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APPENDIX A

ENABLING LEGISLATION FOR BIG THICKET NATIONAL PRESERVE

PUBLIC LAW 93-439,
As amended by: P.L. 94-578, P.L. 98-489, and P.L. 103-46

An Act to authorize the establishment of the Big Thicket National Preserve in the State of Texas, and for other purposes. (88 Stat. 1254) (P.L. 93-439)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) in order to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the State of Texas and to provide for the enhancement and public enjoyment thereof, the Big Thicket National Preserve is hereby established.

(b) The Big Thicket National Preserve (hereafter referred to as the "preserve") shall include the units generally depicted on the map numbered NBR-BT 91,027 which shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior, Washington, District of Columbia, and shall be filed with appropriate offices of Tyler, Hardin, Jasper, Polk, Liberty, Jefferson, and Orange Counties in the State of Texas. The Secretary of the Interior (hereinafter referred to as the "Secretary") shall, as soon as practicable, but no later than six months after the date of enactment of this Act, publish a detailed description of the boundaries of the preserve in the Federal Register. In establishing such boundaries, the Secretary shall locate stream corridor unit boundaries referenced from the stream bank on each side thereof and he shall further make every reasonable effort to exclude from the units hereafter described any improved year-round residential properties which he determines, in his discretion, are not necessary for the protection of the values of the area or for its proper administration. The preserve shall consist of the following units:

Big Sandy Creek unit, Polk County, Texas, comprising approximately fourteen thousand three hundred acres;

Menard Creek Corridor unit, Polk, Hardin, and Liberty Counties, Texas, including a module at its confluence with the Trinity River, comprising approximately three thousand three hundred and fifty-nine acres;

Hickory Creek Savannah unit, Tyler County, Texas, comprising approximately six hundred and sixty-eight acres;

Turkey Creek unit, Tyler and Hardin Counties, Texas, comprising approximately seven thousand eight hundred acres;

Beech Creek unit, Tyler County, Texas, comprising approximately four thousand eight hundred and fifty-six acres;

Upper Neches River corridor unit, Jasper, Tyler, and Hardin Counties, Texas, including the Sally Withers Addition, comprising approximately three thousand seven hundred and seventy-five acres;

Neches Bottom and Jack Gore Baygall unit, Hardin and Jasper Counties, Texas, comprising approximately thirteen thousand three hundred acres;

Lower Neches River corridor unit, Hardin, Jasper, and Orange Counties, Texas, except for a one-mile segment on the east side of the river including the site of the papermill near Evadale, comprising approximately two thousand six hundred acres;

Beaumont unit, Orange, Hardin, and Jefferson Counties, Texas, comprising approximately six thousand two hundred and eighteen acres;

Loblolly unit, Liberty County, Texas, comprising approximately five hundred and fifty acres;

Little Pine Island-Pine Island Bayou corridor unit, Hardin and Jefferson Counties, Texas, comprising approximately two thousand one hundred acres;

Lance Rosier Unit, Hardin County, Texas, comprising approximately twenty-five thousand and twenty-four acres;

(c) The Secretary is authorized to acquire by donation, purchase with donated or appropriated funds, transfer from any other Federal agency, or exchange, any lands, waters, or interests therein which are located within the boundaries of the preserve: *Provided,* That any lands owned or acquired by the State of Texas, or any of its political subdivisions, may be acquired by donation only. After notifying the Committees on Interior and Insular Affairs of the United States Congress, in writing, of his intention to do so and of the reasons therefor, the Secretary may, if he finds that such lands would make a significant contribution to the purposes for which the preserve was created, accept title to any lands, or interests in lands, located outside of the boundaries of the preserve which the State of Texas or its political subdivisions may acquire and offer to donate to the United States or which any private person, organization, or public or private corporation may offer to donate to the United States and he may administer such lands as a part of the preserve after publishing notice to that effect in the Federal Register. Notwithstanding any other provision of law, any federally owned lands within the preserve shall, with the concurrence of the head of the administering agency, be transferred to the administrative jurisdiction of the Secretary for the purposes of this Act without transfer of funds.

Sec. 2. (a) The Secretary shall, immediately after the publication of the boundaries of the preserve, commence negotiations for the acquisition of the lands located therein: *Provided,* That he shall not acquire the mineral estate in any property or existing easements for public utilities, pipelines or railroads without the consent of the owner unless, in his judgment, he first determines that such property or estate is subject to, or threatened with, uses which are, or would be, detrimental to the purposes and objectives of this Act: *Provided further,* That the Secretary, insofar as is reasonably possible, may avoid the acquisition of improved properties, as defined in this Act, and shall make every effort to minimize the acquisition of land where he finds it necessary to acquire properties containing improvements.

(b) Within one year after the date of the enactment of this Act, the Secretary shall submit, in writing, to the Committee on Interior and Insular Affairs and to the Committees on Appropriations of the United States Congress a detailed plan which shall indicate:

(i) the lands and areas which he deems essential to the protection and public enjoyment of this preserve,

(ii) the lands which he has previously acquired by purchase, donation, exchange or transfer for administration for the purpose of this preserve, and

(iii) the annual acquisition program (including the level of funding) which he recommends for the ensuing five fiscal years.

(c) It is the express intent of the Congress that the Secretary should substantially complete the land acquisition program contemplated by this Act within six years after the date its enactment.

Sec. 3. (a) The owner of an improved property on the date of its acquisition by the Secretary may, as a condition of such acquisition, retain for himself and his heirs and assigns a right of use and occupancy of the improved property for noncommercial residential purposes for a definite term of not more than twenty-five years or, in lieu thereof, for a term ending at the death of the owner or the death of his spouse, whichever is later. The owner shall elect the term to be reserved. Unless this property is wholly or partially donated to the United States, the Secretary shall pay the owner the fair market value of the property on the date of acquisition less the fair market value, on that date, of the right retained by the owner. A right retained pursuant to this Section shall be subject to termination by the Secretary upon his determination that it is being exercised in a manner inconsistent with the purposes of this Act, and it shall terminate by operation of law upon the Secretary's notifying the holder of the right of such

determination and tendering to him an amount equal to the fair market value of that portion of the right which remains unexpired.

(b) As used in this Act, the term "improved property" means a detached, one family dwelling, construction of which was begun before July 1, 1973, which is used for noncommercial residential purposes, together with not to exceed three acres of land on, which the dwelling is situated and together with such additional lands or interests therein as the Secretary deems to be reasonably necessary for access thereto, such lands being in the same ownership as the dwelling, together with any structures accessory to the dwelling which are situated on such land.

(c) Whenever an owner of property elects to retain a right of use and occupancy as provided in this section, such owner shall be deemed to have waived any benefits or rights accruing under sections 203, 204, 205, and 206 of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (84 Stat. 1894), and for the purposes of such sections such owner shall not be considered a displaced person
as defined in section 101(6) of such Act.

Sec. 4.(a) The area within the boundaries depicted on the map referred to in section 1 shall be known as the Big Thicket National Preserve. Such lands shall be administered by the Secretary as a unit of the National Park System in a manner which will assure their
natural and ecological integrity in perpetuity in accordance with the provisions of this Act and with the provisions of the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1-4), as amended and supplemented.

(b) In the interest of maintaining the ecological integrity of the preserve, the Secretary shall limit the construction of roads, vehicular campgrounds, employee housing, and other public use and administrative facilities and he shall promulgate and publish such rules and regulations in the Federal Register as he deems necessary and appropriate to limit and control the use of, and activities on, Federal lands and waters with respect to:

(1) motorized land and water vehicles;

(2) exploration for, and extraction of, oil, gas, and other minerals;

(3) new construction of any kind;

(4) grazing and agriculture; and

(5) such other uses as the Secretary determines must be limited or controlled in order to carry out the purposes of this Act.

(c) The Secretary shall permit hunting, fishing, and trapping on lands and waters under his jurisdiction within the preserve in accordance with the applicable laws of the United States and the State of Texas, except that he may designate zones where and periods when, no hunting, fishing, trapping or entry may be permitted for reasons of public safety, administration, floral and faunal protection and management, or public use and enjoyment. Except in emergencies, any regulations prescribing such restrictions relating to hunting, fishing, or trapping shall be put into effect onlv after consultation with the appropriate State agency having jurisdiction over hunting, fishing, and trapping activities.

Sec. 5. Within five years from the date of enactment of this Act, the Secretary shall review the area within the preserve and shall report to the President, in accordance with section 3(c) and (d) of the Wilderness Act (78 Stat. 891; 16 U.S.C. 1132 (c) and (d)), his recommendations as to the suitability or nonsuitability of any area within the preserve for preservation as wilderness, and any designation of any such areas as a wilderness shall be accomplished in accordance with said subsections of the Wilderness Act.

Sec. 6. There are authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act, but not to exceed $63,812,000 for the acquisition of lands and interests in lands and not to exceed 7,000,000 for development.

Approved October 11, 1974.

PUBLIC LAW 94-578

An Act to provide for increases in appropriation ceilings and boundary changes in certain units of the National Park System, and for other purposes. (90 Stat. 2732)

Be it enacted by the Senate and House of Representatives of the United States of American in Congress assembled,

TITLE III-MISCELLANEOUS PROVISIONS

BIG THICKET NATIONAL PRESERVE

SEC. 322. Section 3(b) of the Act of October 11, 1974 (88 Stat. 1254); 16 U.S.C. 698(b)), is amended by deleting "detached, one-family dwelling," and inserting in lieu thereof "detached, year-round one-family dwelling which serves as the owner's permanent place of abode at the time of acquisition.

Approved October 21, 1976.

PUBLIC LAW 98-489

An Act to provide for the acquisition of a visitor contact and administrative site for the Big Thicket National Preserve in the State of Texas. (98 Stat. 2267)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) subsection (c) of the first section of the Act entitled "An Act to authorize the establishment of the Big Thicket National Preserve in the State of Texas, and for other purposes", approved October 11, 1974 (16 U.S.C. 698), is amended by inserting after the first sentence the following new sentence: "The Secretary may also acquire, by any of the above methods, approximately 15 acres of land outside of the boundaries of the preserve in the vicinity of the intersection of United States Highway 69 and State Farm-Market Road 420, in Hardin County, Texas, for purposes of a visitor contact and administrative site.".

(b) Section 6 of such Act is amended by inserting at the end thereof the following new sentence: "Effective October 1, 1984, there is authorized to be appropriated such sums as may be necessary for the acquisition of the visitor contact and administrative site referred to in subsection (c) of the first section of this Act."

Approved October 17, 1984.

PUBLIC LAW 103-46 JULY 1, 1993

An Act to increase the size of the Big Thicket National Preserve in the State of Texas by adding the Village Creek corridor unit, the Big Sandy corridor unit, and the Canyonlands unit. (107 Stat. 229)

Be it enacted by the Senate and House Representatives the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be referred to as the "Big Thicket National Preserve Addition Act of 1993".

SEC. 2. ADDITIONS TO THE BIG THICKET NATIONAL PRESERVE.

(a) ADDITIONS.-Subsection (b) of the first section of the Act entitled "An Act to authorize the establishment of the Big Thicket National Preserve in the State of Texas, and for other purposes", approved October 11, 1974 (16 U.S.C. 698), hereafter referred to as the "Act", is amended as follows:

(1) Strike out "map entitled 'Big Thicket National Preserve'" and all that follows through "Secretary of the Interior (hereafter referred to as the 'Secretary')" and insert in lieu thereof "map entitled 'Big Thicket National Preserve', dated October 1992, and numbered 175-0008, which shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior, and the offices of the Superintendent of the preserve. After advising the Committee on Energy and Natural Resources of the United States Senate and the Committee on Natural Resources of the United States House of Representatives, in writing, the Secretary of the Interior (hereafter referred to as the 'Secretary') may make minor revisions of the boundaries of the preserve when necessary by publication of a revised drawing or other boundary description in the Federal Register. The Secretary".

(2) Strike out "and" at the end of the penultimate undesignated paragraph relating to Little Pine Island-Pine Island Bayou corridor unit.

(3) Strike out the period in the ultimate undesignated paragraph relating to Lance Rosier unit and insert in lieu thereof ";"

(4) Add at the end thereof the following:

"Village Creek Corridor unit, Hardin County, Texas, comprising approximately four thousand seven hundred and ninety-three acres;

"Big Sandy Corridor unit, Hardin, Polk, and Tyler Counties, Texas, comprising approximately four thousand four hundred and ninety-seven acres; and

"Canyonlands unit, Tyler County, Texas, comprising approximately one thousand four hundred and seventy-six acres."

(b) ACQUISITION.–(1) Subsection (c) of the first section of such Act is amended by striking out the first sentence and inserting in lieu thereof the following: "The Secretary is authorized to acquire by donation, purchase with donated or appropriated funds, transfer from any other Federal agency, or exchange, any lands, waters, or interests therein which are located within the boundaries of the preserve: *Provided*, That privately owned lands located within the Village Creek Corridor, Big Sandy Corridor, and Canyonlands units may be acquired only with the consent of the owner: *Provided further*, That the Secretary may acquire lands owned by commercial timber companies only by donation or exchange: *Provided further*, That any lands owned by the State of Texas, or any political subdivisions thereof may be acquired by donation only."

(2) Add at the end of the first section of such Act the following new subsections:

"(d) Within sixty days after the date of enactment of this subsection, the Secretary and the Secretary of Agriculture shall identify lands within their jurisdiction located within the vicinity of the preserve which may be suitable for exchange for commercial timber lands within the preserve. In so doing, the Secretary of Agriculture shall seek to identify for exchange National Forest lands that are near or adjacent to private lands that are already owned by the commercial timber companies. Such National Forest lands shall be located in the Sabine National Forest in Sabine County, Texas, in the Davy Crockett National Forest south of Texas State Highway 7, or in other sites deemed mutually agreeable, and within reasonable distance of the timber companies' existing mills. In exercising this exchange authority, the Secretary and the Secretary of Agriculture may utilize any authorities or procedures otherwise available to them in connection with land exchanges, and which are not inconsistent with the purposes of this Act. Land exchanges authorized pursuant to this subsection shall be of equal value and shall be completed as soon as possible, but no later than two years after date of enactment of this subsection.

"(e) With respect to the thirty-seven-acre area owned by the Louisiana-Pacific Corporation or its subsidiary, Kirby Forest Industries, Inc., on Big Sandy Creek in Hardin County, Texas, and now utilized as part of the Indian Springs Youth Camp (H.G. King Abstract 822), the Secretary shall not acquire such area without the consent of the owner so long as the area is used exclusively as a

youth camp."

(c) PUBLICATION OF BOUNDARY DESCRIPTION.-Not later than six months after the date of enactment of this subsection, the Secretary shall publish in the Federal Register a detailed description of the boundary of the Village Creek Corridor unit, the Big Sandy Corridor unit, and the Canyonlands unit of the Big Thicket National Preserve.

(d) AUTHORIZATION OF APPROPRIATIONS.--Section 6 of such Act is amended by adding at the end thereof the following new sentence: "Effective upon date of enactment of this sentence, there is authorized to be appropriated such sums as may be necessary to carry out the purposes of subsections (c) and (d) of the first section."

Approved July 1, 1993.

APPENDIX B

NATIONAL PARK SERVICE
NONFEDERAL OIL AND GAS RIGHTS REGULATIONS
36 CFR 9B

Subpart--B--Non-Federal Oil and Gas Rights

AUTHORITY: Act of August 25, 1916, 39 Stat. 535 (16 U.S.C. 1, et seq.); and the acts establishing the units of the National Park System, including but not limited to: Act of April 25, 1947, 61 Stat. 54 (16 U.S.C. 241, et seq.); Act of July 2, 1958, 72 Stat. 285 (16 U.S.C. 410, et seq.); Act of October 27, 1972, 86 Stat. 1312 (16 U.S.C. 460dd, et seq.); Act of October 11,1974, 88 Stat. 1256 (16 U.S.C. 698-698e); Act of October 11, 1974, 88 Stat. 1258 (16 U.S.C. 698f-698m); Act of December 27,1974, 88 Stat. 1787 (16 U.S.C. 460ff et seq.).

SOURCE: 43 FR 57825, Dec. 8, 1978, unless otherwise noted.

§ 9.30 Purpose and scope.

(a) These regulations control all activities within any unit of the National Park System in the exercise of rights to oil and gas not owned by the United States where access is on, across or through federally owned or controlled lands or waters. Such rights arise most frequently in one of two situations: (1) When the land is owned in fee, including the right to the oil and gas, or (2) When in a transfer of the surface estate to the United States, the grantor reserved the rights to the oil and gas. These regulations are designed to insure that activities undertaken pursuant to these rights are conducted in a manner consistent with the purposes for which the National Park System and each unit thereof were created, to prevent or minimize damage to the environment and other resource values, and to insure to the extent feasible that all units of the National Park System are left unimpaired for the enjoyment of future generations.

These regulations are not intended to result in the taking of a property interest, but rather to impose reasonable regulations on activities which involve and affect federally-owned lands.

(b) Regulations controlling the exercise of minerals rights obtained under the Mining Law of 1872 in units of the National Park System can be found at 36 CFR Part 9, Subpart A. In area [sic] where oil and gas are owned by the United States, and leasing is authorized, the applicable regulations can be found at 43 CFR, Group 3100.

(c) These regulations allow operators the flexibility to design plans of operations only for that phase of operations contemplated. Each plan need only describe those functions for which the operator wants immediate approval. For instance, it is impossible to define, at the beginning of exploratory activity, the design that production facilities might take. For this reason, an operator may submit a plan which applies only to the exploratory phase, allowing careful preparation of a plan for the production phase after exploration is completed. This allows for phased reclamation and bonding at a level commensurate with the level of operations approved. However, it must be noted that because of potential cumulative impacts, and because of qualitative differences in the nature of the operations, approval of a plan of operations covering one phase of operations does not guarantee later approval of a plan of operations covering a subsequent phase.
[43 FR 57825, Dec. 8, 1978, as amended at 44 FR 37914, June 29, 1979]

§ 9.31 Definitions.

The terms used in this Subpart shall have the following meanings:

(a) *Secretary.* The Secretary of the Interior.

(b) *Director.* The Director of the National Park Service or his designee.

(c) *Operations.* All functions, work and activities within a unit in connection with exploration for and development of oil and gas resources, the right to which is not owned by the United States, including: gathering basic information required to comply with this Subpart, prospecting, exploration, surveying, preproduction development and production; gathering, onsite storage, transport or processing of petroleum products; surveillance, inspection, monitoring, or maintenance of equipment; reclamation of the surface disturbed by such activities; and all activities and uses reasonably incident thereto performed within a unit, including construction or use of roads, pipelines, or other means of access or transportation on, across, or through federally owned or controlled lands and waters, regardless of whether such activities and uses take place on Federal, State or private lands.

(d) *Operator.* A person conducting or proposing to conduct operations.

(e) *Person.* Any individual, firm, partnership, corporation, association, or other entity.

(f) *Superintendent.* The Superintendent, or his designee, of the unit of the National Park System containing lands subject to the rights covered by these regulations.

(g) *Commercial Vehicle.* Any motorized equipment used in direct or indirect support of operations.

(h) *Unit.* Any National Park System area.

(i) *Owner.* The owner, or his legal representative, of the rights to oil and gas being exercised.

(j) *Regional Director.* The Regional Director, or his designee, for the National Park Service region in which the given unit is located.

(k) *Designated Roads.* Those existing roads determined by the Superintendent in accordance with 36 CFR 1.5 and § 4.19 to be open for the use of the general public or for the exclusive use of an operator.

(1) *Oil.* Any viscous combustible liquid hydrocarbon or solid hydrocarbon substance easily liquifiable on warming which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas without resort to manufacturing process.

(m) *Gas.* Any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperature and pressure conditions.

(n) *Site.* Those lands or waters on which operations are to be carried out.

(o) *Contaminating substances.* Those substances, including but not limited to, salt water or any other injurious or toxic chemical, waste oil or waste emulsified oil, basic sediment, mud with injurious or toxic additives, or injurious or toxic substances produced or used in the drilling, development, production, transportation, or on-site storage, refining, and processing of oil and gas.

(p) *Statement for Management.* A National Park Service planning document used to guide short- and long-term management of a unit; to determine the nature and extent of planning required to meet the unit's management objectives; and, in the absence of more specific planning documents, to provide a general framework for directing park operations and communicating park objectives to the public.

[43 F R 57825, Dec. 8, 1978: 44 FR 37914, June 29, 1979, as amended at 60 FR 55791, 11/3/95; 62 FR 30234, 6/3/97]

§ 9.32 Access.

(a) No access on, across or through lands or waters owned or controlled by the United States to a site for operations will be granted except for operations covered by § 9.33 and, except as provided by § 9.38, until the operator has filed a plan of operations pursuant to § 9.36 and has had the plan of operations approved in accordance with § 9.37. An approved plan of operations serves as the operator's access permit.

(b) No operations shall be conducted on a site within a unit, access to which is on, across or through federally owned or controlled lands or waters except in accordance with an approved plan of operations, the terms of § 9.33 or approval under § 9.38.

(c) Any operator intending to use aircraft of any kind for access to a federally-owned or controlled site must comply with these regulations. Failure of an operator to receive the proper approval under these regulations prior to using aircraft in this manner is a violation of both these regulations and 36 CFR 2.17.

(d) No access to a site outside a unit will be permitted across unit lands unless such access is by foot, pack animal, or designated road. Persons using designated roads for access to such a site must comply with the terms of § 9.50 where applicable.

(e) Any operator on a site outside the boundaries of a unit must comply with these regulations if he is using directional drilling techniques which result in the drill hole crossing into the unit and passing under any land or water the surface of which is owned by the United States. Except, that the operator need not comply in those areas where, upon application of the operator or upon his own action, the Regional Director is able to determine from available data, that such operations pose no significant threat of damage to park resources, both surface and subsurface, resulting from surface subsidence fracture of geological formations with resultant fresh water aquifer contamination, or natural gas escape, or the like.

§ 9.33 Existing operations.

(a) Any person conducting operations on January 8, 1979 in accordance with a Federal or State issued permit may continue to do so as provided by this section. After expiration of such existing permits no operations shall be conducted except under an approved plan of operations, unless access is granted by the Regional Director under § 9.38.

(1) All Federal special use permits dealing with access on, across or through lands or waters owned or controlled by the United States to a site for the conduct of operations within any unit issued

prior to January 8, 1979 shall expire according to their terms and shall not be renewed, unless by the terms of the existing permit it must be renewed.

(2) All operations on a site in a unit access to which is on, across, or through federally owned or controlled lands or waters conducted pursuant to a valid State access permit may be continued for the term of that permit, exclusive of any renewal period whether mandatory or discretionary, if conducted in accordance with the permit.

(b) Any person conducting operations on January 8, 1979 in a unit where Federal or State permits were not required prior to January 8, 1979 may continue those operations pending a final decision on his plan of operations; *Provided,* That:

(1) The operator (within thirty (30) days of January 8, 1979), notifies the Superintendent in writing of the nature and location of the operations; and

(2) Within sixty (60) days after such notification, the operator submits, in accordance with these regulations, a substantially complete proposed plan of operations for those operations;

(3) Failure to comply with § 9.33(b) (1) and (2) shall constitute grounds for the suspension of operations.

(c) At any time when operations which are allowed to continue under § 9.33 (a) and (b) pose an immediate threat of significant injury to federally owned or controlled lands or waters, the Superintendent shall require the operator to suspend operations immediately until the threat is removed or remedied. The Superintendent must, within five (5) days of this suspension notify the operator in writing of the reasons for the suspension and of his right to appeal the suspension under § 9.48 [sic. Should be § 9.49.].

[43 FR 57825, Dec. 8, 1978; 44 FR 37914, June 29, 1979]

§ 9.34 Transfers of interest.

(a) Whenever an owner of rights being exercised under an approved plan of operations sells, assigns, bequeaths, or otherwise conveys all or any part of those rights, he, his agent, executor, or representative must notify the Superintendent within sixty (60) days of the transfer of: the site(s) involved; the name and address of the person to whom an interest has been conveyed; and a description of the interest transferred. Failure to so notify the Superintendent shall render the approval of any previously approved plan of operations void.

(b) The transferring owner shall remain responsible for compliance with the plan of operations and shall remain liable under his bond until such time as the Superintendent is notified of the transfer in accordance with paragraph (a). At that time the Superintendent will prohibit the new owner from operating until such time as the new owner has filed with the Superintendent: (1) A statement ratifying the existing plan of operations and stating his intent to be bound thereby, or a new plan of operations, and (2) a suitable substitute performance bond which complies with the requirements of § 9.48.

§ 9.35 Use of water.

No operator may use for operations any water from a point of diversion which is within the boundaries of any unit unless authorized in writing by the Regional Director. The Regional Director shall not approve a plan of operations requiring the use of water from such source unless the operator shows either that his right to the use of the water is superior to any claim of the United States to the water, or where the operator's claim to the water is subordinate to that of the United States that the removal of

the water from the water system will not damage the unit's resources. In either situation, the operator's use of water must comply with appropriate State water laws.

§ 9.36 Plan of operations.

(a) The proposed plan of operations shall include, as appropriate to the proposed operations, the following:

(1) The names and legal addresses of the following persons: The operator and the owner(s) or lessee(s) (if rights are State-owned) other than the operator;

(2) Copy of the lease, deed, designation of operator, or assignment of rights upon which the operator's right to conduct operations is based;

(3) A map or maps showing the location of the perimeter of the area where the operator has the right to conduct operations, as described in § 9.36(a)(2), referenced to the State plane coordinate system or other public land survey as acceptable to the Superintendent;

(4) A map or maps showing the location, as determined by a registered land surveyor or civil engineer, of a point within a site of operations showing its relationship to the perimeter of the area described in § 9.36(a)(2) and to the perimeter of the site of operations; the location of existing and proposed access roads or routes to the site; the boundaries of proposed surface disturbance; the location of proposed drilling; location and description of all surface facilities including sumps, reserve pits and ponds; location of tank batteries, production facilities and gathering, service and transmission lines; wellsite layout; sources of construction materials such as fill; and the location of ancillary facilities such as camps, sanitary facilities, water supply and disposal facilities, and airstrips. The point within the site of operations identified by registered land surveyor or civil engineer shall be marked with a permanent ground monument acceptable to the Superintendent, shall contain the point's State plane coordinate values, and shall be placed at least to an accuracy of third order, class I, unless otherwise authorized by the Superintendent;

(5) A description of the major equipment to be used in the operations, including a description of equipment and methods to be used for the transport of all waters used in or produced by operations, and of the proposed method of transporting such equipment to and from the site;

(6) An estimated timetable for any phase of operations for which approval is sought and the anticipated date of operation completion;

(7) The geologic name of the surface formation;

(8) The proposed drilling depth, and the estimated tops of important geologic markers;

(9) The estimated depths at which anticipated water, brines, oil, gas, or other mineral bearing formations are expected to be encountered;

(10) The nature and extent of the known deposit or reservoir to be produced and a description of the proposed operations, including:

(i) The proposed casing program, including the size, grade, and weight of each string, and whether it is new or used;

(ii) The proposed setting depth of each casing string, and the amount of type of cement, including additives, to be used;

(iii) The operator's minimum specifications for pressure control equipment which is to be used, a schematic diagram thereof showing sizes, pressure ratings, and the testing procedures and testing frequency;

(iv) The type and characteristics of the proposed circulating medium or mediums to be employed for rotary drilling and the quantities and types of mud and weighting material to be maintained;

(v) The testing, logging, and coring programs to be followed;

(vi) Anticipated abnormal pressures or temperatures expected to be encountered; or potential hazards to persons and the environment such as hydrogen sulfide gas or oil spills, along with plans for mitigation of such hazards;

(11) A description of the steps to be taken to comply with the applicable operating standards of § 9.41 of this subpart;

(12) Provisions for reclamation which will result in compliance with the requirements of § 9.39:

(13) A breakdown of the estimated costs to be incurred during the implementation of the reclamation plan;

(14) Methods for disposal of all rubbish and other solid and liquid wastes, and contaminating substances;

(15) An affidavit stating that the operations planned are in compliance with all applicable Federal, State and local laws and regulations

(16) Background information, including:

(i) A description of the natural, cultural, social and economic environments to be affected by operations, including a description and/or map(s) of the location of all water, abandoned, temporarily abandoned, disposal, production, and drilling wells of public record within a two-mile radius of the proposed site. Where such information is available from documents identified in § 9.36(d), specific reference to the document and the location within the document where such information can be found will be sufficient to satisfy this requirement;

(ii) The anticipated direct and indirect effects of the operations on the unit's natural, cultural, social, and economic environment;

(iii) Steps to be taken to insure minimum surface disturbance and to mitigate any adverse environmental effects, and a discussion of the impacts which cannot be mitigated;

(iv) Measures to protect surface and subsurface waters by means of casing and cement, etc.;

(v) All reasonable technologically feasible alternative methods of operations their costs, and their environmental effects, and

(vi) The effects of the steps to be taken to achieve reclamation;

(17) Any other facets of the proposed operations which the operator wishes to point out for consideration; and

(18) Any additional information that is required to enable the Superintendent to establish whether the operator has the right to conduct operations as specified in the plan of operations; to effectively analyze the effects that the operations will have on the preservation, management and public use of the unit, and to make a recommendation to the Regional Director regarding approval or disapproval of the plan of operations and the amount of the performance bond to be posted.

(b) Where any information required to be submitted as part of a proposed plan of operations has been submitted to the Superintendent in substantially the same form in a prior approved plan of operations, a specific cross-reference to that information contained in the prior approved plan of operations will be sufficient to incorporate it into the proposed plan and will satisfy the applicable requirement of this section.

(c) Information and materials submitted in compliance with this section will not constitute a plan of operations until information required by § 9.36(a) (1) through (18), which the Superintendent determines as pertinent to the type of operations proposed, has been submitted to and determined adequate by the Regional Director.

(d) In all cases the plan of operations must consider and discuss the unit's Statement for Management and other planning documents as furnished by the Superintendent, and activities to control, minimize or prevent damage to the recreational, biological physical, scientific, cultural, and scenic resources of the unit, and any reclamation procedures suggested by the Superintendent.

[43 FR 57825, Dec. 8, 1978; 44 FR 37914, June 29, 1979]

§ 9.37 Plan of operations approval.

(a) The Regional Director shall not approve a plan of operations:

(1) Until the operator shows that the operations will be conducted in a manner which utilizes technologically feasible methods least damaging to the federally-owned or controlled lands, waters and resources of the unit while assuring the protection of public health and safety.

(2) For operations at a site the surface estate of which is not owned by the federal government, where operations would constitute a nuisance to federal lands or waters in the vicinity of the operations, would significantly injure federally-owned or controlled lands and waters; or

(3) For operations at a site the surface estate of which is owned or controlled by the federal government, where operations would substantially interfere with management of the unit to ensure the preservation of its natural and ecological integrity in perpetuity, or would significantly injure the federally-owned or controlled lands or waters; *Provided, however,* That if the application of this standard would under applicable law, constitute a taking of a property interest rather than an appropriate exercise of regulatory authority, the plan of operations may be approved if the operations would be conducted in accordance with paragraph (a)(1) of this section, unless a decision is made to acquire the mineral interest.

(4) Where the plan of operations does not satisfy each of the requirements of § 9.36 applicable to the operations proposed.

(b) Within sixty (60) days of the receipt of a plan of operations, the Regional Director shall make an environmental analysis of such plan, and:

(1) Notify the operator that the plan of operations has been approved or rejected, and, if rejected, the reasons for the rejection; or

(2) Notify the operator that the plan of operations has been conditionally approved, subject to the operator's acceptance of specific provisions and stipulations; or

(3) Notify the operator of any modification of the plan of operations which is necessary before such plan will be approved or of additional information needed to effectively analyze the effects that the operations will have on the preservation, management and use of the unit, and to make a decision regarding approval or disapproval of the plan of operations and the amount of the performance bond to be posted; or

(4) Notify the operator that the plan of operations is being reviewed, but that more time, not to exceed an additional thirty days, is necessary to complete such review, and setting forth the reasons why additional time is required. *Provided, however,* That days during which the area of operations is inaccessible for such reasons as inclement weather, natural catastrophe acts of God, etc., for inspection shall not be included when computing either this time period, or that in subsection (b) above; or

(5) Notify the operator that the plan of operations has been reviewed, but cannot be considered for approval until forty-five (45) days after a final environmental statement has been prepared and filed with the Environmental Protection Agency; or

(6) Notify the operator that the plan of operations is being reviewed, but that more time to provide opportunities for public participation in the plan of operations review and to provide sufficient time to analyze public comments received is necessary. Within thirty (30) days after closure of the public comment period specified by the Regional Director, he shall comply with § 9.37(b) (1) through (5).

(c) The Regional Director shall act as expeditiously as possible upon a proposed plan of operations consistent with the nature and scope of the operations proposed. Failure to act within the time limits specified in this section shall constitute a rejection of the plan of operations from which the operator shall have a right to appeal under § 9.49.

(d) The Regional Director's analysis shall include:

(1) An examination of all information submitted by the operator;

(2) An evaluation of measures and timing required to comply with reclamation requirements;

(3) An evaluation of necessary conditions and amount of the bond or security deposit (See § 9.48);

(4) An evaluation of the need for any additional requirements in the plan;

(5) A determination regarding the impact of this operation and cumulative impacts of all proposed and existing operations on the management of the unit; and

(6) A determination whether implementation by the operator of an approved plan of operations would be a major Federal action significantly affecting the quality of the human environment or would be sufficiently controversial to warrant preparation of an environmental statement pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969.

(e) Prior to approval of a plan of operations, the Regional Director shall determine whether any properties included in, or eligible for inclusion in the National Register of Historic Places or National Registry of Natural Landmarks may be affected by the proposed operations. This determination will require the acquisition of adequate information, such as that resulting from field surveys, in order to properly determine the presence and significance of cultural resources within the areas to be affected by operations. Whenever National Register properties or properties eligible for inclusion in the National Register would be affected by operations, the Regional Director shall comply with Section 106 of the Historic Preservations Act of 1966 as implemented by 36 CFR Part 800.

(f) Approval of each plan of operations is expressly conditioned upon the Superintendent having such reasonable access to the site as is necessary to properly monitor and insure compliance with the plan of operations.

[43 FR 57825, Dec. 8, 1978; 44 FR 37914, June 29, 1979]

§ 9.38 Temporary approval.

(a) The Regional Director may approve on a temporary basis:

(1) Access on, across or through federally-owned or controlled lands or waters for the purpose of collecting basic information necessary to enable timely compliance with these regulations. Such temporary approval shall be for a period not in excess of sixty (60) days.

(2) The continuance of existing operations, if their suspension would result in an unreasonable economic burden or injury to the operator; provided that such operations must be conducted in accordance with all applicable laws, and in a manner prescribed by the Regional Director designed to minimize or prevent significant environmental damage; and provided that within sixty (60) days of the granting of such temporary approval the operator either:

(i) Submits an initial substantially complete plan of operations; or

(ii) If a proposed plan of operations has been submitted, responds to any outstanding requests for additional information.

(b) The Regional Director may approve new operations on a temporary basis only when:

(1) The Regional Director finds that the operations will not cause significant environmental damage or result in significant new or additional surface disturbance to the unit; and either

(2) The operator can demonstrate a compelling reason for the failure to have had timely approval of a proposed plan of operations; or

(3) The operator can demonstrate that failure to grant such approval will result in an unreasonable economic burden or injury to the operator.

[43 FR 57825, Dec. 8, 1978, as amended at 44 FR 37914, June 29, 1979]

§ 9.39 Reclamation requirements.

(a) Within the time specified by the reclamation provisions of the plan of operations, which shall be as soon as possible after completion of approved operations and shall not be later than six (6) months thereafter unless a longer period of time is authorized in writing by the Regional Director, each operator shall initiate reclamation as follows:

(1) Where the Federal government does not own the surface estate. the operator shall at a minimum:

(i) Remove or neutralize any contaminating substances; and

(ii) Rehabilitate the area of operations to a condition which would not constitute a nuisance or would not adversely affect, injure, or damage federally-owned lands or waters, including removal of above ground structures and equipment used for operations, except that such structures and equipment may remain where they are to be used for continuing operations which are the subject of another approved plan of operations or of a plan which has been submitted for approval.

(2) On any site where the surface estate is owned or controlled by the Federal government, each operator must take steps to restore natural conditions and processes. These steps shall include but are not limited to:

(i) Removing all above ground structures, equipment and roads used for operations, except that such structures, equipment and roads may remain where they are to be used for continuing operations which are the subject of another approved plan of operations or of a plan which has been submitted for approval, or unless otherwise authorized by the Regional Director consistent with the unit purpose and management objectives;

(ii) Removing all other man-made debris resulting from operations;

(iii) Removing or neutralizing any contaminating substances;

(iv) Plugging and capping all nonproductive wells and filling dump holes, ditches, reserve pits and other excavations;

(v) Grading to reasonably conform the contour of the area of operations to a contour similar to that which existed prior to the initiation of operations, where such grading will not jeopardize reclamation;

(vi) Replacing the natural topsoil necessary for vegetative restoration; and

(vii) Reestablishing native vegetative communities.

(b) Reclamation under paragraph (a)(2) of this section is unacceptable unless it provides for the safe movement of native wildlife, the reestablishment of native vegetative communities, the normal flow of surface and reasonable flow of subsurface waters, and the return of the area to a condition which does not jeopardize visitor safety or public use of the unit.

§ 9.40 Supplementation or revision of plan of operations.

(a) A proposal to supplement or revise an approved plan of operations may be made by either the operator or the Regional Director to adjust the plan to changed conditions or to address conditions not previously contemplated by notifying the appropriate party in writing of the proposed alteration and the justification therefore.

(b) Any proposed supplementation or revision of a plan of operations initiated under paragraph (a) of this section by either party shall be reviewed and acted on by the Regional Director in accordance with § 9.37. If failure to implement proposed changes would not pose an immediate threat of significant injury to federally-owned or controlled lands or waters, the operator will be notified in writing sixty (60) days prior to the date such changes become effective, during which time the operator may submit comments on proposed changes. If failure to implement proposed changes

would pose immediate threat of significant injury to federally-owned or controlled lands or waters, the provisions of § 9.33(c) apply.

§ 9.41 Operating standards.

The following standards shall apply to operations within a unit:

(a) Surface operations shall at no time be conducted within 500 feet of the banks of perennial, intermittent or ephemeral watercourses; or within 500 feet of the high pool shoreline of natural or man-made impoundments; or within 500 feet of the mean high tide line; or within 500 feet of any structure or facility (excluding roads) used for unit interpretation, public recreation or for administration of the unit unless specifically authorized by an approved plan of operations.

(b) The operator shall protect all survey monuments, witness corners, reference monuments and bearing trees against destruction, obliteration, or damage from operations and shall be responsible for the reestablishment, restoration, or referencing of any monuments, corners and bearing trees which are destroyed, obliterated, or damaged by such operations.

(c) Whenever drilling or producing operations are suspended for 24 hours or more, but less than 30 days, the wells shall be shut in by closing wellhead valves or blowout prevention equipment. When producing operations are suspended for 30 days or more, a suitable plug or other fittings acceptable to the Superintendent shall be used to close the wells.

(d) The operator shall mark each and every operating derrick or well in a conspicuous place with his name or the name of the owner, and the number and location of the well, and shall take all necessary means and precautions to preserve these markings.

(e) Around existing or future installations, e.g., well, storage tanks, all high pressure facilities, fences shall be built for protection of unit visitors and wildlife, and protection of said facilities unless otherwise authorized by the Superintendent. Fences erected for protection of unit visitors and wildlife shall be of a design and material acceptable to the Superintendent, and where appropriate, shall have at least one gate which is of sufficient width to allow access by fire trucks. Hazards within visitor use areas will be clearly marked with warning signs acceptable to the Superintendent.

(f) The operator shall carry on all operations and maintain the site at all times in a safe and workmanlike manner, having due regard for the preservation of the environment of the unit. The operator shall take reasonable steps to prevent and shall remove accumulations of oil or other materials deemed to be fire hazards from the vicinity of well locations and lease tanks, and shall remove from the property or store in an orderly manner all scrap or other materials not in use.

(g) Operators will be held fully accountable for their contractor's or subcontractor's compliance with the requirements of the approved plan of operations.

[43 FR 57825, Dec. 8, 1978; 44 FR 37915, June 29, 1979]

§ 9.42 Well records and reports, plots and maps, samples, tests and surveys.

Any technical data gathered during the drilling of any well, including daily drilling reports and geological reports, which are submitted to the State pursuant to State regulations, or to any other bureau or agency of the Federal government shall be available for inspection by the Superintendent upon his request.

§ 9.43 Precautions necessary in areas where high pressures are likely to exist.

When drilling in "wildcat" territory, or in any field where high pressures are likely to exist, the operator shall take all necessary precautions for keeping the well under control at all times and shall install and maintain the proper high-pressure fittings and equipment to assure proper well control. Under such conditions the surface string must be cemented through its length, unless another procedure is authorized or prescribed by the Superintendent, and all strings of casing must be securely anchored.

§ 9.44 Open flows and control of "wild" wells.

The operator shall take all technologically feasible precautions to prevent any oil, gas, or water well from blowing open or becoming "wild," and shall take immediate steps and exercise due diligence to bring under control any "wild" well, or burning oil or gas well.

§ 9.45 Handling of wastes.

Oilfield brine, and all other waste and contaminating substances must be kept in the smallest practicable area, must be confined so as to prevent escape as a result of percolation, rain high water or other causes, and such wastes must be stored and disposed of or removed from the area as quickly as practicable in such a manner as to prevent contamination, pollution, damage or injury to the lands, water (surface and subsurface), facilities, cultural resources, wildlife, and vegetation of or visitors of the unit.

§ 9.46 Accidents and fires.

The operator shall take technologically feasible precautions to prevent accidents and fires, shall notify the Superintendent within 24 hours of all accidents involving serious personal injury or death, or fires on the site, and shall submit a full written report thereon within ninety (90) days. This report supersedes the requirement outlined in 36 CFR 2.17, but does not relieve persons from the responsibility of making any other accident reports which may be required under State or local laws.

§ 9.47 Cultural resource protection.

(a) Where the surface estate of the site is owned by the United States, the operator shall not, without written authorization of the Superintendent, injure, alter, destroy, or collect any site, structure, object, or other value of historical, archeological, or other cultural scientific importance in violation of the Antiquities Act (16 U.S.C. 431-433 (See 43 CFR Part 3)).

(b) Once approved operations have commenced, the operator shall immediately bring to the attention of the Superintendent any cultural or scientific resource encountered that might be altered or destroyed by his operation and shall leave such discovery intact until told to proceed by the Superintendent. The Superintendent will evaluate the discoveries brought to his attention, and will determine within ten (10) working days what action will be taken with respect to such discoveries.

§ 9.48 Performance bond.

(a) Prior to approval of a plan of operations, the operator shall be required to file a suitable performance bond with satisfactory surety, payable to the Secretary or his designee. The bond shall be conditioned upon faithful compliance with applicable regulations, and the plan of operations as approved, revised or supplemented. This performance bond is in addition to and not in lieu of any bond or security deposit required by other regulatory authorities.

(b) In lieu of a performance bond, an operator may elect to deposit with the Secretary or his designee, cash or negotiable bonds of the U.S. Government. The cash deposit or the market value of such securities shall be at least equal to the required sum of the bond. When bonds are to serve as security, there must be provided to the Secretary a power of attorney.

(c) In the event that an approved plan of operations is revised or supplemented in accordance with § 9.40, the Regional Director may adjust the amount of the bond or security deposit to conform to the modified plan of operations.

(d) The bond or security deposit shall be in an amount:

(1) Equal to the estimated cost of reclaiming the site, either in its entirety or in phases, that has been damaged or destroyed as a result of operations conducted in accordance with an approved, supplemented, plan of operations; plus

(2) An amount set by the Superintendent consistent with the type of operations proposed, to bond against the liability imposed by § 9.51(a); to provide the means for rapid and effective cleanup; and to minimize damages resulting from an oil spill, the escape of gas, wastes, contaminating substances, or fire caused by operations. This amount shall not exceed twenty-five thousand dollars ($25,000) for geophysical surveys when using more than one field party or five thousand dollars ($5,000) when operating with only one field party, and shall not exceed fifty thousand dollars ($50,000) for each wellsite or other operation.

(3) When an operator's total bond or security deposit with the National Park Service amounts to two hundred thousand dollars ($200,000) for activities conducted within a given unit, no further bond requirements shall be collected for additional activities conducted within that unit, and the operator may substitute a blanket bond of two hundred thousand dollars ($200,000) for all operations conducted within the unit.

(e) The operator's and his surety's responsibility and liability under the bond or security deposit shall continue until such time as the Superintendent determines that successful reclamation of the area of operations has occurred and, where a well has been drilled, the well has been properly plugged and abandoned. If all efforts to secure the operator's compliance with pertinent provisions of the approved plan of operations are unsuccessful, the operator's surety company will be required to perform reclamation in accordance with the approved plan of operations.

(f) Within thirty (30) days after determining that all reclamation requirements of an approved plan of operations are completed, including proper abandonment of the well, the Regional Director shall notify the operator that the period of liability under the bond or security deposit has been terminated.

[43 FR 57825, Dec. 8, 1978; 44 FR 37915 June 29, 1979]

§ 9.49 Appeals.

(a) Any operator aggrieved by a decision of the Regional Director in connection with the regulations in this Subpart may file with the Regional Director a written statement setting forth in detail the respects in which the decision is contrary to, or is in conflict with the facts, the law, or these regulations, or is otherwise in error. No such appeal will be considered unless it is filed with the Regional Director within thirty (30) days after the date of notification to the operator of the action or decision complained of. Upon receipt of such written statement from the aggrieved operator, the Regional Director shall promptly review the action or decision and either reverse his original decision or prepare his own statement, explaining that decision and the reasons therefor, and forward the statement and record on appeal to the Director for review and decision. Copies of the Regional

Director's statement shall be furnished to the aggrieved operator, who shall have thirty (30) days within which to file exceptions to the Regional Director's decision. The Department has the discretion to initiate a hearing before the Office of Hearing and Appeals in a particular case (See 43 CFR 4.700).

(b) The official files of the National Park Service on the proposed plan of operations and any testimony and documents submitted by the parties on which the decision of the Regional Director was based shall constitute the record on appeal. The Regional Director shall maintain the record under separate cover and shall certify that it was the record on which his decision was based at the time it was forwarded to the Director of the National Park Service. The National Park Service shall make the record available to the operator upon request.

(c) If the Director considers the record inadequate to support the decision on appeal, he may provide for the production of such additional evidence or information as may be appropriate, or may remand the case to the Regional Director, with appropriate instructions for further action.

(d) On or before the expiration of forty-five (45) days after his receipt of the exceptions to the Regional Director's decision, the Director shall make his decision in writing: provided however, that if more than forty-five (45) days are required for a decision after the exceptions are received, the Director shall notify the parties to the appeal and specify the reason(s) for delay. The decision of the Director shall include: (1) A statement of facts; (2) conclusions; and (3) reasons upon which the conclusions are based. The decision of the Director shall be the final administrative action of the agency on a proposed plan of operations.

(e) A decision of the Regional Director from which an appeal is taken shall not be automatically stayed by the filing of a statement of appeal. A request for a stay may accompany the statement of appeal or may be directed to the Director. The Director shall promptly rule on requests for stays. A decision of the Director on request for a stay shall constitute a final administrative decision.

(f) Where, under this Subpart, the Superintendent has the authority to make the original decision, appeals may be taken in the manner provided by this section, as if the decision had been made by the Regional Director, except that the original statement of appeal shall be filed with the Superintendent, and if he decides not to reverse his original decision, the Regional Director shall have, except as noted below, the final review authority. The only decision of a Regional Director under this paragraph which shall be appealable by the Director is an appeal from a suspension under § 9.51(b). Such an appeal shall follow the procedure of paragraphs (a)-(3) of this section.

[43 FR 57825, Dec. 8, 1978; 44 FR 37915, June 29, 1979]

§ 9.50 Use of roads by commercial vehicles.

(a) After January 8, 1978, no commercial vehicle shall use roads administered by the National Park Service without being registered with the Superintendent. Roads must be used in accordance with procedures outlined in an approved plan of operations.

(1) A fee shall be charged for such registration and use based upon a posted fee schedule. The fee schedule posted shall be subject to change upon sixty (60) days of notice.

(2) An adjustment of the fee may be made at the discretion of the Superintendent where a cooperative maintenance agreement is entered into with the operator.

(b) No commercial vehicle which exceeds roadway load limits specified by the Superintendent shall be used on roads administered by the National Park Service unless authorized in writing by the Superintendent, or unless authorized by an approved plan of operations.

(c) Should a commercial vehicle used in operations cause damage to roads, resources or other facilities of the National Park Service, the operator shall be liable for all damages so caused.

§ 9.51 Damages and penalties.

(a) The operator shall be held liable for any damages to federally-owned or controlled lands, waters, or resources resulting from his failure to comply with either his plan of operations, or where operations are continued pursuant to § 9.33, failure to comply with the applicable permit or, where operations are temporarily approved under § 9.38, failure to comply with the terms of that approval.

(b) The operator agrees, as a condition for receiving an approved plan of operations, that he will hold harmless the United States and its employees from any damages or claims for injury or death of persons and damage or loss of property by any person or persons arising out of any acts or omissions by the operator, his agents, employees or subcontractors done in the course of operations.

(c) Undertaking any operations within the boundaries of any unit in violation of this Subpart shall be deemed a trespass against the United States and shall be cause for revocation of approval of the plan of operations.

(1) When a violation by an operator under an approved plan of operations is discovered, and if it does not pose an immediate threat of significant injury to federally-owned or controlled lands or waters, the operator will be notified in writing by the Superintendent and will be given ten (10) days to correct the violation; if the violation is not corrected within ten (10) days approval of the plan of operations will be suspended until such time as the violation is corrected.

(2) If the violation poses an immediate threat of significant injury to federally-owned or controlled lands or waters, approval of the plan of operations will be immediately suspended until such time as the violation is corrected. The operator will be notified in writing within five (5) days of any suspension and shall have the right to appeal that decision under § 9.48 [sic. Should be §9.49.].

(3) Failure to correct any violation or damage to federally owned or controlled lands, waters or resources caused by such violations will result in revocation of plan of operations approval.

[43 FR 57825, Dec. 8, 1978; 44 FR 37915, June 29, 1979]

§ 9.52 Public inspection of documents.

(a) When a Superintendent receives a request for permission for access on, across or through federally-owned or controlled lands or waters for the purpose of conducting operations, the Superintendent shall publish a notice of this request in a newspaper of general circulation in the county(s) in which the lands are situated, or in such publications as deemed appropriate by the Superintendent.

(b) Upon receipt of the plan of operations in accordance with § 9.35(c) [sic. Should be § 9.36(c).], the Superintendent shall publish a notice in the FEDERAL REGISTER advising the availability of the plan for public review and comment. Written comments received within thirty (30) days will become a part of the official record. As a result of comments received or if otherwise deemed appropriate by the Superintendent, he may provide additional opportunity for public participation to review the plan of operations.

(c) Any document required to be submitted pursuant to the regulations in this Subpart shall be made available for public inspection at the office of the Superintendent during normal business hours, unless otherwise available pursuant to § 9.51(b) [sic. Should be § 9.52(b).]. This does not include

those records only made available for the Superintendent's inspection under § 9.41 [sic. Should be § 9.42.] of this Subpart or those records determined by the Superintendent to contain proprietary or confidential information. The availability of such records for inspection shall be governed by the rules and regulations found at 43 CFR Part 2.

[43 FR 57825, Dec. 8, 1978; 44 FR 37915, June 29, 1979]

APPENDIX C

FEDERAL LAWS, REGULATIONS, EXECUTIVE ORDERS, POLICIES, AND GUIDELINES THAT APPLY TO NONFEDERAL OIL AND GAS OPERATIONS

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This appendix summarizes many, but not all, of the legal and policy mandates that currently govern the exercise of nonfederal oil and gas rights in units of the National Park System. The first three laws pertain specifically to the National Park Service. They are followed by:

- Other federal laws and regulations, organized in alphabetical order,
- Executive orders, arranged in numerical order,
- NPS policies, guidelines, and procedures, and
- Selected Texas law and regulations.

This appendix supplements information presented in Table 1.1 of Chapter 1, and Parts II and III of Chapter 2. The following summaries are intended to acquaint the reader with many of the legal and policy requirements that apply to nonfederal oil and gas operations in the Preserve and are not meant as legal interpretations. They cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. Congress may change statutes and agencies may update their regulations and policies. During project planning, operators are responsible for ensuring they have current and complete information on legal and policy requirements for nonfederal oil and gas operations on NPS lands.

NATIONAL PARK SERVICE LAWS

NATIONAL PARK SERVICE ORGANIC ACT OF 1916, as amended, 16 U.S.C. §§ 1 *et seq.*

Resources afforded protection: all resources including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and experience, visual resources
Applicable regulation(s): 36 CFR Parts 1-10, 12-14, 20, 21, 25, 28, 30, 34, and 51

Through this Act, Congress established the National Park Service and mandated that it "shall promote and regulate the use of federal areas known as national parks, monuments…by such means and measures as conform to the fundamental purpose of said parks, monuments…which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Section 3 of the Organic Act provides the Secretary of Interior with the authority to adopt rules and regulations to govern the use and the management of park units. Through this provision of the Organic Act, the NPS promulgated regulations governing the exercise of nonfederal oil and gas rights at 36 CFR Part 9, Subpart B. The regulations at 36 CFR Part 9B control all activities during the exercise of rights to oil and gas not owned by the United States where access is on, across or through federally owned or controlled lands or waters within any NPS unit.

NPS does not intend the regulations to result in the taking of a property interest, but rather intends to impose reasonable regulations on activities that involve and affect federally owned lands. NPS designed the regulations to insure that operators conduct oil and gas activities in a manner consistent with the purposes for which Congress created the NPS unit. Likewise, the regulations prevent or minimize damage to the environment and other resource values and insure that all NPS units remain unimpaired for the enjoyment of future generations.

NATIONAL PARK SYSTEM GENERAL AUTHORITIES ACT, 16 U.S.C. §§ 1a-1 *et seq*.

Resources afforded protection: all resources, including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and experience, visual resources
Applicable regulation(s): 36 CFR Parts 1-199

This act affirmed that while all national park system units remain "distinct in character," they are "united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage." The purpose of this act was "to include all such areas in the system and to clarify the authorities applicable to the system." The act made it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Further, amendments stated that NPS management of park units should not "derogat[e] . . . the purposes and values for which these various areas have been established."

NATIONAL PARK SERVICE OMNIBUS MANAGEMENT ACT of 1998, 16 U.S.C. §§ 5901 *et seq.*

Resources afforded protection: any living or non-living resource
Applicable regulation(s): none

This statute requires the Secretary of Interior to continually improve the NPS's ability to provide management, protection and interpretation of National Park System resources. The statute directs the NPS to manage the units by employing high quality science and information; to inventory the system's resources to create baseline information so that NPS can monitor and analyze future data to determine trends in the resources' conditions; and to use the results of the scientific studies for park management. In the oil and gas context, this requires operators to support their plans of operations with scientific data. Further, it requires the operators to monitor their operations area to ensure that their operations do not adversely impact the park's resources.

PARK SYSTEM RESOURCE PROTECTION ACT, 16 U.S.C. § 19jj

Resources afforded protection: any living or non-living resource that is located within the boundaries of a unit of the National Park System, except for resources owned by a nonfederal entity
Applicable regulation(s): none

The Park System Resource Protection Act makes any person who destroys, causes the loss of, or injures any park system resource strictly liable to the United States for response costs and for damages resulting from such destruction, loss, or injury. A park system resource includes any living

or non-living resource located within the boundaries of a NPS unit, except for resources owned by a non-federal entity. Because the statute imposes strict liability the only defenses arise when an act of god or war caused the damage, a third party who constituted neither an employee or nor an agent of the owner/operator caused solely the damage, or an activity authorized by federal or state law caused the damage.

The Park System Resources Protection Act authorizes the Secretary of the Interior to request the Department of Justice to file a civil action for the costs of replacing, restoring or acquiring the equivalent of a park system resource; the value of any use loss pending its restoration; replacement, or acquisition, the cost of damage assessments; and the cost of response including actions to prevent, to minimize, or to abate injury. Response costs include actions taken by the NPS "…to prevent or minimize destruction, loss of, or injury to park system resources; to abate or minimize the imminent risk of such destruction, loss or injury; or to monitor ongoing effects of incidents causing such destruction, loss or injury."

The Park System Resource Protection Act applies to nonfederal oil and gas activities on National Park System units. Operators need to make sure that they operate within the specifications of their approved 9B plan, comply with all other relevant legal requirements, and take precautions to avoid actions that may damage park system resources.

OTHER APPLICABLE FEDERAL LAWS AND REGULATIONS

AMERICAN INDIAN RELIGIOUS FREEDOM ACT, as amended, 42 U.S.C. §§ 1996 – 1996a

Resources afforded protection: cultural and historic resources
Applicable regulation(s): 43 CFR Part 7

This Act requires the federal government to protect and to preserve Native Americans', Eskimos', Aleuts', and Native Hawaiians' inherent right to believe, to express, and to exercise their traditional religions. It allows them to access, to use, and to possess sacred objects and gives them the freedom to worship through ceremonials and traditional rites. It further directs various federal departments, agencies, and other administrative bodies to evaluate their policies and procedures in consultation with native traditional religious leaders to determine changes necessary to protect and preserve Native American religious cultural rights and practices.

If NPS anticipates a conflict between proposed oil and gas operations and tribal religious rights, it will consult with the tribe as part of the 9B plan approval process. To ensure compliance with this Act, the NPS will consult with tribes during the Plan of Operations approval process.

ANTIQUITIES ACT OF 1906, 16 U.S.C. §§ 431 – 433

Resources afforded protection: cultural, historic, archeological and paleontological resources
Applicable regulation(s): 43 CFR Part 3

As the Archeological Resources Protection Act's forerunner, the Antiquities Act constituted the first general act providing protection for archeological resources. It protects all historic and prehistoric ruins or monuments on federal lands and prohibits their excavation, destruction, injury or appropriation without the departmental secretary's permission. It also authorizes the President of the United States' to proclaim as national monuments public lands having historic landmarks, historic and prehistoric structures, and other objects of historic or of scientific interest. The Antiquities Act also authorizes the President to reserve federal lands, to accept private lands, and to accept relinquishment of unperfected claims for that purpose.

The Act authorizes the departmental secretary to issue permits to qualified institutions to examine ruins, excavate archeological sites, and gather objects of antiquity. Regulations at 43 CFR Part 3 establish procedures for permitting the excavation or collection of prehistoric and historic objects on federal lands. ARPA permits replace Antiquities Act permits.

Operators who excavate, injure, destroy or appropriate any "object of antiquity" while engaging in mineral activities on federal lands without or contrary to an approved plan of operations violate the Antiquities Act and trigger its penalties.

ARCHAEOLOGICAL RESOURCES PROTECTION ACT OF 1979, 16 U.S.C. §§ 470aa – 470mm

Resources afforded protection: archeological resources
Applicable regulation(s): 18 CFR 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7

Congress enacted the Archaeological Resources Protection Act (ARPA) to preserve and protect archeological resources and sites on federal and Indian lands. The law makes it illegal to excavate or to remove from federal or Indian lands any archeological resources without a permit from the federal land manager. It also prohibits the removal, sale, receipt, and interstate transportation of archeological resources obtained illegally (i.e., without permits) from federal or Indian lands.

Agencies may issue permits only to educational or to scientific institutions if the resulting activities will increase knowledge about archeological resources. The law defines archeological resources as material remains of past human life or activities that are of archeological interest and are at least 100 years old. All materials collected on federal lands as a result of permitted activities remain the property of the United States. Those excavated from Indian lands remain the property of the Indian or Indian tribe having rights of ownership over such resources. Congress amended the law to require development of plans for surveying public lands for archeological resources and of systems for reporting incidents of suspected violations.

ARPA also fosters cooperation between governmental authorities, professionals, and the public. The ARPA permit process ensures that individuals and organizations wishing to work with federal resources have the necessary professional qualifications and that these persons follow federal standards and guidelines for research and curation. The process allows the State Historic Preservation Officer (SHPO) to review and comment on ARPA permit applications. Federal agencies do not issue ARPA permits to themselves or to their contractors. The scope of work and contractor’s proposal, which constitute the contract, insures that contractors comply with federal standards and guidelines. The ARPA permit replaces the permit required by the Antiquities Act of 1906.

ARPA imposes severe criminal and civil penalties on anyone who excavates, removes, damages, or otherwise alters or defaces archeological resources without a permit. However, ARPA applies only to lands owned by the United States and lands held in trust by the United States for Indian tribes and individual Indians. ARPA does not apply on the nonfederal surface estate.

A contractor hired by an operator to conduct a cultural resource survey that involves any collection of archeological resources, whether or not excavation or subsurface testing is involved, must obtain an ARPA permit. Operations under an approved 9B plan do not need an ARPA permit for incidental disturbance of archeological resources because these operations occur exclusively for purposes other than excavation or removal of archeological resources. General earth-moving excavations performed under an approved plan of operations do not constitute "excavation or removal" of archeological resources. However, agencies require an ARPA permit before an operator under 36 CFR Part 9B salvages previously unknown archeological resources discovered during operations.

ARPA regulations appear at 43 CFR Part 7, Subparts A and B. Subpart A - "Protection of Archeological Resources, Uniform Regulations," promulgated pursuant to ARPA's section 10(a) jointly by the Secretaries of Interior, Agriculture, and Defense, and the Chairman of the Board of the Tennessee Valley Authority, establishes the uniform definitions, standards, and procedures that all federal land managers must follow when providing protection for archeological resources located on public and on Indian lands. Subpart B - "Department of the Interior Supplemental Regulations," provides definitions, standards, and procedures for federal land managers to protect archeological resources and provides further guidance for Interior bureaus concerning definitions, permitting procedures, and civil penalty hearings. In addition, NPS regulations at 36 CFR §9.47 discuss 9B plans and archeological resources.

Operators who remove, excavate, damage, alter, or deface archeological resources without or contrary to an approved plan of operations, while on federal property violate ARPA and trigger both its civil and criminal penalties.

CLEAN AIR ACT, as amended, 42 U.S.C. §§ 7401 – 7671q

Resources afforded protection: air resources
Applicable regulation(s): 40 CFR Parts 23, 50, 51, 52, 58, 60, 61, 82, and 93; and 48 CFR Part 23

The Clean Air Act (CAA) seeks to "protect and enhance" the quality of the nation's air resources; to promote the public health and welfare and the productive capacity of its population; to initiate and to accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to State and local governments for aid in their development and execution of air pollution programs; and to encourage and to assist the development and the operation of regional air pollution control programs.

The Act requires the U.S. Environmental Protection Agency (EPA) to establish national primary standards to protect human health and more stringent national secondary standards to protect human welfare (National Ambient Air Quality Standards or NAAQS). The statute makes states and local governments responsible for the prevention or control of air pollution. NAAQS exist for sulfur dioxide, particulate matter, ozone, nitrogen dioxide, carbon monoxide, and lead.

Divided into air quality control regions, states must submit Implementation Plans for EPA approval. These plans provide strategies for the implementation, maintenance, and enforcement of national primary and secondary ambient air quality standards for each air quality control region.

Other provisions of the Act include: new source review permit programs, standards of performance for new stationary sources (NSPS), motor vehicle emission and fuel standards, national emission standards for hazardous air pollutants (NESHAPS), studies of particulate emissions from motor vehicles, studies of the cumulative effect of all substances and activities that may affect the stratosphere (especially ozone in the stratosphere), programs to Prevent Significant air quality Deterioration (PSD) in areas attaining the NAAQS, and programs to protect visibility in large national parks and wilderness areas.

All sources of air pollution, including publicly or privately owned facilities, must meet all federal, state, and local requirements under the CAA. In most cases, States and local authorities regulate air pollution control. For the National Park Service, the Prevention of Significant Deterioration of Air Quality (PSD) (42 U.S.C. §§ 7470-7475) and the Visibility Protection (42 U.S.C. § 7479) constitute the most important CAA sections.

The PSD provisions establish a classification system for the United States' clean air areas, which include those designated as Class I, Class II or Class III. National Park System units are designated as Class I or Class II areas. This classification indicates the additional increment of air quality

degradation from particulate matter, sulfur dioxide ($S0_2$), nitrogen dioxide (NO_2), allowed in that area. Class I areas may only degrade by a very small increment of new pollution while Class III areas can degrade substantially. There are currently no Class III areas designated in the country.

As part of the Prevention of Significant Deterioration (PSD) program, Congress designated many National Parks and wilderness areas (including U.S. Fish and Wildlife Service and U.S. Forest Service wilderness areas) mandatory Class I areas. Because states may not redesignate these areas, Congress provided those areas with maximum protection from future air quality degradation. EPA designated all other parts of the country where air quality did not violate the national ambient air quality standards Class II areas where moderate pollution increases may occur. States or Indian tribes may reclassify Class II areas as Class III, thus, allowing significant pollution increases. However, no entity can designate certain Class ll areas, such as national monuments and national recreation areas, as Class III but only Class II, or, at the option of the state, Class I.

Generally, the PSD rules apply only to major new or expanding facilities planning to locate or expand operations in clean air areas. An operator of a facility seeking a new source permit for location or for expansion in a clean air area must meet several requirements including National Ambient Air Quality Standards; PSD Classes I, II and III air pollution increments; and, a special "adverse impact determination" for Class I areas.

To protect the scenic value of visibility in National Parks and wilderness areas, Congress established a national visibility goal in section 169A of the CAA. Congress stated the agencies' goals as "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I federal areas which impairment results from manmade air pollution". Under current EPA regulations, the thirty-six states, including Texas, with mandatory Class I areas must assure reasonable progress toward the national visibility goal with respect to impairment reasonably attributed to major stationary sources of air pollution. EPA reviews new major stationary sources under permitting programs (i.e., PSD and nonattainment area new source review) to assure visibility protection of Class I areas from potential future emissions.

These permitting programs also require that new major sources analyze visibility and other air quality impacts in the general area affected by the new source's emissions regardless of the classification of the area as Class I or Class II. If oil and gas development and operations result in major emissions of air pollutants as defined in PSD and nonattainment area permitting provisions, then such major emitting facilities would need to comply with these requirements as well as any other applicable, federal, state, and local air quality rules and regulations. EPA issued new regulations in July 1999 to address visibility impairment caused by regional haze, but implementation of this program will not occur for several more years.

One particular issue that must be addressed concerns conformity with the Texas ozone nonattainment area State Implementation Plan (SIP). The Clean Air Act Amendments of 1990 required EPA to promulgate rules to ensure that federal actions conform to appropriate nonattainment area SIPs. These rules prohibit federal agencies from taking any action that causes or contributes to any new violation of the NAAQS, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard. The NPS will need to make a conformity determination for any oil and gas permitting decisions made under this management plan as it pertains to existing ozone nonattainment SIPs applicable in the area of the parks.

COASTAL ZONE MANAGEMENT ACT OF 1972, as amended, (16 U.S.C. § 1451 *et seq*.)
Resources afforded protection: coastal waters and adjacent shoreline areas, coastal uses and natural resources
Applicable regulation(s): 15 CFR Parts 923, 930, 933

Congress enacted the Coastal Zone Management Act (CZMA) to preserve, protect, develop, and, where possible, restore or enhance the resources of the Nation's coastal zone. The purpose of the Act is to improve the nation's management of coastal resources, which have been irretrievably damaged or lost due to poorly planned development. Specific concerns were the loss of living marine resources and wildlife habitat, decreasing open space for public use, and shoreline erosion. Congress also recognized the need to resolve conflicts between various uses that were competing for coastal lands and waters (USDOC, NOAA, 1988a). The "coastal zone" means the coastal waters and the adjacent shorelands of the United States. It also includes coastal zones of the Great Lakes.

The CZMA establishes a state-federal partnership in which the states take the lead in managing their coastal resources by developing state CZM programs and plans, while the federal government provides financial and technical assistance. In section 109, the CZMA encourages each state, through a Coastal Zone Enhancement Grants Program, to improve continually its CZM program in one or more of eight identified national priority areas:

- coastal wetlands management and protection,
- natural hazards management (including potential sea and Great Lakes level rise),
- public access improvements,
- reduction in marine debris,
- assessment of cumulative and secondary impacts of coastal growth and development,
- special area management planning,
- ocean resource planning, and
- siting of coastal energy and government facilities.

Approved state CZM programs must provide a mechanism for public participation in permitting processes, consistency determinations and other similar decisions. They must also provide a mechanism to ensure that all state agencies will adhere to the program, and contain enforceable policies and mechanisms to implement the applicable requirements of the state's Coastal Nonpoint Pollution Control Program.

The CZMA requires federal agencies to act in a manner consistent with federally approved state management programs. Federal consistency under the CZMA means that federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a coastal state's or territory's federally approved coastal management program. In states that do not have a coastal zone management program approved by the Secretary of Commerce, the requirement for a consistency review and state concurrence does not apply.

The National Oceanic and Atmospheric Administration's (NOAA) coastal zone management program regulations (15 CFR 923) require that the boundary of a state's coastal zone must exclude federal lands. Units of the National Park System such as Big Thicket National Preserve are excluded from the boundaries of a state's coastal zone. However, the Coastal Zone Reauthorization Amendments in 1990 declared that all federal agency activities, whether located in or outside of the coastal zone, are subject to the consistency requirements of Section 307(c) of the CZMA if the activities affect natural resources, land uses, or water uses in the coastal zone. Additionally, the Texas Coastal Management Program/Final Environmental Impact Statement, prepared in 1996 by the NOAA's Office of Ocean and Coastal Resource Management and the State of Texas Coastal Coordination Council states that, "While activities on excluded federal lands are not required to

comply with the TCMP goals and policies, an activity that has spillover effects on CNRAs is subject to the federal consistency requirement (Part II, 2-5)".

NPS Management Policies require that the NPS comply with provisions of state coastal zone management plans prepared under the Coastal Zone Management Act when such provisions are more environmentally restrictive than NPS management zoning (NPS Management Policies, Chapter 4:8.1.1). Few mineral rights in National Park System units are located in the coastal zone. Jean Lafitte National Historical Park and a segment of the Beaumont Unit of Big Thicket National Preserve are examples of units that contain nonfederal oil and gas rights located in the coastal zone.

In the event that the NPS is considering issuing an access or surface use permit through the approval of a Plan of Operations, and the proposed nonfederal oil and gas operation may have a spillover effect on CNRAs, the NPS will consult with the Texas General Land Office for a consistency determination. In these cases, the Coastal Coordination Council must refer a consistency certification within 45 days of receipt by the Council Secretary of an administratively complete consistency certification, or the action is conclusively presumed to be consistent.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, as amended, 42 U.S.C. §§ 9601 – 9675

Resources afforded protection: human health and welfare and the environment
Applicable regulation(s): 40 CFR Parts 279, 300, 302, 355, and 373

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as "Superfund," provides for cleanup of sites contaminated by hazardous substances in the United States. CERCLA defines "hazardous substance" as any substance: listed under the Resources Conservation and Recovery Act (42 U.S.C. § 6921) as hazardous waste or having the characteristics identified under that section; listed under the Clean Water Act (33 U.S.C. § 1321(b)(2)(a)) as a hazardous substance or (33 U.S.C. § 1317(a)) as a toxic pollutant; listed under the Clean Air Act (42 U.S.C. § 7412) as a hazardous air pollutant; listed under the Toxic Substances Control Act (15 U.S.C. § 2606) as an imminently hazardous chemical substance or mixture; or listed under CERCLA (42 U.S.C. § 9602) as a hazardous substance.

CERCLA explicitly excludes from the definition of hazardous substance petroleum, including crude oil or any fraction of petroleum that is not otherwise specifically listed or designated as a hazardous substance under statutory provisions listed above. It also excludes natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable as fuel from the definition of hazardous substances. (42 U.S.C. § 9601(14)).

Owners or operators of a facility that stored, treated, or disposed of hazardous substances must notify EPA of the location and of the type of waste at the site. EPA puts the most seriously contaminated sites on a National Priorities List (NPL) and updates it annually. Sites on the NPL are eligible for long-term clean up actions funded by the EPA administered Superfund program.

CERCLA also includes reporting requirements for spills or other releases of hazardous substances. CERCLA requires persons in charge of a vessel or facility to report releases (except federally permitted releases) of hazardous substances into the environment to the National Response Center. If releases constitute less than the reportable quantity established by EPA (40 CFR § 302.4), then it does not have to be reported. Failure to report a reportable quantity release warrants a fine of up to $10,000 and imprisonment not to exceed one year (42 U.S.C. § 9603). "Release" means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, dumping or disposing into the environment. "Release" also includes the abandonment of barrels or containers that contain hazardous substances.

CERCLA directs the president to revise and to publish a National Contingency Plan (NCP) for the cleanup of petroleum and of hazardous waste spills. EPA developed the original NCP under section 311 of the Clean Water Act. The NCP details how the EPA will respond to spills of oil or hazardous substances regulated under CERCLA and/or the Clean Water Act. EPA publishes the plan, called the National Oil and Hazardous Substances Pollution Contingency Plan, at 40 CFR Part 300.

CERCLA authorizes the EPA to clean up sites using the Superfund, to issue administrative orders requiring potentially responsible parties (PRPs) to clean up sites, and to obtain court orders requiring PRPs to clean up sites. If EPA uses the Superfund, then CERCLA authorizes EPA to sue PRPs to recover costs of the cleanup. PRPs who have incurred costs cleaning up may sue other PRP's to recover part of the cost of the cleanup.

Under CERCLA, the EPA tries to find all PRPs, including the present owner or operator of a vessel or facility that released or threatened a release of hazardous substances, past owners or operators of a vessel or facility at the time of disposal of the hazardous substance; persons who arranged for disposal of the hazardous substance at the facility; and persons who transported a hazardous substance to the facility.

However, if the PRP can establish that the release or threatened release and the resulting damages occurred solely by an act of God, an act of war, or an unforeseen act or omission of a third party who neither constituted an agent nor an employee of the PRP, then no liability attaches. CERCLA provides an innocent landowner defense under limited circumstances.

Persons liable under CERCLA remain responsible for all response costs incurred by the United States, a state or an Indian tribe. They may also incur liability for damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing the injury, and for the destruction or loss of natural resources. Furthermore they may be responsible for costs of certain health assessments or studies.

CERCLA imposes strict liability meaning the government does not have to prove that the person intended to release, acted negligently in releasing, or caused the release of a hazardous substance into the environment. Moreover, in most cases, any of the liable parties may be held responsible for the entire cost of the cleanup. To recover part of the cleanup costs, the party then sues other liable parties for contribution.

Operators and their contractors should thoroughly investigate waste disposal sites before sending hazardous substances. They should check to make sure disposal sites have the relevant state and federal permits and that the disposal company has provided enough money to properly close the site. If a release occurs from the disposal site, then the persons who disposed of hazardous substances could incur large cleanup bills.

Operators should avoid releases of hazardous substances. Release of an operator's performance bond required under 36 CFR §9.48 does not affect possible subsequent liability under CERCLA for releases of a hazardous substance into the environment.

ENDANGERED SPECIES ACT OF 1973, as amended, 16 U.S.C. §§ 1531 – 1544

Resources afforded protection: plant and animal species or subspecies and their habitat, which have been listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS). Distinct population segments of species of vertebrate fish or wildlife, which interbreed when mature, may also be listed as threatened or endangered, and are afforded protection.

Applicable regulation(s): 36 CFR Part 13; and 50 CFR Parts 10, 17, 23, 81, 217, 222, 225 402, and 450

The Endangered Species Act (ESA) requires federal agencies to ensure that their activities (authorized, funded, or carried out) will not jeopardize the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of critical habitat of such species. The FWS and NMFS administer the Act. The ESA makes it illegal to "take" an endangered species of fish or wildlife without a permit from the FWS or NMFS. “Taking” includes direct killing, hurting, trapping, or harassing. It also includes disrupting a habitat critical to the species' survival. Protective regulations issued at the time of listing for a threatened species of fish or wildlife may also prohibit or limit taking of the species without a permit.

Other federal agencies must formally consult with the FWS or NMFS when they believe that their own actions (including permitting) may affect a listed or a proposed threatened or endangered (T & E) species. The ESA prohibits agency actions occurring within the United States that jeopardize the continued existence of a T & E species and/or destroy or adversely affect designated critical habitat necessary for the species’ survival.

When an operator submits a proposed plan of operations, the NPS and operators must comply with the requirements of the Endangered Species Act and the regulations FWS and NMFS have promulgated to implement it (50 CFR Part 402). First, the NPS requests the FWS or NMFS to provide a list of proposed or listed species and proposed or designated critical habitat in the proposed operations area.

If the FWS or NMFS advises the NPS that listed or proposed T&E species may be present, then the NPS must prepare a biological assessment (BA). The BA evaluates the potential effects of the action on listed and proposed species and designated and proposed critical habitat. The BA must be included with the environmental assessment as required under the National Environmental Policy Act. The BA should include a list of listed and proposed threatened or endangered species occurring in the project area; impacts the project could have on these species and their habitat; project measures intended to mitigate, or reduce adverse impacts to these species and their habitat; and a description of the formal and informal consultation with the FWS or NMFS.

If the BA indicates that the action will not adversely affect any remaining listed species or designated critical habitat and the FWS or NMFS concurs, then formal consultation is not required. Likewise, if the BA indicates that the action is not likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat, and FWS or NMFS concurs, then a conference is not required.

However, if the BA indicates that the action will adversely affect a listed species or critical habitat, then the NPS must formally consult with the FWS or NMFS. At the end of the consultation, the FWS or NMFS provides the NPS and the applicant with its "biological opinion." If the opinion finds the proposed action will jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat, then the FWS or NMFS must suggest reasonable and prudent alternatives to the proposed action. If the FWS or NMFS cannot develop any reasonable and prudent alternatives, then it will indicate that to the best of its knowledge there are no reasonable and prudent alternatives exist. The FWS or NMFS may also formulate conservation recommendations, which will help the NPS reduce or eliminate the impacts the proposed action may have on listed species or designated critical habitat. The NPS will comply with prescribed alternatives when approving the plan of operations or implementing any other related action.

The NPS cannot approve a plan of operations if the FWS or NMFS has found that, no matter how modified, the action will result in "jeopardy” to a listed species or "destruction or adverse modification to habitat" critical to a listed species. Jeopardizing a listed species or habitat critical to a listed species' survival constitutes a "significant injury to federal lands" in the meaning of 36 CFR Part 9B. The 36 CFR Part 9B regulations do not allow the NPS to approve proposed plans that will result in a "significant injury to federal lands."

FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT, as amended (commonly referred to as FEDERAL ENVIRONMENTAL PESTICIDE CONTROL ACT OF 1972), 7 U.S.C. §§ 136 *et. seq.*

Resources afforded protection: human health and safety, and the environment
Applicable regulation(s): 40 CFR Parts 152-180, except Part 157

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, regulates pesticides in the United States. FIFRA prohibits the distribution or sale of unregistered pesticides and establishes procedures for registering pesticides with the EPA. EPA has the authority to suspend or to cancel registrations for pesticides, which cause unreasonable adverse effects on the environment. To gain registration approval, a pesticide must meet EPA criteria regarding efficacy, labeling, and environmental safety. The statute makes illegal using a pesticide in a manner inconsistent with its labeling. EPA determines whether it should classify pesticides for general or restricted use. People may only use pesticides classified for restricted use under the direct supervision of a certified applicator or subject to other restrictions imposed by regulation.

FIFRA also requires EPA to establish regulations for storage and disposal of pesticide containers, excess pesticides and pesticides with canceled registration. The Act also outlines penalties, indemnities, and administrative procedures. In addition, EPA may exempt from any provision of Act any federal or state agency, if it determines emergency conditions, requiring such exemption, exist.

The appropriate NPS pesticide specialist must review and approve use of pesticides, including herbicides and rodenticides, before anyone can use them in units of the National Park System, including those where nonfederal oil and gas operations under a 9B plan occur. An NPS Integrated Pest Management Specialist must review and approve the proposed use of herbicides for clearing areas for oil and gas operations. The parks follow Department of the Interior Departmental Manual - 517; Reference Manual – 77, Natural Resources Management; and NPS Procedures for Pesticide Use Requests when considering proposals for pesticide use.

FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976, 43 U.S.C. §§ 1701 *et seq.*

Resources afforded protection: federal lands and resources administered by the Bureau of Land Management
Applicable regulation(s): 43 CFR Part 2200 for land exchanges and 43 CFR Parts 1700-9000 for all other BLM activities

The Federal Land Policy and Management Act (FLPMA), also known as the “BLM Organic Act”, controls Bureau of Land Management’s (BLM) administration of more than three hundred million acres of federal lands in the western United States and Alaska. FLPMA also contains a land exchange authority (43 U.S.C. § 1716) under which the Secretary of the Interior may exchange federal lands or interests outside National Park System units for nonfederal lands or interests within National Park System units. When appropriate, the NPS and BLM may use this exchange authority to acquire private mineral interests in National Park System units.

BLM regulations at 43 CFR Part 2200 govern federal land exchanges authorized by FLPMA. The regulations describe the appraisal and other procedures BLM uses while conducting land exchanges. However, if the enabling or exchange act for a unit remains inconsistent with these regulations, then the enabling or exchange act applies.

FEDERAL WATER POLLUTION CONTROL ACT OF 1972 (commonly referred to as CLEAN WATER ACT), 33 U.S.C. §§ 1251 *et seq.*
Resources afforded protection: water resources, wetlands, and waters of the U.S.
Applicable regulation(s): 33 CFR 320-330; and 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328

Originally titled the Federal Water Pollution Control Act of 1972 (FWPCA) and significantly amended in 1977 and 1987, the Clean Water Act established a federal policy to restore and to maintain the chemical, physical, and biological integrity of the nation's waters; to enhance the quality of water resources; and to prevent, control and abate water pollution.

To achieve this objective, the CWA establishes the ultimate goal of eliminating the discharge of pollutants into navigable waters of the United States and the interim goal of maintaining water quality that provides for the protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the water. The CWA prohibits the discharge of toxic pollutants in toxic amounts; provides federal assistance to construct publicly owned waste treatment works; develops and implements area-wide waste treatment management processes to assure adequate control of source pollutants in each state; makes a major research and demonstration effort to develop technology necessary to eliminate the discharge of pollutants into navigable waters, waters of the contiguous zone, and the oceans; and develops and implements programs for the control of nonpoint sources of pollution to control both point and nonpoint sources of pollution.

As with most environmental programs, the CWA requires that states set and enforce water quality standards to meet minimum federal (EPA) requirements, including: effluent limitations for point sources of pollution; permits for discharges of pollutants into waters of the United States; and permits for discharges of dredged or fill material into waters of the U.S., including wetlands. TNRCC holds the primary responsibility for protecting Texas' water resources.

The following sections of the CWA remain relevant to oil and gas operators in National Park System units: Section 311 - Spill reporting and spill control; Section 401 - state certification of project compliance; Section 402 - National Pollutant Discharge Elimination System (NPDES); Section 404 - Corps of Engineers dredge and fill permits.

<u>Section 311 (33 U.S.C. § 1321)</u>
Under section 311 no person can discharge oil or hazardous substances in harmful quantities into or upon navigable waters of the U.S., into or upon adjoining shorelines, or into or upon waters of the contiguous zone. Likewise, a person cannot discharge in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974. For oil, a harmful quantity (i.e., quantity that requires reporting) equals that amount which causes a violation of the applicable water quality standard or that amount which causes a film, sheen, or discoloration of the water surface. Persons who discharge a reportable quantity" must report as soon as possible to the U.S. Coast Guard, EPA, and/or State of Texas, which agency depends on the geographic location of the spill and the type of substance spilled.

Hazardous substances are handled differently. Title 40 CFR Part 116 lists about 300 hazardous substances. Title 40 CFR Part 117 defines the reportable quantities for each substance. The reporting requirements of 40 CFR Part 117 do not apply to permitted discharges. (See Section 402 permits below.) Failure to report a discharge can result in criminal penalties including fines and imprisonment. Section 311 also provides for federal cleanup of the spill and places the costs of cleanup on the entity that caused the spill. The section also protects the person in charge who reports the spill from criminal prosecution, but offers no immunity from civil penalties that may apply.

Under section 311, EPA issued regulations (40 CFR Part 112) to prevent the discharge of oil and hazardous substances into the navigable waters of the United States. These regulations require

that any of the facilities described below prepare a Spill Prevention Control and Countermeasure Plan (SPCCP).

The SPCCP requirement applies to non-transportation related onshore and offshore facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing or consuming oil or oil products. It only applies if the facilities due to their location, could potentially discharge oil in harmful quantities into or on the navigable waters of the United States or the adjoining shoreline. (Note: facilities with an underground storage capacity less than 42,000 gallons, or facilities with an above-ground storage capacity less than 1,320 gallons, are exempt from this requirement.)

Under its regulations at 36 CFR Part 9B, the NPS requires a nonfederal oil and gas operator to submit a plan to deal with oil spills and other environmental hazards. A copy of the SPCCP, if one is required under 40 CFR Part 112, will often meet the requirement for oil spill plans under 36 CFR Part 9B.

Section 401 Water Quality Certification (33 U.S.C. § 1341)

Section 401 requires certification from the state or interstate water control agency that a proposed water resources project complies with established effluent limitations and water quality standards. Applicants for federal permits or licenses must obtain this certification. The TNRCC administers the Section 401 certification program except with respect to oil and gas exploration and production, which is the responsibility of the RRC (TNRCC, 1999).

Section 402 Permits (33 U.S.C. § 1342(I)(2))

Under the National Pollutant Discharge Elimination System (NPDES), the EPA controls the discharges of pollutants from their point source into waters of the United States by using a permitting system. A "point source" could be a tank battery, for example. Any entity proposing to or discharging waste flows into U. S. waters needs a NDPES permit. EPA or states with EPA-approved programs issue NDPES permits.

The NPDES permit sets specific discharge limits. The limits rely on most recent pollution control technology, water quality standards, and government imposed schedules for installation of new pollution control equipment. The permit gives directions to the operator for monitoring and reporting discharges. The regulations provide for individual permits, group permits for like facilities, and general permits.

The Water Quality Act of 1987 amended the CWA to address stormwater runoff from industrial facilities. EPA requires a NPDES stormwater runoff permit for runoff that may touch machinery or contaminated material onsite and cause contamination of adjacent property. Industrial facilities include oil and gas exploration, production and development operations. The EPA published its rule on NPDES permit application regulations for storm water discharges at 55 Fed. Reg. 47990 (November 16, 1990).

The CWA exempts mining and oil and gas operations from the Section 402 stormwater permit requirements if,

> "…discharges of stormwater runoff from mining operations, oil and gas exploration, production, processing, or treatment operations or transmission facilities, [are] composed entirely of flows which are from conveyances or systems of conveyances (including but not limited to pipes, conduits, ditches, and channels) used for collecting and conveying precipitation runoff and…are not contaminated by contact with, or do not come into contact with, any overburden, raw material, intermediate products, finished product, by-product, or waste products located on the site of such operations." (33 U.S.C. § 1342(1)(2))

"Contaminated storm water runoff" includes runoff containing a hazardous substance in excess of reporting quantities established at 40 CFR § 117.3 or 40 CFR § 302.4, containing oil in excess of the reporting quantity established at 40 CFR § 110.3 (e.g., causes a visible sheen), or contributing to a violation of a water quality standard.

Section 404 Permits (33 U.S.C. § 1344)

Under section 404, anyone who discharges dredge or fill material into navigable waters needs a permit from the U.S. Army Corps of Engineers. "Navigable waters" mean "…those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce." (33 CFR 329.4)

A determination of navigability, once made, applies over the entire surface of the waterbody and remains in effect even if later actions or events impede or destroy its navigability.

Section 404 regulates discharges into virtually all surface waters where the use, degradation, or destruction of these waters could affect interstate commerce. It also applies to all tributaries and adjacent wetlands of such waters. The COE defines wetlands as areas"inundated or saturated by surface or ground water at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions…" (33 CFR 328.3(b).

The Corps of Engineers may issue individual permits or general permits on a state, regional, or nationwide basis. It issues general permits for certain kinds of similar activities in wetlands that will cause only minimal adverse effects on the environment. General permits do not cover many operators of nonfederal oil and gas properties in National Parks. They must obtain an individual "404" permit to conduct any operations that involve dredging or discharge of fill material into wetlands.

Under the 404 permit program, the COE may issue individual permits or general permits on a state, regional, or nationwide basis. COE uses general permits for certain categories of activities that have only minimal adverse and cumulative effects on the environment. Many operators of nonfederal oil and gas properties in National Parks do not hold general permits. Operators must obtain an individual "404" permit to conduct operations that involve dredging or discharging fill material into wetlands.

Before the issuance of either a NPDES or section 404 permit, the applicant must obtain a section 401 certification. This declaration states that any discharge complies with all applicable effluent limitations and water quality standards.

The NPS cannot waive CWA requirements for oil and gas operators. An operator has full responsibility for obtaining section 402 (NPDES) or/and section 404 (dredge and fill) permits and for reporting spills of oil, or other contaminating and hazardous substances.

HISTORIC SITES, BUILDINGS, AND ANTIQUITIES ACT (HISTORIC SITES ACT OF 1935), 16 U.S.C. §§ 461 – 467

Resources afforded protection: historic sites, buildings and objects
Applicable regulation(s): 18 CFR Part 6; and 36 CFR Parts 1, 62, 63, and 65

This Act establishes a national policy "to preserve for public use, historic sites, buildings, and objects of national significance for the inspiration and benefit" of the American people. The Act authorizes the designation of national historic sites and landmarks, authorizes interagency efforts to preserve historic resources, and establishes fines for violations of the Act. It authorizes surveys of historic and archeological sites, buildings, and objects to determine which remain significant, and provides for the

restoration, reconstruction, rehabilitation, preservation, and maintenance of historic and prehistoric properties of national significance. The Act authorizes the Secretary of the Interior, through the National Park Service, to conduct surveys and studies, to collect information, and purchase significant historic properties. The Secretary may also restore, preserve, maintain, and rehabilitate structures and sites; establish museums; and operate and manage historic sites, and develop educational programs.

LACEY ACT, as amended, 16 U.S.C. §§ 3371 *et seq*.

Resources afforded protection: fish and wildlife, vegetation
Applicable regulation(s): 15 CFR Parts 10, 11, 12, 14, 300, and 904

The Lacey Act prohibits the import, export, transport, sales, receipt, acquisition, or purchase of fish, wildlife, or plants that are taken, possessed, transported, or sold in violation of any federal law, treaty, regulation or Indian tribal law. The act also makes illegal importing, exporting, transporting, selling, receiving, acquiring, or purchasing in interstate or foreign commerce any fish, wildlife or plants taken, possessed, transported or sold in violation of a state law or state regulation (or foreign law for fish and wildlife, but not for plants). The Act also establishes marking requirements for containers or packages containing fish or wildlife.

The 1981 amendments to the Act strengthened federal laws and improved federal assistance to states and foreign governments for enforcement of fish and wildlife laws. The Act has significant civil and criminal penalties for violations and has emerged as a vital tool in efforts to control smuggling and trade in illegally taken fish and wildlife.

The U.S. Fish and Wildlife Service regulations implementing the Lacey Act and other related laws describe the procedures for the assessment of civil penalties (50 CFR Part 11) and for government seizure and forfeiture (50 CFR Part 12).

MIGRATORY BIRD TREATY ACT, as amended, 16 U.S.C. §§ 703 – 712

Resources afforded protection: migratory birds
Applicable regulation(s): 50 CFR Parts 10, 12, 20, and 21

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the United States, Canada, Japan, Mexico, and Russia for the protection of migratory birds. Unless permitted by regulations, under the MBTA a person cannot attempt or succeed at pursuing, hunting, taking, capturing, or killing, possessing, offering to sell, selling, bartering, purchasing, delivering, shipping, exporting, importing, transporting, carrying or receiving any migratory bird, body part (e.g. feathers), nest, egg, or product. The U.S. Fish and Wildlife Service regulations provide procedures for obtaining a migratory bird permit (50 CFR Part 21). Regulations at 50 CFR 20 cover hunting of migratory birds, and regulations at 50 CFR Part 12 cover seizure and forfeiture procedures.

Operators and their employees should avoid actions with respect to migratory birds that could violate the Migratory Bird Treaty Act (e.g. destroying nests and eggs or picking up dead birds).

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, 42 U.S.C. §§ 4321 *et seq.*

Resources afforded protection: the human environment (e.g. cultural and historic resources, natural resources, biodiversity, human health and safety, socioeconomic environment, visitor use and experience)
Applicable regulation(s): 40 CFR Parts 1500-1508

The National Environmental Policy Act (NEPA) mandates that federal agencies assess the environmental effects of a proposed action and engage the public in the analyses of environmental impacts before agencies make decisions affecting the human environment. NEPA requires that federal agencies "utilize a systematic interdisciplinary approach" to ensure the integrated use of resource information in federal decision-making affecting the environment. Federal agencies must complete all analyses, public input, and NEPA documentation in time to aid decision-making. Initiating or completing environmental analysis after making a decision, whether formally or informally, violates both the spirit and the letter of NEPA.

Besides setting environmental planning policy goals, NEPA created the Council on Environmental Quality (CEQ), an agency of the president's office, as the "caretaker" of NEPA. CEQ published NEPA regulations in 1978 (40 CFR Parts 1500-1508). The CEQ regulations apply to all federal agencies and require each agency to "implement procedures to make the NEPA process more useful to agency decision-makers and the public" (40 CFR 1500.2). Agencies must review and update their regulations as necessary. In 1981 CEQ also published a guidance document titled "Forty Most Asked Questions Concerning CEQ's NEPA Regulations" (46 Fed. Reg. 18026, (1981)). Director's Order 12 and Handbook (2001) is the National Park Service's guidance on implementing NEPA.

The NEPA process constitutes an essential component of conservation planning and resource management through the integration of scientific and technical information into management decisions. In order to be effective, agencies cannot fulfill NEPA compliance by conducting an after-the-fact "compliance" effort. A well-crafted NEPA analysis provides useful information about the environmental pros and cons (i.e. impacts) of a variety of reasonable choices (alternatives), similar to an economic cost-benefit analysis, technical planning, or logistical planning. It remains an essential prelude to the effective management of park resources.

NEPA represents a procedural or process-oriented statute rather than a substantive or substance-oriented statute. Other substantive laws may prevent an agency from taking action or components of an action which have "too great" an impact on a particular resource. Within the NPS, the process of environmental analysis under NEPA provides the needed information to make substantive decisions for the long-term conservation of resources.

NEPA has a broad reach. NEPA is triggered regardless of who proposes the action (NPS, private individuals, federal agencies, states, or local governments) or whether the action could have impacts on the human environment. Even though the CEQ regulations give less emphasis to the socioeconomic environment than the physical or natural environment, the NPS considers the socioeconomic environment as an integral part of the human environment. Consequently, NPS will do NEPA analysis even if the impacts remain primarily socioeconomic, including potential impacts on minority and low-income communities (see Executive Order No. 12948, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).

The National Park Service undertakes its environmental analyses in a number of ways. When the NPS considers taking a "major federal action" such as approving a proposed 9B plan of operations, it prepares an environmental assessment (EA) to assess the impacts of the proposed operation and to determine if the NPS must prepare an environmental impact statement (EIS). If, based on the EA's analysis and public comments, the NPS determines that the proposed action would not significantly affect the human environment, the NPS would prepare a decision document called a

Finding of No Significant Impact (FONSI). Conversely, if NPS determines the proposed action would likely cause significant affects on the human environment, then it prepares an EIS. The NPS may prepare an EIS, without first preparing an EA if the action will likely cause significant environmental impacts. Some actions or types of proposals fall under a NEPA "categorical exclusion" (CE). A categorical exclusion is used where the proposal meets specific criteria defined under Department of the Interior regulations and NPS Director's Order 12, for activities that do not have the potential for measurable impacts on park resources.

NATIONAL HISTORIC PRESERVATION ACT OF 1966, as amended, 16 U.S.C. §§ 470 – 470x-6

Resources afforded protection: cultural and historic properties listed in or determined to be eligible for listing in the National Register of Historic Places
Applicable regulation(s): 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810

The National Historic Preservation Act (NHPA) declared a national policy of historic preservation. It encouraged preservation on the state and the private levels, authorized the Secretary of the Interior to expand and to maintain a National Register of Historic Places, established the Advisory Council on Historic Preservation, and required federal agencies to conduct studies of potential effects of their proposed actions on National Register properties and to provide the Advisory Council opportunities to comment (§ 106). The Advisory Council has promulgated regulations, "Protection of Historic and Cultural Properties," at 36 CFR 800, to implement section 106 and presidential directives issued under it.

The NHPA also required federal agencies to identify, evaluate, and nominate cultural resources for inclusion in the National Register. Likewise, agencies must manage for preservation those National Register eligible or listed properties that under their jurisdiction or control.

In 1980 Congress passed a series of amendments to the NHPA and other preservation legislation. These amendments: codified portions of Executive Order No. 11593, which required inventories of federal resources and federal agency programs to protect historic resources; clarified that federal agencies can exclude inventory and evaluation of resources from the one percent fund limit under the 1974 amendments to the Reservoir Salvage Act; and authorizes federal agencies to charge federal permitees and licensees reasonable costs for protection activities.

The 1992 amendments to the Act explicitly call for Native American consultations when potential traditional cultural properties may be on federal lands. If such properties are discovered through the consultations, they should be evaluated for possible eligibility and/or listing in the National Register of Historic Places.

The NPS must consider the potential effects of any proposed oil and gas activities on cultural resources listed on or eligible for listing on the National Register. This responsibility cannot be delegated to nonfederal parties. NPS regulations at 36 CFR § 9.37(e) state that the Regional Director may not approve a proposed plan of operations until the NPS complies with the NHPA. NPS regulations also require that operators provide the information needed for the NPS to make the determinations required under the NHPA. Operators must submit, as part of the environmental section in a proposed plan of operations, a description of the environment to be affected, including the natural and cultural environment.

In general, the NPS will have surveyed its lands as required by section 110 of the NHPA. The NPS cultural resource survey typically constitutes a careful inspection of the ground surface. The NPS uses standard archeological methodology that may include exploratory subsurface testing. The data from the survey indicate whether the lands fulfill the eligibility requirements for listing on the National

Register. Operators may obtain data gathered during NPS surveys for the environmental section of the proposed plan.

When an operator submits a proposed plan of operations, the NPS reviews the cultural resources section. Based upon that review, the staff's knowledge of the affected area's history and prehistory, and the NPS cultural resource surveys, the Regional Director determines if the operations would affect a property listed or eligible for listing on the National Register.

If the NPS finds that the operations would not affect a property listed or eligible for listing, the NPS consults with the State Historic Preservation Officer (SHPO) to obtain agreement. If the SHPO agrees with the NPS, then the Regional Director may issue an archeological clearance for any ground-disturbing operations on federal park lands.

However, if the NPS finds that operations would affect listed or eligible properties, then the NPS prepares an "Assessment of Effect on Cultural Resources". The NPS then consults with the SHPO to determine what steps to take to protect the site. If the NPS and the SHPO cannot agree on a course of action, then the matter is referred to the Advisory Council on Historic Preservation (ACHP). If the operation may affect a park also designated a National Historic Landmark, then the NPS must automatically consult with the ACHP.

Even if the property is listed on the National Register, private surface owners may take any lawful action they want on their own property. Under the authority of the NPS Organic Act and certain unit enabling legislation directing the NPS to regulate mineral activities to protect natural and cultural resources, the NPS can include stipulations in its plan approval to protect cultural resources on private property inside unit boundaries during the course of mineral operations.

NPS regulations at 36 CFR § 9.47 require operators to stop all operations and to notify the Superintendent if cultural resources are "discovered during operations. For the NPS to meet its obligations under the NHPA and the NPS Organic Act, an operator must notify the NPS of cultural resources that may be destroyed by a NPS-approved oil and gas operation. The notification requirement applies even though the operator may own the cultural resources. Notification gives the NPS an opportunity to judge the historic value of the resources, and, if warranted, acquire them from the owner.

An operator under 36 CFR Part 9B may have to salvage cultural resources discovered in the course of operations. The operator may salvage the resources only after the NPS, in consultation with the SHPO, approves a mitigation and salvage plan and chooses a contractor to do the data recovery.

NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT, 25 U.S.C. §§ 3001 – 3013

Resources afforded protection: Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony
Applicable regulation(s): 43 CFR Part 10

The Native American Graves Protection and Repatriation Act (NAGPRA) protects Native American and Native Hawaiian cultural items and establishes a process for the authorized removal of human remains, funerary objects, sacred objects, and objects of cultural patrimony for sites located on lands owned or controlled by the federal government. The Act also provides for the transfer of ownership of cultural objects to Native American or Native Hawaiian individuals, organizations, or tribes. It addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian cultural items by federal agencies and museums. NAGPRA contains data gathering, reporting, consultation, and permitting provisions. The Act emphasizes consultation with Native

American and Native Hawaiian organizations to ensure that these entities play a major role in the treatment of specific cultural objects.

Regulations at 43 CFR Part 10 address the rights of lineal descendants, Indian tribes, and Native Hawaiian organizations to Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony. They require federal agencies and institutions that receive federal funds to provide information about these items to these people and, upon presentation of a valid request, to dispose of or to repatriate these objects to them. Section 10.4 describes the regulatory requirements under NAGPRA for inadvertent discoveries of human these items.

Appendix R - "NAGPRA Compliance," in NPS Director's Order 28 - Cultural Resources Management, describe NPS-specific guidance for implementing NAGPRA. If NPS anticipates an operation may impact Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony protected by NAGPRA, then it will consult with the appropriate Native American or Native Hawaiian organization as part of the 9B plan approval process.

NOISE CONTROL ACT OF 1972, 42 U.S.C. §§ 4901 – 4918

Resources afforded protection: human health and welfare
Applicable regulation(s): 40 CFR Part 211

The Act establishes a national policy to promote an environment free from noise that jeopardizes the public's health and welfare. To accomplish this, the Act provides for the coordination of federal research and activities to control noise, authorizes the establishment of federal noise emission standards for products distributed in commerce, and provides information to the public respecting the noise emission reduction characteristics of such products.

The Act authorizes and directs that federal agencies carry out the programs within their control in a manner that furthers the Act's policies. Agencies having jurisdiction over any property or facility or engaged in any activity resulting or potentially resulting in increased noise must comply with federal, state, interstate, or local requirements. Agencies must, upon request, furnish information to the EPA regarding the nature, scope, and results of noise research and noise control programs and must consult with EPA in prescribing standards or regulations respecting noise. The Act also provides for citizen lawsuits. Any person may commence civil action against the United States or any government instrumentality or agency that violates any noise control requirement.

Operators must ensure that their facilities, equipment, and operations comply with all applicable federal, state, interstate, or local noise emission requirements. NPS management policies provide that the NPS will strive to preserve the natural quiet and natural sounds associated with the physical and biological resources of the parks (e.g. waves breaking on the shore, wind in the trees, and bird and wildlife sounds). NPS should prevent or minimize unnatural sounds that adversely affect park resources or values or the visitors' enjoyment of them.

OIL POLLUTION ACT, 33 U.S.C. §§ 2701 – 2761

Resources afforded protection: water resources, natural resources
Applicable regulation(s): 15 CFR Part 990; 33 CFR Parts 135, 137, and 150; 40 CFR Part 112; 49 CFR Part 106

The Oil Pollution Act expands the federal role in spill response, estabishes contingency planning requirements for vessels and certain facilities, establishes the Oil Spill Liability Trust Fund, increases liability for spills of oil or hazardous substances from vessels and facilities, creates requirements for double hulls on new tankers, and increases requirements for research and development of spill response technologies.

OPA imposes liability for removal costs and damages resulting from discharge of oil into the U.S.'s navigable waters, its adjoining shorelines, or the exclusive economic zone. Damages incurred include injuries to natural resources, loss of natural resources, and loss of use of natural resources. Natural resources include land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other resources belonging to the United States, state, local, foreign governments or Indian tribes.

Liability does not apply to discharges allowed by a permit issued under a federal, state or local law. In addition, liability does not apply if the responsible party establishes that the discharge, damages, or removal costs occurred solely because of an act of God, an act of war, or a third party who constitutes neither an agent nor employee of the responsible party. However, despite these defenses, the responsible party remains liable if he fails to report the incident, help or cooperate as requested, or comply with certain orders. Also, OPA has increased penalties for regulatory noncompliance, broadened the response and enforcement authorities of the federal government, and preserved state authority to establish law governing oil spill prevention and response.

OPA provides new requirements for government and industry oil spill contingency planning. The "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP) was expanded to encompass a three-tiered approach. The federal government directs all public and private response efforts for certain types of spill events. Area committees, composed of federal, state, and local government officials, must develop detailed, location-specific Area Contingency Plans. Owners or operators of vessels and certain facilities that pose a serious threat to the environment must prepare their own facility response plans.

OPA may require nonfederal oil and gas operations on units of the National Park System to develop contingency plans. Contingency plans developed to meet the requirements of OPA may also satisfy the NPS 9B requirement for a contingency plan. NPS would determine if the OPA required plan meets NPS requirements as part of the 9B plan approval process.

PIPELINE SAFETY ACT OF 1992, 49 U.S.C. §§ 60101 *et seq*.

Resources Afforded Protection: human health and safety, and the environment
Applicable Regulation(s): 49 CFR Parts 190-195

This Act allows the Department of Transportation (DOT) to create and to enforce oil and gas pipeline safety regulations. The act creates design, construction, maintenance, and testing standards for all new, changed, or relocated interstate and intrastate pipelines. DOT's Office of Pipeline Safety regulates interstate pipeline safety but state agencies may also be approved to regulate intrastate pipelines. States that get approval to implement the program may enforce stricter standards than those in the Act. Violations of the Act can lead to civil and criminal penalties. The Act replaced the Hazardous Liquid Pipeline Safety Act of 1979, the Hazardous Materials Transportation Act, and the Natural Gas Pipeline Safety Act of 1968.

Oil and gas pipelines exist within several units of the National Park System, including Big Thicket National Preserve. Operators of oil and gas pipelines crossing NPS units must comply with the Pipeline Safety Act of 1992. NPS regulations at 36 CFR 9B require a 9B plan of operations for the construction or use of oil and gas pipelines (flowlines and gathering lines) in connection with nonfederal oil and gas operations within a NPS unit. Transpark pipelines (those owned and operated by persons or entities exercising rights not tied to the oil and gas ownership within the park boundary) located in rights-of-way that predate the establishment of the park unit do not qualify as an existing operations exempted from a plan of operations by 36 CFR § 9.33. Rather, the NPS will issue a Special Use Permit (SUP) to regulate maintenance activities along the right-of-way corridor, including but not limited to mowing and trimming vegetation, pipeline inspection and testing, removal

of fluids from oil and gas pipelines, and installing, shutting down, or replacing pipelines (36 CFR §1.6).

RESOURCE CONSERVATION AND RECOVERY ACT, 42 U.S.C. §§ 6901 *et seq.*

Resources afforded protection: natural resources, human health and safety
Applicable regulation(s): 40 CFR 240-280; and 49 CFR 171-179

The Resource Conservation and Recovery Act (RCRA) seeks to promote the protection of health and the environment and to conserve valuable material and energy resources. RCRA regulates the management of hazardous waste from generation to final disposal. The law consists of nine subtitles. Two subtitles create significant regulatory programs: Subtitle C establishes a hazardous waste program from generation to disposal; Subtitle D addresses disposal of nonhazardous solid waste. "Solid waste" includes garbage, refuse, and other discarded materials. It includes solids, liquids, and containerized gases.

The requirements of Subtitle C apply if the waste falls under EPA's criteria governing hazardous waste. EPA codified the regulatory criteria for hazardous waste at 40 CFR Parts 260 and 261. EPA codified a list of hazardous wastes (known as listed wastes) in Subpart D of Part 261. Subpart C of Part 261 establishes the criteria for determining whether a solid waste constitutes a hazardous waste by exhibiting a characteristic of corrosivity, reactivity, ignitability, or toxicity (known as characteristic waste). EPA can regulate a solid waste because it either appears on the hazardous waste lists or displays a characteristic of a hazardous waste.

The 1980 amendments to RCRA excluded certain oil, gas, and geothermal drilling and production wastes from the hazardous waste requirements of Subtitle C. The amendments specifically exempt drilling fluids, produced water, and other drilling and production wastes. In 1988, the EPA decided to keep the exemption for oil and gas exploration and production wastes. State agencies regulate the exempted wastes under the less strict Subtitle D governing nonhazardous waste.

Oil field workers must understand how RCRA works because mistakes can be costly for operators. The Act dictates that when Subtitle C and Subtitle D wastes are mixed, the mixture becomes a Subtitle C hazardous waste. It does not matter if the mixture loses all of its hazardous characteristics. For example, if the rig mechanic dumps used motor oil into the reserve pit, the entire volume of drilling muds, cuttings, rig wash, excess cement, and harmless completion fluids becomes a hazardous waste. This remains true even if it does not exhibit hazardous properties.

RCRA provides for strict civil and criminal penalties. Persons who do not comply with RCRA will receive fines of as much as $25,000 per day per violation. It does not matter whether or not EPA first served the person with a compliance order. It is up to the operator to know and comply with RCRA. The operator cannot wait to receive a compliance order and make corrections to avoid a penalty. Also, RCRA's criminal penalties can fine an operator as much as $50,000 and imprison the operator for as many as 2 years if they "knowingly" cause transportation of hazardous materials without a manifest.

In addition, the RCRA exemption from Subtitle C for oil and gas drilling and production waste does not exclude these wastes from the operation of RCRA section 7003. Section 7003 allows EPA to compel any person who contributed or contributes to the handling, storage, treatment, transportation or disposal of the hazardous waste in a manner that causes an imminent and substantial danger to take any action to protect human health and the environment. Because this can include expensive cleanup actions to protect human health and the environment, operators should handle waste from their operations in such a way that it does not contaminate the environment either now or in the future.

Regardless of oil and gas exploration and production wastes' exemption from Subtitle C regulation, the NPS will likely require operators to dispose of all wastes associated with the oil and gas operation outside of the park. NPS requirements for waste disposal in an operator's plan of operations will provide for the strict protection of park resources and values.

RIVERS AND HARBORS ACT OF 1899, as amended, 33 U.S.C. §§ 401 *et seq.*

Resources afforded protection: shorelines and navigable waterways, tidal waters, wetlands
Applicable regulation(s): 33 CFR Parts 114, 115, 116, 321, 322, and 333

Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waterway of the United States. In order to obstruct or alter the waterway, a person must obtain a permit from the Army Corps of Engineers. Activities requiring a permit include constructing structures in or over any waters of the U.S., excavating material from the water, conducting stream channelization, and depositing materials in such waters.

SAFE DRINKING WATER ACT OF 1974, 42 U.S.C. §§ 300f *et seq.*

Resources afforded protection: human health, water resources
Applicable regulation(s): 40 CFR Parts 141-148

The Safe Drinking Water Act (SDWA) protects the safety of drinking water supplies throughout the United States by establishing national standards enforceable by each state. The Act provides for the establishment of primary regulations to protect human health and of secondary regulations relating to the taste, odor, and appearance of drinking water. Primary drinking water regulations include either a maximum contaminant level (MCL) or a prescribed treatment technique that prevents adverse health effects to humans. A MCL constitutes the permissible level of a contaminant in water delivered to any user of a public water system. States should only use prescribed treatment techniques when a MCL remains uneconomical or technologically infeasible.

The Act's 1986 amendments require EPA to publish a list of contaminants every three years, which EPA knows or anticipates will occur in public water systems.

The most important part of the SDWA as far as the NPS and petroleum operators are concerned is the Underground Injection Control (UIC) permit program. Under the program, the EPA regulates underground injection of wastes or other materials. The EPA has authorized many states to administer the UIC permit program.

Owners of underground injection wells must obtain permits or be authorized by rule under the UIC program to operate the wells. The permit holder must prove to the state or federal permitting agency that, through sound and prudent practice and well construction, the underground injection will not endanger drinking water sources. The NPS will approve a plan of operations involving underground injection only when the wells have valid UIC permits.

The UIC program defines five classes of underground injection wells. Class II wells may relate to oil and gas operations in National Parks. The following fluids may be injected into Class II wells: 1). waste fluids produced by oil and gas operations and that are exempt from the hazardous waste requirements of RCRA, subtitle C (for example, produced brine, recovered treatment fluids, and waste waters from gas plants), 2). fluids used for enhanced recovery of oil and natural gas, and 3). fluids for below ground storage of hydrocarbons.

EXECUTIVE ORDERS

PROTECTION AND ENHANCEMENT OF THE CULTURAL ENVIRONMENT, Exec. Order No. 11593, 36 Fed. Reg. 8921 (1971)

Resources afforded protection: cultural resources

Executive Order No. 11593 instructs all federal agencies to support the preservation of cultural properties. It directs them to identify and nominate cultural properties under their jurisdiction to the National Register. Moreover, the executive order state that federal agencies must "exercise caution…to assure that any federally owned property that might qualify for nomination is not inadvertently transferred, sold, demolished, or substantially altered."

FLOODPLAIN MANAGEMENT OF 1977, Exec. Order No. 11988, 42 Fed. Reg. 26951 (1977)

Resources afforded protection: floodplains, human health, safety, and welfare

Executive Order No. 11988 seeks to avoid, where practicable alternatives exist, the short-term and long-term adverse impacts associated with floodplain development. In carrying out agency responsibilities, federal agencies must reduce the risk of flood losses, minimize the impacts of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by floodplains. If an agency proposes an action in a floodplain, then the agency must consider alternatives to avoid adverse effects and incompatible development in the floodplain. Agencies must also provide opportunity for early public review of any plans for actions in floodplains.

PROTECTION OF WETLANDS, Exec. Order No. 11990, 42 Fed. Reg. 26961 (1977)

Resources afforded protection: wetlands

Executive Order No. 11990 seeks to avoid adverse impacts on wetlands when there is a practicable alternative. Executive agencies, in carrying out their land management responsibilities, must minimize wetlands destruction, loss, or degradation and preserve and enhance the wetlands' natural and beneficial values.

FEDERAL COMPLIANCE WITH POLLUTION CONTROL STANDARDS, Exec. Order No. 12088, 43 Fed. Reg. 47707 (1978)

Resources afforded protection: natural resources, human health and safety

Executive Order No. 12088 delegates each executive agency head the responsibility for taking all necessary actions to prevent, control, and abate environmental pollution. It gives the EPA authority to conduct reviews and inspections for the purpose of monitoring federal facility compliance with pollution control standards. Section 1-101 requires prevention, control, and abatement of pollution from federal facilities. Section 1-201 requires federal agencies to cooperate with state, interstate, and local agencies to prevent, to control, and to abate environmental pollution.

GOVERNMENTAL ACTIONS AND INTERFERENCE WITH CONSTITUTIONALLY PROTECTED PROPERTY RIGHTS, Exec. Order No. 12630, 53 Fed. Reg. 8859 (1988)

Resources afforded protection: private property rights, public funds

Executive Order No. 12630 seeks the following: to assist agencies in reviewing their actions to prevent unnecessary takings and in proposing, planning, and implementing agency actions with due regard for the constitutional protections provided by the 5th Amendment to the Constitution of the U.S; to account in decision-making for those takings necessitated by statutory mandate; and to reduce the risk of undue or inadvertent burdens on the federal treasury resulting from lawful government action.

When an agency requires a private party to obtain a permit to undertake a specific use of private property, any conditions imposed on the permit must substantially advance the governmental interest that is impacted by the land use. The permitting processes must be kept to the minimum necessary so that the government does not interfere with the use of private property during the process.

FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS, Exec. Order No. 12898 (amended by Exec. Order No. 12948, 60 Fed. Reg. 6379 (1995)

Resources afforded protection: human health and safety

This executive order requires that federal agencies incorporate environmental justice into their mission. Environmental justice promotes the fair treatment of people of all races, incomes, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should receive a disproportionate share of the negative environmental impacts from the execution of this country's domestic and foreign policy programs.

INDIAN SACRED SITES, Exec. Order No. 13007, 61 Fed. Reg. 26771 (1996)

Resources afforded protection: Native Americans' sacred sites

To the extent practicable, permitted, and consistent with essential agency functions, all federal land management agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. Consistent with this executive order, if a proposed plan of operations may affect the physical integrity of, the ceremonial use of or the access to these sites by Native American religious practitioners in federally recognized tribes, then the Superintendent will consult with the tribe as part of the 9B approval process.

INVASIVE SPECIES, Exec. Order No. 13112, 64 Fed. Reg. 6183 (1999)

Resources afforded protection: vegetation and wildlife

This executive order seeks to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts they cause. It outlines federal agency duties, creates a new Invasive Species Council, defines the council's duties, and authorizes the creation an Invasive Species Management Plan. Executive Order No. 13112 also creates a framework for planning and for coordination involving all stakeholders, which it defines as states, tribal entities, local government agencies, academic institutions, scientific communities, and

non-governmental entities such as environmental groups, agricultural groups, conservation organizations, trade groups, commercial interests, and private landowners.

Federal agencies should use the programs and authorities to prevent the introduction of invasive species; detect and respond rapidly to control populations of such species in a cost-effective and an environmentally sound manner; monitor invasive species populations accurately and reliably; provide for restoration of native species and habitat conditions in invaded ecosystems; conduct research on invasive species and develop technologies to prevent their introduction; provide environmentally sound control of invasive species; promote public education on invasive species and means to address them.

The order directs agencies not to authorize, fund, or carry out any action likely to cause or promote the introduction or the spread of invasive species in the United States or elsewhere. However, agencies can determine that the benefits outweigh the potential harm and ensure that they take prudent measures to minimize harm. Federal agencies should consult with the Invasive Species Council and undertake actions consistent with the Invasive Species Management Plan with the cooperation of stakeholders.

RESPONSIBILITIES OF FEDERAL AGENCIES TO PROTECT MIGRATORY BIRDS, Exec. Order No. 13186, 66 Fed. Reg. 3853 (2001)

Resources afforded protection: migratory birds

This executive order defines federal agency responsibilities to protect migratory bird populations, in furtherance of the purposes of the migratory bird conventions, the Migratory Bird Treaty Act (16 U.S.C. §§ 703-711), the Bald and Golden Eagle Protection Acts (16 U.S.C. §§ 668-668d), the Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-666c), the Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1544), the National Environmental Policy Act of 1969 (42 U.S.C. §§ 4321-4347), and other pertinent statutes.

This executive order directs each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement, within 2 years, a Memorandum of Understanding (MOU) with the Fish and Wildlife Service that shall promote the conservation of migratory bird populations.

ACTIONS TO EXPEDITE ENERGY- RELATED PROJECTS, Exec. Order No. 13212, 66 Fed. Reg. 28357 (2001)

Protection afforded to: all resources

This executive order establishes an interagency task force to coordinate, monitor, and assist executive departments and federal agencies to expedite the increased production, transmission, and conservation of energy, in a safe and environmentally sound manner. Specifically, it provides for executive departments and federal agencies where appropriate to expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections, to the extent permitted by law and regulations.

POLICIES, GUIDELINES AND PROCEDURES

NATIONAL PARK SERVICE MANAGEMENT POLICIES (2001)

Resources afforded protection: all resources including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and experience, visual resources

The NPS Management Policies is the service-wide policy document of the National Park Service. These policies provide the overall foundation, set the framework, and provide direction for management decisions within the NPS. Management policy direction may be general or specific; it may prescribe the process through which decisions are made, how an action is to be accomplished, or the results to be achieved. Management Policies guide NPS staff to manage National Park System units consistently and professionally to achieve the Congressional mandate of the National Park System. Adherence to NPS policy is mandatory, unless specifically waived or modified by the Secretary, the Assistant Secretary, or the Director of the NPS.

These policies cover park system planning, land protection, natural resource management, cultural resource management, wilderness preservation and management, interpretation and education, use of the parks, park facilities, and commercial visitor services.

The second tier of NPS policies (level 2 guidance) are Director's Orders which clarify or supplement the NPS Management Policies. As they are completed, Director's Orders will replace existing NPS guidelines and special directives. The most detailed and comprehensive guidance implementing service-wide policy, called level 3 guidance, are handbooks or reference manuals and are a compilation of legal references, operating policies, standards, procedures, general information, recommendations, and examples to assist field staff in carrying out the NPS Management Policies.

Specific language pertinent to NPS minerals management is contained in the following chapters: Chapter 6 – Wilderness – Section 6.4.9 (page 72), Chapter 8 – Use of Parks – Section 8.7 (pages 94-96), Chapter 9 – Park Facilities – Section 9.1.3.3 (page 103).

DEPARTMENT OF THE INTERIOR, DEPARTMENTAL MANUAL, DM 516 – NEPA POLICIES (1980)

Resources afforded protection: all resources including cultural resources, historic resources, natural resources, human health and safety

Section 516 of the Departmental Manual establishes the Department of Interior's policies for implementing the National Environmental Policy Act. It includes policies about initiating the NEPA process, categorical exclusions, and preparing environmental assessments and environmental impact statements.

DEPARTMENT OF THE INTERIOR, DEPARTMENTAL MANUAL DM 517 – PESTICIDES (1981)

Resources afforded protection: human health and safety and the environment

DM 517 establishes Department of the Interior policy for the use of pesticides on the lands and waters under its jurisdiction and for compliance with the Federal Insecticide, Fungicide, and Rodenticide Act.

DEPARTMENT OF THE INTERIOR, DEPARTMENTAL MANUAL DM 519 – PROTECTION OF THE CULTURAL ENVIRONMENT (1994)

Resources afforded protection: archeological, prehistoric resources, historic resources, Native American human remains, and cultural objects

DM 519 describes the policies and responsibilities of the Department of the Interior for managing, preserving, and protecting prehistoric resources, historic resources, Native American human remains, and Native American cultural objects located on Indian and public lands administered by the Department.

NPS DIRECTOR'S ORDER 12 AND HANDBOOK – CONSERVATION PLANNING, ENVIRONMENTAL IMPACT ANALYSIS, AND DECISION MAKING (2001)

Resources afforded protection: all resources including natural resources, cultural resources, human health and safety, socioeconomic environment, visitor use

Director's Order 12 and Handbook sets forth policy and procedures for the NPS to comply with the National Environmental Policy Act, including direction on the analysis process and documentation of environmental impact assessments. The Director's Order and handbook are derived in whole or part from the CEQ regulations or Interior NEPA quidelines, giving them the force of law. Director's Order 12 and Handbook does not conflict with CEQ regulations, but rather includes specific NPS requirements beyond those imposed by CEQ to help facilitate the mandates of the Organic Act, and other laws and policies that guide NPS actions.

NPS DIRECTOR'S ORDER 28 – CULTURAL RESOURCE MANAGEMENT (1998)

Resources afforded protection: cultural, historic, and ethnographic resources

Director's Order 28 is the comprehensive guideline for management of cultural resources in units of the National Park Service. It elaborates on the policies articulated in the "NPS Management Policies" and offers guidance in applying federal laws and the Secretary's Standards to establish, to maintain, and to refine park cultural resource programs. Director's Order 28 also establishes procedures for complying with NHPA sections 10 and 106.

Director's Order 28, Appendix R: NAGPRA Compliance provides direction on complying with the Native American Graves Protection and Repatriation Act. Appendix R requires that an operator who inadvertently discovers human remains, funerary objects, sacred objects, or objects of cultural patrimony immediately notify the park's superintendent first by telephone and then in writing. The operator must stop activity in the area of the discovery for a specified time and make a reasonable effort to protect the human remains or objects. The superintendent will notify the appropriate Native American tribes or Native Hawaiian organizations and begin consultation about the disposition of the items.

DIRECTOR'S ORDER AND REFERENCE MANUAL 53 – SPECIAL PARK USES (2000)

Resources afforded protection: all resources including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and experience, visual resources

DO-53 defines and clarifies legal and policy requirements for special uses in NPS units and describes Special Use Permit (SUP) requirements and provisions. Applicable regulations for Special Use Permits are 36 CFR Parts 1 – 5.

Special park uses are defined as activities that take place in a unit of the National Park System and: provide a benefit to an individual, group or organization, rather than the public at large; require written authorization and some degree of management control from the NPS in order to protect park resources and the public interest; are not prohibited by law or regulation; and are neither initiated, sponsored, nor conducted by the NPS. A special park use may involve either rights or privileges, and may or may not support the purposes for which a park was established.

The NPS applies the Special Use Permit regulations at 36 CFR Parts 1 – 5 and guidance in Director's Order/Reference Manual 53 to control activities within rights-of-way associated with transpark oil and gas pipelines. Mowing and trimming vegetation, inspection or testing pipelines, removal of fluids from oil and gas pipelines and installing, shutting down or replacing pipelines, are common activities in pipeline rights-of-way requiring an approved NPS Special Use Permit. Special Use Permits for transpark pipelines must be approved before these activities can occur. The SUP must include a performance bond and mitigation measures to protect park resources, values, and ensure the protection of public health and safety.

RM 77 – NATURAL RESOURCE MANAGEMENT (2004)

Resources afforded protection: all natural resources

Natural Resource Management Reference Manual #77 offers comprehensive guidance to National Park Service employees responsible for managing, preserving, and protecting the natural resources found in National Park System units. It guides the actions of park managers to ensure that their decisions protect park natural resources and values, and comply with federal law, federal regulation, Department of Interior policy, and National Park Service policy. Natural resources include native plants, native animals, water, air, soils, topographic features, geologic features, paleontologic resources, natural quiet, and clear night skies. Reference Manual 77 covers natural resources management, uses in parks, planning, and program administration and management. A listing of topics included in RM 77 can be found at: http://www.nature.nps.gov/rm77/.

Reference Manual 77 serves as the primary "Level 3" guidance on natural resource management in units of the National Park System, replacing NPS-77, The Natural Resource Management Guideline, issued in 1991 under the previous NPS guideline series. The transition of NPS-77 into Reference Manual #77 is still in progress. The document provides special guidance on a number of in-park uses, like mineral development, that can adversely impact natural resources and values.

NPS DIRECTOR'S ORDER AND PROCEDURAL MANUAL 77-1 – WETLAND PROTECTION (2002)

Resources afforded protection: wetlands

NPS Director's Order 77-1 and Procedural Manual implement Executive Order No. 11990, Protection of Wetlands. They establish policies, requirements, and standards to protect wetlands. Operators must perform a wetlands delineation when proposed operations could potentially cause direct and/or indirect impacts to wetlands. The Corps of Engineers and the NPS review the wetlands delineation for adequacy. When proposed operations cannot avoid direct and/or indirect impacts on wetlands, the operator must compensate for these impacts by restoring a disturbed wetlands area in the unit at a minimum 1:1 compensation ratio. The compensation ratio can be greater if the functional values of the site being impacted are high and the restored wetlands will be of a lower functional value. Operators must perform the compensation before or concurrently with the occurrence of impacts associated with approved oil and gas operations. When operations are completed, the operator must restore the site to its pre-impact wetlands condition.

NPS must comply with Executive Order No. 11990 and the NPS Wetland Protection Guideline (DO 77-1) as part of the 36 CFR 9B procedure for approving a plan of operations for nonfederal oil and gas operations within a unit of the National Park System.

NPS DIRECTOR'S ORDER AND PROCEDURAL MANUAL 77-2 – FLOODPLAIN MANAGEMENT (2003)

Resources afforded protection: floodplains

Director's Order and Procedural Manual 77-2 replaces NPS Special Directive 93-4 and provides NPS policies and procedures for implementing Executive Order No. 11988, Floodplain Management. NPS policy seeks to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare; and restore and preserve the natural and beneficial values served by floodplains. The NPS will protect and preserve the natural resources and functions of floodplains; avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains; avoid direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks; and restore, when practicable natural floodplain values previously affected by land use activities within floodplains. If it is not practicable to locate or relocate development or inappropriate human activities outside the floodplain, the NPS will, prepare a Statement of Findings in accordance with the Procedural Manual 77-2; take all reasonable actions to minimize the impact to the natural resources in floodplains; use nonstructural methods to reduce hazards to human life and property; and ensure that structures and facilities located in floodplains are designed to be consistent with the intent of the standards and criteria of the National Flood Insurance Program (44 CFR Part 60).

The Director's Order requires the NPS to classify proposed actions into one of three action classes - the 100-year (base floodplain), 500-year, or extreme regulatory floodplain. If a preliminary floodplain assessment shows that the area may experience flooding, then the applicable regulatory floodplain must be shown on a map, and information on flood conditions and hazards must be developed.

During project planning, the NPS identifies and evaluates practicable alternative sites for the proposal outside of the regulatory floodplain. If practicable sites are identified, NPS policy gives preference to locating the proposed action at a site outside the regulatory floodplain. If there is no practicable alternative site for the proposal, then the NPS will apply mitigation measures to protect floodplain resources, values, and human life and property.

NPS must comply with Executive Order No. 11988 and the NPS Floodplain Management Guideline as part of the 36 CFR 9B procedure for approving a plan of operations for nonfederal oil and gas operations within a unit of the National Park System.

SECRETARY OF THE INTERIOR'S "STANDARDS AND GUIDELINES FOR ARCHEOLOGY AND HISTORIC PRESERVATION," 48 FR 44716 (1983) (also published as Appendix C OF NPS DIRECTOR'S ORDER 28 – CULTURAL RESOURCE MANAGEMENT)

Resources afforded protection: cultural and historic resources

Prepared under the authority of sections 101(f), (g), and (h) and 110 of the National Historic Preservation Act, the Standards and Guidelines provide basic technical standards, guidelines, and advice about archeological and historical preservation activities and methods. While the standards and guidelines are not regulatory, NPS Director's Order 28 requires the NPS to comply with their substantive and procedural requirements.

GOVERNMENT-TO-GOVERNMENT RELATIONS WITH NATIVE AMERICAN TRIBAL GOVERNMENTS, Presidential Memorandum signed April 29, 1994

Resources afforded protection: Native Americans

In order to ensure that NPS recognizes and respects the rights of sovereign tribal governments, this memorandum instructs each executive department and agency to operate in a government-to-government relationship with federally recognized tribes and to consult with tribal governments prior to taking any action that might affect them. The memorandum directs agencies to assess the impacts of their programs and policies on tribes and to take their rights and concerns into consideration during development of any plan, programs, or projects. NPS must also remove any impediments to working directly with tribal governments in designing agency plans, programs, and projects. Finally, it instructs agencies to try to work cooperatively to carry out the intent of the memorandum and to tailor federal programs to meet the unique needs of tribal communities.

SELECTED TEXAS LAWS AND REGULATIONS

TEXAS NATURAL RESOURCES CODE, TITLE 2, CHAPTER 40 (1991)

Resources afforded protection: human health and safety, natural resources

This chapter codifies the Oil Spill Prevention and Response Act of 1991 for the State of Texas. Section 111 covers oil and gas pipelines and section 117 covers hazardous liquid or CO_2 pipelines. This chapter also provides for liability for natural resources damages from spills.

TEXAS NATURAL RESOURCES CODE, TITLE 3, CHAPTERS 81 THROUGH 85 (1991)

Resources afforded protection: human health and safety, natural resources
Applicable regulation(s): "Rules Having Statewide General Application to Oil, Gas and Geothermal Resource Operations within the State of Texas" (TAC tit. 16, part 1, § 3)

The Railroad Commission of Texas has state responsibility for regulating oil and gas operations. Its rules, regulations, and forms, published in the "Rules Having Statewide General Application to Oil, Gas and Geothermal Resource Operations within the State of Texas," apply to all fields and districts within the state. However, if the "Rules" conflict with the special rules governing any field or district, then the special rules govern.

TEXAS ADMINISTRATIVE CODE, TITLE 16, PART 1 – RAILROAD COMMISSION OF TEXAS, CHAPTER 3 – OIL AND GAS DIVISION

Resources afforded protection: human health and safety, natural resources

The Texas Railroad Commission promulgated the oil and gas rules (regulations) for the State of Texas in 1991. The oil and gas statewide rules implement, interpret, or prescribe law or policy. They also describe the Commission's procedures or practice requirements. The rules emphasize maximizing hydrocarbon production, eliminating wasteful field practices of reserves, protecting human health and safety, protecting natural resources, and reporting requirements, and information collecting requirements.

The following list of statewide rules protects natural resources and human health and safety. Additional statewide rules may apply in conjunction with other relevant legal and policy mandates for oil and gas operations.

§ 3.8 – Water Protection
§ 3.9 – Disposal Wells
§ 3.13 – Casing Cementing, Drilling, and Completion Requirements
§ 3.14 – Plugging
§ 3.20 – Notification of Fire Breaks, Leaks, or Blow-outs
§ 3.21 – Fire Prevention and Swabbing
§ 3.22 – Protection of Birds
§ 3.24 – Check Valves Required
§ 3.36 – Oil, Gas, or Geothermal Resource Operation in Hydrogen Sulfide Areas
§ 3.46 – Fluid Injection into Productive Reservoirs
§ 3.57 – Reclaiming Tank Bottoms, Other Hydrocarbon Wastes, and Other Waste Materials
§ 3.70 – Pipeline Permits Required
§ 3.91 – Cleanup of Soil Contaminated by a Crude Oil Spill
§ 3.93 – Water Quality Certification
§ 3.99 – Cathodic Protection Wells
§ 3.100 – Seismic Holes and Core Holes

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APPENDIX D

TYPES OF OIL AND GAS OPERATIONS

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INTRODUCTION

The petroleum industry is a continuous cycle of searching for new oil and gas reservoirs, developing and producing them, and finally abandoning the property once the hydrocarbons are depleted.

There are four general phases of petroleum development. The phases are (1) exploration, (2) drilling, (3) production, and (4) abandonment/reclamation. Surface uses vary for each phase in terms of intensity and duration. Also, operations related to one or all of the phases may be occurring in the same area at any given time.

To be of interest to the petroleum industry, petroleum deposits must be commercially valuable. There must be a reasonable chance of making a profit on the eventual sale of the oil and gas. Factors such as the market price of oil and gas, the amount of recoverable petroleum, the expected production rates, and the cost of drilling wells, producing, and transporting the product to market all determine the economic viability of developing a deposit once it is discovered.

The following sections are meant to provide the reader with a general understanding of common activities associated with each phase of oil and gas development.

EXPLORATION OPERATIONS

Occurrence of Petroleum

Petroleum deposits are not large underground caverns filled with oil and gas as the term reservoir might suggest. Rather, petroleum accumulates in tiny spaces within the buried rock layers. Most scientists today agree that petroleum was formed from large amounts of very small plant and animal life. These organic materials accumulated in ancient seas, which, over great periods of time, have covered much of the present land area. As time passed, sediments rich in organic matter were buried deeper and deeper. The increased pressure and temperature caused these organic remains to change into oil and natural gas. Once formed, the oil and gas migrated upward until certain forms and shapes of underground rocks halted the upward movement, trapping the hydrocarbons in large quantities. The search for these traps is the focus of the first phase of oil and gas development and exploration.

Geological Exploration

The search for oil and gas often begins with geological exploration. The exploration geologist is looking for clues on the surface that would suggest the possibility of petroleum deposits below. Surface studies comprise the first stage of exploratory fieldwork. Geological surveys of the land surface are made using aerial photographs, satellite photographs, maps of surface outcrops of specific formations or rock types, and geochemical analyses. Field crews map surface attributes and collect surface samples of rock for analysis.

Creating maps of surface outcrops and geochemical analyses requires fieldwork. Little equipment is needed other than surveying gear and rock and soil sampling supplies. These activities require a small field party of two to four persons who can work out of a single vehicle or on foot. Access to remote areas can be gained by a four-wheel-drive vehicle, small all-terrain vehicles, helicopter, pack animals, or by walking. A small boat may access shallow estuarial and near-shore areas. Constructing roads or digging channels for boats in shallow water areas is not required at this early stage.

Geochemical analysis often requires subsurface samples to be taken from a ditch or a shallow corehole. The coreholes are not usually big, but may generate some cuttings.

Geophysical Exploration

Geological exploration can narrow the area being searched, but subsurface geology may or may not be accurately indicated by surface outcrops. Geophysical prospecting extends the search beneath the earth's surface. The surveys identify and map characteristics favorable to oil and gas accumulation deep underground. Geophysical operations include gravitational, magnetic, and seismic surveys. Of these, the seismic survey is most common.

Gravitational and Magnetic Surveys: Gravitational and magnetic field studies yield regional or reconnaissance-type data. These surveys detect variation in gravitational attractions and magnetic fields of the various types of rock below the surface.

Gravity surveys are generally done with small, portable instruments called gravity meters or gravimeters. The number and placement of measurement points in a gravity survey depend on the site's characteristics. These include feasibility of access and the spacing pattern necessary to detail the features selected for mapping. The field party required is not large, usually 3 to 6 people. Travel on foot is possible with the smaller portable gravimeters. Progress, however, is slow, so most surveys use four-wheel-drive vehicles. In marshy areas, the use of special swamp or marsh buggies is quite common with gravity survey crews. Airborne survey operations are not yet practical due to present instrument limitations and the relatively large and rapid changes in altitude and acceleration characteristic to aircraft.

The objective of most surveys can be achieved when gravity stations are confined to existing roads or waterways. Where roads or waterways do not exist, a large level of latitude in positioning stations is possible to account for logistical or environmental constraints. Disturbance of the land surface is minimal when established access is already available. Methods of access to roadless areas are similar to those required for geological explorations described above. The surveying technique itself does not require any physical disturbance of the surface.

Magnetic surveys are often used in place of or to supplement gravity surveys. These surveys are done with relatively small airborne or portable ground instruments called magnetometers. Flight patterns usually consist of a series of parallel lines at 1- to 2-mile intervals.

Airborne surveys require geodetic and ground control points. These must be installed on the ground before the survey can take place, if not already present. A majority of the lower 48 states have been surveyed, so these points are already in place. If not, however, the area must be accessed by overland vehicles or helicopters. The size of the field party required is not large. The access to roadless areas is similar to that required for geological exploration described above. The surveying technique itself does not require any physical disturbance of the surface.

Seismic Surveys: Whereas gravity and magnetic surveys provide regional information, seismic survey can provide enough subsurface detail to locate potential oil and gas traps.

A seismic survey gathers subsurface geological information by recording impulses from an artificially generated shock wave. The energy waves travel downward toward underground formations. A series of sensitive instruments, called geophones, set out at surveyed points on the ground, record the energy waves as they are reflected off the subsurface formations and back to the surface. Cables or radio transmitters transfer information from the geophones to a recorder truck that receives and records the reflected seismic energy. Sophisticated computers analyze the data and generate a "picture" of the rocks underground. Each survey line provides a cross-section of the rock formations beneath it, and many lines may be run to create a complete picture.

In remote areas where there is little known subsurface data, a series of short seismic lines may be required to determine the attitude of the subsurface formations. After this, the pattern of seismic lines or grids is designed to make the final data more accurate and valuable. Although alignment is fairly critical, some source and recording stations may be moved or skipped for environmental or logistical reasons without seriously affecting the results of the investigation.

A more recent technique called 3-D Seismic works on the same principle as conventional seismic, but energy and recording stations are placed at a much denser spaced grid. There may be up to 150 energy source locations and 200 recording stations per square mile on a 3-D seismic project. Surveys commonly exceed a 25-square-mile-area. The 3D-Seismic surveys can provide enough detail to locate traps that have been "missed" by conventional geophysical methods and exploratory drilling. Even in areas that have been heavily explored and developed, 3D-Seismic is helping to optimize new field development and find new targets within producing fields. New life is being brought to areas thought to have been played out.

Seismic methods are usually referred to by the various methods of generating the shock wave. These include weight drop, vibrators, dinoseis, and explosives. No matter what method of generating energy is used, the procedures for preparing the line and recording the data are relatively similar. The procedure for "shooting" a line consists of first surveying and flagging the locations for the geophones and the positions of the energy sources. Second, the geophones and the connecting cable are laid down. The cable is either connected with more cable to the recording truck or to a radio transmitter to send the data to the recording truck. Normally the recording truck will be within a short distance of the transmitter or within line of sight. Once the geophones and ground cable are in place, the energy source is put in place. The detonation of the energy source, whether by truck or by explosive, is controlled by the recording truck. The shock wave is set off, and the seismic signal recorded. Once the signal is recorded, the cable is picked up and the entire process is repeated on the next segment of the line.

The most common energy source in seismic work is explosives placed in holes drilled to depths of up to 200 feet. Explosives may range from ½- to 50-pound charges. Drills can be mounted on trucks, boats, or specially designed airboats or ATVs, depending on the type of access required. In rugged topography, or to reduce surface disturbance associated with access, portable drills are sometimes carried by helicopter or by hand. Other field equipment can include vehicles to carry water for drilling operations, personnel, surveying equipment, recording equipment, and computers.

Existing roads are used if possible, but reaching some lines may require clearing vegetation and loose rock to improve access for the crews and the trucks. Each mile of seismic line cleared to a width of 8 to 15 feet represents disturbance of about an acre of land. A network of low-standard temporary roads and trails can result from these operations. The alignment of these trails usually consists of straight lines dictated by the grid, often with little regard for steep slopes or rough terrain. Level topography with few trees and shrubs would require little or no trail construction. An area with rugged topography or larger vegetative types such as trees and large shrubs would require more trail preparations. Temporary roads and trails are usually constructed with bulldozers.

Seismic crews consist of several surveying people, people for laying and retrieving the cable and geophones, the truck drivers and drillers for the energy source, personnel in the recording truck and miscellaneous water truck drivers, cleanup people, and field crew managers. The size of the seismic crews vary from 15 to 80 people. On most seismic jobs, the people and equipment are transported in trucks or four-wheel-drive vehicles. However, the surveying, cable laying, and sometimes the drilling can be done on foot in some situations.

Under normal conditions, 3 to 5 miles of line can be surveyed each day using the explosive methods. Crews may be in the field for 1 to 4 weeks for an average conventional survey. An average 3-D survey may take several months to complete.

DRILLING AND PRODUCTION OPERATIONS

Stratigraphic Test

Sometimes operators need underground rock samples to further define and confirm data from a geophysical exploration program. A stratigraphic test, commonly called a “strat” test, involves drilling a hole primarily to obtain geological information. Small-diameter holes are drilled to 100 feet or several thousand feet with small, truck-mounted drilling equipment. A space of ½ acre or less may be cleared of vegetation and leveled for the average strat test drill site. A road may be needed to get equipment to the site. As the rock is drilled, the resulting rock chips are brought to the surface by a high-pressure airflow or circulating drilling mud. The geologist analyzes the cuttings in order to correlate this geological and geophysical data to other known subsurface structure in order to prepare a subsurface geological map.

A space of about ½ acre or less is leveled and cleared of vegetation for the average strat test drill site. If air drilling is employed, drill cuttings are blown into a reserve pit next to the drill truck through what is known as a blooey line. If mud is used as a drilling fluid, mud pits may be dug. More commonly, portable mud tanks are used. Usually 1 to 3 days are required to drill the strat test holes, depending on the well depth and the hardness of the bedrock. In areas with shallow, high-pressure, water-bearing zones, casing may be required to keep water out of the hole.

Once the surface and subsurface geological and geophysical information is interpreted and a potential oil or gas trap is located, exploratory wells are drilled to test for the actual presence of oil or natural gas.

Oil and Gas Well Drilling

Classification of Wells: Wells drilled for oil and gas are classified as either exploratory or development wells. An exploratory well is drilled either in search of an as-yet-undiscovered pool of oil or gas (a wildcat well) or to extend greatly the limits of a known pool. Exploratory wells may be

classified as (1) wildcat, drilled in an unproven area; (2) field extension or step-out, drilled in an unproven area to extend the proved limits of a field; or (3) deep test, drilled within a field area but to unproven deeper zones. Development wells are wells drilled in proven territory in a field to complete a pattern of production.

Exploration, or wildcat, well drilling, and the equipment involved are well beyond that of strat test drilling. At a common height of 180 feet, the rig stands as tall as a 12-story building. An average drilling rig needs a level location of about 3 acres. The drilling pad and access road must be capable of supporting thousands of tons of equipment. The access road may need to be widened and upgraded to accommodate heavy loads.

Choosing the Site: Once exploration activities have narrowed the search to specific drilling targets, the operator must select an exact spot on the surface to drill the well. The industry prefers to drill vertically, and usually chooses a drill site directly above the desired bottomhole location. When topographical, geological, or environmental constraints prevent a drill site from being located directly above the bottomhole location, the use of direction drilling can achieve the objective. Reaches of over a mile are common for 10,000-foot-deep wells, and extended reach wells have been drilled with over 2 miles of horizontal departure.

Directional drilling involves deviating a wellbore from its vertical along a predetermined course to a target located at some depth and some horizontal distance away. It is a common practice in the industry today, with a number of uses. Directional drilling techniques can be applied if the target zone lies underneath an inaccessible location such as a heavily urbanized area, mountain, or water body, and the drill rig must be located elsewhere. The technique is most often used in offshore applications to allow many wells to be drilled from one location. It can be used to drill around or through fault planes, salt domes, or obstructions in the hole, and to provide relief to a nearby well that has blown out. More recently, the technique has been used to move surface locations as an environmental protection measure.

While directional drilling allows flexibility in the selection of the drill site, there are technical, physical, and economic constraints on its use. Geological factors such as target depths, formation properties (stability, type, dip angle, etc.), and contemplated horizontal departures physically complicate and restrict the opportunities for using directional drilling. Sophisticated equipment and specialized personnel are needed to monitor and guide the direction of the well as it is being drilled. The cost of using this technique typically ranges from 10 percent to 50 percent higher than the cost of a vertical well. While directional drilling can be applied in a wide variety of situations, project specific conditions must always be taken into account.

Accessing the Site: Wildcat drilling often takes place in remote areas. Preliminary exploration work will not have contributed any new roads to an area, although there may be some cross-country trails. Temporary access roads will have to be constructed. Existing roads may need upgrading to accommodate the heavier loads associated with truck traffic. One lane is usually adequate. Installation of culverts or other engineering structures will be needed in steep terrain or when crossing stream channels. Soil texture, topography, and moisture conditions might dictate that roads be surfaced with material such as gravel, oyster shells, caliche, or ground limestone. Heavy equipment such as graders, bulldozers, front-end loaders, and dump trucks are commonly used in constructing roads. In marshy areas, a roadbed may be laid with heavy boards.

Preparing the Drill Site: To accommodate the rig and equipment, the drill site must be prepared. Site preparation may include extensive clearing, grading, cutting, filling, and leveling of the drill pad using heavy construction equipment. Soil material suitable for plant growth is often removed first and stockpiled for later use in reclamation. The operator may also dig reserve pits to hold large volumes of drilling mud and drill cuttings. In environmentally sensitive areas, such as Alaska and California, a large effort is made not to alter the surface area comprising the drill site more than is necessary. For

example, reserve pits may not be dug. Instead, large steel bins are placed on the site to receive the cuttings and other materials that are normally dumped into the reserve pits. These bins can then be trucked away from the site and the material inside them disposed of properly. Also, even in areas where reserve pits are excavated, they are often lined with thick plastic sheeting to prevent any contaminated water or other materials from seeping into the ground. The drill pad typically occupies about 2 to 3 acres.

Directional drilling may require a larger-sized rig and additional support facilities that may lead to larger pad sizes. For inland water sites, drilling barges that sit on the bottom may be used as a foundation for the drill rig. Some dredging may be done on these sites to create a slip, and protective skirts or pilings may be installed around the barge to prevent erosion by currents and tidal flow. In deeper water, jack-up, submersible and semi-submersible, rigs and drill ships may be used to drill wildcat wells. An offshore platform is required to drill development wells in deep water.

Since a source of freshwater is required for the drilling mud and for other purposes, a water well is sometimes drilled prior to moving the rig onto the location. If other sources are available, the water may be piped or trucked to the site.

At the exact spot on the surface where the hole is to be drilled, a rectangular pit called a cellar is dug, or culvert-like pipe is driven into the ground. If the cellar is dug, it may be lined with boards, or forms may be built and concrete poured to make walls for the cellar. The cellar is needed to accommodate drilling accessories that will be installed under the rig later.

In the middle of the cellar, the top of the well is started, sometimes with a small truck-mounted rig. The conductor hole is large in diameter, perhaps as large as 36 inches or more; is about 20 to 100 feet deep; and is lined with conductor casing, which is also called conductor pipe. If the topsoil is soft, the conductor pipe may be driven into the ground with a pile driver. In either case, the conductor casing keeps the ground near the surface from caving in. Also, it conducts drilling mud back to the surface from the bottom when drilling begins, thus the name conductor pipe.

Usually, another hole considerably smaller in diameter than the conductor hole is dug beside the cellar and also lined with pipe. Called the rathole, it is used as a place to store the kelly when it is temporarily out of the borehole during certain operations. Sometimes on small rigs, a third hole, called the mousehole, is dug. On large rigs, it is not necessary to dig a mousehole because of the rig floor's height above the ground. In either case, the mousehole is lined with pipe and extends upward through the rig floor and is used to hold a joint of pipe ready for makeup.

Rigging Up: With the site prepared, the contractor moves in the rig and related equipment. The process, known as rigging up, begins by centering the base of the rig, called the substructure, over the conductor pipe in the cellar. The substructure supports the derrick or mast, pipe, drawworks, and sometimes the engines. If a mast is used, it is placed into the substructure in a horizontal position and hoisted upright. A standard derrick is assembled piece by piece on the substructure. Meanwhile, other drilling equipment such as the mud pumps are moved into place and readied for drilling.

Other rigging-up operations include erecting stairways, handrails, and guardrails; installing auxiliary equipment to supply electricity, compressed air, and water; and setting up storage facilities and living quarters for the toolpusher and company man. Further, drill pipe, drill collars bits, mud supplies, and many other pieces of equipment and supplies must be brought to the site before the rig can make hole.

Mobilizing the drill rig to the location requires moving 10 to 25 large truckloads of equipment over public highways and smaller roads. In very remote locations, entire drilling crews and service personnel may be temporarily housed onsite. A typical drilling crew consists of five people. Drilling operations are continuous, 24 hours a day and 7 days a week. The crews usually work two 12-hour

shifts. With the drilling crew, geologists, engineers, supervisors, and specialized service providers, there may be anywhere from 5 to over 20 people on a drilling location at any given time. An irregular stream of traffic to and from the rig occurs day and night.

Drilling the Surface Hole: Rotary drilling is used almost universally in modern-day drilling. Drilling is accomplished by rotating special bits under pressure. Starting to drill is called "spudding in" the well. To spud in, a large bit, say 17 ½ inches in diameter as an example, is attached to the first drill collar and is lowered into the conductor pipe by adding drill collars and drill pipe one joint at a time until the bit reaches the bottom. While drilling, the rig derrick and associated hoisting equipment support the drill string's weight. The combination of rotary motion and weight on the bit causes rock to be chipped away at the bottom of the hole.

The rotary motion is created by a square or hexagonal rod, called a kelly, which fits through a square or hexagonal hole in a large turntable, called a rotary table. The rotary table sits on the drilling rig floor and as the hole advances, the kelly slides down through it. With the kelly attached to the top joint of pipe, the pump is started to circulate mud, the rotary table is engaged to rotate the drill stem and bit, and weight is set down on the bit to begin making hole. When the kelly has gone as deep as it can, it is raised, and a joint of drill pipe about 30 feet long is attached in its place. The drill pipe is then lowered, the kelly is attached to the top of it, and drilling recommences. By adding more and more drill pipe, the hole can steadily penetrate deeper.

Large volumes of fluid, generically called drilling mud, circulate down the drill pipe to the drill bit and back to the surface. The mud lubricates and cools the bit and carries drill cuttings to the surface. The composition of the mud system depends on the types of formations being drilled, economics, water availability, pressure, temperature, and many other significant factors. Mud can be as simple as freshwater, or a complex emulsion of water, oil, chemicals, clays, and weighting material. Chemicals added to the mud help drill and protect the hole's integrity. Weighting material is often added to prevent formation fluids from flowing into the well as it is being drilled. Mud systems can be highly toxic or relatively benign. The drilling mud along with cuttings from the well account for the largest volume of waste generated at the wellsite.

The first part of the hole is known as the surface hole. Even though the formation that contains the hydrocarbons may lie many thousands of feet below this point, drilling ceases temporarily because steps must now be taken to protect and seal off the formations that occur close to the surface. For example, freshwater zones must be protected from contamination by drilling mud. To protect them, special pipe called casing is run into the hole and cemented.

Tripping Out: The first step in running casing is to pull the drill stem and bit out of the hole. Pulling the drill stem and bit out of the hole in order to run casing, change bits, or perform some other operation in the borehole is called tripping out. To trip out, the drilling crew uses the rig's hoisting system, or drawworks, to raise the drill stem out of the hole.

Attached to the traveling block is a set of drill pipe lifting devices called elevators. Elevators are gripping devices that can be latched and unlatched around the tool joints of the drill pipe. The crew latches the elevators around the drill pipe, and the driller raises the traveling block to pull the pipe upward. When the third joint of pipe clears the rotary table, the rotary helpers set the slips and use the tongs to break out the pipe. The pipe is usually removed in stands of three joints. Removing pipe in three-joint stands, rather than in single joints, speeds the tripping out process. With the stand of pipe broken out, the crew guides it into position on the rig floor to the side of the mast or derrick.

The derrickman unlatches the elevators from the top of the pipe and stands the pipe back in the derrick. Working as a close-knit team, the driller, rotary helpers, and derrickman continue tripping out until all the drill pipe, the drill collars, and the bit are out of the hole. At this point, the only thing in the hole is drilling mud, because mud was pumped into the hole while pipe was tripped out.

Running Surface Casing: Once the drill stem is out, often a special casing crew moves in to run the surface casing. Casing is large-diameter steel pipe, and is run into the hole with the use of special heavy-duty casing slips, tongs, and elevators. Casing accessories include centralizers, scratchers, a guide shoe, a float collar, and plugs.

Centralizers keep the casing in the center of the hole so that when the casing is cemented, the cement can be evenly distributed around the outside of the casing. Scratchers help remove mud cake from the side of the hole so that the cement can form a better bond. The guide shoe guides the casing past debris in the hole, and has an opening in its center out of which cement can exit the casing. The float collar serves as a receptacle for special cementing plugs, and allows drilling mud to enter the casing at a controlled rate. The plugs begin and end the cementing job, and serve to keep cement separated from the mud so that the mud cannot contaminate the cement. The casing crew, with the drilling crew available to help as needed, runs the surface casing into the hole one joint at a time. Casing is available in joints of about 40 feet. Once the hole is lined from bottom to top with casing, the casing is cemented in place.

Cementing: The cementing of oil well casing annuli is a universal practice done for a number of reasons, depending on casing type. Conductor casings can be cemented to prevent the drilling fluid from circulating outside the casing, causing the very surface erosion the casing was intended to prevent. Surface casings must be cemented to seal off and protect freshwater formations, provide an anchor for blowout preventer equipment, and give support at the surface for deeper strings of casing. Intermediate strings of casing are cemented in order to seal off abnormal pressure formations, effectively isolate incompetent formations that might cause drilling problems unless supported by casing and cement, and shut off zones of lost circulation. Production casing is cemented to prevent the migration of fluids to thief zones, to prevent sloughing of formations that could result in reduced production, and to isolate productive zones for future development.

An oilwell cementing service company usually performs the job of cementing the casing in place. The cement used to cement oilwells is not too different from the cement used as a component in ordinary concrete. Basically, oilwell cement is Portland cement with special additives to make it suitable for various conditions of pumping, pressure, and temperature.

Cementing service companies stock various types of cement and use special trucks to transport the cement in bulk to the well site. Bulk cement storage and handling at the rig location make it possible to mix the large quantities needed in a short time. The cementing crew mixes the dry cement with water, often using a recirculating mixer (RCM). This device thoroughly mixes the water and cement by recirculating part of the already-mixed components through a mixing compartment. Powerful cementing pumps move the liquid cement (slurry) through a pipe to a special valve made up on the topmost joint of casing. This valve is called a cementing head, or plug container. As the cement slurry arrives, the bottom plug is released from the cementing head and precedes the slurry down the inside of the casing. The bottom plug keeps any mud that is inside the casing from contaminating the cement slurry where the two liquids interface. Also, the plug wipes off mud that adheres to the inside wall of the casing and prevents it from contaminating the cement.

The plug travels ahead of the cement until it reaches the float collar. At the collar the plug stops, but continued pump pressure breaks a seal in the top of the plug and allows the slurry to pass through a passageway in it. The slurry flows out through the guide shoe, and starts up the annulus between the outside of the casing and the wall of the hole until the annulus is filled.
A top plug is released from the cementing head and follows the slurry down the casing. The top plug keeps the displacement fluid, usually drilling mud, from contaminating the cement slurry. When the top plug comes to rest on the bottom plug in the float collar, the pumps are shut down and the slurry is allowed to harden. Allowing time for the cement to set is known as waiting on cement (WOC) and varies in length. In some cases, it may be only a matter of a few hours; in other cases, it may be 24

hours or even more, depending on well conditions. Adequate WOC time must be given to allow the cement to set properly and bond the casing firmly to the wall of the hole. After the cement hardens and tests indicate that the job is good -- that is, that the cement has made a good bond and no voids exist between the casing and the hole -- drilling can be resumed.

Tripping In: To resume drilling, the drill stem and a new, smaller bit that fits inside the surface casing must be tripped back into the hole. The bit is made up on the bottommost drill collar. Then, working together, the driller, floormen, and derrickman make up the stands of drill collars and drill pipe and trip them back into the hole.

When the drill bit reaches bottom, circulation and rotation are begun and the bit drills through the small amount of cement left in the casing, the plugs, the guide shoe, and into the new formation below the cemented casing. As drilling progresses and hole depth increases, formations tend to get harder; as a result, several round trips (trips in and out of the hole) are necessary to replace worn bits.

Controlling Formation Pressure: During all phases of drilling, an important consideration is well control. Well control is preventing the well from blowing out by using proper procedures and equipment. A blowout is the uncontrolled flow of fluids -- oil, gas, water, or all three -- from a formation that the hole has penetrated.

Blowouts threaten lives, property, and pollution of the environment. Rig crews receive extensive training in how to recognize and react to impending blowouts, making them relatively rare events.

The key to well control is understanding pressure and its effects. Pressure exists in the borehole because it contains drilling mud and in some formations because they contain fluids. All fluids -- drilling mud, water, oil, gas, and so forth -- exert pressure. The denser the fluid (the more the fluid weighs), the more pressure the fluid exerts. A heavy mud exerts more pressure than a light mud. For effective control of the well, the pressure exerted by the mud in the hole should be higher than the pressure exerted by the fluids in the formation.

Pressure exerted by mud in the hole is called hydrostatic pressure. Pressure exerted by fluids in a formation is called formation pressure. The amount of hydrostatic pressure and formation pressure depends on the depth at which these pressures are measured and the density, or weight, of each fluid. Regardless of the depth, hydrostatic pressure must be equal to or slightly greater than formation pressure, or the well kicks. The well kicks, formation fluids enter the hole, if hydrostatic pressure falls below formation pressure. Thus, one of the crew's main concerns during all phases of the drilling operation is to keep the hole full of mud whose weight is sufficiently high to overcome formation pressure.

However, unexpectedly high formation pressures can be encountered. Formation fluids can be swabbed, or pulled, into the hole by the piston-like action of the bit as pipe is tripped out of the hole. Also, the mud level in the hole can fall so that the hole is no longer full of mud. Whatever the reason, when hydrostatic pressure falls below formation pressure, crew members have a kick on their hands, and they must take quick and proper action to prevent the kick from becoming a blowout.

Helping the crew keep an eye on the rig's operation are various control instruments located on the driller's console. Some rigs have data processing systems that utilize slave computer display terminals, or CRTs (short for cathode ray tubes), on the rig floor, in the mud logging trailer, in the toolpusher's trailer, and in the company man's trailer. When limits that have been programmed into the system are exceeded, the system goes into an alarm condition.

Whether the kick warning signs come from electronic monitors, a computer printout, or the behavior of the mud returning from the hole, an alert drilling crew detects the signs and takes proper action to shut the well in. To shut a well in, large valves called blowout preventers, which are installed on top of the cemented casing, are closed to prevent further entry of formation fluids into the hole. Once the well is shut in, procedures are begun to circulate the intruded kick fluids out of the hole. Also, weighting material is added to the mud to increase its density to the proper amount to prevent further kicks, and the weighted up mud is circulated into the hole. If the mud has been weighted the proper amount, then normal operations can be resumed.

Running and Cementing Intermediate Casing: At a predetermined depth, drilling stops again in order to run another string of casing. Depending on the depth of the hydrocarbon reservoir, this string of casing may be the final one, or it may be an intermediate one. Intermediate casing is smaller than surface casing because it must be run inside the surface string and to the bottom of the intermediate hole. In general, it is run and cemented in much the same way as surface casing.

Final Depth and Well Evaluation: Using a still smaller bit that fits inside the intermediate casing, the next part of the hole is drilled. Often, the next part of the hole is the final part of the hole unless more than one intermediate string is required. After cementing the intermediate casing, drilling resumes by tripping the new bit and drill stem back in the hole. The intermediate casing shoe is drilled out, and drilling the new hole resumes.

While drilling and once reaching the total depth (TD) of the well, the operator collects information to determine if hydrocarbons have been encountered. To help the operator decide whether to abandon the well or to set a final, or production, string of casing, several techniques can be used. A thorough examination of the cuttings made indicates whether the formation contains sufficient hydrocarbons. A geologist catches cuttings at the shale shaker and analyzes them in a portable laboratory at the well site. He often works closely with a mud logger logger -- a technician who monitors and records information brought to the surface by the drilling mud as the hole penetrates formations of interest.

Well logging is another valuable method of analyzing downhole formations. Using a mobile laboratory, well loggers lower sensitive tools to the bottom of the well on wireline and then pull them back up the hole. As they pass back up the hole, the tools measure and record certain properties of the formations and the fluids (oil, gas, and water) that may reside in the formations. Logging tools can also be run as part of the drill string to measure hole conditions and formation properties as the well is being drilled. This is called “measurement while drilling” or MWD.

If logging results indicate commercial quantities, a drill stem test (DST) may be run. Tools are positioned on the drill pipe to isolate the zone to be flow tested. Downhole formation pressure and fluids enter the tool and activate a recorder. Test may be designed to allow formation fluids to flow to the surface during the test or just to allow a certain volume to enter into the wellbore. In either case, provisions must be made at the surface to separate formation fluids from the mud, and to store and dispose of formation liquids. Natural gas produced during drill stem test is vented or flared. A properly designed and run DST can give excellent indication of the types and volumes of fluid the zone is capable of producing.

In addition to well logging and drill stem testing, formation core samples can be taken from the hole and examined in a laboratory.

Setting Production Casing: After the drilling contractor has drilled the hole to final depth and the operating company has evaluated the formations, the company decides whether to set production casing or plug and abandon the well. If the well is judged to be a dry hole --that is, not capable of producing oil or gas in commercial quantities -- the well will be plugged and abandoned.

Several cement plugs will be put in the well to seal it permanently. Cement plugs will be designed and placed to protect the zones of usable water from pollution and to prevent escape of oil, gas, or other fluids to the surface or other zones. Plugging and abandoning a well are considerably less expensive than completing it.

On the other hand, if evaluation reveals that commercial amounts of hydrocarbons exist, the company may decide to set casing and complete the well. The services of a casing crew and cementing company will once more be arranged for; and the production casing will be run and cemented in the well.

The drilling contractor nears the end of his job when the hole has been drilled to total depth and production casing has been set and cemented. In some cases, the rig and crew remain on the location to "complete" the well, or make it ready for production. In other cases, the drilling contractor moves his rig, and the operator brings in a smaller, less expensive completion rig and crew to finish up the job.

Well Completion: Completion equipment and methods employed are quite varied. The perforated completion is by far the most popular method of completing a well. Perforating is the process of piercing the casing wall, cement, and rock to provide openings through which formation fluids may enter the wellbore. Perforating is accomplished by placing guns holding special explosive charges opposite the zone to be produced. The charges are shaped so that an intense, directional explosion is formed. The well must have a good cement job and well-designed and well-executed perforation methods to get effective formation flow.

Explosives used in perforating guns are very stable. Accidents are rare as long as the people involved use proper procedures. Perforating guns may be run in the well on tubing or by wireline. Firing is accomplised by applying electric current, pressure, or mechanical force to a firing head located on the perforating gun.

The final string of pipe usually run in a producing well is the tubing. Tubing is a string of relatively small diameter pipe through which the hydrocarbons are produced. Tubing sizes vary from less than 2 inches in diameter up to 4½ inches for large volume producers. In a flowing well, its smaller diameter produces more efficient flow than casing. Also, since it is not cemented in the hole, tubing may be removed when it becomes plugged or damaged. Tubing, when used with a packer, keeps well fluids and formation pressures away from the casing. Well fluids and high pressures can damage casing, necessitating costly repairs.

The packer consists of a pipelike device through which well fluids can flow. Rubber sealing elements form a fluid tight seal around the inside of the casing. Gripping elements, called slips, hold the packer in place. Because the packer seals off the space between the tubing and the casing, produced fluids are forced into and up the tubing.

Another device often installed in the tubing string near the surface is a "subsurface safety valve." The valve remains opened, as long a flow is normal. When the valve senses a loss in pressure or significantly increased flow (such as would occur with a flowline break), the valve closes automatically. Subsurface safety valves can prevent uncontrolled well flow in the event of massive surface equipment failure.

Finally, a tubing head is installed at the top of the well to support the tubing. Valves, gauges, and flow control devices are installed on top of the tubing head. Together, they make up what is commonly called a Christmas tree.

When reservoir pressures are not sufficient for the well to flow on its own, operators employ artificial lift methods. The most common by far is rod pumping. A plunger pump is installed deep in the well and connected by rods to a pumping unit on the surface. The pump jack moves the rods up and down to work the downhole pump. Pump jacks are often driven with electric motors or natural gas engines. The gas lift method works by injecting high-pressure gas into the fluid column of a swell to lighten and raise the fluid by expansion of the gas. Instead of pump jacks, there will be a source of high-pressure gas in the field, usually from a gas compressor. The hydraulic pumping method uses a fluid to drive a downhole motor, which in turns drives a pump that pumps the oil to the surface. Surface equipment for hydraulic pumping includes a high-pressure pump and vessels to separate the hydraulic fluid from produced fluid. Yet another type of artificial lift is electric submersible pumping, usually only used on very high-volume wells. An electric motor attached to a pump is installed downhole. Electric current is supplied to the motor through special heavy-duty armored cable. Surface facilities may just be a small transformer/control box.

The well may be stimulated to enhance flow. Stimulation may be performed before or after the completion equipment is installed. Two common types of stimulation are formation acidization and hydraulic fracturing. Stimulation treatments can improve flow to the point where commercial production is achieved in an otherwise uneconomical well.

Formation acidizing is treating the hydrocarbon-bearing rock with large volumes of acid. The most common types of acid used are hydrochloric (HCl) and hydrofluoric (HF). Oilfield acids contain additives to prevent of delay corrosion of the well's tubulars, inhibit sludging and emulsion reactions with oil in the formation, and make the acid easier to pump. The aim in acidizing is to enlarge the pore spaces and passages by dissolving rock, thus enlarging existing flow channels and opening new ones to the wellbore.

Acid is brought to the well location in tanker trucks and pumped using one or more truck-mounted pumps. Spent acid that is flowed back from the well is often kept separate from field production. The spent acid may be put into temporary tanks until it is trucked off to disposal.

In hydraulic fracturing, fluid is pumped into the formation at high enough pressures and rates to split the rock. Proppants are pumped with the fluid to hold the crack open once pumping stops. Sand and sintered bauxite beads are two common propping agents. Fracturing fluid must not only break down the formation, but also extend and transport the proppant into the fracture. The industry has developed a multitude of complex fluid and proppant systems to achieve the best results in the many varied types of reservoirs.

Many truck-mounted pumps and temporary storage tanks are needed on location to fracture-treat wells. Larger well locations may be needed if hydraulic fracturing is part of a completion procedure.

Field Development: If the wildcat well produces oil or gas in commercial quantities, one or more additional wells are normally drilled to confirm the initial finding and further test and define the extent of the oil or gas reserves. Location of the confirmation wells is dependent upon analysis of discovery well data and any existing seismic surveys. Confirmation progresses by drilling one well after another, each dependent on the results of the previous wells.

With more information in hand, facilities can be designed to handle production from the field. Next, development wells are drilled as needed to efficiently drain the reservoir. The procedures for drilling development wells are about the same as for wildcats, except that there may be a variation in the

amount and type of subsurface sampling, testing, and evaluation. More detailed seismic work may be performed to aid in the location of development wells.

A state Oil & Gas Commission usually establishes the field well spacing pattern. Typical well spacing may be one well every 640, 320, 160, 80, or 40 acres. Completely filled spacing patterns would translate to 1, 2, 4, 8, or 16 wells per square mile, respectively. In general, oil well spacing is denser than for gas wells, and shallow well spacing is denser than for deeper wells.

Access roads to development wells are usually better planned and constructed than those for wildcat wells because these wells tend to have a longer life. Typically a lease area will have one main route, with side roads to each well or multiwell pad location. Change from temporary to permanent roads does not take place until a well has been established as being capable of production. The amount of roadway required per square mile of field is 4 miles, based upon a spacing pattern of 40 acres and a separate pad for each well.

Directional drilling is sometimes used to concentrate the surface locations of two or more wells in one area. This technique minimizes the amount of surface area (roads and well pads) needed to develop a field. Multiple well pads may be used when developing a field inside the limits of a city or in environmentally sensitive areas.

Other surface equipment and support facilities are brought in or constructed during field development. For example, a battery of storage tanks or a pipeline may be required to handle produced oil or gas. Separation and treatment facilities are required to separate gas and water from oil. Storage tanks are required to hold brines produced during oil extraction, and a proper disposal capability, most typically reinjection, must be developed. Natural gas must be properly disposed of (usually flared) or treated to remove impurities if it is to used or sold.

Well Servicing and Workover Operations: Sometimes it is necessary to repair downhole mechanical problems. Workover rigs are often used to repair downhole equipment or assist in large stimulation jobs. The most common well servicing operation is related to artificial lift installation, tubing string repairs, and work on other downhole completion equipment that may be malfunctioning. More involved workover operations might include cleanout of sand, scale, or paraffin deposits that accumulate in the well, casing repair, cementing, perforating new or existing zones of production, or even some limited drilling operations.

Workover rigs are scaled-down drilling rigs. They are usually equipped to stand the pipe in the derrick, rotate pipe while it is in the hole, and circulate workover fluids down and back up the well. Workover rigs are usually self-contained on a truck. They are highly mobile and can be rigged up and rigged down quickly. A well servicing jog to replace a rod pump may last only 1 or 2 days. A major workover operation to change or “recomplete” to another productive zone may last more than a month.

PLUGGING/ABANDONMENT/RECLAMATION

Workover rigs are also used to plug and abandon wells once they are depleted. Plugging operations consist of removing the tubing, packer, and other completion equipment; pumping cement across producing zones; and placing cement plugs at various depths to protect freshwater zones. Finally, a cement plug is set at the surface to cap the well, and wellhead equipment is cut off. A permanent abandonment marker is often placed to identify the well’s location.

The surface owner and regulatory agencies often dictate surface reclamation. Reclamation can range from just removing equipment to reclaiming the area to conditions that existed before drilling the well.

Full-scale reclamation can include the following:

- Removal of structures, equipment, and debris used or generated during operations;
- Removal or remediation of contaminated soils;
- Recontouring of disturbed areas to near original grade;
- Spreading and preparation of topsoil;
- Planting of native vegetation, usually grasses, but sometimes also tree saplings;
- Erosion protection measures such as mulching; and
- Monitoring of revegetation and erosion control efforts.

Reclamation may last a few days or a few years, depending on the degree of contamination on the site and the ability of native species to grow.

APPENDIX E

REMAINING OIL AND GAS RESOURCES BENEATH BIG THICKET NATIONAL PRESERVE ASSESSMENT METHODOLOGY

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Introduction

The Central Energy Team of the USGS was retained by the National Park Service to assess the undiscovered oil and gas resource potential of Big Thicket National Preserve in east Texas. The oil and gas plays of the entire Gulf Coast region were most recently assessed in 1995 (Schenk and Viger, 1996). Big Thicket National Preserve lies along the east Texas Gulf Coast and is within the Western Gulf Province. The oil and gas plays developed in 1995 for the Western Gulf Province formed the basis for this more localized assessment of Big Thicket National Preserve.

The first step in the assessment process was to define hydrocarbon plays that were then assessed for undiscovered oil and gas resources. A play is defined as a set of known or postulated oil and (or) gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathway, timing, trapping mechanism, and hydrocarbon type. The geologic formations that may be productive in the future at Big Thicket National Preserve include the Upper Cretaceous Tuscaloosa Formation, Upper Cretaceous Austin Chalk (Austin Group), the Paleocene-Eocene Wilcox Group, the Eocene Yegua Formation and other sandstones of the Claiborne Group, the Oligocene Vicksburg Formation, and the Oligocene Frio Formation. The two plays developed for this assessment reflect genetic groupings of this stratigraphy.

Following the geologic definition of the plays, the second step involved data allocation and evaluation, which formed the basis of this geologically based field-size assessment. Third, the geologic data from the geologist was entered into a Monte Carlo simulation model to calculate undiscovered oil and gas resources for each of the plays. Finally, in Step 4, the allocations of undiscovered resources to Big Thicket National Preserve were made using an analysis of richness factor.

Step 1. Geologic Play Definition

The oil and gas plays of the 1995 Assessment were developed to assess much larger areas of the Gulf Coast (Schenk and Viger, 1996) than we are interested in for this study. Here, we defined two plays that merge much of the oil and gas field data that was divided stratigraphically for the 1995 Assessment so that the allocation of resources to Big Thicket National Preserve is based on field rather than reservoir data. For example, in the 1995 Assessment the area of Big Thicket National Preserve was underlain by several plays that extended across much of coastal Texas. These plays were combined to make the assessment of the small parcel of land of Big Thicket more manageable.

The two plays developed for this study are the Tertiary Oil and Gas Play and the Upper Cretaceous Gas Play. The Tertiary Oil and Gas Play contains all or parts of the following plays from the 1995 National Assessment (Schenk and Viger, 1996): 4701- Houston Salt Dome Flank Oil and Gas; 4719- Lower Wilcox Fluvial Oil and Gas; 4720- Lower Wilcox Downdip Overpressured Gas; 4722- Upper Wilcox Shelf Edge Gas and Oil; 4723- Upper Wilcox Downdip Overpressured Gas; 4726- Yegua Updip Fluvial-Deltaic Oil and Gas; 4727- Yegua Downdip Gas; 4728- Vicksburg Updip Gas Play; 4735- Frio SE Texas/S. Louisiana Mid-Dip Gas and Oil; and 4736- Frio SE Texas/Louisiana Downdip Gas. The Upper Cretaceous Gas Play contains all or parts of the following plays from the 1995 National Assessment: 4709- Tuscaloosa Deep Sandstone Gas; 4710- Woodbine South Angelina Flexure Oil and Gas; and 4711- Austin Shelf Edge Gas and Oil.

Tertiary Oil and Gas Play

General Description

The Tertiary Oil and Gas Play is bounded to the west by the San Marcos Arch, to the north by the updip extent of Tertiary reservoirs, and to the south by the postulated downdip extent of potential fluvial, deltaic, shoreline, shelf, and shelf-edge deltaic reservoirs. The Tertiary Oil and Gas Play as defined for this assessment is a combination of several more narrowly defined stratigraphic plays for the U.S. National Oil and Gas Assessment (Schenk and Viger, 1996). Big Thicket National Preserve is confined within this play, and represents approximately 0.6% of the total play area (see Figure 1 on page G-8).

The Tertiary stratigraphic section in the Gulf Coast represents episodic sedimentation where major clastic wedges prograded gulfward from north to south (Winker, 1982; Galloway and others, 1991). The major clastic wedges that are important to the assessment of Big Thicket include the Wilcox, the Yegua (Claiborne Group), the Vicksburg, and the Frio. Each of these sedimentary wedges contains significant oil and gas discoveries (Galloway and others, 1983; Kosters and others, 1989), but the Yegua (and associated sandstones) and Frio intervals are the main units underlying the area of Big Thicket, and have the best potential for undiscovered oil and gas in the area.

The play boundary was drawn to encompass fluvial, deltaic, shoreline, barrier, shelf, and shelf-edge deltaic reservoirs in the stratigraphic units from the Wilcox to the Frio. These facies are predicted to form the main reservoirs in undiscovered fields. Other reservoirs may be present, such as slope/fan sandstones in the Wilcox interval.

Reservoirs and Reservoir Quality

Reservoirs in this play are considered to be mainly fluvial, deltaic, shoreline, barrier, shelf, and shelf-edge deltaic sandstones. Published information on reservoir quality of the Wilcox to Frio sandstones shows that in general the fluvial-deltaic-shoreline sandstones exhibit excellent reservoir properties (Bebout and others, 1978; Coleman and Galloway, 1990; Humphrey, 1986; Loucks and others, 1977; Richmann and others, 1980; Taylor and Al Shaieb, 1986). Wilcox sandstones have porosities up to 26%, with permeabilities up to 600 millidarcys (mD). However, permeabilities in potential slope/fan sandstones would be lower, up to 250 mD. Yegua sandstones and other Claiborne Group sandstones such as the Sparta and Queen City have porosities up to 35%, with permeabilities up to 2000 mD. Vicksburg and Frio sandstones exhibit porosities up to 30%, with permeabilities up to 1500 mD.

Source Rocks

Source rocks for the hydrocarbons in this play are not known for certain, which is true for most passive margin deltaic sequences. However, analyses of several of the mudstone intervals in the Tertiary section have shown that the mudstones may have been sources for some of the oil and

gas in Tertiary reservoirs (Tanner and Fuex, 1990). For the area of Big Thicket National Preserve, the predominant undiscovered hydrocarbon is gas rather than oil, given the depths involved in the play, the thermal history, and exploration and production to date.

Traps and Seals

The sedimentary section in this play is cut by several major growth faults, leading to complex structures throughout the section. The growth faults range from the Wilcox fault zone downdip through the Frio growth fault zone. The structures associated with growth faults and salt movement form the structures that are the traps in this play. Structures include faulted rollover anticlines, anticlines, and complexly faulted growth structures. The seals for this play are the marine mudstones that encase the fan sandstones, or encase the slope channel sandstones, or may be from the juxtaposition of mudstones against sandstones along faults. Smaller traps within the play may be stratigraphic.

Exploration

Exploration in the Tertiary Oil and Gas Play has been extensive, leading to the discovery of at least 307 oil fields and 487 gas fields greater than a minimum size of 0.5 million barrels. Given the degree of exploration maturity, the prediction is that median size of undiscovered fields will be smaller in general than in the past. The potential for undiscovered hydrocarbons in the play area is considered good, but that the chance for discovering a large field is small.

Upper Cretaceous Oil and Gas Play

General Description

The Upper Cretaceous Oil and Gas Play was developed for this study to include the assessment of undiscovered resources in the Tuscaloosa Formation, the Austin Chalk, and possibly the Eagle Ford Formation. These stratigraphic units are productive to the north of Big Thicket National Preserve, but predicted extensions of potential reservoirs down dip and beneath Big Thicket forms the geologic basis for this play. We postulate that slope/fan sandstones of the Tuscaloosa Formation have the best potential for undiscovered resources in the area of Big Thicket. However, only a portion of the area of Big Thicket exists within the postulated play boundary. Big Thicket represents approximately 0.32% of the total area of the Upper Cretaceous Gas Play (see Figure 2 on page G-9).

Reservoirs and Reservoir Quality

Reservoirs in the Tuscaloosa (and coeval Woodbine) Formation in the play area are interpreted to be slope-channel sandstones and basin-floor submarine fan sandstones (Siemers, 1978). Porosities in ultra-deep Tuscaloosa sandstones are anomalously high, with porosity in sandstones at 20,000 feet as high as 20% and permeabilities as high as 100 mD. The preservation of such excellent reservoir properties may be partly attributed to early chloritic grain coatings on framework grains that served to inhibit the subsequent formation of porosity-reducing cements (Thomson, 1979). Depths to undiscovered reservoirs may be up to 25,000 feet. The geologic uncertainty in this play is centered on two issues- the distribution of Tuscaloosa slope and fan sandstone facies and the distribution of adequate reservoir porosity within the play area.

Reservoirs in the Austin Chalk and Eagle Ford formations are interpreted to be fractured mudstones and micritic carbonates, similar to reservoirs producing from the shallower Austin trend in Texas. The existence of reservoir quality fractured Austin Chalk in the play area is conjectural at this time, but the possibility for adequate fractured reservoir does exist in the downdip Austin.

Source Rocks

Source rocks for potential gas in the Tuscaloosa Formation sandstones are interpreted to be mudstones of the Tuscaloosa, Austin, and/or Eagle Ford intervals. Source rocks for potential gas in the Austin and Eagle Ford formations are interpreted to be organic-bearing mudstones within these formations, leading to self-sourced reservoirs.

Traps and Seals

Traps for the Tuscaloosa sandstones are interpreted to be mainly stratigraphic, since the sandstones are slope-channel and basin-floor sandstones encased in coeval mudstones. Seals are provided by the enclosing mudstones. Traps in the Austin and Eagle Ford intervals are more subtle, in that fractured intervals are interpreted to be intercalated with non-fractured intervals, providing the traps and seals.

Exploration

The Upper Cretaceous Gas Play contains 16 gas fields larger than a threshold value of 36 bcf. The degree of exploration in this play to date is considered immature. The ultra-deep area of this play, with the potential for Tuscaloosa sandstones reservoirs, is considered to have excellent potential for gas, a conclusion also reached in the 1995 National Assessment (Schenk and Viger, 1996).

Step 2. Oil and Gas Data Allocation and Evaluation

Once the plays were defined geologically, we then organized and allocated all of the pertinent oil and gas information for existing fields for each play using digital techniques.

Data Retrieval and Data Allocations

The oil and gas field data for the play areas were initially retrieved from the Nehring Significant Oil and Gas Field File, a commercially available database. Oil and gas wells for the play areas were retrieved from the Petroleum Information Well History Control One-Line File, another commercially available database. The oil and gas fields and wells for each play were allocated digitally within the play boundaries using Arc/Info.

One of the basic tenets of assessment methodology that we used in this study is that estimates must be available for discovered field size within each play. Field size is the sum of 1) oil and/or gas production to date, 2) calculated reserves, and 3) and estimate of field growth (inferred reserves). The total production and reserves data are from the Nehring database, but we must estimate the amount of growth that may occur in each field within each play.

Field growth is a long-acknowledged phenomenon of oil and gas fields. Basically, the reported size of a field changes with time, with most fields growing with time compared to a field's first reported size, for several reasons. For all fields in a play we must make an estimate of the grown size before we can begin to use plots of the historical data in our assessment process. For the plays defined in this study, we used a growth function that was developed for onshore Gulf Coast fields by Root (1996) for the 1995 National Assessment. All of the historical data plots were constructed using field sizes incorporating field growth.

We assessed the undiscovered oil and gas resource within each play for this study. We did not make a separate assessment of the amount of oil and gas (inferred reserves) that would potentially be available from field growth of existing fields. We only assessed the potential for new field discoveries; if a deeper pool were discovered in an existing salt-dome field, for example, that

pool would fall under the category of reserves in an existing field. This is a critical distinction that must be considered when using the results of this assessment.

Plots of Historic Data

Once grown fields were digitally assigned to each play, then a series of plots of the historic data were constructed that were used as guides in the development of distributions of sizes and numbers of undiscovered accumulations, with the geology of the play being a major constraint. The data plots included numbers of accumulations discovered with time, numbers of fields vs field size, field size vs time, field size vs numbers of exploratory wells, numbers of fields vs exploratory wells, and a series of plots with parameters such as API gravity, gas/oil ratio, and reservoir depth. These plots are used in conjunction with play geology and predictions as to future trends, technologies, and new exploration concepts to estimate a distribution of undiscovered field size and number for each play. Ancillary data, such as gas/liquids ratio and natural gas/liquids ration were included so that we could calculate co-products such as natural gas liquids and associated gas resources.

Data Form

The data form used in the assessment is one that is now standard for assessments by the Central Energy Team. Key input parameters include minimum field size to be assessed; the risk structure for hydrocarbon charge, adequate reservoirs, and timing; distributions of sizes and numbers of undiscovered accumulations, and input for co-product calculations. The form was completed for each play. Following the completion of the data form, a formal review meeting was held during which the geologist presented the geology of each play, and defended the input data on the form to a group comprising the USGS assessment review team. Once the review was completed, the data form was released to the modeler for input in the Monte Carlo process.

Step 3. Quantitative Methodology

The data on the form was input into a Monte Carlo model. The Monte Carlo model produced an estimate of undiscovered resources in each play. Calculations of undiscovered resources were made using a USGS program based on Microsoft Excel and Crystal Ball, a commercial Monte Carlo simulation program that works within Excel. During each iteration of the simulation, a sample taken from the field size distribution gave the number of undiscovered fields within the play. Many independent samples from the field size distribution were taken and summed. A key result from the Monte Carlo simulations is the prediction of the “most likely largest undiscovered field” in the play. Amounts of natural gas liquids and geographic resource allocations were calculated by multiplication of appropriate factors given on the data form. This was redone for a total of fifty thousand iterations, producing relatively smooth output distributions.

Step 4. Allocation of Undiscovered Resources to Big Thicket

To allocate undiscovered resources from the plays to the area of Big Thicket National Preserve, we used a method called “richness-factor analysis” (Crovelli, 1983). The essence of this method is to determine the degree to which undiscovered resources can be reasonably assigned from a larger play to a smaller parcel of land such as Big Thicket, given the percentage of land that Big Thicket occupies within the play and the geographic position of Big Thicket with respect to the petroleum geology of the play. For example, Big Thicket represents about 0.6% of the Tertiary Oil and Gas Play; if undiscovered resources were evenly distributed across the play, then Big Thicket would contain 0.6% of the resources of the play. However, the geology of the play, particularly the distribution of potential Yegua and associated reservoirs, suggests that the amount of resource may be twice (richness factor of 2) that of a one-to-one assessment of Big Thicket. Thus, Big Thicket would be “enriched” relative to the rest of the play. Given the geology of the plays and the

exploration trends and new concepts, we chose a richness factor of 2 for the Tertiary Oil and Gas Play, and a richness factor of 1.5 for the Upper Cretaceous Gas Play.

Assessment Results

Results of the richness-factor allocation of conventional oil and gas resources from the assessment of the two plays are given in Table 1 on page E-7. One result of the Monte Carlo simulation procedure is the estimation of the most likely "largest undiscovered field" in each play. For the Tertiary Oil and Gas Play, the simulation predicted a "most likely largest oil field size" of about 8.7 million barrels, and a "most likely largest gas field size" of 121 bcf. This suggests that within the play boundary, including the area of Big Thicket, there is a probability at the mean for an oil field and a gas field of these sizes. For the Upper Cretaceous Gas Play, the simulation suggested a "most likely largest gas field size" of 1.37 tcf, a field that could partially underlie the area of Big Thicket National Preserve.

The application of the richness factors to the assessment results from the two plays indicate that, at the mean, Big Thicket may contain 1.15 million barrels of oil in undiscovered oil fields, 3.21 bcf of associated gas, 32.92 bcf of gas in undiscovered gas fields, and approximately 1 million barrels of condensate in undiscovered gas fields as allocated from the Tertiary Oil and Gas Play; Big Thicket may contain 33.98 bcf in undiscovered gas fields, and approximately 1 million barrels of condensate in undiscovered gas fields as allocated from the Upper Cretaceous Gas Play. Assuming perfect positive correlation between the plays, the results by fractile can be summed as follows for Big Thicket; 1.15 million barrels of oil in undiscovered oil fields, 3.21 bcf gas in oil undiscovered oil fields, 66.90 bcf gas in undiscovered gas fields, and 2.01 million barrels of condensate in gas and oil fields.

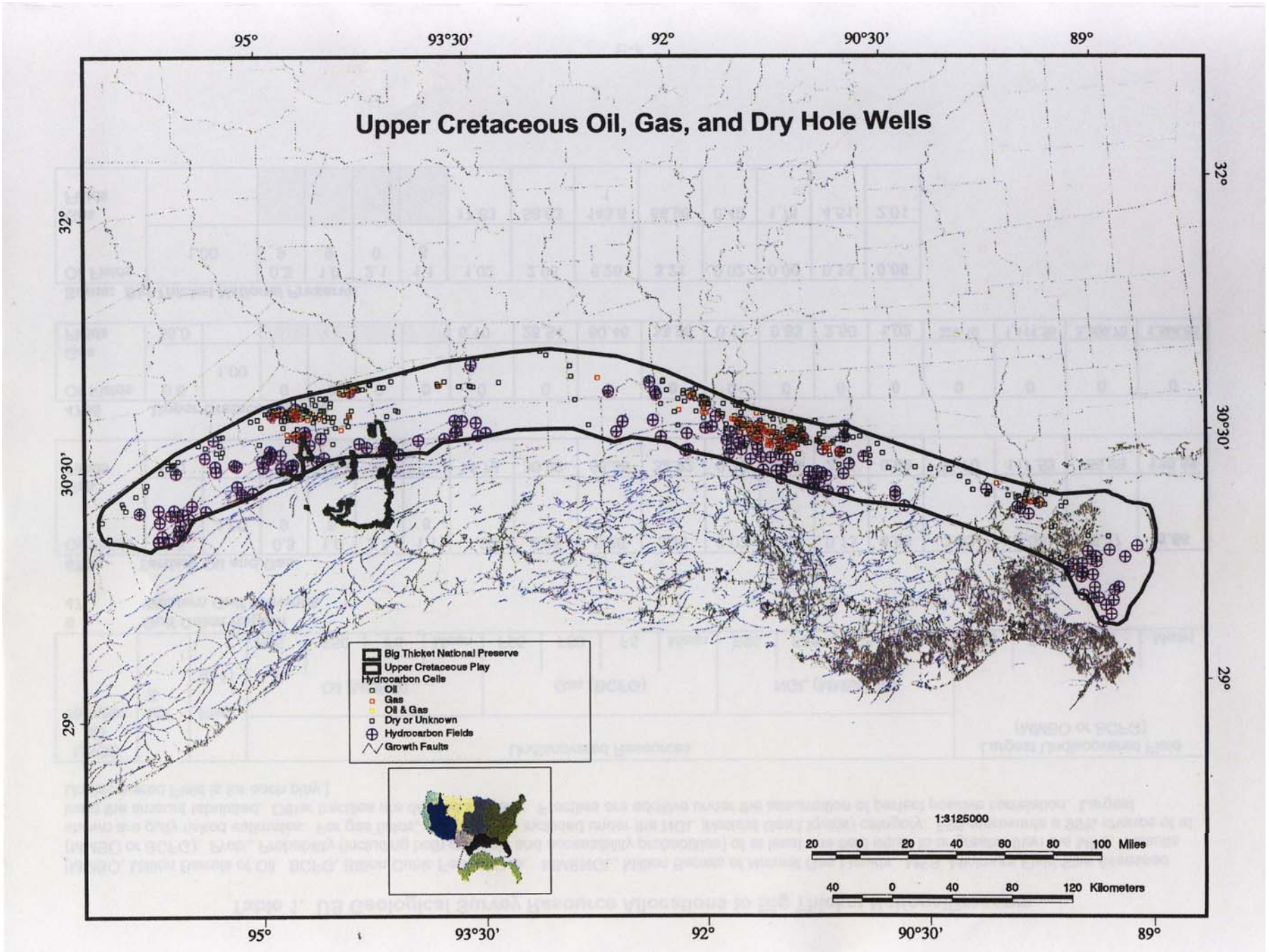
These values of undiscovered resources of oil and gas for Big Thicket National Preserve represent resources in potential new field discoveries, not inferred reserves from the growth of existing fields. With the proliferation of new technologies such as 3-D seismic the potential for growth of existing fields in the area of Big Thicket is high. In many areas of the U.S. the potential for field growth is higher than the potential for new field discoveries. The assessment of inferred reserves in existing fields was not a component of this study.

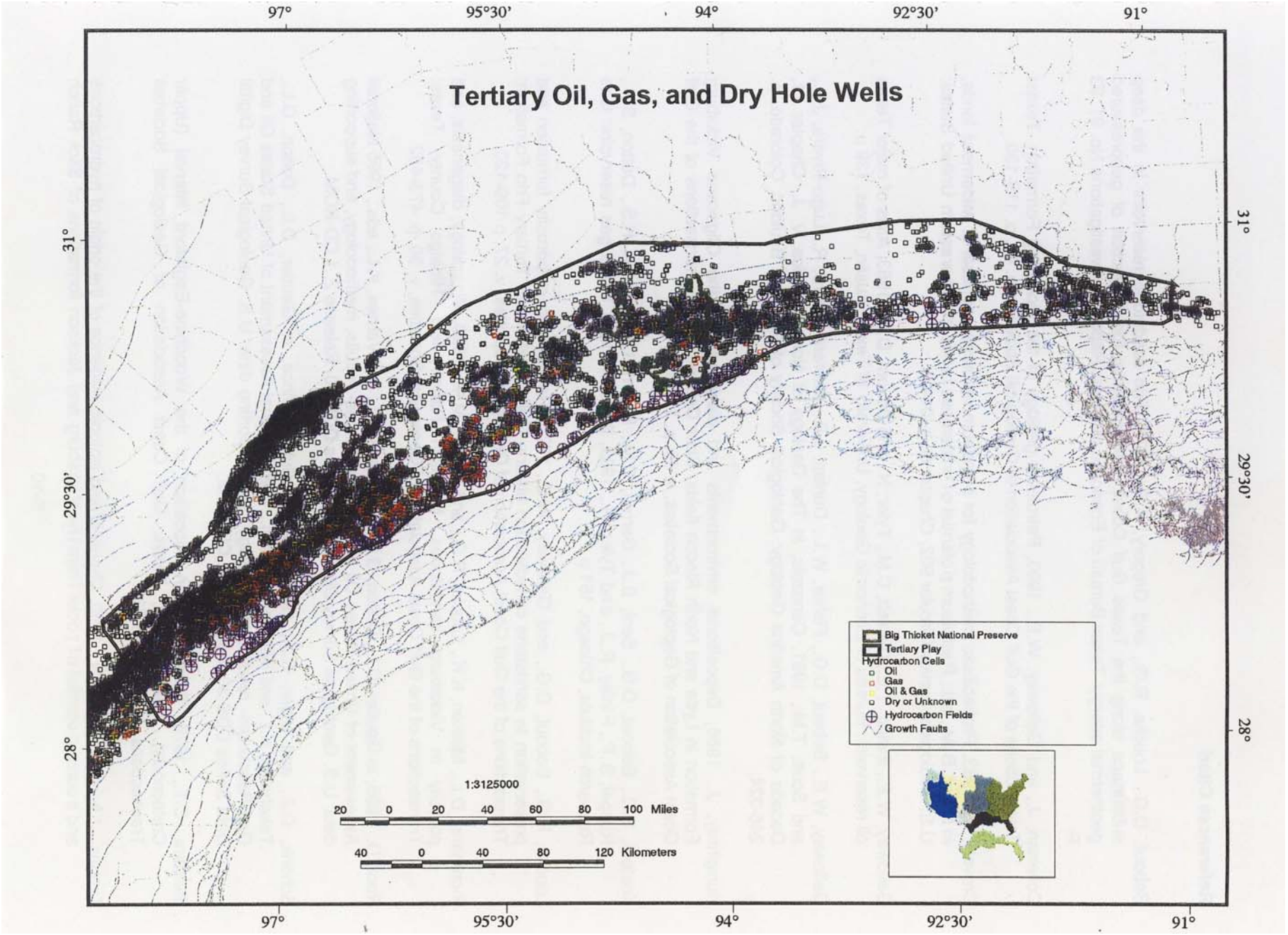
Table 1. U.S. Geological Survey Assessment Results for Big Thicket National Preserve

MMBO – Million Barrels of Oil
BCFG – Billion Cubic Feet of Gas
MMBNGL – Million Barrels of Natural Gas Liquids

For gas fields, all liquids are included under the NGL (Natural Gas Liquids) category.
F95 represents a 95% chance of at least the amount tabulated. Other fractiles are defined similarly. Fractiles are additive under the assumption of perfect positive correlation.

USGS ID Number	Undiscovered Resources																		Largest Undiscovered Field (MMBO or BCFG)					
	Oil (MMBO)						Gas (BCFG)						NGL (MMBNGL)											
	F95	F75	F50	F25	F5	Mean	F95	F75	F50	F25	F5	Mean	F95	F75	F50	F25	F5	Mean	F95	F75	F50	F25	F5	Mean
6	**Gulf Coast Region**																							
47	**Western Gulf Province**																							
4754	**Tertiary Oil and Gas**																							
Oil Fields	0.39	0.75	1.09	1.48	2.10	1.15	1.02	2.00	2.96	4.15	6.26	3.21	0.02	0.04	0.06	0.08	0.13	0.06	3.93	6.05	8.08	10.87	15.27	8.66
Gas Fields							11.73	20.73	30.09	42.59	63.35	32.92	0.32	0.59	0.88	1.27	2.01	0.99	65.70	92.64	117.53	147.37	185.63	120.69
4755	**Upper Cretaceous Gas**																							
Oil Fields	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Gas Fields							6.10	15.85	28.54	46.79	80.46	33.98	0.17	0.45	0.83	1.39	2.50	1.02	329.10	689.82	1,111.36	1,778.39	3,369.78	1,366.05
Sums:	**Big Thicket National Preserve**																							
Oil Fields	0.39	0.75	1.09	1.48	2.10	1.15	1.02	2.00	2.96	4.15	6.26	3.21	0.02	0.04	0.06	0.08	0.13	0.06						
Gas Fields							17.83	36.58	58.63	89.38	143.81	66.90	0.49	1.04	1.71	2.66	4.51	2.01						


Upper Cretaceous Oil, Gas, and Dry Hole Wells
95°
93°30'
92°
90°30'
89°
32°
30°30'
29°
Big Thicket National Preserve
Upper Cretaceous Play
Hydrocarbon Cells
Oil
Gas
Oil & Gas
Dry or Unknown
Hydrocarbon Fields
Growth Faults
1:3125000
20 0 20 40 60 80 100 Miles
40 0 40 80 120 Kilometers


Tertiary Oil, Gas, and Dry Hole Wells
97°
95°30'
94°
92°30'
91°
31°
29°30'
28°
Big Thicket National Preserve
Tertiary Play
Hydrocarbon Cells
Oil
Gas
Oil & Gas
Dry or Unknown
Hydrocarbon Fields
Growth Faults
1:3125000
20 0 20 40 60 80 100 Miles
40 0 40 80 120 Kilometers

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APPENDIX F

GUIDELINE FOR THE DETECTION AND QUANTIFICATION OF CONTAMINATION AT OIL AND GAS OPERATIONS

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I. WHAT IS THE PURPOSE OF THIS DOCUMENT?

This document is to be used as a guideline for collecting samples at sites within National Park Service (NPS) units where there are oil or gas operations. Samples will indicate whether or not contamination exists at the site as a result of an operation.

It is important that specific contaminants are tested for and that specific methodology is used so that contamination is accurately defined and so that results taken at different times by different people at the same site can be reliably compared. This guideline presents methodology for analyzing soil, sediment, groundwater, and surface water.

Specifically, guidelines are presented for: 1) when owner/operators must collect samples, 2) what contaminants to test for, 3) how to collect samples, 4) quality assurance/quality control, 5) how to analyze samples in the laboratory, 6) required detection limits and choosing environmental benchmarks, and 7) sample plan and reporting requirements.

Note that in this guideline “Superintendent” refers to the Superintendent and/or members of his/her staff who will represent him/her on these issues. In many cases, the Superintendent's actual involvement may be only that of approving the recommendations of the staff member(s).

II. WHEN AND WHERE TO COLLECT SAMPLES

The Superintendent can require sampling by an operator at a site if it has recently experienced a release, has a history of releases, or the facility is operated in a manner that poses a risk of releasing crude oil, natural gas condensates, produced water, or any other “contaminating substance” associated with an oil or gas operation.

Sampling can occur at any time during or after an operation. ("After" refers to when an owner/operator sells the operation, transfers its leasing rights, or closes the operation and abandons the site.) In most instances, sampling by the operator should be conducted under the direction of a Sampling and Analysis Plan that has been approved by the Superintendent to ensure all work will be performed in a professional manner, meets the resource protection needs of the park, and with the knowledge of the appropriate Park staff.

Sampling will be biased, not random, focusing on areas where contamination is obvious (visible) or suspected (such as near production or storage facilities). The exact sample locations and number of samples collected are site-specific and will be determined by the Superintendent, or proposed by the site operator in a Sampling and Analysis Plan or Work Plan submitted to the Superintendent for review and approval. Owner/operators are responsible for sample collection, sample analyses, and reporting of results, not NPS.

Sample data from a nearby (but off-site) "clean" location will be needed to determine "background" concentrations at the site for the contaminants of concern. A comparison of the contaminated site data with "background" data will allow resource managers to determine how contaminated the site is. If the site has been remediated, comparisons of sample data with "background" data can indicate if the clean-up met the Superintendent's remediation goals for the site.

Note that incoming owner/operators at new or existing oil or gas operations may wish to test the site for contamination before they begin operations. If they choose to do so, it is strongly suggested they test for the contaminants and use the methodology given in this guideline so that if samples are required during or after the operation for any reason, all data can be reliably compared.

III. WHAT CONTAMINANTS TO TEST FOR

Contaminating substances that can be found at oil and gas sites are primarily crude oil, natural gas condensate, produced water, drilling mud, lube (motor) oil, and solvents. The individual contaminants found in these substances are listed in Table 1. Though other contaminants also are found in these substances, those in Table 1 were chosen because of their greater environmental toxicity and because they are good indicators of the presence of the contaminating substance(s) of interest.

When contamination of a site by one of these six contaminating substances is being investigated, sampling and analyses for some or all of the individual contaminants found in that contaminating substance should occur. Two lists of contaminants were compiled and are designated as "Tier I" (the smaller group, indicated by "xx" in Table 1) and "Tier II" (the more comprehensive group, indicated by both "xx" and "x"). Having two tiers to choose from allows the Superintendent flexibility in what contaminants he/she requires that the operator test for. The Tier I contaminants are included in the Tier II contaminants and therefore will always be tested for.

Tier I sampling should be conducted when basic information is needed. For instance, if contamination at a site is suspected but not known, testing for Tier I contaminants will confirm this; it will also give an idea of the severity of contamination. Tier I sampling might also be conducted where Park natural resources (like groundwater, vegetation, or surface water) are at low/no risk.

Table 1: Contaminants to test for when investigating various types of contamination at oil and gas sites. Contaminants that should be tested for during Tier I sampling are indicated by "xx", while those with either an "x" or "xx" should be tested for during Tier II sampling.

	where found:	Contaminating substances individual contaminants are associated with:					
contaminant	soil/sediment = S groundwater/ surface water = W	crude oil	condensate [i]	produced water	drilling mud	lube (motor) oil	solvents [k]
PAHs [a]	S, W	x	x	x	x	x	x
TPH [b]	S, W	xx	xx	x	x	xx	xx
BTEX [c]	S, W	x	xx	x	x	x	xx
metals [d]							
arsenic	S, W	x		x	x	x	
barium	S, W	x		xx	xx	x	
cadmium	S, W	x		x	x		
chromium	S, W	x		x	xx	x	
copper	S, W	x		x	x	x	
iron	S, W		x				
lead	S, W	x		x	x	xx	
magnesium	S, W	x		x	x	x	
mercury [e]	S, W	x		x	x		
nickel	S, W	xx		x		x	
selenium	S, W	x			x		
strontium	S, W	x		xx			
vanadium	S, W	xx		x	x		
zinc	S, W	x		xx	x	xx	
ammonia [f]	W	x		x			
calcium	W			x	x	x	
chloride	S, W			xx			
potassium	W	x		x	x		
sodium	S, W				xx	xx	xx
sulfates	W			x			
gross alpha emissions [g]	W			x			
radium-226 [g]	S			xx			
pentachlorophenol	S, W				x		
surfactants	S, W				x		
pH	S, W	x	x	x	x		
conductivity/salinity [h]	S, W		x	xx	xx		
TDS	W			x	x		
grain size	S	x	x	x	xx	x	
total organic carbon	S	x	x	x	x	x	x
percent moisture [i]	S	xx	xx	xx	xx	xx	xx
static water level [j]	W	xx	xx	xx	xx	xx	xx
temperature	W	xx	xx	xx	xx	xx	xx

a = Polycyclic Aromatic Hydrocarbons. The lab analysis required in this guideline detects approximately 38 individual compounds including the priority pollutant “parent” compounds and their alkylated homologs. See Table 2 for a full list of these. Note that these 38 compounds are measured with a single analytical test (i.e. there is not a separate test for each compound). When testing water for PAHs, do for groundwater only unless ongoing surface water contamination from adjacent contaminated soil, sediment, or aquifer is suspected.

b = Total Petroleum Hydrocarbons. Certain "ranges" of hydrocarbons should be analyzed for, depending on the contaminating substance. For crude oil, a “full range” or “wide range” TPH scan should be conducted; for natural gas condensate a “lighter end” TPH scan, like for “gasoline range organics” (GRO) or total volatile petroleum hydrocarbons (TVPH) C_6-C_{10} should be conducted; and for diesel fuel a TPH scan for “diesel range organics” (DRO) or total extractable petroleum hydrocarbons (TEPH) C_{11}-C_{34} should be conducted. See section VI.A for details.

c = Benzene, Toluene, Ethylbenzene, Xylene. Only test for these in soil, sediment, or surface water if contamination is very recent and sampling is for initial (preliminary) assessment purposes.
d = analyze all metals for the “total recoverable” fraction

e = analyze soil (or sediment) for mercury only if mercury manometers are suspected to have been used on-site in the past (natural gas operations only)

f = report both the “total” and “unionized” fractions

g = note that if gross alpha in water exceeds a certain level, further testing for radioactive elements may be required. Radium-226 analyses must use gamma spectroscopy; this test takes approx. 30 days. At sites where produced water contamination may be more recent (in the last 10 yrs), gamma ray emissions in the soil can be preliminarily measured in the field (e.g. with a MicroRmeter) to determine if the radium-226 soil analyses are necessary.

h = salinity can be calculated from conductivity measurements

i = percent moisture is necessary to calculate the required dry weight and wet weight units

j = for groundwater only

k = can be from a gas production facility or a gas pipeline

l = various solvents can be used on-site (e.g. benzene, toluene, ethylbenzene, xylene, various petroleum products, etc.). Analyte tested for depends on the particular solvent used on-site.

Table 2: Polycyclic aromatic hydrocarbons (PAHs) detected by the recommended “expanded scan” analysis for PAHs (see section VI.A). These compounds include the so-called priority pollutant “parent” compounds plus their alkylated homologs. Note that the 38 compounds below are measured with a single analytical test (that is, there is not a separate analytical test for each compound).

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(e)pyrene

Benzo(a)pyrene
Biphenyl
Chrysene
Chrysene, C1-
Chrysene, C2-
Chrysene, C3-
Chrysene, C4-
Dibenzo(a,h)anthracene
Dibenzothiophene
Dibenzothiophene, C1-
Dibenzothiophene, C2-
Dibenzothiophene, C3-
Fluoranthene
Fluoranthenes/Pyrenes, C1-
Fluorene
Fluorene, C1-
Fluorene, C2-
Fluorene, C3-
Ideno(1,2,3,c,d)pyrene
Naphthalene
Naphthalene, C1-
Naphthalene, C2-
Naphthalene, C3-
Naphthalene, C4-
Perylene
Phenanthrene
Phenanthrenes/Anthracenes, C1-
Phenanthrenes/Anthracenes, C2-
Phenanthrenes/Anthracenes, C3-
Phenanthrenes/Anthracenes, C4-

Tier II sampling should be conducted when more detailed information is needed. For instance, if clean-up activities at a site have been completed, testing for Tier II contaminants will confirm if all (or nearly all) the contaminants have, in fact, been removed. Tier II sampling might also be conducted at sites where important Park natural resources are at a higher risk of being exposed to contaminants and where more stringent cleanup standards than those promulgated by a State regulatory body may be appropriate..

The Superintendent will determine whether Tier I or II is needed. Some combination of the two may also be used. He/she may also choose to omit or add contaminants to the Tier I or II lists should the situation warrant it.

Note that Table 1 does not include all possible contaminants associated with oil or gas operations. Other contaminating substances involved are: caustic solutions used in natural gas sweetening (these can contain sodium, pH, amines, and EDTA contaminants); glycols used in natural gas dehydration; and surfactants, acidizing agents, corrosion inhibitors, solvents, biocides, etc. used in oil or gas well workover and completion. The Superintendent may require that contaminants associated with these substances be tested for if they are suspected of having been released on-site.

IV. HOW TO COLLECT SAMPLES

A. Sample Locations

1. Soil

Background samples should be collected from an area as close to the site as possible where it is certain no contaminating substances from the site could have reached (from surface runoff, off-site dumping, migration from wind, etc.).

For soils that are known to be contaminated, samples should be collected from the spot and depth where contamination appears to be highest. For sites where soils are suspected of being contaminated, seek out areas near production facilities, storage tanks, valves, etc., and adjacent low points in the topography where contaminated runoff may have passed over or "puddled up" and concentrated. Collect sample at a depth where contamination would be highest: in most cases probably the top one to two inches. Note that releases in very porous (e.g. sandy) soil may percolate down and pool immediately above deeper, less porous soil layers (e.g. clay or silt strata, particularly if saturated), pool at the water table, or concentrate in highly organic layers..

For sites where removal of contaminated soils has already occurred, a sample should be collected in the top inch or so of the newly exposed soil to insure that all the contaminants that percolated down into the soil were, in fact, removed. (Note: At hydrocarbon release sites, screening of soils at the base of the excavation for volatile organic compounds/VOCs with a photo-ionization detector could improve the confidence that Tier II sample selection is sufficient to confirm a site is clean.)

All samples will be grab samples. (As a rule, composite samples should not be collected.) Where contamination is suspected but not known, the sampling device probably should be some type of tube or auger in order to capture equal amounts of soil over the depth of the profile; depending on the properties of the soil (like how hard or rocky it is), however, other devices (like a trowel) may work better. Sample collectors may have to communicate with the laboratory to ensure that enough soil is collected for the various analyses.

For BTEX samples, see section B.1. below.

The total number of samples to be collected will be site-specific and determined by the Superintendent. Enough samples should be collected and analyzed to meet the Tier I or Tier II sampling objective (see section III).

2. Sediment

Background samples should be collected from sediment adjacent to the sediments in question, but where it is reasonably certain no contaminating substances from the site (or other sites in the area) could have reached (from surface runoff, off-site dumping, etc.).

As with soils, sediments known to be contaminated should be sampled from the spot and depth where contamination appears to be highest. For sediments suspected of being contaminated, seek out areas near production facilities, storage tanks, valves, etc., and adjacent areas where potentially contaminated sediment in runoff could have settled out. Sample the sediment that has accumulated since the spill/release began. In some cases this may be the top ¼ inch, in others it may be the top several inches.

For sites where removal of contaminated sediments has already occurred, samples should be collected in the newly exposed sediment to insure that all contaminants were, in fact, removed.

All samples will be grab samples. (As a rule, composite samples should not be collected.) Where contamination is suspected but not known, or the layer of contaminated sediment is more than a couple inches thick, the sampling device probably should be some type of tube or auger in order to capture equal amounts of sediment over the depth of the profile; depending on the properties of the sediment (like how rocky it is) and the depth of the water, however, other devices may work better. Sample collectors may have to communicate with the laboratory to ensure that enough sediment is collected for the various analyses.

The total number of samples to be collected will be site-specific and determined by the Superintendent. Enough samples should be collected and analyzed to meet the Tier I or Tier II sampling objective (see section III).

3. Groundwater

Groundwater samples should be collected if the Superintendent determines that hydrogeological conditions at the site are such that groundwater resources under or near the site are reasonably at risk. Samples can be collected either via established monitoring wells or with "push" technology (such as Geoprobe®).

It is critical that: a) sampling occurs in the right areas (for example, one location must be upgradient of the potential point of impact and at least two must be downgradient); and b) wells are screened at the appropriate depths to intercept any contaminant plume(s). (This will require knowledge of the local hydrogeology and the contaminants involved and their environmental fate characteristics). If "push" technology is used to collect soil samples for lab analysis or for on-site screening of various media (soil, ground water) for contaminants and samples are collected on more than one occasion, care must be taken to sample the exact same locations and at the same depths in the aquifer. Typically, once contamination is found in ground water using screening methodologies, monitoring wells are required by State regulatory agencies to ensure sample quality and integrity is sufficient to base regulatory decisions.

"Low-flow" sample collection methods should be used as per the EPA guidance document in IV.B.3 below.

Groundwater samples should not be filtered.

For BTEX samples, see section B.3. below.

All samples will be grab samples. (As a rule, composite samples should not be collected.) Sample collectors may have to communicate with the laboratory to ensure that enough sample is collected for the various analyses.

The total number of samples to be collected will be site-specific and determined by the Superintendent or through his/her approval of the owner/operator's Sampling and Analysis Plan after consultation with Park resource staff. Enough samples should be collected and analyzed to meet the Tier I or Tier II sampling objective (see section III).

4. Surface Water

Background samples should be collected upstream of any possible inputs of contaminated water (e.g. surface runoff or shallow groundwater) from the site.

Where contamination is obvious, such as in a surface sheen, collect samples right at the surface, avoiding any scum, algae, or other detritus on the water surface if possible (and note in fieldbook if present). Where a contaminating substance such as chlorinated solvents (dense nonaqueous phase liquids , or DNAPLs) was released or is suspected at the bottom of an aquifer (e.g. above a clay layer or aquitard), then collect samples at a depth immediately above the base of the aquifer, the depth of the first fine-grained layer below the water table, or both. For surface water suspected of being contaminated but it is unknown whether the contaminants are "floaters" or "sinkers," collect samples at a depth of 3-12 inches.

For BTEX samples, see section B.4. below.

Again, all samples will be grab samples. (As a rule, composite samples should not be collected.) Sample collectors may have to communicate with the laboratory to ensure that enough sample is collected for the various analyses.

The total number of samples to be collected will be site-specific and determined by the Superintendent. Factors such as flow, depth, and the size of the water body are important here. Enough samples should be collected and analyzed to meet the Tier I or Tier II sampling objective (see section III).

B. Sample Collection Methodologies

Acceptable sampling methodology must be used so that results are as representative as possible. Sample collection can be complex and should be conducted by experienced professionals (typically a contractor). This could also help if the values or methods are challenged by one of the interested parties involved (State regulatory agency, Park, owner/operator etc.). Furthermore, experienced professionals are also trained in the appropriate precautions to protect the health and safety of the sample collector(s) from exposure to potentially harmful contaminants or hazardous situations that could develop.

Methodologies that should be used are typically those accepted/sanctioned by the appropriate State regulatory agency or are found in publications of widely recognized organizations (e.g. EPA, NOAA) that conduct environmental research.. Acceptable methodologies are listed below for each environmental media (soil, sediment, etc.). In general, the State is authorized as the lead regulatory agency and should be the initial contact for appropriate sampling methodologies to employ when various environmental media are believed contaminated. In site-specific situations where a sensitive Park resource is threatened and more stringent cleanup than that required by a State agency may be appropriate, Park staff should consult WASO support offices as needed for appropriate criteria prior to discussion of more stringent cleanup levels with the owner/operator. If sample collection methodologies other than the above are used, they must contain the following to be acceptable: 1) Applicability of the procedure, 2) Equipment required, 3) Detailed description of procedures to be followed in collecting the samples, 4) Common problems encountered and corrective actions to be followed, and 5) Precautions to be taken. The methodology to be used must be cited in the sample plan. A basic description of collection methodology should be included in the report to the Superintendent (section VIII).

1. Soil

Methods from source documents published by the following organizations are acceptable:
-State Governing Regulatory Agency
-U.S. EPA
-American Society for Testing and Materials
-U.S. Department of the Interior

-American Petroleum Institute

Note that when collecting soil samples for BTEX analysis, specialized equipment and collection methods are necessary. Use a coring device such as the EnCore™ sampler or disposable plastic syringes. For detailed guidance, see section 4.1 and method 5035 in Chapter 4 of EPA's SW-846, Update III (full reference in section VI.A. below).

2. Sediment

Methods from source documents published by the following organizations are acceptable:
- State Governing Regulatory Agency
-U.S. EPA
-American Society for Testing and Materials
-U.S. Department of the Interior
-American Petroleum Institute

3. Groundwater

Use: Environmental Protection Agency. 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. EPA/530/R-93-001. Office of Solid Waste, EPA, Washington, D.C.; or Publications of State Governing Regulatory Agency (DEQ, DEM, State EPA etc.)

"Low-flow" sampling should be conducted; for guidance, see:
Puls, R.W. and M.J. Barcelona. 1996. Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. EPA/540/S-95/504. Office of Solid Waste and Emergency Response, EPA, Washington, D.C.

Note that when collecting water samples for BTEX analysis, specialized equipment and collection methods are necessary. For detailed guidance, see section 4.1 and method 5030B in Chapter 4 of EPA's SW-846, Update III (full reference in section VI.A. below).

4. Surface Water

Methods from source documents published by the following organizations are acceptable:
-State Governing Regulatory Agency
-U.S. EPA
-American Society for Testing and Materials
-U.S. Department of the Interior
-American Petroleum Institute

Also recommended is this NPS guidance: Stednick, J.D. and D.M. Gilbert. 1998. Water quality inventory protocol: Riverine environments. National Park Service, Water Resources Division, Technical Report no. NPS/NRWRD/NRTR-98/177. Fort Collins, CO, 103 pp.

Note that when collecting water samples for BTEX analysis, specialized equipment and collection methods are necessary. For detailed guidance, see section 4.1 and method 5030B in Chapter 4 of EPA's SW-846, Update III (full reference in section VI.A. below).

C. Sample Containers, Preservation, Storage

Refer to documents listed in sections VI.A. below and IV.B. above for specific guidance, including 40 CFR Part 136, if necessary. EPA's SW-846, Update III is especially helpful.

Note that sediment samples should not be acidified for metals and that neither groundwater nor surface water samples should be filtered. Remember special conditions when sampling for BTEX (see section 4.1 and methods 5030 and 5035 in Chapter Four of SW-846, Update III) and for any metals requiring unusually low detection limits.

D. Chain of Custody

Proper chain-of-custody procedures must be used in sample handling (collection, shipping, storage, analysis). For examples, see Standard Methods for the Examination of Water and Wastewater for general guidance, and SW-846, Update III, Chapter 9, section 9.2.2.7 for detailed guidance.

V. QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control (QA/QC) plans or Quality Assurance Project Plans (QAPPs) ensure that the data generated are scientifically valid, defensible, and of known precision and accuracy. Some of the basic elements of QA/QC or QAPP plans are:

- data quality objectives (DQO)
- field operating procedures (such as sample management, decontamination, equipment calibration, etc.)
- field QA/QC requirements (such as data handling, collection of control samples like blanks, spikes and duplicates, etc.)
- lab operating procedures (such as sample management, equipment calibration, etc.)
- lab QA/QC procedures (such as data handling, control samples, etc.).

A QA/QC plan should be in place before any sampling begins. Basic QA/QC procedures to be followed should be described briefly in the sample plan (section VIII). If a certain QA/QC guidance document is used, it should be cited in the sample plan. Many guidance documents are available—several through EPA—including the following, recommended here:

> Environmental Protection Agency. 1997. Test methods for evaluating solid waste, physical/chemical methods (SW-846), 3rd edition, Update III, Chapter One. EPA Office of Solid Waste and Emergency Response, EPA, Washington, D.C.

Adherence to the QA/QC plan should be documented throughout the project and demonstrated in the final report to the Superintendent.

Aspects of quality assurance that may be helpful can be found in:

> Environmental Protection Agency. 1996. The volunteer monitor's guide to quality assurance project plans. EPA Office of Wetlands, Ocean and Watersheds 4503F. EPA publication number: EPA 841-B-96-003. Also available at: http://www.epa.gov/owow/monitoring/volunteer/qappcover.htm

VI. HOW TO ANALYZE SAMPLES IN THE LABORATORY

A. Analytical Methods

Metals analyses must use the methods in EPA's SW-846, Update III (or more recent). This applies to soil, sediment, groundwater, and surface water samples. Groundwater and surface water methods can also include EPA's 200 series for metals, or the 1600 series where extremely low (state-of-the-art) detection limits are desired. The full reference for the SW-846 document is:

> Environmental Protection Agency. 1997. Test methods for evaluating solid waste, physical/chemical methods (SW-846), 3rd edition, Update III. EPA Office of Solid Waste and Emergency Response, EPA, Washington, D.C.

Polycyclic aromatic hydrocarbon (PAH) analyses must use a modification of method 8270 in EPA's SW-846, Update III. Developed by the National Oceanic and Atmospheric Administration (NOAA), this method is referred to as "GC/MS method 8270 in selective ion mode (SIM)", and is informally referred to as the "expanded scan" for PAHs. Consult the following for a detailed explanation of methodology:

> Lauenstein, G.G., and A.Y. Cantillo (1998). Sampling and analytical methods of the National Status and Trends Program Mussel Watch Project: 1993-1996 update. NOAA Technical Memorandum NOS ORCA 130. 233 pp.

Total petroleum hydrocarbons (TPH) analyses will be for certain "ranges" of hydrocarbons, depending on the contaminating substance present. For crude oil, a **"wide range" or "full range" TPH scan** should be conducted to measure the heavier fractions. For natural gas condensate a "lighter end" TPH scan, such as for **"gasoline range organics" (GRO)**, should be conducted. For diesel fuel, a TPH scan for **"diesel range organics" (DRO)** should be conducted to measure the mid-range fractions. Although many analytical methods are available for TPH, samples should be analyzed using only GC/FID (gas chromatograph/flame ionization detection) methodology. Method 8015B in EPA's SW-846, Update III is highly recommended.

Benzene, toluene, ethylbenzene, and xylene (BTEX) analyses should use method 8260B in EPA's SW-846, Update III. Analysis for BTEX compounds is typically done in place of a TPH analysis when a refined product is released as opposed to crude oil.

Ammonia analyses should use EPA method 350.1 (or equivalent APHA method 4500-NH3 H, or USGS method 4523-85). Samples should not be filtered.

For all other contaminants in Table 1, use methods approved in 40 CFR Part 136 (EPA, Standard Methods for the Examination of Water and Wastewater (latest edition), ASTM, or USGS). Methods in the NPS, Water Resources Division "Water quality inventory protocol" (section IV.B.4 above) can also be used.

B. Laboratories

Samples must be sent to an experienced lab that can: 1) perform the above analytical methods; 2) achieve the required detection limits (section VII below); 3) perform the required QA/QC procedures (section V above); and 4) provide the information required in the sample plan and the final report to the Superintendent (section VIII below).

Note that in regards to the PAH analytical method (as specified in VI.A. above), only a few labs nationwide (perhaps a dozen) currently can perform this analysis. Many of these same labs can also "fingerprint" samples; that is, by analyzing hydrocarbon-contaminated samples, they can identify the type and source of the petroleum product at the site. A partial list of these labs follows (no government endorsement implied):

Arthur D. Little, Inc.
25 Acorn Park
Cambridge, MA. 02140
(617) 498-5000

Battell Marine Science Lab
1529 West Sequim Bay Rd.
Sequim, WA 98382
(360) 683-4151

Geochemical and Environmental Research Group
Texas A&M University
833 Graham Rd.
College Station, TX. 77845
(409) 862-2323 ext. 115

Woods Hole Group, Environmental Laboratories
375 Paramount Drive, Suite B
Raynham, MA 02767-5154
(508) 822-9300 or 563-5030

VII. DETECTION LIMITS

Note: The term "detection limit" used herein refers to what is commonly called the "reporting limit" and occasionally called the "quantitation limit. A detection limit is what a lab (using a particular instrument in some combination with analytical method and skill level of operator) can quantify low levels of a contaminant substance with acceptable confidence. It does not refer to the sometimes much lower "instrument detection limit" or "method detection limit" where how well the value obtained represents the true value may be of low confidence. Also note that detection limits should not be confused with cleanup standards or cleanup criteria. Required cleanup levels/criteria are usually set by State regulatory authorities as the acceptable contaminant residue (usually well above detection limits) that may remain in some environmental media after a remedial effort has occurred. NPS is authorized to require more stringent cleanup criteria on a case-by-case basis, particularly in site-specific situations where sensitive ecological resources could be threatened. Widely accepted, peer-reviewed research may then be used to support the NPS position that State criteria are not sufficiently protective and lower cleanup criteria are warranted.

Labs should achieve the detection limits (DLs) provided in Table 3 below. These DLs are below federal (and presumably state) standards and most other criteria currently in the literature. Therefore, analytical methods that achieve these DLs will be able to indicate if most standards and criteria are being met. Note, however, that the DLs for two contaminants—PAHs and mercury—are above some of the more strict standards or criteria that exist. This is because many labs cannot achieve DLs this low, and the DLs in the table were chosen so that most experienced and well-equipped labs could achieve them. Lower DLs are achievable for PAHs and mercury at some labs that have the expertise and special instrumentation (see section VI.B. above for examples).

If the natural resources at or near the site are particularly sensitive, pristine, or important to the Park, the Superintendent may wish to choose the strictest available standard or criteria as the remediation goal. He/she would then have to request some lower DLs (lower than those in Table 3) from the lab for PAHs and mercury.

For the contaminants in Table 1 that are not listed in Table 3, commonly reported DLs are acceptable.

Table 3: Maximum acceptable detection limits ("reporting limits") for surface water, groundwater, soil, and sediment samples. Lower detection limits are also acceptable.

Contaminant	Detection limit for surface water and groundwater samples	Detection limit for soil and sediment samples (dry weight)
PAHs	10 ppt [a]	1 ppb [c]
TPH	50 ppb	0.1 ppm
benzene	1 ppb	25 ppb
toluene	5 ppb	25 ppb
ethylbenzene	5 ppb	25 ppb
xylene	5 ppb	25 ppb
ammonia	0.05 ppm	--
arsenic	5 ppb	0.5 ppm
barium	1 ppb	1 ppm
cadmium	0.5 ppb	0.2 ppm
chromium	3 ppb	1 ppm
copper	5 ppb	1 ppm
iron	0.1 ppm	10 ppm
lead	1 ppb	5 ppm
mercury	0.2 ppb [b]	0.2 ppm [d]
nickel	5 ppb	5 ppm
selenium	1 ppb	1 ppm
strontium	10 ppb	5 ppm
vanadium	10 ppb	1 ppm
zinc	10 ppb	5 ppm

water units:
ppm = parts per million = milligrams per liter = mg/L
ppb = parts per billion = micrograms per liter = ug/L
ppt = parts per trillion = nanograms per liter = ng/L

soil/sediment units:
ppm = parts per million = milligrams per kilogram = mg/kg = micrograms per gram = ug/g
ppb = parts per billion = micrograms per kilogram = ug/kg = nanograms per gram = ng/g

a - DLs as low as 1 ppt may be achievable
b - DLs as low as 0.1 ppb, or even 10 ppt, may be achievable
c - DLs as low as 0.25 ppb may be achievable
d - DLs as low as 25 ppb, or even 1 ppb, may be achievable

For an extensive list of federal standards and other published environmental criteria for most of the contaminants in Table 1, consult NPS Water Resources Divisions' "Environmental Contaminants Encyclopedia" at the website http://www.aqd.nps.gov/toxic. Note that there may be state standards, other criteria, or in some cases, updated federal standards that are not listed in this Encyclopedia.

VIII. SAMPLE PLAN AND REPORTING REQUIREMENTS

A. Sample Plan

The owner/operator should submit a Sampling and Analysis Plan to the Superintendent for approval before samples are collected. The plan must include:

- sampling objectives (such as, “identify contaminants and concentrations involved,” “determine spatial extent of spill,” “determine if remediation is complete,” etc.)
- the contaminating substances being investigated (such as crude oil, natural gas condensate, produced water, etc.)
- list of individual contaminants that will be tested for (see Table 1)
- analytical methods to be used (see section VI. A.)
- type of samples to be collected (such as soil, sediment, groundwater, or surface water)
- citation and brief description of sample collection methodology to be used (see section IV. B.)
- specific sample locations and number of samples at each (Superintendent will walk the site and choose exact locations; this information may not be available until the time when samples are actually collected)
- total number of samples (this information may not be available until the time when samples are actually collected)
- acknowledgment that detection limits (that is, “reporting limits”) specified herein (section VII) will be achieved
- brief description of QA/QC procedures to be followed and citation of any guidance document used (see section V)
- acknowledgment that proper chain-of-custody procedures will be initiated and followed

B. Reporting Requirements

Upon completing sample collection and analyses, the owner/operator shall submit a report to the Superintendent. This report shall include:

- sample ID number/name
- description of sample locations (include maps, sketches, or photos)
- sample depth
- brief description of spill area (apparent extent of spill, topography, vegetation, surface water features, apparent soil conditions, etc.)
- date and time of sampling
- name of sample collector
- information pertinent to the sample collection methodology used (sampling devices used, how samples were collected, etc.)
- sample containers used, any preservation methods, and storage conditions of samples
- date and time of analyses
- name of chemist/technician performing analyses
- type of sample (soil, sediment, groundwater, or surface water)
- sample fraction measured (such as “total”, “total recoverable”, etc.)
- analytical results and units (mg/kg, µg/L, etc.)
- percent moisture (for soil/sediment samples)
- wet weight *and* dry weight units (for soil/sediment samples)
- analytical methods used
- detection limits (that is, “reporting limits”) achieved
- method detection limits (MDL) for the analytical methods used
- indication of analyses done in the field (such as pH, conductivity, etc.)
- field observations made while collecting samples
- lab and field QA/QC results and procedures followed
- name of analytic equipment used
- appropriate chain-of-custody forms

VIII. SPILL RESPONSE AND NOTIFICATION PROCEDURE FOLLOWING RELEASE OF A CONTAMINATING SUBSTANCE FROM A NONFEDERAL OIL AND GAS OPERATION IN A PARK UNIT

A. Initial Park Staff Actions Following Discovery of a Release

1. Secure the area to protect human health and safety

2. Notify operator of the release and immediate need to control the source and contain the release, and obtain information of the released substance

3. Initial site assessment to identify park resources potentially as risk from the release (surface water, wetlands, cultural resources, etc.), and quantity of released substance

4. Direct operator during initial spill containment actions to protect natural and cultural resources at risk, and to protect human health and safety

5. Notify Regional Spill Response Coordinator and relay all pertinent information

6. Obtain 5 liter sample of released substance (Note: need preservation and storage guidance for park staff) and initiate chain of custody documentation

7. Continue to oversee operator containment actions and maintain security

8. Park Superintendent advises operator that the operation is immediately "suspended" pursuant to NPS regulations at 36 CFR §9.51(c)(2)

9. Park staff prepares a detailed Case Incident Report on the spill event

B. Regional Spill Response Coordinator Notification Duties

1. Contact National Response Center to advise of release and obtain case number

2. Notify Environmental Quality Division (Dan Hamson), Geologic Resources Division (Jim Woods), Regional Minerals Coordinator (Linda Dansby), and Water Resources Division (Matt Hagermann) if release threatens water resources

3. Coordinate a conference call with above technical offices and park staff to define appropriate course of action relative to spill containment, public health and safety, site assessment, damage assessment, and operator responsiveness and capability

4. Notify pertinent state regulatory agencies and state trustees

C. Coordination of Response, Clean-up and Damage Assessment

1. All involved NPS staff track time and all other expenditures associated with the spill event

2. Park Superintendent prepares formal suspension notice for Regional Director's signature in accordance with NPS regulations at 36 CFR §9.51(c)(2)

3. Park staff coordinates with designated On Scene Coordinator (EPA, Coast Guard, or NPS staff expert if EPA or Coast Guard does not dispatch a coordinator) and state regulatory agencies to oversee operator spill response and initial clean-up actions

4. Park staff coordinates with On Scene Coordinator (OSC) and state trustee agencies in the conduct of resource damage assessment (Note: operator may contract with approved consulting firm/laboratory to conduct assessment work)

5. All involved NPS offices evaluate site assessment results and reach consensus on additional remediation actions and reclamation goals, and communicate recommendations to park Superintendent. (Note: NPS regulations at 36 CFR §9.39(a)(1)(i) and §9.39(a)(2)(iii) require operators to remove or neutralize any contaminating substance)

6. Park staff coordinates with OSC and state trustee agencies in monitoring remediation and reclamation actions

7. Park Superintendent and NPS technical working group evaluates final remediation/reclamation success and determines if further legal action against the operator is required (Note: operators are liable for any damages to federally-owned or controlled lands, waters or resources pursuant to 36 CFR §9.51(a).

APPENDIX G

U.S. FISH AND WILDLIFE SERVICE COUNTY-BY-COUNTY LISTING THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

(AUGUST 2004)

E = Federally listed as endangered	T = Federally listed as threatened
C = Candidate Taxon, Ready for Proposal	AD = Proposed Delisting

HARDIN COUNTY		
E	RED-COCKADED WOODPECKER	*Picoides borealis*
E	TEXAS TRAILING PHLOX	*Phlox nivalis ssp. texensis*
JASPER COUNTY		
AD, T	BALD EAGLE	*Haliaeetus leucocephalus*
T	LOUISIANA BLACK BEAR	*Ursus americanus luteolus*
E	NOVASOTA LADIES'-TRESSES	*Spiranthes parksii*
E	RED-COCKADED WOODPECKER	*Picoides borealis*
C	Louisiana pine snake	*Pituophis ruthveni*
JEFFERSON COUNTY		
E, T	GREEN SEA TURTLE	*Chelonia mydas*
E	HAWKSBILL SEA TURTLE	*Eretmochelys imbricata*
E	KEMP'S RIDLEY SEA TURTLE	*Lepidochelys kempii*
E	LEATHERBACK SEA TURTLE	*Dermochelys coriacea*
T	LOGGERHEAD SEA TURTLE	*Caretta caretta*
E, T	PIPING PLOVER	*Charadrius melodus*
ORANGE COUNTY		
AD, T	BALD EAGLE	*Haliaeetus leucocephalus*
LIBERTY COUNTY		
AD, T	BALD EAGLE	*Haliaeetus leucocephalus*
E	RED-COCKADED WOODPECKER	*Picoides borealis*
POLK COUNTY		
AD, T	BALD EAGLE	*Haliaeetus leucocephalus*
E	RED-COCKADED WOODPECKER	*Picoides borealis*
E	TEXAS TRAILING PHLOX	*Phlox nivalis ssp. texensis*
TYLER COUNTY		
AD, T	BALD EAGLE	*Haliaeetus leucocephalus*
E	RED-COCKADED WOODPECKER	*Picoides borealis*
E	TEXAS TRAILING PHLOX	*Phlox nivalis ssp. texensis*
C	Louisiana pine snake	*Pituophis ruthveni*

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APPENDIX H

TEXAS PARKS AND WILDLIFE DEPARTMENT SPECIAL SPECIES LIST

The Texas Biological

and Conservation Data System

The Texas Biological and Conservation Data System (TXBCD), established in 1983, is the Department's most comprehensive source of information on rare, threatened, and endangered plants and animals, exemplary natural communities, and other significant features. Though it is not all-inclusive, the TXBCD is constantly updated, providing current or additional information on statewide status and locations of these unique elements of natural diversity.

The TXBCD gathers biological information from museum and herbarium collection records, peer reviewed publications, experts in the scientific community, organizations, qualified individuals, and on-site field surveys conducted by TPWD staff on public lands or private lands with written permission. TPWD staff botanists, zoologists, and ecologists perform field surveys to locate and verify specific occurrences of high-priority biological elements and collect accurate information on their condition, quality, and management needs.

The TXBCD can be used to help evaluate the environmental impacts of routing and siting options for development projects. It also assists in impact assessment, environmental review, and permit review.

Given the small proportion of public versus private land in Texas, the TXBCD does not include a representative inventory of rare resources in the state. Although it is based on the best data available to TPWD regarding rare species, these data cannot provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in any area. Nor can these data substitute for on-site evaluation by qualified biologists. The TXBCD information is intended to assist the user in avoiding harm to species that may occur.

Please use the following citation to credit the TXBCD as the source for this county level information:

> Texas Biological and Conservation Data System. Texas Parks and Wildlife, Wildlife Diversity Branch. County Lists of Texas' Special Species. [county name(s) and revised date(s)].

For information on obtaining a project review form or a site-specific review of a project area for rare species, and for updated county lists, please call (512) 912-7011.

Last Revised Date: 21 Nov 2003

Notes for County Lists of Texas' Special Species

The Texas Parks and Wildlife (TPWD) county lists **include**:

Vertebrates, Invertebrates, and Vascular Plants on the special species lists of the Texas Biological and Conservation Data System. These special species lists are comprised of all species, subspecies, and varieties that are federally listed; proposed to be federally listed; have federal candidate status; are state listed; or carry a global conservation status indicating a species is imperiled, very rare, or vulnerable to extirpation.

Colonial Waterbird Nesting Areas and Migratory Songbird Fallout Areas are contained on the county lists for coastal counties only.

The TPWD county lists **exclude**:

Natural Plant Communities such as Little Bluestem-Indiangrass Series (native prairie remnant), Water Oak-Willow Oak Series (bottomland hardwood community), Saltgrass-Cordgrass Series (salt or brackish marsh), Sphagnum-Beakrush Series (seepage bog).

Other Significant Features such as non-coastal bird rookeries, migratory bird information, bat roosts, bat caves, invertebrate caves, and prairie dog towns.

These lists will never be all inclusive for all rare species distributions. In order to keep the lists to a reasonable length, historic ranges for some state extirpated species, full historic distributions for some extant species, accidentals and irregularly appearing species, and portions of migratory routes for particular species are not included.

The **revised date** on each county list reflects the last date any changes or revisions were made for that county and reflects current listing statuses and taxonomy.

Species that appear on county lists do not all share the same probability of occurrence within a county. *Some species are migrants or wintering residents only. Additionally, a few species may be historic or considered extirpated within a county. Species considered extirpated within the state are so flagged on each list.*

This information is for your assistance only; due to continuing data updates, **please do not reprint or redistribute the information, instead refer all requesters to our office to obtain the most current information available.**

Last Revised Date: 21 Nov 2003

Federal Status | State Status

HARDIN COUNTY

******* DRAFT ***** DRAFT ***** DRAFT***** DRAFT ***** DRAFT ***** DRAFT*******
UNDER CONSTRUCTION *** SPECIES MAY BE ADDED/DELETED WITH QUALITY CONTROL**

*** AMPHIBIANS ***

Pig Frog (*Rana grylio*) – prefers permanent bodies of open water with emergent vegetation; actively mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bachman's Sparrow (*Aimophila aestivalis*) - inhabits mature open pine forests with grassy understory, regenerating pine clear-cuts (1-7 years post re-planting), or open habitats with a dense ground cover of grasses and forbs, or palmetto scrub; in Texas, known to occur only in the far eastern portion of the state; most abundant in forests south of Angelina National Forest		T
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow (*Ammodramus henslowii*) - wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Red-cockaded Woodpecker (*Picoides borealis*) - cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, & loblolly	LE	E
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
Wood Stork (*Mycteria americana*) – forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

	Federal Status	State Status
*****FISHES*****		
Blue Sucker (*Cycleptus elongatus*) - usually inhabits channels and flowing pools with a moderate current; bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles		T
Creek Chubsucker (*Erimyzon oblongus*) - small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks		T
Paddlefish (*Polyodon spathula*) - prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir		T
Western Sand Darter (*Ammocrypta clara*) - clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate		
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) - catholic in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Prairie Vole (*Microtus ochrogaster taylori*) - extreme northern Panhandle of Texas (specimen records from Lipscomb and Hansford counties) and western Panhandle of Oklahoma; formerly known from southeastern Texas, as well; tall-grass prairie; colonial; create series of shallow, underground burrows and surface runways under vegetation; breeding habits not well known, but probably breed throughout the year		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		

	Federal Status	State Status

*** REPTILES ***

Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October — T

Louisiana Pine Snake (*Pituophis ruthveni*) - mixed deciduous-longleaf pine woodlands; breeds April-September — C1 — T

Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September — T

Sabine Map Turtle (*Graptemys quachitensis sabinensis*) – Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall

Texas Horned Lizard (*Phrynosoma cornutum*) - open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September — T

Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto — T

*** VASCULAR PLANTS ***

Chapman's orchid (*Platanthera chapmanii*) - in Texas, restricted to wetland pine savannas, one of the states most endangered habitats; flowering July-August

Long-sepaled false dragon-head (*Physostegia longisepala*) – moist, acid loams in the fire-maintained transition zone between pine flatwoods and coastal prairies; also, wet, borrow ditches along roadsides and moist areas in manmade clearings in pine woodlands; flowering early May to late June

Texas screwstem (*Bartonia texana*) - sandy soils in dry mesic pine or mixed pine-oak forests and forest borders; usually in fire-maintained longleaf pine savannas, but also in more mesic habitats; flowering (June-?)

Texas trailing phlox (*Phlox nivalis* ssp. *texensis*) - endemic; deep sandy soils in fire-maintained openings in upland longleaf pine savannas or bluejack oak woodlands; flowering March-early April — LE — E

White firewheel (*Gaillardia aestivalis* var. *winkleri*) – endemic; deep, loose, well-drained sands in openings in pine-oak woodlands and along unshaded margins, principally of the Village Creek watershed; flowering late spring (May-June) and sporadically through early fall

Status Key:

LE, LT	-	Federally Listed Endangered/Threatened
PE, PT	-	Federally Proposed Endangered/Threatened
E/SA, T/SA	-	Federally Listed Endangered/Threatened by Similarity of Appearance
C1	-	Federal Candidate for Listing, Category 1; information supports proposing to list as endangered/threatened
DL, PDL	-	Federally Delisted/Proposed for Delisting
NL	-	Not Federally Listed
E, T	-	State Listed Endangered/Threatened
"blank"	-	Rare, but with no regulatory listing status

Species appearing on these lists do not all share the same probability of occurrence. Some species are migrants or wintering residents only, or may be historic or considered extirpated.

	Federal Status	State Status

JASPER COUNTY

******* DRAFT ***** DRAFT ***** DRAFT***** DRAFT ***** DRAFT ***** DRAFT*******
UNDER CONSTRUCTION ** SPECIES MIGHT BE ADDED/DELETED DURING QUALITY CONTROL**

*** AMPHIBIANS ***

Pig Frog (*Rana grylio*) – prefers permanent bodies of open water with emergent vegetation; actively mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bachman's Sparrow (*Aimophila aestivalis*) - inhabits mature open pine forests with grassy understory, regenerating pine clear-cuts (1-7 years post re-planting), or open habitats with a dense ground cover of grasses and forbs, or palmetto scrub; in Texas, known to occur only in the far eastern portion of the state; most abundant in forests south of Angelina National Forest		T
Bald Eagle (*Haliaeetus leucocephalus*) – found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow (*Ammodramus henslowii*) – wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Red-cockaded Woodpecker (*Picoides borealis*) - cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, & loblolly	LE	E
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

FISHES

Blue Sucker (*Cycleptus elongatus*) - usually inhabits channels and flowing pools with a moderate current; bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles		T

JASPER COUNTY cont.	Federal Status	State Status
Creek Chubsucker (*Erimyzon oblongus*) – small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks		T
Paddlefish (*Polyodon spathula*) - prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir		T
Western Sand Darter (*Ammocrypta clara*) - clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate		
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		
***** REPTILES *****		
Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Louisiana Pine Snake (*Pituophis ruthveni*) - mixed deciduous-longleaf pine woodlands; breeds April-September	C1	T
Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T
Sabine Map Turtle (*Graptemys quachitensis sabinensis*) – Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall		

	Federal Status	State Status
Texas Horned Lizard (*Phrynosoma cornutum*) - most likely introduced; open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March- September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Bog coneflower (*Rudbeckia scabrifolia*) - hillside seepage bogs and associated broadleaf semi-evergreen acid seep forests; usually on Catahoula Formation or near the Catahoula-Willis contact; flowering late summer-fall		
Long-sepaled false dragon-head (*Physostegia longisepala*) – moist, acid loams in the fire-maintained transition zone between pine flatwoods and coastal prairies; also, wet, borrow ditches along roadsides and moist areas in manmade clearings in pine woodlands; flowering early May to late June		
Navasota ladies'-tresses (*Spiranthes parksii*) – endemic; margins of and openings within post oak woodlands in sandy loams along intermittent tributaries of rivers; flowering late October-early November	LE	E
Nodding yucca (*Yucca cernua*) - hardwood forests on brownish acid clays of the Redco Series; flower/fruiting June-November		
Texas screwstem (*Bartonia texana*) – sandy soils in dry mesic pine or mixed pine-oak forests and forest borders; usually in fire-maintained longleaf pine savannas, but also in more mesic habitats; flowering (June-?)		
Texas trillium (*Trillium pusillum* var. *texanum*) - acid hardwood bottoms and lower slopes, often in or downslope from acidic sphagneous hillside seeps; flowering March-mid April		

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
PE, PT	- Federally Proposed Endangered/Threatened
E/SA, T/SA	- Federally Listed Endangered/Threatened by Similarity of Appearance
C1	- Federal Candidate for Listing, Category 1; information supports proposing to list as endangered/threatened
DL, PDL	- Federally Delisted/Proposed for Delisting
NL	- Not Federally Listed
E, T	- State Listed Endangered/Threatened
"blank"	- Rare, but with no regulatory listing status

Species appearing on these lists do not all share the same probability of occurrence. Some species are migrants or wintering residents only, or may be historic or considered extirpated.

	Federal Status	State Status

JEFFERSON COUNTY

******* DRAFT ***** DRAFT ***** DRAFT***** DRAFT ***** DRAFT ***** DRAFT*******
UNDER CONSTRUCTION ** SPECIES MIGHT BE ADDED/DELETED DURING QUALITY CONTROL**

*** AMPHIBIANS ***

Pig Frog (*Rana grylio*) – prefers permanent bodies of open water with emergent vegetation; actively mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Brown Pelican (*Pelecanus occidentalis*) - largely coastal and near shore areas, where it roosts on islands and spoil banks	LE	E
Henslow's Sparrow (*Ammodramus henslowii*) – wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Interior Least Tern (*Sterna antillarum athalassos*) – this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Piping Plover (*Charadrius melodus*) - wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	LT	T
Reddish Egret (*Egretta rufescens*) - resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear		T
Snowy Plover (*Charadrius alexandrinus*) – wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats		
Sooty Tern (*Sterna fuscata*) – predominately "on the wing"; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July		T
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T

JEFFERSON COUNTY cont.	Federal Status	State Status
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

*** BIRDS-RELATED ***

Colonial waterbird nesting areas - many rookeries active annually

Migratory songbird fallout areas - oak mottes and other woods/thickets provide foraging/roosting sites for neotropical migratory songbirds

*** MAMMALS ***

Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		

*** REPTILES ***

Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Atlantic Hawksbill Sea Turtle *(Eretmochelys imbricata*) - Gulf and bay system	LE	E
Green Sea Turtle *(Chelonia mydas*) – Gulf and bay system	LT	T
Gulf Saltmarsh Snake (*Nerodia clarkii*) - saline flats, coastal bays, & brackish river mouths		
Kemp's Ridley Sea Turtle *(Lepidochelys kempii*) - Gulf and bay system	LE	E
Leatherback Sea Turtle *(Dermochelys coriacea*) - Gulf and bay system	LE	E
Loggerhead Sea Turtle *(Caretta caretta*) - Gulf and bay system	LT	T

JEFFERSON COUNTY cont.

	Federal Status	State Status
Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T
Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*) - coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide		
Texas Horned Lizard (*Phrynosoma cornutum*) - open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Chapman's orchid (*Platanthera chapmanii*) - in Texas, restricted to wetland pine savannas, one of the states most endangered habitats; flowering July-August

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
PE, PT	- Federally Proposed Endangered/Threatened
E/SA, T/SA	- Federally Listed Endangered/Threatened by Similarity of Appearance
C1	- Federal Candidate for Listing, Category 1; information supports proposing to list as endangered/threatened
DL, PDL	- Federally Delisted/Proposed for Delisting
NL	- Not Federally Listed
E, T	- State Listed Endangered/Threatened
"blank"	- Rare, but with no regulatory listing status

Species appearing on these lists do not all share the same probability of occurrence. Some species are migrants or wintering residents only, or may be historic or considered extirpated.

	Federal Status	State Status

LIBERTY COUNTY

******* DRAFT ***** DRAFT ***** DRAFT***** DRAFT ***** DRAFT ***** DRAFT*******
UNDER CONSTRUCTION *** SPECIES MAY BE ADDED/DELETED WITH QUALITY CONTROL**

*** AMPHIBIANS ***

Houston Toad (*Bufo houstonensis*) - endemic; species sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations	LE	E

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bachman's Sparrow (*Aimophila aestivalis*) - inhabits mature open pine forests with grassy understory, regenerating pine clear-cuts (1-7 years post re-planting), or open habitats with a dense ground cover of grasses and forbs, or palmetto scrub; in Texas, known to occur only in the far eastern portion of the state; most abundant in forests south of Angelina National Forest		T
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow (*Ammodramus henslowii*) - wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Red-cockaded Woodpecker (*Picoides borealis*) - cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, & loblolly	LE	E
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

*** BIRDS-RELATED ***

Colonial waterbird nesting areas - many rookeries active annually

	Federal Status	State Status
***** FISHES *****		
Creek Chubsucker (*Erimyzon oblongus*) - small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks		T
Paddlefish (*Polyodon spathula*) - prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir		T
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		
***** REPTILES *****		
Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Louisiana Pine Snake (*Pituophis ruthveni*) - mixed deciduous-longleaf pine woodlands; breeds April-September	C1	T
Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T
Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*) - coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide		
Texas Horned Lizard (*Phrynosoma cornutum*) - open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
PE, PT	- Federally Proposed Endangered/Threatened
E/SA, T/SA	- Federally Listed Endangered/Threatened by Similarity of Appearance
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Federal Status | State Status

ORANGE COUNTY

******* DRAFT ***** DRAFT ***** DRAFT***** DRAFT ***** DRAFT ***** DRAFT*******
UNDER CONSTRUCTION ** SPECIES MIGHT BE ADDED/DELETED DURING QUALITY CONTROL**

*** AMPHIBIANS ***

Pig Frog (*Rana grylio*) – prefers permanent bodies of open water with emergent vegetation; actively mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Brown Pelican (*Pelecanus occidentalis*) - largely coastal and near shore areas, where it roosts on islands and spoil banks	LE	E
Henslow's Sparrow (*Ammodramus henslowii*) – wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Interior Least Tern (*Sterna antillarum athalassos*) – this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Piping Plover (*Charadrius melodus*) - wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	LT	T
Reddish Egret (*Egretta rufescens*) - brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear		T
Snowy Plover (*Charadrius alexandrinus*) – wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats		
Sooty Tern (*Sterna fuscata*) – predominately "on the wing"; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July		T
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T

ORANGE COUNTY cont.	Federal Status	State Status
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
***** BIRDS-RELATED *****		
Colonial waterbird nesting areas - many rookeries active annually		
Migratory songbird fallout areas - oak mottes and other woods/thickets provide foraging/roosting sites for neotropical migratory songbirds		
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		
***** REPTILES *****		
Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Gulf Saltmarsh Snake (*Nerodia clarkii*) - saline flats, coastal bays, & brackish river mouths		
Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T
Sabine Map Turtle (*Graptemys quachitensis sabinensis*) – Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall		

ORANGE COUNTY cont.

	Federal Status	State Status
Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*) - coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide		
Texas Horned Lizard (*Phrynosoma cornutum*) - open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Chapman's orchid (*Platanthera chapmanii*) - in Texas, restricted to wetland pine savannas, one of the states most endangered habitats; flowering July-August

Long-sepaled false dragon-head (*Physostegia longisepala*) – moist, acid loams in the fire-maintained transition zone between pine flatwoods and coastal prairies; also, wet, borrow ditches along roadsides and moist areas in manmade clearings in pine woodlands; flowering early May to late June

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
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POLK COUNTY

	Federal Status	State Status
***** BIRDS *****		
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bachman's Sparrow (*Aimophila aestivalis*) - open pine woods with scattered bushes or understory, brushy or overgrown hillsides, overgrown fields with thickets and brambles, grassy orchards; nests on ground against grass tuft or under low shrub		T
Bald Eagle (*Haliaeetus leucocephalus*) – found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow (*Ammodramus henslowii*) - wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Red-cockaded Woodpecker (*Picoides borealis*) - cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, & loblolly	LE	E
Swallow-tailed Kite (*Elanoides forficatus*) – lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
*****FISHES*****		
Creek Chubsucker (*Erimyzon oblongus*) – small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks		T
Paddlefish (*Polyodon spathula*) - prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir		T
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T

POLK COUNTY cont.	Federal Status	State Status
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		

*** REPTILES ***

Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Louisiana Pine Snake (*Pituophis ruthveni*) - mixed deciduous-longleaf pine woodlands; breeds April-September	C1	T
Texas Horned Lizard (*Phrynosoma cornutum*) - most likely introduced; open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Texas screwstem (*Bartonia texana*) – sandy soils in dry mesic pine or mixed pine-oak forests and forest borders; usually in fire-maintained longleaf pine savannas, but also in more mesic habitats; flowering (June-?)		
Texas trailing phlox (*Phlox nivalis* ssp. *texensis*) - endemic; deep sandy soils in fire-maintained openings in upland longleaf pine savannas or bluejack oak woodlands; flowering March-early April	LE	E

Status Key:
LE,LT - Federally Listed Endangered/Threatened
PE,PT - Federally Proposed Endangered/Threatened
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	Federal Status	State Status

TYLER COUNTY

*** AMPHIBIANS ***

Pig Frog (*Rana grylio*) – prefers permanent bodies of open water with emergent vegetation; actively mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

*** BIRDS ***

American Peregrine Falcon (*Falco peregrinus anatum*) - potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Bachman's Sparrow (*Aimophila aestivalis*) - inhabits mature open pine forests with grassy understory, regenerating pine clear-cuts (1-7 years post re-planting), or open habitats with a dense ground cover of grasses and forbs, or palmetto scrub; in Texas, known to occur only in the far eastern portion of the state; most abundant in forests south of Angelina National Forest		T
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow (*Ammodramus henslowii*) – wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking		
Red-cockaded Woodpecker (*Picoides borealis*) - cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, & loblolly	LE	E
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

FISHES

Blue Sucker (*Cycleptus elongatus*) - usually inhabits channels and flowing pools with a moderate current; bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles		T

TYLER COUNTY cont.	Federal Status	State Status
Creek Chubsucker (*Erimyzon oblongus*) - small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks		T
Paddlefish (*Polyodon spathula*) - prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir		T
Western Sand Darter (*Ammocrypta clara*) - clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate		
***** MAMMALS *****		
Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - within historical range in eastern Texas; inhabits bottomland hardwoods and large tracts of undeveloped forested areas; dens in tree hollows, rock piles, or under brush piles	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		T
Red Wolf (*Canis rufus*) (extirpated) - formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
Southeastern Myotis Bat (*Myotis austroriparius*) - roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures		
***** REPTILES *****		
Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Louisiana Pine Snake (*Pituophis ruthveni*) - mixed deciduous-longleaf pine woodlands; breeds April-September	C1	T
Northern Scarlet Snake (*Cemophora coccinea copei*) - mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T

TYLER COUNTY cont.

	Federal Status	State Status
Texas Horned Lizard (*Phrynosoma cornutum*) - most likely introduced; open, arid and semi-arid regions with sparse vegetation, which could include grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March- September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) - swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Chapman's orchid (*Platanthera chapmanii*) - in Texas, restricted to wetland pine savannas, one of the states most endangered habitats; flowering July-August

Long-sepaled false dragon-head (*Physostegia longisepala*) – moist, acid loams in the fire-maintained transition zone between pine flatwoods and coastal prairies; also, wet, borrow ditches along roadsides and moist areas in manmade clearings in pine woodlands; flowering early May to late June

Navasota false foxglove (*Agalinis navasotensis*) – sparsely vegetated sandy soils on outcrop of the calcareous sandstone Oakville Formation; flowering September-October

Southern lady's-slipper (*Cypripedium kentuckiense*) – the only *Cypripedium* in east Texas; dry to mesic forests in various topographic positions; flowering April-June

Texas screwstem (*Bartonia texana*) - sandy soils in dry mesic pine or mixed pine-oak forests and forest borders; usually in fire-maintained longleaf pine savannas, but also in more mesic habitats; flowering (June-?)

Texas trailing phlox (*Phlox nivalis* ssp. *texensis*) - endemic; deep sandy soils in fire-maintained openings in upland longleaf pine savannas or bluejack oak woodlands; flowering March-early April	LE	E

White firewheel (*Gaillardia aestivalis* var. *winkleri*) – endemic; deep, loose, well-drained sands in openings in pine-oak woodlands and along unshaded margins, principally of the Village Creek watershed; flowering late spring (May-June) and sporadically through early fall

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
PE, PT	- Federally Proposed Endangered/Threatened
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APPENDIX I

NATIONAL PARK SERVICE WELL PLUGGING GUIDE FOR NONFEDERAL OIL AND GAS WELLS IN THE STATE OF TEXAS

Prepared by
Pat O'Dell, Petroleum Engineer
Geologic Resources Division
National Park Service
Denver, Colorado
March 2004

I. INTRODUCTION

When plugging wells in National Parks in the State of Texas, operators have to follow both the Railroad Commission of Texas (RCT) and National Park Service (NPS) regulations. This guide is intended to help operators plan the downhole aspects of plugging operations that will meet both RCT and NPS requirements.

The guide focuses on the downhole aspects of permanently plugging and abandoning a well.

II. REGULATIONS

National Park Service

The National Park Service (NPS) regulates[1] plug and abandonment operations for all wells in National Park Units that are reached by crossing Federal property. Even wells that have been exempt[2] from NPS regulatory requirements often lose their exempt status when they are to be plugged and abandoned. An operation loses its exempt status when there is a change in operations that requires a new State or Federal permit. Texas requires a plugging permit thus triggering the NPS plan and bonding requirements.

For operators that are used to working on federal onshore leases, it is useful to know that the NPS uses the minimum standards of the *Department of Interior's Onshore Oil and Gas Order Number 2, Section III.G., Drilling Abandonment for Plugging Wells in Parks* (from *Federal Register*, Vol. 53, No. 223, Friday, November 18, 1988, pages 46810 and 46811). The plugging requirements of Onshore Order No. 2 were written specifically for plugging newly drilled wells. However, the same standards may be applied to the permanent abandonment of exhausted producers or service wells.

[1]The regulations at Title 36 of the Code of Federal Regulations, Part 9, Subpart B (36 CFR 9B) cover nonfederal oil and gas operations in units of the National Park System.

[2]See 36 CFR 9.33, "Existing Operations."

The NPS regulations require operators to submit a plan of operations (plan) for approval. Once approved, the plan serves as the operator's permit from the NPS. The plan details all activities of an oil and gas operation, describes how reclamation will be completed, and is the basis for setting performance bond amounts.

Texas

The Railroad Commission of Texas (RCT) regulates the plugging and abandonment of wells associated with oil, gas, and geothermal resource operations. The plugging rules are found in the Statewide Rules, Rule 14, Plugging. A guidance manual entitled "Well Completion and Plugging Procedures Reference Manual" is also available from the Railroad Commission.

III. WELL PLUGGING GOALS

Texas and the NPS have the same goals in plugging a well. They are:

- to protect the zones of usable water from pollution, and
- to prevent escape of oil, gas, or other fluids to the surface or other zones.

The following well plugging objectives serve to accomplish these goals.

1) Set cement plug(s) to isolate all formations bearing oil, gas, geothermal resources, and other prospectively valuable minerals.
2) Set cement plug(s) to isolate all formations bearing usable-quality water.
3) Set a cement plug to isolate the surface casing from open hole below the casing shoe.
4) Finally set a cement plug to seal the well at the surface.

The NPS is not responsible for protecting private mineral interests. Where plugs are set solely to protect nonfederal mineral resources such as oil, gas, coal, potash, etc., the NPS will defer to the state requirements.

IV. GENERAL REQUIREMENTS

The plugging procedure needs to include the following general requirements to meet Texas and NPS requirements. When NPS standards differ from Texas, the more stringent would apply.

Cement Quality

All cement for plugging shall be an approved API oil well cement without volume extenders and shall be mixed in accordance with API standards. Slurry weights shall be reported on the cementing report. In special situations such as when high temperature, salt sections, or highly corrosive sections are present, specific cement compositions may be required.

Reference: Texas Rule 14, §3.14(d)(4)
Onshore Order No. 2, § III (G)(7)

Cement Volumes

All cement plugs except the surface plug shall have sufficient slurry volume to fill at least 100 feet of hole, plus an additional 10 percent of slurry for each 1,000 feet of depth. No plug, except the surface plug, shall be less than 25 sacks with prior approval. This requirement addresses the ability to mix and place uncontaminated cement at depth. The cement and workover fluids tend to mix at the lead and tail end of the cement slurry as it is pumped downhole. The clean cement in the middle provides the plug's integrity. An additional washout factor may be applied when plugging openhole sections.

Reference: Texas Rule 14, § 3.14(d)(11)
Onshore Order No. 2, § III (G)(1)(ii) & (iii) & (G)(2)

Cement Placement

Cement plugs must be placed by the circulation or squeeze method through tubing or drill pipe.

The dump bailer method may be used only to place cement caps above a bridge plug or retainer.

Reference: Texas Rule 14, § 3.14(d)(3)
Onshore Order No. 2, § III (G)(2)(iii)

Plugging Fluid

Each of the intervals between plugs must be filled with mud having sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered while drilling.

In the absence of known data, the Federal regulations require a minimum mud weight of 9.0 pounds per gallon. Texas regulations require a minimum mud weight of 9.5 pounds per gallon. Unless a specific waiver is granted by the RCT, the NPS will require use of 9.5 pound per gallon mud.

Reference: Texas Rule 14, § 3.14(d)(9)
Onshore Order No. 2, § III (G)(9)

Uncemented Annular Space

Whenever a cement plug is required at a depth in cased hole where the annular space is not cemented, the uncemented annular section must be cemented by perforating the casing and pumping cement into the annular space. At shallow depths, small diameter pipe can be run in the annular space and cement circulated in place.

Reference: Texas Rule 14, § 3.14(f)(2) & (g)(2)
Onshore Order No. 2, § III (G)(9)

V. REQUIRED PLUGS

The following sections summarize where cement plugs need to be placed in a well to meet the goals outlined in Section II and satisfy the requirements of TRC Rule 14 and Federal Onshore Order No. 2

Zones of Production

The RCT requires a 100-foot long placed immediately above each perforated interval. The NPS requires cement to be placed across each perforated interval and extend at least 50 feet below the bottom perforations (except where limited by total depth) and 50 above the top perforations.

To meet both standards, the operator should place a cement plug from 50 feet below the bottom perforation to 100 feet above the top perforation.

Instead of the cement plug, a bridge plug or retainer can be set above the perforations and capped with cement. The bridge plug method can be used if there is no exposed open hole below the perforations. The RCT requires the bridge plug to be placed "immediately" above the perforations and capped with at least 20 feet of cement. The NPS requires the bridge plug to be no further than 100 feet above the perforations and capped with 50 feet of cement. If a bailer is used to place cement on top of the bridge plug, then 35 feet is enough.

When using bridge plugs to abandon perforated intervals, the operator would follow the more conservative 50-foot cement cap standard (or 35-foot cement cap if a bailer is used) to satisfy both the RCT the NPS.

The NPS is not responsible for protecting private mineral interests. For plugs set solely to protect nonfederal mineral resources such as oil, gas, coal, potash, etc., the NPS will defer to the state requirements.

Reference: Texas Rule 14, § 3.14(g)(3)
Onshore Order No. 2, § III (G)(2)

Zones Containing Liquid or Gas with the Potential to Migrate

Any zone that contains liquid or gas with the potential to migrate requires a plug extending from at least 50 feet below its bottom to at least 50 feet above its top. <u>This NPS requirement pertains only to abandonment of an open hole section or an uncemented cased hole section where there are no cement plugs scheduled between the zone containing liquid or gas with the potential to migrate and the base of the deepest usable quality water zone.</u>

Reference: Onshore Order No. 2, § III (G)(1)(i)(a)

Usable-Quality Water Zones

The RCT and Federal regulations require that zones of usable-quality water be protected. The Texas Commission on Environmental Quality determines the depth to which usable-quality water must be protected. Whenever a cement plug is the only isolating medium for a zone of usable water quality, the NPS standard is to test that plug by tagging with the drill string. Both Texas and the NPS have the option to require testing of any plug to ensure its integrity. So when designing the well plugging procedure, operators should plan for testing of plugs set to isolate zones of usable quality water.

Reference: Texas Rule 14, § 3.14(d)(1) & (7)
Onshore Order No. 2, § III (G) Introduction & (G)(6)

The Surface Casing Shoe

The RCT and Federal requirements for placing a plug across the shoe of the surface casing are the same.

If the inner casing string(s) have been cemented across the shoe of the surface casing, then a 100-foot plug is placed with its center at the surface casing shoe depth.

If the inner casing string(s) are not cemented, the operator has choices. The operator can choose to cut and recover casing so that a plug can be set directly across the surface casing shoe. The operator can also choose to perforate the casing and circulate cement behind the inner casing string across the surface casing shoe.

If casing is removed, the NPS will require a cement plug to be placed to extend at least 50 feet above and below the stub. It may be beneficial for operators to cut the casing at a depth so that one plug could be set to meet requirements for both the casing stub and the exposed casing shoe.

Reference: Texas Rule 14, § 3.14(e), (f)(2), &(g)(2)
Onshore Order No. 2, § III (G)(3) & (4)

The Surface Plug

The RCT requires a 10-foot surface plug for all inland wells. The Federal standard is a 50-foot surface plug. The operator would follow the more conservative Federal standard to satisfy both the RCT and the NPS. The cement plug must extend at least 50 feet. The plug is placed in the smallest casing and all annuli that extend to the surface. The top of the plug is placed as close to the eventual casing cutoff point as possible.

Reference: Texas Rule 14, § 3.14(d)(8)
Onshore Order No. 2, § III (G)(8)

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GLOSSARY

Abandonment: The termination of oil and gas production operations, removal of facilities, plugging of the well bore, and reclamation of surface disturbances.

Access: Any way, means, or method of entering or traversing on, across, or through federally owned or controlled lands or waters (36 CFR § 9.30(a)), including but not limited to: vehicle, watercraft, fixed-wing aircraft, helicopter, offroad vehicle, mobile heavy equipment, snowmobile, pack animal, and foot.

Action: Any federal activity including, but not limited to, acquiring, managing, and disposing of federal lands and facilities; facilitating human occupation or visitation; providing federally undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including, but not limited to, water and related land resources planning, and regulating and licensing activities.

Affected Environment: Surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that could potentially be affected by oil and gas activities. The environment of the area to be affected or created by the alternatives under consideration (40 CFR § 1502.15).

Aggradation: The natural building up of the earth's surface by deposition, such as the raising of a streambed by deposition of sediment to establish or maintain uniformity of grade or slope.

Alternative: A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of several policies, plans, or projects proposed for decision-making.

Alternative, No-Action: An alternative that maintains established trends or management direction.

American Petroleum Institute: Founded in 1920, this national oil trade organization is the leading standardizing organization on oil field drilling and producing equipment. It maintains departments of transportation, refining, and marketing in Washington, D.C., and a department of production in Dallas.

Aquifer: A water-bearing rock, rock formation, or group of formations. Aquifers can be either unconfined or confined.

Barrel: A measure of volume for petroleum products. One barrel is the equivalent of 42 U.S. gallons or 0.15899 cubic meters. One cubic meter equals 6.2897 barrels.

Base Flood: That flood which has a one percent chance of occurring in any given year (also known as the 100-year flood). This term is used by the National Flood Insurance Program to indicate the minimum level of flooding to be used by a community in its floodplain management regulations.

Base Floodplain: The 100-year floodplain.

Billion Cubic Feet (BCF): Measurement of gas at standard pressure and temperature, measured in billion cubic feet of gas.

Biological Diversity: The variety of life and the processes that govern life. There are four major components of biological diversity: **genetic**—variation of genes within a species; **species**—

variation of the kinds of plants and animals; **community/eco-system**—variation of the ways in which the many species of plants and animals aggregate into interacting groups; and **process**—variation in the physical, chemical, and biological forces to which genes, species, communities, and ecosystems respond.

Blowout: An uncontrolled explosion of gas, oil, or other fluids from a drilling well. A blowout or "gusher" occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid and when blowout prevention equipment is absent or fails.

Blowout Preventer (BOP): One of several valves installed at the wellhead to prevent the escape of pressure either in the annular space between the casing and drill pipe or in open hole (i.e., hole with no drill pipe) during drilling or completion operations.

Brine: Water containing relatively large concentrations of dissolved salts, particularly sodium chloride. Brine has higher salt concentrations than ordinary ocean water.

Cement Casing: To fill the annulus between the casing and hole with cement to support the casing and prevent fluid migration between permeable zones.

Christmas Tree: The control valves, pressure gauges, and chokes assembled at the top of a well to control the flow of oil and gas after the well has been completed.

Completion: The activities and methods to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

Conditions of Approval (COAs): Provisions or requirements under which a Plan of Operations is approved.

Contaminating Substance: Those substances, including, but not limited to, salt water or any other injurious or toxic chemical; waste oil or waste emulsified oil; basic sediment; mud with injurious or toxic substances produced or used in the drilling, development, production, transportation, or on-site storage, refining, and processing of oil and gas (36 CFR § 9.31(n)).

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effort on the environment, conducts environmental studies, and advises the President on environmental matters.

Critical Habitat: (1) The specific areas within the geographical area occupied by the species…on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations protection; and (2) specific areas outside the geographical area occupied by the species…upon a determination by the Secretary that such areas are essential for the conservation of the species.

Cultural Landscape: A cultural landscape is a geographic area, including both cultural and natural resources and the wildlife and domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Cultural Resource: Cultural resources include archeological sites; historic sites, buildings, and districts; cultural landscapes; and traditional cultural properties.

Drilling Fluid ("Mud"): Circulating fluid, one function of which is to force cuttings out of the wellbore and to the surface. While a mixture of clay, water, and other chemical additives is the most common drilling fluid, wells can also be drilled using air, gas, or water as the drilling fluid.

Development Concept Plan (DCP): The Development Concept Plan bridges the gap between the General Management Plan and the comprehensive or preliminary design, providing guidance for the development and use of a particular geographic area within a park.

Directional Drilling: Intentional deviation of a wellbore from the vertical (90 degrees). Although wellbores are normally drilled vertically, it is sometimes necessary or advantageous to drill at an angle from the vertical.

Dry Hole: Any well incapable of producing oil or gas in commercial quantities. A dry hole may produce water, gas, or even oil, but not enough to justify production.

Ecotone: An ecological community of mixed vegetation formed by the overlapping of adjoining communities.

Edaphic: Of or pertaining to soil, especially as it affects living organisms.

Effects: see Impacts

Endangered Species: Any species that is in danger of extinction throughout all or a significant portion of its range.

Environmental Assessment (EA): A concise public document prepared to provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact. An EA includes a brief discussion of the need for a proposal, the alternatives considered, the environmental impacts of the proposed action and alternatives, and a list of agencies and individuals consulted.

Environmental Impact Statement (EIS): A document prepared to analyze the impacts on the environment of a proposed project or action and released to the public for comment and review. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed project or action.

Exploration: The search for deposits of useful minerals or fossil fuels; prospecting; preparatory to development.

Extirpate: To destroy the whole of; exterminate.

Federally Owned and Controlled Lands: Land that the United States possesses fee title through purchase, donation, public domain, or condemnation. It also includes land that the United States holds any interest, such as a lease, easement, rights-of-way, or cooperative agreement.

Federally Owned and Controlled Waters: All surface waters in the boundaries of a National Park System unit without regard to whether the title to the submerged lands lies with the United States or another party.

Floodplain: The lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, and including at a minimum, that area subject to temporary inundation by a regulatory flood.

Flowlines and Gathering Lines: Lines that transport petroleum and natural gas or other associated products from under the park, from the wellhead to storage and treatment facilities, from treatment and storage facilities to pipelines, or from the wellhead to pipelines.

Fragipan: A natural subsurface layer that has a very low organic content, high bulk density and/or high mechanical strength relative to the overlying and underlying layers (horizons); is very hard (seems cemented) when dry, but shows a moderate to weak brittleness when moist. The layer typically has a very low permeability to water, and restricts the penetration of roots.

Gas: Any fluid, either combustible or noncombustible, which is produced in a natural state from the earth, and which maintains a gaseous or rarefied state at ordinary temperature and pressures (36 CFR § 9.31(m)).

General Management Plan (GMP): The GMP is the major planning document for all National Park System units. The GMP sets forth the basic philosophy for managing a unit, and provides strategies for resolving issues and achieving identified management objectives over a 5 to 10-year period. The GMP includes an environmental impact assessment and other required compliance documentation.

In a GMP, the National Park Service should prescribe general strategies for managing nonfederal oil and gas exploration and development if such activity is an issue in a unit. Pertinent information that might be included in a GMP includes:

- where and when nonfederal oil and gas operations may occur under statutory or regulatory authorities;
- impacts of exploration and development on unit resources and values;
- location of nonfederal oil and gas rights in relation to areas planned for park-related development, preservation, or interpretation; and
- existing or potential impacts from nonfederal oil and gas activity conducted on lands adjacent to the unit.

The GMP also establishes "management zones" in a unit according to criteria and procedures contained in DO-2 (NPS Director's Order, Planning Process). Management zoning is prescriptive, based on surface resources and visitor-related values.

Geophysical Exploration: Geophysical exploration primarily consists of 3-D seismic operations and typically involves selective cutting of vegetation along source and receiver lines, drilling shot holes along source lines, placing explosives at the bottom of each shot hole, placing cables and other recording equipment along receiver lines, and detonating explosives.

Hydrocarbons: Organic compounds consisting of hydrogen and carbon, such as petroleum, crude oil or natural gas, whose densities, boiling points, and freezing points increase as their molecular weights increase. The smallest molecules of hydrocarbons are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

Hydraulic and Hydrologic Hazards: Hazards to human life or property caused by the conditions of flow (deep water, high velocities, debris loads, etc.) or by the characteristics of flooding (rate of flood rise, rapidity of response to causative events, etc.).

Hydroperiod: Number of days per year that an area of ground is covered with water.
Hydrophyte: A plant that grows in and is adapted to an aquatic or very wet environment.

Impacts: ***Direct Impacts*** are caused by the action and occur in the same place and at the same time as the action. ***Indirect Impacts*** are caused by the action and are later in time or farther removed in distance, but are still anticipated. ***Cumulative Impacts*** are the impacts on the

environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions (in the NPS, major actions are synonymous with significant actions) taking place over a period of time (see 40 CFR Part 1508.7). The degree or intensity of impact (i.e., negligible, minor, moderate, or major) can be beneficial or adverse, and can be further described by duration of impact (i.e., short-term or long-term).

Impermeable: Preventing the passage of fluid. A formation may be porous yet impermeable if there is an absence of connecting passages between the voids within it.

Lease: A legal document executed between a landowner, as lessor, and a company or individual, as lessee, that grants the right to exploit the premises for minerals or other products.

Long-term: Describes impacts that would occur over a 20-year period, or longer.

Management Policies: National Park Service Management Policies is the basic Servicewide policy document of the National Park Service and will be revised at appropriate intervals to consolidate servicewide policy decisions. The management of the National Park System and NPS programs is guided by the U.S. Constitution, public laws, proclamations, executive orders, rules and regulations, and directives of the Secretary of the Interior and the Assistant Secretary for Fish and Wildlife and Parks. Other laws, regulations, and policies related to the administration of federal programs, although not cited, may also apply.

Mesic: Of, pertaining to, or adapted to an environment having a balanced supply of moisture.

Midden: A trash deposit.

Mitigation: "Mitigation," is defined in NPS Director's Order 12 as a "modification of the proposal or alternative that lessens the intensity of its impact on a particular resource. The definition references 40 CFR § 1508.20, which states:

1. Avoiding the impact altogether by not taking a certain action or parts of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact of repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
5. Compensating for the impact by replacing or providing substitute resources or environments.

The term "mitigation" is used interchangeably in this Final Plan/EIS with other terms, including "mitigation measure," "mitigation techniques," and "mitigation strategies."

Monocline: A geologic formation in which all strata are inclined in the same direction.

National Environmental Policy Act of 1969 (NEPA): Public Law 91-190. The National Environmental Policy Act of 1969 (NEPA) as amended, is landmark environmental protection legislation establishing as a goal for federal decision making a balance between use and preservation of natural and cultural resources. NEPA requires all federal agencies to (1) prepare in-depth studies of the impacts of and alternatives to proposed "major federal actions," (2) use the information contained in such studies in deciding whether to proceed with the actions, and (3) diligently attempt to involve the interested and affected public before any decision affecting the environment is made.

National Register of Historic Places (NRHP): A listing of architectural, historical, archeological, and cultural sites of local, state, or national significance, established by the Historic Preservation Act of 1966 and maintained by the National Park Service.

Natural Floodplain Values: Attributes of floodplains which contribute to ecosystem quality, including soils, vegetation, wildlife habitat, dissipation of flood energy, sedimentation processes, ground water (including riparian ground water) recharge, etc.

Natural Gas: A highly compressible, highly expandable mixture of hydrocarbons having a low specific gravity and occurring naturally in a gaseous form. Besides hydrocarbon gases, natural gas may contain appreciable quantities of nitrogen, helium, carbon dioxide, and contaminants.

No Surface Use (NSU): Access across the surface or use of the surface for nonfederal oil and gas operations would be limited or not permitted in Special Management Areas (SMAs). Operations include, but are not limited to: gathering information for development of a plan of operations; geophysical exploration; construction or use of roads or other means of access; construction or use of drilling pads and well pads, well completion and production; use of production equipment and facilities; well servicing and workover operations, construction or use of flowlines and gathering lines; transport or processing of petroleum products; and inspection, monitoring or maintenance of wells and equipment. Under this constraint, operators may produce and develop the oil and gas resources beneath the Preserve by directionally drilling from sites outside the NSU area. NSU is also used with an offset or distance stipulation, or timing stipulation.

Offset: An area between two different land uses that is intended to resist, absorb, or otherwise preclude developments or intrusions between the two use areas.

Oil: Any viscous, combustible liquid hydrocarbon or solid hydrocarbon substance easily liquefiable on warming, which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas without resort to manufacturing processes**.**

Operations: Defined as "all functions, work and activities within a unit in connection with exploration for and development of oil and gas resources" (36 CFR § 9.31(c)). Operations include, but are not limited to:

- reconnaissance to gather natural and cultural resources information;
- line-of-sight surveying and staking;
- geophysical exploration;
- exploratory drilling;
- production, gathering, storage, processing, and transport of petroleum products;
- inspection, monitoring, and maintenance of equipment;
- well "work-over" activity;
- construction, maintenance, and use of pipelines;
- well plugging and abandonment;
- reclamation of the surface; and
- construction or use of roads, or other means of access or transportation, on, across, or through federally owned or controlled lands or waters.

If an operator desires to conduct nonfederal oil and gas operations in a National Park System unit, and operations require access on, across, or through federally owned or controlled lands or waters, the 36 CFR Part 9B regulations require that the operator:

- possess a right to the nonfederal oil and gas in the unit (36 CFR § 9.36(a) (2)),
- file a plan of operations with the NPS and receive approval from the Regional Director prior to commencing operations (36 CFR § 9.32(a)), and
- submit a performance bond or security deposit to the NPS (36 CFR § 9.48(a)).

Operator: Person(s) who may have rights to explore and develop nonfederally owned oil and gas in NPS units, including:

- Owners: individuals, corporations, local and state governments, Indian tribes (when the tribe owns the oil and gas in fee), etc.;
- Lessees: individuals or corporations that lease oil and gas from the owner; and
- Contractors: individuals or corporations under contract with the owner, lessee, or operator.

Organic Act: Congress formally established the National Park Service by the Act of August 25, 1916, which is commonly called the National Park Service Organic Act. The Organic Act mandates the Service ". . .to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. §§ 1 *et seq.).* This unambiguous statement of purpose for the National Park System directs that preservation and public enjoyment of the natural, scenic, and cultural resources in a manner that leaves them unimpaired is the fundamental purpose of all national parks, monuments, and other reservations.

The Organic Act authorized the Secretary of the Interior to promulgate rules and regulations necessary for the management of the national parks, monuments, and other reservations under the Secretary's jurisdiction (16 U.S.C. § 3). This authority, among others, provides the basis for the regulations in 36 CFR Chapter 1, including the NPS regulations in 36 CFR Part 9, governing mining claims and nonfederally owned oil and gas.

Paleoindian: Paleoindians are people who hunted now-extinct animals prior to 6,000 years ago.

Palustrine: Nontidal wetlands dominated by trees, shrubs, or persistent emergents.

Permeability: The capacity to transmit fluids or gases through soil or rock materials; the degree of permeability depends upon the size and shape of the pore spaces and interconnections, and the extent of the interconnections.

Pipelines: Oil and gas lines that have their point of origin and end point outside the park and for the most part are not supporting nonfederal oil and gas operations in the park.

Plan of Operations: Application submitted by an operator describing how proposed oil and gas operations would be conducted in a unit of the National Park System pursuant to the NPS's Nonfederal Oil and Gas Rights Regulations, 36 CFR 9B, and containing information requirements pertinent to the type of operations being proposed (36 CFR §§ 9.36(a) through (d)).

Practicable: Capable of being done within existing constraints. The test of what is practicable depends upon the situation and includes consideration of the pertinent factors such as environment, cost, or technology (excerpted from NPS Director's Order 77-2 - Floodplain Management).

Production: The phase of mineral extraction where minerals are made available for treatment and use.

Reclamation: The process of returning disturbed land to a condition that will be approximately equivalent to the pre-disturbance condition in terms of sustained support of functional physical processes, biological productivity, biological organisms, and land uses.

Record of Decision: The document that is prepared to substantiate a decision based on an EIS. It includes a statement of the decision made, a detailed discussion of decision rationale, and the reasons for not adopting all mitigation measures analyzed, if applicable.

Recovery Plan: A plan required for each listed threatened/endangered species and generated by a task force under the leadership of the U.S. Fish and Wildlife Service. The plan describes the specific management actions necessary to restore the threatened or endangered species to recovery status, including the estimated cost and time involved. The FWS coordinator oversees implementation of the plan.

Regional Director: There are seven geographic regions under which the units of the National Park System are organized. Big Thicket National Preserve is located within the Intermountain Region of the National Park Service. The Regional Director is the chief decision-maker.

Regulatory Floodplain: The specific floodplain which is subject to regulation by Executive Order 11988, "Floodplain Management," and the NPS's Floodplain Management Guideline (DO77-2). For Class I Actions, the Base Floodplain (100-year) is the regulatory floodplain; for Class II Actions, the 500-year return period floodplain is the regulatory floodplain; for Class III Actions, the Extreme floodplain is the regulatory floodplain.

Revegetation: The reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance, such as seed bed preparation, reseeding, and mulching.

Scoping Process: An early and open public participation process for determining the scope of issues to be addressed in an Environmental Impact Statement, and for identifying significant issues related to a proposed action.

Seismic hole or shot hole: Any hole drilled for the purpose of securing geophysical information to be used in the exploration or development of oil, gas, or other mineral resources.

Shut-in well: An oil and gas well in which the inlet and outlet valves have been shut off so that it is capable of production but is temporarily not producing.

Special Management Area (SMA): Areas that include park resources and values that are particularly susceptible to adverse impacts from oil and gas geophysical exploration and drilling and production operations. These areas are formally proposed under Alternatives B and C; and specific operating stipulations are proposed for each of these SMAs to protect them from adverse impacts from oil and gas operations.

Split Estate: Refers to the situation where the mineral estate is owned or controlled by a party other than the owner of the land surface in the same area.

Statement for Management (SFM): A National Park Service planning document used to guide short- and long-term management of a unit; to determine the nature and extent of planning required to meet the unit's management objectives; and, in the absence of more specific planning documents, to provide a general framework for directing park operations and communicating park objectives to the public.

Succession: The natural replacement of one biotic community by another.

Superintendent: The Superintendent (or his/her designee) of the unit of the National Park System containing lands subject to the rights covered by the Nonfederal Oil and Gas Rights Regulations, 36 CFR 9B.

Taking: To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Threatened Species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Timing Limitation (Seasonal Restriction): Constraint that prohibits surface use during specified time periods. This constraint does not apply to the operation and maintenance of production facilities unless analysis demonstrates that such constraints are needed and that less stringent, project-specific constraints would be insufficient.

Vertical Drilling: Drilling of a well vertically (90 degrees) to reach a target zone straight underneath the surface location.

Wetlands: Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year. (Classification of Wetlands and Deepwater Habitats of the United States (Cowardin *et al*. 1979))

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