U.S. DEPARTMENT OF ENERGY
STRATEGIC PETROLEUM RESERVE
PROJECT MANAGEMENT OFFICE
NEW ORLEANS, LOUISIANA

Site Environmental Report
For
Calendar Year 2016

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STRATEGIC PETROLEUM RESERVE

SITE ENVIRONMENTAL REPORT

FOR

CALENDAR YEAR 2016

Document No. 0270 – 1

Prepared for the U. S. Department of Energy
Strategic Petroleum Reserve Project Management Office
under Contract No. DE-FE0011020

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OPERATIONS

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United States Government **Department of Energy**

memorandum

DATE: SEP 13 2017

REPLY TO ATTN OF: 17-ESH-007
FE-4441 (WWoods)

SUBJECT: SITE ENVIRONMENTAL REPORT FOR CALENDAR YEAR 2016 – STRATEGIC PETROLEUM RESERVE

TO: Robert F. Corbin, Deputy Assistant Secretary for Petroleum Reserves, FE-40

Attached for your information is a hard copy of the Strategic Petroleum Reserve's Site Environmental Report for Calendar Year 2016 along with its proposed distribution list. This report will not be distributed until this office receives authorization for release.

After authorization for release is received, an electronic version of the report will be available at:

http://www.spr.doe.gov/esh/default.html

To the best of my knowledge, this report accurately summarizes and discusses the results of the 2016 Environmental Monitoring Program.

Please authorize the release of this report to the attached distribution.

If you have any questions or desire additional information, please contact Paul Oosterling of the Project Management Office, Office of Technical Assurance at (504) 734-4339 or by e-mail at Paul.Oosterling@spr.doe.gov.

William C. Gibson, Jr.
Project Manager
Strategic Petroleum Reserve

Attachment:
As Stated

QUESTIONNAIRE/READER COMMENT FORM

Please submit your questions/comments on a photocopy of this page and forward it to the following address:

Fluor Federal Petroleum Operations, LLC
Environmental Department, EF-20
850 South Clearview Parkway
New Orleans, LA 70123

A copy of your comments will be sent to the originator for response.

Date: _____

Name of Submitter:_____

Street or P.O. Box: _____

City/State/Zip code: _____

Organization (if applicable): _____

Comments:

_____

_____

_____

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_____

_____

(Attach other sheets as needed)
(for originator's use)

Subject Matter Expert (SME): _____ Date: _____

SME's Response:_____

_____

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A&E	Architect and Engineer
AFFF	Aqueous Film Forming Foam
ANAB	ANSI-ASQ National Accreditation Board
ANSI	American National Standards Institute
AP	Affirmative Procurement
APHA	American Public Health Association
ASQ	American Society for Quality
ASRC	Arctic Slope Regional Corporation
ASTM	American Society for Testing and Materials
ATS	Assessment Tracking System
avg	Average
bbl	Barrel (1 bbl = 42 gallons)

Abbreviations and Acronyms	
BC	Bayou Choctaw
BDL	Below Detectable Limit
BH	Big Hill
BIG	Buy It Green
bls	Below Land Surface
BM	Bryan Mound
BOD5	Five Day Biochemical Oxygen Demand
ºC	Degrees Celsius
CAA	Clean Air Act
CAP	Corrective Action Plan
CB	Certification Body
CBT	Computer-Based Training
CEQ	Council for Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFS	Cubic Feet Per Second
CFR	Code of Federal Regulations
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COE	United States Army Corps of Engineers
CPG	Comprehensive Procurement Guidelines
CV	Coefficient Of Variation

Abbreviations and Acronyms	
CWA	Clean Water Act
CY	Calendar Year
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
DOE	United States Department of Energy
DOT	United States Department of Transportation
E&P	Exploration and Production
EA	Environmental Assessment
EFCOG	Energy Facility Contractors Group
EFH	East Fillhole
EIQ	Emissions Inventory Questionnaire
EIS	Emissions Inventory Summary
EIS	Environmental Impact Statement
EMP	Environmental Monitoring Plan
EMS	Environmental Management System
EO	Executive Order
EOT	Extension of Time
EPA	United States Environmental Protection Agency
EPACT	Energy Policy Act
EPCRA	Emergency Planning and Community Right-to-Know Act
EPEAT	Electronic Product Environmental Assessment Tool
ERP	Emergency Response Procedure

Abbreviations and Acronyms	
ERT	Emergency Response Team
ESA	Endangered Species Act
ES&H	Environmental Safety & Health
E-W	East-West
FEMP	Federal Energy Management Program
FFCA	Federal Facilities Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
fps	Feet Per Second
FRP	Facility Response Plan
ft	Feet
ft/yr	Feet Per Year
F&WS	United States Fish and Wildlife Service
FY	Fiscal Year
GALCOE	U.S. Army Corps of Engineers, Galveston District
GHG	Green House Gas
GLO	General Land Office
gpd	Gallons Per Day
GSA	General Services Administration
GWPMP	Ground Water Protection and Management Plan
HAP	Hazardous Air Pollutant
HW	Hazardous Waste
ICW	Intracoastal Waterway

Abbreviations and Acronyms	
ISM	Integrated Safety Management
ISO	International Organization for Standardization
LA	Louisiana
LAC	Louisiana Administrative Code
lbs	Pounds
LCF	Light Commercial Facility
LCMS	Lake Charles Meter Station
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDNR	Louisiana Department of Natural Resources
LPDES	Louisiana Pollutant Discharge Elimination System
m	Meters
m3	Cubic Meters
ml	Milliliters
m/yr	Meters Per Year
max	Maximum
MCC	Motor Control Center
MCL	Maximum Contaminant Levels
MDEQ	Mississippi Department of Environmental Quality
MDR	Maximum Diversion Rate
mg/l	Milligrams Per Liter
mmb	Million Barrels

Abbreviations and Acronyms	
MPAR	Maintenance Performance Appraisal Report
m/sec	Meters Per Second
M&O	Management & Operating
MS	Mississippi
MSDS	Material Safety Data Sheets
MSGP	Multi-Sector General Permit
mt	Metric Tons
MW	Monitoring Well
N	North
NAAQS	National Ambient Air Quality Standards
NAEP	National Association of Environmental Professionals
NE	Northeast
NEPA	National Environmental Policy Act
NFAATT	No Further Action At This Time
NFRAP	No Further Remedial Action Planned
NHPA	National Historic Preservation Act
NIMS	National Incident Management System
NO	New Orleans
NODCOE	U.S. Army Corps of Engineers, New Orleans District
NOEC	No Observed Effect Concentration
NOI	Notice of Intent
NORM	Naturally Occurring Radioactive Material

Abbreviations and Acronyms	
NOV	Notice Of Violation
NOx	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (CERCLA)
N-S	North-South
NSR	New Source Review
NW	Northwest
NWP	Nationwide Permit
OCC	Operations Control Center
O&G	Oil And Grease
OPA	Oil Pollution Act of 1990
OSPRA	Oil Spill Prevention and Response Act
OVA	Organic Vapor Analyzer
P2	Pollution Prevention
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
pH	Negative Logarithm Of The Hydrogen Ion Concentration
PM10	Particulate Matter (less than 10 microns)
PMO	Project Management Office
PPA	Pollution Prevention Act of 1990
PPOA	Pollution Prevention Opportunity Assessment
PPP	Pollution Prevention Plan

Abbreviations and Acronyms	
ppt	Parts Per Thousand
PREP	Preparedness for Response Exercise Program
PSD	Prevention Of Significant Deterioration
PSI	Pounds Per Square Inch
PVC	Polyvinyl Chloride
PW	Periphery Well
PZ	Piezometer
QC	Quality Control
QPL	Qualified Products List
RAB	Registrar Accreditation Board
RCRA	Resource Conservation and Recovery Act
RRC	Railroad Commission of Texas
REC	Recognized Environmental Concern
RECAP	Risk Evaluation Corrective Action Program
ROD	Record of Decision
RWIS	Raw Water Intake Structure
S	South
SAL	Salinity
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SE	Southeast
SER	Site Environmental Report

Abbreviations and Acronyms	
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO2	Sulfur Dioxide
SOC	Security Operations Center
SPCC	Spill Prevention Control and Countermeasures
SPR	Strategic Petroleum Reserve
SPRPMO	Strategic Petroleum Reserve Project Management Office
SQG	Small Quantity Generator
STP	Sewage Treatment Plant
s.u.	Standard Units
SW	Southwest
SWPPP	Stormwater Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TCLP	Toxicity Characteristic Leaching Procedure
TDH&PT	Texas Department of Highways and Public Transportation
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TPQ	Threshold Planning Quantity
TPWD	Texas Parks and Wildlife Department
tpy	Tons Per Year
TRI	Toxic Chemical Release Inventory

Abbreviations and Acronyms	
TSCA	Toxic Substance Control Act
TSD	Treatment Storage Disposal
TSS	Total Suspended Solids
TVP	True Vapor Pressure
TX	Texas
UIC	Underground Injection Control
URS	United Research Services
VOC	Volatile Organic Compound
VWS	Verification Well Study
WCP	Water Conservation Plan
WAD	Work Authorization Directive
W	West
WH	West Hackberry

Version History 0270 – 1., Site Environmental Report for Calendar Year 2016		
VERSION	DESCRIPTION	EFFECTIVE DATE
1.0	New document.	

Executive Summary

The purpose of the annual U. S. Department of Energy (DOE) Strategic Petroleum Reserve (SPR) Site Environmental Report (SER) is to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts performed by the management and operations (M&O) Contractor, Fluor Federal Petroleum Operations. The SER serves the public by summarizing monitoring data collected to assess how the SPR impacts the environment.

The SER provides a balanced synopsis of non-radiological monitoring and regulatory compliance data. It also affirms that the SPR has been operating within acceptable regulatory limits and illustrates the success of SPR efforts toward continual environmental improvement.

During 2016, the SPR was in compliance with all applicable federal and state environmental regulations. Against the active permits in effect across all SPR sites, there were 904 permit related analyses conducted. There was one permit non-compliances reported during 2016. There were three reportable crude oil or brine spills 2016. Reportable oil and brine spills have substantially declined over the years. There were also no Clean Air Act (CAA), Clean Water Act (CWA) or Resource Conservation and Recovery Act (RCRA) Notice of Violations (NOV) received in 2016. The SPR facilities continued to operate as Conditionally Exempt Small Quantity Generators (CESQG) during CY 2016. The Superfund Amendments and Reauthorization Act (SARA) Title III, Tier Two reports, which list the type and quantity of hazardous substances on SPR facilities were submitted on time and provided to the appropriate agencies.

Environmental compliance and management audits were conducted in-house, by the DOE Strategic Petroleum Reserve Project Management Office (SPRPMO) appraisal teams and by the M&O Contractor during 2016. Six low risk or minor deviations from internal requirements and regulations were identified during internal audits in FY2016.

The SPR Environmental Management System (EMS) is certified by a third party registrar against the International Organization for Standardization (ISO) 14001:2004 standard. A third party recertification audit conducted in 2016 identified seven minor non-conformances. The third party registrar verified that the SPR's EMS remains suitable, adequate, and effective.

The Questionnaire/Reader Comment Form located in the front of this document may be utilized to submit questions or comments to the originator.

1 Introduction

This Strategic Petroleum Reserve (SPR) annual Site Environmental Report for calendar year 2016 was prepared to inform the U.S. Department of Energy (DOE), environmental agencies, and the public about environmental management performance and data gathered at or near SPR sites. It also summarizes compliance with environmental standards and requirements and highlights significant programs and efforts. Under contract DE-FE0011020, Fluor Federal Petroleum Operations LLC (FFPO) assumed management in April 2014.

1.1 Background Information

The SPR was established by the Energy Policy and Conservation Act in 1975. It provides the United States with sufficient petroleum reserves to mitigate the effects of a significant oil supply interruption. The mission of the SPR is to maintain a constant state of operational readiness to drawdown the reserve and supply oil to the country in an emergency as directed by the President of the United States. The Secretary of Energy also has the authority to acquire oil to fill the reserve or exchange current holdings to alter the mix of oil, to test the SPR's capabilities through test sales or to "loan" oil to refineries when their supplies have been temporarily disrupted.

The DOE Office of Deputy Assistant Secretary for the Petroleum Reserves has overall programmatic responsibility for establishing the SPR objectives. The SPR Project Management Office (SPRPMO) Project Manager is responsible for implementing these goals and objectives, including articulating an environmental policy (Appendix B) that is responsive to Departmental requirements. This Policy is applied to SPR operations through the M&O contractor.

Emergency crude oil supplies are stored by the SPR in salt caverns. The caverns were created deep within the massive Louann salt deposits that underlie most of the Texas and Louisiana coastline. The caverns currently in use were created through the process of solution mining. The utilization of the caverns to store crude oil provides assurance against normal hazards associated with the aboveground storage, offers the best security, and is the most affordable means of storage.

The Gulf Coast was chosen as the SPR site due to its large concentration of underground salt domes, and its large number of refineries and crude oil distribution capabilities. These attributes provide the flexibility needed to respond to a wide range of supply disruptions. As of December 2016 the SPR had approximately 695 million barrels of oil.

1.2 Locations, Facilities and Operations

The SPR presently consists of four Gulf Coast underground salt dome oil storage facilities, warehouse facilities, and a project management facility. St. James Terminal was leased to Shell Pipeline in January 1997, is not an active SPR storage facility; but continues as SPR property and is addressed in applicable sections of this report.

1.2.1 Bayou Choctaw

The Bayou Choctaw storage facility is located in Iberville Parish, Louisiana. The storage facility occupies 356 acres of the Bayou Choctaw salt dome, including off-site satellite brine disposal wells and associated brine piping.

The Bayou Choctaw salt dome was selected as a storage site early in the SPR program due to its existing brine caverns, which were readily converted to oil storage, and its proximity to commercial marine and pipeline crude oil distribution facilities. Development of the site was initiated in 1977 and completed in 1991. One additional cavern was acquired, modified and completed in 2012.

The area surrounding the site is a freshwater swamp, which includes substantial stands of bottomland hardwoods with interconnecting waterways. Small canals and bayous flow through the site area and join larger bodies of water off-site. The site proper is normally dry and protected from spring flooding by the site's flood control levees and pumps. The forest and swamp provides habitat for a diverse wildlife population, including many kinds of birds, mammals and reptiles including the American alligator.

Table 1-1 SPR Bayou Choctaw Storage Facility	
Location	**Plaquemine, LA**
Caverns	**7**
Authorized Storage Capacity	**76,000,000 Barrels**
Drawdown Rate	**515,000 Barrels/Day**

1.2.2 Big Hill

The Big Hill storage facility is located in Jefferson County, Texas. The site covers approximately 270 acres of the Big Hill salt dome. Off-site facilities include an intake structure that provides raw (brackish) water for cavern development and fluid movements, a brine line for brine disposal and a crude oil pipeline for receiving and distributing oil in commence.

Big Hill is the SPR's most recently constructed storage facility and is located close to commercial marine and pipeline crude oil distribution facilities. Development of the site was initiated in 1982 and completed in 1991.

Most of the site is upland habitat, consisting of tall grass with a few 150-year-old live oak trees. The nearby ponds and marsh provide excellent habitat for a diverse population of wildlife including the American alligator, over-wintering waterfowl, and several species of birds and mammals.

Table 1-2 SPR Big Hill Storage Facility	
Location	**Winnie, TX**
Caverns	**14**

Authorized Storage Capacity	**170,000,000 Barrels**
Drawdown Rate	**1,100,000 Barrels/Day**

1.2.3 Bryan Mound

The Bryan Mound storage facility located in Brazoria County, Texas. The facility occupies 500 acres and encompasses almost the entire Bryan Mound salt dome. Off-site facilities include a brine pipeline for brine disposal and crude oil pipelines for receiving and distributing oil in commerce.

The Bryan Mound salt dome was selected as a storage site early in the SPR program due to its existing brine caverns, which were readily converted to oil storage. Development of the site was initiated in 1977 and completed in 1987.

The marsh and prairie areas surrounding Bryan Mound are typical of those found throughout this region of the Texas Gulf Coast. Brackish marshland dominates the low-lying portions of the site. The coastal prairie is covered with tall grass forming cover and feeding grounds for wildlife. Marshes and tidal pools provide diverse habitats for a variety of birds, aquatic life and mammals.

Table 1-3 SPR Bryan Mound Storage Facility	
Location	**Freeport, TX**
Caverns	**20**
Authorized Storage Capacity	**254,000,000 Barrels**
Drawdown Rate	**1,500,000 Barrels/Day**

1.2.4 West Hackberry

The West Hackberry storage facility is located in Cameron Parish, Louisiana. The facility occupies 565 acres over the West Hackberry salt dome. Off-site facilities include an intake structure that provides raw (brackish) water for cavern development and fluid movements, brine disposal wells with associated brine piping and crude oil pipelines for receiving and distributing oil in commerce.

The West Hackberry salt dome was selected as a storage site early in the SPR program due to its existing brine caverns, which were readily converted to oil storage. Development of the site was initiated in 1977 and completed in 1988.

Numerous canals and natural waterways bisect the area. The surrounding area consists of marshland with natural ridges that support grass, trees and affect water flow through the marshes. These marshlands provide habitat for a variety of wetland and wildlife species.

Table 1-4 SPR West Hackberry Storage Facility	
Location	**Hackberry, LA**
Caverns	**22**
Authorized Storage Capacity	**227,000,000 Barrels**
Drawdown Rate	**1,300,000 Barrels/Day**

1.2.5 New Orleans

The project management office for SPR operations is housed in two adjacent office buildings with a nearby warehouse in Harahan, Louisiana, part of the New Orleans metropolitan area. This facility is the main office where the SPR was managed throughout 2016. Activities conducted at the New Orleans office complex are predominantly administrative. Office and warehouse space is leased, not owned, by the Department of Energy.

1.2.6 Stennis

The Stennis Warehouse facility is located in Hancock County, Mississippi. The warehouse and adjacent concrete aprons and parking lot occupy approximately 3.4 acres within the John C. Stennis Space Center. The warehouse, leased from the U.S. Army from 2004 to 2011, is now leased from NASA. It is used to maintain and store heavy equipment and piping in support of the four storage sites. It also has office space permanently used by its tenants and, if needed, temporarily used by headquarters personnel.

1.2.7 St. James Terminal

The St. James Terminal located along the Mississippi River in St. James Parish, Louisiana was leased to Shell Pipeline in 1997. The 173-acre site consists of the main facility and two satellite docks located on the west Mississippi River batture. A small onsite area was identified as contaminated with crude oil, and remediation efforts toward clean closure were implemented that resulted with a No Further Action At This Time (NFA-ATT) determination by LDEQ in 2008.

Figure 1-1 SPR Site Locations

2 Compliance Summary

The federal, state and local regulations, Executive Orders (EOs) and DOE orders and directives that the SPR operates under are summarized in Table 2-1.

A list of all applicable environmental regulations is provided in Appendix A1 and A2.

2.1 Regulatory Compliance Summary

The principal agencies responsible for enforcing environmental regulations at SPR facilities are: Environmental Protection Agency (EPA) Regions IV and VI,

- New Orleans and Galveston Districts of the U.S. Army Corps of Engineers (COE) NODCOE & GALCOE,
- U.S. Fish and Wildlife Service (F&WS),
- Louisiana Department of Environmental Quality (LDEQ),
- Louisiana Department of Natural Resources (LDNR),
- Louisiana Department of Wildlife and Fisheries (LDWF),
- Railroad Commission of Texas (RRC),
- Texas Commission on Environmental Quality (TCEQ),
- Texas General Land Office (TGLO),
- Texas Parks and Wildlife Department (TPWD) and
- Mississippi Department of Environmental Quality (MDEQ).

These agencies issue permits, review compliance reports, inspect site operations, and oversee compliance with regulations.

Table 2-1 Federal & State Environmental Regulations Applicable to the SPR

Regulatory Program Description	Compliance Status	Report Section
Clean Water Act (CWA), EPA Region VI, RRC, LDEQ and MDEQ establish standards and issuing permits to improve water quality. LDEQ has primary enforcement responsibility for NPDES in LA. In TX, EPA and RRC issue NPDES permits.	SPR sites comply with the CWA through permitting under the NPDES program, following Spill Prevention, Control and Countermeasures regulations and complying with wetlands usage program.	2.3.1, 5.3, 5.4 & 5.5
Oil Pollution Act (OPA) of 1990 and TGLO improved the nation's ability to prevent and respond to oil spills and provide requirements for contingency planning both by government and industry.	To meet OPA requirements the SPR conducts emergency drills at sites quarterly in accordance with National Preparedness for Response Program (PREP), along with full equipment deployment announced/unannounced exercises at each site annually.	2.3.2

Table 2-1 Federal & State Environmental Regulations Applicable to the SPR		
Regulatory Program Description	**Compliance Status**	**Report Section**
Safe Drinking Water Act (SDWA) LDNR and RRC - Louisiana and Texas Underground Injection Control (UIC) programs regulate underground hydrocarbon storage, related brine disposal, and oil field wastes. TCEQ enforces the SDWA in Texas by regulating Public Water Systems for health based violations to ensure potable water provided is safe to drink.	SPR sites comply with SDWA through permitting under the LA and TX UIC programs. The SPR operates 63 oil storage caverns, 21 saltwater disposal wells and 2 brine pipelines that extend into the Gulf of Mexico per the permit requirements. Texas SPR sites are considered PWS distribution systems who purchase potable water. Texas SPR sites systems are classified as "Non-Transient, Non-Community" Water Systems (NTNCWS). The sites have established Site Monitoring Plans which require routine sampling of potable water systems.	2.3.3 & 5.3
Clean Air Act (CAA), the LDEQ and TCEQ regulates the release of air pollutants through permits and air quality limits.	SPR sites comply with provisions of the CAA and State Implementation Plans (SIP) through permitting and following applicable regulations. All SPR facilities operate in accordance with the provisions of the applicable state air permits.	2.3.4 & 5.2
Pollution Prevention Act of 1990, LDEQ, RRC and EPA Region VI focus on reducing the amount of pollution through cost-effective changes in production, operation, and raw materials use.	Each SPR site operates in accordance with a Stormwater Pollution Prevention Plan (SWPPP) prepared in accordance with EPA multi-sector general stormwater discharge authority for stormwater associated with industrial activity and similar LA and MS state requirements, using Pollution Prevention Program principles as the basis for limiting or precluding storm water contamination.	2.3.5 & 5.8

Table 2-1 Federal & State Environmental Regulations Applicable to the SPR		
Regulatory Program Description	**Compliance Status**	**Report Section**
Resource Conservation and Recovery Act (RCRA), LDEQ, EPA and RRC govern the generation, storage, handling and disposal of hazardous wastes.	In CY16 SPR facilities continued to operate as Conditionally Exempt Small Quantity Generators (CESQG). Hazardous wastes are not treated, stored, or disposed at any SPR sites therefore the sites are not RCRA-permitted.	2.3.6 & 5.6
Toxic Substances Control Act (TSCA) regulates the manufacture, use and distribution of all chemicals.	Procedures are in place to prohibit purchase of equipment containing either friable asbestos or PCBs.	2.3.7 & 5.7
National Environmental Policy Act (NEPA) requires federal agencies to follow a prescribed process to anticipate impacts on the environment of proposed major federal actions and alternatives	SPR is in full compliance with NEPA requirements. Site-wide procedure and workflow have been established for implementing the NEPA requirements.	2.3.8
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) LDEQ and TCEQ regulate the manufacture, use, storage and disposal of pesticides and herbicides.	The SPR hires state certified pesticide applicators to apply pesticides. In addition only chemical products on the SPR Qualified Products List (QPL) are allowed on site.	2.3.9
Endangered Species Act, LDWF and TPWD prohibit activities that would jeopardize the existence of an endangered or threatened species or cause adverse modification to critical habitat.	The Fish &Wildlife Service is consulted about the appropriate actions taken with regard to threatened and endangered species.	2.3.10 & 5.10
Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds Migratory Bird Act"	In a continuing effort to minimize disruption and provide suitable habitat to migratory birds at SPR sites, bird-nesting areas are closed or otherwise protected during critical periods to prevent disturbance as a result of site operations.	2.3.11
National Historic Preservation Act (NHPA) and State Historic Preservation Office (SHPO) identify,	No places on are eligible to the National Register of Historic Places are located on or adjacent to	2.3.12

Table 2-1 Federal & State Environmental Regulations Applicable to the SPR		
Regulatory Program Description	**Compliance Status**	**Report Section**
evaluate and protect historic properties eligible for listing in the National Register of Historic Places. NHPA is administered by state historic preservation offices.	SPR sites. The BM site is located on a TX State Historical Place for its significance to the sulfur mining industry and long-term development of the nearby town of Freeport.	
Executive Order 11988 "Floodplain Management", **Executive Order 11990** "Protection of Wetlands", NODCOE, GALCOE, LDEQ and RRC	The SPR ensures compliance with EO 11988 & 11990 by maintaining compliance with NEPA requirements, identifying potential environmental impacts, and obtaining permits through the Corps Of Engineers and state coastal management agencies.	2.3.13
Executive Order 13693 "Planning for Federal Sustainability in the Next Decade" (issued 03/19/15) The goal is to maintain Federal Leadership in sustainability and greenhouse gas emission reductions.	The SPR Sustainability Program includes projects and activities that support the achievement of goals and targets of the Executive Order 13693 that replaced the above two. A Site Sustainability Plan is completed and submitted to DOE on an annual basis which is due in November of every year.	2.3.14 & 5.9
Superfund Amendments and Reauthorization Act (SARA), EPA, LDEQ, LDNR and TCEQ SARA Title III specifies a number of responsibilities and reporting obligations for facilities with hazardous chemicals. **Emergency Planning and Community Right to Know Act** (EPCRA) establishes requirements for federal, state and local governments, Indian tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals	The SPR prepared and distributed SARA Title III Tier Two reports, also known as Emergency Planning and Community Right-to-Know Act (EPCRA) Section 312 reports by March 1, 2016 to state and local emergency planning committees and local fire departments. The SPR was not required to submit Toxic Chemical Release Inventory (TRI) reports for any of the SPR sites in 2016 because the SPR did not introduce any crude oil into commerce.	2.3.15 & 5.7

2.2 Environmental Permit Compliance Summary

Permits in effect during 2016 include eight state and federal CWA wastewater discharge permits, nine CAA permits, 35 active original structure COE wetlands (Section 404 of CWA) permits (not counting associated modifications and amendments), and more than 100 oil field pit, underground injection well, salt mining and hydrocarbon storage permits. Detailed site specific information about the major permits is presented in tabular form in Section 5.1.

During 2016, an air permit application was submitted to the Louisiana Department of Environmental Quality (LDEQ) for the renewal of the Bayou Choctaw air permit. An air permit by rule was also obtained from the Texas Commission on Environmental Quality (TCEQ) in 2016 for the demolition of the existing Bryan Mound Crude Oil Storage Tank Number 2 (BMT-2) and the construction of a new replacement tank.

Both Bayou Choctaw and West Hackberry SPR sites received renewed water discharge permits during calendar year 2016. The Bayou Choctaw general permit was re-issued in March 2016 as part of the LDEQ statewide renewal; and, the West Hackberry individual permit renewal was effective June 2016, following acceptable submission of an application in May 2015.

2.2.1 Permit Compliance

Compliance with environmental permits is assured by meeting conditions detailed within the permit. These conditions can be monitoring of components or processes, monitoring of pollutant effluents to ensure they meet permit limits, maintaining structures in their original condition, and inspecting facilities.

Air quality operating permits require piping components such as valves, flanges, pressure relief valves, and pump seals be inspected for leaks of VOCs on a regular basis (biennially in TX and annually in LA) using organic vapor analyzers (OVA). In addition, the TX permits require that the flanges be inspected visually, audibly, and or by olfactory methods to identify any possible leaks on a weekly basis. All SPR air permits contain permit limitations based on pollutant emission rates in pounds per hour and tons per year.

The SPR ensures compliance with these permit limits by monitoring the processes that emit the pollutants. This includes monitoring use of generators, volumes of crude oil, diesel, and gasoline moved through tanks, volume of paint, and others. The results of this monitoring are reported to the agencies annually by BM and BH (if applicable) through an Emissions Inventory Questionnaire (EIQ). The BC and WH sites do not require reporting because they are below the required emission limit to report in Louisiana. All 2016 air reports were submitted to the appropriate agencies on time.

Water discharge permits require that analytical permit limits are met and reported. Other permit conditions require visual monitoring of effluents to ensure they have no visible sheen or foaming. All SPR sites periodically (daily, monthly and/or quarterly) monitor permit limit compliance with quarterly reporting through NPDES, LPDES, and RRC Statewide Rule 8 Discharge Monitoring Reports (DMRs). All such reports were submitted to appropriate agencies on time in 2016. Detailed site specific information about major permits is presented in tabular form in Section 5.1. The Big Hill and Bryan Mound NPDES DMRs were successfully switched

to the EPA's electronic reporting system known as NETDMR commencing in January 2015, therefore, all DMRs for the entire 2016 calendar year reporting period were processed electronically and on time.

2.2.2 Non-Compliances

There was one non-compliance out of a total of 1143 permit-related laboratory analyses reported in 2016. With the one permit non-compliances an overall project-wide compliance rate of 99.9 percent for 2016 was achieved.

On June 7, 2016 at the Bryan Mound site, regular monthly testing samples for outfall 002 were obtained for the permit prescribed contaminant parameters: pH, BOD5, and TSS. The BOD5 testing, performed offsite by a contract laboratory, determined a value of 26 mg/l which did not exceed the DAILY MAX of 45 mg/l but exceeded the DAILY AVERAGE of 20 mg/l.

Operational conditions were found to be within normal ranges for the other parameters tested and for the flow; however, it was suspected that introduction of floor cleaning rinse potentially could have affected the BOD5 test results and the basic oxygen demand (BOD) and load on the plant.

As a result, the plant operations were suspended so that the unit could be cleaned and reseeded in rapid fashion to restore satisfactory operations for follow-on sampling before the close of the monitoring period.

An additional sample was obtained for BOD5 on June 30, producing an improved result of 15 mg/l; however, the combination of the two test results still produced an average of 20.5 mg/l, which exceeded the DAILY AVERAGE limit of 20 mg/l for the June monitoring period. During this period the plant operations did not appear abnormal and all other sampling parameters and flow were within the normal range and permitted limits.

Early sampling was scheduled in the July monitoring period to assess satisfactory operations of the unit and confirm the short-term duration of this temporary and limited excursion. The discharge of the unit is to an onsite pond with no direct outlet to a water of the US, providing in excess of 21 days of additional tertiary treatment downstream. No observable impacts were recorded or associated with this noncompliance.

2.2.3 Non-Routine Releases

State and federal agencies require notification if the amount of material spilled meets or exceeds the reportable criteria. This reportable criterion is established by each agency with jurisdictional responsibility. The majority of the non-routine releases of pollutants occur with the spills of crude oil and brine into the environment from SPR operations. In 2016 there were three reportable releases at the Strategic Petroleum Reserve.

There was one reportable release at the Bayou Choctaw site on 07/06/2016. While performing maintenance on crude oil header valve 4H000PV57 an estimated quantity of 2 gallons of crude oil was released into the swampy area east of the roadway to cavern 19 which is a wetland. The area was cleaned and notifications to outside agencies were made per the BC Site ERP.

There was one reportable release at the Bayou Choctaw site on 08/28/2016. BC security personnel discovered a brine leak near building 401. Operations personnel confirmed the material was brine and estimated 3 to 4 barrels of brine had been released. The fluid movements were suspended, the area was cleaned, notifications were completed, and the source of the leak was repaired.

During March FY16 there was one reportable spill that occurred at the West Hackberry site. Approximately 1 to 2 cups of hydraulic oil were released into Black Lake during the loading of equipment on a barge.

During 2015 the SPR moved (received and transferred internally) 15.63 million m^3 (98.32 mmb) of oil and disposed of 0.77 million m^3 (4.86 mmb) of brine. The long-term trend for crude oil and brine spills and releases has declined substantially from 26 in 1990 to three reportable releases in 2016. Reportable Oil and Brine Spills from 1982 through 2016 are summarized in Table 2-2. Additionally, Figure 2-1 provides an illustration of reportable brine and crude releases at the SPR from 1990 to 2016.

Table 2-2 Number of Reportable Oil & Brine Spills 1982-2016

Year	Type of Spill	Total Spills	Volume Spilled m^3 (barrels)	% Spilled of Total Throughput
1982	Brine	43	443.8 (2,792)	0.0005
	Oil	24	847.0 (5,328)	0.00704
1983	Brine	44	259.4 (1,632)	0.0002
	Oil	21	380.9 (2,396)	0.00281
1984	Brine	17	314.0 (1,975)	0.0003
	Oil	13	134.8 (848)	0.00119
1985	Brine	16	96,494.8 (607,000)	0.1308
	Oil	7	85.4 (537)	0.00122
1986	Brine	7	275.6 (1,734)	0.0017
	Oil	5	1232.5 (7,753)	0.01041
1987	Brine	22	96.5 (608)	0.0003
	Oil	5	2.5 (16)	0.00002
1988	Brine	12	93.8 (586)	0.0001
	Oil	6	8.8 (55)	0.00001
1989	Brine	17	131,231.6 (825,512)	0.1395
	Oil	11	136.4 (858)	0.00004
1990	Brine	12	11,944.3 (74,650)	0.0170
	Oil	14	74.8 (467)	0.00003
1991	Brine	7	1,156.8 (7,230)	0.004
	Oil	6	37.9 (237)	0.0004
1992	Brine	9	48.0 (302)	0.003
	Oil	5	1.9 (12)	0.00006
1993	Brine	6	59.2 (370)	0.001
	Oil	6	36.9 (232)	0.0007
1994	Brine	2	14.4 (90)	0.0006
	Oil	7	6.2 (39)	0.0003
1995	Brine	3	131.1 (825)	0.0028
	Oil	2	56.3 (354)	0.0006
1996	Brine	5	179.7 (1,130)	0.0014
	Oil	4	4.7 (30)	0.00002
1997	Brine	0	0	0.0

Table 2-2 Number of Reportable Oil & Brine Spills 1982-2016				
Year	Type of Spill	Total Spills	Volume Spilled m^3 (barrels)	% Spilled of Total Throughput
	Oil	1	0.32 (2)	4.0 x 10-9
1998	Brine	3	6.2 (39)	0.00028
	Oil	1	Sheen	N/A
1999	Brine	0	0	0.0
	Oil	1	31.8 (200)	0.00056
2000	Brine	0	0	0.0
	Oil	1	11.1 (70)	0.00011
2001	Brine	1	0.019 (0.12)	5.60×10^{-7}
	Oil	2	1.6 (10)	0.0000163
2002	Brine	2	2.1 (13)	3.9×10^{-6}
	Oil	0	0	0.0
2003	Brine	0	0	0.0
	Oil	3	1.1 (7)	0.0000104
2004	Brine	1	1.6 (10)	2.2×10^{-7}
	Oil	0	0	0.0
2005	Brine	1	27 .0 (170)	5.5×10^{-6}
	Oil	0	0	0.0
2006	Brine	0	0	0.0
	Oil	2	0.5 (3)	3.3×10^{-6}
2007	Brine	0	0	0.0
	Oil	0	0	0.0
2008	Brine	0	0	0.0
	Oil	0	0	0.0
2009	Brine	1	0.8 (5)	0.000018
	Oil	0	0	0.0
2010	Brine	0	0	0.0
	Oil	0	0	0.0
2011	Brine	1	1.9 (12)	0.000045
	Oil	0	0	0.0
2012	Brine	0	0	0.0
	Oil	0	0	0.0
2013	Brine	0	0	0
	Oil	0	0	0
2014	Brine	1	0.8 (5)	0.000133
	Oil	0	0	0
2015	Brine	0	0	0
	Oil	0	0	0
2016	Brine	1	0.64 (4)	0.00008
	Oil	2	0.0002 (0.05)	5.1×10^{-8}

2.2.4 Environmental Reportable Project Events

Project events equal all reportable spills and all discharge permit non-compliances. These events are used to provide a summary of SPR performance as illustrated in Figure 2-2. During 2016 there were four environmental reportable project events at the SPR as previously described in Sections 2.2.2 and 2.2.3

Figure 2-1 Reportable Oil & Brine Spills 1990 - 2016

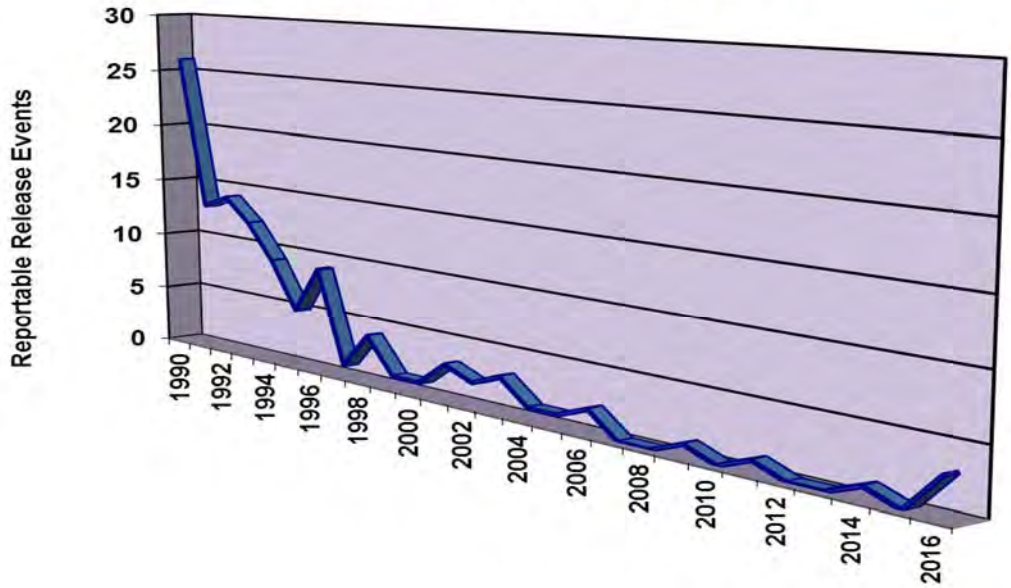
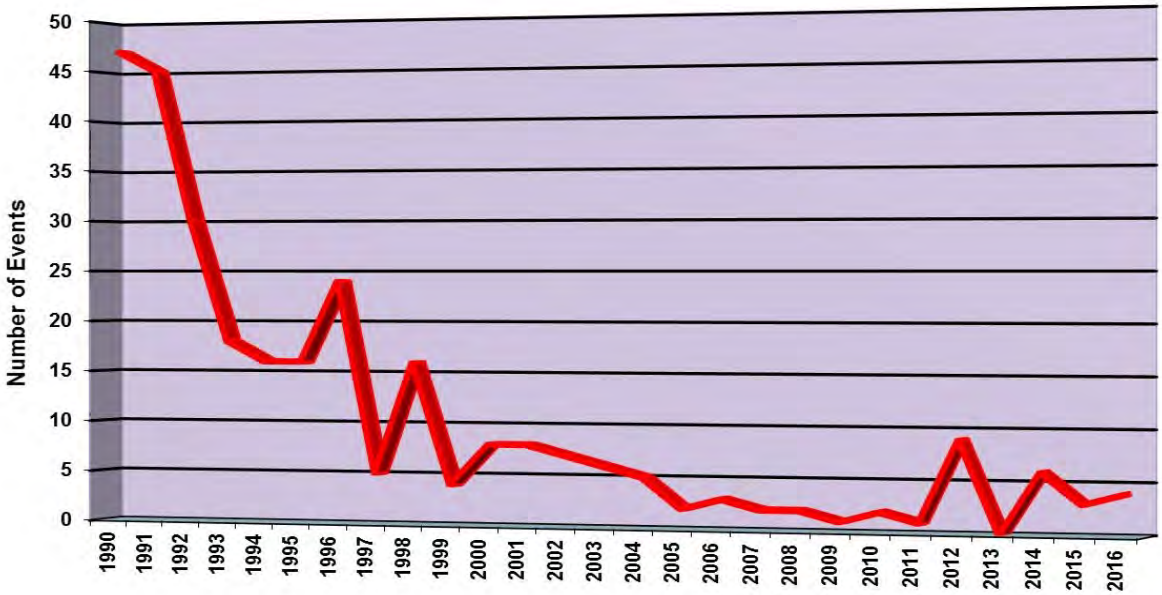


Figure 2-2 Environmental Reportable Project Events 1990 - 2016



2.3 Compliance Status

A major component of the SPR's compliance program is associated with meeting regulations under the CWA. At the beginning of the year, the SPR sites had a total of 95 wastewater and stormwater discharge monitoring stations that remained unchanged during this period, and 35 active (core-structure) individual wetland permits authorizing various structures at each of the

sites. The SPR is also required to meet many requirements under the CAA and the SDWA and conduct waste management activities in accordance with RCRA and state guidelines. The following sections highlight primary SPR compliance activities by environmental statute.

2.3.1 Clean Water Act (CWA)

SPR sites comply with the CWA through permitting under the National Pollutant Discharge Elimination System (NPDES) program. Additionally, the sites follow the Spill Prevention, Control and Countermeasures (SPCC) regulations, comply with the requirements of the Oil Pollution Act (OPA) of 1990, and comply with the wetlands usage program.

In 2016, no modifications, changes or renewals were needed to either the state (Rule 8) or federal (NPDES) water discharge permits for the two Texas sites. The two federal NPDES and the two state Rule 8 permits became effective November 1, 2014, and remained in full force for 2016.

Louisiana has primary enforcement responsibility for the NPDES discharge program, issuing permits under the CWA. The SPR maintains a LA statewide permit from LDEQ for discharge of hydrostatic test water that minimizes permit-filing fees and increases flexibility in support of site construction and maintenance activities. In May of 2015, a renewal application was prepared and supplied to LDEQ for the West Hackberry LPDES permit 180 days prior to expiration per regulation. The existing permit was administratively extended when the application was determined to be administratively complete and the final renewed permit was issued May 3, 2016, with an effective date of June 1, 2016.

At the Bayou Choctaw facility, the LPDES General Permit authority to discharge water was automatically renewed statewide by LDEQ in December 2015; and, official written confirmation of the site specific renewal was dated March 28, 2016.

Each SPR storage site and the Stennis warehouse comply with federal SPCC regulations and in LA with the state SPCC regulations by following a plan that addresses prevention and containment of petroleum and hazardous substance spills. All SPR SPCC plans are current in accordance with Title 40 CFR 112 and corresponding state regulations. There were no changes made to any of the SPR SPCC Plans in 2016.

The SPR sites obtain permits from the COE and Coastal Zone Management representatives of the responsible state agencies whenever fill, discharge, or dredging occurs in a wetland. During 2015 the maintenance dredging clause for the existing construct and maintain wetlands permit for the WH RWIS was renewed (Extension of Time) by the New Orleans District and exercised. There were no wetlands permits issued to the SPR by the Galveston District. There were, however, several maintenance notifications for traveling screen removals for repair and associated replacements at two of the sites.

2.3.2 Oil Pollution Act (OPA) of 1990

SPR emergency programs, planning, and management are guided by OPA 1990 regulatory standards for onshore storage facilities, pipelines, and marine terminal facilities. Facility Response Plans (FRP) on the SPR have been combined with the site emergency response procedures in accordance with the EPA “One Plan” scheme and meet or exceed the requirement of OPA 1990 and related state acts such as the Oil Spill Prevention and Response Act (OSPRA)

in TX. The plans are approved by the appropriate federal and state regulatory agencies. The TX sites maintain their individual OSPRA certifications in accordance with state requirements.

The SPR conducts emergency drills or hands-on training of its sites each quarter in accordance with the National Preparedness for Response Program (PREP), along with full equipment deployment announced and unannounced exercises at each site annually. A professional staff of emergency management personnel from the M&O New Orleans staff coordinates these drills and exercises and includes the participation of public and regulatory/governmental agencies as available.

The SPR utilizes the National Incident Management System (NIMS), the response management system required by the National Oil and Hazardous Substances Pollution Contingency Plan. SPR site and New Orleans response management personnel have been trained in the unified Incident Command System, and a team of selected New Orleans personnel is available to support extended site emergency operations when needed.

2.3.3 Safe Drinking Water Act (SDWA)

The SPR oil storage caverns and brine disposal wells are regulated by the SDWA. The EPA granted primacy under the SDWA to both LA and TX Underground Injection Control (UIC) programs, which regulate underground hydrocarbon storage, related brine disposal, and oil field wastes. The SPR operates 21 saltwater disposal wells for LA sites. In TX, brine is disposed via brine pipelines that extend into the Gulf of Mexico. Some ancillary commercial disposal wells are used occasionally. The 2016 Annual Report Form OR-1 for underground injection was completed and submitted on schedule to the LDNR using the newly implemented and required electronic reporting process.

Historic groundwater evaluations have indicated the presence of some shallow groundwater impacts from salt water at the BM and WH sites. At BM, data suggest that use of unlined brine storage pits by the previous industrial tenants may have been a major contributor to the salt impacted groundwater located east of the site's closed large brine storage pond. As part of the site’s overall groundwater surveillance, the post-closure monitoring near the BM brine storage pond is provided through this report to the RRC as requested.

The WH site completed closure of its brine ponds in 1999 under a Corrective Action Plan (CAP) negotiated with LDNR. All remedial recovery pumping was successfully completed in 2001. Post closure monitoring for three closed anhydrite ponds of certain wells for 30 years is currently met by monitoring quarterly and reporting annually in this Site Environmental Report (SER), which is shared with LDNR. A 2002 proposal for resumption of a site-wide groundwater monitoring program addressing both the brine pond and anhydrite pond closures was approved by LDNR in 2004 and has been followed since.

Groundwater monitoring of the uppermost interconnected aquifer at all SPR sites is mandated through DOE orders for surveillance assessment and are coordinated on the SPR through the Environmental Monitoring Plan (EMP). Details of the groundwater monitoring of the site wide well nets are presented in Section 6.

Local public water systems supply drinking water to all storage sites, NO headquarters, and the NO and Stennis warehouses. Potable water systems at BM and BH are classified by state and federal regulations as "non-transient, non-community" public water distribution systems, and these sites are required to have potable water monitoring programs. Unlike BH and BM, WH and BC facilities are not required to have potable water monitoring programs and are recognized as water purchasers only.

In 2016, potable water samples were taken monthly at BH and BM for coliform monitoring and weekly samples are collected and analyzed for residual chloramine (disinfectant). Average disinfectant levels are reported to TCEQ on a Disinfectant Level Quarterly Operating Report (DLQOR) on a quarterly basis. Calculated results at both sites did not exceed the regulatory maximum contaminant levels (MCL) for disinfectants. All coliform results were also below the MCL.

Potable water is sampled and tested for lead and copper annually at BH and a tri-annually at BM. In 2016 testing for disinfection by-products (DBP) (Trihalomethanes and Haloacetic Acids) was conducted through TCEQ at BM and BH. Test results for DBPs were below the MCL at both sites. Other potable water parameters monitored for compliance include asbestos, nitrite, and nitrate with varied monitoring schedules. Samples were collected by a TCEQ contractor and tested for nitrate and nitrite at BH and BM in FY16. All results were below the affiliated MCLs.

2.3.4 Clean Air Act (CAA)

SPR sites comply with the applicable provisions of the CAA and State Implementation Plans (SIP) through permitting and following applicable regulations. The state agencies have primacy (LDEQ and TCEQ). All SPR sites are located in attainment areas for all National Ambient Air Quality Standards (NAAQS) pollutants with the exception of ozone. The BH and WH sites are located in attainment areas for ozone; therefore, it is regulated by the Prevention of Significant Deterioration (PSD) permitting program. The BC and BM sites are located in non-attainment areas for ozone; therefore, the New Source Review (NSR) permitting program applies. None of the SPR sites are considered to be major sources of air emissions during normal operations under PSD, NSR, Title III hazardous air pollutant (HAP), or Title V operating permit regulations. All of the facilities operate in accordance with the provisions of the applicable state air permits.

2.3.5 Pollution Prevention Act of 1990

Each SPR site operates in accordance with a Stormwater Pollution Prevention Plan (SWPPP) prepared in accordance with EPA multi-sector general stormwater discharge authority for stormwater associated with industrial activity and similar LA and MS state requirements. This multimedia document consolidates these regulatory agency requirements with EO 13693, which require a Pollution Prevention Program (PPP) and the related Waste Minimization and Solid Waste Management Plans. SPR Pollution Prevention Program principles form the basis for our SWPPPs required by the NPDES and state water discharge programs.

2.3.6 Resource Conservation and Recovery Act (RCRA)

Hazardous wastes generated on the SPR are managed in strict compliance with state and EPA hazardous waste programs. The EPA has delegated the hazardous waste program to LDEQ in LA and MDEQ in MS. SPR TX sites fall under jurisdiction of the RRC, which has not yet received delegation; therefore, the SPR complies with both EPA and RRC regulations in TX.

Large quantities of hazardous waste are not routinely generated at the SPR. The sites continued to operate as Conditionally Exempt Small Quantity Generators (CESQG) in 2016. Hazardous wastes are not treated, stored, or disposed at SPR sites and therefore, the sites are not RCRA-permitted treatment, storage, and disposal (TSD) facilities. Each site has an EPA generator number that is used to track the manifesting of hazardous waste for off-site treatment or disposal. None of the SPR sites are identified on the National Priority Listing (NPL) under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

SPR non-hazardous wastes associated with underground hydrocarbon storage activities are regulated under corresponding state programs for managing drilling fluids, produced waters, and other wastes related to the exploration, development, production or storage of crude oil or natural gas. These wastes are referred to as Exploration and Production (E&P) wastes. Hazardous E&P wastes are exempted from RCRA, but Congress did not include the underground storage of hydrocarbons in the E&P scope. Under LA and TX regulations, underground storage of hydrocarbons "is" included in the E&P scope. In order to remain in compliance with federal law, the SPR does not dispose of hazardous waste under E&P exemption. The SPR characterizes all E&P wastes to determine if they exhibit hazardous characteristics, and any that do are managed and disposed as hazardous waste. The SPR disposes of non-hazardous wastes generated by the E&P process at state-approved E&P disposal facilities.

The SPR achieved the 100% Affirmative Procurement (AP) purchases target for FY16. All purchases qualified as recycled products or justified virgin products. There were no purchases of virgin products in 2016. The DOE and M&O contractor's corporate environmental policies stress the SPR's commitment to waste management and environmental protection (Appendix B).

2.3.7 Toxic Substances Control Act (TSCA)

Friable asbestos is not present on the SPR sites. Small amounts of non-friable asbestos usually in the form of building materials, seals, or gaskets are disposed of as they are taken out of service in accordance with applicable solid waste regulations. Non-asbestos replacement components are used. No liquid-filled electrical equipment or hydraulic equipment currently used on the SPR has been identified as containing polychlorinated biphenyl (PCB). Procedures are in place to prohibit purchase of equipment containing asbestos or PCBs.

2.3.8 National Environmental Policy Act (NEPA)

All design reviews, engineering change proposals, deviations, waivers and purchase requisitions were evaluated for NEPA review in 2016. Out of these documents, 35 required NEPA categorical exclusion documentation. None of the projects associated with these documents had potential to adversely affect any environmentally or culturally sensitive resources, such as structures of historic, archeological, or architectural significance or any threatened or endangered species or their habitat. Also, no wetlands were adversely impacted as a result of these actions. All of these NEPA reviews resulted in categorical exclusions that required no further action.

The purpose of the NEPA Program is to review all SPR projects in the early planning stages to ensure environmental impacts and requirements are adequately evaluated. All SPR activities must have, or have had, a NEPA review. For most projects, the NEPA document is a "Record of NEPA Review" (RONR), which suggests a project is a categorical exclusion (CX) or that the

project is covered under an existing NEPA document. For those few projects not covered by a RONR, a higher level of NEPA review is required, and is part of the planning process. A RONR is required if the project's value is greater than $150,000 (for information systems, construction contracts, and service contracts) or for any project or task that might cause significant environmental impact. The following are reviewed for NEPA compliance:

- Conceptual Design Reports
- Definitive Engineering Scopes
- Statements of Work
- Work Orders or Service Orders
- Engineering Change Proposals
- Deviations and Waivers
- Design Reviews
- Purchase Requests
- Scopes of Work

A signed NEPA document is required 1) prior to detailed design beyond conceptual design, 2) before a scope of work is issued for construction or 3) before manpower commitment. The NEPA process is key in identifying environmental aspects for incorporation into the EMS.

Two projects were reviewed in 2016 and determined to require Environmental Assessments. Environmental Assessment, DOE/SPR/EA was prepared for the Repair/Enhancement of Access to Remote Pipeline Valve Stations for the West Hackberry Strategic Petroleum Reserve site. The Finding of No Significant Impact and the Final Environmental Assessment was issued by DOE on December 21, 2016.

Environmental Assessment, DOE/EA-2039 was prepared for the Brine Disposal Pipeline Replacement Project associated with the West Hackberry Strategic Petroleum Reserve site. The Environmental Assessment is ongoing.

2.3.9 Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)

Much of the SPR property is developed with buildings, piping, cable trays, and other structures where pesticide and herbicide use is necessary to control unwanted vegetation and other pests. During 2016 the SPR used pesticide products to control pests in buildings and around work areas, control vegetation throughout site grounds, and security zone areas, and to mitigate the reduction of the number of personnel dedicated to mowing. Although pesticide use is necessary, there is a concerted effort made, through screening of chemicals prior to purchase, to restrict the use of products to the least harmful to the environment and site employees.

2.3.10 Endangered Species Act (ESA)

In a continuing effort to minimize disruption and provide suitable habitat to migratory birds at SPR sites, bird-nesting areas are closed or otherwise protected during critical periods to prevent disturbance as a result of site operations. The U.S. Fish & Wildlife Service (F&WS) is consulted regarding appropriate actions that may affect migratory birds or threatened and endangered species. For example, the F&WS is consulted prior to removal and/or relocation of threatened, endangered and nuisance wildlife.

Consideration of potential impacts to endangered species at the SPR was included as part of the original conditional coverage through the re-issued Multi Sector General Permit (MSGP). During the process, a required signatory on each Notice of Intent (NOI) precipitated a formal review of site-specific potential endangered species impacts. This was accomplished prior to finalizing the NOIs and involved an update/comparison step with original Environmental Impact Statements (EISs), with the current ESA lists, and a generalized evaluation or assessment of any potential impacts relating to or resulting from SPR stormwater "sheet flow" run-off. No potential impacts were discerned at that time. The MSGP coverage has since been migrated to either the individual or general permits issued to each site.

2.3.11 Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds & Migratory Bird Act

SPR storage facilities are located in a variety of environments and on migratory pathways along the TX and LA Gulf Coast. As such, a variety of waterfowl and song birds frequent SPR sites during the migratory season. Environmental awareness of migratory bird issues commences at the site level. Each site ES&H Manager implements site-wide surveillance in the conduct of normal operations. Selected fields are not mowed from early fall through early spring at BC, BM, BH, and WH to provide food and shelter for migrating birds and nesting and brooding of resident birds. When discovered, nesting areas are flagged in the field for the duration of the nesting season (e.g. terns and killdeer); and equipment has been designated for limited/restricted use on occasion when they harbor bird nests (e.g. by mockingbird, mourning dove, and shrikes).

2.3.12 National Historic Preservation Act

No site projects required certified reviews by the LA State Historical Preservation Office (SHPO) in 2016. No locations on or adjacent to SPR sites are on or eligible to the National Register of Historic Places. The BM SPR site is located on a TX State Historical Place for its significance to the sulfur mining industry and long-term development of the nearby town of Freeport. A monument commemorates the historical significance of this location.

2.3.13 Executive Order 11988 Floodplain Management & Executive Order 11990 Protection of Wetlands

Since the SPR's inception, compliance with EO 11988 has been maintained by complying with NEPA requirements, identifying potential environmental impacts, and obtaining permits through the COE and state coastal management agencies prior to any construction, maintenance, rehabilitation, or installation of structures and facilities. The measures that illustrate the SPR compliance with EO 11988 are also used to comply with EO 11990 and ensure that any practicable steps to minimize harm to wetlands are identified and taken.

2.3.14 Executive Order 13693, Planning for Federal Sustainability in the Next Decade

EO 13693, "Planning for Federal Sustainability in the Next Decade", was signed and implemented in March, 2015. The goal of EO 13693 is to maintain Federal Leadership in sustainability and greenhouse gas emission reductions. The Executive Order incorporates and builds upon past Executive Orders and Memorandums and has extended many current requirements to FY 2025. Executive Order 13693 revokes the following:

- Executive Order 13423 (January 24, 2007), *Strengthening Federal Environmental, Energy, and Transportation Management.*
- Executive Order 13514 (October 5, 2009), *Federal Leadership in Environmental, Energy, and Economic Performance*.
- Presidential Memorandum of December 2, 2011 (Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings), and
- Presidential Memorandum of May 24, 2011 (Federal Fleet Performance).

The SPR performed review and comparison of all three EO's and associated goals and updated activities and projects at the SPR that support EO 13693 goals.

DOE Order DOE O 436.1 (Departmental Sustainability) and SPR PMO Order 436.1 (Site Sustainability) both delineate requirements and responsibilities to DOE and contractor personnel for implementing the goals of the two executive orders. These goals comprise the SPR Sustainability Program and are as follows:

- Increase energy efficiency and reduce Scope 1 and 2 green house gas (GHG) generation
- Reduce Scope 3 GHG generation
- Conduct an annual comprehensive GHG inventory
- Increase use of renewable energy and implement renewable energy generation projects on DOE property
- Install meters
- Reduce fleet consumption of petroleum products
- Promote high performance sustainable building design and construction
- Install cool roofs
- Promote regional and local planning
- Increase potable and industrial/landscape/agricultural (ILA) water use efficiency and management
- Achieve EPA's stormwater management objectives
- Promote pollution prevention and waste elimination
- Increase diversion of non-hazardous solid waste and construction/demolition materials and debris
- Increase diversion of compostable and organic material from waste streams
- Reduce paper use and acquisition
- Reduce and minimize the quantity of toxic and hazardous chemicals and materials acquired, used, and disposed
- Increase use of acceptable alternative chemicals and processes, including those that will reduce the use of chemicals that could threaten GHG reduction targets
- Implement pest management and other landscaping management practices
- Increase sustainable acquisition
- Meter data centers
- Promote electronic stewardship and energy efficient data centers
- Continue implementation and achieving these goals through an environmental management system

Each year the SPR Sustainability Planning Committee oversees the identification, selection, scheduling, budgeting, and implementation of projects and activities that support the sustainability program. A brief synopsis of the goals, activities, and projects that support the goals and FY16 performance are found in Section 5.

2.3.15 Superfund Amendments and Reauthorization Act (SARA) & Emergency Planning and Community Right-to-Know Act (EPCRA)

SARA Title III Tier Two reports, also known as Emergency Planning and Community Right-to-Know Act (EPCRA) Section 312 reports were prepared and distributed as required by March 1, 2017 to state and local emergency planning committees and local fire departments. Table 2-3 contains a summary of the inventory information that was submitted for 2016.

SPR sites are required to report under EPCRA Section 313, by submitting Toxic Chemical Release Inventory (TRI) Form R when reporting thresholds, defined by emissions from crude oil placed in commerce, are exceeded. Specifically, when crude oil is placed in commerce, it is considered to be repackaging of hazardous substances and must be reported. This form must be submitted by July 1 for the reporting thresholds exceeded during the preceding calendar year. The submittal of a TRI Form R was not required for any of the SPR sites in 2016 because the SPR did not introduce any crude oil into commerce.

Table 2-3 2015 SARA Title III Tier Two Summary for the SPR

SPR Site	Chemical Name (Category)	*Max Daily Amount (lbs)	Location On Site
BC	Chemguard 3% MS-AFFF C-301	1,000 – 9,999	OPS., Foam Deluge Building
	Crude Oil Petroleum	> 1 Billion	Flammable Storage Building, Site Tanks, Piping, Underground Caverns
	Diesel Fuel	10,000 – 99,999	Emergency Generator Fuel Tank,
	Diesel Fuel #2	1,000 – 9,999	Property Tank #2
	Gasoline, Including Casing Head	1,000 – 9,999	Property Tank 1
	Hydrochloric Acid	0 – 99	Environmental Laboratory
	KAM Generator Solution A	0 – 99	Environmental Laboratory
	Nitric Acid	0 – 99	Environmental Laboratory
	Nitrogen Balance Gas	0 – 99	Control Building
	Sulfur in Petroleum Crude Oil	0 - 99	Environmental Laboratory
	Xylene	0 – 99	Envir Flam. Cabinet
BH	Asphalt	10,000 – 24,999	Laydown Yard
	Chemguard 3% MS AFFF C301	10,000 – 99,999	Operations Buildings 16, 805 and 834
	Crude Oil Petroleum	> 1 Billion	Flammable Storage Building, Site Tanks, Piping, Underground Caverns
	Diesel Fuel	25,000 – 49.999	Operations, BHT-4, 11, and 50, BHSE-196 Trailer, Bldg 805and Property Annex BHT-51
	Gasoline	10,000 – 24,999	Bldg. 805 and BHT-52
	GMA Garnet	10,000 – 24,999	Maintenance Laydown Yard
	Hydrochloric Acid	0 – 99	Environmental Laboratory
	Hydrogen Sulfide	0 – 99	I&C Office
	Nitric Acid	0 – 99	Environmental Laboratory
	Non-Flammable Gas Mixture	0 – 99	I&C Office
	Potassium Chloride Solution	0 – 99	Environmental Laboratory
	Sulfuric Acid	0 – 99	Environmental Laboratory
	Xylene	0 – 99	Crude Oil Storage Bldg.

Table 2-3 2015 SARA Title III Tier Two Summary for the SPR			
SPR Site	**Chemical Name (Category)**	***Max Daily Amount (lbs)**	**Location On Site**
BM	1-125PPM Vol. Hydrogen Sulfide Balance Nitrogen – Cal. Gas	0 – 99	Property Building 202
	78HBC00000 (Paint)	0 - 99	Bldg 243
	Buckeye 3% MIL SPEC AFFF (BFC 3MS)	10,000 – 24,999	Bldg 207
	Chemguard 3% MS AFFF C301	75,000– 99,999	Operations Buildings 242 and 206
	Crude Oil Petroleum	1 Billion	Flammable Storage Building, Site Tanks, Piping, Underground Caverns
	DB-23 Bonder	0 - 99	Brine Pump Area
	Diesel	25,000 – 49,999	Fuel Tank, BMT-20, BMP- 29 and 217 , Bldg 242, RWIS, Brine Pump, and Workover Rig
	Gasoline	10,000 – 24,999	Operations Building 242
	Hydrogen Sulfide	100 – 499	Buildings 244 and 201
	Non-Flammable Gas Mixture 4-1 F/Calibration Gas	0 – 99	Buildings 244 and 201
	Sealed Lead Acid Battery	500 – 999	Warehouse
Stennis	CAT ELC Extended Life Coolant	10,000 – 24,999	West Wall
Offsite Pipelines	Crude Oil, Petroleum	50,000,000 – 99,999,999	Pipelines In Calcasieu Parish, La (West Hackberry)
	Crude Oil, Petroleum	10,000,000 – 49,999,999	Pipelines In Cameron Parish, La (West Hackberry)
NO	Diesel Fuel	100 – 999	Tank, Building 850
	Diesel Fuel	1,000 – 9,999	Tank, Building 900
WH	Amercoat 68 HS Powder	100 – 999	Flammable Storage Building
	Buckeye 3% Mil Spec AFFF	10,000 – 99,999	Operations Buildings 303, 304, 305 and 316
	Buckeye Platinum 3%-6% Low Temp AR-AFFF	1,000 – 9,999	Operations Buildings 305 and 316
	Chemguard BC Dry Chemical	1,000 – 9,999	Operations Building 305
	Crude Oil Petroleum	> 1 Billion	LCMS Piping, Site Tanks, Piping, Underground Caverns, Warehouse E
	Diesel Fuel	1,000 – 9,999	MTC, Fuel Pump Tank
	Diesel Fuel #2	1,000 – 9,999	Workover Rig
	FC-203CF Lightwater Brand AFFF	1,000 – 9,999	Operations Foam Storage Building
	Gasoline, Including Casing Head	10,000 – 99,999	Fuel Pump Tank, Laydown Yard and HPPP Flammable Cabinet
	GMA Garnet	1,000 – 9,999	MTC, Paint Laydown Yard
	Hydrochloric Acid	0 – 99	Environmental Laboratory
	Mobil DTE Oil BB	1,000 – 9,999	Degas General
	Mobil DTE Oil Heavy	1,000 – 9,999	Degas General
	Mobill Pegasus 505	1,000 – 9,999	Degas General
	Nitrogen	1,000 – 9,999	MTC Laydown Yard
	Propane	10,000 – 99,999	Degas General and LCMS Propane Tank
	Sulfur in Petroleum Crude Oil	0 - 99	Environmental Lab
	Sulfuric Acid	0 – 99	Environmental Lab

* Reporting range specified by LA and TX SARA Title III Tier Two Reporting Requirement.

2.3.16 Federal Facilities Compliance Act

During 2016 none of the SPR sites generated any waste considered to be hazardous and radioactive (mixed waste); therefore, this act did not apply to the SPR.

2.3.17 Atomic Energy Act of 1954

X-ray and other sealed radioactive sources are used at the SPR to perform analytical, monitoring and scanning activities. Conformance with this act is demonstrated by following state implementing agency radiation control regulations.

2.3.18 Preventing and Reporting Spills

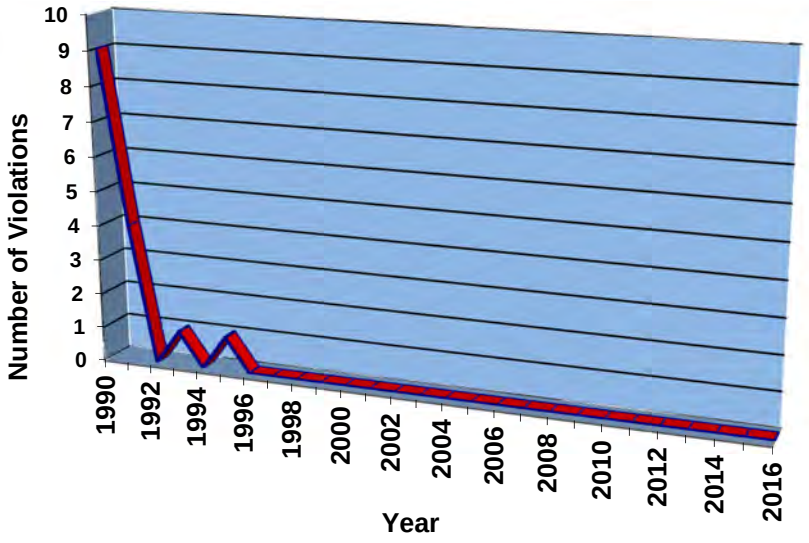
The SPR crude oil storage sites are located near marsh or other wetland areas so protection of the environment through oil spill prevention and control is a primary commitment. Verbal notification and associated written reports to the appropriate regulatory agencies (e.g. National Response Center) occur as required, if the spill meets the reportable criteria. Each SPR site has structures in place to contain or divert any harmful release that could impact surrounding waterways or land areas. Onsite spill control equipment, detailed emergency plans, and extensive training are used to ensure that the environment is safeguarded.

Site Emergency Response Procedures address spill reporting requirements of the SPR M&O, DOE, and appropriate regulatory agencies. Specific reporting procedures are dependent upon several key factors including quantity and type of material spilled, immediate and potential impacts of the spill, and spill location (e.g., wetland or water body). All spills of hazardous substances are first verbally reported to site management and then through the reporting system to New Orleans M&O and DOE management. The tool to document these spills is the Operations Control Center (OCC) Non-Routine and Occurrence Report form that is completed at the site level and then forwarded to the New Orleans OCC. Final written reports from the sites are submitted after cleanup, unless otherwise directed by the DOE or appropriate regulatory agency.

2.3.19 Notices of Violation, Notices of Deficiency, Notices of Intent to Sue, and other types of enforcement actions issued to the site

During 2016 the SPR did not have any compliance or cleanup agreements, environmental violations cited by regulators, notices of violation, notices of deficiency, notices of intent to sue or other types of enforcement actions issued at any of the sites. The SPR has continued to maintain a status of low risk to the environment. NOVs related to CAA, CWA and RCRA activities have declined significantly from nine in 1990 to zero since 1996 to date, as depicted in Figure 2-3.

Figure 2-3 Number of Violations 1990 - 2016



2.4 Major Environmental Issues and Actions

2.4.1 Gassy Oil

When SPR crude oil is brought to surface facilities, methane and ethane gas (non-regulated) that has migrated from the salt in the salt dome is released, stripping regulated pollutants (VOCs) into the atmosphere. Also, geothermal processes raise the crude oil temperature, elevating the true vapor pressure (TVP) potentially above the atmospheric pressure of 14.7 pounds per square inch (PSI). This elevated vapor pressure may exceed regulatory limits for storage in floating roof tanks, potentially affecting some of the SPR sites and the receiving commercial terminals (customers). Beginning in 1995 the SPR conducted operations to separate and remove gas from stored oil, in addition to heat exchangers used to cool oil prior to transport offsite. Operation of the degas plant began at BH in early 2004 and completed operations in October 2006. The degas plant was disassembled and moved to BM in 2007. Operations started in September 2007, and were completed in February 2011. The scope was developed for the degas project in 2012. The initial phase of the proposed project to disassemble the unit at BM, transport, and reassemble over at the WH SPR site began in 2013. Operation of the degas plant at WH started in August, 2014 and is ongoing in 2016.

2.4.2 Cavern Integrity

Texas Administrative Code (TAC), Title 16, Part 1, Chapter 3, Rule 3.95 (o) (3) requires storage wellhead components and casing to be inspected at least once every 10 years for corrosion, cracks, deformations or other conditions that may compromise integrity and that may not be detected by the five-year mechanical integrity test. In response, the SPR initiated a multi-sensor caliper program in 2008 to evaluate the condition of the last cemented casing string. In some instances, where caliper results showed an irregularity, a downhole camera was run to better define the anomaly. If the anomaly is determined to be structural, plans are made to remediate the issue. The remediation varies depending on the type of anomaly involved. These remediations have been worked in conjunction with state regulatory agencies and in full compliance with the regulatory requirements. Once a cavern is depressured for workover, the

wellhead components are taken off and inspected. This work continues in conjunction with the cavern workover and remediation programs. These programs were expanded to include the LA SPR sites in addition to the required TX sites. During 2016, remediation workovers were performed at Bryan Mound on well BM 112 and at Big Hill on wells BH-103, BH-104, and BH-112.
In March 2016, LDNR issued a compliance order with a civil penalty of $2,000.00 to the SPR based on an evaluation of a mechanical integrity test (MIT) completed in April 2015 at West Hackberry Cavern 107. LDNR determined that the SPR failed to provide nofification of the MIT failure and also failed to take the cavern out of service. In response to the compliance order, the M&O agreed to pay the civil penalty and completed corrective actions to re-establish compliance.

2.4.3 Big Hill Brine Pond 9

Early in 2016, construction work began in the Big Hill Anhydrite Pond for the Phase I Pilot Test following the details of the Pond 9 Closure Plan approved by the RRC in April 2015. The Pilot Test was devised to accommodate an in-pond small scale test for evaluation of the proposed washing technique and was completed near the end of July. The Pilot Test had three primary success criteria that included aspects of safe access for men and equipment; controlled installation of 36 well points capable of long-term pumping/dewatering; and a confirmed reduction of chloride content in samples taken of the anhydrite residuals before, during and after rinsing. Each of these criteria were achieved and a final report of findings along with a petition to proceed to the Closure Plan's Phase II, Full Wash activity was submitted to the RRC on September 1st.

On September 22, the RRC concurred with the success of the Pilot Test and approved the SPR's recommendation to proceed with the Phase II, Full Wash activity. Upon receipt, the Scope of Work for Phase II was bid and a contract was awarded on October 24. With the contract award made, actual site mobilization and well point installation commenced mid-November and continued through the remainder of the calendar year. During this timeframe, of well point installation and construction of piping manifolds for pumping and fluids removal, late fall and winter rains provided ample fresh water for washing salt [chloride content] as the construction work proceeded. Dissolved sodium chloride salt removed, as the well net grew, is directed as a salt-bearing solution to the adjacent Pond 37 of the Big Hill brine management system. By the close of the year the operational dewatering system consisted of the following components: Two air compressors of five total planned; Two-hundred eighty (280) well points of 684 planned; and, Eight double diaphragm pumps of 15 total planned. Work on this project continued in earnest into 2017, with progress and results reported to the RRC, as defined in the Plan approval, on regular calendar quarters.

2.5 DOE Onsite Appraisal

SPRPMO Management Appraisal teams conduct visits to all SPR sites annually to audit environmental compliance and EMS practices. Issues and programs reviewed in FY16 included chemical and waste management, air and water quality, and pollution prevention. There were three environmental finding associated with these assessments.

2.6 Organizational Assessments

The New Orleans M&O Environmental group conducts annual audits at all SPR sites covering compliance with all environmental programs and the EMS. Assessors were independent of the operating sites and were not accountable to those directly responsible for the issues audited. Specific topics are chosen based on current management concerns and the results of previous audits. The M&O identified three minor deviations from internal requirements and regulations during FY16. Corrective action plans were developed and implemented for all. All audit findings are tracked to completion in the SPR's Assessment Tracking System (ATS).

2.7 Regulatory and ISO 14001 Registrar Inspections/Visits

There were thirteen inspections or visits by or on behalf of regulatory agencies and the ISO 14001 certification body to SPR facilities in 2016. These visits are summarized in Table 2-4. The visits are usually conducted on a routine basis by the regulatory agencies to ensure compliance or to address concerns regarding activities at the SPR facilities. The ISO 14001 registrar's visit was a surveillance audit to validate the SPR's environmental management system is in compliance with the ISO14001:2004 standard. Although there were seven non-conformances identified, corrective actions were immediately put into place and all findings were successfully closed. The M&O maintains ISO14001 registration.

Table 2-4 Summary of Regulatory & Third-Party Inspections/Visits 2016

Site	Organization	Remarks
BC	LDEQ	Follow-up on reported spill
	LDNR	Cavern/Well Mechanical Integrity Test
	ISO 14001 CB	Surveillance Audit – Certification remains in effect
BH	TGLO	Annual Oil Spill Prevention and Response audit - site passed.
	TCEQ	RTCR Potable water NAP Traning
	RRC	Inspection
BM	TCEQ	Potable Water Inspection RTCR Potable Water NAP Training Water Master Site Meter Inspection
	TGLO	Annual OSPRA Audit
	ISO 14001 CB	Surveillance Audit -Certification remains in effect
NO	ISO 14001 CB	Surveillance Audit – Certification remains in effect
ST	NASA	Environmental and Safety Inspections. No Findings.
	ISO 14001 CB	Surveillance Audit – Certification remains in effect

Table 2-4 Summary of Regulatory & Third-Party Inspections/Visits 2016		
Site	**Organization**	**Remarks**
WH	Army Special Forces from Fort Bragg	Force on Force Exercise
	West CameronPort Diecrector	Discharge permit renewal

2.8 EISA S432 Energy/Water Survey at West Hackberry

Section 432 of the Energy Independence and Security Act (EISA) of 2007 requires that each Federal installation complete comprehensive energy and water audits of 25% of its covered facilities each year. According to EISA, "covered facilities" include buildings, installations, structures, or other property owned operated, constructed, or manufactured and leased to the Federal Government for which the cost of utilities is paid by the Federal Government, and that constitute at least 75% of facility energy use at each agency.

For FY16, the last year of the current four-year cycle, the M&O contractor chose to evaluate the West Hackberry site. As defined by the "Energy Savings Assessment Training Manual" (a DOE Office of Energy Efficiency and Renewable Energy publication), the M&O conducted a Type I audit – a walk-through survey – to identify readily observable problem areas and possible opportunities for conserving energy and water. Two M&O ES&H personnel managed the survey and were assisted by site personnel. Numerous site personnel were interviewed. The review included site buildings and processes that use energy and water, relative to mission operation.

The survey evaluated 24 buildings and the crude oil, brine, and raw (fire) water processes. According to the DOE Facilities Information Management System (FIMS), 92,596 SF of building and structures (excluding pump pads) at West Hackberry are identified as energy-consuming structures. Of this, 97% or 89,861 SF were evaluated in this survey. Examining raw water, brine, and crude oil pump pads assured that at least 75% of all areas where energy is used were examined, because process energy consumption dwarfs building-energy consumption.

Based on visual observations, a list of approximately 47 potential energy- and water-conservation measures (ECMs and WCMs) was developed, by building and process. Rough cost approximations associated with these conservation measures were also estimated. The following energy and water conservation opportunities were found repeatedly:

- Install occupancy-sensing light switches
- Weather-seal doors
- Install more efficient lighting in buildings and outside for security
- Install light switches where circuit breakers are the sole means of energizing lighting
- Install more efficient plumbing fixtures
- Install insulation above ceiling tiles and seal penetrations in walls
- Upgrade HVAC thermostats allowing set-backs
- Turn off lights and appliances when unneeded

Overall condition of West Hackberry was good. No large wasteful energy and potable water issues were observed, and all personnel interviewed were satisfied with their work area illumination. The use of LED technology in other areas outside of the Control Room is ECM in need of expanded implementation across the site. Substantial potable water conservation measures may be limited to industrial uses at the pump pads and fire system.

3 Environmental Management System (EMS)

To illustrate its commitment to excellence with regard to environmental management, the M&O operates within an EMS that is third party certified against the International Organization for Standardization (ISO) 14001 standard.

The scope of the EMS is the operation and management of the SPR under the M&O, the M&O's personnel, and on-site subcontractors at SPR facilities including SPR off-site crude oil, raw water, and brine pipelines. All site personnel receive computer-based ISO 14001 EMS training annually. The training provides an overview of the ISO 14001 standard and the importance of conformity with the SPR's environmental policy and procedures. Several environmental staff members have completed ISO 14001 Lead Auditor certification training allowing them to assist in performing SPR site assessments and due-diligence inspections of disposal and recycling facilities.

3.1 EMS Certification

On May 19, 2000, the EMS was first evaluated by an independent CB accredited by the American National Standards Institute/American Society for Quality (ANSI-ASQ) National Accreditation Board (ANAB) and certified in conformance with the ISO 14001 standard. The EMS was recertified in 2003, 2006, 2009, 2012, and 2015. Between certification and recertification activities surveillance audits are conducted by the CB to evaluate the SPR EMS.

3.2 Integration of EMS with Integrated Safety Management System

DOE delegates responsibility and authority for the environmental component of the Integrated Safety Management System (ISM) to the M&O. The purpose of ISM is to ensure that environmental, safety, and health requirements are an integrated but discernible part of the performance of all work, from the initial planning stage through to feedback and improvement. The SPR EMS Manual formalizes the environmental portion of ISM and defines the scope of the EMS in regard to the elements of the ISO 14001:2004(E) Standard. Although compliance with ISM does not ensure compliance with the ISO 14001:2004(E) Standard, the M&O has tailored the EMS to comply with both standards.

3.3 EMS Implementation

Conformance of the EMS to the ISO 14001 standard is illustrated through the SPR EMS Manual. The manual provides descriptions and references to SPR policies, plans, procedures, environmental aspects and impacts and objectives and targets that form the foundation of the EMS. Conformance with and implementation of each of the 17 ISO elements are discussed, as are the environmental management programs conducted in 2016 to achieve environmental objectives. This document is reviewed and revised annually.

A brief synopsis of how the SPR EMS conforms to the ISO 14001:2004 standard is provided in Table 3-1.

Table 3-1 Elements of the SPR EMS	
Element	**Implementation Summary**
Environmental Policy	The SPR operates only in an environmentally responsible manner. Top management commits to and directs that all functional levels will: • comply with applicable legal and other requirements to which the SPR subscribes which relate to the environmental aspects of SPR activities, • prevent pollution through design, processes, practices, techniques, materials, products and services so that detrimental environmental impact is reduced or eliminated, and • continually improve environmental performance and sustainability through the EMS. The SPR Environmental Policy is signed by the DOE Project Manager to communicate senior management's (DOE and M&O) environmental priorities. It is implemented by top management and is applicable to all SPR personnel and those who work on behalf of the SPR. Its scope includes SPR facilities and pipelines. Protection of the environment, workers and the public is of vital importance. Environmental protection is integrated into all phases of SPR activities.
Environmental Aspects	The M&O has a procedure to identify the environmental aspects (significant and otherwise) of its activities within the EMS defined scope. This includes aspects that can be controlled and those that can be influenced taking into consideration planned or new developments and new or modified activities. Significant environmental aspects are taken into account in establishing, implementing and maintaining the EMS. The following environmental aspects are considered significant: Air emissions — Spills/Releases Natural resource preservation — Fire Discharges — Cavern integrity Energy use — Waste Aspects of future activities are sought during the environmental review of purchase requests and designs. The design review process provides a mechanism by which new designs are reviewed by appropriate personnel, including the environmental organization, for adverse environmental effects, compliance, and continuous improvement. The design review process fits together with National Environmental Policy Act (NEPA) at the conceptual stage, where new and previously recognized aspects are readily identified. The environmental review addresses compliance, pollution prevention opportunities, and general design or process improvements. Both of these processes provide the overall mechanism by which all projects and other issues are reviewed for their impact on the environment.
Legal and Other Requirements	Applicable legal and other requirements that affect the SPR are described in permits issued by Federal and State agencies and the ES&H Standards List, which is provided in Appendix A1. The standards list is updated quarterly to reflect any necessary changes. Information on pertinent new or changed requirements is disseminated to the M&O subject matter experts (SMEs), affected departments, and appropriate management for review and feedback. If determined to be applicable, the SMEs provide guidance or information to affected departments and appropriate management for implementation.
Objectives, Targets, and Programs	Performance measures were tracked by the SPR EMS in FY 2016. Some objectives have two targets, a “minimum” level that all DOE contractors should meet and a more challenging “stretch” level. EMS targets are either identified directly in contract Work Authorization Directives (WADs) as contract objectives or indirectly through activities required by the DOE Strategic Sustainability Performance Plan (SSPP) to achieve Executive Order 13693. Refer to Tables 5-16 and 5-17 for all SPR institutional and sustainability objectives and targets and activities that support them.

Table 3-1 Elements of the SPR EMS	
Element	**Implementation Summary**
Resources, Roles, Responsibility and Authority	The M&O organization, roles, responsibilities, and authority are defined, documented, and communicated at all levels throughout the organization. The Human Capital department maintains job descriptions and organizational charts with all positions. Ultimately, the M&O is held responsible by DOE for environmental stewardship at SPR facilities. DOE and M&O subcontracted personnel who work at SPR facilities and those who work on their behalf also comply with the M&O's written environmental protection criteria. The EMS Management Representative is appointed by top management. Each SPR facility has a designated site EMS focal point responsible for communicating and working EMS issues at that facility. Other EMS focal points have been designated by the SPRPMO including security contractors.
Competence, Training and Awareness	The M&O determines training needs for each M&O employee, offers training as appropriate to SPR contractors, and requires training for subcontractors as needed based on activity. The M&O uses several types of training methodologies to educate workers, to achieve or improve worker competency and to improve their awareness and control of the environmental aspects and impacts of their activities and understanding of their roles and responsibilities to support the EMS. Training courses and personnel requirements are available from the Performance Improvement/Training Coordinator at each storage site. In M&O contracts, environmental competency requirements for subcontractors are included in the contract boilerplate.
Communication	The M&O communicates internally throughout the organization and to DOE and other SPR contractors in numerous ways, such as through phone, e-mail, letters, meetings, and tailgate discussions. Several procedures are used for communicating internally between organizations and various levels within the SPR and externally between interested parties. Information regarding environmental aspects and the EMS is also communicated verbally in meetings at all levels of management., such as staff and scheduling meetings, readiness, technical, and project reviews, emergency response critiques, and EMS management reviews. Response to external inquiries, including responses to inquiries related to significant environmental aspects, is provided to outside interested parties. The SPR maintains an Environmental Advisory Committee (EAC) as a communications conduit with the general public, environmental, cavern and pipeline engineering, and emergency management communities. Storage sites actively participate in emergency response and security activities with their communities such as through Community Awareness Emergency Response (CAER), local emergency planning committees (LEPC), and mutual aid programs. Annually, the M&O prepares this SPR Site Environmental Report that describes SPR environmental activities during the previous year. The report is distributed throughout the SPR as well as to the public (through libraries, media, elected officials, and interested parties).
Documentation	Environmental intentions are described at the highest level through DOE's SPR Environmental Policy. The scope of the EMS, its elements, and supporting documents are described in detail in the SPR EMS Manual. Records required by the ISO 14001 standard are maintained in accordance with the M&O's record management system.
Control of Documents	Configuration management dictates operating procedures and records be controlled. Publications are managed in an electronic document management system. External documents such as externally generated operations/maintenance logistics manuals are also controlled. Instructional and reference documents (both internal and external) that are part of the EMS are located or registered in an electronic web site. Some documents are purposely maintained in hard copy, such as "grab and go" documents that are used in emergencies. Hard copy locations and responsible holders are identified. All controlled documents are approved, revised as necessary, and maintained current.

Table 3-1 Elements of the SPR EMS	
Element	**Implementation Summary**
Operational Control	The M&O identifies operations and activities that are associated with significant aspects and impacts. Operational controls have been established for activities associated with significant aspects. These include broad as well as more aspect-specific documents (i.e. procedures and instructions) that address operational activities, planning, scheduling, maintenance, repair, and replacement of SPR equipment. Environmental boilerplate is attached as needed to vendor service and construction contracts to communicate specific requirements and procedures for controlling environmental aspects. Environmental permits provide specific environmental performance criteria that must be met to minimize adverse environmental impacts.
Emergency Preparedness and Response	The M&O is responsible for SPR emergency response. The emergency management program is a comprehensive emergency management system program with site-specific emergency response procedures. The emergency management program provides the framework for development, coordination, control, and direction of all emergency planning, preparedness, readiness assurance, response, and recovery actions.
Monitoring and Measurement	DOE requires all DOE contractors have comprehensive and integrated assurance systems for all aspects of operations essential to mission success. These systems identify and address program and performance deficiencies, opportunities for improvement, and provide requirements to report deficiencies to responsible authorities, establish and effectively implement corrective and preventive actions, and share lessons learned across all aspects of operations. SPR Monitoring and measurement requirements for regulatory compliance are described in this Site Environmental Report. Internal procedures provide guidance in monitoring and measuring significant aspects/impacts and regulatory/programmatic monitoring of air, surface water, and groundwater. Objectives and targets based on the significant aspects and Executive Order 13693 are reviewed, tracked, and reported to upper management monthly. Process instruments and measurement and other testing equipment are calibrated to support operational control.
Evaluation of Compliance	Compliance with legal and other requirements is evaluated annually through a review of the environmental requirements in the ES&H Standards List and through organizational assessments (OAs) at each site. Compliance criteria examined during OAs are based on the environmental requirements identified on the ES&H Standards List. They pertain to water, air, waste, pollution prevention/waste minimization, and management oversight. Data taken to support permit requirements (i.e. water data that are reported on discharge monitoring reports) are evaluated to ascertain compliance with respective permits. Through the contractor assurance system (CAS) DOE requires the M&O to have established, auditable programs and systems. CAS addresses many types of assessments (self-, 3rd party, independent assessments, management walk-throughs), event reporting, worker feedback mechanisms, and issues management (analysis of causes, identifying and tracking corrective actions, monitoring and closure, and verification of effectiveness). Contractors must annually submit to DOE detailed CAS program descriptions for, among others, environmental, safety and health, safeguards and security, and emergency management – programs that are integrated into the EMS.
Non-conformity, Corrective Action and Preventive Action	The M&O subscribes to DOE's Occurrence Reporting and Processing System to identify, investigate, and correct non-conformances that occur during facility operations and activities. This includes spills and non-compliances with requirements. Operating experience of DOE and DOE contractor organizations is systematically reviewed for lessons learned, and the results are disseminated. This process reinforces the core functions and guiding principles of the DOE Integrated Safety Management System (ISMS) to enhance mission safety and reliability, and it provides mutual integration with the lessons

Table 3-1 Elements of the SPR EMS	
Element	**Implementation Summary**
	learned requirements of other DOE directives. The SPR participates in the DOE-wide program for management of operating experience (OE) to prevent adverse operating incidents and to expand the sharing of good work practices among DOE sites. Assessment findings are managed and tracked in the Assessment Tracking System (ATS), a computer-based database. ATS is available to personnel throughout the SPR, and each finding/nonconformity entry in the database describes the issue and identifies responsibility for resolution. A corrective action plan is required for each SPR finding/nonconformity and includes, as applicable: 1) remedial action taken, 2) cause of the finding/nonconformity, 3) long-term corrective action planned, and 4) estimated date for completion of the plan. Results of corrected findings/nonconformities are examined during the subsequent assessments to determine the effectiveness of corrective action taken.
Control of Records	The SPR's records management system is based on federal requirements established by the National Archives and Records Administration (NARA). NARA has developed a list of federal records and a general schedule for their disposition. The M&O further defines this schedule in a records and disposition schedule which provides guidance and instruction for the records management program, establishes policy and objectives for records management practices, assigns records management responsibilities at all levels of operations, and identifies and classifies records.
Internal Audit	The EMS is audited routinely by the M&O as part of their OAs at each facility. Both the compliance program and environmental management are reviewed extensively during these assessments. The entire scope of the EMS is audited at least annually. Audit plans that include criteria, scope, and audit methods are developed and approved prior to the assessments. Nonconformities are identified and tracked to completion in the ATS. M&O EMS auditors have received ISO internal auditor training prior to conducting such an audit.
Management Review	The Management Review Team is composed of the M&O project manager and Assistant Project Managers. The EMS Management Representative reports on EMS performance to the team to evaluate improvement. Site Directors, site EMS focal points, and the M&O Environmental Director are also invited to participate, DOE and security contractor representation is also included. Management reviews are twice during the year, and all elements of the standard are reviewed at least once annually. Suitability, adequacy, and effectiveness of the EMS are evaluated and voted on by team members at each meeting. Management review is also provided through weekly senior staff meetings, bimonthly project review meetings, quarterly energy efficiency/pollution prevention (E2P2) meetings, semiannual contract performance evaluations, and the occurrence reporting program.

4 Environmental Radiological Program Information

Radioactive sources at the SPR consist of electrically-generated X-ray that is used in laboratory and security scanning equipment or other sealed sources brought on site for the purpose of performing radiography and cavern wire-line type logging operations. Procedures are in place to protect personnel from exposure during these operations. In addition the SPR is subject to inspections by the nuclear regulatory agencies (NRC and NNSA), TCEQ and required notices to employees are posted on each X-ray scanning device and at entry points to rooms containing this equipment.

4.1 Sealed Sources

At the SPR sealed sources of radiation are used for monitoring activities related to the physical properties of crude oil and brine caverns, and pipeline integrity. During 2016, a subcontractor was preparing a cavern for its mechanical integrity test at the Bayou Choctaw site, when a cable broke. The tool string that was lost down hole consisted of an interface tool that contained a Cesium 137, 150 millicurie sealed source. The incident was reported to the Nuclear Regulatory Commission (NRC) authorities and was labeled according to standards set forth by the Louisiana Department of Environmental Quality (LDEQ).

5 Environmental Program Information

The SPRPMO Environmental, Safety, and Health Division is responsible for development and oversight of ES&H programs and provides direction, technical guidance, and independent oversight to its prime contractors in implementation of environmental programs and assessment of contractor performance. The SPR has had an Environmental Protection Program since its inception in 1978. The SPRPMO assigned contractual responsibilities for implementation of the program to the M&O contractor. The M&O contractor operates on behalf of DOE with regard to waste classification, representations, shipments, and disposal for all SPR activities. A summary of the programs and procedures that presently make up the SPR environmental protection program is provided in Table 5-1.

Associated plans supporting the SPR environmental program include the M&O contractor's Continuity of Operation Program (COOP) Implementation Plan, site-specific Emergency Response Procedures with spill reporting procedures; site-specific Spill Prevention Control and Countermeasure (SPCC) plans; Environmental Monitoring Plan (EMP) which includes the Ground Water Protection Management Program (GWPMP) plan; and Pollution Prevention (P2) Plan which includes the SWPPP for each site. The EMP, GWPMP, and P2 Plan are reviewed and updated annually; and SPCC plans are reviewed and revised as needed or every five years per regulation.

Associated procedures that support the SPR environmental program are located in the M&O contractor's Environmental Instructions Manual. These procedures identify requirements, responsible personnel, deadlines, and governing standards. Each site has developed instructions where needed that implement the environmental program specific to their facility

Table 5-1 SPR Environmental Protection Program Components

Programs & Procedures	Description
National Environmental Policy Act (NEPA) Program	A comprehensive environmental review of all projects including purchase requisitions, engineering scopes of work, engineering change proposals, design reviews, and design changes for all SPR activities
Wetland & Floodplain Management Program	Addresses projects that have an impact on Section 404 of the CWA, Section 10 of the Rivers and Harbors Act, and state coastal zone management programs
Inspections, Appraisals, Assessments & Surveillance	Provides regular monitoring to ensure compliance with regulatory and policy requirements
Non-Routine Reporting System	Notification of oil, brine, or hazardous substance spills, and noncompliant effluent discharges, to identify impact of same on property and environment, and to comply with regulatory requirements
Routine Reporting Program	Fulfills self-reporting obligations under water, air and waste permits and regulations
Permit Monitoring Program	Ensures compliance with all permit requirements and limitations, onsite operations and maintenance activities

Table 5-1 SPR Environmental Protection Program Components	
Programs & Procedures	**Description**
Environmental Monitoring & Surveillance Program	Detect any possible influence routine SPR operation may have on surface waters and groundwater on or near SPR sites and provide baseline data in the event of an environmental upset
Discharge Procedures	Used by SPR sites when releasing liquid from any authorized containment or control system
Environmental Training Program	Ensures applicable personnel are aware of the SPR EMS, environmental laws and regulations and are proficient in oil and hazardous material spill prevention and safe handling of hazardous waste
Pollution Prevention (P2) Program	Focuses on source reduction, recycling, reuse, affirmative and bio-based procurement, proper disposal of all wastes generated on SPR sites, and other sustainability goals
Underground Injection Control Program (mandated by the Safe Drinking Water Act)	Ensure sound operation of Class II underground wells/caverns for brine disposal or hydrocarbon storage
Regulatory Review Program	Identifies new environmental requirements pertinent to the SPR

Proper SPR operation with respect to the environment involves several types of reports and reporting procedures. The M&O contractor provides reports to, or on behalf of DOE. Table 5-2 is a list of environmental regulations and reporting requirements applicable to SPR.

Table 5-2 Federal, State, and Local Routine Regulatory Reporting Requirements				
Regulation, Statute or Directive	**Regulated Area**	**Enforcement Agency**	**Types of Required Permits, Applications, or Documentation**	**Routine Reporting Requirements**
Clean Air Act	Control of hydrocarbon emissions from tanks, valves, and piping	Texas Commission on Environmental Quality (TCEQ)	Air Emissions Permit	Annual Emissions Inventory Questionnaires
			Air Emissions Permit Special Requirement	Monthly Tank Emissions (BM only)

Table 5-2 Federal, State, and Local Routine Regulatory Reporting Requirements

Regulation, Statute or Directive	Regulated Area	Enforcement Agency	Types of Required Permits, Applications, or Documentation	Routine Reporting Requirements
Clean Water Act	Wastewater discharges	US EPA Region VI	NPDES Permit	Quarterly monitoring reports
		LA Dept. of Env. Quality (LDEQ)	Water Discharge Permit	
		Railroad Commission of Texas (RRC)	Water Discharge Permit	
	Spill Prevention, Control and Countermeasures (SPCC)	U.S. EPA, LDEQ	SPCC Plan	Submit existing plan when spills on navigable waters >1000 gals or occur ≥2x in 1 year
	Discharge notification	LDEQ, TCEQ, RRC, U.S. DOT, EPA	Verbal and written notification	Non-permitted discharges over Reportable Quantity
	Dredging maintenance, and any construction in wetlands for structures (Sections 404 & 10)	U.S. Army Corps of Engineers (COE)	Construct & Maintain Permit, Maintenance Notifications	Two-week advance of work start, notice suspension, and end.
SPR Environmental Management System (EMS) Manual	Environmental Planning and Monitoring	DOE	Environmental Monitoring Plan	Annual revision
			Ground Water Protection Management Program Plan	Annual review
			Site Environmental Report	Annual report
			Performance Indicators	Monthly and quarterly updates
	Waste Management / Pollution Prevention		Annual Report on Waste Generation and Pollution Prevention Progress	Annual summary of all wastes
SPRPMO Order 451.1D	NEPA Compliance	DOE	NEPA Planning Summary	Annual Report
			EIS Supplement Analysis	As needed
EO 13693 and FAR Clauses	Affirmative Procurement (AP)	DOE	Affirmative Procurement Report	Annual report (combined with EPEAT and Biobased reports)
	Electronic Product Environmental Assessment Tool (EPEAT)	DOE	EPEAT Report	Annual report (combined with AP and Biobased reports)
	Compliance with Sustainability Goals	DOE	Implementation Report	Quarterly status reports

Table 5-2 Federal, State, and Local Routine Regulatory Reporting Requirements				
Regulation, Statute or Directive	**Regulated Area**	**Enforcement Agency**	**Types of Required Permits, Applications, or Documentation**	**Routine Reporting Requirements**
	Environmental Management Systems (EMS)	DOE	EMS Progress Report	Annual Report
	Annual SPR Site Sustainability Plan (SSP)	DOE	Annual report on progress in meeting goals of EO 13423 and 13514	Annual report
Farm Security and Rural Investment Act of 2002	Procurement	USDA	Biobased Procurement Report	Annual report (combined with Affirmative Procurement and EPEAT reports)
Federal Migratory Bird Act	Disturbance of bird nests	US F&WS	Special Purpose Permit	As requested by USFWS
Miscellaneous State EnvironmentalRegulations	Water withdrawal from coastal areas	TCEQ	Water Appropriation Permit	Annual Usage Report
	Pipeline usage	RRC	Pipeline and Gathering System Certification (T-4C)	Annual Certification
	Operation of relined brine ponds 7&37 BH	RRC	Operate and Maintain Permit, Leak Detection and Liner Inspection	Retain on site
	Surveillance of closed brine and anhydrite ponds	LDNR, RRC	Closure agreements, annual ground water monitoring results	Report in SER
National Environmental Policy Act	Review of proposed projects for environmental considerations	CEQ	Environmental Impact statements, Environmental Assessments	Only when not tiered under other EIS or EA.
			Categorical Exclusions	For projects that require consent.
	Inclusion of cooperating agencies in NEPA process	CEQ	Agency participation in NEPA activities to ensure adequate information in the decision-making process	Memorandum, as needed
Oil Spill Prevention & Response Act of 1991	Oil spill response in Texas coastal zone	TGLO	Discharge Prevention and Response Plan	Report spills of oil as required
			Discharge Prevention and Response Facility Cert.	Annual review by agency.
Pollution Prevention Act of 1990	Strategy to incorporate pollution prevention into ES&H goals	EPA, DOE	Pollution Prevention Plan, Waste Min Plan, Waste Mgmt Plan, Stormwater Pollution Prevention Plan	Annual update to Pollution Prevention Plan

Table 5-2 Federal, State, and Local Routine Regulatory Reporting Requirements				
Regulation, Statute or Directive	**Regulated Area**	**Enforcement Agency**	**Types of Required Permits, Applications, or Documentation**	**Routine Reporting Requirements**
Resource Conservation and Recovery Act	Hazardous waste generation and disposal	LDEQ	Annual Generators Report	Annual report to agency
			LA Notification of HW Activity	New waste stream, change in generator status
			LA Uniform HW Manifest	Complete and submit w/disposal
		RRC	TX Uniform HW Manifest	Complete and submit w/disposal
			Oil and Gas Waste Report	Annotate Report to Agency
			Texas Notification of hazardous waste activity	New waste stream or change in generator status
	Used oil burned for recovery	LDEQ, RRC	Uniform HW Manifest (Recycling)	Complete and submit w/disposal
	Non-hazardous oilfield waste (exploration and production)	LDNR	Non-Hazardous Oilfield Waste Shipping Control Ticket (UIC-28)	Complete and submit w/disposal
	Non-hazardous special	LDEQ, TCEQ	Shipping Paper	Complete and submit w/disposal
	Waste Management	LDEQ, TCEQ	Monthly waste inventory	Complete for documentation
			Weekly waste inspection form	Complete for documentation
	Affirmative Procurement	EPA	Affirmative Procurement Report	Annual Report (combined with EPEAT and Biobased reports)
Safe Drinking Water Act	Cavern formation, well workovers, and salt-water disposal wells	LDNR, Office of Conservation, Under-ground Injection and Mining Division	Well Work over Permit (WH-1)	Well Work over Report
			Cavern Inspection (29-M)	Semi-annual Cavern Inspection Report
			Saltwater Disposal (UIC-10)	Annual Saltwater Disposal Well Report
			Cavern Integrity Test Report	Annual Cavern Integrity
			Oil Wells Integrity (W-10)	Annual Oil Well Status Report

Table 5-2 Federal, State, and Local Routine Regulatory Reporting Requirements				
Regulation, Statute or Directive	**Regulated Area**	**Enforcement Agency**	**Types of Required Permits, Applications, or Documentation**	**Routine Reporting Requirements**
		RRC	Brine Injection Permit (H-10)	Annual Disposal/ Injection Wells Reports
		TCEQ	Weekly disinfectant residual concentration sampling and reporting (BM and BH)	Quarterly to agency
			Monthly total coliform sampling and analysis (BM and BH)	Retain results on site
			Annual disinfectant and disinfectant by-products sampling and analysis (BM)	Results submitted to TCEQ
			Lead and copper sampling, analysis, and reporting	Frequency varies based on past test results
Superfund Amendment Reauthorization Act	Reporting of inventories of hazardous substances and materials stored on site	LA Dept. of Public Safety and Corrections, Texas Dept. of Health	Title III, Tier II	Annual Inventory Report
		TX Dept. of State Health Services Tier II Chemical Reporting Program		
		MS Emergency Management Agency		
	Reporting of discharges of all listed hazardous materials	EPA	Toxic Release Inventory, Form R	Submit when threshold exceeded

5.1 Environmental Program Permits

The active environmental permits required by regulatory agencies to construct, operate, and maintain the SPR are discussed by site.

The SPRPMO negotiated a 20-year long-term leasing arrangement for use of the St. James site by the private corporation Shell Pipeline in 1997. Shell Pipeline retains all responsibility for maintaining necessary permits at St. James concurrent with their operations and that lease.

There are no permits for the Stennis Warehouse facility. A Certificate of No Exposure, declaring that all activities are conducted in a manner that will not expose potential pollutants to stormwater, was approved by the MDEQ in lieu of operating under a multi-sector general permit. The five-year cycle Certificate of No Exposure to stormwater was successfully renewed, as required, in June 2014, prior to a July expiration date. Air emissions from Stennis Warehouse

operations are *de minimus*, requiring no permitting or reporting activity.

The SPR holds a general permit to discharge hydrostatic test water in the state of Louisiana that applies to all of the Louisiana SPR sites and their offsite pipelines. This permit requires quarterly discharge monitoring reporting.

LDEQ has primacy for the NPDES program in Louisiana that includes responsibility for all compliance and enforcement actions relating to the discharge of water in Louisiana. The LDEQ-issued a renewed individual discharge permit that also covered stormwater associated with industrial activity in 2016 for WH. For BC, a combination of LCGP and MSGP coverage was renewed statewide in December 2015 and in the following March a site permit-specific notification was received completing the internal state renewal.

In Texas, the RRC has only partial primacy for the NPDES program; BH and BM therefore operate under parallel EPA and RRC discharge permits. In addition to supplying renewal applications in 2013 for the NPDES permits expiring in 2014, the two Texas SPR sites also operate under authority granted with Statewide Rule 8 water discharge permits issued by the RRC. Both the EPA permits and the RRC five-year term permits were renewed in 2014 in order to maintain alignment, and all four permits became effective on November 1, 2014.

The air permits for the SPR facilities are administered by the LDEQ in Louisiana and the TCEQ in Texas. During 2016, an air permit application was submitted to the Louisiana Department of Environmental Quality (LDEQ) for the renewal of the Bayou Choctaw air permit. An air permit by rule was also obtained from the Texas Commission on Environmental Quality (TCEQ) in 2016 for the demolition of the existing Bryan Mound Crude Oil Storage Tank Number 2 (BMT-2) and the construction of a new replacement tank.

5.1.1 Bayou Choctaw Permits

Bayou Choctaw permits are listed in Table 5-3. Individual work permits are received from the Louisiana Underground Injection Control Division of LDNR for each well work over performed. State inspectors periodically visit the site to observe SPR operations. BC operates under the water and air programs delegated to Louisiana by EPA.

The site's security perimeter "clear sight zone" authorized and implemented by the NODCOE in the summer of 2006 was maintained by site personnel throughout 2016. This permit was modified to allow for the annexation of and construction work to the cavern 102 well pad. Additional appurtenances included a temporary personnel escape bridge and temporary ditch and ring levee during well construction. A water use survey was filed in 2016 for BC to the USGS/LDNR covering CY 2015.

Table 5-3 Bayou Choctaw Environmental Permits

Permit Number	Issuing Agency	Permit Type	Effective Date	Expiration Date	Comments
LAG480540	LDEQ	LPDES	03/28/16	11/30/20	(1),(2)
1280-00015- 02	LDEQ	Air	12/2/99	Open	(3)
None	LDNR	Injection	01/11/83	Open	(4)
LMNOD-SP (Bull Bay) 3	COE	Constr. & Maintain	01/30/79	- *	(5)

Table 5-3 Bayou Choctaw Environmental Permits					
Permit Number	**Issuing Agency**	**Permit Type**	**Effective Date**	**Expiration Date**	**Comments**
LMNOD-SP (Iberville Parish Wetlands) 7	COE	Constr. & Maintain	09/26/77	-	(6)
MNOD-SP (Iberville Parish Wetlands) 10	COE	Constr. & Maintain	06/12/78	-	(7)
LMNOD-SP (Iberville Parish Wetlands) 17	COE	Constr. & Maintain	11/06/78	-	(8)
LMNOD-SP (Iberville Parish Wetlands) 31	COE	Constr. & Maintain	05/27/80	-	(9)
LMNOD-SP (Iberville Parish Wetlands) 102	COE	Constr. & Maintain	09/26/77	-	(10)
WN-20-020-0168	COE	Constr. & Maintain	04/02/02	-	(11)
WT-20-020-2654	COE	Constr. & Maintain	08/20/02	-	(12)
WT-20-020-3621	COE	Constr. & Maintain	09/17/02	-	(13)
LMNOD-SP (Bayou Plaquemine)	COE	Constr. & Maintain	09/26/77	-	(14)
CT-20-030-1379-0	COE	Constr. & Maintain	03/12/03	-	(15)
CT-20-030-1501-0	COE	Constr. & Maintain	03/28/03	-	(16)
CT-20-030-3087-0	COE	Constr. & Maintain	07/25/03	-	(17)
MVN-2004-4453-CT	COE	Constr. & Maintain	10/14/04	-	(18)
MVN-2003-2234-CT	COE	Constr. & Maintain	02/2/06 Mod 10/4/11	-	(19)

* COE permits remain active for the life of the structure.

(1) LDEQ cancelled the LPDES converted permit LA0053040 and LA MSGP permit LAR05M577 replacing both with a single Light Commercial Facility (LCF) general permit LAG480540. The permit was renewed at the end of 2015 via internal state renewal action and the site received a site specific permit in March 2016.
(2) The state's LPDES LCF general permit (LAG48000) was renewed 1DEC11 and discharge authority was given to BC on 15AUG11 after review of a full NOI from March. The former BC LCGP permit number remained intact.
(3) Site air operating permit modified 12/99
(4) Letter of financial responsibility to plug and abandon injection wells.
(5) Maintain Bull Bay 24" brine disposal pipeline recorded with applicable Registrar of Deeds.
(6) Construct and maintain well pads (brine disposal wells).
(7) Enlarge existing well pads and construct access roads (brine disposal wells 1, 2, & 3.)
(8) Construct and maintain access road to brine disposal well area. NOTE: brine disposal pipeline was constructed under NWP authority and maintenance is allowed in conjunction with the access road permit. Major maintenance performed in 1996.
(9) Construct and maintain well pad, levees, access road & appurtenances to Cavern 102 and additional bank stabilization, warehouse pad and culvert per additions of 1983.
(10) Construct and maintain ring levee, drill site and appurtenances, Well 101.
(11) Install and maintain fill with culverts for parking. Permit authorized a construction period until 4/30/2007.
(12) Install and maintain culverts and fill to construct minor roadway crossings. Activity authorized under NWP-14 and provides a construction period until 8/20/2004.
(13) Replace, repair and maintain security fence with concrete footing and curbing. Activity authorized under NWP-3 and provides a construction period until 9/17/2004.
(14) Install and maintain 36" petroleum products pipeline under and across Bayou Plaquemine
(15) Install and maintain a replacement N-S bridge for an existing, permitted N-S bridge on the Main Site. Activity authorized under NWP-3; provides a construction period until 3/12/2005.
(16) Install and maintain a replacement brine disposal access road bridge for an existing permitted structure on the brine disposal access road. Activity authorized under NWP-3, provides a construction period until 3/28/2005.
(17) Install and maintain a bulkhead and fill for bank stabilization in the North-South Canal on the Main Site. Activity authorized under NWP-13 providing a construction period until 7/25/2005.
(18) Install and maintain refurbished Bailey Bridge crossing over Wilbert's Canal via NWP14, providing construction period for 2 years.
(19) Implement and maintain an expanded clear sight security perimeter zone. Requires compensatory mitigation and long-term oversight of the mitigation bank sites. Modified to include the acquisition of BC 102 and development of clear zone and cavern pad. Included compensatory mitigation via wetland mitigation bank credit purchases.

5.1.2 Big Hill Permits

Big Hill permits are listed in Table 5-4. In 2016, the site appropriated 0.247 million m^3 (200.45 acre-feet) of water from the Intracoastal Waterway (ICW) exclusive of water for fire protection. This represents 0.67 percent of the current revised total allowable withdrawal for a year. The

certified annual report of water usage was forwarded to the TCEQ as required in 2016.

The M&O contractor is registered with TCEQ as a Public Water System Operations Company (registration # WC0000183) since BH provides sanitary control of their purchased water distribution system on-site. This three-year registration was successfully initiated in April 2014, at the contract changeover to FFPO. In addition, the M&O contractor is also registered as a Wastewater Operations Company (registration #OC0000202) which was likewise initiated in 2014 at contract changover for a similar three-year period.

Required annual reporting for 2016 involved the performance of a brine line integrity test sent to Region 6 EPA, raw water usage to TCEQ, Water Conservation Plan implementation reporting to TWDB; and crude oil pipeline system operations renewal (T4C) to the RRC. Work undertaken adjacent to jurisdictional wetlands was authorized by NWP3-Maintenance and involved the offsite inspection and repair of the site's 48-inch brine disposal pipeline in 2016.

Table 5-4 Big Hill Environmental Permits

Permit Number	Issuing Agency	Permit Type	Effective Date	Expiration Date	Comments
TX0092827	EPA	NPDES	11/01/14	10/31/19	(1)
NOT	EPA	NPDES	1/17/09	none	(2)
SWGCO-RP 16536 (01,02,03,04, 05)	COE	Constr. & Maintain	01/11/84	Dredging clause to 12/2008	(3) (4)
P-7	F&WS	Constr. & Operate	07/31/86	06/30/2036	(5)
9256	TCEQ	Air	01/11/08	01/10/2018	Site Air Permit
PBR 100485	TCEQ	Air	01/24/12	Open	Cavern Leaching
PBR 107009	TCEQ	Air	02/20/13	Open	Frac Tanks for Workovers
02939	RRC	Operate	11/28/83	Open	(6)
UHS-006	RRC	Water Discharge.	11/01/14	10/31/19	(7)
4045A	TNRCC	Water Use	11/14/83	Open	(8)

(1) Renewal submitted June 2013. Accepted as administratively complete January 2014; comments to draft permit made June 2014; final permit issued September 2014, effective 11/1/2014.
(2) NPDES coverage for Stormwater Associated with Industrial Activity was written into the individual permit TX0092827, as a result the former MultiSector General Permit (MSGP) coverage was terminated with a Notice of Termination instrument.
(3) Permits and modifications to construct and maintain RWIS, raw water 48" pipeline, brine disposal 48" pipeline, crude oil 36" pipeline. Maintenance dredging clause renewed until 12/31/08. Modified in 1996 for new integrity test method.
(4) Completion of raw water, brine disposal, and crude oil pipeline extended. Amended to install offshore pipeline by trenching. Dredging clause is allowed to lapse due to no RWIS dredging needed before expiration indicated above. Shall be renewed with next maintenance dredging activity/project.
(5) Completion of pipeline construction extended. (48" Brine Pipeline)
(6) Permits to create, operate, and maintain an underground hydrocarbon storage facility consisting of 14 caverns.
(7) Corresponds to TX0092827 (EPA-NPDES). Amendment request filed October 2014, early renenwal in order to coincide with EPA renewal effective 1NOV14. Permit language corresponds to EPA permit and with same effective date.
(8) Permit amended in 1990 to allow for annual diversion of no more than 117,291 ac feet of water and to authorize diversion until termination of the project as a SPR operation. Modified in 1996 to reduce water set aside down to 30,000 acre/ft per year. Maximum Diversion Rate (MDR) 175 cubic feet per second (CFS).

5.1.3 Bryan Mound Permits

Bryan Mound permits are listed in Table 5-5. The BM site has a permit from TCEQ for the appropriation of state waters for the leaching program, site utility and fire protection systems which commencing in June 2015, was transferred to the jurisdiction of a newly formed Brazos River Water Master Program for administration. The permit requires a monthly tally and forecasting communication and then an annual tally is provided by the agency to assess their management fee. In 2016, the site used a total of 0.023 million m^3 (19.01 acre-feet) of water

from the Brazos River Diversion Channel, representing 0.04 percent of the annual water usage authorized.

The M&O contractor is registered with TCEQ as a Public Water System Operations Company (registration # WC0000183) since BM provides sanitary control of their purchased water distribution system on-site. This three-year registration was successfully initiated in April 2014, at the contract changeover to FFPO. In addition, the M&O contractor is also registered as a Wastewater Operations Company (registration #OC0000202) which was likewise initiated in 2014 at contract changover for a similar three-year period.

Required annual reporting for 2016 involved the successful brine line integrity test to Region 6 EPA, raw water usage to TCEQ, Water Conservation Plan implementation reporting to TWDB; and crude oil pipeline system operations renewal (T4C) to the RRC. A maintenance dredging clause notification was made to perform routine maintenance dredging of the approach to the RWIS in 2016.

Table 5-5 Bryan Mound Environmental Permits

Permit Number	Issuing Agency	Permit Type	Effective Date	Expiration Date	Comments
TX0074012	EPA	NPDES	11/01/14	10/31/19	(1)
NOT	EPA	NPDES	1/17/09	None	(2)
SWGCO-RP-12347 (03), repl. by SWG-2006-2568	COE	Constr & Maintain	02/22/78	Dredging clause open to 12/2017	(3)
3681A	TNRCC	Water Use	07/20/81	Open	(4)
UHS-004	RRC	Water Disch	11/01/14	10/31/19	(5)
82-8475	TDH&PT	Constr.	01/01/83	Open	(6)
SWGCO-RP-11666	COE	Constr. & Maintain	10/15/77	- *	(7)
SWGCO-RP-12112	COE	Constr. & Maintain	07/25/77	-	(8)
SWGCO-RP-12062 (03)	COE	Constr. & Maintain	10/10/78	-	(9)
SWGCO-RP-14114 (01)	COE	Constr. & Maintain	05/18/85	-	(10)
SWGCO-RP-16177	COE	Constr. & Maintain	09/07/82	-	(11)
SWGCO-RP-13435 (01)	COE	Constr. & Maintain	05/21/79	-	(12)
04994	RRC	Operate	08/01/00	Open	(13)
6176B	TCEQ	Air	05/31/13	05/31/23	Air Permit
PBR 100484	TCEQ	Air	01/24/12	Open	Cavern Leaching
PBR regulations	TCEQ	Air	05/13/13	Open	Frac Tanks for Workovers
PBR 142987	TCEQ	Air	10/27/16	Open	BMT-2

* COE permits remain active for the life of the structure.

(1) Renewal submitted June 2013. Accepted as administratively complete January 2014; comments to draft permit made J8ne 2014; final permit issued September 2014, effective 11/1/2014.
(2) NPDES coverage for Stormwater Associated with Industrial Activity was written into the individual permit TX0074012, as a result the former MultiSector General Permit (MSGP) coverage was terminated with a Notice of Termination instrument.
(3) Maintenance dredging of raw water intake extended to 12/31/06. (SWGCO-RP 12347 authorized construction of RWIS). Extension/renewal authorizes spoil area addition. A renewed Extension of Time (EOT) re-authorized maintenance dredging for a ten year period effective July10, 2007.
(4) Permit expires at project end, covers 52,000 ac/ft/yr and MDR of 130 CFS per 2001 amendment.
(5) Corresponds with TX0074012 (EPA-NPDES). Renewal submitted 12/15/2008; RRC acted on permit in mid March2009, effective 4/1/09.
(6) Corresponds with SWGCO-RP-16177.
(7) For 30” crude oil pipeline to 3 miles SW from Freeport
(8) For 30” crude oil pipeline to 2 miles S from Freeport

(9) For 36" brine disposal pipeline & diffuser. Revision/amendment (01) deleted special condition (a) requiring maximized deep well injection; (02) approved construction of 24" replacement pipeline and diffuser in January 12, 1993. (03) Added the offshore additions the new integrity test method.
(10) General permit for pipeline crossings by directional drilling in navigable waters
(11) Place an 8" water line (PVC, potable; 6" as-built)
(12) For construction of cavern pads 101, 102, 103, 111, and 113 in wetlands. Mod.01 added access road and fill placement for DCS-2.
(13) Pipeline distribution system registration to operate crude oil lines. Renewed annually with T-4C.

5.1.4 West Hackberry Permits

West Hackberry permits are listed in Table 5-6. WH authority to discharge wastewater from four named outfalls with an individual LPDES permit was re-issued effective June 2016 with the remainder of the retained stormwater held and released from secondary containments and the site's stormwater associated with industrial activity covered under this same permit and as addressed in the site's current SWPPP maintained throughout the year. The Degas Unit was moved from the BM site to the WH site and became fully operational in August 2014, with a single named outfall of retained stormwater being added with the renewed coverage and revised SWPPP

A single maintenance notification for repair of a traveling screen associated with the site's RWIS was made as required per the standing wetlands permit for the structure situated on the south shore of the ICW north of the WH site. In addition, the maintenance dredging clause associated with this same structure and permit was renewed and the dredging occurred with the spoils placed for beneficial use in 2015. A water use survey was filed for WH in 2016 to the USGS/LDNR covering CY2015.

Table 5-6 West Hackberry Environmental Permits

Permit Number	Issuing Agency	Permit Type	Effective Date	Expiration Date	Comments
LA0053031	LDEQ	LPDES	6/1/16	5/31/21	(1)
LAR05M559	LDEQ	LPDES	05/9/16	5/8/21	(2)
LMNOD-SP (LTCS) 26	COE	Constr.& Maintain	02/08/79	-	(3)
LMNOD-SP (Black Lk) 31	COE	Constr.& Maintain	10/26/82	-	(4)
LMNOD-SP (Black Lk) 43	COE	Constr.& Maintain	07/26/84	-	(5)
LMNOD-SP (Gulf of Mexico) 2574	COE	Constr.& Maintain	08/11/80	-	(6)
LMNOD-SE (LTCS) 40	COE	Constr.& Maintain	05/25/88	-	(7)
LMNOD-SP (Cameron Parish Wetlands) 162	COE	Constr. & Maintain	03/09/78	-	(8)
None (Letter)	LDNR	Injection	01/11/83	Open	(9)
971198-9	LDNR	Injection	09/27/83	Open	(10)
0560-00019-04	LDEQ	Air	2/20/12	Open	Site air permit (includes degas plant)
SWGCO-RP-12342	COE	Constr. & Maintain	03/28/78	-	(11)
LMNOD-SP (Cameron Parish Wetlands) 152	COE	Constr. & Maintain	03/16/78	-	(12)
LMNOD-SP (Cameron Parish Wetlands) 276	COE	Constr. & Maintain	02/11/80	-	(13)
WN20-000-3972-0	COE	Constr. & Maintain	8/31/00	-	(14)
WO-20-020-1136	COE	Constr. & Maintain	01/25/02 02/19/02	-	(15)
WO-20-020-3607	COE	Constr. & Maintain	10/23/02	-	(16)

Table 5-6 West Hackberry Environmental Permits					
Permit Number	**Issuing Agency**	**Permit Type**	**Effective Date**	**Expiration Date**	**Comments**
WW-20-030-3748	COE	Constr. & Maintain	10/22/03	-	(17)
MVN-1997-00068 WB	COE	Constr. & Maintain	6/9/15	6/9/20	(18)

(1) LDEQ obtained primacy and issued an LPDES permit with former NPDES number, effective 11/1/2004.
(2) LPDES Multi-Sector General Permit (MSGP) coverage for Stormwater Associated with Industrial Activity obtained as a renewal with a NOI dated 1/22/01.
(3) Construct and maintain RWIS and 42" raw water pipeline. Modified in 1998 to add the recirculation system discharge point; and in 2006, programmatic general Category II permit MVN-2006-1387-WY was issued for RWIS maintenance modifications and for the 48" replacement pipeline; carries consistency determination C20060053 from LDNR.
(4) Maintenance dredging for firewater canal and extended boat slip access amendment of 1993.
(5) Construction of erosion control dike completed in 1986. Maintenance dredging open until 7/26/94; addition of riprap amendment of 1993 open until 1995.
(6) Amended to install parallel pipeline (05/29/86); offshore brine line and diffuser remains inactive.
(7) Permit to construct and maintain 36" crude oil pipeline from site to Texoma/Lake Charles Meter Station (LCMS).
(8) Permit to maintain 42" crude oil pipeline.
(9) Letter of financial responsibility to close all injection wells on this site. Still active
(10) Approval to construct and operate wells 117A and B.
(11) For 42" crude oil pipeline crossings of waters & waterways in Texas
(12) For brine disposal wells, well pads, and brine disposal pipelines, (12", 20", & 24")
(13) For well pads, levees, and access roads (Wells 110, 111, 112, 113, 114, & 115)
(14) Category I programmatic general permit. Repair exposed 42" crude oil pipeline.
(15) Restore riprap along the north perimeter dike adjacent to Cavern 6 and Black Lake. Permit authorized a construction period until 1/25/2007.
(16) Deposit fill in the fire ditch. Permit authorized a construction period until 10/23/2007.
(17) Modifications to the existing Boat Ramp; and, re-establishment of the erosion control breakwater in Black Lake along the north side of the site. Authorizes construction period until October 31, 2008 and includes an associated Water Quality Certification and Federal Consistency Determination for the activity.
(18) Time extension granted for maintenance dredging at the RWIS for five-year period commencing with the date of the letter response; carries consistency determination C20090198 mod 1 from LDNR.

5.2 Air Quality

Air pollutants of concern emitted by the SPR sites are either hazardous or have an impact on the ambient air quality. Benzene, toluene, ethyl benzene, and xylene are Hazardous Air Pollutants (HAPs) that are emitted in relatively small quantities and do not trigger HAP reporting. The non-hazardous pollutants that have an impact on air quality are non-methane/non-ethane VOCs, nitrogen oxides (NOx), sulfur dioxides (SO_2), carbon monoxide (CO), and particulate matter (PM_{10}). The quantity of these pollutants emitted is minor relative to other facilities in the respective air quality regions.

Monitoring for air pollutants consists of monitoring processes and calculating the volume through the use of acceptable industry practices. These results are compared to the permitted limits to ensure that they are in compliance. Monitoring at the SPR consists of measuring the following in order to quantify emissions:

- run-time of diesel powered emergency electrical generators;
- volume and type of crude oil flowed through frac tanks, floating roof tanks, diesel tanks, gasoline tanks, and oil-water separators;
- volume of paint and solvent used on-site;
- volume of brine which may release VOCs placed into the brine ponds/brine tanks;
- number of piping components that emit over the acceptable regulatory limits by monitoring all components with an OVA.

Monitoring for air pollutants is conducted at both TX and LA sites. The results are reported to the TX state agency through EIQs. The LA sites are exempt from reporting because their emissions are below the regulatory threshold for reporting in their respective air quality regions. Even though the results of monitoring for BC and WH are not reported, they are used to determine ongoing compliance with the permit and assure adequate performance of emission control equipment.

In addition, air pollution control equipment monitoring is performed at SPR sites. Air regulations require that seals on internal and external floating roof tanks be inspected at frequent intervals for visible tears, holes, or cumulative gaps exceeding regulatory limits, and to ensure they are operating accordingly. The BH and BM sites each have an external floating roof tank that requires inspection of the primary (every five years) and secondary (semi-annual) seals.

5.2.1 Bayou Choctaw

Located in a marginal nonattainment area for ozone, BC is permitted to emit 7.4 metric tons per year (tpy) (8.14 tpy) of VOC. Since this site emits less than nine metric tpy (10 tpy), it is not required to submit an emissions inventory summary (EIS) to report its annual emissions. Although BC is exempt from reporting emissions, monitoring was conducted in 2015 on all permitted sources. These sources include the volume of crude oil in slop tanks and frac tanks, volume of brine flowing through the brine pond, fugitive emissions from monitoring piping components for acceptability, and monitoring the run-time of the emergency generators. BC operated in accordance with all air quality regulatory requirements in 2016. Table 5-7 provides a summary of the permitted limits and actual emissions for BC.

Table 5-7 Parameters for Bayou Choctaw Emission Points

Emission Point Description	Parameter	Permit Limits Metric tpy (tpy)	Actual Emissions Metric tpy (tpy)
Crude & Slop Oil Tanks	VOC	2.43 (2.67)	0.30 (0.33)
Gasoline Fuel Tank	VOC	0.52 (0.57)	0.17 (0.19)
Frac Tanks	VOC	1.42 (1.56)	0.02 (0.02)
Brine Pond	VOC	1.14 (1.26)	0.05 (0.05)
Fugitive Emissions	VOC	1.66 (1.83)	0.05 (0.06)
Air Eliminator	VOC	0.04 (0.04)	0 (0)
Emergency Generators/Pumps	VOC PM_{10} SO_2 NOx CO	0.19 (0.21) 0.18 (0.20) 0.72 (0.79) 5.54 (6.09) 1.26 (1.39)	0.01 (0.01) 0.01 (0.01) 0 (0) 0.19 (0.21) 0.05 (0.05)

5.2.2 Big Hill

Located in an ozone attainment area, BH is permitted to emit 25.81 metric tpy (28.24 tpy) of VOC. BH is required to use an EIQ to report its annual emissions if requested by TCEQ. Monitoring was conducted in 2016 on all permitted sources, such as the volume of crude oil in slop tanks, frac tanks, and surge tanks; volume of brine into the brine pond; and monitoring the run-time of the emergency generators. BH operated in accordance with all air quality regulatory

requirements in 2016. Table 5-8 provides a summary of the permitted limits and actual emissions for BH.

Table 5-8 Parameters for Big Hill Emission Points

Emission Point Description	Parameter	Permit Limits Metric tpy (tpy)	Actual Emissions Metric tpy (tpy)
Crude & Slop Oil Tanks	VOC	1.45 (1.60)	0.98 (1.08)
Gasoline & Diesel Fuel Tanks	VOC	0.35 (0.39)	0.17 (0.19)
Frac Tanks	VOC	10.04	0.08 (0.09)
Brine Pond	VOC	11.97 (13.15)	1.15 (1.27)
Fugitive Emissions	VOC	2.59 (2.86)	0.10 (0.11)
Air Eliminator	VOC	0.07 (0.08)	0 (0)
Solvent Recycler	VOC Acetone	0.01 (0.01) 0.01 (0.01)	0 (0) 0 (0)
Emergency Generators/Pumps	VOC PM_{10} SO_2 NOx CO	0.10 (0.11) 0.09 (0.10) 0.64 (0.70) 2.30 (2.54) 0.53 (0.58)	0.02 (0.02) 0.02 (0.02) 0.02 (0.02) 0.38 (0.42) 0.08 (0.09)

5.2.3 Bryan Mound

Located in a marginal non-attainment area for ozone, BM is permitted to emit 12.38 metric tpy (13.62 tpy) of VOC. Since the site emits more than nine metric tpy (10 tpy), it is required to use an EIQ to report its annual emissions. Monitoring was conducted in 2016 on all permitted sources. These sources include the volume of crude oil in slop tanks, frac tanks, one external floating roof tank and one internal floating roof tank; volume of brine into the brine tank; and monitoring the run-time of the emergency generators.

BM operated in accordance with all air quality regulatory requirements in 2016. BM Crude Oil Tank 4 (BMT-4) experienced an internal floating roof failure in May 2015. Final cleanup of the tank was completed and emissions were reported to TCEQ in April 2016. TCEQ closed their investigation in August 2016. Table 5-9 provides a summary of the permitted limits and actual emissions for BM.

Table 5-9 Parameters for Bryan Mound Emission Points

Emission Point Description	Parameter	Permit Limits Metric tpy (tpy)	Actual Emissions Metric tpy (tpy)
Crude & Slop Oil Tanks	VOC	8.52 (9.37)	1.54 (1.70)
Gasoline & Diesel Fuel Tanks	VOC	0.38 (0.42)	0.33 (0.36)
Frac Tanks	VOC	25.0	4.88 (5.38)
Brine Tank	VOC	4.92 (5.42)	0.26 (0.29)
Fugitive Emissions	VOC	0.89 (0.98)	0.08 (0.09)
Paints & Solvents	VOC	0.62 (0.68)	0.05 (0.06)

Table 5-9 Parameters for Bryan Mound Emission Points			
Emission Point Description	**Parameter**	**Permit Limits Metric tpy (tpy)**	**Actual Emissions Metric tpy (tpy)**
Emergency Generators/Pumps	VOC PM_{10} SO_2 NO_x CO	0.06 (0.07) 0.06 (0.07) 0.50 (0.55) 1.62 (1.79) 0.37 (0.41)	0.04 (0.04) 0.03 (0.03) 0.02 (0.02) 0.58 (0.64) 0.13 (0.14)

5.2.4 West Hackberry

Located in an ozone attainment area, WH is permitted to emit 49.03 metric tpy (53.93 tpy) of VOC. Since the site emits less than 90.8 metric tpy (100 tpy), it is not required to submit an EIQ to report its annual emissions. Although WH is exempt from reporting emissions, monitoring was conducted in 2016 on all permitted sources. These sources include the volume of crude oil in slop tanks and frac tanks, volume of brine into the brine tank, monitoring piping components to determine fugitive emission acceptability, degas plant emissions and monitoring the run-time of the emergency generators. WH operated in accordance with all air quality regulatory requirements in 2016. Table 5-10 provides a summary of the permitted limits and actual emissions for WH.

Table 5-10 Parameters for West Hackberry Emission Points			
Emission Point Description	**Parameter**	**Permit Limits Metric tpy (tpy)**	**Actual Emissions Metric tpy (tpy)**
Slop Oil Tanks & Sump	VOC	1.92 (2.11)	0.17 (0.19)
Gasoline Fuel Tank	VOC	0.73 (0.81)	0.41 (0.45)
Frac Tanks	VOC	23.85 (26.29)	5.56 (6.13)
Brine Tanks	VOC	20.20 (22.22)	0.67 (0.74)
Fugitive Emissions	VOC	0.12 (0.13)	0.10 (0.11)
Air Eliminator	VOC	0.06 (0.07)	0 (0)
Emergency Generator/Pump	VOC PM_{10} SO_2 NO_x CO	0.25 (0.28) 0.25 (0.27) 1.11 (1.22) 8.31 (9.14) 1.90 (2.09)	0.05 (0.05) 0.05 (0.05) 0 (0) 1.67 (1.84) 0.38 (0.42)
Degas Plant	VOC PM_{10} SO_2 NO_x CO	1.39 (1.53) 1.26 (1.39) 0.35 (0.39) 13.89 (15.31) 17.52 (19.31)	0.19 (0.21) 0.34 (0.37) 0.02 (0.02) 3.74 (4.12) 4.93 (5.43)

5.3 Water Discharge Effluent Monitoring

The water discharge permit-monitoring program fulfills the requirements of the EPA NPDES, and corresponding states RRC Rule 8 and LPDES programs. All SPR point source discharges are conducted in compliance with these federal and state programs.

SPR personnel regularly conducted point source discharges from all sites during 2016. These discharges are grouped as follows:

a. brine discharged to the Gulf of Mexico;

b. stormwater runoff from tank, well, and pump pads;
c. rinse water from vehicles at specific locations draining to permitted outfalls;
d. effluent from package sewage treatment plants; and
e. hydrostatic test water from piping or tanks.

The SPR disposed of 0.77 million m^3 (4.86 mmb) of brine (mostly saturated sodium chloride solution with some infrequent discharges of lower salinities than normally attributed to brine) during 2016. Approximately 81.3% of the brine was disposed in the Gulf of Mexico via the BH (70.6% of the total) and BM (10.7% of the total) brine disposal pipelines. The remaining 18.7% was disposed in saline aquifers via injection wells at WH (15.5% of the total) and BC (3.2% of the total). These figures represent an overall project-wide decrease of brine disposal of about 34% compaed to 2015.

During 2016, 1143 measurements and analyses were performed and reported to monitor wastewater discharge quality from the SPR in accordance with NPDES and corresponding state permits. With a single non-compliance experienced in 2016, the SPR was in compliance with permit requirements for 99.9 percent of the analyses performed.

Parameters monitored varied by site and discharge. Separate tables provide specific parameters and the most frequent sampling interval (based on permit limitations). More frequent measurements are often made of certain parameters that assist with unit operations; these additional data are reported as required by the permits. The data measurement variation and compliance rates observed during CY 2016 is discussed in separate site specific sections.

Discharge monitoring reports (DMRs) are prepared and submitted in accordance with site-specific permit requirements. All discharge permits issued to the SPR require quarterly reporting to the appropriate agency(s) (LDEQ, or RRC and EPA). Should a noncompliance or reportable bypass occur during the reporting period, an explanation of the cause and actions taken to correct the event is included in the corresponding quarterly report.

5.3.1 Bayou Choctaw

BC personnel performed and reported a total of 53 measurements on permitted outfalls and reporting stations to monitor LPDES permit compliance during 2016. Table 5-11 provides the permit required monitoring parameters and limits for the BC outfalls. There were no permit non-compliances at BC in 2016 resulting in a 100 percent site compliance performance record for the year.

Most monitoring is related to water discharges regulated under the LDEQ Office of Water Resources LPDES permit. Discharges are from two package sewage treatment plants (STP), a permit limited vehicle rinsing station with the site's stormwater runoff from well pads, and pump pads (containment areas), addressed as a cross-reference to the LA MSGP and in the permit required SWPPP.

Table 5-11 Bayou Choctaw Outfall Sampling Parameters

Location/Discharge	Parameter	Frequency	Compliance Range
Sewage Treatment Plants	Flow BOD_5	1/6 months 1/6 months	(Report only, GPD) <45 mg/l Avg.

Table 5-11 Bayou Choctaw Outfall Sampling Parameters			
Location/Discharge	**Parameter**	**Frequency**	**Compliance Range**
	TSS pH Fecal Coliform	1/6 months 1/6 months 1/6 months	<45 mg/l max 6.0 – 9.0 s.u. <400 col./100 ml
Stormwater (from former named/numbered outfalls)	Systematic Visual Observation	1/quarter (if discharging)	maintain written observations
Vehicle Rinsing (without soaps and/or detergents)	Flow COD TSS Oil and grease pH	1/quarter 1/quarter 1/quarter 1/quarter 1/quarter	Estimate in GPD ≤200 mg/l avg and ≤300 mg/l max ≤45 mg/l <15 mg/l 6.0-9.0 s.u.

5.3.2 Big Hill

During 2016, 635 measurements were performed and reported to monitor NPDES and state discharge permit compliance. Table 5-12 provides the permit required monitoring parameters and limits for the BH outfalls. There were no non-compliances during 2016 resulting in a 100 percent site compliance performance level.

Water discharges at BH are regulated and enforced through the EPA NPDES permit program and the similar RRC discharge permit program (Rule 8). The discharges at the site involve brine to the Gulf of Mexico, hydroclone blow down into the ICW, effluent from the sewage treatment plant, and stormwater from well pads and pump pads. There were, however, no discharges during 2016 from the hydroclone blow down system.

Table 5-12 Big Hill Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Brine to Gulf	Flow	Continuously	report only
	Exit Velocity	1/day	record
		1/month	18 fps min, 20 fps max (3 month rolling avg)
	Density	1/day	Record
		1/month	1160 kg/m^3 max (3 month rolling average
	Oil & Grease	1/month	<15 mg/l max,<10 mg/l avg.
	TDS	1/month	report only
	TSS	1/month	report only
	pH	1/month	6.0 - 9.0 s.u.
	Biomonitoring	4/year (minnow)	Lethal NOEC 2.6%
		4/year (shrimp)	Lethal NOEC 2.6%
	Integrity Tests	1/year	within 4%
Stormwater Outfalls (well pads & other containments)	Oil and Grease	1/six months	<15 mg/l
	TOC	1/six months	< 75 mg/l
	pH	1/six months	6.0 - 9.0 s.u.
	Salinity	1/six months	<8 g/l (ppt)

Table 5-12 Big Hill Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Raw Water Backwash	Flow	1/week(fed)	report
	TSS	1/week(fed)	report
	pH	1/week(fed)	6.5 to 9.0 su
Recirculated Raw Water	Flow	1/month	Report only
	pH	1/month	6.5 to 9.0 su
Sewage Treatment Plant	Flow	5 /week	Report
	BOD_5	1/month	<45 mg/l max and <20 mg/l avg.
	TSS	1/month	<45 mg/l max and <20 mg/l avg.
	pH	1/month	6.0 - 9.0 s.u.
Stormwater RWIS Transformer OWS	Oil and Grease	1/six months	<15 mg/l
	TOC	1/six months	< 75 mg/l
	pH	1/six months	6.5 - 9.0 s.u.
	Salinity(disch)	1/month	Report (g/l)
	Salinity(rcvstr)	1/month	Report (g/l)

5.3.3 Bryan Mound

BM personnel made and reported 389 measurements on permitted outfalls for the purpose of monitoring NPDES and state discharge permit compliance during 2016. Table 5-13 provides the permit-required parameters and limits for the BM outfalls. There was single non-compliance resulting in a site compliance performance level of 99.7 percent for the calendar year. The single BOD5 excursion was observed against the monthly average observed of 20.5 mg/l on two samples (26 mg/l and 15 mg/l) taken in June versus 20 mg/l allowable monthly average.

Water discharges at BM are regulated and enforced through the EPA NPDES permit program and the similar RRC discharge permit program for state waters (Rule 8).

Table 5-13 Bryan Mound Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Brine to Gulf	Flow	Continuously	Report
	Exit Velocity	1/day	Record
		1/month	18 fps min, 20 fps max (3 month rolling avg.)
	Density	1/day	Record
		1/month	1210 kg/m^3 max (3 month rolling avg.)
	Oil & Grease	1/month	$\leq$15 mg/l max, $\leq$ 10 mg/l avg.
	TDS	1/month	Report
	TSS	1/month	Report
	pH	1/month	6.0 to 9.0 su
	Biomonitoring	4/year (minnow)	Lethal NOEC 2.9%
		4/year (shrimp)	Lethal NOEC 2.9%
	Integrity test	1/year	Within 4%

Table 5-13 Bryan Mound Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Stormwater (Well pads & other containments)	Oil and Grease	1/six months	<15 mg/l max
	TOC	1/six months	<75 mg/l max
	pH	1/six months	6.5 to 9.0 s.u.
	Salinity	1/six months	< 8 g/l max
Recirculated Raw Water	Flow	1/month	Report
	pH	1/month	6.0 to 9.0 su
Sewage Treatment Plant	Flow	1/month	Report only
	BOD_5	1/month	<20 mg/l avg. <45 mg/l max
	TSS	1/month	<20 mg/l avg. <45 mg/l max
	pH	1/month	6.0 - 9.0 s.u.

5.3.4 West Hackberry

WH personnel performed and reported 66 measurements on permitted outfalls to monitor LPDES permit compliance during 2016. Table 5-14 provides the permit-required parameters and limits for the WH outfalls. There were no permit non-compliances during 2016 resulting in a 100 percent site compliance level.

The water discharges at the WH site were regulated under the EPA (NPDES) permit administered by the state of Louisiana under the LPDES permit program.

Table 5-14 West Hackberry Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Stormwater (Wellpads & Containments at Slop Oil Tank battery, slop oil tank booster pump pad, brine storage tank area, High Pressure Pump Pad, Fuel Storage Area, Emergency Generator, Lake Charles Meter Station, and RWIS Transformer Area), Raw Water Test Discharges (incl. Non-contact Once-through Cooling Water and Diversion Water)	Visual Observations made in accordance with Sector P (SIC Code 5171) of the current MSGP	1/quarter	Perform and record standardized observations and maintain onsite in accordance with the SWPPP and/or site instruction
External Vehicle Rinsing/Washing	Flow (Daily Max) COD TSS O&G pH	1/quarter 1/quarter 1/quarter 1/quarter 1/quarter	Report est. (gpd) ≤200 mg/l avg and ≤300 mg/l max ≤45 mg/l ≤15 mg/ 6.0 to 9.0 s.u.

Table 5-14 West Hackberry Outfall Sampling Parameters			
Location/ Discharge	**Parameter**	**Frequency**	**Compliance Range**
Treated Sanitary Wastewater	Flow	1/6months	Report est. (gpd)
	BOD_5	1/6months	≤ 30 mg/l avg and ≤ 45 mg/l max
	TSS	1/6months	≤ 30 mg/l avg and ≤ 45 mg/l max
	pH	1/6months	6.0 to 9.0 s.u.
	fecal coliform	1/6months	≤ 200 col./100 ml avg& ≤ 400 col./100 ml max
Non-contact cooling water	Flow	1/month	Report Daily max and Monthly avg
	TOC	1/month	≤ 50 mg/l max
	pH	1/month	6.0 to 9.0 s.u.
	Water Temp	1/month	Report Inst max
Stormwater Degas	Flow	1/quarter	Report Daily max and Monthly avg
	TOC	1/quarter	≤ 50 mg/l max
	Oil&grease	1/quarter	< 15 mg/l max
	pH	1/quarter	6.0 to 9.0 s.u.

5.4 Surface Water Quality Surveillance Monitoring

Surface waters of the BC, BH, BM, and WH SPR sites were sampled and monitored for general water quality according to the SPR EMP in 2016. Monitoring is conducted to provide early detection of surface water quality degradation resulting from SPR operations. It is separate from, and in addition to, the water discharge permit monitoring program.

Data and statistics are presented in tabular form, by site, in Appendix D, Tables D-1 through D-4. Observed values that were below detectable limit (BDL) were assigned a value of one-half the detection limit for statistical calculation purposes. In addition to commonly used summary statistical methods, the coefficient of variation (CV) treatment was incorporated to identify data sets with a high incidence of variation. Values approaching or exceeding 100 percent indicate that one standard deviation from the stated mean encompasses zero. This method draws attention to highly variable or skewed data sets for further evaluation. Extremely low values of CV (approaching or equal to 0 percent) indicate the standard deviation is small, relative to the mean, such as would be the case with very stable data, or if a preponderance of the measurements fell below the method limit of detectability.

5.4.1 Bayou Choctaw

Samples were collected and analyzed monthly, where possible, for seven surface water-monitoring stations. Monitoring stations A through G are identified in Figure D-1. Parameters monitored (Table D-1) include pH, salinity (SAL), temperature, dissolved oxygen (DO), oil and grease (O&G), and total organic carbon (TOC). A discussion of each parameter follows.

Hydrogen Ion Activity - The annual median values of pH for all the monitored stations ranged from 7.2 to 7.7 s.u., which is consistent with ambient conditions of the surrounding waters. The complete range for all measurements at all stations for 2016 is 6.7 to 8.6 s.u. Fluctuations observed are attributed to environmental and seasonal factors such as variations in rainfall, temperature, and aquatic system flushing.

Temperature - Observed temperature ranged from 6.7 °C to 31.3 °C. Temperature fluctuations were consistent among all stations and are attributed solely to meteorological conditions since the BC site produces no thermal discharges.

Salinity - Salinity measurements in 2016 save for the month of January were all at or below 0.5 ppt (indicating below detectable limits). All stations revealed below detectable limits throughout the year in their respective databases. In January, however, a backorder of calibration standard forced the use of a field refractometer method. The switch to this method for the single month for all stations resulted in a higher method detection limit that is can only be shown at each station as a Maximum. Higher water conditions and therefore more flushing may have influenced the salinity readings this year in response to the return of a nearly normal rainfall pattern for the regionwith occasional spates of excessive rainfall events.

Oil and Grease –No quantification above BDL for O&G was found amongst the seven reporting stations. This means that for 2016, O&G levels were found to be BDL 100 percent of the timefrom the 28 measurements made.

Dissolved Oxygen - Overall, DO average and median levels are relatively low (several being below a suggested minimum threshold <5 mg/l supportive of aquatic life). The range for all stations is 1.0 mg/l to 13.8 mg/l, with annual means and medians for all stations ranging from 3.6 mg/l to 7.5 mg/l. These low numbers are attributed to high temperature and high natural organic loading combined with low flow and minimal flushing typically observed at times in the two wetland area stations. The peak level of 13.8 mg/l occurred at station A.

Total Organic Carbon - Average annual TOC concentrations ranged from 26.9 to 51.2 mg/l. High TOC readings typically correlate with high organic loading that is usually found in stagnant or sluggish water bodies of limited volume, such as an evaporating pool of water. The highest value measured was 87.3 mg/l occurring at Station B suggesting low flows to stagnant water for several months as Station B also had the highest average TOC for this year. The relatively low values observed around the site sampling locations as well as the peaks produced no discernible physical impacts and are not out of line with the natural setting or system receiving episodic rainfall.

General Observations - Based on the above discussion, the following general observations are made regarding the quality of BC surface waters.

- The surrounding surface waters continue to have a neutral to slightly basic pH, with infrequent more basic excursions attributable to a localized flushing (runoff) action with the high but episodic rainfall.
- Observed salinity measurements remained low and within the historical range.
- Temperature variations were caused by seasonal changes. There are no thermal processes that directly discharge at any SPR site.

- Low minimum and annual average DO levels are attributed to high temperatures and organic loading resulting from low flow and minimal flushing typically observed in backwater swamp areas.
- Again this year none of the seven stations reported measurable oil and grease levels as with 2015.

5.4.2 Big Hill

Monitoring stations were established at five locations (Figure D-2) to assess site-associated surface water quality and to provide early detection of any surface water quality degradation that may result from SPR operations. It must be noted that Station A had no sampling this year. Because this sample point is located at an overflow point to a former onsite stock pond that first receives the site's treated effluent in addition to rainfall and stormwater run-off, it has become impossible to obtain a flowing surface water sample from the station as it has been overtaken with vegetative growth backfill from the general low-flow conditions experienced throughout the past several years. Parameters tested at the other stations include pH, temperature, SAL, O&G, DO and TOC (Table D-2).

Hydrogen Ion Activity - The 2016 data show the pH of site and surrounding surface waters remained between 6.4 and 8.4 s.u. The annual median values of pH for each of the monitored stations ranged from 6.6 to 7.3 s.u. and indicate that in general the area waters sampled became slightly more acidic versus last year's readings.

Temperature - Temperatures observed in 2016 ranged from 12 °C to 31 °C exhibiting the characteristics expected from seasonal meteorological changes. All stations reported very similar ranges and temporal fluctuations throughout the year.

Salinity – Long-term average annual salinities are usually quite low for the BH stations and physical setting and the individual monthly tests typically range from fresh on the site all year long to a maximum, usually in the upper teens, associated with the tidally influenced RWIS location on the ICW (Station C) nearest the Gulf. Because of its location, Station C also routinely has a higher mean and a higher median salinity as compared to the other stations. This year only Station C reported highly variable salinity data with a CV value well above 100 percent (109.1 percent). However, the means at only two of the four sampled locales dropped (freshened) versus 2015.

Only one of the remaining stations was completely free of at least several readings higher than BDL.

Oil and Grease – No oil & grease value was found above the historic detectable limit of 5 mg/l this year. No indication of oil impacts from SPR activities was found or observed during any of the sampling episodes.

Dissolved Oxygen - Dissolved oxygen generally is greatest in the winter and spring and lowest from summer through fall. DO peaks were observed in the months of January and February and the lowest values were determined in the summer to early fall generally in the June to August timeframe this year. The lowest variability of a full 12 month set of data points was found at the RWIS measuring point of the ICW (Station C) with a CV value of 26.7 percent where the

general size of the water body is expected to impart a more consistent dissolved oxygen level but not entirely without variation in the year. The station with the most DO variability during the year was sampling station E with a CV of 80.8. The overall range in DO this year is found to be 0.1 mg/l to 12.5 mg/l with a mean range of 4.3 mg/l to 6.3 mg/l from all tests and stations. Three of the monitoring stations produced a sample during the year with DO levels below 1 mg/l. Levels below 1.0 mg/l cannot be expected to support much aerobic life; values below 2.0 mg/l generally define anoxic conditions. The low values were not persistent and may have been associated with high temperatures and varying degrees of flushing, peak primary production, or both.

Total Organic Carbon - Average annual TOC concentrations varied from 8.5 to 14.0 mg/l over the year at the four monitored stations. The range in TOC from all samples is 4.8 to 21.5 mg/l. Stations B, D and E had noticeably higher levels of TOC than other stations. The consistently higher TOC levels observed are believed to be a result of intermittent reduced flushing (dry spells) combined with higher organic loading reaching the receiving waters and stagnating off and on throughout the year.

General Observations - Based on the above discussion, the following general observations are made regarding the quality of BH surface waters.

- The fresh surface waters have a slightly basic tendency this year in terms of the range of median pH, however, with the receiving waters tested showing a tendency to be slightly more acidic than in 2015, in terms of median values.
- The observed salinity measurements were lower at the site and increased in natural fashion from fresh water to an intermediate brackish water at the ICW.
- Area surface waters were neither contaminated nor affected by SPR crude oil. None of the O&G measurements made from the four stations monitored were found to be above the traditional detection limit of 5 mg/l.
- Temperature variations followed seasonal meteorological changes.
- In general, low dissolved oxygen and high total organic carbon fluctuations were within typical ranges indicative of seasonal meteorological and biological influences for such a setting and range of environments. DO levels did drop below 1.0 mg/l this year at three of the four monitored stations and TOC values did not rise above 21.5 mg/l. The TOC values are noticeable natural improvements in their own right versus last year's datasets.

5.4.3 Bryan Mound

Surface receiving waters surrounding the BM site were monitored during 2016. Blue Lake has seven sampling stations and Mud Lake has three established stations. Surface water monitoring stations are identified in Figure D-3. Stations A through C and E through G are located along the Blue Lake shoreline to monitor effects of site runoff. Stations H and I are located along the Mud Lake shoreline to monitor effects of site runoff. Stations D and J, located further from the site, serve as controls. The results from these controls will not be included in the analysis, but will serve as references.

Parameters monitored in the BM surface waters include pH, temperature, salinity, oil and grease, dissolved oxygen, and total organic carbon (Table D-3). Both Blue Lake and Mud Lake water

levels were high enough this year to accomplish a full 12 monthly sampling events which is consistently better than the last three years.

Hydrogen Ion Activity - In 2016, the pH range for Blue Lake and Mud Lake stations was from 6.4 to 8.8 s.u. for the combined datasets. The control point for Blue Lake produced a range of 7.0 s.u. to 8.3 s.u. The range for the Mud Lake control was 6.5 to 7.9 s.u. The results reveal a slightly basic condition for Blue Lake, with a slightly more acidic Mud Lake, while also proving an analogous condition for the controls. These data are indicative of natural waters devoid of carbon dioxide and generally hard in regard to mineral content. Marine and brackish waters, such as those in Blue Lake and Mud Lake, typically have somewhat elevated pH levels and high mineral content. The pH fluctuations measured this year are comparable to the normal range of variability historically seen at the Bryan Mound site.

Temperature - Temperatures observed in 2016 ranged from 7.9 °C to 28.4 °C and reflect a complete set of monthly ambient surface water testing in Blue Lake and a nearly complete set of samples for Mud Lake. The observation can be made, however, that the range of fluctuation is attributed to ambient meteorological events.

Salinity - Observed salinity fluctuations ranged from BDL to 4.6 ppt in Blue Lake and from BDL to 13.6 ppt in Mud Lake. Salinity fluctuations are attributed to meteorological and tidal conditions rather than site operations, since salinity observed at control sample stations D and J varied consistently with those found along both site shorelines. The higher salinity values in Mud Lake this year may be caused by the tidal and wind influences on the lake and its more direct link with the nearby Gulf of Mexico through the ICW.

Oil and Grease – One sample at the eight stations and two control locales was found above the detectable limit (5.0 mg/l) displayed as 2.5 mg/l for statistical calculations. These data favorably reflect continued good site housekeeping and effective site spill prevention, control, and response efforts. The low value of 8.5 mg/l observed in October at Blue Lake Station A, was ephemeral in nature, not confirmed with adjacent station samples taken the same day and was not found to produce a noticeable sheen or any discernable impacts.

Dissolved Oxygen - During 2016, DO was measured throughout the year at each Mud Lake and Blue Lake station. Mud Lake, reflecting a slightly fresher regime this year would be expected to have a higher oxygen carrying capacity and for the most part this is the case. Means and median DO levels are found to be higher throughout the year in Mud Lake. Fluctuations in DO levels in each lake are consistent with their respective control points. All measurements indicate “no apparent impact” from SPR operations. Blue Lake means and medians that range from 7.1 mg/l to 7.8 mg/l and 6.1 mg/l to 7.7 mg/l respectively, confirm that overall DO levels were adequate for aquatic life throughout the year. Blue Lake’s lowest DO measurement of 3.4 mg/l, was quite below Mud Lake’s low of 8.7 mg/l this year; however, means for the Mud Lake stations were above 11.0 mg/l and medians were found above 11.2 mg/l support the likelihood that lower DO levels although not unheard of, are infrequent, and that Mud Lake must receive a higher degree of overall mixing that must be influential to the available DO for the water body.

Total Organic Carbon - In 2016, all 84 TOC measurements of Blue Lake ranged from 11.8 to 47.5 mg/l. The 33 TOC observations made from the three Mud Lake range from 11.0 mg/l to 40.2 mg/l. Both control points have similar test results to monitoring stations in the irrespective lakes. The TOC levels observed in both lakes are, however, indicative of healthy, unaffected ambient conditions.

General Observations - Based on the above discussions, the following general observations are made regarding the quality of BM surface waters.

- The observed pH was stable for the period tested and slightly basic in both Blue Lake and Mud Lake, but typical of brackish waters. Of the two receiving waters, Mud Lake was only just slightly more acidicthis year.
- Temperature and salinity fluctuations observed during the period tested are attributed to meteorological and tidal conditions rather than site operations.
- TOC is found to be about the same in both receiving waters this year.
- The dissolved oxygen level measured in both Blue Lake and Mud Lake was within typical ranges indicative of seasonal, meteorological, and biological influences for such a setting and environment and overall were found to be notably higher in both lakes during 2016 versus 2015.

5.4.4 West Hackberry

In 2016, six surface water quality stations (Figure D-4) were monitored monthly at WH. Parameters monitored (Table D-4) include pH, temperature, salinity, dissolved oxygen, oil and grease, and total organic carbon.

Hydrogen Ion Activity - The pH of surface waters ranged between 6.5 and 8.2 s.u., and annual median values ranged from 7.3 to 7.9 s.u. from all stations. The ambient waters measured were more basic in overall range than last year's data. Station E, sampling main site run-off produced the highest median value this year of 7.9 s.u. Stations A, B, D and E, also produced the higher values of 8.2 s.u. versus the remaining stations. Although the long onsite travel paths would typically produce long and intermittent travel times over crushed limestone placed for erosion control and traffic ability would tend to raise the pH levels. Fluctuations of observed pH were relatively minor and could only be attributable to environmental and seasonal factors such as variation in rainfall, temperature, algae and biotic growth, aquatic system flushing and the buffering effects of crushed limestone gravel on slightly acidic rainfall.

Temperature - Observed temperatures in 2016 were consistent with observations at other sites and were indicative of regional climatic effects. No off-normal measurements were observed. Recorded temperatures ranged from 10 °C to 34 °C and are very consistent among stations.

Salinity - Meteorological factors such as wind, tide, and rainfall contributed to the salinity variation observed in brackish Black Lake (Stations A, B, and C) and the ICW (Station F). Salinity ranges observed in these water bodies (2.5 to 12.0 ppt in Black Lake) and (0.5 ppt to 9.4 ppt in the ICW) are more conducive to supporting euryhaline organisms with variable salinity tolerance and those with sufficient mobility to avoid salinity stresses that occur with seasonal changes. Station F on the ICW reflected a wider range due to the influences of the tides and

proximity to diluted but saltier Gulf waters. However, mean annual salinity observed at the ICW (3.0 ppt) was lower than stations in Black Lake (5.6 to 5.9 ppt) due largely to the fresher water influences received from more northerly drainage ways to the ICW and brackish water with limited movement to or from Black Lake. Main site Stations D and E had the lowest salinities, with all 24 samples being BDL. Salinities observed at these two upland site stations were therefore salt free 100% of the year. In general it may be said that the salinity measurements this year in Black Lake are somewhat lower than those taken in 2015 with the remaining stations also reporting slightly less salty values.

Oil and Grease – All observed O&G levels were below the detectable limit (5 mg/l) for each of the six monitoring stations during 2016. These data are reflective of effective spill prevention and good housekeeping practices being maintained by site personnel.

Dissolved Oxygen - Minimum DO levels were at concentrations that support aquatic life, ranging from 4.6 to 14.9 mg/l from all stations. Dissolved oxygen was most variable at onsite Station E as opposed to the open and flowing receiving water stations. Since all other parameters have similar patterns with the other stations, Station E's variable and wider ranging DO values can be attributed to natural factors, such as aeration and biological oxygen demand. Station D, this year, produced the lowest single measurement (4.6 mg/l) and close to the highest value as well. Greater surface area and water movement through currents and wave action always provide continuous aeration of the lake and ICW water. Mean DO values ranged from 7.5 to 8.6 mg/l across the six sampling stations.

Total Organic Carbon - TOC concentrations for 2016 ranged from 2.4 to 14.0 mg/l with site stations D and E experiencing both the highest and lowest single values of all the stations again this year. This range is not out of line with the nature of these water bodies and is very consistent with though more variable with the measurements obtained during the year at all Black Lake stations. The average annual TOC concentrations by station ranged from 4.1 to 8.2 mg/l with stations D and E experiencing the most variability. Because the variation is so consistent among the remaining stations, and especially so for the Black Lake stations, it is indicated that these measurements reflect a return of near normal rainfall to Black Lake and the surrounding environs.

General Observations - The following observations are made, based on the above discussion, concerning operational impacts on the WH aquatic environs.

- pH and temperature were observed within ranges routinely expected from the archival history, setting and conditions experienced in the year. Measurements of pH from all stations remained fairly stable, and in general, the waters remained slightly basic. The measurements and observations made appear to be reflective of the return to more abundant coastal derived rainfall and the typical seasonal influences.
- Detectable salinity levels were found mainly in Black Lake and the ICW. The salinity measurements made throughout 2016 were consistent with the ambient and slightly brackish receiving water environment, reflective of the return of abundant coastal derived rainfall to the area.

- Oil and grease measurements are made quarterly throughout the year by routine in order to include seasonality in the dataset. Historically, the O&G tests here are typified by BDL measurements. With the exception of the single spurious measurement back in 2014, the site has maintained a complete BDL record at all stations and for all samples made during the current year and the previous year. This is reflective of a focus on good housekeeping associated with all operations and a high degree of attention on spill prevention.
- All dissolved oxygen levels at site and Black Lake stations were sufficiently high and do not appear adversely affected by site operations. Onsite station E produced the lowest level of all stations and stations E and F the higher variability and the larger ranges. None of the data from either locale suggest any impact or effects from SPR operations.
- Total organic carbon concentrations were quite similar at all stations with the exception of stations D and E throughout the year suggesting no substantial transient bio-contamination or ecological events. The increased variability observed at the onsite drainage station D results from the wider range of the values found (D had the highest value and Station E the lowest value) of all sample locations during the year but nothing indicative of any impact, insult or impairment.

5.5 Waste Management

The waste minimization program reduces the generation of all wastes including hazardous, non-hazardous municipal solid, construction and demolition (C&D) and Exploration & Production (E&P) wastes.

The SPR successfully met their waste goals for FY16 by diverting at least 20% of hazardous waste, 50% of non-hazardous waste and 50% of C&D waste. SPR goals are developed in accordance with our Environmental Management System and are set by Fiscal Year. Environmental staff members were able to assist in this success by a thorough review of the potential waste streams, evaluation of recycling alternatives, communication with SPR personnel, and consultation with federal and state regulatory agencies as required.

While performance goals are set for each fiscal year, the following waste data for Calendar Year 2016 is provided for informational purposes. During CY16, 22% of non-hazardous E&P wastes (97,190 lbs.) and 56% of non-hazardous wastes (412,042 lbs.) generated was reclaimed or recycled in accordance with state solid waste programs. All C&D wastes (755 lbs.) generated in CY16 was sent for disposal. 99.9% of hazardous waste generated during CY16 (886,207.2 lbs.) was sent for reclaimation or recycling. This consisted primarily of crude oil tank bottoms or sludge mixtures generated by cleaning Bryan Mound Tank 4. Materials recycled during CY16 are summarized in Table 5-15.

Table 5-15 SPR Recycled Materials

Category	Recycled (lbs)	Recycled (Metric Tons)
Aluminum-Plastic Comingled	1,233	0.55
Antifreeze	18,614	8.44
Ballasts	772	0.35

Table 5-15 SPR Recycled Materials		
Category	**Recycled (lbs)**	**Recycled (Metric Tons)**
Capacitors	28	0.01
Cardboard	18,632	8.45
Crude Oil Tank Bottoms (hazardous)	886,067.7	401.91
Electronics	5,890	2.67
Fuel Filters	6	0.00
Lamps, Non-Hazardous	937	0.42
Oil Filters	170	0.07
Office Paper	165,055	74.86
Plastic	882	0.40
Scrap metal	140,598	63.77
Toner Cartridges	2,350	1.06
Used Oil	55,836	25.32

5.6 Chemical Management

All people using chemical containing products on the SPR are required to choose chemical products that are approved and listed on the Qualified Products List (QPL). The QPL is used to control and limit the quantity of toxic constituents found in chemical products, and also the potential for the generation of hazardous wate generated on the SPR.

Personnel requesting chemical containing products forward the SDS to the Chemical Management Specialist who reviews the product for potential impacts to the environment, adherence to the SPR Building Specifications and green requirements for paints, adhesives, sealants; recycled content in materials; and exclusion constituents that contain EPA's 17 High Priority Toxic Chemicals.

The Chemical Management Specialist confers with the Industrial Hygienist regarding concerns he may have from a health and safety standpoint; and with the Waste Management Specialist to discuss the potential for waste generation that might occur from the use of the requested materials. If necessary, the Water or Air Specialist may also be brought into the review. The sub-contractor or site personnel are contacted when additional information is needed as to the proposed use of or quantity needed for the job. If the product is rejected for use, an acceptable substitute is presented.

The SPR Chemical Management Program is successful in restricting use of chemical products to those that are more environmentally friendly and safer for employees.

5.7 Pollution Prevention

The SPR's Pollution Prevention program integrates P2 activities into all SPR operations to minimize risks to the environment. All SPR employees have P2 responsibilities under this program as every employee generates waste which must be appropriately managed. A few of the many ongoing successful SPR P2 projects include paper use reduction, municipal solid waste

diversion, paint waste elimination, exploration & production (E&P) waste recycling, sustainable acquisition, and spill prevention.

FY16 saw a considerable increase in SPR well drilling and workover activities which have potential to generate huge volumes of waste, much of it non-hazardous. By properly managing the projects on the front end, zero hazardous drilling wastes were produced. Contractor waste management plans and controlled use of approved chemical products with less environmental impact were critical to the success of this accomplishment.

P2 announcements and suggestions are communicated via the SPR's newsletter "What's Happening", and routine email distributions including pertinent local information and useful web links. These communications are published on the M&O Environmental webpage, which is available to all SPR employees. In 2016, the SPR continued its aggressive integration of the P2 and EMS programs into its business operations, providing both cost savings and pollution reduction.

5.8 Sustainability

The SPR Sustainability Program was initiated in 2007 with the advent of EO 13423, broadened in 2009 with EO 13514, and then revised with EO 13693 in 2015, but it has never been a unique and separate program. It focuses on resource conservation and pollution prevention, so it includes the objectives of the air, water, waste, and chemical management programs that were well established prior to 2007. Like other programs, the sustainability program is planned, implemented, monitored and measured, evaluated, reported, and improved through the SPR EMS.

Many SPR sustainability goals – identified as "objectives" in the EMS – were created during the initial development of the SPR EMS, after evaluating SPR activities and recognizing the environmental aspects of these activities that must be controlled. These are referred to as SPR-specific "institutional" objectives. Other sustainability goals identified and mandated by the executive orders were included in the EMS in 2007, 2009, and 2015. All goals/objectives and their targets are called "performance measures" and are discussed as follows.

Fifty-two performance measures were tracked by the SPR EMS in FY16 (thirty-two sustainability goals/sub-goals and twenty institutional performance measures). A target is established for each objective/goal. Some objectives have two targets, a "minimum" level that all DOE contractors should meet and a more challenging "stretch" level.

Performance measures are either discretely identified in the M&O contractor's Work Authorization Directives (WADs) as contract objectives, or they support the WADs, or they are delineated by the goals of Executive Order 13693.

Performance measures are agreed upon for each fiscal year by DOE and the M&O contractor and tracked for success. Some focus on specific disciplines, such as the Environmental or Emergency Management departments, while others involve all disciplines. All performance measures were related to significant environmental aspects or interests to top management.

Refer to Tables 5-16 and 5-17 for a synopsis in meeting performance measures. Institutional performance measures have been monitored and measured annually for more than 11 years. They are based strictly on SPR-specific environmental aspects.

The M&O has tracked performance against the DOE sustainability goals and rated performance against three categories of risk and three levels of severity (high, medium, low) of not achieving the SSP goals. The risk of non-attainment of goals is categorized as follows:

A. Technical risks: Technology is available/not available in current facilities and systems to attain the goal.
B. Management risks: Management systems and/or policies may require changes for which approval authority is outside the DOE or requires and internal DOE policy or procedural change.
C. Financial risks: Funds are/are not identified in current or out-year targets to achieve the goal.

Risk levels are defined as follows:

- High: Risk in at least one of the three categories is so significant that non-attainment of goal is likely or expected.
- Medium: Risk in at least one of the categories above is so significant that it is moderately likely that it may not be achieved.
- Low: Any risks associated with this goal are being satisfactorily mitigated such that attainment of the goal is likely.

The risk categories (A, B, and C) are included in Table 5-17 for those goals with high and medium attainment risk. Table 5-17 summarizes the sustainability goal performance. Risk of not achieving the goals is included as well as current performance and future actions. Of the 32 goals below tracked in FY16, 18 were achieved, 8 were progressing toward achievement, and 6 had not yet shown progress.

Table 5-16 2016 Institutional Objectives & Targets with Performance

Aspect	Objective	Status 2016	Performance
1) Continual Improvement	EMS Implementation Team and the Prioritization Committee to revisit and restructure the SPR's Aspects/Impacts to more closely represent the SPR of today. The Significant Aspects will be identified and communicated to FFPO personnel.	Complete	N/A
2) Continual Improvement	Develop/implement a process to ensure all findings and non-conformances are addressed at all sites to identify if a finding is applicable at other sites,	Complete	N/A

Table 5-16 2016 Institutional Objectives & Targets with Performance			
Aspect	**Objective**	**Status 2016**	**Performance**
3) Continual Improvement	Establish a multi-disciplinary team of site and NOLA personnel (Document Control Team) to resolve the challenges users face in accessing instructional documents.	Complete	N/A
4) Continual Improvement	Document Control Team recommended and obtained management approval of long-term actions to resolve controlled document access challenges. 1) Consolidate to a single Document & Forms Center 2) Migrate documents & forms into new single location	Complete	Document Dashboard is available on the SPR Homepage
5) Discharges	Reduce permit exceedances reported on the Discharge Monitoring Reports *Target: ≤8/*	Zero	Below Target
6) Spill, Air Emission, Monitoring, Wetlands Disturbance, Drainage, Navigation, Public Exposure	Avoid Clean Water Act, Clean Air Act, and RCRA (waste) enforcement actions (Notices of Violation – NOVs) *Minimum & Target. 0/year*	Zero	Zero Since FY00
7) Spills	Reduce reportable occurrences of releases from operational facilities *Minimum: ≤6/year Target: ≤4/year*	Three	Below Target
8) Waste	Reduce and minimize the acquisition, use and disposal of hazardous chemicals and materials by at least 20%. *Minimum: >20% Target: N/A*	99%	Above the target
9) Waste	Divert at least 50% Construction & Demolition Debris *Minimum: ≥50% Target: N/A*	96%	Above target
10) Waste	Divert at least 50% of Non-Hazardous Solid Waste *Minimum : 50%Target = N/A*	62%	Above Target
11) Waste / Resource Use	Demonstrate Qualified Products List (QPL) compliance	Slightly <100%	N/A
12) Waste, Spill, Air Emissions Resource Use	Review all P.R.s, designs, SOWs, and other documents submitted for Environmental review. *Minimum: N/A. Target: 100%*	100%	100% since 2001

Table 5-16 2016 Institutional Objectives & Targets with Performance			
Aspect	**Objective**	**Status 2016**	**Performance**
13) Monitoring and Surveillance Results	Submit environmental documents on time to DOE & Regulators (timeliness and quality) *Minimum: N/A. Target: 100%*	100%	100% since 2001
14) Spill Monitoring & Surveillance	Submit annual Pipeline Integrity Report. *Minimum: N/A. Target: On Schedule*	Complete	Completed on Schedule
15) Spill	Ensure key emergency equipment is available. *Minimum: 90% Target: 100%*	100%	>Minimum since 2000
16) Spill Fire	Ensure BOAs are in place for spill response and clean up at each site. *Minimum: 1/site. Target: 2/site*	On Target	Target since 2001
17) Spill Fire	Ensure emergency preparedness and response capabilities through quarterly training ERT members. *Minimum: 95% ERT trained/site* *Target: 100% ERT trained/site*	100%	>Minimum since 2000
18) Spill	Successfully complete PREP drills / exercises. *Minimum: N/A. Target: 100% PREP objectives tested/site/yr*	100%	100% for regulatory compliance
19) Public Involvement	Plan/administer community outreach program. Complete community outreach activities using the Annual DOE SPR Public Outreach Plan as a baseline. *Minimum: Complete all activities.* *Target: Complete additional activities.*	Complete	Consistently ≥minimum of 100% by completing additional activities since 2002
20) Spill Air Emissions Waste	Meet weighted average (MPAR) of quality of maintenance, preventive maintenance completion, maintenance support, scheduling effectiveness, productivity, corrective maintenance backlog, readiness of critical must-operate equipment. *Minimum: 95%/month. Target: 98%/month*	Above Target	Generally meeting the target but always exceeding the minimum since FY00

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
Goal 1: Greenhouse Gas Reduction				
1.1	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY08 baseline (2016 target: 22%)	**Baseline:** 35,971 mt **Current:** 27,156 mt **Progress toward goal:** 25% reduction	-Promote telecommuting. -Behavioral modification -Energy audits -Reduce travel in GOV's -Fleet Management	Medium - A
1.2	25% Scope 3 GHG reduction by FY25 from a FY 2008 baseline (2016 target: 7%)	**Baseline:** 4,749 mt **Current:** 5,250 mt **Progress toward goal:** 11% increase	-Promote telecommuting -Continue promoting video conferencing in place of air and ground business travel -Enforce GOV car pooling and van pooling in leased vehicle fleet	Medium - B
Goal 2: Sustainable Buildings				
2.1	25% energy intensity (Btu per gross square foot) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY25 from FY15 baseline	**Baseline (2015):** 398,137 Btu/GSF **Current:** 567,236 Btu/GSF **Progress toward goal:** Established new 2015 baseline	-Promote telecommuting -Behavioral modification -Continue annual energy/water surveys -Building envelope upgrades. -LED light installations -Induction lighting replacements	Medium - B
2.2	EISA Section 432 energy and water evaluations	**Baseline:** Cover 25% of applicable buildings & structures/yr. (4 sites in 4 years). **Current:** Energy/Water surveys conducted at BC, BM, BH, and WH since 2013. **Progress toward goal:** 100%	-One of the four crude oil storage sites will be evaluated annually. Fourth storage site (WH) to be surveyed FY16 to complete current 4-year cycle. -Repeat 4-year cycle in FY17	Low
2.3	Meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate	**Baseline:** Total of 29 standard electric utility meters at four storage sites. **Current:** 24 additional power meters installed to provide advanced sub-metering at storage sites. Software upgrades allow energy monitoring of 83 pumps. Meter tracking for all 4 storage sites complete in FY15. **Progress toward goal:** Additional metering should allow monitoring of 90% of energy used on the storage sites.	-Energy monitoring began in FY14. Tracking will continue at all 4 storage sites.	Low
2.4	At least 17% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the *revised* Guiding Principles for HPSB by FY25, with progress to 100% thereafter.	**Baseline:** At least two buildings at each storage site would meet the 15% coverage. **Current:** No existing buildings comply yet with 100% of Guiding Principles, but 8 are proposed. **Progress toward goal:** 5% (based on annual GP progress review and up-date). Funding has not been provided per the budget module request.	-In FY16, funding was not requested for the work required for HPSB compliance because it was determined to be non-mission critical and does not impact operational readiness.	Medium - C

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
2.5	Efforts to increase regional and local planning coordination and involvement	**Current:** Local transportation planning activities were evaluated for each storage site. Annual Beach Sweep Participation. Coordinated with local, regional, and state water compliance agencies on various water related projects (LA & TX).	-Impact assessments will adulate future transpiration related activates as changes are made to facilities. -There are no new buildings or leases planned for FY17. -Continue coordination efforts with water compliance agencies.	Low
2.6a	Net Zero Buildings: Percentage of the site's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY25.	**Baseline:** None **Current:** There are no major renovations planned on existing buildings. **Progress toward goal:** No action needed currently.	-Based on funding, all new buildings and selected existing buildings to meet or exceed guiding principles.	Medium - C
2.6b	Net Zero Buildings: Percentage of new buildings (> 5,000 gross square feet) entering the planning process designed to achieve energy net-zero beginning in FY20.	**Baseline:** None **Current:** There is no new construction of buildings planned. **Progress toward goal:** No action needed currently.	-Based on funding, all new buildings and selected existing buildings to meet or exceed guiding principles.	Low
Goal 3: Clean & Renewable Energy				
3.1	"Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY16-17, working towards 25% by FY25.	**Baseline:** None **Current:** 10% of FY15 energy consumption purchased as RECs. **Progress toward goal:** Purchased 10% of FY15 energy consumption in wind credits. Plans for REC purchases that would equal or exceed 10% of energy consumed during previous year.	-Studies completed by the SPR A&E contractor on potential renewable energy projects determined that they were not economically viable. -Continue purchasing wind credits at minimum 10% of previous year's energy consumption. Project(s) will be funded appropriately as part of a balanced budget.	Low
3.2	"Renewable Electric Energy" requires renewable electric energy account for not less than 10% of total agency electric consumption in FY16-17, working to 30% of total agency electric consumption by FY25.	**Baseline:** None **Current:** 10% of FY15 energy consumption purchased as RECs. **Progress toward goal:** Purchased 10% of FY15 energy consumption in wind credits. Plans for REC purchases that would equal or exceed 10% of energy consumed during previous year.	-Continue purchasing wind credits at a minimum of 10% of the previous year's energy consumption. Project(s) will be funded appropriately as part of a balanced budget.	Low

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
Goal 4: Water Use Efficiency and Management				
4.1	36% potable water intensity (Gal per gross square foot) reduction by FY25 from a FY07 baseline. (2016 target: 18%)	**Baseline:** 20.6 gal/GSF **Current:** 19.2 gal/GSF **Progress toward goal:** 7% increase.	-Use DOE building specs that have been greened to reflect water saving plumbing fixtures. These will be considered for future replacement and new construction. -Continue conducting site energy/water surveys to identify all industrial uses of potable water for further evaluation for reduction. Because a large amount of potable water is used for industrial processes, this goal is difficult to achieve.	Medium - C
4.2	30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY25 from a FY10 baseline. (2016 target: 12%)	**Baseline:** 5.1 M gal **Current:** 5.2M gal **Progress toward goal:** 2% increase.	- Further evaluation for the reduction of ILA water for industrial uses. -Create a promotional campaign to remind personnel to reduce water use and promptly repair leaks.	Low
Goal 5: Fleet Management				
5.1	30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY25 from a FY14 baseline. (2016 target: 3%; 2017 target: 4%)	**Established new 2014 Baseline:** 793g CO2e/mi **Current:** 921g CO2e/mi. **Progress toward goal:** 16% increase	-Flex fuel vehicles will be replaced with hybrids and low greenhouse gas vehicles when applicable.	Low
5.2	20% reduction in annual petroleum consumption by FY15 relative to a FY05 baseline; maintain 20% reduction thereafter. (2016 target: 20%)	**Baseline:** (2005) 126,404 gal consumed (FAST compliant fleet) **Current:** 54,632 gal **Progress toward goal:** 57% reduction. Flex fuel vehicles have been replaced with hybrids and low greenhouse gas vehicles when applicable.	-Continued effort to acquire more fuel efficient vehicles and reduce travel. -Enforce employee business carpooling and van pooling in leased vehicle fleet. -Continue annual vehicle fleet optimization exercise -Promote video conferencing.	Low
5.3	10% increase in annual alternative fuel consumption by FY15 relative to a FY05 baseline; maintain 10% increase thereafter. (2016 target: 10%)	**Baseline:** 16,055 gal of CNG used in light duty trucks in FY 2005 **Current:** No CNG used (no AFV trucks left) **Progress toward goal:** 0% increase.	-Submitted an AFV waiver for FY16. -Continued effort to replace conventional light duty gasoline vehicles with AFV's will depend on fueling infrastructure.	Medium – C

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
5.4	75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2016 target: 75%)	**Baseline:** There are no DOE owned light duty vehicles in fleet. **Current:** No light duty AFV's purchased in FY14. **Progress toward goal:** Not applicable since there were no purchases.	-AFV's will be evaluated if light duty vehicles are purchased. -Currently 57% of the leased fleet is classified as AFV's (E-85 fuel compatible).	Low
5.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY25. (2016 target: 4%)	**Baseline:** 110 fleet vehicles – no plug-in or zero emission vehicles as part of the fleet. **Current:** There are no plug-in or zero emission vehicles as part of the current fleet.	-When passenger vehicles must be replaced/ purchased, plug-in hybrid vehicles and zero emissions vehicles will be considered.	Medium - C
Goal 6: Sustainable Acquisition				
6.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring Bio Preferred and bio based provisions and clauses are included in 95% of applicable contracts.	**Baseline:** None **Current:** Overall success was 100% (4 out of 4 applicable contracts), which surpasses the 95% target. **Progress toward goal:** Continue strengthening requirements for federally-mandated designated products in all purchasing programs as necessary.	-Continue review of purchase requisitions and summaries of work to assure environmentally preferable materials and products are used where appropriate.	Low
Goal 7: Pollution Prevention & Waste Reduction				
7.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris.	**Baseline:** None **Current:** 62% of non-hazardous solid waste was diverted **Progress toward goal:** 263 mt of 424 mt of non-hazardous solid waste was diverted.	-Continue to meet non-hazardous waste generation and recycling targets. -Continue scrutinizing activities to minimize waste and promote recycling.	Low
7.2	Divert at least 50% of construction and demolition materials and debris.	**Baseline:** None **Current:** 96% was diverted **Progress toward goal:** 33 mt of 34 mt of C&D waste were diverted.	-Continue to evaluate construction tasks before they begin with waste management plans, and identify and find ways to maximize recycling.	Low
Goal 8: Energy Performance Contracts				
8.1	Annual targets for performance contracting to be implemented in FY17 and annually thereafter.	**Baseline:** None **Current**: Currently the SPR has no energy savings performance contracts (ESPCs) or utility energy services contracts (UESCs).	-One potential area where ESPC may be possible: replacing high-pressure sodium (HPS) security lighting with energy efficient induction or LED lighting.	Medium - C

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
Goal 9: Electronic Stewardship				
9.1	Purchases – 95% of eligible acquisitions each year are EPEAT-registered products.	**Baseline:** None **Current:** EPEAT registered electronics acquired are as follows: 100% of the computers; 96.2% of LCD monitors; and 100% TVs. There were no new purchases of thin clients, printers and scanners, facsimiles, or multi-functional devices.	-Continue review of purchase requisitions and summaries of work, and periodically conduct electronics inventories to assure EPEAT registered and Energy Star qualified electronics are acquired where appropriate.	Low
9.2	Power management – 100% of eligible PCs, laptops, and monitors have power management enabled.	**Baseline:** None **Current:** -100% of eligible electronic devices (PCs, laptops, monitors, printers, scanners, and multi-functional devices) have power management enabled. -100% of virtual desk top function available to users -Thin Client devices available to 48% of users. -All printers set to go into power saver mode when not in use. -All monitors are set to go to sleep after 20 minutes of being idle. **Performance:** Effort being made to enable power management on all eligible equipment.	-All ineligible electronic equipment will be replaced with eligible equipment when needed/appropriate.	Low
9.3	Automatic duplexing – 100% of eligible computers and imaging equipment have automatic duplexing enabled.	**Baseline:** None **Current:** All capable printers have automatic default set to duplex printing across the SPR. Only 3% (7 out of 219 items) of the printers, copiers, and multi-functional devices are incapable of duplex printing or ineligible for power management.	-All SPR computers are set to default to duplex printing. All SPR personnel are encouraged to use the duplex printing option when printing. -All ineligible electronic equipment will be replaced with eligible equipment when needed/appropriate.	Low
9.4	End of Life – 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	**Baseline:** None **Current:** 100% of used electronics were reused or recycled. 212 items were recycled and 14 items were donated or transferred.	-Continue to recycle, donate or transfer all used electronic equipment.	Low
9.5	Data Center Efficiency.	**Baseline:** None **Current:** Two new Liebert HVAC systems were installed in FY15. New systems expected to have high efficiency to improve (decrease) power utilization effectiveness (PUE) of datacenter. No meter dedicated to data center energy consumption. **Progress toward goal:** No meter, but power usage data is available	-Examine feasibility of using the DC Pro data center energy use and analysis tool to reveal other reasonable energy improvements that could be made to the data center. - Additionally, old servers are being replaced incrementally with newer ones that are Energy Star approved.	Medium – C

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
		from power distribution unit (PDU) for all the computing equipment operating in the data center. This can not, however, meter energy consumption by the center's air conditioning system.		
Goal 10: Climate Change Resilience				
10.1	Update policies to incentivize planning for, and addressing the impacts of climate change.	**Baseline**: None **Current**: SPR published initial Natural Phenomena Hazards Assessment (NPHA), in Dec. 2007. This NPHA was updated in Jan. 2014 to include hurricane assessments and all other natural phenomena. SPR Environmental Advisory Committee composed of experts from outside specialists, universities, and communities near SPR sites, consulted in developing 2007 NPHA and have continued to be involved in SPR NPHA and have presented presentations on the progress of the program.	-The NPHA will be continue to be reviewed and revised as needed- -The EAC will continue to be involved in climate change policies and planning. -M&O staff professionals will continue to complete courses related to climate change to stay up to date with the current issues and risks and how to manage these risks as related to coastal environments.	Low
10.2	Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.	**Baseline**: None **Current**: The SPR has established working relationships for extreme weather events with local, Parish/County, State, and Federal agencies. Many of these are in the area of emergency response, and joint drills have been practiced. To date, these relationships have not yet been expanded to climate change, except peripherally.	-In FY16 SPR is working directly with U.S. DOE Sustainability Performance Office (SPO) to develop baseline SPR Climate Change Resiliency Study (CCRS). CCRS is facilitated by a contractor team that prepared a CCRS at National Renewal Energy Laboratory (NREL) for the SPO. It is expected this CCRS will be completed by end of FY17.	Low
10.3	Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.	**Baseline**: None **Current**: Primary SPR program addressing climate change is NPHA Program; primary and secondary natural phenomena hazard evaluations, and all have been addressed by SPR in 2007 NPHA Report.	-The SPR has been analyzing climate change since at least 2007 and how it affects human health and safety. Additional phenomena continue to be recognized in the 2014 revision.	Low
10.4	Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.	**Baseline**: None **Current**: It is SPR practice and procedure to include NPH analyses (including climate change) in all process hazard analyses, hazard surveys, and emergency planning hazard assessments. These analyses results and recommendations are published, and the recommendations are tracked to completion. Additionally, the SPRPMO	-The SPR has a mature sustainability program as well as a compliant ISO 14001 EMS in place. The SPR plans to incorporate the results of the SPO CCRS into both of these programs. Both the SPR Sustainability Program and the EMS system have built into their formal processes outreach and internal communications to better educate the workforce.	Low

Table 5-17 FY 2016 Sustainability Goals, Performance, and Planned Actions				
SSPP Goal #	**DOE Goal**	**Performance Status through FY 2016**	**Planned Actions & Contribution**	**Risk of Non-attainment**
		occasionally requests and receives briefings on special natural phenomena/climate change issues.		
10.5	Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.	**Baseline**: None **Current**: SPR procedures are updated as new information is vetted. Following the impacts of Hurricane Katrina (2005) and Hurricane Ike (2008) on the SPR, several studies were completed for improving SPR capacity to better withstand NPH's. The SPR Ten Year Site Plan published in 2012 covers sustainability in several sections, primarily in conjunction with buildings. Since the SPR SSP is part of the Ten Year Site Plan by reference, the FY13 revision of the plan included this information on climate change resiliency.	-In FY 2016, a project-wide CCRS will be conducted and the results will be utilized to adapt current procedures if necessary. -As the SPR is located in a coastal area that has changed over time, many SPR programs and plans recognize climate changes (sea level rise, coastal land loss, and increased storm impacts).	Low

5.9 Wildlife

The four SPR storage sites are located on the Central and Mississippi Flyways. The coastal position of BM, BH and WH in particular make them the last resting and feeding stop for migrating birds before they make the arduous trip across the Gulf of Mexico, to the wintering areas in central and South America and the first stopover when they migrate back to North America in the spring. Without places along the way that provide an adequate food supply for the quick replenishment of fat reserves, water, and shelter from predators, these birds are not likely to survive.

In an effort to provide a resting place for migrating birds selected habitat areas at BH, BM and WH are not mowed from early fall through spring to provide food, shelter and nesting habitat for migrating and resident birds. Nest boxes and platforms are provided for waterfowl to raise their young. Purple Martin houses have been installed at WH and BH to attract mosquito eating Martins, and Eastern Bluebird nest boxes and Wood Duck nest boxes have been installed at BC. At all sites when ground nests for terns, Stilts, Killdeer and Nighthawk are discovered they are flagged until the chicks have fledged. Equipment harboring active bird nests are designated for limited/restricted use.

Select SPR site personnel have received wildlife rescue training in order to relocate wildlife found on the site, and trained in rehabilitation techniques such as oiled wildlife response, which allows personnel to work under the supervision of a licensed rehabilitator or manage contract rehabilitators.

Besides maintaining wildlife habitat areas, activities focus on educating personnel about the wildlife found in their area. At BM, interpretive signage is installed around the ponds in the habitat areas that identifies the waterfowl species most likely to be observed. Throughout the year informative papers and posters highlighting specific wildlife topics are sent to the sites for posting on their wildlife bulletin boards.

The sites also conduct periodic avian inventories per the Memorandum of Understanding (MOU) between US Fish and Wildlife and DOE. Inventories are uploaded to the Cornell Ornithology Laboratory database and are used to assess the health and movement of populations of migratory birds. The SPR has an active dialog with Cornell ornithologists regarding unusual observations, and dearth or abundance of species.

BH and BC developed a wildlife web page within the site's website that contains photographs taken of the different bird species observed and counted as well as other interesting wildlife information. The sites have actively involved employees in their wildlife program by posting photographs taken by site personnel of wildlife seen on site.

6 Ground Water Protection Program

Ground water monitoring is performed at all four SPR sites to comply with the SPR Environmental Management System (EMS) Manual (ASI5400.55), and also in the case of the WH site, a state agency agreement. Salinity is measured and the potential presence of hydrocarbons is screened at all sites using TOC as an indicator. In addition, pH and temperature are taken along with the physical attribute depth to water for each well at each sampling episode. The overall monitoring scheme performed at WH is governed by an agreement between DOE and the LDNR to report annual ground water monitoring data through this document. At the Weeks Island, Louisiana site, long-term ground water monitoring has been accepted as complete as part of the state approved decommissioning plan. BM ground water quality is conveyed for a pond closure annually to the RRC via copy of this report. Wells surrounding the operating brine storage and disposal pond system at BH monitor groundwater as part of permit required leak detection. The St. James terminal has undergone and completed a remediation to satisfy state criteria for some limited historic crude oil leakage there and because follow-on studies indicated no further action required; no permanent ground water monitoring well system is indicated for the leased facility**.**

Available ground water salinity data collected for the past five years are presented graphically (Appendix C), for the historic site well nets and for the more recently installed Periphery Well (PW) series. These data are then discussed within each site-specific section and any gaps in data for the graphs are noted. The Y-axis has been standardized with appropriate exceptions noted at either the 0–10 ppt or 0–100 ppt as the baseline dependent upon the historical range, providing easier comparisons among the monitoring stations.

Three of the storage sites have a long history of industrialized development primarily involving the mining of salt and associated minerals that were used for various purposes and as feedstock. A 10 ppt cut-off for salinity is used in this report for making comparisons for assessing affected and unaffected waters. This is not a regulatory limit but rather a value, given the setting, which represents usable versus unusable water. At BM, however, because of its particular site specific and historic mining conditions, a 20 ppt cut-off is employed for evaluating the generalized ambient shallow ground water conditions there.

6.1 Bayou Choctaw

The Plaquemine Aquifer, the main source of fresh water for the site through an Iberville Parish public connection and several surrounding municipalities, is located approximately 18 m (60 ft) below the surface and extends to a depth of 150 to 182 m (500-600 ft). The upper 18 m (60 ft) of sediment in the aquifer consists predominantly of Atchafalaya clay. The interface of freshwater and saline water occurs at a depth of 122 to 150 m (400-500 ft) below the surface on the dome. Ground water levels in the Plaquemine Aquifer are said to respond locally with the Mississippi River, flowing away from it during the high river stage and towards the river when in the low stage. Other, more predominant, local influences to the general site-wide flow patterns are manifested by structural features.

Historically, there have been four monitoring wells (BC MW1, BC MW2, BC MW3, and BC MW4) surrounding the brine storage pond at BC (Figure C-1). These wells were drilled roughly

9 m (30 ft) below land surface (bls) generally at the corners of the structure to monitor potential impact from the brine storage pond and any other potential nearby shallow contamination sources. Seven additional similarly screened wells were installed at various locations around the main site, and one off-site near a selected brine disposal well pad (PW-wells)and BC PW3 was plugged and abandoned in that original Verification Well Study (VWS).

These periphery wells (PWs) have now been added to the site's monitoring scheme to enhance evaluation of ground water flow direction and outlying salinity movements and variation. The CY 1996 Site Environmental Report contains a detailed overview of the Phase II (periphery well) studies of this site. An adjunct of these studies is the determination of an estimated linear velocity of the ground water movement within the shallow monitored zone. For BC the water in the shallow zone moves an estimated 1.2 to 2.4 m (4 feet to 8 feet) per year in a generally radial direction off the main site and underlying dome, loosely mimicking the ground contours (Figure C-2).

Ground water salinity observed at all of the four pond wells (BC MW1 through BC MW4, Figure C-3) has historically been above an ambient cut-off concentration of 10 ppt, somewhat high for a fresh water environment. This condition of elevated salinity is attributed to a previous owner's saltwater brining operations and possibly some more recent brine handling activities on the dome. Four of these wells (BC MW1, BC MW2, BC MW3, and BC MW4) exhibit 5-year traces that confirm last year's spurious salinity spikes were measured and then have abruptly fallen off in 2016. The brief excursions were inexplicable back in 2011 as well. This year's data are observed to return to BDL's for each of the pond wells. And the spikes from last year shall now become a record of the almost site-wide event. All the wells can exhibit seasonal salinity fluctuations that are affected generally by rainfall cycles and lag time for recharge. Higher salinity values usually occur in late winter and early spring, and lower salinity measurements have been observed in late spring and summer. Well BCMW3 as an example, shows a trend reversal this year 2016, due to these end of year BDL measurements reversing a former flat trend indicative of the passing of a small saltwater plume from an historic brine piping release. BC MW1 shows a slight increasing 5-year trend, having all of its measured values well below 10 ppt until the single 2015 value of 11 ppt exerts control into this year's trace that the BDLs cannot erase or offset. This year after a long multi-year decline to below the 10 ppt cut-off, well BC MW2 began showing large salinity fluctuations (spikes and declines) returning, at times, to its historic highs. In this year's trace historic high measurements in 2011 move beyond the five-year chart period and now even with a single spike at the end of 2015, a downward trend is evident with the BDL's of 2016. This well is downgradient of the operating pond and does not appear to be affected by any persistent salt effects.

Past surface brine spills and other activities from previous occupants of the area may have also affected the ground water salinity observed in these shallow wells. The long-term salinity range observed at well BC MW3, that had been much greater than that of the other three historical wells, appears to be returning to the ambient conditions more reflective of background, as observed with wells BC MW1 and BC MW2. Well BC MW4 located down gradient of the site and south of the E-W canal has an historic elevated overall salinity concentration, but the recent long-term trending reflecting a downward trace similar to BC MW3 has changed to an upward trend because of the series of higher values at the end of 2015. Such wild swings and spurious

data have been observed in the past and much of the variability exhibited with the earlier historic data may have resulted from over purging and inconsistently applied sampling techniques. Water levels taken on the wells from the fall of 2016, when reduced to elevations and contoured, define an interpreted piezometric surface indicating that ground water movement is radial in all directions from a high [recharge] point on the dome around Cavern 15. A broad flat ground water sink is still evident along the western edge of the site and possibly in response to low water levels measured in the most easterly wells BC MW3 and BC MW4.

The 2016 salinity data from each well revealing a keynote signature this year with spikes and swings being replaced with lower values and BDLs, the traces combined with such slow ground water movement being applied to the series of salinity values mostly below 10 ppt, small fluctuations in concentration can often cause the five-year trends to change direction (flip-flop) with a single year's data addition. With the low BDL measurements evident in many of the wells this year, we are now presented with a generalized pattern of flat to downward trending traces in the salinity data with few exceptions.

Well BC MW2, the intercept well immediately down gradient of the brine pond reveals a muted decreasing five-year trace resulting from a return to lower salinities in 2010 versus the spike experienced in 2015. The well is showing long-term lower salinity values evident for three calendar years all below BDL save for a single 11 ppt measurement at the end of the year. This well shall continue to be observed closely because of its downgradient position of the pond, but the lower numbers commencing in 2012 and persisting with BDL values for almost four years, keep the well off the assigned site "watch list."

Periphery well BC PW2 monitors an area of historical residual surface soil salt impact that affects shallow ground water and this year's five-year trace continues to indicate a steady improving or freshening trend from 40 ppt to below 20 ppt. This area is up gradient of and therefore not associated with the current brine pond operations. The site-wide BDL pattern is also eveident in this year's dataset.

Although it has in the past captured the most saline ground water on the site, BC MW3 is now exhibiting an essentially stable and decreasing trend. The slightly decreasing five-year trend varying around the 10 ppt cut-off is now revealing a continuing downward trend with numerous BDLs in 2016. Former impacts from a historical 1991 brine piping leak appear to have completely passed this well now in an easterly downgradient direction.

Five of the seven PW well series wells indicate decreasing or flat five-year salinity trends. Well BC PW1 reveals a trend reversal to a flat trace driven primarily by the 2015 spikes in the data, then returning to BDL levels in 2016.

All of these monitored locations appear to fluctuate regularly over the entire period of record, but generally with decreasing trend lines and especially with decreasing variability for each well despite the occasional trend reversals noted in the shorter-term five-year windows presented. Future ground water data, including that from the periphery wells added from the Phase II verification studies and ongoing inspections of the brine pond and site piping, will assist in identifying any potential contamination originating from SPR activities. The shallow ground

water monitoring well net for this site is adequately placed and sampled to serve as a complete site-wide detection monitoring system.

6.2 Big Hill

The three major subsurface hydrogeological formations in the BH site vicinity are the Chicot and Evangeline Aquifers and the Burkeville Aquitard. The major source of fresh water is the Chicot Aquifer, which is compressed from uplift and piercement over the BH salt dome. Fresh water in the upper Chicot Aquifer over the dome is limited from near the surface to a depth of -30 m (-98 ft) below mean sea level, with the natural waters becoming more mineralized and brackish with depth The town of Winnie, situated off the dome and to the west, uses fresh water from the upper Chicot Aquifer. Beaumont and nearby Port Arthur both draw fresh water from the lower Chicot Aquifer. Historic [file] permits for cathodic protection borings provide a "depth of usable quality water to protect" ranging from 400 to 450 feet which means that any borings/wells penetrating beyond this depth must be properly cased to limit or preclude hydraulic cross-connections.

Sampling of six monitoring wells (wells BH MW1 to BH MW6) around the brine disposal pond system (Figure C-4) began in 1987 which was converted to the low-flow method in May 1995. Ground water contours from these and all of the Big Hill site monitor wells developed on fall quarter 2016 data are shown on Figure C-5.

The interconnected brine pond system is comprised of three contiguous PVC-lined above grade ponds (anhydrite settlement, oil recovery and brine ponds). All three have an under drain system contained within a surrounding slurry wall system keyed to an underlying clay bed. Commencing in August 2006, a renovation project to replace the liner material in the oil recovery and brine ponds in the series, was implemented. The project was completed there and the three-pond system was re-commissioned in August 2007. In 2012 an application was filed with the RRC to reline the anhydrite pond. The design approach proposed involved converting the accumulated anhydrite into a leachate collection system supporting a new PVC liner and operating pond placed over them but within the existing dikes. The application was administratively denied in 2013 and an additional sampling study of the anhydrite was completed as part of a re-evaluation project plan proposed and accepted by the RRC. In 2014, additional time was granted to develop a complete closure plan based on a Conceptual Closure Design submitted early in the year. Based upon comments received the design evolved to a "clean closure" plan proposal utilizing a full scale in-pond rinsing test (Pilot Test) developed to address entrained but washable chlorides from the insoluble anhydrite materials. In April 2015, the RRC approved the clean closure plan with hold and concur points occurring after the Pilot Test results are reviewed for success. Similar hold points and approvals are also in-place at the conclusion of full-scale washing, if approved and when completed. During 2016, the Pilot Test was found to meet all success criteria and the petition to move forward with the Phase II Full-Wash activities was approved, with construction in the pond commencing before the end of the year.

Salinity data collected from the six permit required wells surrounding the ponds have indicated complete and consistent results indicating no ground water effects associated with pond operation since monitoring began in 1987 with two exceptions. The first exception occurred with upgradient well BH MW2 in 2001 and the second occurred with three site wells (BH MW2,

BH MW5 and BH PW4 in 2008 after Hurricane Ike came ashore.

The 2001 salinity increase in BH MW2, up-gradient (northwest of) the ponds, is attributed to a previous brine release from buried brine header piping. This freshening trend continued until Hurricane Ike forced a huge storm surge of saltwater from the Gulf that inundated the site in 2008. Three wells BH MW2, BH MW5, and BH PW4, were impacted by the saltwater pushed onto the site overtopping some well casings temporarily and allowing saltwater to infiltrate through permeable surface soils including adjacent piping sandy backfill and also the breather holes in their caps. These three wells have shown remarkable recoveries during the time since Ike with well BH PW4 returning to BDL. The two pond-service wells have revealed long-term downward trending with all measurements for both below 10 ppt since 2008/2009, as the salt is slowly purged reflecting the limited impact as the salt water effects clear from the sand pack materials surrounding the screens with the routine low-flow sampling methodology. BH MW2 now shows all data at less than 1 ppt or BDL the fall of 2013 and BH MW5 shows all measurements in the current 5-year window below 2 ppt with 3 exceptions. The three values reported as 2 ppt occurred in sporadic fashion at the end of 2014 and the first measurement of 2015, when the handheld refractometer use was curtailed after a replacement instrument with the correct 1 ppt detection limit became available. All measurements of BH MW5 are now and have been below 10 ppt and most now vary around 1 ppt or below for this year's 5-year trace.

The gradients and flow direction remain very similar to the previous contoured maps staggered throughout the calendar years in order to account for any seasonality. Near brine storage pond system (wells MW1 through MW6) the flow is southeasterly. The overall basic shallow flow regime mimics the ground surface elevations and appears to be moving radially off the underlying salt dome structure. This contouring appearance cannot be completely corroborated due to lack of control points off the site in a north and westerly directions. However, as with the other SPR sites it is suspected that regional flow regimes are locally modified by the underlying domal piercements.

Well BH PW5 located at the most up-gradient point of the site shows a clean and flat trace and well BH PW4 near the southwest corner, below the closed mud pits, which had also cleaned and flat lined since a year after Ike, shows a single spurious spike to 1 ppt late in 2015 and BDLs throughout 2016. This year's 5-year trace from site wells depicts 2012 data for the oldest SER review.

The well BH PW2 was plugged and abandoned as part of the original VWS Study in the 1995/1996 timeframe and therefore is not depicted as an active well on the site well locator map.

6.3 Bryan Mound

Site monitoring wells screened in two water bearing zones, 6 and 15 m (20 and 50 ft) bls, indicate that no usable quantities of shallow fresh water exist in the uppermost inter-connected aquifer overlying the BM salt dome structure. This generalization was confirmed by the additional salinity data from VWS in 1995-96. However, the Chicot and Evangeline Aquifers are fresh to slightly saline in the Bryan Mound area, and fresh water for Brazoria County is obtained from the upper portions of the Chicot up gradient of the BM salt dome. Historic [file] permits for cathodic protection borings provide a "depth of usable quality water to protect"

ranging from 225 to 350 feet which means that any borings/wells penetrating beyond this depth must be properly cased to limit or preclude hydraulic cross-connections.

Fifteen monitoring wells were drilled at BM in four phases between 1981 and 1990 (Figure C-7). Wells BM BP1S, BM BP2S, and BM PZ2S have been removed from monitoring service due to casing damage. Five additional shallow well locations and one additional deep well were installed in 1996 as part of the VWS, and all of these were incorporated into the site's monitor well net.

All five-year traces this year reflect only the low-flow sampling method which produces less data variability and which helps assure more consistent and representative sampling of the shallow aquifers across the SPR. The resulting trending graphs now more accurately reflect the Bryan Mound site's ground water conditions. Three of the 12 total shallow zone wells around the site reveal a decreasing trend for the current 5 year windows with one of the remaining ten wells having a nominal flat trace. Two of the six total deep wells reveal a saltier trend this year. Of the remaining four deep zone wells, three have freshening trends and one is flat for the period. Five total wells could not be accessed for sampling this year so we have no current data points to include in the trending. Physical access was the primary culprit with flooding or excessively wet conditions in combination with transient construction activities sporadically affecting the ground water sampling activities.

Well BM MW1D although located down gradient of a pre-DOE source has had a series of decidedly downward 5-year traces responding to freshening data points from 2006 onward. Even with these large swings in the dataset, the five-year trending remains downward for this year through a series of extremely pronounced fluctuations with the trace and trending controlled by 2014 and 2015 lows.

Salinity trends are evident in both salt-affected and unaffected areas in the 18 total wells being tracked (12 shallow zone and 6 deep zone). Elevated ground water salinity measurements in both the deep and shallow zones near the former brine pond and pump pad area have, however, remained relatively constant over time. This year the counting statistics for the 5-year trends are: 4 of the 12 shallow zone wells are trending upward; 2 of the 6 deep zones are trending upward, and with 5 of the 18 wells having insufficient data this year to provide time-series interpretations. When samples do become available, the time series plots shall span the data gaps and the trending shall resume.

After an overall step change in salinity evident in both the paired wells back in 1995, BM MW1S and BM MW1D, a decidedly consistent and similar freshening (downward) trend has been observed in both wells until the 2005 five-year trace where the deep zone well BM MW1D began trending upwards briefly, while the shallow zone well screened above it, BM MW1S, continued its consistent freshening. Both wells currently show large swings in their 5-year windows and the freshening trend in both remains. This may be the result of a slug of salty water slowly passing this position in both the wells.

Salinity measurements (>20 ppt) observed in the shallow zone near the SOC (BM MW5) and the historic anhydrite disposal area maintains a 5-year trace with only a slightly upward trend for

three years now. The swings and trending are not indicative of any noteworthy releases (slugs) passing and the slight upward trend is now produced by a single elevated value occurring late in 2015. A variety of salinity swings are found in this year's traces of the well pair BM MW2S and BM MW2D. The flattening of the trace occurring in the shallow well (MW2S) since 2012 remains flat this year and stable around 10 ppt. The trace in the deep-well complement continues to trend downward and has stabilized around a 60 ppt level this year. This well-pair reveals an impressive hydraulic separation of 5.2 feet in downward direction (shallow well to deep well) for the data contoured this year in this portion of the site.

Salinity observed in the unaffected (<20 ppt) deep and shallow well pair at the northwest corner of the site (BM MW4S and BM MW4D) have reversed their downward trends now due to saltier values observed since the 2011 lows and the upward trending persists this year. All of the measurements in both the shallow and deep well are below 10 ppt. The underlying deep zone well now is also trending slightly upward but more slowly and at a lower overall salinity, indicative of differing waters. The hydraulic separation is very weak in this portion of the site.

BM MW3 continues to show a flat to slightly increasing salinity trend over this five-year period due to stabilized salinity values all below the 10 ppt cut-off since 2009 which continue, with a few exceptions, into 2015.

Site ground water movement in the shallow, 6 m (20 ft) bls, zone is found to be flowing radially (in all directions) off the dome (see Figure C-8). The flow directions in the deeper zone results from a NW-SE trending recharge zone causing flow to move in a northeasterly manner over basically half the site and in a southwesterly manner for the remaining half (see Figure C-9) again responding to the topographic expression of the underlying piercement. The water level data for the fall quarter of 2016. were contoured after reducing the depths to water measurements to elevations using the 2005 re-leveled measuring points. Again this year, the data do not produce any dramatic changes in flow direction interpretation but reveal gradients that appear to continue to steepened on portions of the site near the edges of the dome as recharge (rising water levels) in both the monitored zones and higher water levels in the adjacent lakes remain noticeable this year.

Both of the monitor zones exhibit low average linear velocity ranging from an estimated 1.5 m/yr (5 ft/yr) in the shallow zone to 3 m/yr (10 ft/yr) in the deeper zone. This slow movement is due to the combined effects of the clay content of the water bearing strata, lowering the intrinsic permeability and the low observed hydraulic gradients found across the site due to lack of nearby groundwater offtake. The low average velocity characteristic has the effect of extending groundwater travel times towards the flanks of the dome, while also promoting natural attenuation via diffusion and dilution with the slowly moving subsurface waters.

When contoured, two major areas emerge where ground water salinity exceeds ambient conditions (>20 ppt) for the Bryan Mound site. The first area stretches from the closed DOE brine pond eastward to the brine pump pads and to the vicinity of an older small brine pond demolished by DOE in 1989, and then southward towards the center of the site and below the maintenance building already discussed. Operations pre-dating DOE ownership included brine retention in two separate unlined elongated abandoned ponds reclaimed (filled) by DOE in this

same area. The second and considerably smaller area lies southeast of the security operations center (SOC) adjacent to a closed anhydrite and drilling muds confinement area.

Elevated salinity observed at shallow monitor wells since their installation, BM PZ1S, BM MW1S, and former BM BP1S, has been speculated to be associated with the large SPR brine storage pond. The large brine pond with a Hypalon® (chlorosulfonated polyethylene) membrane was originally constructed in 1978, and subsequently enlarged (height added) with installation of a new Hypalon® liner and a concrete weight coat in 1982. The BM brine pond was removed from service in September 1998 and closed in early spring of 1999. Because of the very slow ground water movement rates and the estimated long lag-time needed for vertical migration, the salinity measurements observed in the pond area and especially those to the northeast and east could be the result of seepage occurring from before the1982 renovations of the pond, or also from operations occurring before the SPR. Salinity of deep complements to wells BM PZ1S and former BM BP1S (BM PZ1D and BM BP1D) are much lower and considered ambient (<20 ppt) for the site. They would support an interpretation of no apparent direct communication with the shallow zone in this area both from the measured salinity levels and head difference. The flow gradient in the deep zone beneath the former BM brine pond has also helped to limit and restrict pre-DOE salinity impacts found to the east keeping the movement more easterly and in the vicinity of the former historic unlined brine storage. The shallow zone well BM PZ1S, the most directly down gradient well from the former large brine pond, reveals a trending reversal this year to a slightly downward (freshening) trace due largely to a peak in 2013 moving to the left. With addition of 2016 being flat to a slightly downward slide as well the overall trace shows some stability and freshening. The shallow zone well BM MW1S also maintains a steadily freshening 5-year trend even with large swings in the dataset evident in 20140 to 2015 timeframe continuing all the way into 2016. Well BM BP1D, located south of the former SPR brine pond maintained a 5-year downward trending and overall was found below 10 ppt through 2016.

Data from the VWS completed in the summer of 1996 indicate that the primary location of shallow zone salinity impact is in the area of well BM MW1S, which is mirrored by elevated salinity in the underlying deep zone around BM MW1D. This is down gradient of the location of former below grade unlined brine retention ponds from operations that preceded SPR ownership. The high salinity of the deep well may also indicate some limited hydraulic communication of the two ground water zones occurring in or just up gradient of their location. Water levels confirm continued hydraulic separation but with a large downward head difference of 6.8 feet.. Both the wells reveal steady freshening indicative of a slow moving saltwater slug passing and dispersing.

From the time the former SPR brine pond was closed in 1999, the shallow ground water could have moved an estimated 85 feet laterally. However, given the anticipated long lag-time for vertical migration and then the lateral distances required to reach the nearest monitor wells, it is expected to be a considerable time for post-closure salinity changes to become evident in the annual monitoring.

Suspect historical brine contamination located south of the site’s maintenance building may be responsible for producing another area of elevated salinity. An active source has neither been identified nor associated with any known historical SPR operations or incidents, and therefore it

most likely predates SPR occupation. Salinity measurements exceeding ambient levels (> 20 ppt) have also been observed historically in both zones at wells BM MW2S and BM MW2D, with the shallow well BM MW2S fluctuating at or below 10 ppt then experiencing a big swing in 2009 (spike and return) with subsequent data moderating to present. This area is masked when contoured, falling under the general "blanket" of the effects associated with the pre-SPR brining operations located in the north central portion of the site already described. This area may therefore be considered part of that historic saltwater release; being affected more by diffusion and dispersion rather than direct flow. The head difference here is decidedly downward across the separation layer between the two wells and the underlying deeper zone is more heavily impacted (trending from 65 to 55 ppt) into 2016.

Salt water effects are not evident at the northwest corner of the site. Shallow zone monitor wells BM MW3S and BM MW4S near the southwest corner and west of the former brine pond, respectively, have historically remained relatively stable in the unaffected 5 to 10 ppt range. The ground water salinity at the northwest corner of the site is consistent or better than the salinity observed in Blue Lake, the adjoining surface water feature. The well pair BM MW4S and BM MW4D is also down to side gradient, respectively, of an onsite anhydrite disposal area and their data do not reveal any impacts.

6.4 St. James Terminal

The Chicot Aquifer is the principal regional aquifer at St. James. The upper strata of the Chicot Aquifer are in direct hydrologic contact with the Mississippi River. Much of the ground water contained in this aquifer is slightly brackish. In the St. James area only the uppermost units contain fresh water.

6.5 West Hackberry

The Chicot Aquifer, which occurs closest to the surface in the Hackberry area, contains predominantly fresh water with salinity increasing with depth and with proximity to the Gulf of Mexico. Much of the ground water pumping from the Chicot Aquifer takes place in the Lake Charles area. Pumping is so great that a cone of depression has been created which has reversed the regional southerly flow direction towards the north near the coast below Lake Charles. The fresh/saline water interface is approximately 213 m (700 ft) bls off the sides of the West Hackberry dome and more shallow directly over the diapir where our site is situated. Possibly a result of the piercement by the diapir, laterally limited permeable water bearing soil found affected and monitored at the West Hackberry site is much nearer the ground surface, with a shallow sandy zone at roughly 6 m (20 ft) bls and a deeper more silt containing sand zone at roughly 15 m (50 ft) bls. Details provided by the VWS in 1996 indicate that the two zones contrast sharply in permeability, and as a result, their estimated linear velocity measurements are quite different. The range of linear velocity estimated for the shallow zone is from 50 to 200 feet of movement per year, which results from both a wide permeability range and varying gradients across the site. The deep zone exhibits a generalized velocity estimated to be only 7.5 feet per year (ft/yr), which is largely due to the more silty and clayey nature of the sands combined with the low ambient hydraulic gradients evident within the site's limited well net.

Situated directly atop the salt dome and given the long industrialized history of the site and the immediate area, a 10 ppt cut-off for salinity is used in comparisons for determining affected and

unaffected waters as historical ambient conditions have been found highly variable across the site.

The 1991 Contamination Assessment Report and Remedial Alternatives Analysis identified the former brine pond as a source of ground water contamination. The decommissioned brine pond was one of five adjoining ponds comprising a pond system and solids management system that handled brine and anhydrite solids pumped from the construction of storage caverns. Brine pond construction activity implemented per the state approved brine pond-decommissioning plan was concluded in November 1999.

Eleven monitoring wells and 15 former recovery wells (Figure C-11) have been installed on the WH site in five phases. All were historically used to either monitor or control brine contamination movement beneath the brine pond system. Salinity data gathered over the past five years at all wells is depicted in Figure C-14. Four of the seven wells originally installed for VWS were retained for additional water level measurement around the periphery of the main site, bringing the site total up to 30; in the late fall 2006 three wells which were not part of any outside monitoring agreement (WH RW1S, WH RW1D, and WH RW2D), were plugged and abandoned due to cap maintenance construction activity for a closed anhydrite pond, bringing the final site total wells down to 27. Salinity data are depicted in the five-year trending graphs for all of these wells, which are available in Appendix C; however, certain wells are tested for salinity only once per year per the 2002 site-wide monitoring proposal approved by LDNR in early 2004.

WH personnel began using the low flow technique for sampling all non-pumping wells in December 1995 and for all wells after recovery pumping ended in April 2001. Water level measurements from both zones for the fall quarter of 2016 have been reduced to elevations, contoured, and are presented as Figures C-12 and C-13, Shallow Zone and Deep Zone, respectively. The contour map of the water levels in the underlying deep zone reveals a rather flat surface for the semi-confined water bearing zone. The pressure gradient (potentiometric surface) is flat (low) across the site and continues to promote only very slow travel times and indecisive travel paths beneath the WH site on this portion of the dome. The general appearance is that of a confined to semi-confined water bearing zone, receiving some recharge potential (mounding) somewhere near wells WH P1D, WH P2D, and especially WH P4D, and with a potentiometric “sink” suggested with the same measurements within the limited area bounded by the wells WH RW3D, WH RW4D, and WH MW1D.

Over the years the slug of shallow zone saltwater seepage from the former brine pond, being removed from any source, has changed its shape, is growing smaller, and drifts slowly towards the east and while elongating northerly. Of note, again this year, all the plume affected wells in the shallow monitoring zone: WH P3S, WH P4S, and WH P12S, all reveal downward (freshening) 5-year trending. The implication is that fresher recharge is continuing to aid with the diffusion and dispersal of the saltwater slug. The center of the slug is now found atop the wells WH P3S and WH P4S, with 2016 average annual salinity values of 29.75 ppt and 24.25 ppt, respectively. The shape of the slug is oriented essentially N-S, which has been greatly influenced by the salinity reduction to BDL at the WH RW2S well location, and then also by the continuing freshening conditions occurring at well WH P3S and WH P4S. This is a slow

attenuation process primarily driven by dilution and diffusion. The regional drought has also had a past influence, especially with the shallow zone as a return to more normal rainfall patterns and amounts promotes local recharge which is helpful. Both of these affected wells reveal trending traces that confirm long-term continued freshening and stability (moderation of swings and spikes) that are reflective of gradual dispersion and diffusion occurring with the saltwater contained in the stratified layering. The gradual dispersion is being aided by the slow groundwater movement and localized recharge influences. The small slug of affected waters is in transition to a more mature stage of natural attenuation.

After sporadic spikes of elevated salinity were initially experienced with pond closure construction early in 1999, a general decreasing salinity trend developed at wells: WH P1S, WH P5S, and WH RW1S, along the west side of the former brine pond. Former pumping wells WH P1S and WH P5S both began exhibiting salinity below the 10 ppt cut-off within 2002, with nearby well WH RW1S joining them in that range for 2004 and remaining so through 2005 until it was plugged and abandoned in November 2006 as part of the closed south anhydrite pond cap maintenance project. Well WH P13S remains aligned with this group by maintaining a series of five-year traces of BDL values and with an even longer history of values below 10 ppt. Well WH RW2S has also joined the BDL group, presumably reflecting a long-term favorable response to the same 2006 cap maintenance activity.

Many shallow zone wells exhibited an obvious salinity drop upon cessation of active recovery, indicative of fresher recharge and wells no longer pulling salty water through the formation to their screens. Relatively few (most notably hard pumped well WH P3S) responded with an abrupt salinity spike at shut-in. These wells were formerly pulling a fresher water mix across their screened length when actively pumping. This improving salinity response will undoubtedly be delayed to the wells on the east and situated directly in the core of the slug as the overlying salt impregnated soils slowly respond to the now diminished percolation and to the slow post-closure recharge.

Ground water salinity conditions over the site continue to improve and have settled into long-term gradual freshening trends which commenced post-recovery The graphs now reveal a more “quiet” shallow zone monitoring response which began occurring shortly after the pond system was shut-in in early 1999 for pond closure construction and then resumed when the recovery pumping was officially ended in the spring of 2001. Shallow monitoring wells WH P8, WH P9, and WH P11 at caverns 8, 9, and 11, respectively, are located away from the former brine pond and intercept unaffected waters that are near ambient levels, comparable to up-gradient well WH P6S. Two of these wells (WH P8 and WH P11) have detected minor localized but historic impacts from former firewater line leakage and have since returned to ambient unaffected levels over the present five-year history. These two wells are tested only annually now for salt content per the approved monitoring plan.

Shallow zone monitoring wells WH P6S, WH P12S, and WH P13S, and deep zone monitoring wells WH P2D, WH P6D, WH P12D, WH P13D, and WH MW1D are nearer the former brine pond than wells at the caverns and at the site’s perimeter and apart fromwell WH P12S, intercept ambient unaffected ground water. Well WH P12S is the only down gradient long-term [non-recovery] monitoring well that is affected by the shallow zone brine plume extending eastward

from the former brine pond. Its salinity remains elevated (11.45 ppt annual average based on the 4 measurements in 2016) which is generally consistent since sampling began in 1992 (range 8.8 to 39 ppt, Std. D = 7.31 ppt, avg. = 23.92 ppt, n = 97). The overall trend since 1992 to present is slightly downward with a general short-term trace from 2002 to 2006 revealing a gradual rise just for that period. This year we see the salinity continuing to freshen and find that the 2016 annual average of 11.45 ppt also continues below the historic average of 23.92 ppt. This freshening regime occurring so distant from the source and at the leading edge of the recognized brine plume (some 300 feet) coupled with the corresponding freshening of well WH P3S may be indicative of gradual long-term dissipation and dispersal effects on the historic saltwater slug. This shallow zone well seems to be situated at the very edge of the diffusion "halo" and, which now, with no pumping-derived gradient, is undergoing natural attenuation from dispersion and diffusion. The positive changes with the shallow plume are now becoming easily recognizable in conjunction with the remainder of the site as a whole.

Well WH P12D, is the deep well complement to WH P12S, and has a long history of measurements below the 10 ppt cut-off. The early history of the well's traces included a long period of values below BDL (1 ppt); then a fairly rapid rise occurring in the years 2003 to 2004, presumably a lag-time response to the pond closure construction, was observed to peak around 7 ppt. The salinity then abruptly freshened throughout 2004 and has since presented a slow but steady rising salinity; from around 3 ppt to the present annual average for 2016 of 9.1 ppt. The climbing trend remains constant enough to warrant more closely watching the measurements and to also trying to deduce a reasonable explanation for the temporal influences at play. The impacted area for the deep zone wells is a smaller and more limited area found south of the former brine pond and more westerly near well WH P4D, some 300 feet away. The head difference (8.6 feet this year) confirms significant separation between the two zones here and the difference remains persistently in a downward direction. The current and historic salinity levels in the overlying shallow zone cannot be ruled out as a potential source for the deep well's long-term trending. However, as such, the long-term freshening observed with the shallower WH P12S well could also potentially predict an eventual moderation of the current deep well response.

As defined in the final state approved closure plan, the synthetic liner once held in-place beneath the concrete weight-coat of the former brine pond was required to be pierced to preclude any future concerns with long-term hydraulics (forming a barrier) and as a result, the salt-affected soils beneath the liner shall continue to respond naturally to rainfall conditions and weather events.

7 Quality Assurance

The SPR sites undergo periodic evaluation throughout the year in the form of annual internal audits as well as inspections by outside federal and state agencies. The structured laboratory quality assurance program has continued through the systematic application of acceptable accuracy and precision criteria at SPR laboratories. Compliance with this and other environmental program requirements was reviewed and evaluated at each site by means of the M&O contractor's Organizational Assessments and program inspections at selected sites by state and federal environmental agencies. Results from the environmental program assessments are addressed in Section 2 of this report.

7.1 Field Quality Control

All field environmental monitoring and surveillance activities are performed in accordance with standard procedures, which are maintained in the M&O contractor Laboratory Programs and Procedures Manual, the EMP, and in individual sampling and analytical work instructions. These procedures include maintenance of chain-of-custody, collection of quality control (QC) samples, and field documentation.

7.2 Data Management

SPR and contractor laboratories generate SPR data. All data generated by SPR laboratories are recorded and maintained in bound, numbered, and signed laboratory notebooks. Contractor laboratory data and accompanying QC data are received by the site laboratory or environmental department and retained on site as part of the original data file.

Water quality data are added to the SPR ES&H Data Management System for retention, manipulation, and interpretation. The data are compiled and appear in various reports such as this SER, in support of assessments of the SPR, evaluations of explained events, and development of appropriate responses.

7.3 Laboratory Accuracy and Precision Program

The SPR laboratory quality assurance program is based on the U.S. EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories. This program focuses on the use of solvent or standard and method blanks, check standards, and for instrumental methods, final calibration blanks and final calibration verification standards with each analytical batch to verify quality control. Additionally, replicate and spiked samples are analyzed at a 10 percent frequency to determine precision and accuracy, respectively.

Analytical methodology is based on the procedures listed in Table 7-1. Sufficient quality assurance analyses were performed in 2016 to verify the continuing high quality of SPR laboratory data.

7.4 Control of Subcontractor Laboratory Quality

The M&O Contractor subcontracts some of the required analytical work. The Laboratories Programs and Procedures Manual contains mandatory guidelines by which such contracts must be prepared. In addition, the respective laboratory staff and M&O Contractor Quality Assurance, Operations and Maintenance, and Environmental staff review laboratory procurement documents.

Only subcontractor laboratory service vendors that are state accredited under the National Environmental Laboratory Accreditation Program (NELAP) are approved for use on the SPR.

Table 7-1 SPR Wastewater Analytical Methodology

Parameter	Method	Source*	Description
Biochemical Oxygen Demand	5210(B) 405.1	APHA EPA-1	5 Day, 20 ºC 5 Day, 20 ºC
Chemical Oxygen Demand	D1252-88(B) 410.4 5220(D)	ASTM EPA-1 APHA	Micro Spectrophotometric Proc. Colorimetric, Manual Closed Reflux, Colorimetric
Fecal Coliform	Part III-C-2 9222(D)	EPA-2 APHA	Direct Membrane Filter Method Membrane Filter Procedure
Residual Chlorine	4500-C1(G) 330.5 8021	APHA EPA-1 Hach	DPD Colorimetric Spectrophotometric, DPD DPD Method
Oil & Grease (Total, Recoverable)	413.1	EPA-1	Gravimetric, Separatory Funnel Extraction
Oil & Grease (Partition, Gravimetric)	5520-(B)	APHA	Gravimetric, Separatory Funnel Extraction
Total Organic Carbon	415.1 D4839-88 5310(C) D2579(A) 5310(B)	EPA-1 ASTM APHA ASTM APHA	Combustion or Oxidation Persulfate – UV Oxidation, IR Persulfate – UV Oxidation, IR Combustion – IR Combustion - IR
Dissolved Oxygen	D888-87(D) 360.1 360.2 4500-O(C) 4500-O(G)	ASTM EPA-1 EPA-1 APHA APHA	Membrane Electrode Membrane Electrode Winkler Method with Azide Mod. Winkler Method with Azide Mod. Membrane Electrode
Hydrogen Ion conc. (pH)	D1293-84(A&B) 150.1 4500-H^+(B)	ASTM EPA-1 APHA	Electrometric Electrometric Electrometric
Total Dissolved Solids	160.1 2540(C)	EPA-1 APHA	Gravimetric, Dried at 180ºC Gravimetric, Dried at 180ºC

Table 7-1 SPR Wastewater Analytical Methodology			
Parameter	**Method**	**Source***	**Description**
(Residual, Filterable)			
Total Suspended Solids (Residual, Non-Filterable)	160.2 2540(D)	EPA-1 APHA	Gravimetric, Dried at 103-105ºC Gravimetric, Dried at 103-105ºC
Salinity	D4542-85 (Sect. 7) 2520(B) & 2510 210B	ASTM APHA APHA (16th Ed.)	Refractometric Electrical Conductivity Hydrometric
Biomonitoring	1006.0 1007.0	EPA-3 EPA-3	*Menidia beryllina* 7 day survival *Mysidopsis bahia* 7 day survival

EPA-1 = U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes, Document No. EPA - 600/4-79-020.

APHA = American Public Health Association, et al., Standard Methods for the Examination of Water and Wastewater.

EPA-2 = U.S. EPA, Microbiological Methods for Monitoring the Environment: Water and Wastes, Document No. EPA-600/8-78-017.

ASTM = American Society for Testing and Materials, Annual Book of Standards, Section 11 - Water, Volumes 11.01 and 11.02.

Hach = Hach Company, Hach Water Analysis Handbook.

EPA-3 = U.S. EPA, Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Document No. EPA/600/4-87/028.

Appendix A1 Environmental Standards List

DESCRIPTION	STANDARD
National Environmental Policy Act Implementing Procedures	10 CFR 1021
Compliance with Flood Plain/Wetlands Environmental Review	10 CFR 1022
Occupational Radiation Protection - Applicable and Enforceable Portions	10 CFR 835
Storage, treatment, and disposal of nondefense toxic and hazardous materials	10 USC 2692
Boiler And Pressure Vessels - Degas Project Only	120 IAC
(Aviation) Operating Requirements: Domestic, Flag, and Supplemental Operations	14 CFR 121
(Aviation) Certifications and Operations	14 CFR 125
(Aviation) Certification and Operations of Scheduled Air Carriers with Helicopters	14 CFR 127
(Aviation) Rotorcraft External Load Operations	14 CFR 133
(Aviation) Operating Requirements: Commuter and On-Demand Operations	14 CFR 135
(Aviation) Agricultural Aircraft Operations	14 CFR 137
(Aviation) Certification and Operation: Land Airport Serving Certain Air Carriers	14 CFR 139
(Aviation) Repair Stations	14 CFR 145
(Aviation) Objects Affecting Navigable Airspace	14 CFR 77
(Aviation) Notification And Reporting - Accidents and Incidents	14 CFR 830
(Aviation) General Operating and Flight Rules	14 CFR 91
Oil and Gas Division	16 TAC 1.3
Environmental Recycling	16 TAC 1.4
Fish and Wildlife Coordination Act	16 U.S.C. §§ 661-666c
Bald and Golden Eagle Protection Acts	16 U.S.C. §§ 668-668d
Migratory Bird Treaty Act	16 U.S.C. §§ 703-711
Endangered Species Act	16 USC Parts 1531-1544
Radiation Control	25 TAC 1.289
Commerce In Explosives (ATF)	27 CFR 55
Imminent Danger	29 CFR 1903.13
Posting of Notice: Availability of the Act, Regulations, and Applicable Standards	29 CFR 1903.2
Recordkeeping and Reporting Occupational Injuries and Illnesses	29 CFR 1904
General (1 through 8)	29 CFR 1910 SUBPART A
Adoption and Extension of Established Federal Standards (11 through 19)	29 CFR 1910 SUBPART B
Walking-Working Surfaces (21 through 30)	29 CFR 1910 SUBPART D
Means of Egress (35 through 38)	29 CFR 1910 SUBPART E
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Control of Air Pollution from Sulfur Compounds	30 TAC 1.112
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DELETED Control of Air Pollution from Motor Vehicles	30 TAC 1.114 DELETED
Control of Air Pollution from Volatile Organic Compounds	30 TAC 1.115
Control of Air Pollution by Permits for New Construction or Modification	30 TAC 1.116
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DELETED Federal Operating Permits Program	30 TAC 1.122 DELETED
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DELETED Chemical Accident Prevention and Minimization of Consequences	33 LAC III.59 DELETED
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Asbestos	40 CFR 763
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Underground Injection Control Program: Criteria and Standards	40 CFR 146
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Section 404 (b) (1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	40 CFR 230
Guidelines for Storage and Collection of Residential, Commercial, and Institutional Solid Wastes	40 CFR 243
Comprehensive Procurement Guideline for Products Containing Recovered Materials	40 CFR 247
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Standards for Owners and Operators of Hazardous Waste, Treatment, Storage, and Disposal Facilities	40 CFR 264
Standards for Management of Specific Hazardous Wastes	40 CFR 266
Land Disposal Restrictions	40 CFR 268
Requirements for Authorization of State Hazardous Waste Programs	40 CFR 271
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Standard for Universal Waste Management	40 CFR 273
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Technical Standards and Corrective Action Requirements for Owners and Operators of UST	40 CFR 280
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National Oil and Hazardous Substances Pollution Contingency Plans	40 CFR 300

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General Pretreatment Regulations for Existing and New Sources of Pollution	40 CFR 403
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Determination of Emissions from Volatile Compounds Leaks	40 CFR 60, Appendix A, Method 21
DELETED National Emission Standards for Hazardous Air Pollutants	40 CFR 61 DELETED
DELETED National Emission Standards for Hazardous Air Pollutant for Source Categories	40 CFR 63 DELETED
Assessment and Collection of Noncompliance Penalties	40 CFR 66
State Operating Permit Programs	40 CFR 70
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PCB Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions	40 CFR 761
Regulations of Fuels and Fuel Additives	40 CFR 80
EPA Regulations Designating Areas for Air Quality Planning	40 CFR 81
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Confiscation and disposal of explosives	40 LA RS 1472.11
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License; manufacturer-distributor, dealer, user, or blaster of explosives	40 LA RS 1472.3
Possession without license prohibited; exceptions (Explosives)	40 LA RS 1472.4
Reports of losses or thefts; illegal use or illegal possession (Explosives)	40 LA RS 1472.7
Energy Policy Act of 2005	42 USC 15801
Energy Conservation Reauthorization 1998	42 USC 6201 et seq.
Energy Policy and Conservation Act 1975 and 1994	42 USC 6291-6309
RCRA and Affirmative Procurement	42 USC 6962
National Environmental Policy	42 USC Chapter 55
Air Pollution Prevention and Control	42 USC Chapter 85
National Energy Policy Act of 1992	42 USC Chapter 91
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Oil Spill Prevention and Response Plans	49 CFR 130
General Information, Regulations, and Definitions	49 CFR 171
Hazardous Material Tables, Hazardous Materials Communications Requirements and Emergency Response Information Requirements	49 CFR 172
Shippers - General Requirements for Shipments and Packaging	49 CFR 173
Carriage by Public Highway	49 CFR 177
DOT Response Plans for Onshore Pipelines	49 CFR 194
Transportation of Hazardous Liquids by Pipeline	49 CFR 195
Drug and Alcohol Testing	49 CFR 199
Commercial Driver's License Standards; Requirements and Penalties	49 CFR 383
Endangered and Threatened Wildlife and Plants and Migratory Bird Permits	50 CFR 10, 13, 17, 21, 22
General Provisions	50 CFR 450
Disposal of Birds or Quadrupeds Becoming a Nuisance	56 LA RS 112
US Department of Agriculture Federal Biobased Products Preferred Procurement Program	7 CFR 3201-3202
Pesticide	7 LAC XXIII
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	7 USC 136
Farm Security and Rural Investment Act (FSRIA) of 2002, Section 9002	7 USC 8102
Control of Nuisance Wild Quadrupeds	76 LAC V.1.25
Nuisance Wildlife Control Operator Program	76 LAC V.1.27
Stennis Warehouse Spill Prevention, Control, and Countermeasures Plan	AAA 4010.10
Property Management Manual	AAA 7003.7
Threshold Limit Values For Chemical Substances - Current Year & Applicable Substances	ACGIH TLV
Area Contingency Plan for Lake Charles	ACP USCG
Area Contingency Plan for Port Arthur	ACP USCG
Area Contingency Plan for New Orleans	ACP USCG
Area Contingency Plan for Galveston	ACP USCG
Area Contingency Plan for EPA Region 6	ACP-EPA
Hazardous Materials Management Education Program Observations and Recommendations: Environmental Mgmt, Hazardous Waste Minimization, and Pollution Prevention for the SPR Operations	AIHMM

DESCRIPTION	STANDARD
OBSOLETE- July 2014 Drill and Exercise Program Plan	AL 5500.11-OBSOLETE
Standard Methods for the Examination of Water and Wastewater	American Public Health Assoc.
OSHA Referenced Standards	ANSI Standards
Environmental Management Systems Specification With Guidance For Use	ANSI/ISO 14001:2004
Compilation of Air Pollutant Emission Factors	AP-42
Permit Regulations for the Construction and/or Operation of Air Emissions Equipment (Mississippi)	APC-S-2
Amer. Petroleum Institute - Recommended Practices and Guides	API
API Standard 653 for Tank Inspection, Repair, Alteration, and Reconstruction	API - Standard
Environmental Effects of Army Actions	AR 200-2
OBSOLETE - July 2014 Conduct of Training for the SPR M&O Contractor	ASI 3400.1 - OBSOLETE
Integrated Logistics Support Procedures	ASI 4000.10
SPR Plant Maintenance System	ASI 4330.16
Environmental Instructions Manual	ASI 5400.15
Conduct of Operations at the SPR	ASI 5480.19
Accident Prevention Manual	ASI 5480.22
Quality Assurance Instructions	ASI 5700.15
Design Review Procedure	ASI 6430.15
Configuration Management	ASL 4700.1
SPR Environmental Monitoring Plan	ASL 5400.57
Fire Protection Manual	ASL 5480.18
Emergency Readiness Assurance Plan	ASL 5500.10
Emergency Response Team Organization and Training Plan	ASL 5500.25
Emergency Management Plan and Implementing Procedures	ASL 5500.58
Drawdown Management Plan	ASL 6400.18
Cavern Inventory & Integrity Control Plan	ASL 6400.30
Drawdown Readiness Program Plan	ASL 7000.397
OSHA Referenced Standards	ASME Standards
Environmental Policy	ASP 5400.2
DELETED - July 2014 SPR Crosstalk Information Exchange Program	ASR 7000.2 - DELETED
Readiness Review Board	ASR 7000.7
Membership in BRAMA	BC BRAMA
Membership in Greater Baton Rouge Industry Alliance	BC Greater BR Industry Alliance
Membership in Iberville CAER	BC Iberville CAER
Membership in the Iberville LEPC	BC Iberville LEPC
Membership in West Baton Rouge LEPC	BC West Baton Rouge LEPC
Bayou Choctaw Emergency Response Procedures	BCI 5500.3
Bayou Choctaw Spill Prevention, Control, and Countermeasures Plan	BCL 5400.16

DESCRIPTION	STANDARD
Safety Agreement with NEWPARK	BH & NEWPARK
Membership in the LEPC	BH LEPC
Membership in the Local Law Enforcement Agency for BH	BH LLEA
Membership in Sabine-Neches Chiefs Mutual Aid	BH Sabine-Neches Chiefs Mutual Aid
Big Hill Emergency Response Procedures	BHI 5500.4
Big Hill Spill Prevention, Control, and Countermeasures Plan	BHL 5400.21
Membership in the BMAT for BM	BM BMAT
Membership in the Brazosport CAER	BM CAER
Membership in the LEPC	BM LEPC
Membership in the Local Law Enforcement Agency at BM	BM LLEA
Agreement between BM and VDD on restrictions to working on Hurricane Levees near BM	BM VDD
Bryan Mound Emergency Response Procedures	BMI 5500.5
Bryan Mound Spill Prevention, Control, and Countermeasures Plan	BML 5400.17
Seminar on Site Characterization for Subsurface Remediations	CERI-89-224
Fire Prevention and Protection; Emergency Services and Communication; and Hazardous Materials	Chapter 13 Jefferson Parish Code of Ordinances
County Regulation of Matters Relating to Explosives and Weapons Subchapter A. Explosives	Chapter 235 TX Statutes, Local Government, Title 7
Operation and Movement of Vehicles (Explosives)	Chapter 545 TX Statutes, Transportation, Title 7
Vehicle Equipment (Explosives)	Chapter 547 TX Statutes, Transportation, Title 7
Hoisting And Rigging Handbook	DOE HDBK, 1090-9
DOE Waste Minimization reporting Requirements, Nov. 1994	DOE Guideline
Waste Minimization Reporting System (Wmin) User's Guide	DOE Handbook
Pollution Prevention Handbook	DOE Handbook
Guidance for the Preparation of the Waste Minimization and Pollution Prevention Awareness Plan, Dec 1993	DOE Handbook
EPA's Interim Final Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program	DOE Memorandum
For all applicable DOE Orders See Contract No. DE-FE0011020 Applicable Standards List	DOE Orders
Pollution Prevention Program Plan	DOE S-0118
Paint Repair of Exterior Metal Surfaces	DOE Standard Spec. 17900
Management of Polychlorinated Biphenyls (PCBs)	DOE/EH-0350
Performance Objectives and Criteria for Conducting DOE Environmental Audits	DOE/EH-0358
Annual report on Waste Generation and Waste Minimization Progress	DOE/EM-0276
Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems	DOE/EP-0108
Waste Minimization/Pollution Prevention Crosscut Plan 1994	DOE/FM-0145
Fire Protection	DOE-STD-1066-2012
Fire Protection for Relocatable Structures	DOE-STD-1088-95

DESCRIPTION	STANDARD
All SPR Environmental Permits as listed in the Annual Site Environmental Report (SER)	Environmental Permits
Protection and Enhancement of Environmental Quality	EO 11514
Floodplain Management	EO 11988
Protection of Wetlands	EO 11990
Federal Compliance with Pollution Control Requirements	EO 12088
Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations	EO 12898
Marine Protected Area	EO 13158
Responsibilities of Federal Agencies to Protect Migratory Birds	EO 13186
Energy Efficient Standby Power Devices	EO 13221
Preserve America	EO 13287
REVOKED Strengthening Federal Environmental, Energy, and Transportation Management	EO 13423 REVOKED
REVOKED Federal Leadership in Environmental, Energy, and Economic Performance	EO 13514 REVOKED
Planning for Sustainability in the Next Decade	EO 13693
Protocol for Equipment Leak Emission Estimates, Jun 1993	EPA 453/R-93-026
Practical Guide for Groundwater Sampling	EPA 600/2-85/105
Handbook for Analytical Quality Control in Water and Wastewater Laboratories	EPA 600/4-79-019
Methods for Chemical Analysis of Water and Wastes	EPA 600/4-79-020
Handbook for Sampling and Sample Preservation of Water and Wastewater	EPA 600/4-82-029
Addendum to Handbook for Sampling and Sample Preservation, EPA 600/4-82-029	EPA 600/4-83-039
Microbiological Methods for Monitoring the Environment, Water and Wastes	EPA 600/8-78-017
Facility Pollution Prevention Guide	EPA 600/R-92/088
Short Term Methods for Measuring Acute Toxicity of Effluents to Aquatic Organisms	EPA 821-R-02-014
Water Measurement Manual	EPA 832B81102
Storm Water Management for Industrial Activities	EPA 833-R-92-002
Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, 4/1/86	EPA Region IV
Current National Water Quality Criteria	EPA Web Site
EPA Waste Minimization Opportunity Assessment Manual	EPA,ISBN:0-86587-752-1
Specification for 8’ and 12’ Unlighted and Externally Lighted Wind Cone Assembly	FAA AC 150/5345-27
Heliport Design, January 4, 1988	FAA AC 150/5390-2
Obstruction Marking and Lighting, October 1985	FAA AC 70/7460-1G
For all applicable FAR and DEAR Clauses see Contract DE-FE0011020, Applicable Clauses List	FAR and DEAR Clauses
Factory Mutual - Approval Guide and Loss Prevention Data Sheets	FM
Hazardous Waste Management Regulations (Mississippi)	HW-1
Oil Cos. International. Marine Forum - International Oil Tanker & Terminal Safety Guide	ICIMF
OSHA Referenced Standards	IEEE Standards

DESCRIPTION	STANDARD
OBSOLETE: STRATEGIC PETROLEUM RESERVE MANAGEMENT AND OPERATING AND CONSTUCTION MANAGEMENT SERVICES CONTRACTORS- ENVIRONMENTAL	IWA: DOE-DM-AGSC OBSOLETE
OBSOLETE: STRATEGIC PETROLEUM RESERVE MANAGEMENT AND OPERATING AND CONSTUCTION MANAGEMENT SERVICES CONTRACTORS- SAFETY AND HEALTH	IWA: DOE-DM-AGSC OBSOLETE
Pollution Prevention Assessment Manual for Texas Businesses	LP 92-03
Surface Water and Ground Water Use and Protection (Mississippi)	LW-2
Regarding Implementation of the Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds"	MOU- USFWS
MOU with ATFE for Louisiana Sites during Emergencies	MOU with ATFE in LA
MOU with ATFE for the Texas Sites during Emergencies	MOU with ATFE TX
MOU with the BCSO for BM during Emergencies	MOU with BCSO
MOU with Cameron Parish Sheriff's Office for WH during Emergencies	MOU with CamPSO
MOU with Calcasieu Parish Sheriff's Office for WH during Emergencies	MOU with CPSO
MOU with Entergy	MOU with Entergy
MOU with the FBI for Louisiana Sites during Emergencies	MOU with FBI in LA
MOU with the FBI for the Texas Sites during Emergencies	MOU with FBI TX
MOU with Ft. Polk for Louisiana Sites during Emergencies	MOU with Ft. Polk
MOU with JCSO for BH during Emergencies	MOU with JCSO
MOU with LA Homeland Security for Louisiana Sites during Emergencies	MOU with LA Homeland Security
MOU with LA State Police for Louisiana Sites during Emergencies	MOU with LA State Police
MOU with US Army 797th Explosive Ordinance Co. for the Texas Sites during Emergencies	MOU with US Army 797 EOC
SPR Gas and Geothermal Heat Effects on Crude Oil Vapor Pressure, Dec. 1994	MP 94W0000131
Power to capture or destroy animals injurious to property	MSC Section 49-1-39
Nuisance Wildlife	MSC Section 49-7-1
Laboratory Programs & Procedures	MSL 7000.133
National Association of Corrosion Engineers	NACE
National Electric Safety Code	NEC
Fire Protection Handbook	NFPA
Fire Code	NFPA 1
Standard for Portable Fire Extinguishers	NFPA 10
Standard for Fire Service Professional Qualifications Accreditation and Certification Systems	NFPA 1000
Life Safety Code®	NFPA 101
Guide on Alternative Approaches to Life Safety	NFPA 101A
Standard for Fire Officer Professional Qualifications	NFPA 1021
Standard for Professional Qualifications for Fire Inspector and Plan Examiner	NFPA 1031
Standard for Professional Qualifications for Fire Investigator	NFPA 1033
Standard for Fire Service Instructor Professional Qualifications	NFPA 1041
Standard for the Installation of Smoke Door Assemblies and other Opening Protectives	NFPA 105

DESCRIPTION	STANDARD
Standard for Industrial Fire Brigade Member Professional Qualifications	NFPA 1081
Standard for Low-, Medium-, and High-Expansion Foam	NFPA 11
Standard for Emergency and Standby Power Systems	NFPA 110
Standard on Stored Electrical Energy Emergency and Standby Power Systems	NFPA 111
Standard for the Installation of Sprinkler Systems	NFPA 13
Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems	NFPA 13E
Standard for the Installation of Standpipe and Hose Systems	NFPA 14
Recommended Practice for Fire Service Training Reports and Records	NFPA 1401
Standard for Fire Service Respiratory Protection Training	NFPA 1404
Standard on Training for Initial Emergency Scene Operations	NFPA 1410
Standard for Water Spray Fixed Systems for Fire Protection	NFPA 15
Standard on Fire Department Occupational Safety and Health Program	NFPA 1500
Standard on Emergency Services Incident Management System and Command Safety	NFPA 1561
Standard on Fire Department Infection Control Program	NFPA 1581
Standard on Comprehensive Occupational Medical Program for Fire Departments	NFPA 1582
Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems	NFPA 16
Standard on Disaster/Emergency Management and Business Continuity Programs	NFPA 1600
Standard for Dry Chemical Extinguishing Systems	NFPA 17
Standard for Fire Safety Symbols and Emergency Symbols	NFPA 170
Standard for Automotive Fire Apparatus	NFPA 1901
Standard for the Inspection, Maintenance, Testing & retirement of in Service Automotive Fire Apparatus	NFPA 1911
Standard on Fire Hose	NFPA 1961
Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances	NFPA 1962
Standard for Fire Hose Connections	NFPA 1963
Standard for Spray Nozzles	NFPA 1964
Standard for Fire Hose Appliances	NFPA 1965
Standard on Protective Ensemble For Structural Fire Fighting and Proximity Fire Fighting	NFPA 1971
Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Fire and Emergency Services	NFPA 1981
Standard on Personal Alert Safety Systems (PASS)	NFPA 1982
Standard on Fire Service Life Safety Rope and Equipment for Emergency Service	NFPA 1983
Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies	NFPA 1991
Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies	NFPA 1992
Standard on Protective Clothing for Emergency Medical Operations	NFPA 1999
Standard for the Installation of Stationary Pumps for Fire Protection	NFPA 20
Standard on Clean Agent Fire Extinguishing Systems	NFPA 2001
Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire	NFPA 2012
Standard for Smoke and Heat Venting	NFPA 204

DESCRIPTION	STANDARD
Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire	NFPA 2113
Standard for Water Tanks for Private Fire Protection	NFPA 22
Standard on Types of Building Construction	NFPA 220
Standard for High Challenge Fire Walls, Fire Walls, & Fire Barrier Walls	NFPA 221
Standard for the Protection of Records	NFPA 232
Standard for the Installation of Private Fire Service Mains and Their Appurtenances	NFPA 24
Standard for Safeguarding Construction, Alteration, and Demolition Operations	NFPA 241
Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems	NFPA 25
Standard Methods of Tests of Fire Resistance of Building Construction and Materials	NFPA 251
Standard Methods of Fire Tests of Door Assemblies	NFPA 252
Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	NFPA 253
Standard Method of Test of Surface Burning Characteristics of Building Materials	NFPA 255
Recommended Practice for Fire Flow Testing and Marking of Hydrants	NFPA 291
Flammable and Combustible Liquids Code	NFPA 30
Fire Protection Standard for Pleasure and Commercial Motor Craft	NFPA 302
Standard for the Control of Gas Hazards on Vessels	NFPA 306
Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves	NFPA 307
Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair	NFPA 326
Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases	NFPA 329
Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines	NFPA 37
Standard for Tank Vehicles for Flammable and Combustible Liquids	NFPA 385
Standard for Heliports	NFPA 418
DELETED Code for the Storage of Liquid and Solid Oxidizers	NFPA 430 DELETED
Standard on Fire Protection for Laboratories Using Chemicals	NFPA 45
Standard for Professional Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents	NFPA 472
Standard for Competencies for EMS Personnel Responding to Hazardous Materials/WMD Incidents	NFPA 473
Explosive Materials Code	NFPA 495
Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas	NFPA 497
Building Construction and Safety Code	NFPA 5000
Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation	NFPA 505
Standard for Fire Prevention During Welding, Cutting, and Other Hot Work	NFPA 51B
ANSI Z223.1-2012 National Fuel Gas Code	NFPA 54
Compressed Gases and Cryogenic Fluids Code	NFPA 55
Guide to the Fire Safety Concepts Tree	NFPA 550

DESCRIPTION	STANDARD
Liquefied Petroleum Gas Code	NFPA 58
Standard on Industrial Fire Brigades	NFPA 600
Standard for Security Services in Fire Loss Prevention	NFPA 601
National Electrical Code	NFPA 70
Standard for Fire Retardant Treated Wood and Fire Retardant Coatings for Building Materials	NFPA 703
Standard System for the Identification of the Hazards of Materials for Emergency Response	NFPA 704
Recommended Practice for Electrical Equipment Maintenance	NFPA 70B
Standard for Electrical Safety in the Workplace	NFPA 70E
National Fire Alarm and Signaling Code	NFPA 72
Standard for the Protection of Information Technology Equipment	NFPA 75
Standard on Water Mist Fire Protection Systems	NFPA 750
Recommended Practice on Static Electricity	NFPA 77
Standard for the Installation of Lightning Protection Systems	NFPA 780
Electrical Standard for Industrial Machinery	NFPA 79
Standard for Fire Doors and other Opening Protectives	NFPA 80
Recommended Practice for Protection of Buildings from Exterior Fire Exposures	NFPA 80A
Standard for Fire Protection in Wastewater Treatment and Collection Facilities	NFPA 820
Standard Classifications for Incident Reporting and Fire Protection Data	NFPA 901
Standard for the Installation of Air-Conditioning and Ventilating Systems	NFPA 90A
Standard for the Installation of Warm Air Heating and Air-Conditioning Systems	NFPA 90B
Guide for Fire and Explosion Investigations	NFPA 921
Standard for Smoke-Control Systems Utilizing Barriers & Pressure Differences	NFPA 92A
SPR Qualified Products List	No number
Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook (LDOTD and LDEQ)	No number
FFPO and DOE Standard Environmental Contract Boilerplate	No Number
SPRPMO Level III Design Criteria	No number
Earth Manual, 3rd Ed., U.S. Department of the Interior, Bureau of Reclamation	No number
Louisiana's Suggested Chemical Weed Control Guide for 1994 (LA Cooperative Extension Services)	No number
The Sterling Brine Handbook (Int'l Salt Co.)	No number
Technical Guidance Package for Chemical Sources, Storage Tanks, TCEQ, Feb 2001	No number
Membership in Louisiana Environmental Leadership Program (LaELP) http://www.deq.state.la.us/assistance/elp	No number
OBSOLETE - July 2014 Environmental, Safety, and Health Management Plan (FY 1998 - FY 2002)	No number - OBSOLETE
OBSOLETE: DM/AGT cooling water discharge agreement	No Number OBSOLETE
OBSOLETE- Membership in Clean Texas Program http://www.cleantexas.org/index.cfm	No number OBSOLETE
Organizational and Management Assessments	NOI 1000.72
Pipkin Ranch Road use restrictions in emergencies	Pipkin Ranch Road

DESCRIPTION	STANDARD
Mississippi DWFP Nuisance Animals	Public Notice LE-3799 and LEI 3799
Louisiana Department of Environmental Quality Risk Evaluation/Corrective Action Program	RECAP (2003)
Pollution Prevention Assessment Manual	RG-133
Summary of Work	S# 01010
Demolition of Facilities	S# 02050
Excavation, Backfilling, & Compaction	S# 02222
Dikes & Embankments	S# 02223
Roadways (Texas)	S# 02230
Roadways (Louisiana)	S# 02233
Drilled and Belled Concrete Piers	S# 02362
Piles and Pile Driving	S# 02364
Steel Sheet Piling	S# 02369
Fences & Gates	S# 02444
Sensor - Compatible Fences and Gates	S# 02445
Signage	S# 02450
Seeding	S# 02485
Asphaltic Concrete Pavement	S# 02513
Asphaltic Concrete Pavement (Louisiana)	S# 02514
Cast-In-Place Concrete	S# 03300
Shotcrete	S# 03361
Grout	S# 03600
Brick Masonry	S# 04210
Concrete Unit Masonry	S# 04220
Structural Steel green	S# 05120
Metal Roof Deck	S# 05310
Rough Carpentry	S# 06100
Finish Carpentry	S# 06200
Vinyl Sheet Piles	S# 06521
Rigid Insulation	S# 07212
Built-Up Bituminous Roofing	S# 07510
Aluminum Clad Flashing Membrane	S# 07550
Fluid Applied Roofing	S# 07560
Sealants & Caulking	S# 07920
Metal Doors & Frames	S# 08100
Flush Wood Doors	S# 08211
Hurricane Windows	S# 08520
Glass & Glazing	S# 08800
Gypsum Wallboard	S# 09250
Ceramic Tile	S# 09310

DESCRIPTION	STANDARD
Resilient Rubber Flooring	S# 09650
Resilient Tile Flooring	S# 09660
Carpet - Glue Down	S# 09688
Epoxy Flooring	S# 09722
Interior Painting	S# 09900
Painting (Buildings)	S# 09901
Metal Toilet Partitions	S# 10162
Toilet Room Accessories	S# 10800
Prefabricated Industrial/Commercial Metal Building	S# 13121
Modular Insulated Building	S# 13126
Prefabricated Metal Shelter/Housing	S# 13127
Prefabricated Fiberglass Shelter/Housing	S# 13128
Duct Insulation	S# 15258
Plumbing Systems	S# 15400
Plumbing Fixtures & Trim	S# 15450
Air Cooled Condensing Unit	S# 15695
Packaged Terminal Air Conditioners	S# 15731
Conduit	S# 16111
Wood Poles	S# 16503
Lighting	S# 16510
DOE Policy on Signatures of RCRA Permit Applications	SEN-22-90
Nonhazardous Solid Waste Management Regulations and Criteria (Mississippi)	SW-2
Texas Tier Two Reporting Forms and Instructions	TCRA, 505-507 SARA Title III
Special Licenses and Permits	TPWC Chapter 43
Birds; Protection of Nongame Birds; Destroying Nests or Eggs	TPWC Chapter 64
Alligators	TPWC Chapter 65
Disposition of Protected Wildlife	TPWC Section 43.024
Alligators in Texas: Rules, regulations, and general information, 2013-2014	TPWD
Texas Regulations for Control of Radiation - General provisions	TRCR part 11
Texas Regulations for Control of Radiation - Fees	TRCR part 12
Texas Regulations for Control of Radiation - Hearing and Enforcement Procedures	TRCR part 13
Standards for Protection Against Radiation - Permissible Doses, Precautionary Procedures, Waste Disposal	TRCR part 21
Notices, Instructions and Reports to Workers; Inspections	TRCR part 22
Radiation Safety Requirements and Licensing and Registration Procedures for Industrial Radiography	TRCR part 31
Licensing of Radioactive Material -Exemptions, Licenses, General Licenses, Specific Licenses, Reciprocity, Transport	TRCR part 41
State Fire Marshall (Explosives)	TX Statute Chapter 417 State Fire Marshall
Fire Protection Engineering for Facilities	UFC 3-600-01

DESCRIPTION	STANDARD
International Conference of Building Officials - Uniform Building Code and Uniform Fire Code	UFC/UBC
Underwriter's Laboratory - Building Materials, Fire Resistance, Fire Prot. Equip., & Haz. Location Equip. Directories	UL
West Hackberry Emergency Response Procedures	WHI 5500.9
West Hackberry Spill Prevention, Control, and Countermeasures Plan	WHL 5400.20

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Appendix A2 - SPRPMO ES&H Directives

DIRECTIVE	DESCRIPTION
DOE O 151.1C	Comprehensive Emergency Management System
DOE O 225.1B	Accident Investigations
DOE O 231.1B Admin Chg. 1	Environment, Safety and Health Reporting
DOE O 420.1C Change 1	Facility Safety
DOE O 422.1 Admin Chg. 1, Admin Chg. 2	Conduct of Operations
DOE O 430.1B, Change 1, Change 2	Real Property Asset Management
DOE O 436.1	Departmental Sustainability
DOE O 440.2C, Admin Change 1	Aviation Management Safety
DOE O 460.1C	Packaging and Transportation Safety
DOE O 460.2A	Departmental Materials Transportation and Packaging Management
DOE P 450.4A	Safety Management System Policy
SPRPMO O 232.1A	Occurrence Reporting and Processing System
SPRPMO O 420.1D	Conduct of Operations Requirements for SPR Facilities
SPRPMO O 436.1A	Site Sustainability
SPRPMO O 440.2B	Aviation Implementation Plan
SPRPMO O 451.1D	National Environmental Policy Act Implementation Plan
SPRPMO P 451.1D	SPR Environmental Policy
SPRPMO N 450.8	Strategic Petroleum Reserve Environmental, Security, Safety & Health, and Emergency Preparedness Goals FY2011
SPRPMO N 450.4	Implementation of Environmental, Safety and Health Contractor Requirements Documents

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Appendix B

SPRPMO Policy 451.1E, “SPR Environmental Policy”

U. S. Department of Energy
STRATEGIC PETROLEUM RESERVE PROJECT MANAGEMENT OFFICE
New Orleans, La.

POLICY

SPRPMO P 451.1E

APPROVED: **5/4/16**

SUBJECT: SPR ENVIRONMENTAL POLICY

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1. **PURPOSE AND SCOPE.** This environmental policy applies to the facilities and pipelines that comprise the Strategic Petroleum Reserve (SPR). The mission of SPR is to store petroleum and maintain drawdown readiness. To achieve its mission, the Department of Energy (DOE) and SPR contractors will design, develop, construct, operate, and maintain SPR facilities and operations in a manner that shall be sustainable, resource-efficient, and will protect the quality of the environment consistent with all applicable environmental laws, regulations, and standards. Environmental protection will be integrated at all management levels and into all phases of activity.

   This environmental policy is implemented by SPR top management through an environmental management system (EMS) under an integrated safety management umbrella.

2. **POLICY STATEMENT.** The SPR operates only in an environmentally responsible manner.

   Environmentally responsible manner means that top management pledges all functional levels will:

   a. Comply with applicable Federal, State, and local environmental legal, regulatory, and other requirements which relate to the environmental aspects of SPR activities;

   b. Prevent pollution by undertaking measures to prevent the generation of wastes, and other residual materials requiring disposal or release to the environment through recycling, reuse, and source reduction. Where the generation of such wastes cannot be avoided, the SPR Project Management Office will take action to reduce their volume and toxicity and ensure proper disposal; and

c. Improve environmental performance via the EMS and by establishing and maintaining documented environmental objectives and targets.

This Environmental Policy provides the framework for setting and reviewing environmental objectives and targets that assure excellence in environmental management. Management communicates the Poilicy to all persons for, or on behalf of, the SPR. It is available on request at all SPR facilities and electronically on-line at www.spr.doe.gov and www.fluorfpo.com.

The SPR Environmental, Safety and Health Division of Technical Assurance is responsible for prompting the periodic review of this Policy by DOE and Fluor Federal Petroleum Operations top management as well as its update.

William C. Gibson, Jr.
Project Manager
Strategic Petroleum Reserve

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Appendix C

GROUND WATER SURVEILLANCE MONITORING

DURING 2016

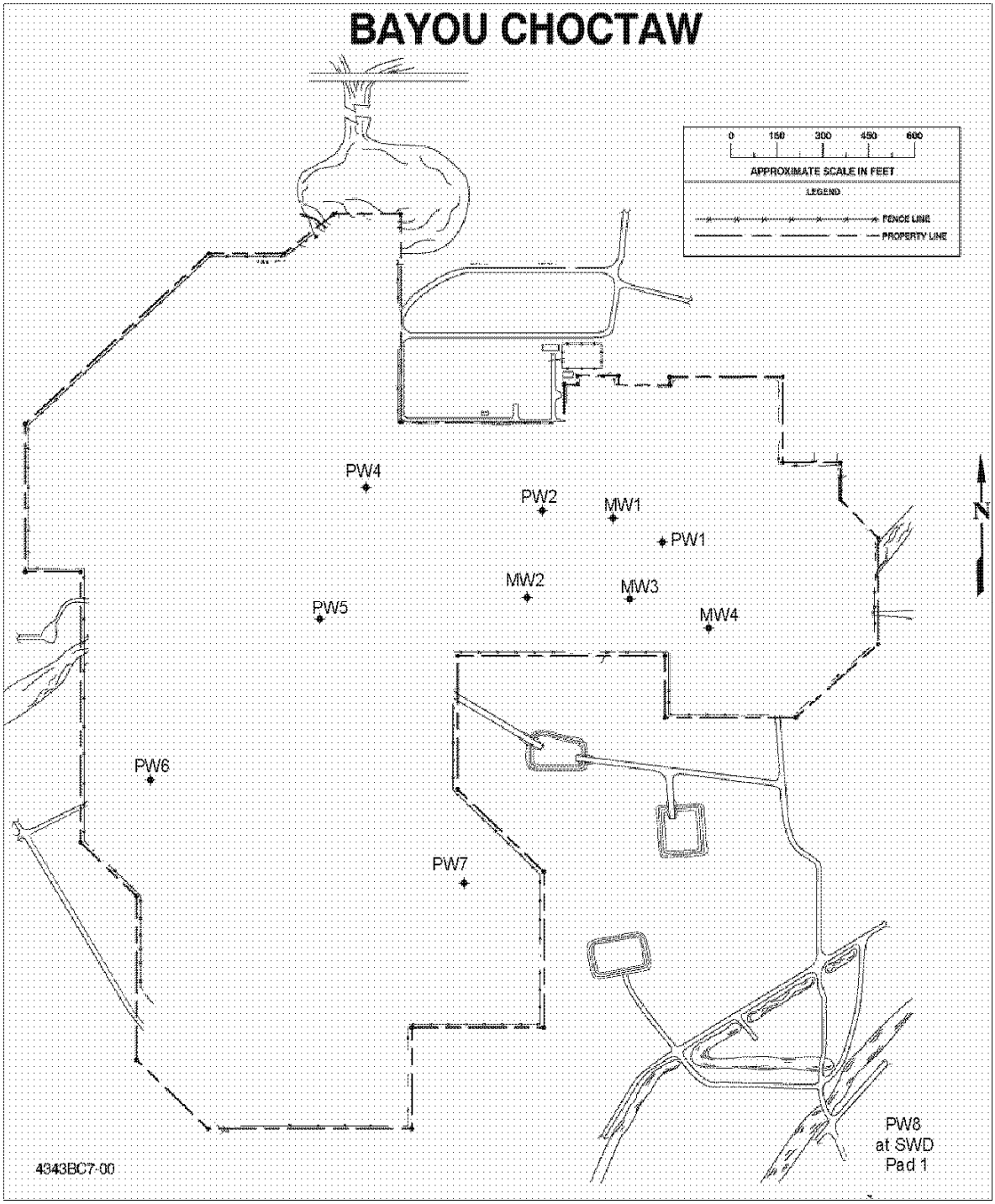


Figure C-1. Bayou Choctaw Ground Water Monitoring Stations

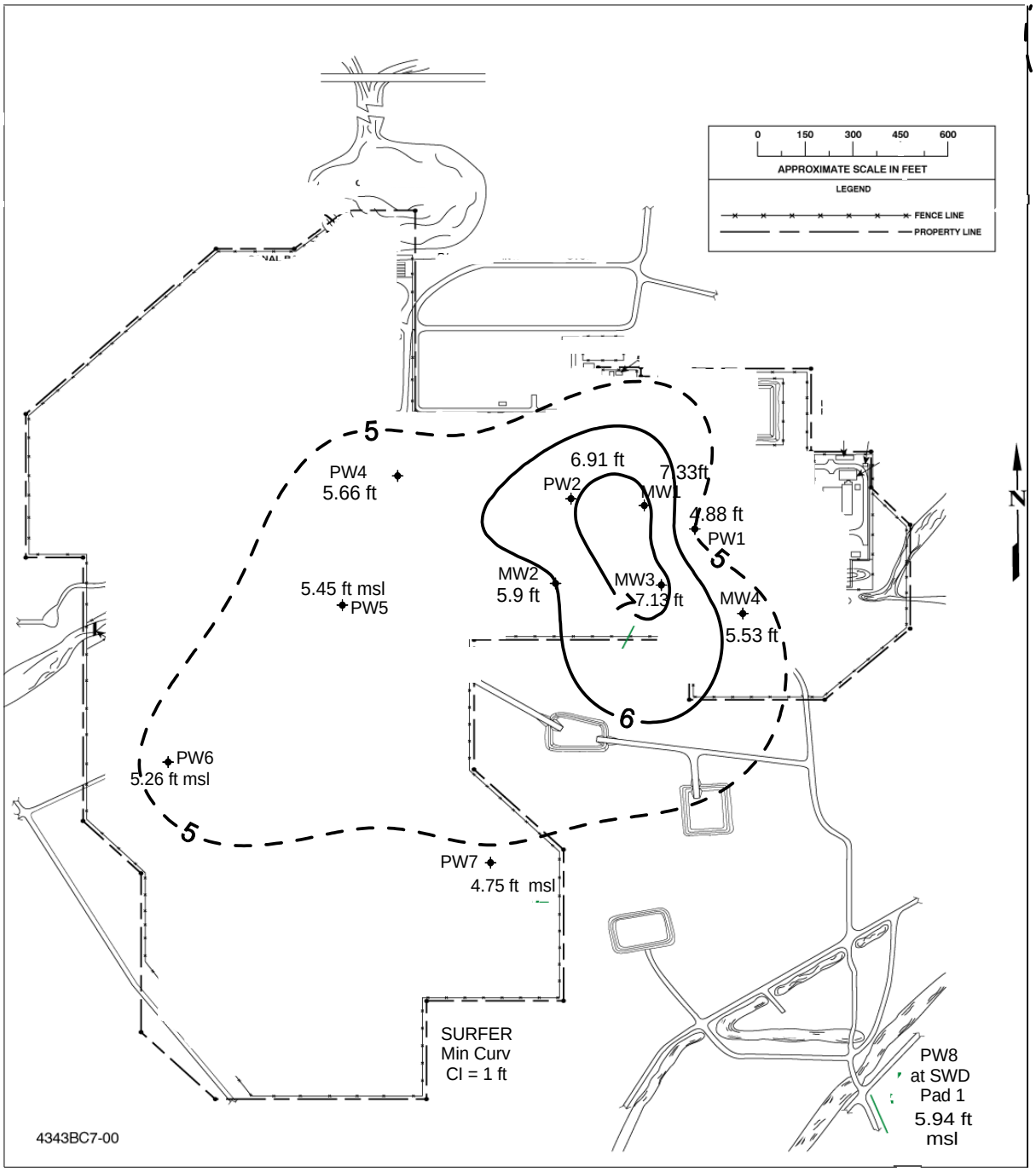


Figure C-2. Bayou Choctaw Ground Water Contoured Elevations Fall 2016

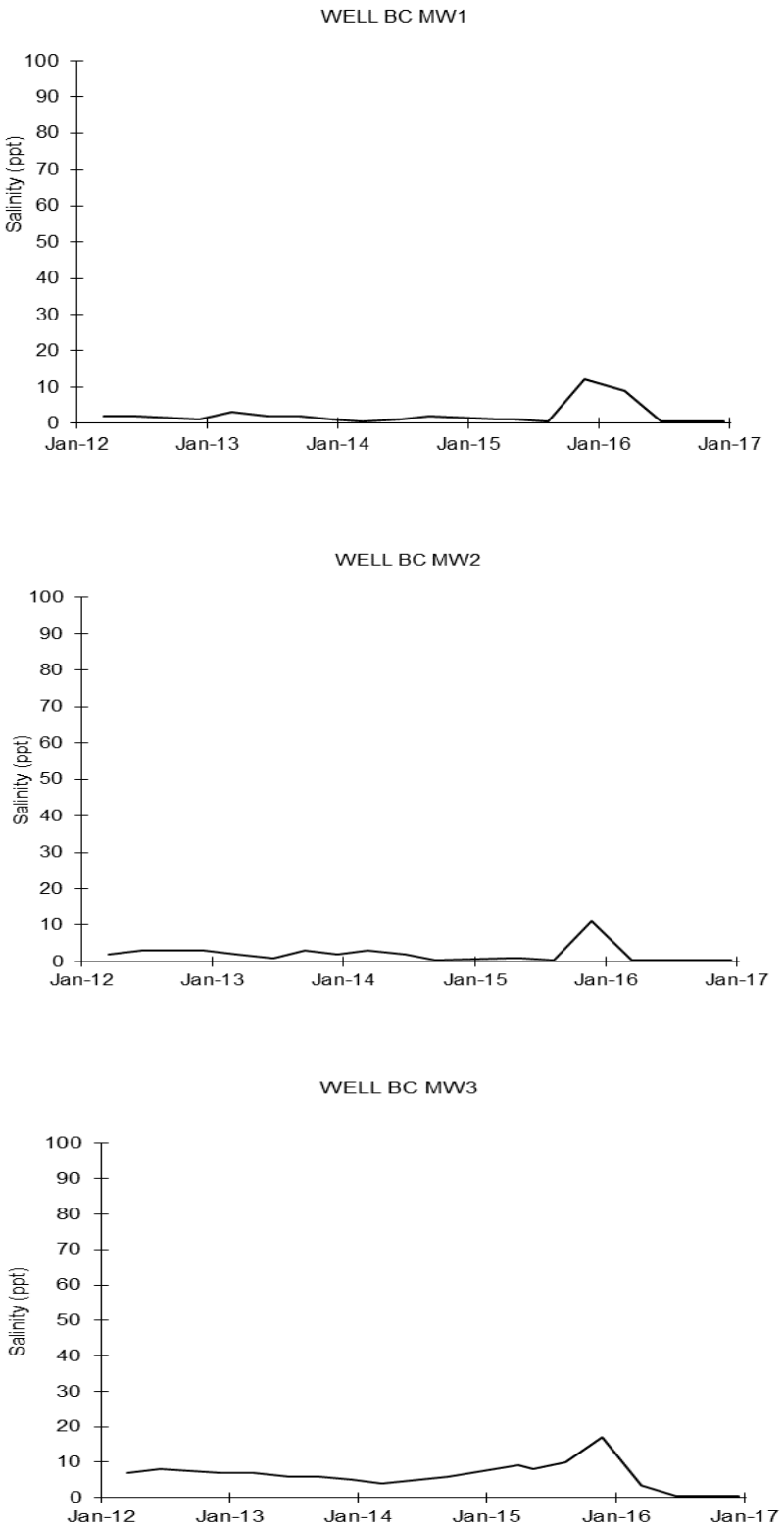
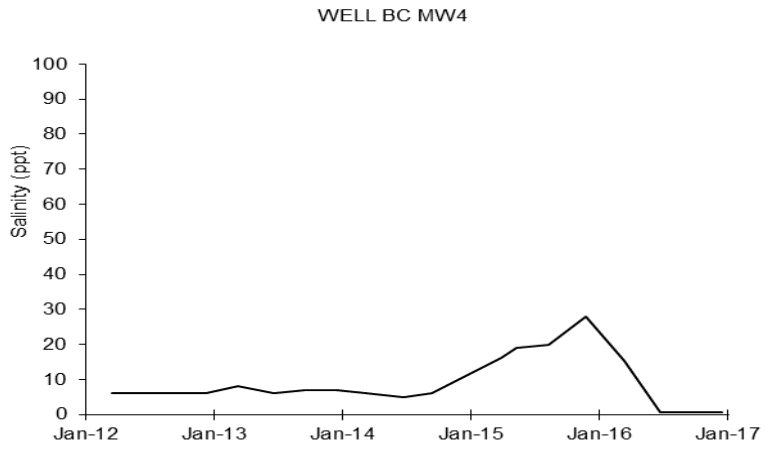
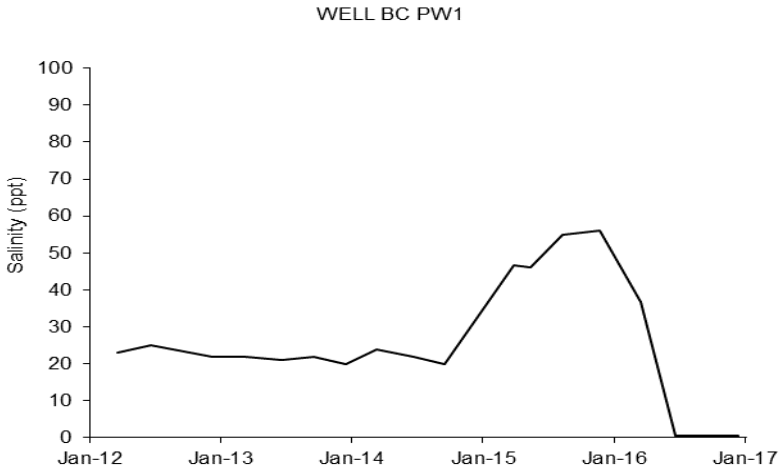


Figure C-3. Bayou Choctaw Ground Water Monitoring Well Salinities





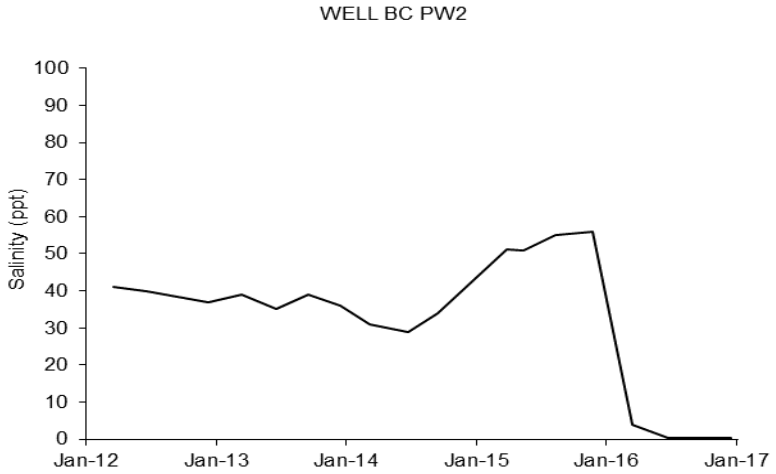
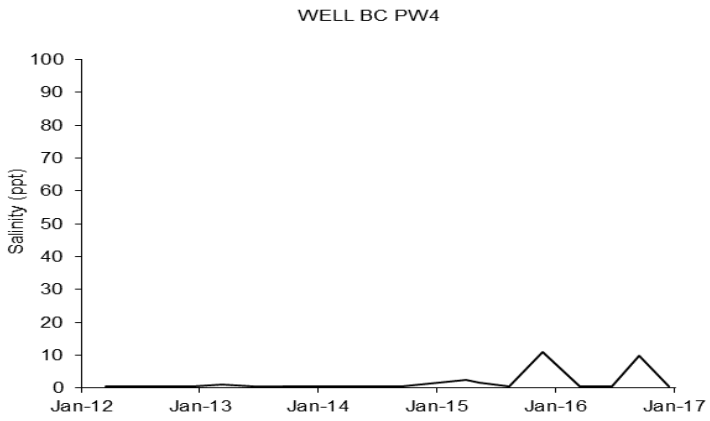
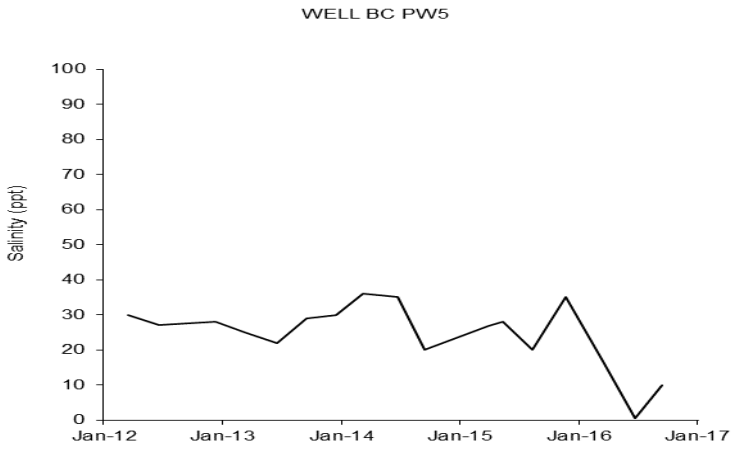


Figure C-3. Bayou Choctaw Ground Water Monitoring Well Salinities (continued)





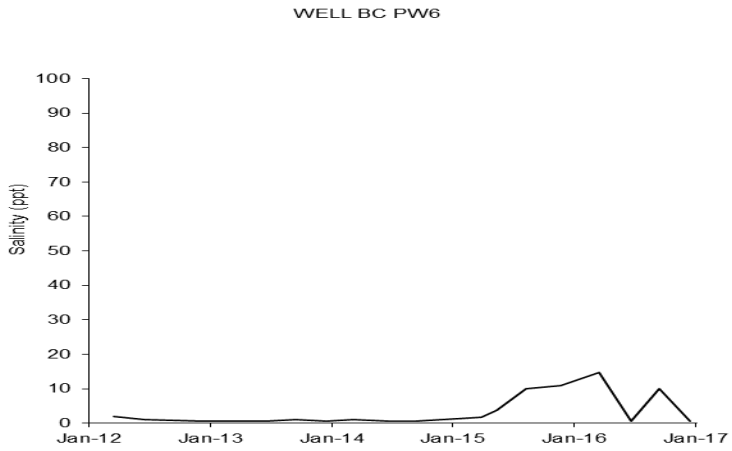
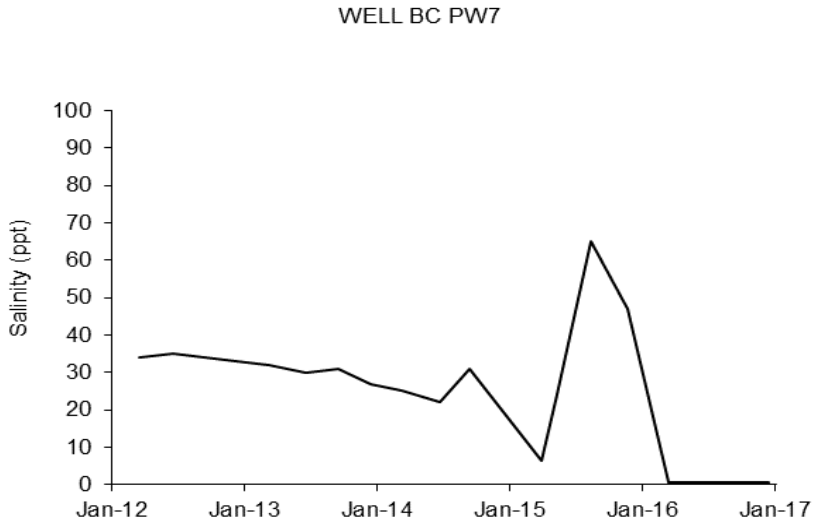


Figure C-3. Bayou Choctaw Ground Water Monitoring Well Salinities (continued)



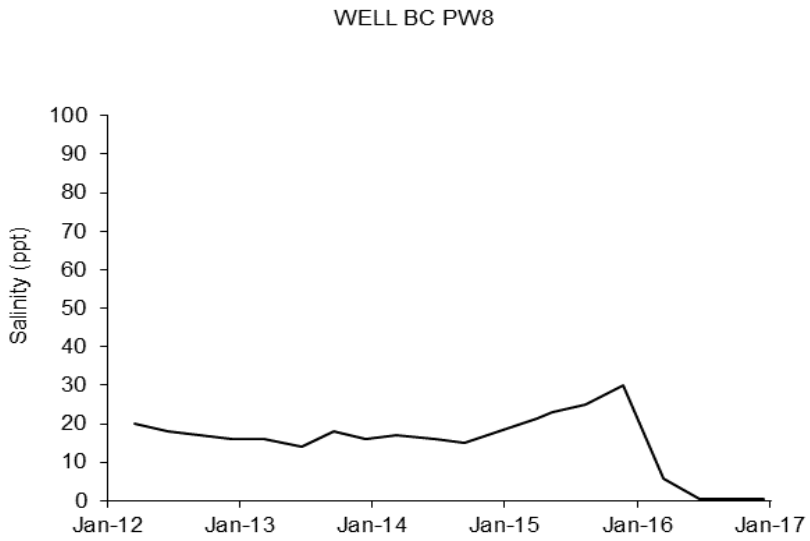


Figure C-3. Bayou Choctaw Ground Water Monitoring Well Salinities (continued)

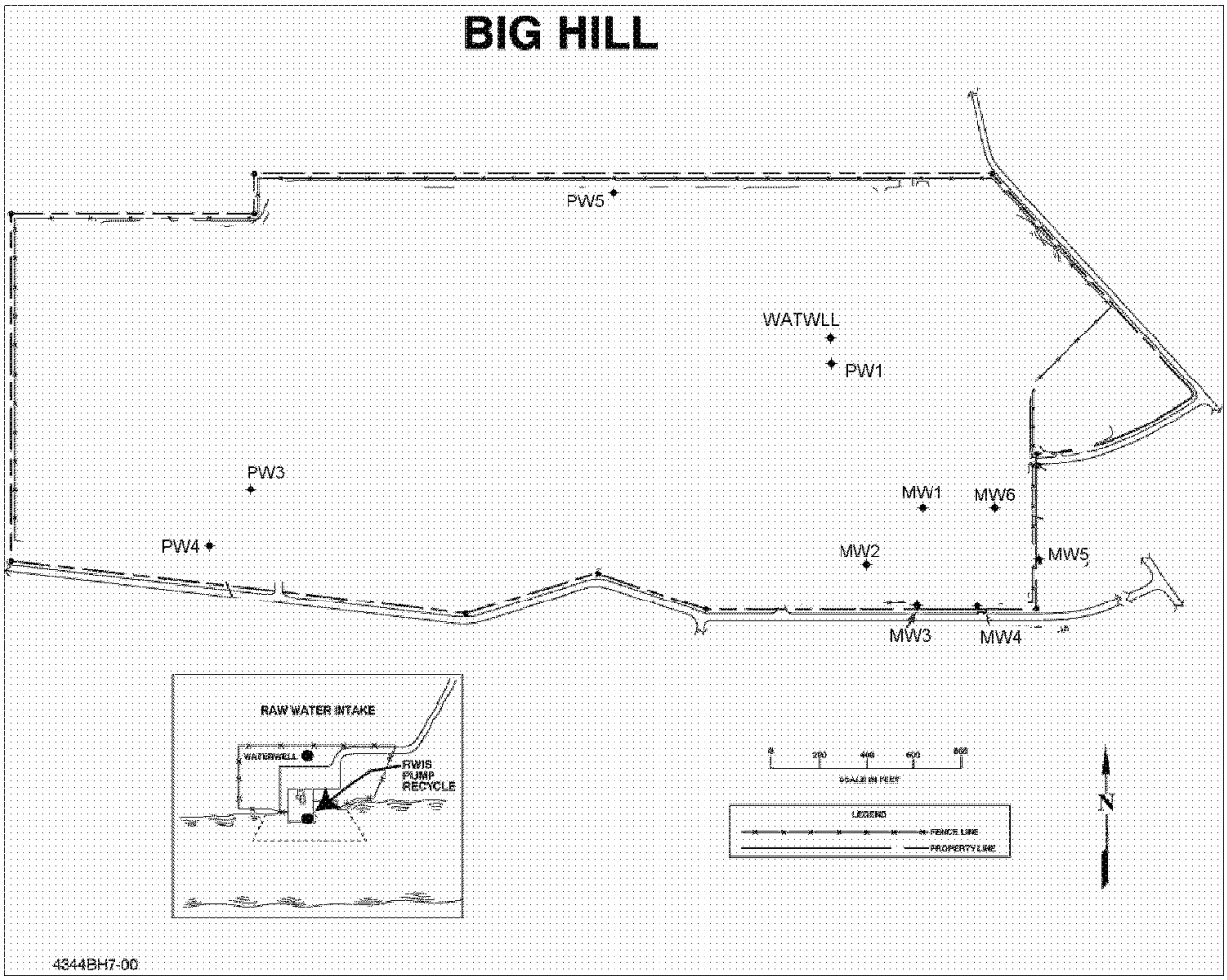
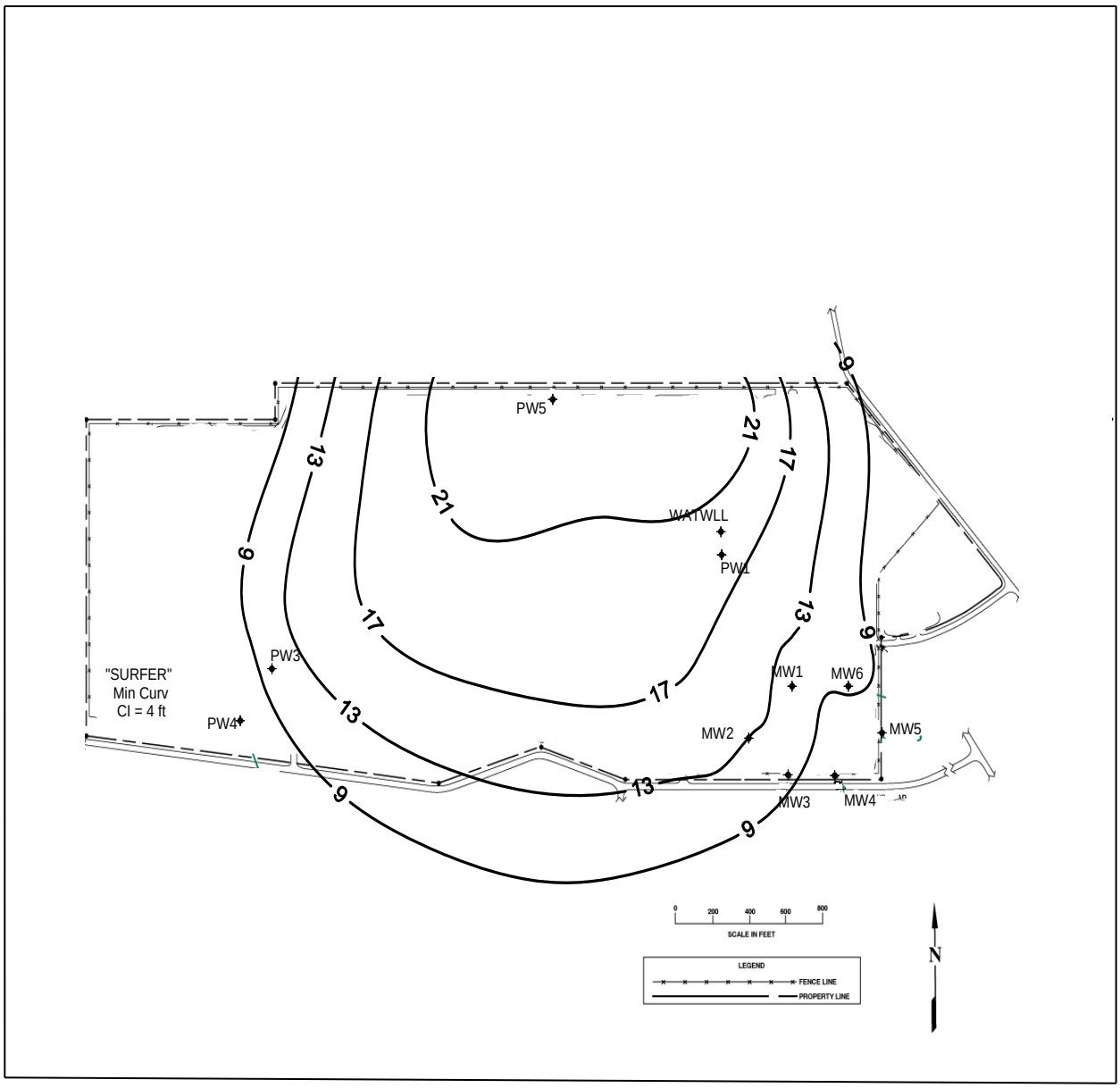


Figure C-4. Big Hill Ground Water Monitoring Stations



4344BH7-00

(in feet msl)

MW1	12.39	MW6	11.04
MW2	12.66	PW1	15.7
MW3	11.7	PW3	12.18
MW4	8.69	PW4	7.06
MW5	4.17	PW5	21.05

Figure C-5. Big Hill Ground Water Contoured Elevations Fall 2016

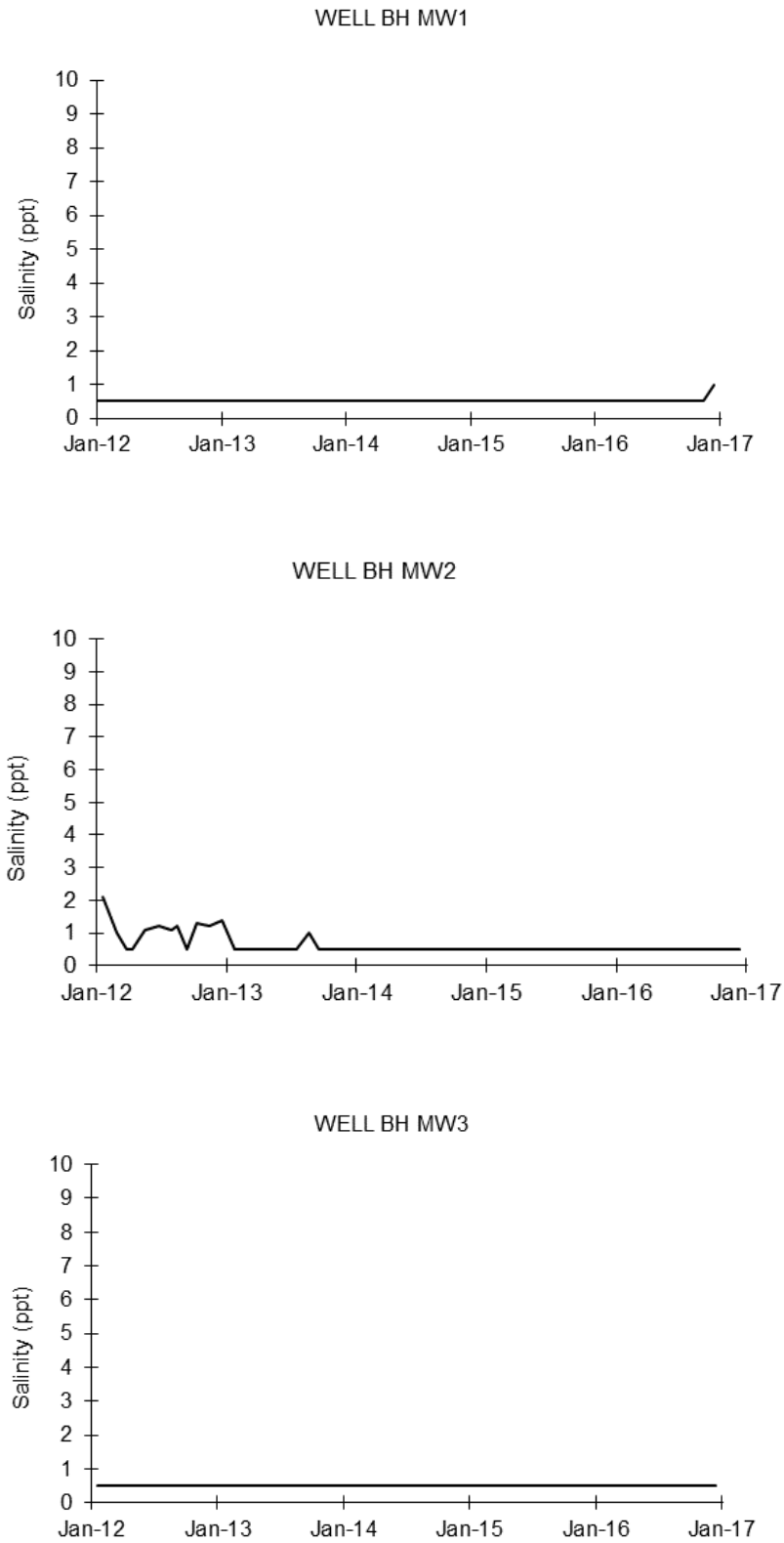
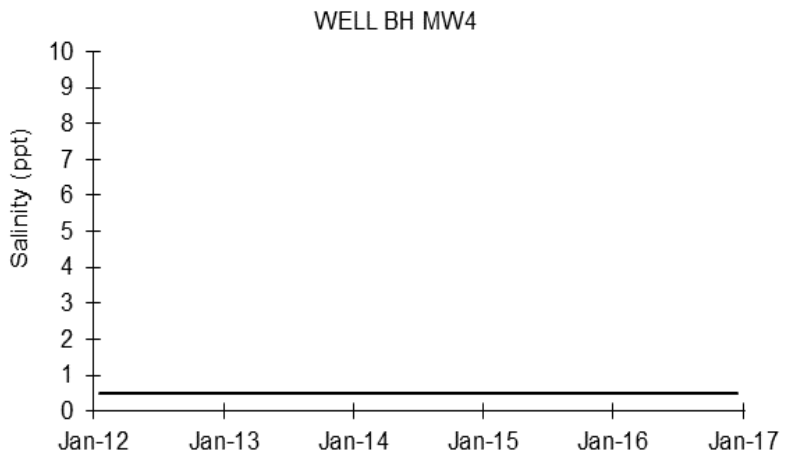
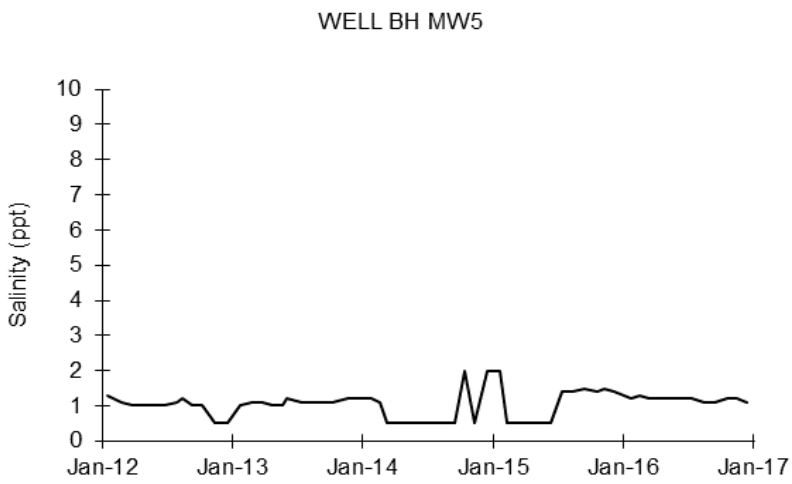


Figure C-6. Big Hill Ground Water Monitoring Well Salinities





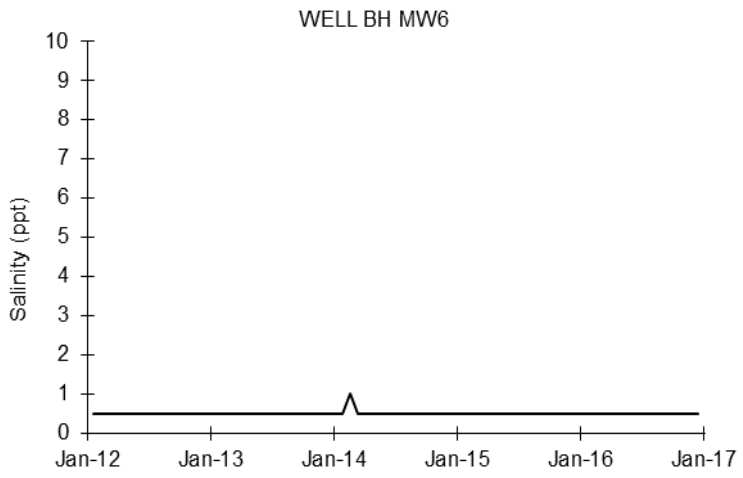
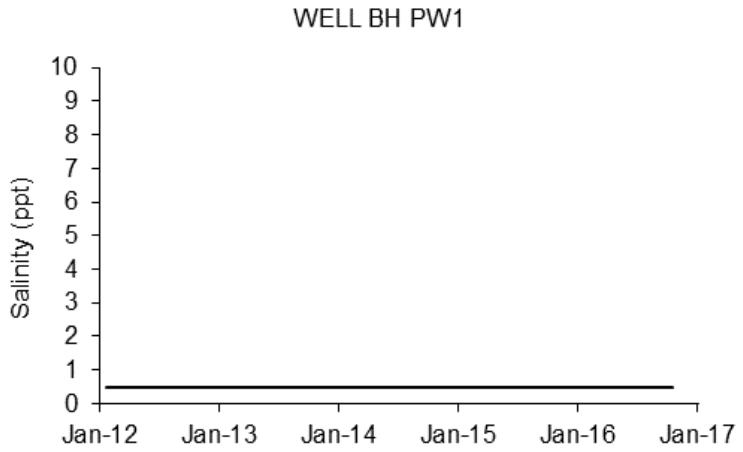
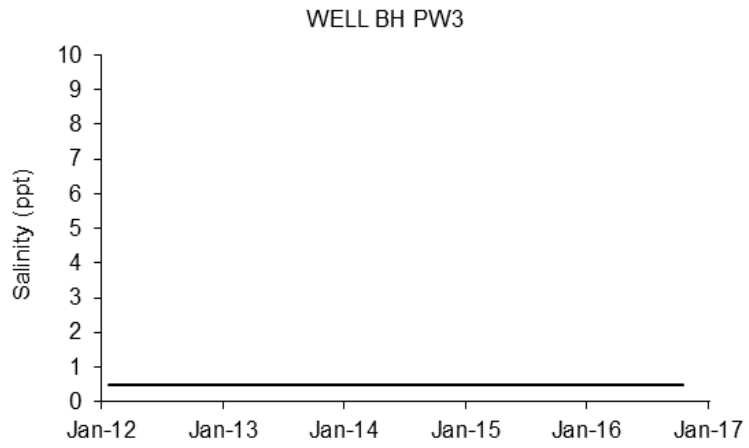


Figure C-6. Big Hill Ground Water Monitoring Well Salinities (continued)





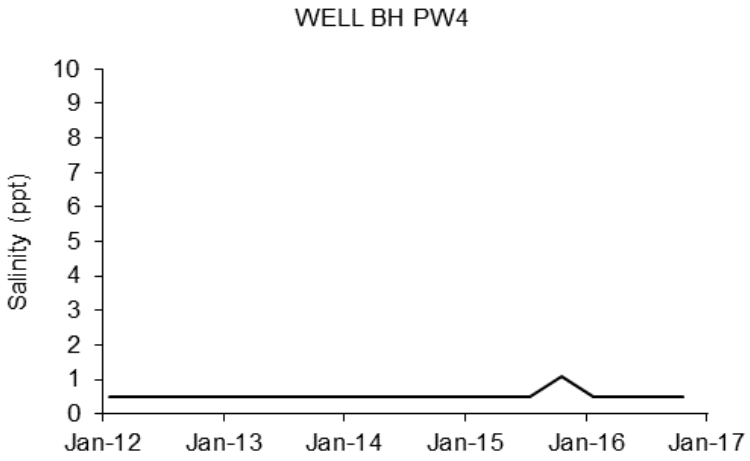


Figure C-6. Big Hill Ground Water Monitoring Well Salinities (continued)

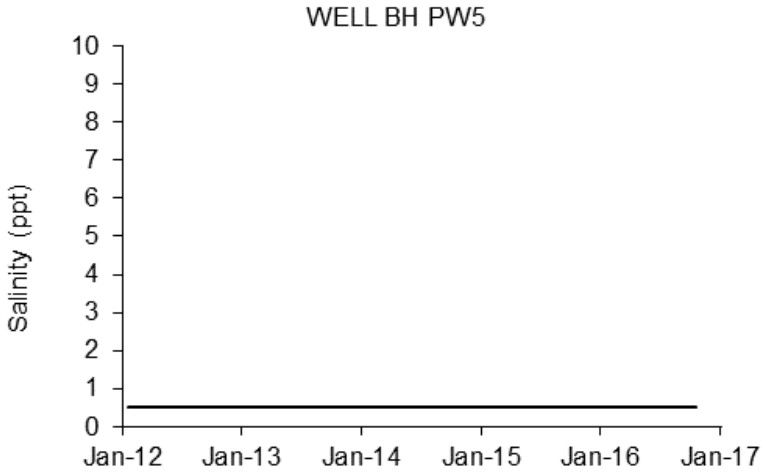


Figure C-6. Big Hill Ground Water Monitoring Well Salinities (continued)

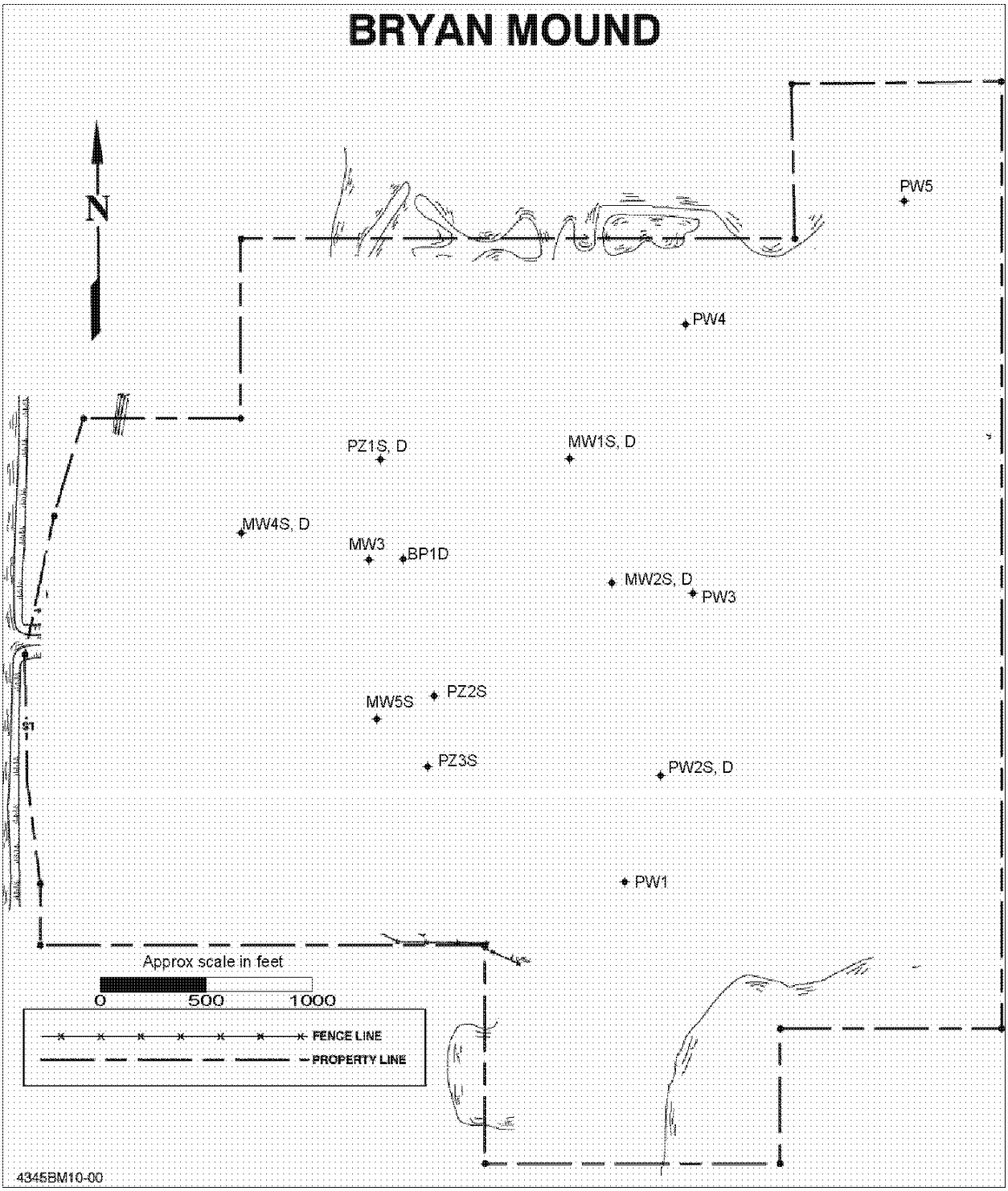


Figure C-7. Bryan Mound Ground Water Monitoring Stations, Deep and Shallow

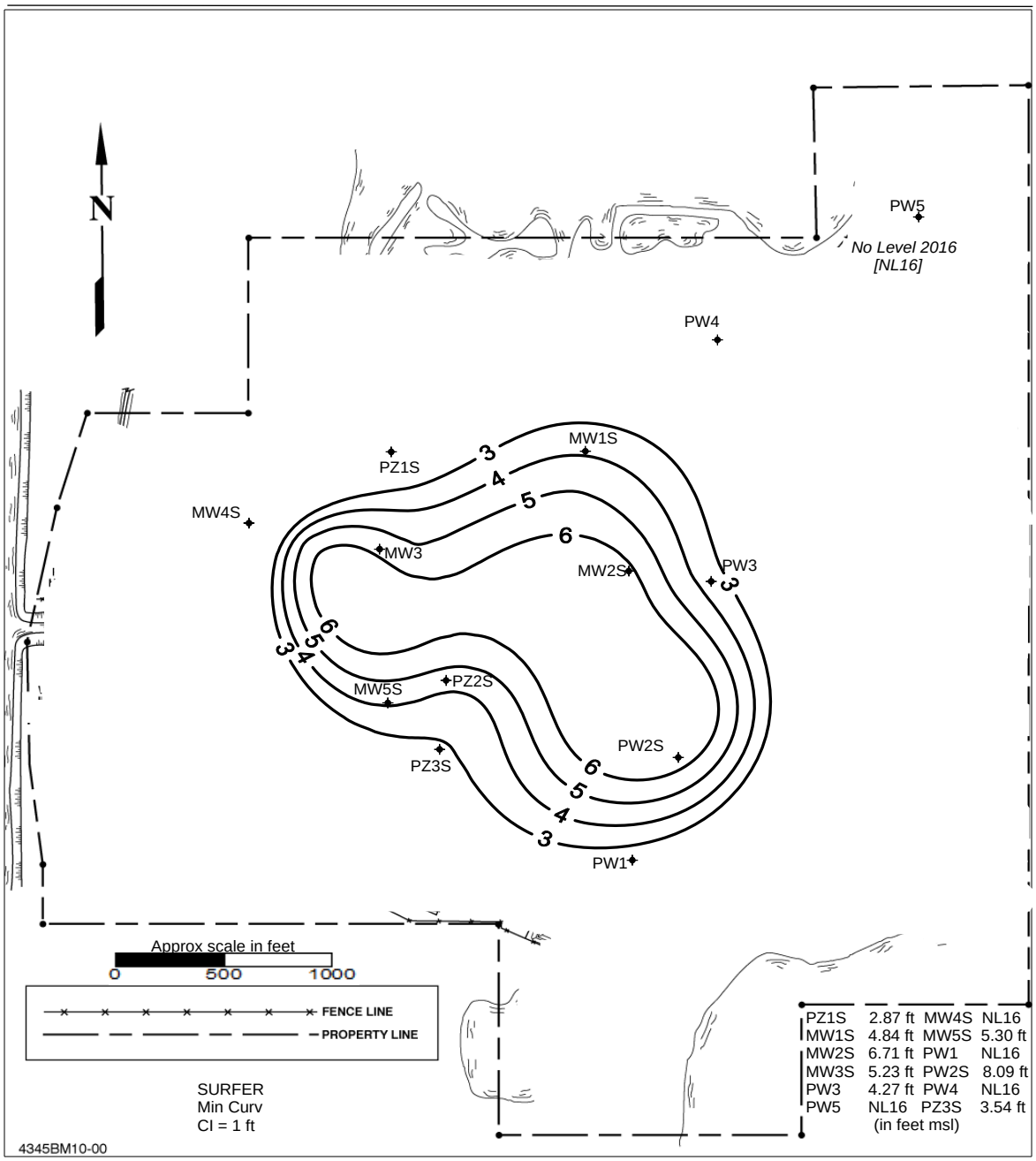


Figure C-8. Bryan Mound Shallow Ground Water Zone Contoured Elevations Fall 2016

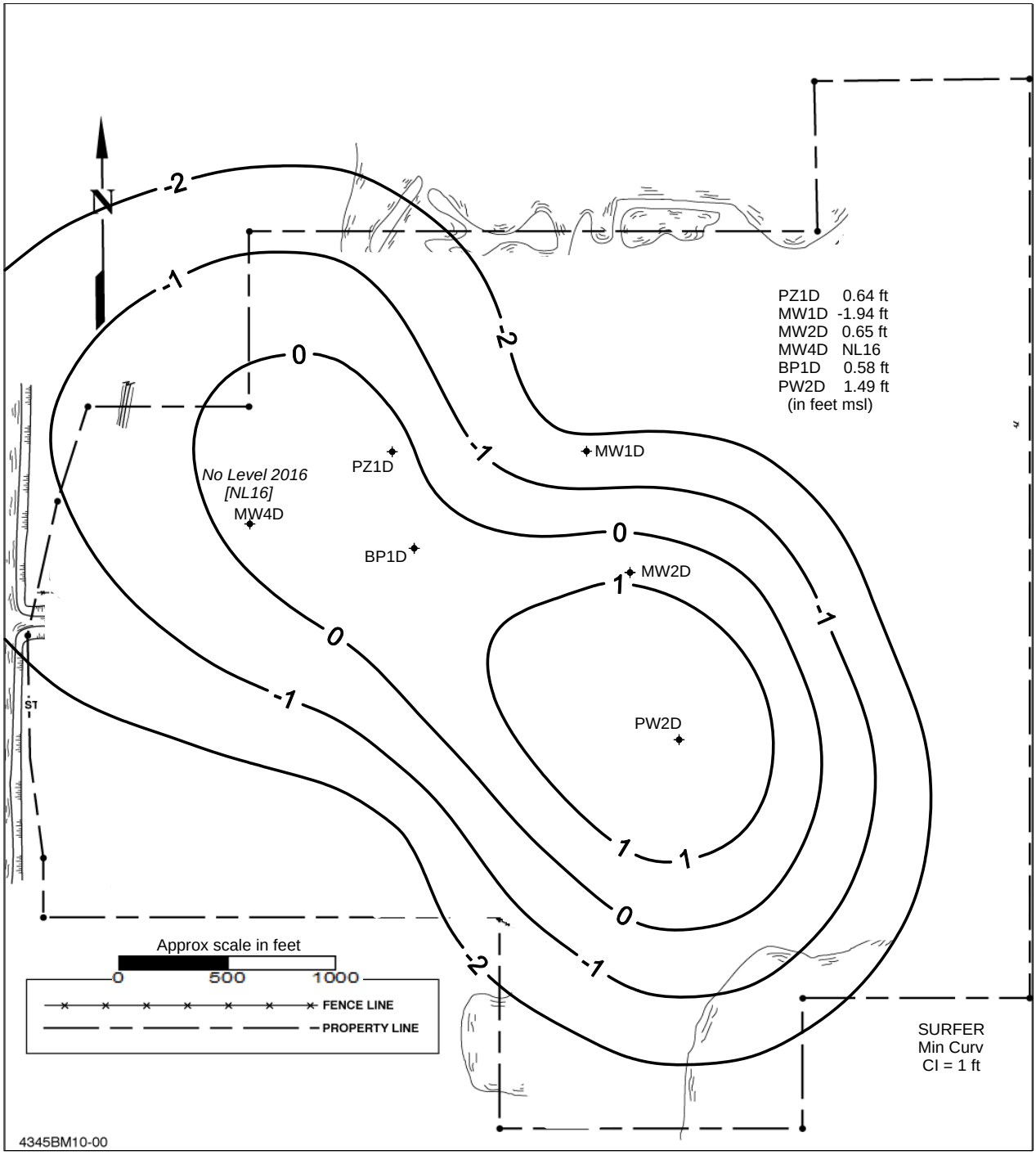
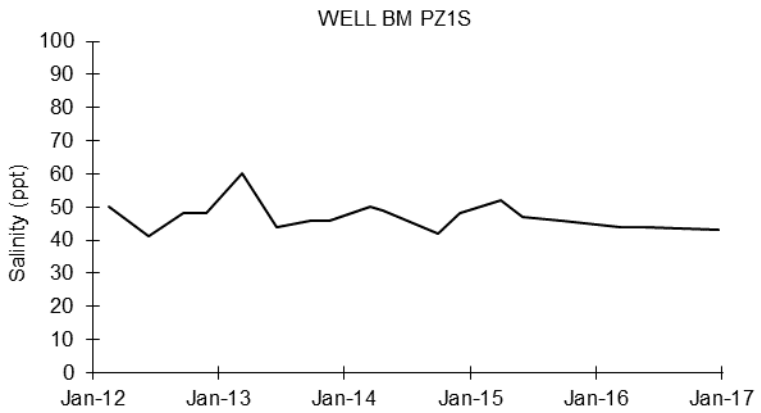
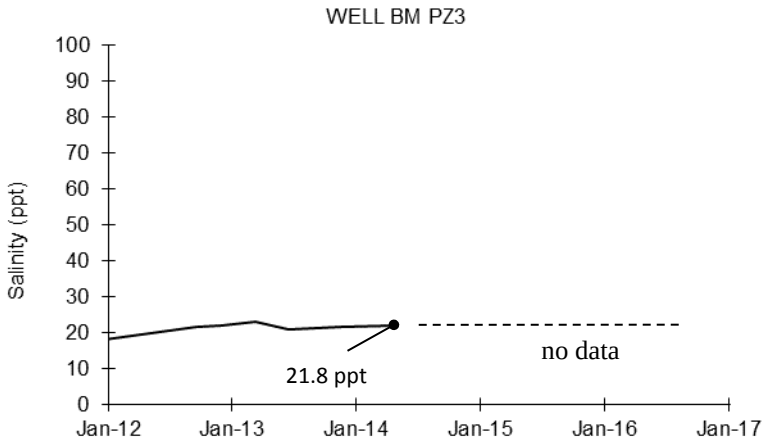


Figure C-9. Bryan Mound Deep Ground Water Zone Contoured Elevations Fall 2016





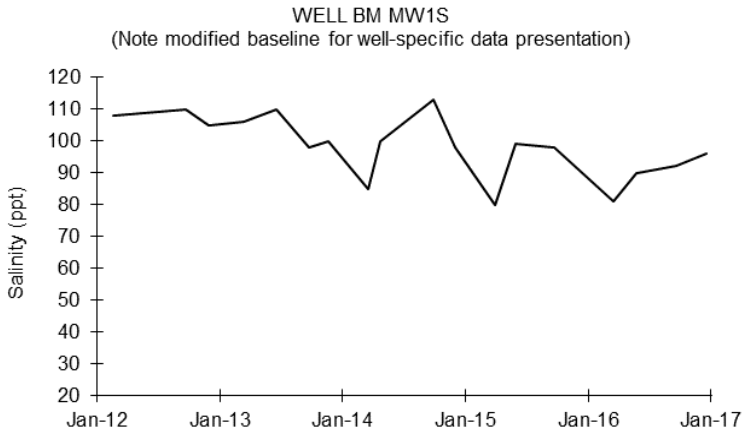
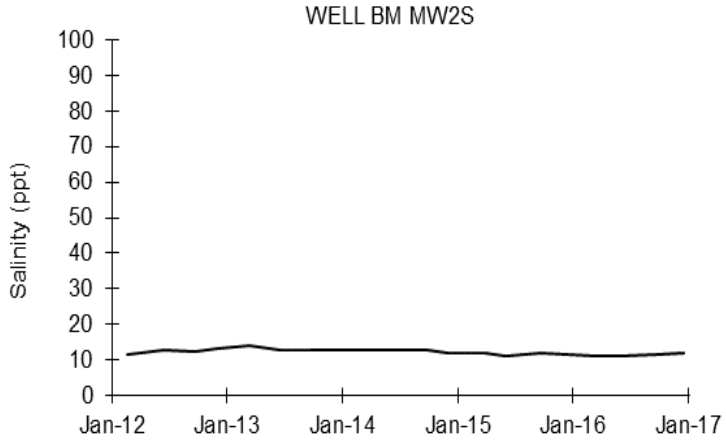
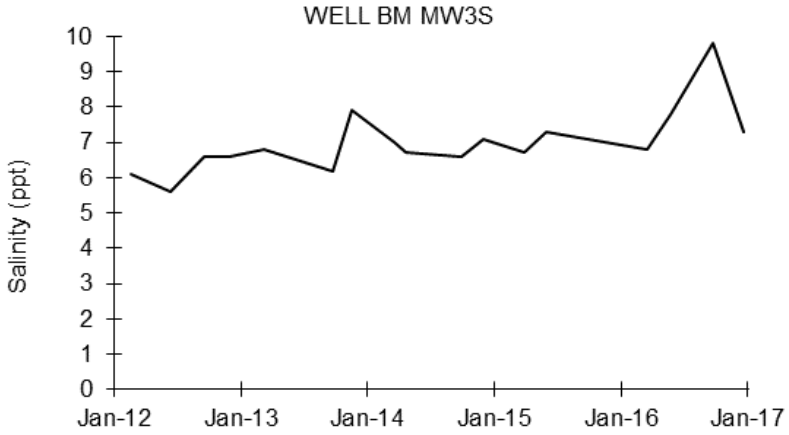


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities





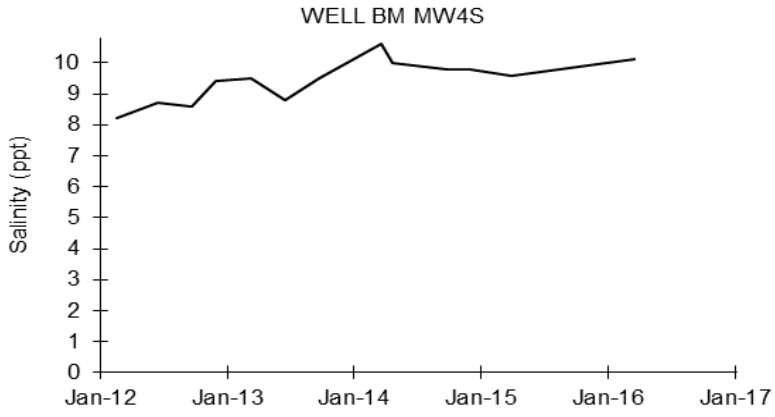
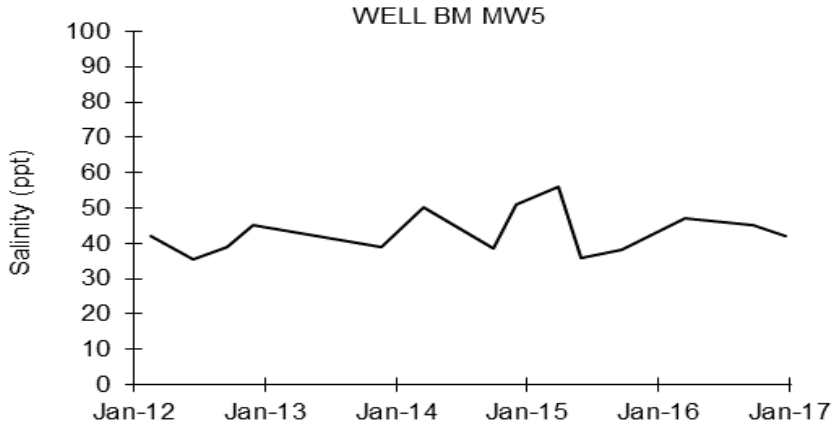
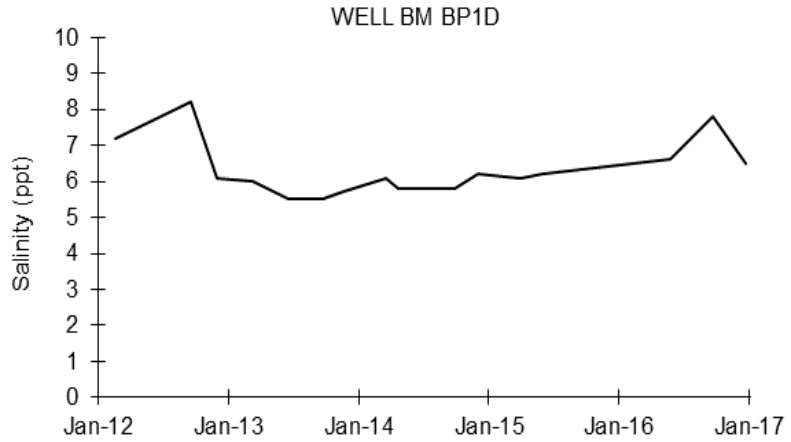


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities (continued)





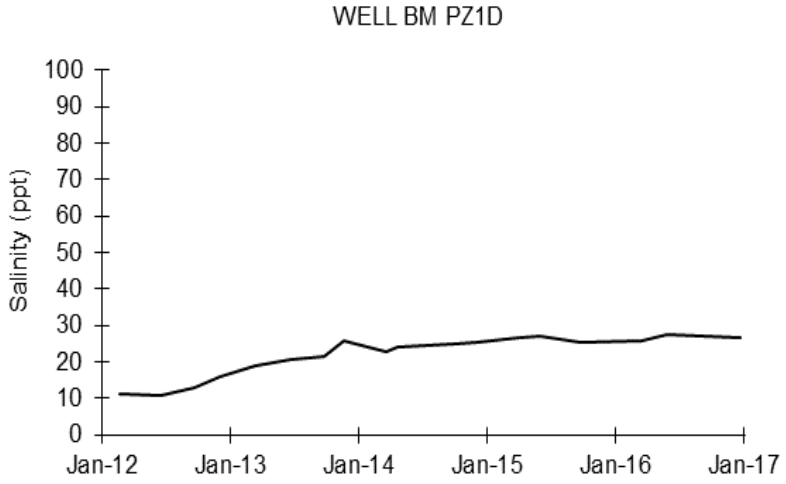
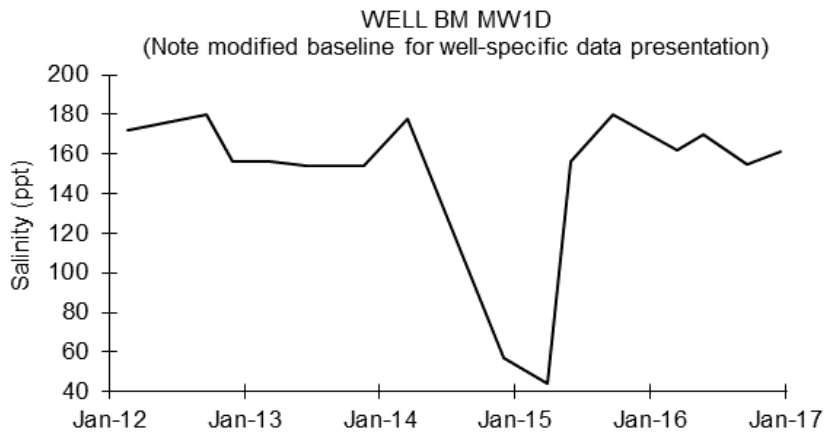
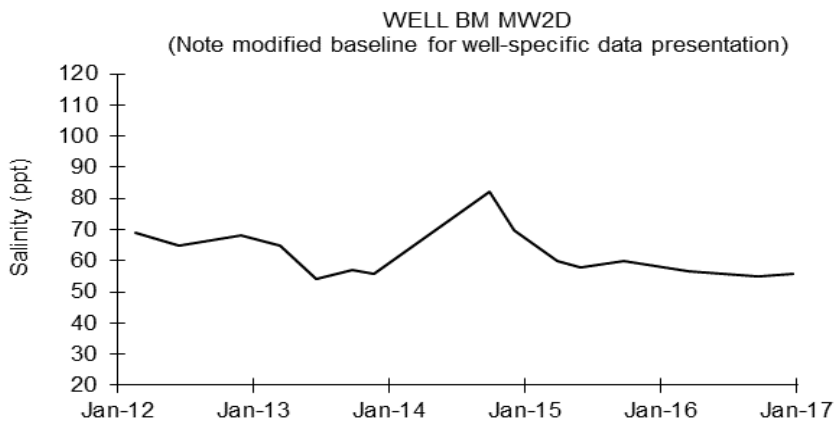


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities (continued)





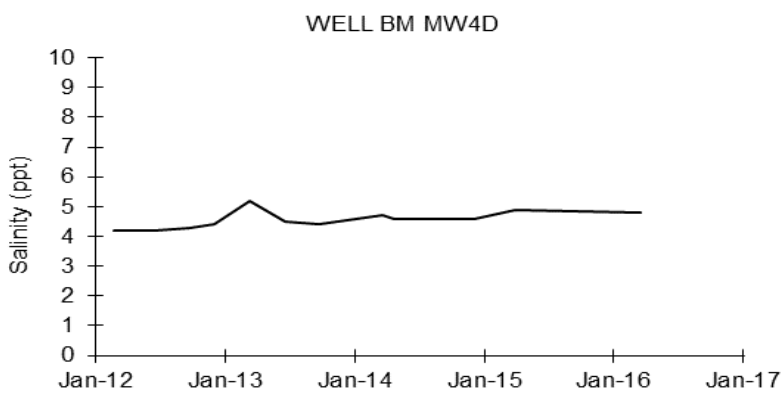
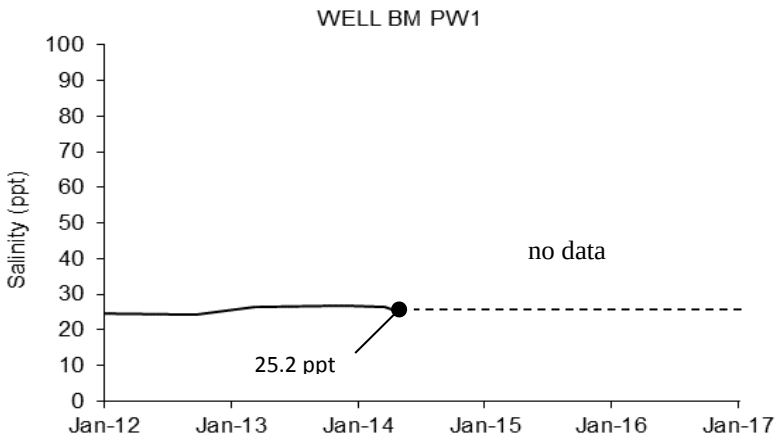
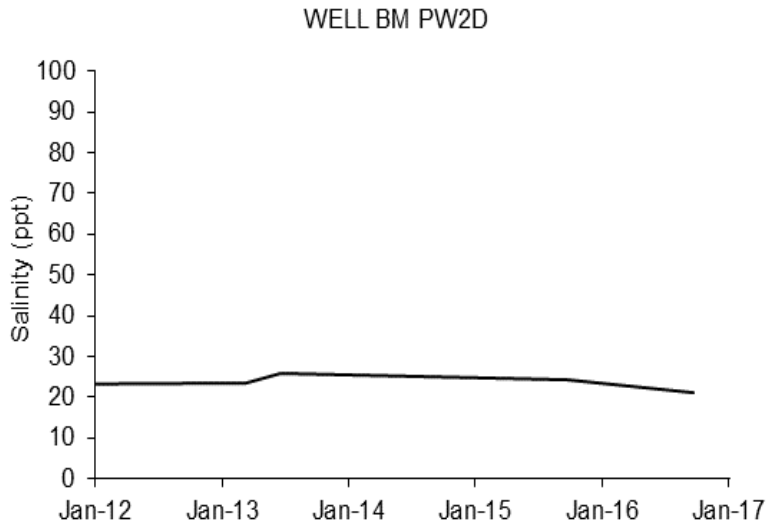


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities (continued)





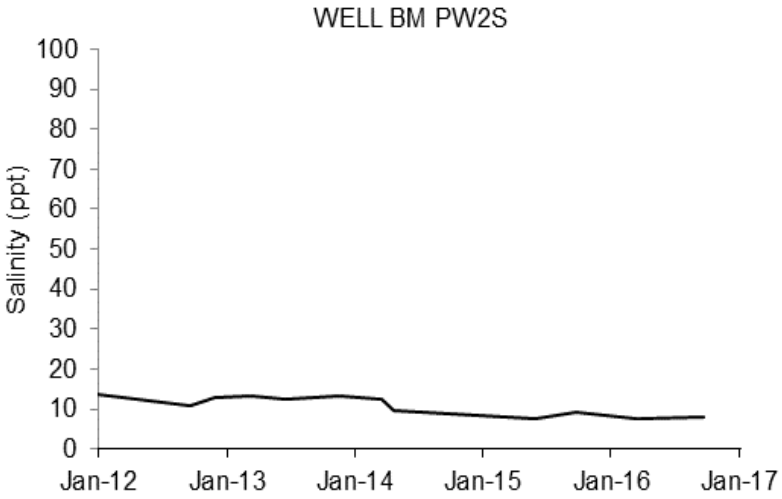
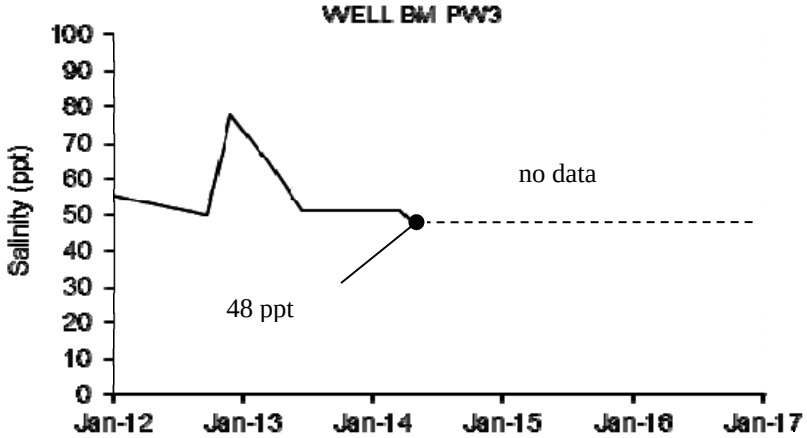
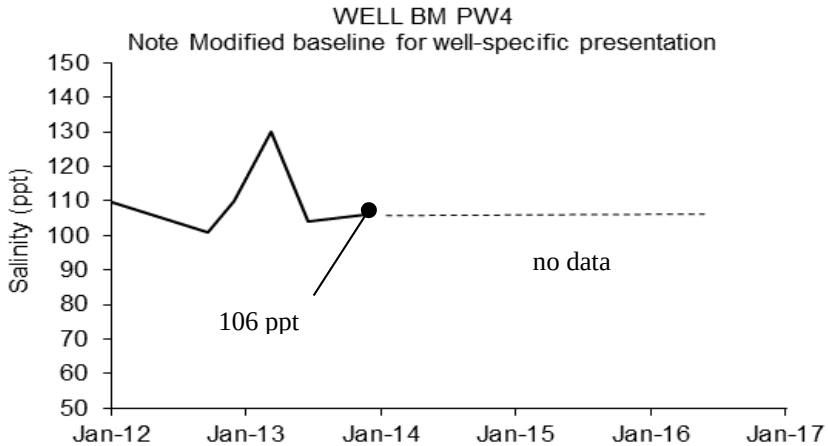


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities (continued)





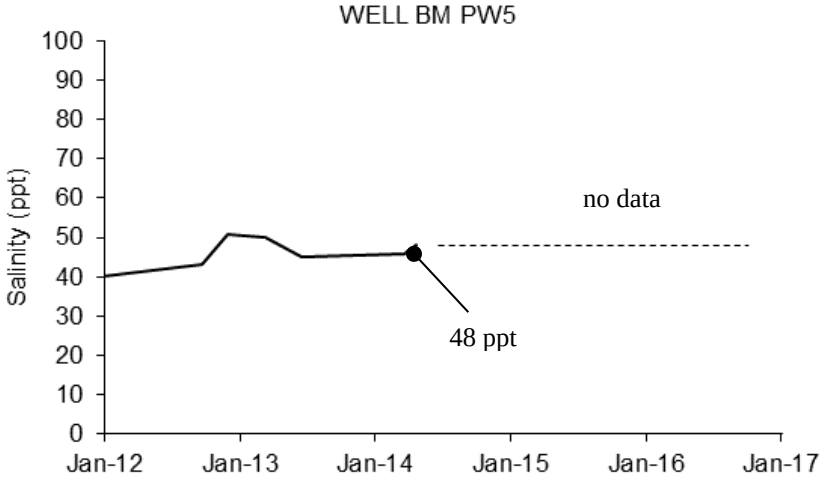


Figure C-10. Bryan Mound Ground Water Monitoring Well Salinities (continued)

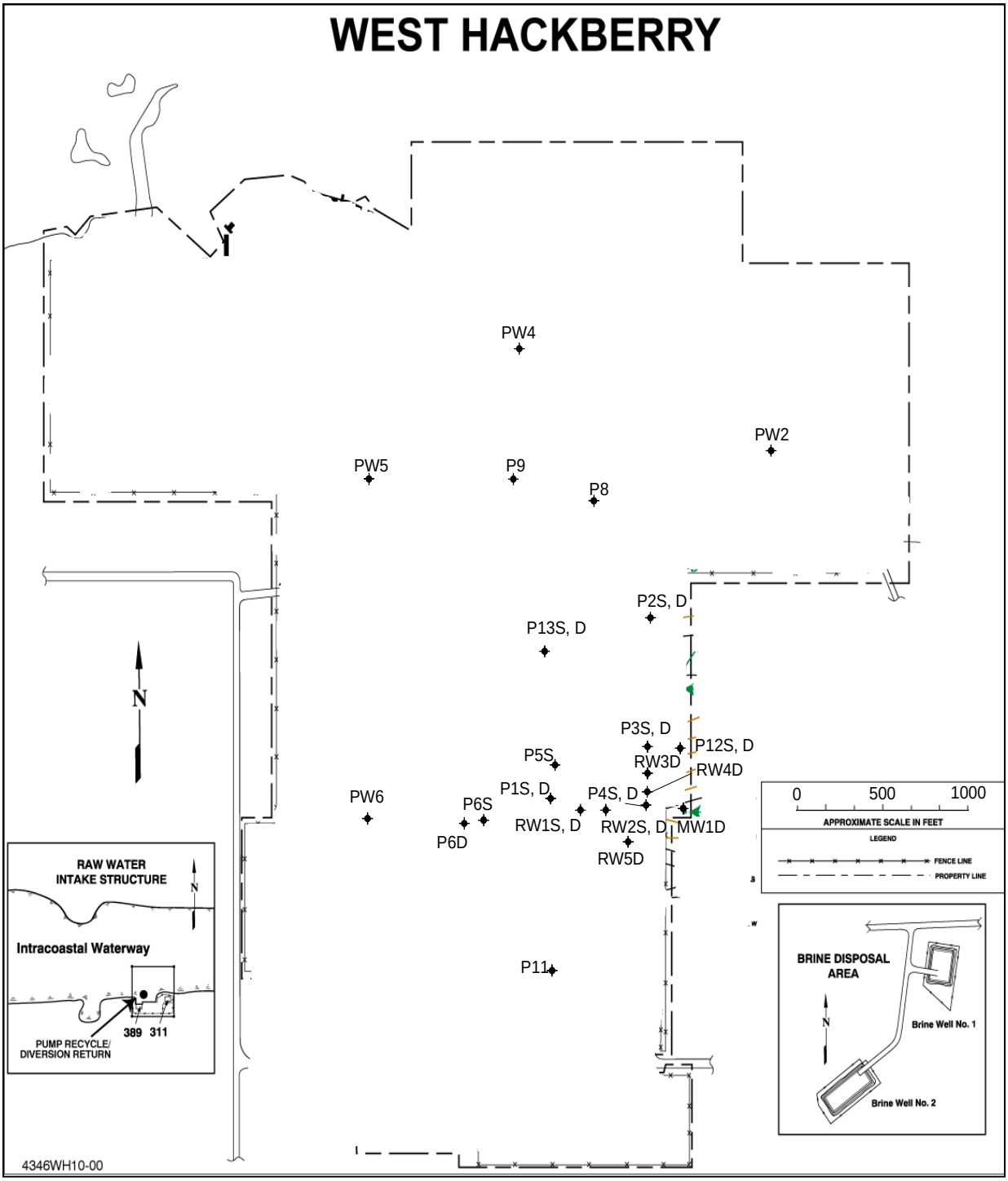


Figure C-11. West Hackberry Ground Water Monitoring Stations, Deep and Shallow

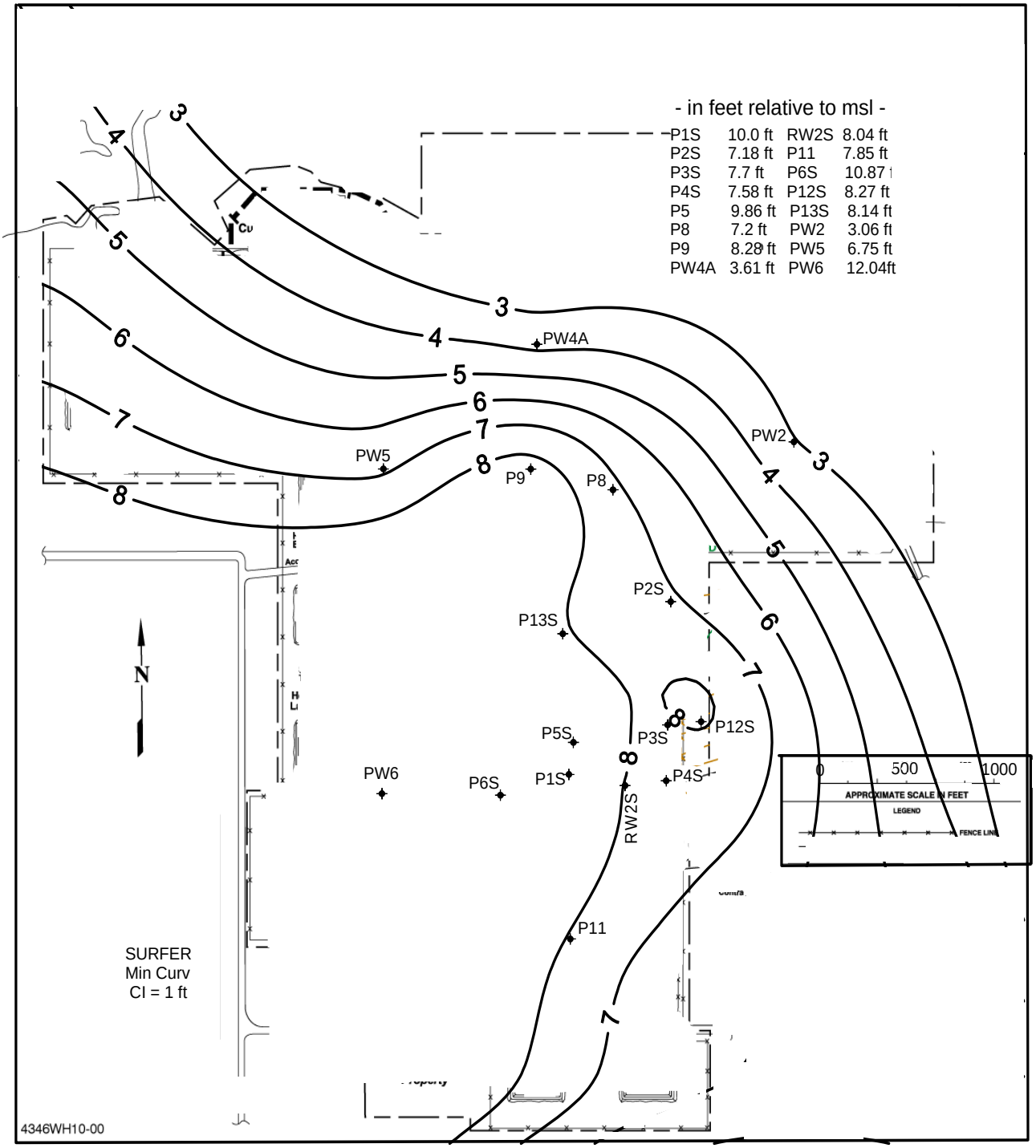


Figure C-12. West Hackberry Shallow Ground Water Zone Contoured Elevations Fall 2016

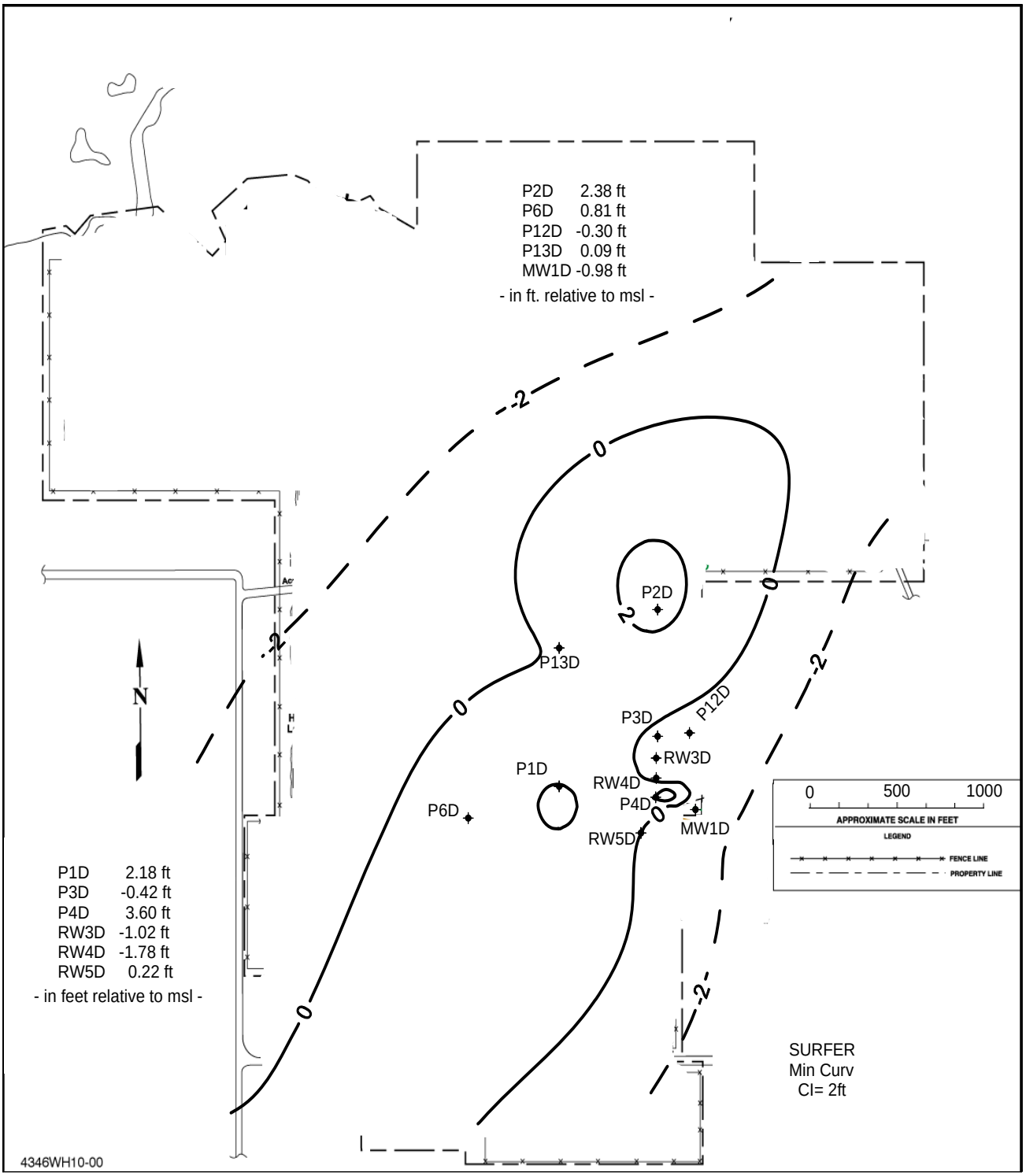


Figure C-13 West Hackberry Deep Ground Water Zone Contoured Elevations Fall 2016

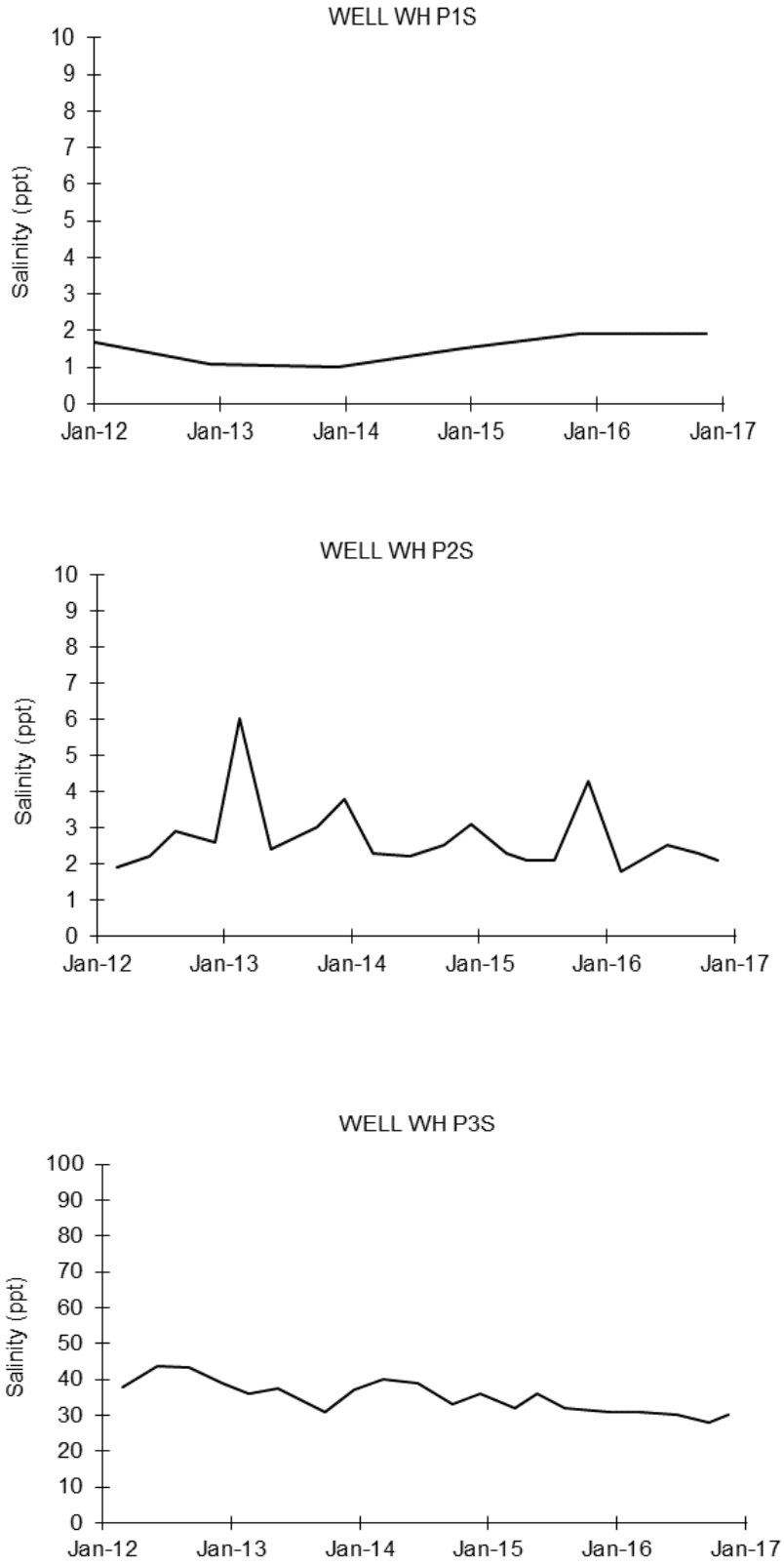
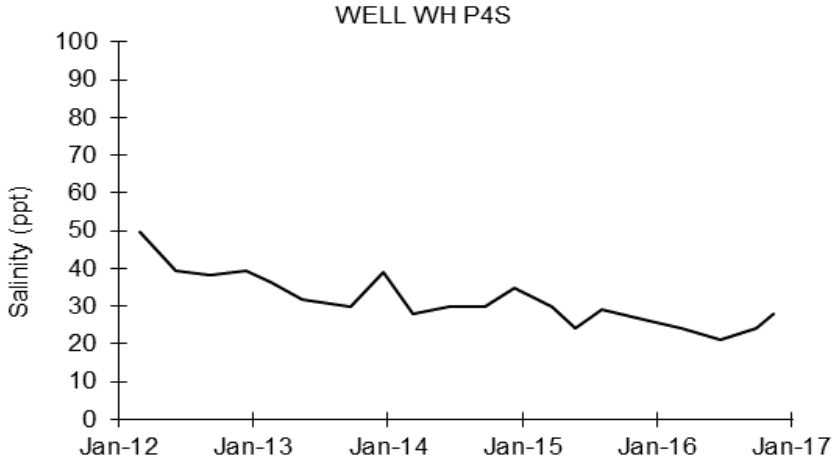
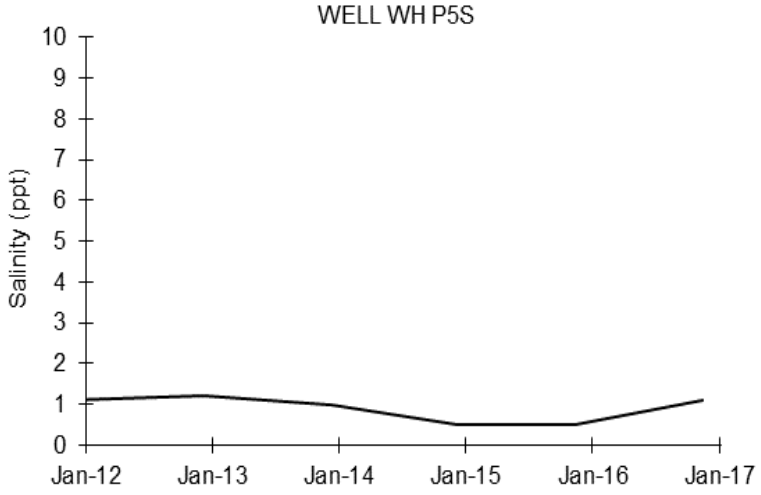


Figure C-14. West Hackberry Ground Water Monitoring Well Salinities





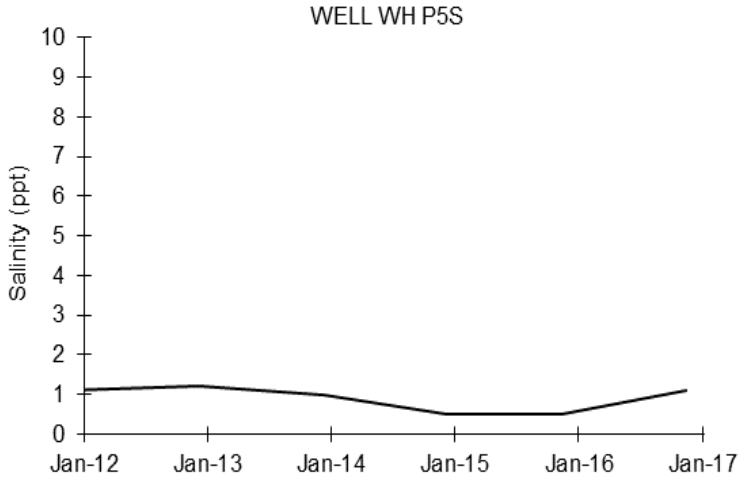
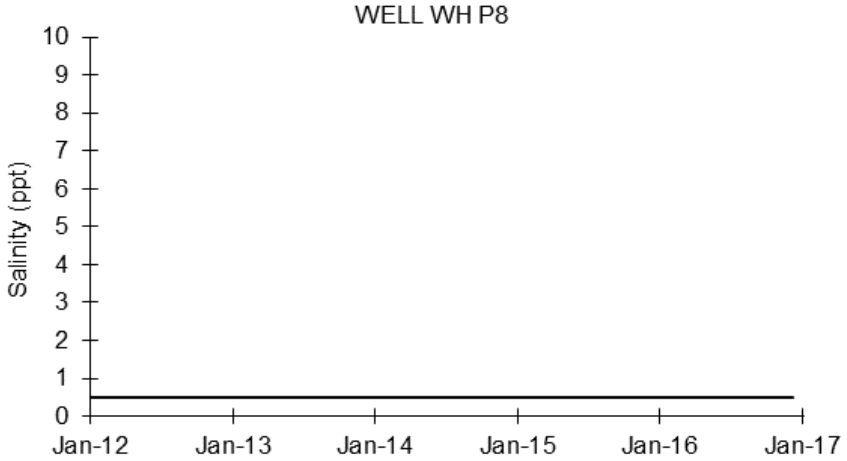
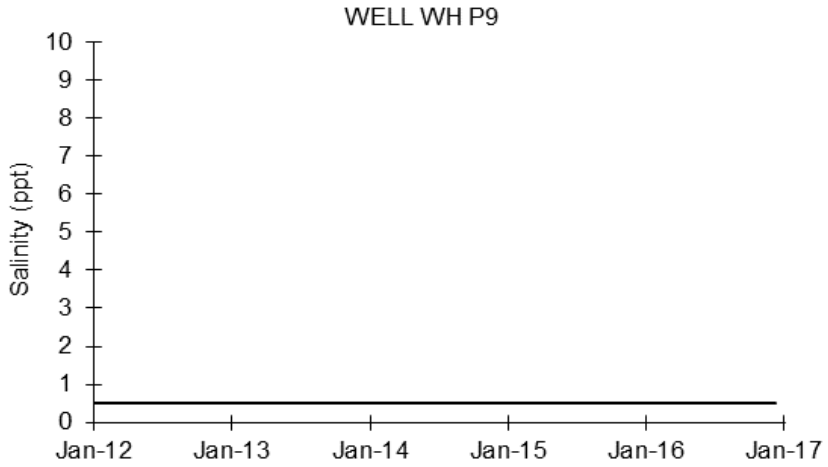


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





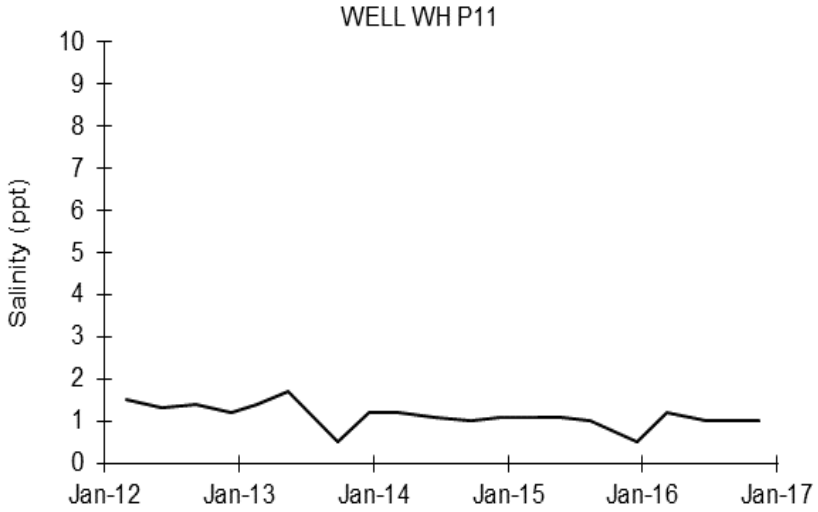
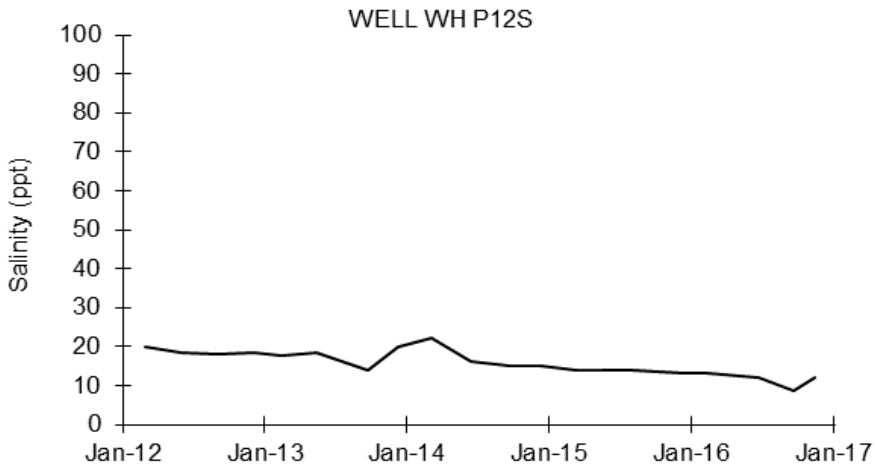
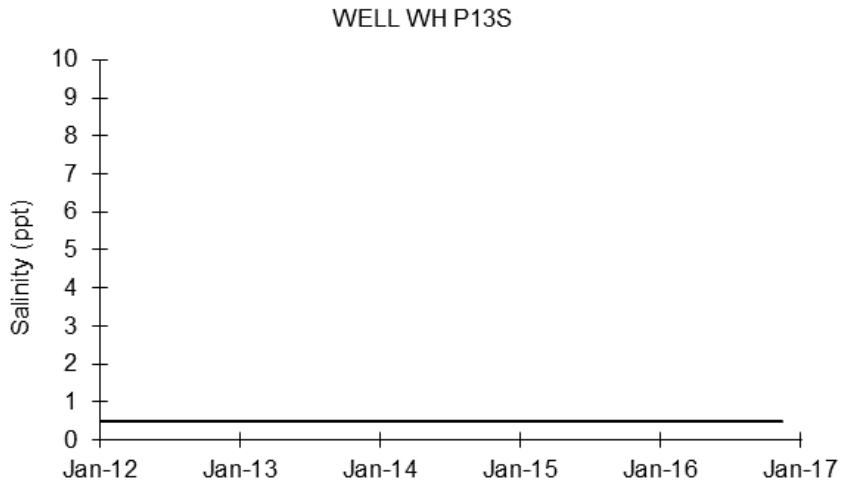


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





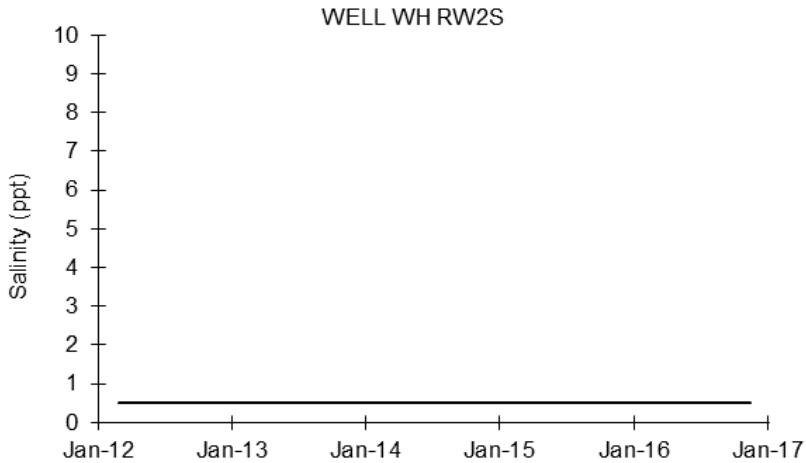
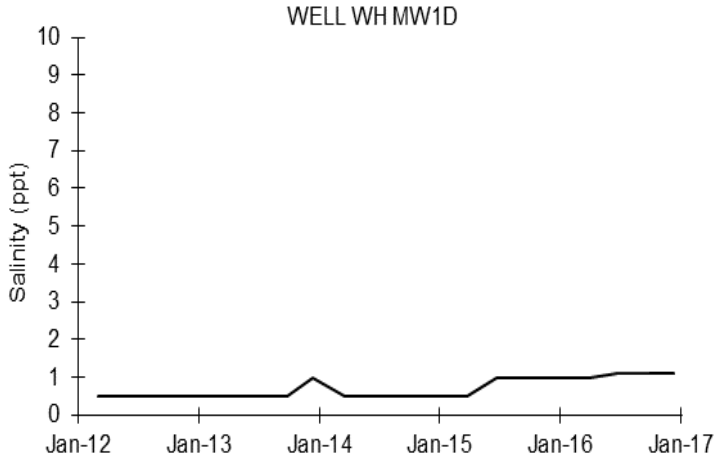
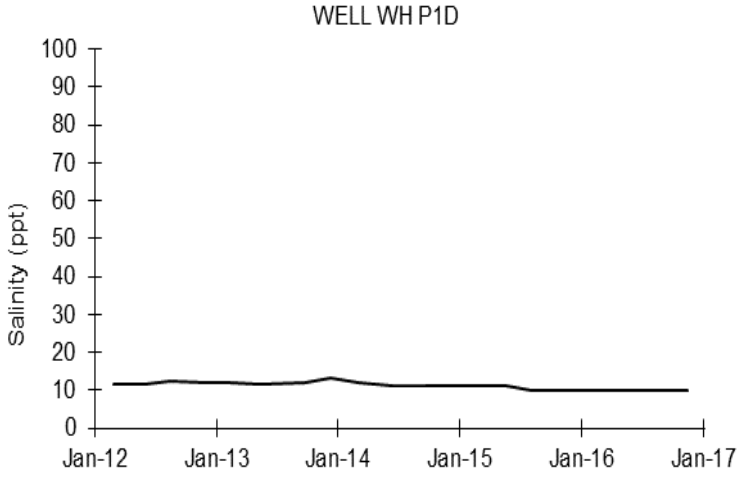


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





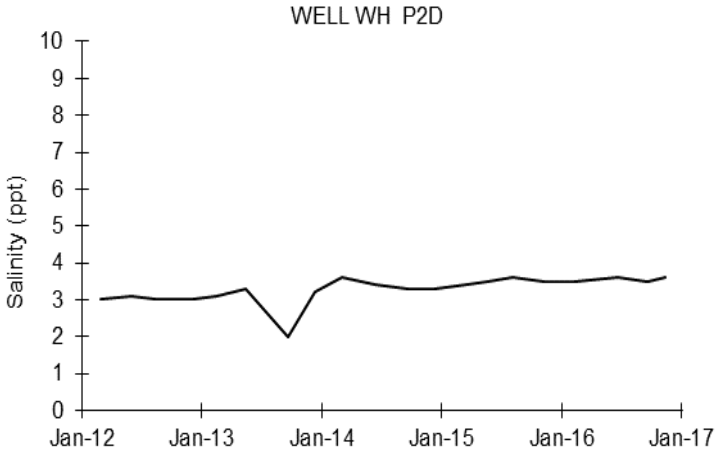
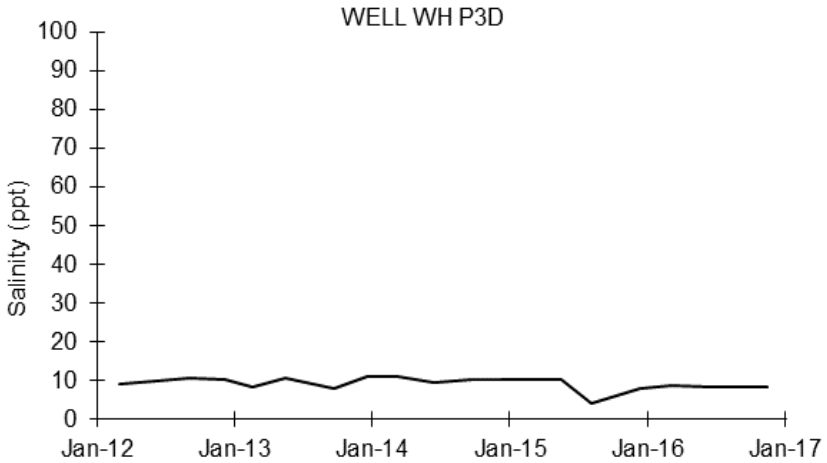
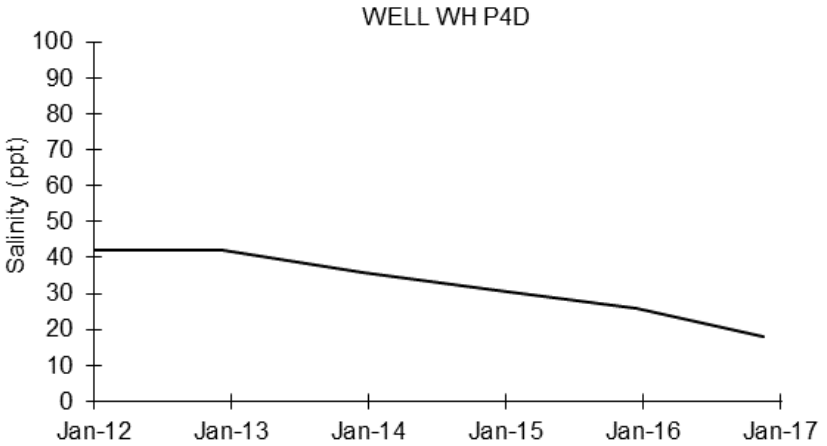


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





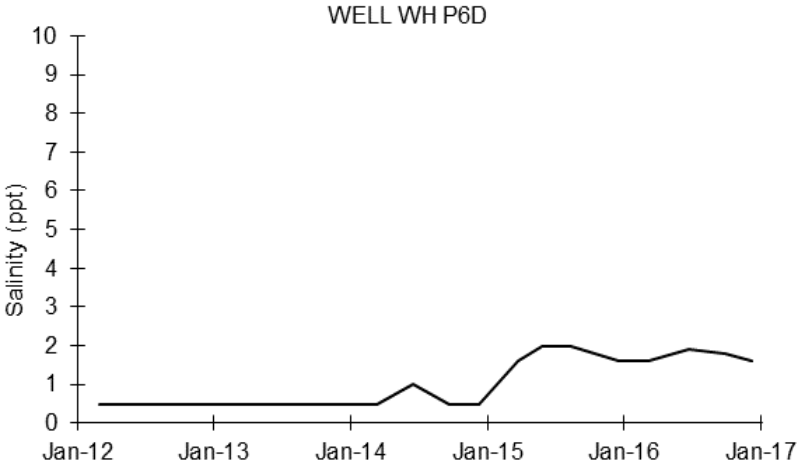
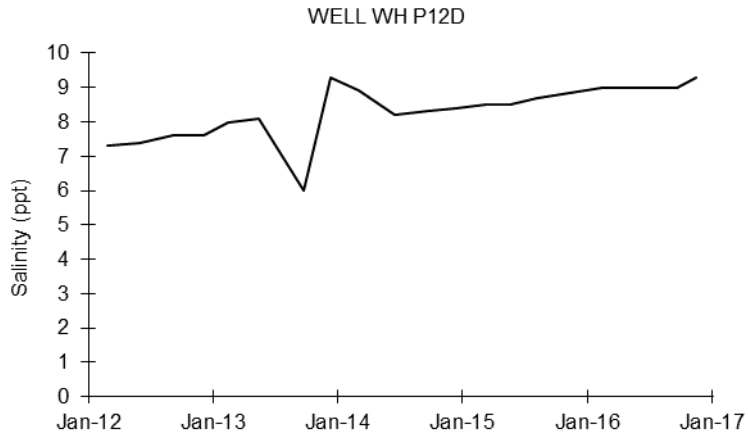
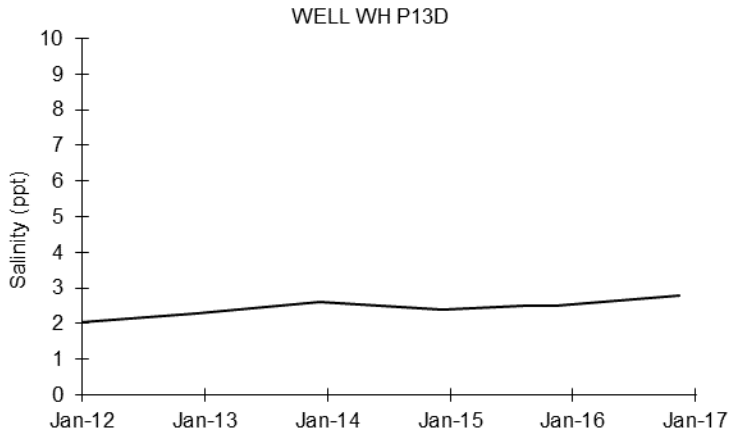


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





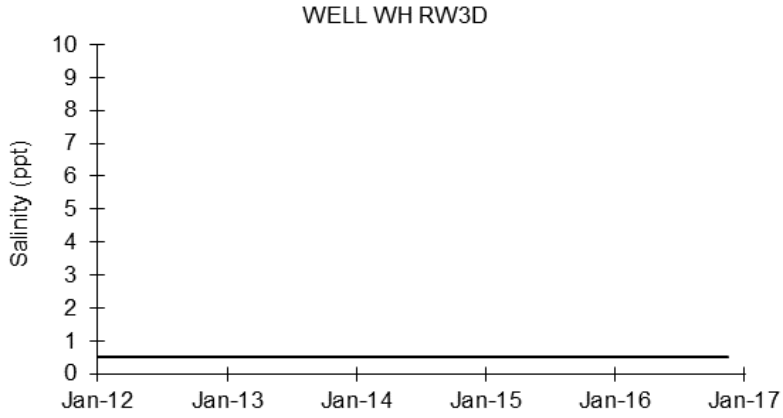
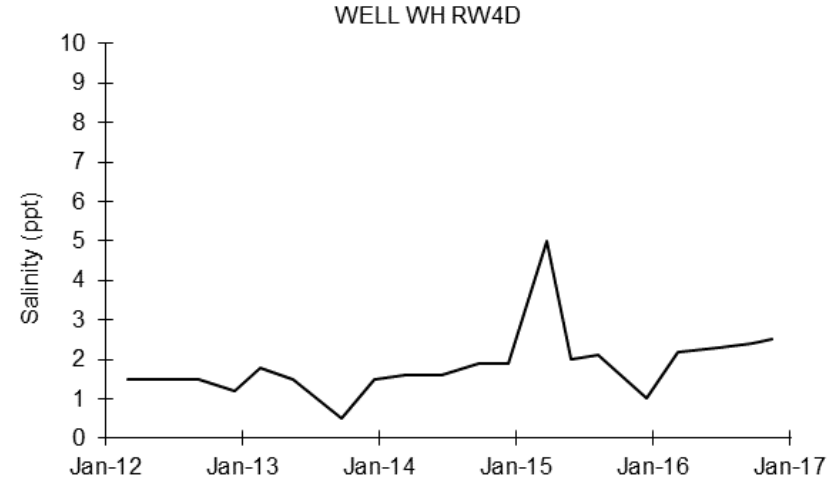
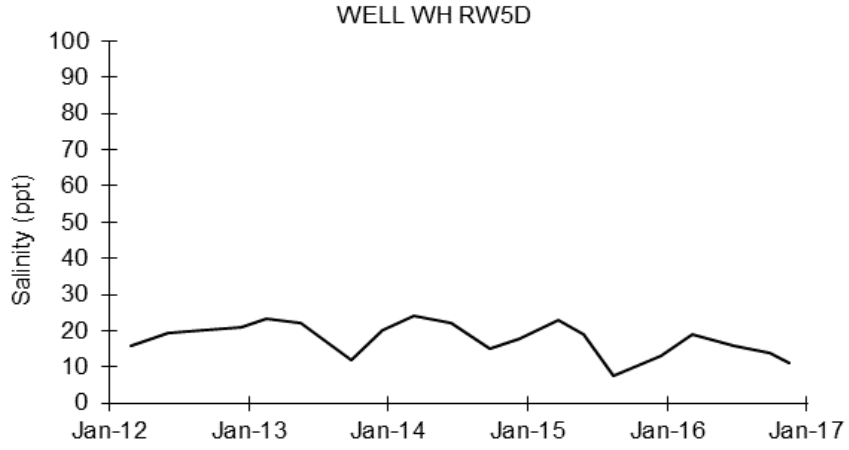


Figure C-14. West Hackberry Ground Water Well Salinities (continued)





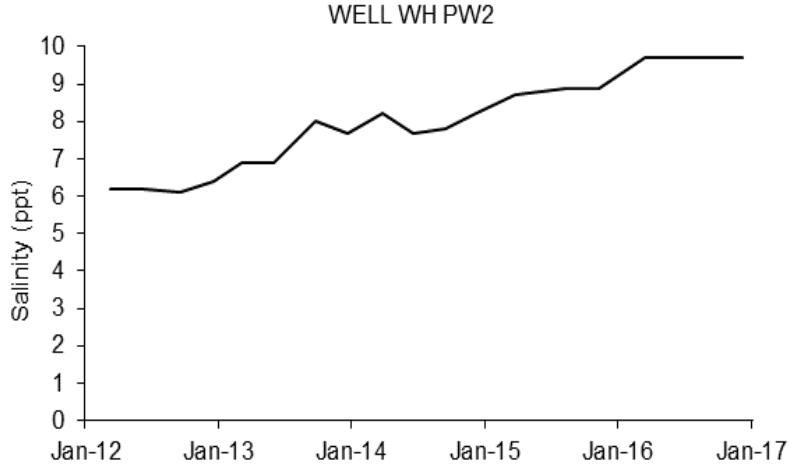


Figure C-14. West Hackberry Ground Water Well Salinities (continued)

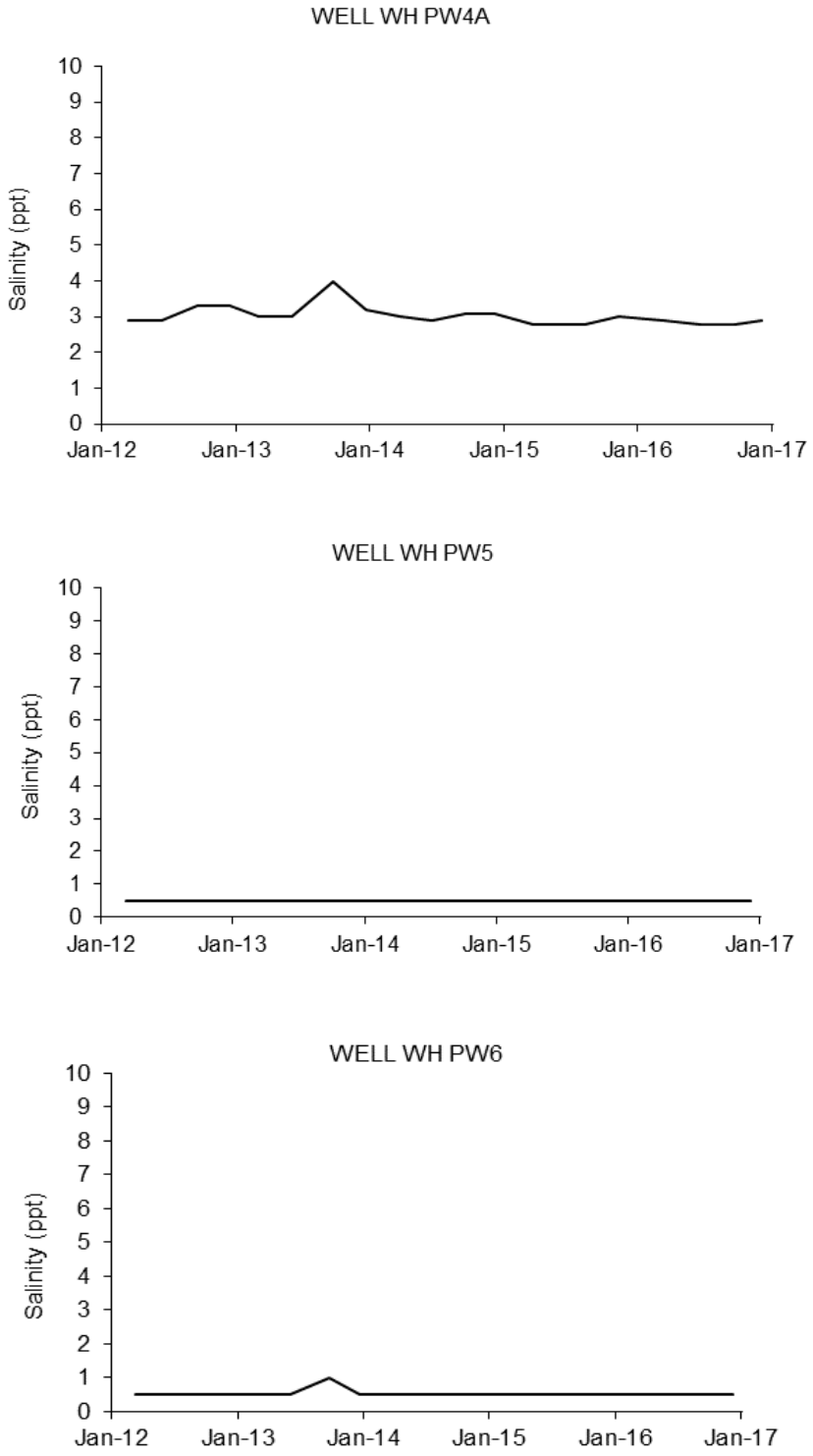
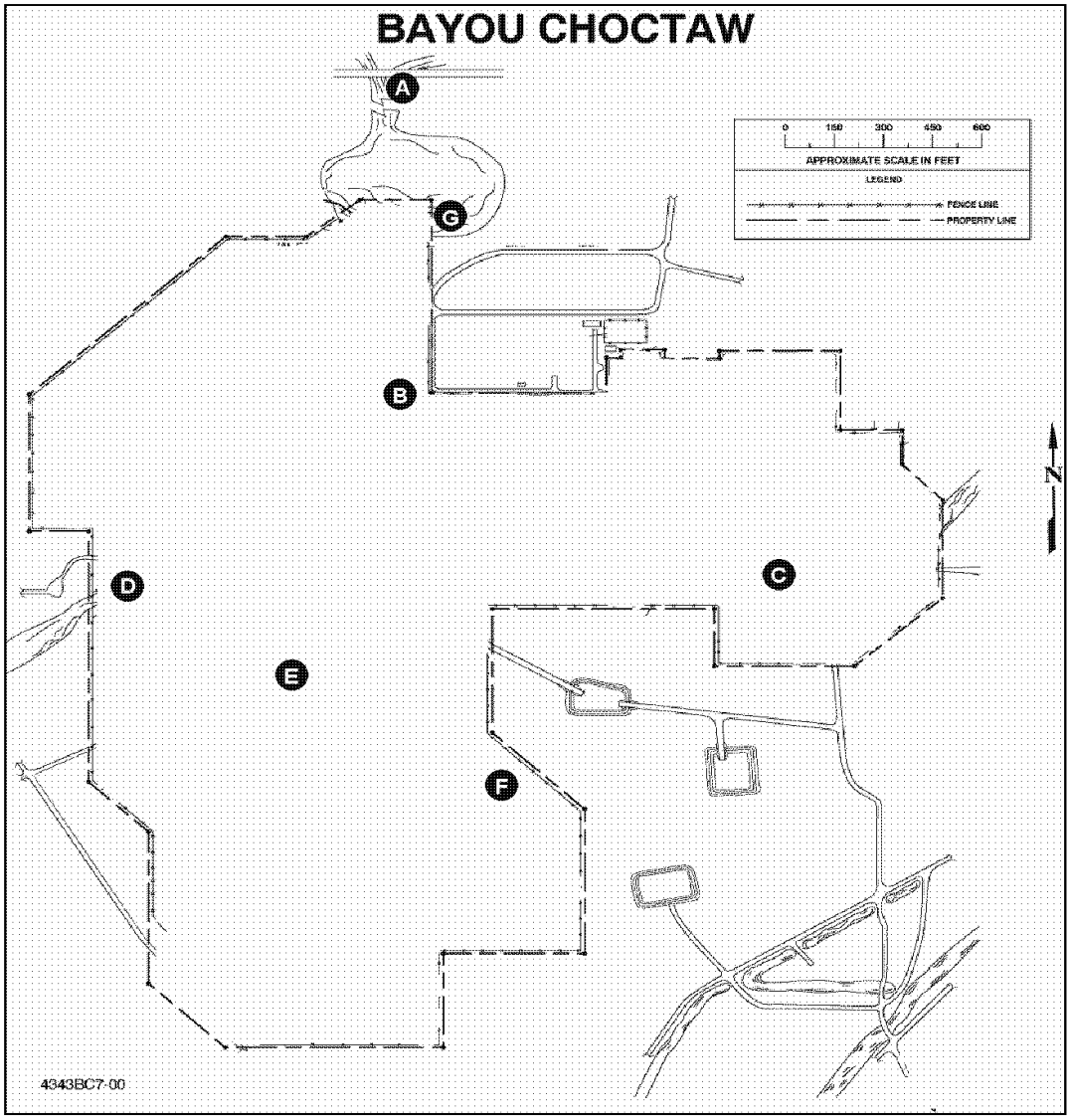


Figure C-14. West Hackberry Ground Water Well Salinities (continued)

End of Appendix

Appendix D

SURFACE WATER QUALITY SURVEILLANCE MONITORING DURING 2016



Water Quality Monitoring Stations

A	Canal north of Cavern Lake at perimeter road bridge
B	Ditch running under the road to warehouse on West side of the road in area of heat exchangers.
C	East-West Canal at Intersection of road to brine disposal wells
D	East-West Canal
E	Wetland Area
F	Wetland Area
G	Near Raw Water Intake

Figure D-1. Bayou Choctaw Environmental Monitoring Stations

8.1.1.1.1 Table D-1. 2016 Data Summary for Bayou Choctaw Monitoring Stations

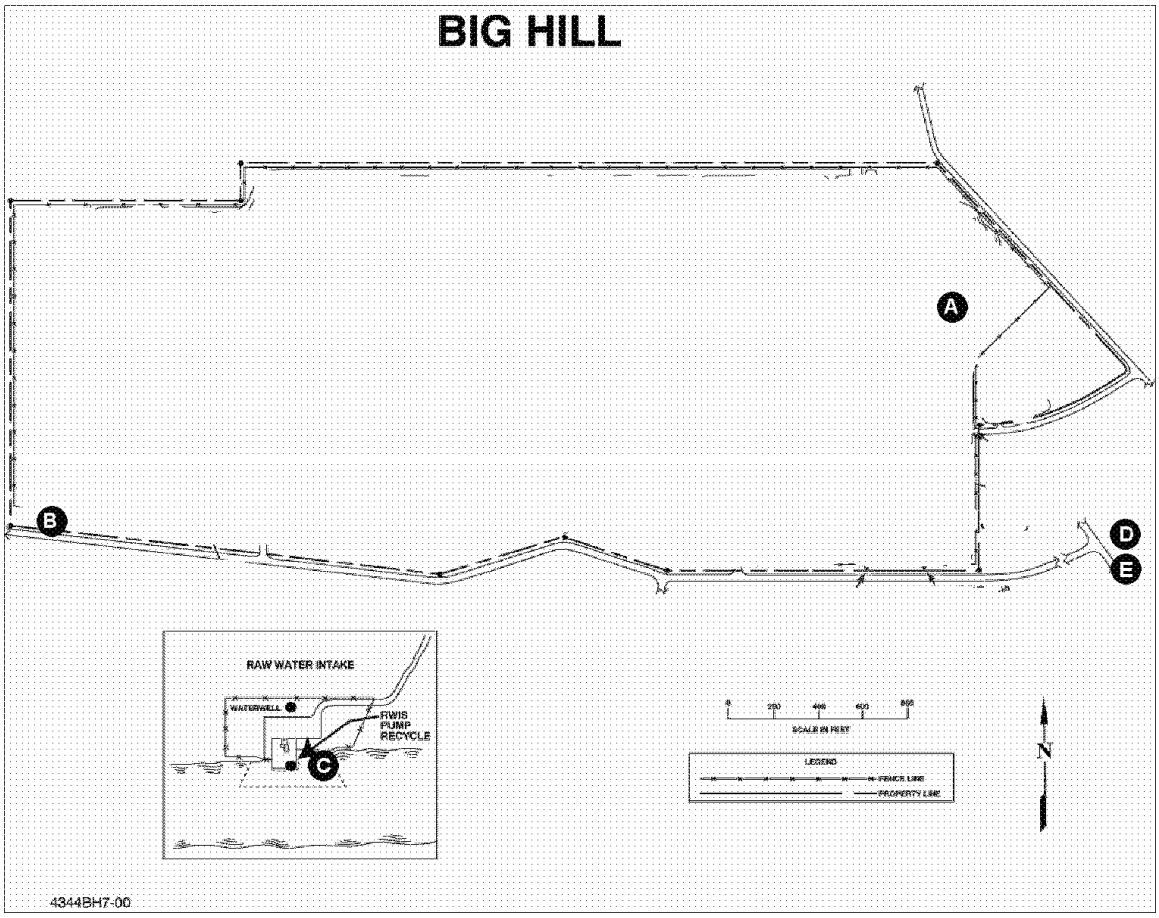
Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
A	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	11	NV	0
	Maximum	13.8	2.5	8.0	4.0	31.3	40.9
	Minimum	1.4	2.5	7.1	0.5	12.5	20.0
	Mean	5.5	2.5	NV	0.8	21.7	26.4
	Median	3.6	2.5	7.6	0.5	22.8	24.6
	Standard Deviation	4.2	0.0	NV	1.0	6.1	5.7
	Coefficient of Variation	76.4	0.0	NV	125.0	28.1	21.6
B	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	11	NV	0
	Maximum	10.6	2.5	8.4	4.0	29.6	87.3
	Minimum	1.2	2.5	7.0	0.5	6.7	18.2
	Mean	5.5	2.5	NV	0.8	21.1	51.2
	Median	5.1	2.5	7.7	0.5	22.9	42.4
	Standard Deviation	3.1	0.0	NV	1.0	6.4	23.8
	Coefficient of Variation	56.4	0.0	NV	125.0	30.3	46.5
C	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	11	NV	0
	Maximum	9.9	2.5	8.6	5.0	30.2	37.4
	Minimum	1.1	2.5	7.1	0.5	11.5	23.3
	Mean	4.9	2.5	NV	0.9	21.8	29.4
	Median	4.6	2.5	7.5	0.5	23.2	28.9
	Standard Deviation	3.1	0.0	NV	1.3	6.7	4.9
	Coefficient of Variation	63.3	0.0	NV	144.4	30.7	16.7
D	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	11	NV	0
	Maximum	12.6	2.5	8.5	4.0	30.4	36.9
	Minimum	1.2	2.5	7.0	0.5	11.6	19.5
	Mean	4.8	2.5	NV	0.8	22.1	28.1
	Median	4.1	2.5	7.6	0.5	23.1	27.7
	Standard Deviation	3.6	0.0	NV	1.0	6.2	4.9
	Coefficient of Variation	75.0	0.0	NV	125.0	28.1	17.4
E	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	11	NV	0
	Maximum	11.4	2.5	8.6	5.0	28.3	41.7
	Minimum	1.0	2.5	7.0	0.5	8.8	19.4
	Mean	4.7	2.5	NV	0.9	20.9	30.4
	Median	3.5	2.5	7.2	0.5	22.6	29.6
	Standard Deviation	3.5	0.0	NV	1.3	6.9	7.2
	Coefficient of Variation	74.5	0.0	NV	144.4	33.0	23.7

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table D-1. 2016 Data Summary for Bayou Choctaw Monitoring Stations (continued)

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
F	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	10	NV	0
	Maximum	18.3	2.5	8.3	5.0	29.4	45.7
	Minimum	1.2	2.5	6.7	0.5	9.1	20.6
	Mean	6.1	2.5	NV	0.9	20.8	30.3
	Median	6.2	2.5	7.3	0.5	22.6	30.2
	Standard Deviation	5.0	0.0	NV	1.3	7.4	9.3
	Coefficient of Variation	82.0	0.0	NV	144.4	35.6	30.7
G	Sample Size	12	4	12	12	12	12
	Number of BDL	0	3	NV	11	NV	0
	Maximum	12.9	2.5	8.2	5.0	29.8	43.6
	Minimum	1.6	2.5	7.0	0.5	11.4	20.1
	Mean	5.5	2.5	NV	0.9	21.6	26.9
	Median	4.4	2.5	7.5	0.5	23.1	24.6
	Standard Deviation	3.8	0.0	NV	1.3	6.4	6.3
	Coefficient of Variation	69.1	0.0	NV	144.4	29.6	23.4

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.



Water Quality Monitoring Stations

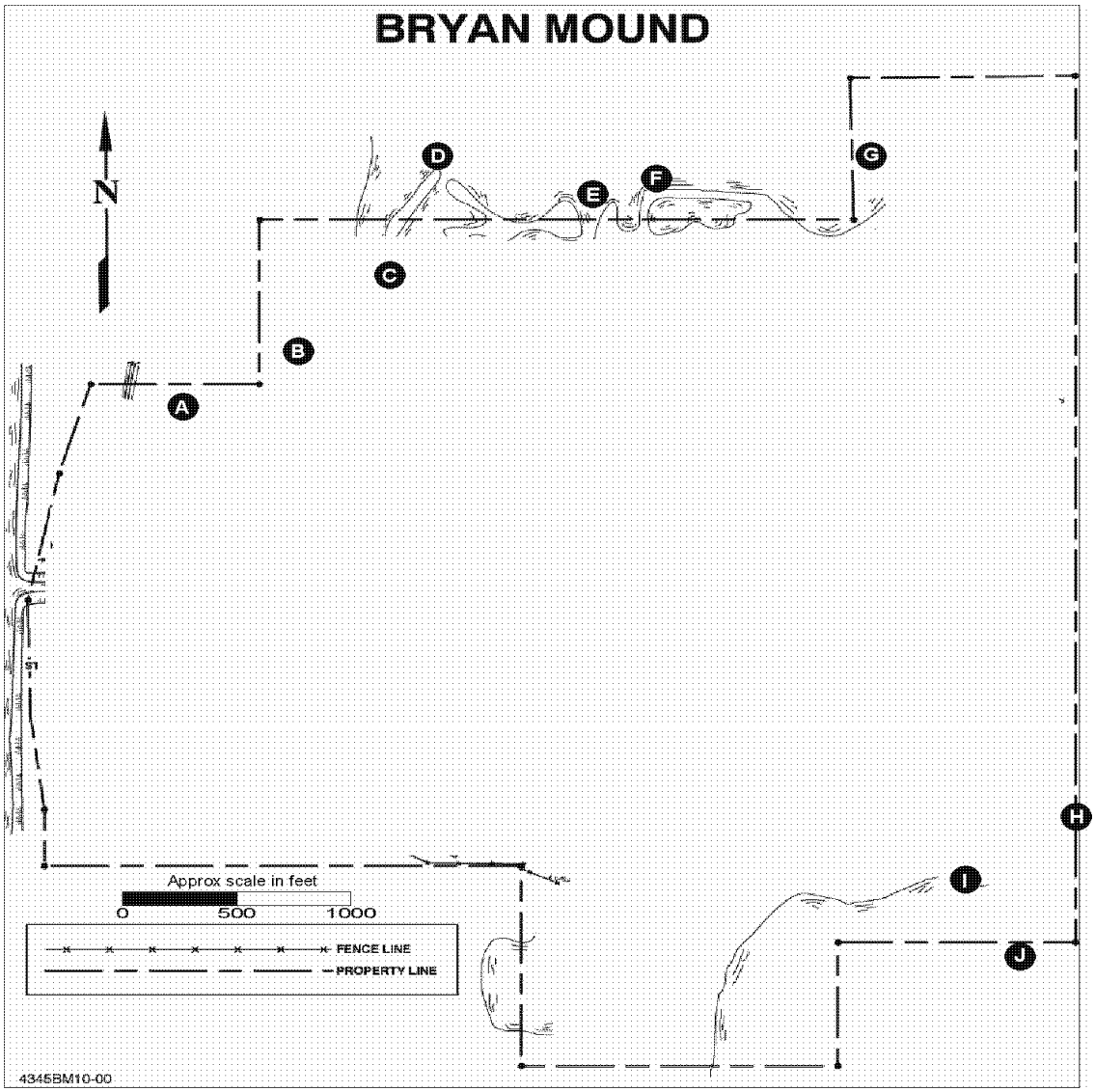
A Pond receiving effluent from site sewage treatment plant (STP)
B Wilbur Road ditch – southwest of site
C RWIS at Intracoastal Waterway
D Pipkin Reservoir – (1.8 Miles from map location)
E Gator Hole – (3.1 Miles from map location)

Figure D-2. Big Hill Environmental Monitoring Stations

Table D-2. 2016 Data Summary for Big Hill Monitoring Stations

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
A	Sample Size	0	0	0	0	0	0
	Number of BDL	ND	ND	ND	ND	ND	ND
	Maximum	ND	ND	ND	ND	ND	ND
	Minimum	ND	ND	ND	ND	ND	ND
	Mean	ND	ND	ND	ND	ND	ND
	Median	ND	ND	ND	ND	ND	ND
	Standard Deviation	ND	ND	ND	ND	ND	ND
	Coefficient of Variation	ND	ND	ND	ND	ND	ND
B	Sample Size	12	4	12	12	12	12
	Number of BDL	1	4	NV	7	NV	0
	Maximum	7.8	2.5	7.3	3.4	31.0	18.6
	Minimum	0.1	2.5	6.6	0.5	13.0	8.7
	Mean	4.3	2.5	NV	1.1	23.8	13.5
	Median	5.9	2.5	7.0	0.5	24.5	14.1
	Standard Deviation	2.7	0.0	NV	0.9	5.7	2.9
	Coefficient of Variation	62.8	0.0	NV	81.8	23.9	21.5
C	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	4	NV	0
	Maximum	8.2	2.5	7.6	16.6	31.0	11.8
	Minimum	3.6	2.5	6.9	0.5	13.0	4.8
	Mean	6.0	2.5	NV	4.4	24.1	8.5
	Median	6.0	2.5	7.3	3.2	24.5	8.9
	Standard Deviation	1.6	0.0	NV	4.8	6.1	2.3
	Coefficient of Variation	26.7	0.0	NV	109.1	25.3	27.1
D	Sample Size	12	4	12	12	12	12
	Number of BDL	1	4	NV	12	NV	0
	Maximum	11.9	2.5	8.4	0.5	31.0	19.0
	Minimum	0.1	2.5	6.4	0.5	14.0	8.2
	Mean	6.3	2.5	NV	0.5	24.3	14.0
	Median	6.9	2.5	6.9	0.5	25.5	14.4
	Standard Deviation	3.7	0.0	NV	0.0	5.0	3.8
	Coefficient of Variation	58.7	0.0	NV	0.0	20.6	27.1
E	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	7	NV	0
	Maximum	12.5	2.5	7.1	2.3	30.0	21.5
	Minimum	0.7	2.5	6.4	0.5	12.0	6.0
	Mean	5.2	2.5	NV	1.0	24.0	13.7
	Median	4.2	2.5	6.6	0.5	25.5	14.1
	Standard Deviation	4.2	0.0	NV	0.6	5.8	4.7
	Coefficient of Variation	80.8	0.0	NV	60.0	24.2	34.3

Note: BDL = Number of samples that were below the detectable limit.
ND = No data, unable to obtain samples for testing
NV = Not a valid number or statistically meaningful.



Water Quality Monitoring Stations

A	Blue Lake
B	Blue Lake
C	Blue Lake
D	Blue Lake – Control Point 1
E	Blue Lake
F	Blue Lake
G	Blue Lake
H	Mud Lake
I	Mud Lake
J	Mud Lake – Control Point 2

Figure D-3. Bryan Mound Environmental Monitoring Stations

8.1.1.1.2 Table D-3. 2016 Data Summary for Bryan Mound Monitoring Stations

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
A	Sample Size	12	4	12	12	12	12
	Number of BDL	0	3	NV	1	NV	0
	Maximum	12.3	8.5	7.8	4.6	28.1	47.5
	Minimum	3.4	2.5	6.5	0.6	14.2	15.1
	Mean	7.3	4.0	NV	2.5	22.3	24.1
	Median	6.6	2.5	7.2	2.4	23.4	21.8
	Standard Deviation	2.7	3.0	NV	1.4	4.8	8.4
	Coefficient of Variation	37.0	75.0	NV	56.0	21.5	34.9
B	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	1	NV	0
	Maximum	12.8	2.5	8.0	4.6	28.1	44.3
	Minimum	3.5	2.5	6.6	0.6	14.2	12.2
	Mean	7.4	2.5	NV	2.5	22.3	22.8
	Median	6.8	2.5	7.4	2.4	23.4	21.0
	Standard Deviation	2.7	0.0	NV	1.4	4.7	8.1
	Coefficient of Variation	36.5	0.0	NV	56.0	21.1	35.5
C	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	1	NV	0
	Maximum	12.8	2.5	8.8	4.6	28.1	45.0
	Minimum	3.5	2.5	6.2	0.6	14.3	17.1
	Mean	7.4	2.5	NV	2.5	22.3	23.7
	Median	6.7	2.5	7.4	2.4	23.4	21.7
	Standard Deviation	2.9	0.0	NV	1.4	4.7	7.3
	Coefficient of Variation	39.2	0.0	NV	56.0	21.1	30.8
D	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	1	NV	0
	Maximum	12.1	2.5	8.3	4.6	28.2	42.9
	Minimum	4.0	2.5	7.0	0.6	14.2	12.1
	Mean	7.1	2.5	NV	2.5	22.3	21.8
	Median	6.1	2.5	7.2	2.4	23.4	20.3
	Standard Deviation	2.6	0.0	NV	1.4	4.8	7.6
	Coefficient of Variation	36.6	0.0	NV	56.0	21.5	34.9
E	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	0	NV	0
	Maximum	12.2	2.5	8.1	4.6	28.1	39.6
	Minimum	3.9	2.5	6.5	0.6	14.3	11.8
	Mean	7.3	2.5	NV	2.5	22.3	21.4
	Median	6.4	2.5	7.7	2.4	23.4	21.1
	Standard Deviation	2.6	0.0	NV	1.4	4.7	6.9
	Coefficient of Variation	35.6	0.0	NV	56.0	21.1	32.2

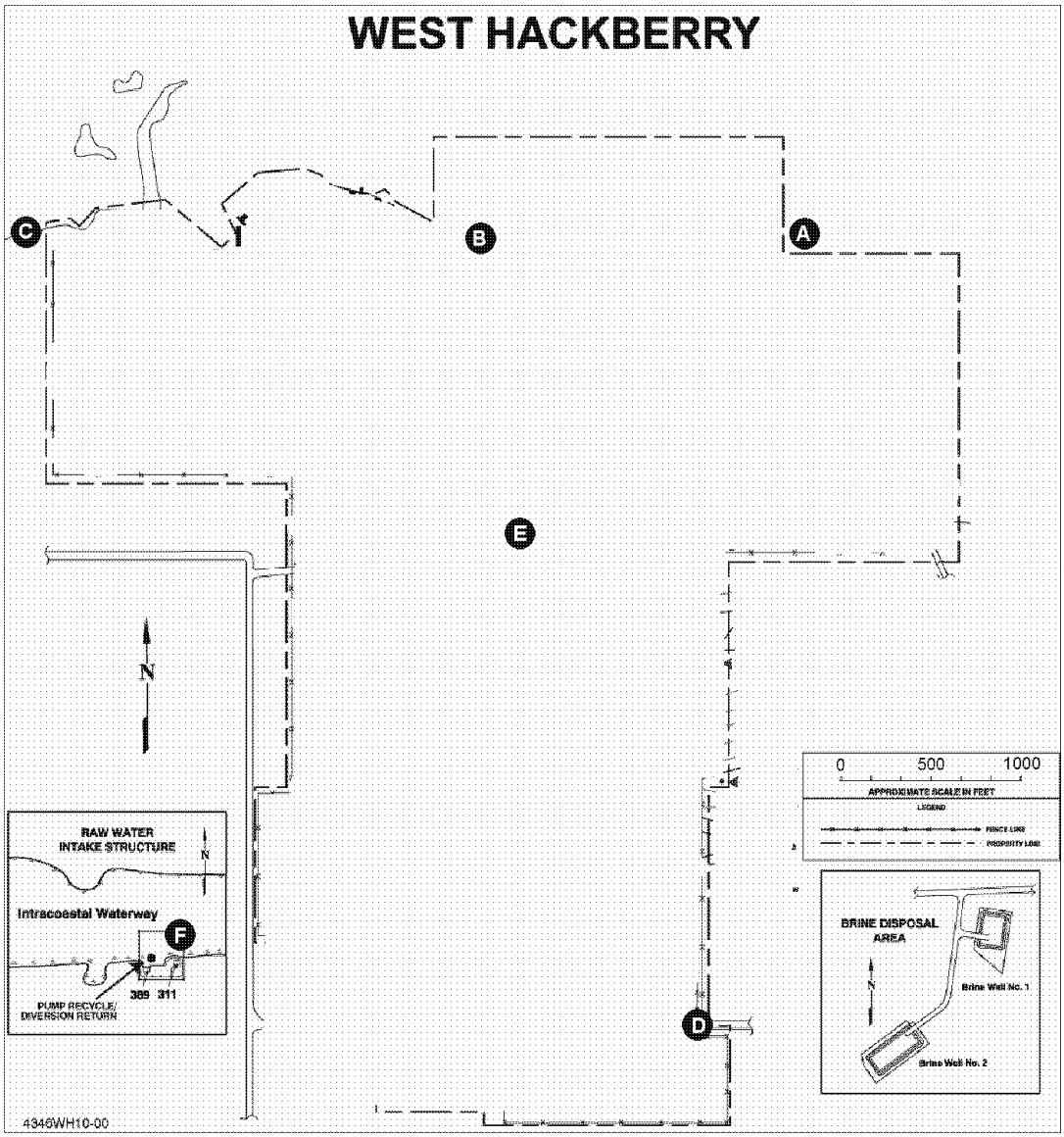
8.1.1.1.3

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table D-3. 2016 Data Summary for Bryan Mound Monitoring Stations (continued)

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
F	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	1	NV	0
	Maximum	12.1	2.5	8.0	4.6	28.2	40.2
	Minimum	3.7	2.5	6.9	0.6	14.2	14.2
	Mean	7.4	2.5	NV	2.5	22.3	21.5
	Median	6.7	2.5	7.5	2.4	23.4	20.1
	Standard Deviation	2.6	0.0	NV	1.4	4.8	6.7
	Coefficient of Variation	35.1	0.0	NV	56.0	21.5	31.2
G	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	1	NV	0
	Maximum	12.4	2.5	7.7	4.6	28.1	37.6
	Minimum	3.5	2.5	7.1	0.6	14.3	14.9
	Mean	7.8	2.5	NV	2.5	22.3	21.0
	Median	7.7	2.5	7.4	2.4	23.4	19.5
	Standard Deviation	2.9	0.0	NV	1.4	4.7	6.1
	Coefficient of Variation	37.2	0.0	NV	56.0	21.1	29.0
H	Sample Size	11	4	11	11	11	11
	Number of BDL	0	4	NV	1	NV	0
	Maximum	13.6	2.5	7.9	13.6	28.3	40.2
	Minimum	8.7	2.5	6.5	0.8	14.6	11.6
	Mean	11.2	2.5	NV	5.3	22.6	23.8
	Median	11.3	2.5	6.9	3.1	22.6	23.8
	Standard Deviation	1.7	0.0	NV	4.8	3.9	7.7
	Coefficient of Variation	15.2	0.0	NV	90.6	17.3	32.4
I	Sample Size	11	4	11	11	11	11
	Number of BDL	0	4	NV	1	NV	0
	Maximum	14.0	2.5	8.0	13.6	28.3	39.4
	Minimum	8.5	2.5	6.4	0.8	14.6	9.9
	Mean	11.3	2.5	NV	5.3	22.6	23.6
	Median	11.3	2.5	6.9	3.1	22.6	25.0
	Standard Deviation	2.0	0.0	NV	4.8	3.9	8.1
	Coefficient of Variation	17.7	0.0	NV	90.6	17.3	34.3
J	Sample Size	11	4	11	11	11	11
	Number of BDL	0	4	NV	1	NV	0
	Maximum	14.6	2.5	7.9	13.6	28.4	36.4
	Minimum	8.4	2.5	6.5	0.8	7.9	11.0
	Mean	11.0	2.5	NV	5.3	21.3	23.1
	Median	11.2	2.5	6.9	3.1	22.6	24.0
	Standard Deviation	2.0	0.0	NV	4.8	6.0	7.4
	Coefficient of Variation	18.2	0.0	NV	90.6	28.2	32.0

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.



Water Quality Monitoring Stations

A Black Lake
B Black Lake
C Black Lake
D Southeast drainage ditch
E High-pressure pump pad
F Raw water intake structure (Intracoastal Waterway)

Figure D-4. West Hackberry Environmental Monitoring Stations

Table D-4. 2016 Data Summary for West Hackberry Monitoring Stations

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
A	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	0	NV	0
	Maximum	12.3	2.5	8.2	12.0	34.0	8.7
	Minimum	6.0	2.5	7.4	2.5	10.0	6.5
	Mean	8.4	2.5	NV	5.9	23.4	7.5
	Median	7.8	2.5	7.9	4.7	24.5	7.3
	Standard Deviation	2.1	0.0	NV	3.2	7.2	0.8
	Coefficient of Variation	25.0	0.0	NV	54.2	30.8	10.7
B	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	0	NV	0
	Maximum	12.8	2.5	8.2	12.0	34.0	8.9
	Minimum	6.3	2.5	7.5	2.6	10.0	6.5
	Mean	8.4	2.5	NV	5.7	23.3	7.6
	Median	7.7	2.5	7.9	4.6	24.5	7.5
	Standard Deviation	2.1	0.0	NV	3.1	7.3	0.8
	Coefficient of Variation	25.0	0.0	NV	54.4	31.3	10.5
C	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	0	NV	0
	Maximum	14.9	2.5	8.1	12.0	34.0	8.8
	Minimum	6.2	2.5	7.6	2.5	11.0	6.4
	Mean	8.6	2.5	NV	5.6	23.8	7.6
	Median	7.7	2.5	7.8	4.6	24.5	7.5
	Standard Deviation	2.6	0.0	NV	3.0	7.0	0.8
	Coefficient of Variation	30.2	0.0	NV	53.6	29.4	10.5
D	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	12	NV	0
	Maximum	13.4	2.5	8.2	0.5	30.0	14.0
	Minimum	5.2	2.5	7.4	0.5	13.0	3.6
	Mean	8.1	2.5	NV	0.5	23.5	6.1
	Median	7.3	2.5	7.7	0.5	23.0	5.0
	Standard Deviation	2.5	0.0	NV	0.0	6.2	3.0
	Coefficient of Variation	30.9	0.0	NV	0.0	26.4	49.2

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table D-4. 2016 Data Summary for West Hackberry Monitoring Stations (continued)

Station	Statistical Parameters	Dissolved Oxygen (mg/L)	Oil & Grease (mg/L)	pH (s.u.)	Salinity (ppt)	Temperature (°C)	Total Organic Carbon (mg/L)
E	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	12	NV	0
	Maximum	12.9	2.5	8.2	0.5	30.0	8.6
	Minimum	4.6	2.5	7.5	0.5	14.0	2.4
	Mean	8.1	2.5	NV	0.5	23.0	4.1
	Median	7.5	2.5	7.9	0.5	23.0	3.5
	Standard Deviation	2.6	0.0	NV	0.0	6.0	1.8
	Coefficient of Variation	32.1	0.0	NV	0.0	26.1	43.9
F	Sample Size	12	4	12	12	12	12
	Number of BDL	0	4	NV	6	NV	0
	Maximum	12.7	2.5	7.6	9.4	32.0	10.4
	Minimum	4.7	2.5	6.5	0.5	11.0	6.6
	Mean	7.5	2.5	NV	3.0	23.3	8.2
	Median	6.7	2.5	7.3	1.2	24.5	8.3
	Standard Deviation	2.4	0.0	NV	3.1	6.7	1.1
	Coefficient of Variation	32.0	0.0	NV	103.3	28.8	13.4

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

End of Appendix

REFERENCES

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Standard Methods for the Examination of Water and Wastewater. Washington, D.C.: American Public Health Association.

Fluor Federal Petroleum Operations (FFPO) Continuity of Operations Implementation Plan, AAA9020.158

. Emergency Response Procedures. All sites: BCI5500.3, Bayou Choctaw; BHI5500.4, Big Hill; BMI5500.5, Bryan Mound, WHI5500.9, West Hackberry, AAA9020.159 New Orleans and AAA9020.160 Stennis.

ISO 14001 Environmental Management Systems Manual. ASI5400.55.

Laboratory Programs and Procedures Manual, MSI7000.133.

Pollution Prevention Plan, ASL5400.41.

. Spill Prevention Control and Countermeasures Plans. All sites: BCL5400.16, Bayou Choctaw; BHL5400.21, Big Hill; BML5400.17, Bryan Mound; WHL5400.20, West Hackberry.

SPR Environmental Monitoring Plan, ASL5400.57.

Faust, S. D., & Osman M. A.. Chemistry of Natural Waters. Ann Arbor: Ann Arbor Science Publishers, 1981.

Geraghty & Miller, Inc. Environmental Services. Contamination Assessment Report and Remedial Alternatives Analysis, Strategic Petroleum Reserve, West Hackberry, Louisiana. April 12, 1991.

Louisiana Office of Water Resources. State of Louisiana Water Quality Standards.

Oilfield Testers & Equipment Co., Contract S01M-035687. NORM Survey. March 25, 1991.

Reid, George K. and Richard D. Wood. Ecology of Inland Waters and Estuaries. New York: D. Van Nostrand Company.

Sandia National Laboratories. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Bryan Mound Salt Dome. SAND80-7111. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Weeks Island Salt Dome. SAND80-1323. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report West Hackberry Salt Dome. SAND80-7131. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Bayou Choctaw Salt Dome. SAND80-7140. December 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Big Hill Salt Dome. SAND81-1045. September 1981; available from National Technical Information Service.

Texas Department of Water Resources. Texas Surface Water Quality Standards.

Texas Water Commission. Spill Response Map Series Coastal Region and Support Data, LP90-09, August 1989.

U. S. Department of Energy. Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana. July, 1994. U.S. Department of Energy.

_____. Environmental Assessment and Finding of No Significant Impact to Address the Proposed Site Modifications at the Strategic Petroleum Reserve's West Hackberry Raw Water Intake Structure Site, Cameron Parish, Louisiana. November 10, 2005.

_____. FY 1997 - FY 2001 Strategic Petroleum Reserve Project Management Office Environmental, Safety and Health Management Plan. May 25, 1995. U. S. Department of Energy.

_____. Environmental Assessment on the Leasing of the Strategic Petroleum Reserve St. James Terminal. January, 1995. U.S. Department of Energy.

_____. Environmental Assessment on the Leasing of the Strategic Petroleum Reserve Weeks Island Facility. December, 1995. U.S. Department of Energy.

_____. Finding of No Significant Impact for Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana. September, 1994. U.S. Department of Energy.

_____. Final Environmental Impact Statement, Strategic Petroleum Reserve, Seaway Group Salt Domes. 3 vols. June 1978; available from National Technical Information Service.

_____. Final Environmental Impact Statement, Strategic Petroleum Reserve, Capline Group Salt Domes. 4 vols. July 1978; available from National Technical Information Service.

_____. Final Environmental Impact Statement, Strategic Petroleum Reserve, Texoma Group Salt Domes. 5 vols. November 1978; available from National Technical Information Service.

_____. Final Environmental Impact Statement, Site Selection for the Expansion of the Strategic Petroleum Reserve. 2 volumes. December 2006, available from National Technical Information Service.

_____. Final Supplement to Final Environmental Impact Statement, Strategic Petroleum Reserve, Phase III Development, Texoma and Seaway Group Salt Domes. October 1981; available from National Technical Information Service.

_____. Strategic Petroleum Reserve, Environmental Monitoring Plan. U. S. Department of Energy.

U. S. Environmental Protection Agency. Quality Criteria for Water; available from U.S. Government Printing Office.

_____. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019; Cincinnati, Ohio: Office of Research and Development.

_____. Compilation of Air Pollutant Emission Factors, Supplement No. 12. April 1981; Research Triangle Park, N.C.: Office of Air Quality Planning and Standards.

_____. Methods for Chemical Analysis of Water and Wastes EPA-600/4-79-020. Cincinnati, Ohio: Office of Research and Development.

. Air Pollution Engineering Manual. Method AP-42; Research Triangle Park, N.C.: Office of Air Quality Planning and Standards.

End of References

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End of Site Environmental Report