPUDDED ON 7-20-2010

Justus Rigel

RECEIVED

JUL 26 2010

STATE OIL & GAS BOARD

MISSISSIPPI STATE OIL & GAS BOARD
APPLICATION FOR PERMIT TO DRILL, WORKOVER OR CHANGE OPERATOR

25429

APPLICATION TO DRILL WORKOVER CHANGE OF OPERATOR

NAME OF COMPANY OR OPERATOR Tellus Operating Group, LLC				DATE 03/19/2010	
ADDRESS 602 Crescent Place, Suite 100		CITY Ridgeland	STATE MS	ZIP 30157	TELEPHONE (601) 898-7444
NAME OF WELL Emerson Crosby Family Trust		WELL NO. 1	ELEVATION (GROUND)		CIRCLE TYPE OF PROPOSED WELL OIL <input type="checkbox"/> GAS <input checked="" type="checkbox"/> OTHER (NAME)
WELL LOCATION (WHEN POSSIBLE, GIVE FOOTAGE FROM SECTION LINES) 2435 feet North of the South line and 952 feet East of the West line of		SECTION - TOWNSHIP - RANGE Section 23 - Township 10 North - Range 4 East			
		LATITUDE - LONGITUDE (NEW WELLS) (dd.ddddd)			
FIELD & RESERVOIR (IF WILDCAT, SO STATE) Wildcat, Smackover Formation and all other pools and formations encountered			API No. (EXISTING WELL)		APPROX. DATE WORK BEGINS after permit
COUNTRY Madison					
PROPOSED DEPTH 13,500 FEET	PROPOSED LENGTH OF SURFACE CASING 4000 FEET	NUMBER OF ACRES IN DRILLING UNIT 2240 ACRES	DISTANCE FROM PROPOSED LOCATION TO NEAREST DRILLING UNIT LINE 2485 FEET	DISTANCE FROM PROPOSED LOCATION TO NEAREST DRILLING, COMPLETED OR APPLIED FOR WELL more than 3000 FEET	
NAME OF DRILLING CONTRACTOR					
ADDRESS CITY STATE ZIP					
FOR CHANGE OF OPERATOR ONLY - SIGNATURE OF FORMER OPERATOR REQUIRED FOR TRANSFER OF WELL					
AUTHORIZED REPRESENTATIVE SIGNATURE			NAME OF FORMER OPERATOR		
NOTE: AREA FIELD INSPECTOR OR FIELD DIRECTOR (JACKSON OFFICE) OF DATES OF SPUDDING AND REACHING TOTAL DEPTH. Mississippi State Oil and Gas Board, 500 Graymont Avenue, Suite E, Jackson, MS 39202 601-354-7142					
REMARKS: (IF THIS IS AN APPLICATION TO WORKOVER, BRIEFLY DESCRIBE WORK TO BE DONE, GIVING PRESENT PRODUCING ZONE AND EXPECTED NEW PRODUCING ZONE) Petition to Force Integrate, with Alternate Charges, Approve an Exception Unit, and obtain related relief in Docket No. 129-2010					
STATE OIL & GAS BOARD					
ARE THERE SEPARATELY OWNED TRACTS OR INTERESTS IN THE DRILLING UNIT FOR WHICH THIS PERMIT IS SOUGHT? (REF. MS. STATUTE 53-3-7)	YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>	IF YES, HAVE THE PERSONS OWNING THE DRILLING RIGHTS IN SAID TRACTS OR INTERESTS AND THE RIGHTS TO SHARE IN THE PRODUCTION THEREFROM AGREED TO DEVELOP THEIR LANDS AS A DRILLING UNIT AND TO THE DRILLING OF THE WELL? (REF. MS. STATUTE 53-3-7)	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>

Executed this the 19th day of March, 2010.

State of Mississippi
 County of Madison

C. Glen Bush
 Signature of Affiant

I, C. Glen Bush, the undersigned, and authority, on this day personally appeared C. Glen Bush known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath, states that he is duly authorized to make the above report and that he has knowledge of the facts stated herein, and that said report is true and correct.

Subscribed and sworn to before me this 19th day of March, 2010.

SEAL
 My commission expires _____

Signature Teresa E. Milligan
 Notary Public in and for Mississippi
 County Madison

PERMIT NUMBER 2010-OPD-179
 APPROVAL DATE 4-21-10
 APPROVED BY Board

NOTICE: BEFORE SENDING THIS FORM, BE SURE THAT ALL INFORMATION REQUESTED IS GIVEN. SEE INSTRUCTIONS ON REVERSE SIDE OF FORM.

MISSISSIPPI STATE OIL & GAS BOARD
 APPLICATION FOR PERMIT TO DRILL,
 WORKOVER OR CHANGE OPERATOR
 FORM 2 (Rev. 4/01)
 A. P. I. WELL NUMBER
 STATE MS COUNTY 089 WELL 20141

INSTRUCTIONS
READ CAREFULLY AND COMPLY FULLY

**Permit Fee of Three Hundred Dollars (\$300.) Must Accompany Application to
Drill for Oil, Gas or Injection. (See Statewide Rules 4 and 63)**

Application must be filed in duplicate on every well and on dual wells. Do not begin operations on any location until approval from the Board has been received. It is mandatory that the proposed location covered by this notice conform to Statewide Rule 7 for oil, Statewide Rule 8 for gas and Statewide Rule 63 for injection. Attach a certified plat drawn to scale, locating thereon all previously drilled and drilling wells and proposed location with reference to the two nearest drilling unit lines. Designate scale and northerly direction. Give legal description of unit on this form or attach to application. Permit void after six (6) months from date of approval if permitted operation has not begun.

Refer to Statewide Rule 11 for surface casing requirements for oil and gas well and Statewide Rule 63 for injection wells.

Before any person shall commence the drilling of any well in search of oil or gas, such person shall file with the Board on Form 2 his application for permit to drill, accompanied by a certified plat and by a fee of three hundred dollars (\$300.), either in cash or check. (See Statewide Rule 4)

Before any person shall commence the drilling of a stratigraphic test or any well below the fresh water level, other than an oil or gas well or an injection well, such person shall file with the Board on Form 2 his application for permit to drill, accompanied by a fee of three hundred dollars (\$300.), either in cash or check. (See Statewide Rule 4)

Before any person shall commence the drilling of an injection well, such person shall file with the Board on Form 2 his application for permit to drill, accompanied by a fee of three hundred dollars (\$300.), either in cash or check. (See Statewide Rules 4 and 63)

Before any person shall commence operations to rework an abandoned well to an injection well, such person shall file with the Board on Form 2 his application to rework, accompanied by a fee of three hundred dollars (\$300.), either in cash or check. (See Statewide Rules 4 and 63)

Before any person shall commence operations to rework an operating well or injection well to recomplete to another zone, formation or reservoir, such person shall file with the Board on Form 2 his application to rework, accompanied by a fee of one hundred dollars (\$100.), either in cash or check. (See Statewide Rules 4 and 63)

File an amended Form 2 if any change in operating ownership of a well is made. A permit fee of one hundred dollars (\$100.) must accompany an application for the change of operator.

NOTE: When two or more separately owned tracts of land are embraced within an established drilling unit or when there are separately owned interests in all or part of an established drilling unit for which the permit is sought, the application shall affirmatively state whether or not there are separately owned tracts or interests in the drilling unit for which the permit is sought, and if so, whether or not the person(s) owning the drilling rights therein and the rights to share in the production therefrom have agreed to develop their lands as a drilling unit and to the drilling of the well, as contemplated by Section 53-3-7, Mississippi Code of 1972. For any petition requesting a Board Hearing, consult Rules of Order and Procedure for Hearing Before the State Oil and Gas Board of Mississippi as outlined in the Statutes, Rules of Procedure and Statewide Rules and Regulations.