2.0 Description of the Nuclear Power Plant and Site and Plant Interaction with the Environment

The Omaha Public Power District's (OPPD's) Fort Calhoun Station, Unit 1 is a single-unit nuclear power plant located on the southwestern bank of the Missouri River, approximately 31 km (19 mi) north of downtown Omaha, Nebraska. Unit 1 is an operating pressurized-water nuclear reactor and the subject of this action. In addition to the nuclear unit, the site features include the power-generation and ancillary facilities, a switchyard and maintenance area, the administration building and training building, a firing range (for security staff), a meteorological tower, a closed water-treatment sludge landfill, and sanitary-waste lagoons. The plant and its environment are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term

Fort Calhoun Station is located in Washington County, Nebraska, and consists of 267 ha (660 ac) of land. Approximately 55 ha (135 ac) of this land is occupied by plant facilities or maintained as part of the plant operations. Figures 2-1 and 2-2 show the site location and features within 80 km (50 mi) and 10 km (6 mi), respectively. The site region encompasses portions of eastern Nebraska and western Iowa and is characterized by a maximum relief of approximately 91 m (300 ft) (OPPD 2002a).

The region surrounding Fort Calhoun Station was identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)[(a)] as having a low population density. Fort Calhoun Station employs a workforce of about 632 permanent employees and about 140 contractor employees. The OPPD refuels Fort Calhoun Station, Unit 1 at 18-month intervals. During refueling outages, site employment increases by as many as 600 workers for temporary duty (typically, 30 to 40 days). The nearest municipalities are Blair, Nebraska, approximately 10 km (6 mi) to the northwest, and Fort Calhoun, Nebraska, approximately 8 km (5 mi) south of Fort Calhoun Station.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

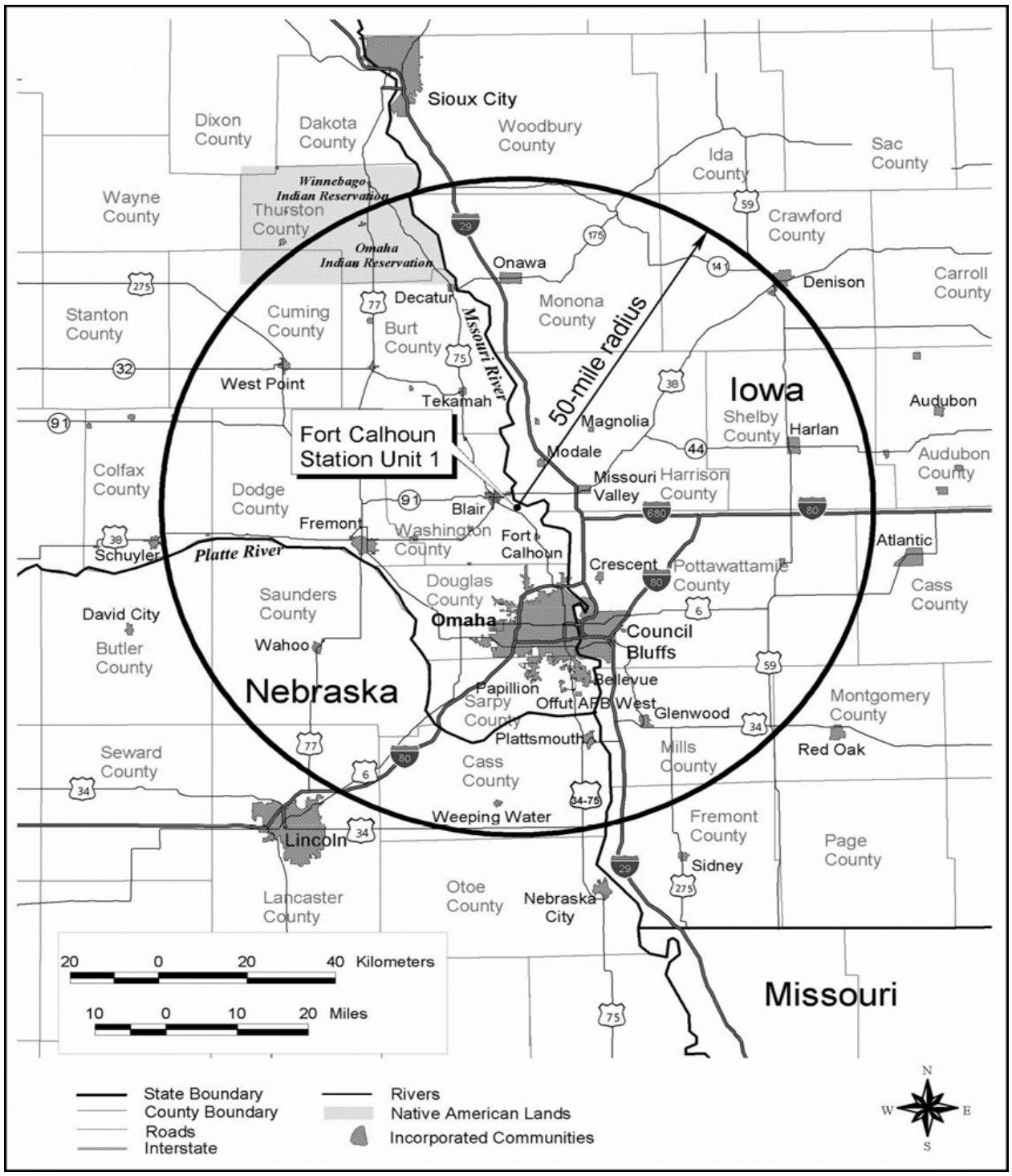


Figure 2-1. Location of Fort Calhoun Station, 80-km (50-mi) Region

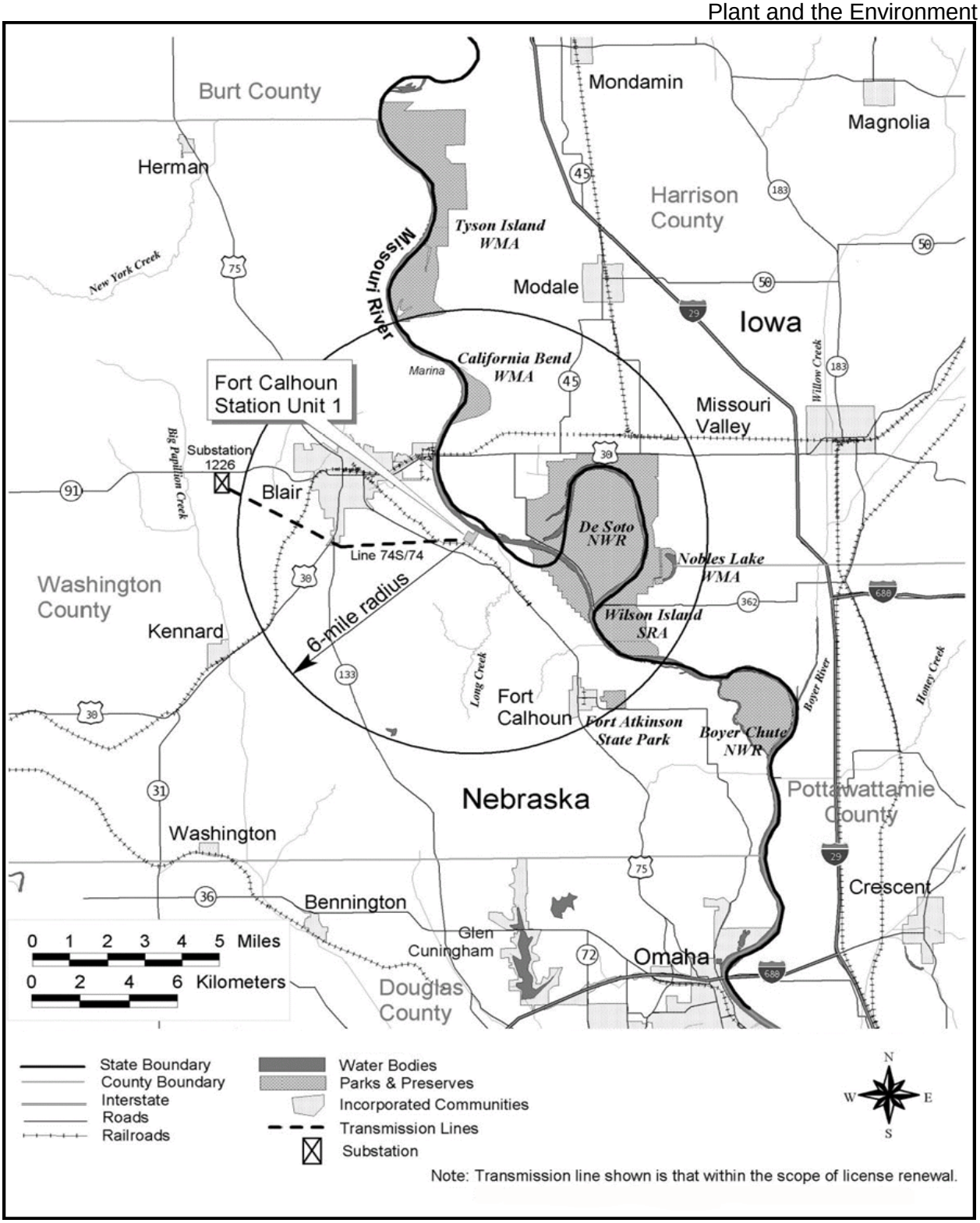


Figure 2-2. Location of Fort Calhoun Station, 10-km (6-mi) Region

2.1.1 External Appearance and Setting

Located in the dissected till plains of the central lowlands physiographic province, the Fort Calhoun Station region is characterized by a maximum relief of approximately 91 m (300 ft). Fort Calhoun Station, Unit 1 and its supporting structures can be seen from the immediate surrounding area and by recreational users on the Missouri River. Approximately 85 percent of the site is on relatively level ground on the river bottomlands (OPPD 2002a).

The main channel of the Missouri River, its associated flat bottomlands and bluffs, and the dissected loess-covered till plains of western Iowa and drift hills of Nebraska are defining natural features in the region. The Missouri River is highly modified and controlled for most of its length as a result of numerous U.S. Army Corps of Engineers (USACE) actions. The reach of the river on which Fort Calhoun Station is located has been modified by a system of dikes and revetments designed to provide a continuous navigation channel without the use of locks and dams.

2.1.2 Reactor Systems

The Fort Calhoun Station, Unit 1 nuclear-steam-supply system consists of a pressurized-water reactor and its associated coolant system designed by Combustion Engineering. The steam and power conversion system, including its turbine generator, is designed to permit the generation of a net electrical output of approximately 476 megawatts (MW[e]). See Figure 2-3 for the layout of Fort Calhoun Station. The reactor was initially licensed to operate at a maximum power level of 1420 megawatts thermal (MW[t]). However, on the basis of additional safety and environmental evaluations, the NRC issued a license amendment on August 15, 1980, to allow operation at the system's full-rate power level of 1500 MW(t). The NRC authorized Fort Calhoun Station, Unit 1 to operate at full power with the issuance of Operating License DPR-40, which was effective August 9, 1973 (OPPD 2002a).

The reactor's primary containment building is constructed of steel-reinforced concrete and houses the reactor, steam generators, reactor coolant pumps, other nuclear-steam-supply system components, and equipment for refueling and other operations. The containment building provides a highly reliable, essentially leak-tight barrier against the escape of radioactive material. The containment system is designed to withstand an internal pressure of 60 pounds per square inch above atmospheric pressure (psig). Together with its engineered safety features, the containment system is designed to provide adequate radiation protection for both normal operation and postulated design-basis accidents, such as earthquakes, tornadoes, or loss of coolant. The Fort Calhoun Station reactor is licensed for uranium dioxide fuel that has a maximum enrichment of 5.0 percent by weight uranium-235. Maximum fuel enrichment through Fuel Cycle 20, which began in April 2001, is 4.66 percent by weight uranium-235.

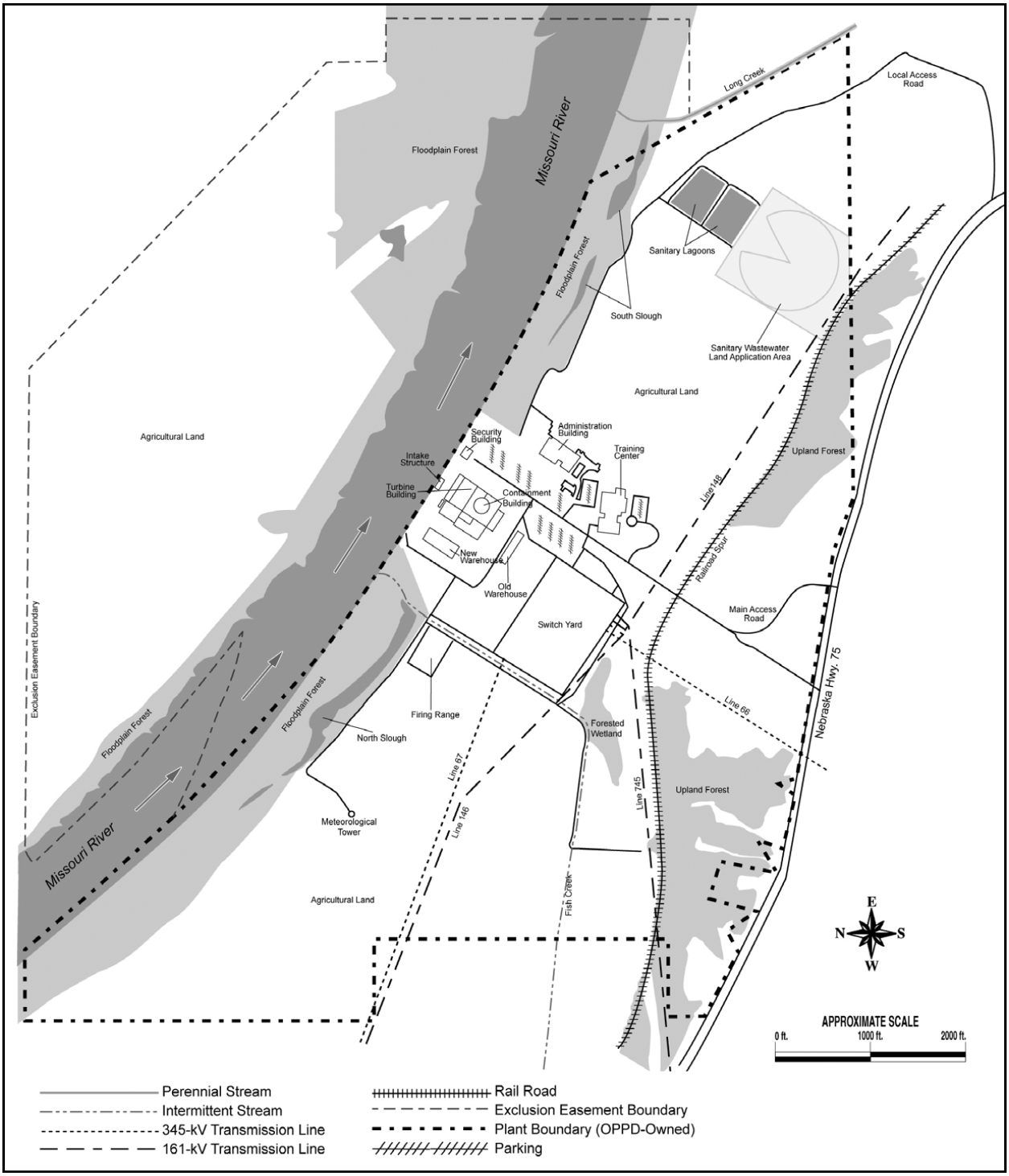


Figure 2-3. Fort Calhoun Station Layout

The approximate maximum fuel burn-up is less than 53,000 megawatt-days per metric ton uranium (MWd/MTU) (OPPD 2002a).

2.1.3 Cooling- and Auxiliary-Water Systems

During its operations, Fort Calhoun Station obtains water from (1) a once-through, noncontact cooling system that uses water from the Missouri River and (2) potable water supplies from the City of Blair Municipal Water System. In addition, a small quantity (less than 6.3 L/s [100 gpm]) of groundwater from two onsite wells is used at the plant. The groundwater is used predominantly to (1) adjust water levels and (2) flush the sanitary-waste lagoons and the center-pivot irrigation system, which is used to land-apply treated effluent from the lagoons. Details of the once-through cooling system and groundwater withdrawals are discussed in the following sections.

2.1.3.1 Cooling-Water System

The once-through, noncontact cooling system (water is self-contained, and cooling water does not come into contact with the reactor core) at Fort Calhoun Station consists of an intake structure that collects cooling water from the water source (the Missouri River). The cooling water is used to remove heat from internal (contained) coolants and is then released directly back into the water source. Thermal-plume studies were initiated in the early days of the plant's operation and have recently been repeated at Fort Calhoun Station (OPPD 1976, EPA 2003). These studies examined the impact of discharging the heated water back into the water source and identified a thermal gradient that moves parallel to the shoreline of the Missouri River. This thermal gradient does not significantly impact gross ambient temperatures in the river. The maximum change in the temperature of the receiving water is regulated by the State of Nebraska under the Clean Water Act using National Pollution Discharge Elimination System (NPDES) permits.

At Fort Calhoun Station, the intake structure is a reinforced-concrete building that extends approximately 24 m (80 ft) along the bank of the Missouri River at river mile (rmi) 645.85. Most of the water withdrawn at the structure is used in the circulating-water system, which employs three pumps operating at 7571 L/s (2000 gal/s). The water in the circulating-water system removes heat from the main (turbine) condensers and other turbine plant-heat exchangers, which are used to cool turbine bearings, lubricating oil, and related equipment (OPPD 2002a).

Water is also withdrawn from the intake structure by the raw-water system, which provides once-through cooling water to component cooling-water-heat exchangers. This cooling water removes heat from various auxiliary systems, the spent fuel pool, ventilation equipment, pump

components, and other equipment. The raw-water system consists of four pumps; each pump has an operating capacity of 336 L/s (89 gal/s). During normal plant operations, only one pump operates, but two pumps may operate in the summer when ambient river temperatures are higher.

Water enters the intake structure through six separate inlet bays. Vertical trash screens or racks (steel bars placed approximately 8 cm [3 in.] apart) are placed on each inlet to prevent large debris from entering the system. Debris that accumulates on the trash racks is removed periodically by isolating the outer portion of the inlet bay and using the surface sluice system to backwash the racks. Approximately 3 m (9.8 ft) beyond the gates are traveling screens with a 1-cm (3/8-in.) mesh to prevent small debris from entering the system. Any debris that is washed from the traveling screens is then directed to a screen wash trough that discharges back to the river at the downstream end of the intake structure.

Water passing through the intake screens enters three pump cells with two inlet bays per cell. The pumps for both the circulating-water system and the raw-water system take suction from this area of the intake structure. The circulating-water-system pumps, transfer water from the pump cells to the intake tunnel and through the main condensers and turbine plant-heat exchangers. Side streams from the intake tunnel provide water for backwashing the trash racks and traveling screens and for operating the surface sluice system.

Under extreme low-flow conditions, the average velocity of intake water flowing through the sluice gate openings in the curtain walls is approximately 0.85 m/s (2.8 ft/s). The estimated average approach velocities to the traveling screens are 0.2 and 0.3 m/s (0.7 and 1.1 ft/s) at river surface elevations of 302 and 300 m (992 and 983 ft), respectively. These two river surfaces correspond to normal- and low-flow conditions in this reach of the Missouri River.

Once cooling water from the Missouri River passes through the main condensers and heat exchangers, the water is discharged from a below-grade, reinforced-concrete discharge tunnel that measures 10 by 4 m (33 by 14 ft). This tunnel is approximately 12 m (40 ft) downstream of the intake structure. The floor of the discharge structure protrudes an additional 8 m (25 ft) downstream to protect against riverbed scouring.

2.1.3.2 Auxiliary-Water Systems

Fort Calhoun Station uses groundwater (less than 6.3 L/s [100 gpm]) pumped from two onsite wells to provide makeup and flushing water for various components of the sewage-treatment system. These components include flushing the center-pivot irrigation systems for land-application of sewered waste water and maintaining adequate water levels in the two sanitary-

waste lagoons. Groundwater pumping for these purposes occurs on an irregular schedule that is relatively infrequent.

2.1.4 Radioactive-Waste Management Systems and Effluent-Control Systems

The OPPD uses liquid, gaseous, and solid radioactive-waste management systems to collect and process the liquid, gaseous, and solid wastes that are by-products of the operation of Fort Calhoun Station, Unit 1. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases to the environment within regulatory limits. The Fort Calhoun Station, Unit 1 waste-disposal system meets the design objectives of 10 CFR Part 50, Appendix I ("Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as Is Reasonably Achievable' for Radiological Material in Light-Water-Cooled Nuclear Power Reactor Effluents") and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes.

Radioactive material in the reactor coolant is the source of gaseous, liquid, and solid radioactive wastes in light-water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination.

Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids, and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant-design modifications and operations and routine maintenance activities. Solid wastes are shipped to a waste processor for volume reduction before disposal at a licensed burial site. Spent resins and filters are stored or packaged for shipment to a licensed offsite processing or disposal facility (OPPD 2001b).

Fuel rods that have exhausted a certain percentage of their fuel and that have been removed from the reactor core for disposal are called spent fuel. Fort Calhoun Station, Unit 1 currently operates on an 18-month refueling cycle. Spent fuel is stored onsite in the spent fuel pool in the auxiliary building adjacent to the containment building. Spent fuel has been stored at Fort Calhoun Station since 1973.

The *Offsite Dose Calculation Manual* (ODCM) describes the methods used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from Fort Calhoun Station, Unit 1 (OPPD 1999).

The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the following:

- The concentration of radioactive liquid effluents released from the site to the unrestricted area will not exceed 10 times the concentration specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 7.4 Bq/mL (2×10^{-4} μCi/mL).

- The dose or dose commitment to a member of the public from any radioactive materials in liquid effluents released to unrestricted areas shall be limited to the design objectives of 10 CFR Part 50, Appendix I: (1) less than or equal to 0.015 mSv (1.5 mrem) to the total body and less than or equal to 0.05 mSv (5 mrem) to any organ during any calendar quarter and (2) less than or equal to 0.03 mSv (3 mrem) to the total body and less than or equal to 0.1 mSv (10 mrem) to any organ during any calendar year.

- The air dose to areas at and beyond the site boundary due to noble gases in gaseous effluents shall be limited to the design objectives of 10 CFR Part 50, Appendix I, of less than or equal to 0.1 mGy (10 mrad) for gamma radiation and less than or equal to 0.2 mGy (20 mrad) for beta radiation during any calendar year.

- The dose to any individual or dose commitment to any organ of an individual in unrestricted areas due to the release of iodine-131, tritium, and radioactive materials in particulate form with half-lives greater than eight days (excluding noble gases) in airborne effluents shall not exceed 0.075 mSv (7.5 mrem) in any calendar quarter and 0.15 mSv (15 mrem) from all exposure pathways during any calendar year.

- The dose to any individual member of the public from the uranium fuel cycle (including Fort Calhoun Station nuclear facility operations) will not exceed the maximum limits of 40 CFR Part 190 (less than 0.25 mSv [25 mrem]) and 10 CFR Part 20 (5 mSv [500 mrem] in a year and 0.02 mSv [2 mrem] in any hour).

2.1.4.1 Liquid-Waste Processing Systems and Effluent Controls

Potentially radioactive liquid wastes originating from the reactor coolant liquids, auxiliary-systems process wastes, and hotel wastes (laundry and shower drains) are collected in waste-drain tanks located in the containment building and the auxiliary building. (OPPD 1999). In the radioactive waste processing building, liquid wastes can then be processed through a charcoal filter and a demineralizer system, which remove most radioactive materials and dissolved solids. Hotel wastes can also be processed through the filters and demineralizer if necessary. The processed liquid waste is collected in one of two liquid-waste monitoring tanks and is

sampled before being released to the overboard header. The overboard header is the only path through which liquid radioactive waste from the plant can be released to the environment. Releases from the overboard header enter the condenser-circulating-water-discharge tunnel downstream of the warm-water recirculation return. The overboard header is equipped with a radiation monitor that will interrupt the flow if the waste activity reaches a predetermined set point (OPPD 2001b).

Potentially radioactive liquid wastes can also be generated from steam-generator blowdown. The steam generators are located in the containment building. Blowdown wastes from the steam generators are discharged directly to the raw water system and then to the circulating-water-discharge tunnel. There are two radiation monitors that control liquid effluent releases from the steam-generator blowdown. If a high alarm set point is reached on either monitor, the blowdown isolation valves are automatically closed.

The ODCM prescribes the alarm/trip set points for the liquid-effluent radiation monitors. There are three liquid-effluent radiation monitors for the two potentially radioactive liquid-waste discharge pathways at Fort Calhoun Station. The alarm/trip set point for each liquid-effluent monitor is based on the radioactivity measurements in a batch of liquid to be released or in the continuous liquid discharge (OPPD 1999).

During 2001, there was a total volume of 1.66×10^8 L (4.39×10^7 gal) of liquid waste released prior to dilution (OPPD 2002c). In this liquid waste, there was a total fission and activation product activity of 0.02 TBq (0.56 Ci) and a total tritium activity of 6.43 TBq (175 Ci). These volumes and activities are typical of past years. The actual liquid waste generated is reported in the *Annual Radioactive Effluent Release Report for the Fort Calhoun Station Unit 1* (OPPD 2002c). See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

The OPPD does not anticipate any increase in liquid-waste releases during the renewal period.

2.1.4.2 Gaseous-Waste Processing Systems and Effluent Controls

There are three air effluent-discharge pathways at Fort Calhoun Station, Unit 1: the condenser off-gas, the laboratory (CARP facility) and RWPB exhaust stack, and the auxiliary building exhaust stack (OPPD 1999). Condenser off-gases originate from operations in the turbine building. Chemistry laboratories and various waste operations vent through the laboratory and the RWPB. The auxiliary building exhaust stack receives discharges from the waste-gas decay tanks, containment purge, containment-vent systems, and the auxiliary building ventilation system.

Radioactive waste gases are normally present in trace amounts in reactor coolant liquids. These gases are collected, compressed, stored, analyzed, and monitored in the airborne radioactive-waste disposal system. Waste gases are collected in a vent header. Two waste-gas compressors take suction from the vent header, compress the gas, and then deliver it to one of the four gas-decay tanks. Waste gases collected in the waste-gas-decay tanks include hydrogen, nitrogen, particulates, and fission product gases (i.e., xenon and krypton) (OPPD 2001b). The contents of a filled decay tank are analyzed to determine whether a batch of waste gas must be retained to permit radioactive decay or whether it is suitable for controlled release to the atmosphere. Prior to release, waste gases are passed through high-efficiency particulate air (HEPA) filters and charcoal absorbers so that particulates and iodines in the waste gases are removed before the waste gases enter the auxiliary building ventilation stack. Once these gases are released to the ventilation stack, the gases are mixed with dilution air and can be combined with gases from other pathways. A radiation recorder-controller monitors the auxiliary building ventilation-system exhaust for gaseous activity and automatically closes a control valve in the gas discharge header upon detecting a high-activity reading.

There may be small amounts of radioactive gases in the work spaces in the containment, auxiliary, CARP, and radioactive-waste-processing buildings. However, the concentrations are too dilute and the volumes of carrier gases are too large to permit collection. The amounts of radioactivity released in low-concentration waste gas are known, measured, and recorded.

Radioactive gaseous wastes from Fort Calhoun Station, Unit 1 are released through three monitored release points. These release points are continuously monitored for noble gases, and radioiodines and particulate activity, as appropriate (OPPD 1999). Two radiation-monitoring systems provide noble-gas monitoring and iodine-and-particulate sampling for the auxiliary building exhaust stack. The laboratory and the RWPB has one monitoring system for noble gases, particulates, and iodine. The condenser off-gas has one monitor for noble-gas activity only. These release points are continuously monitored, and the ODCM prescribes alarm/trip set points for these monitors. The auxiliary building and condenser off-gas monitoring systems provide alarms and automatic closure of the release path when radiation levels exceed a preset level, thereby terminating discharge (OPPD 1999). The laboratory and the RWPB monitoring systems provide alarms only.

During 2001, there was a total fission and activation-gas activity of 122 TBq (3330 Ci), a total iodine activity of 2.46×10^{-4} TBq (6.71×10^{-3} Ci), a total particulate activity of 9.63×10^{-8} TBq (2.63×10^{-6} Ci), and a total tritium activity of 0.05 TBq (1.45 Ci) released from Fort Calhoun Station (OPPD 2002c). These releases are typical of past years. The actual gaseous waste generated is reported in the *Annual Radiological Effluent Release Report for Fort Calhoun*

Station Unit 1 (OPPD 2002c). See Section 2.2.7 of this SEIS for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases. The OPPD does not anticipate any increase in gaseous releases during the renewal period.

2.1.4.3 Solid-Waste Processing

Solid wastes from Fort Calhoun Station consist of spent process resins, used waste and process filters, dewatered ion-exchange and filtration media, and miscellaneous materials from station and radioactive-waste facility operation and maintenance (OPPD 2001b). Spent resin from the filtration/ion-exchange system is sluiced to a high-integrity container (HIC) that is stored and eventually shipped for disposal. Used filters are placed in a shielded container, stored in the cask decontamination area, and eventually shipped offsite. Miscellaneous solid wastes, such as equipment parts, laboratory glassware, clothing, tools, and rags, are stored prior to offsite shipment (OPPD 2001b). The solid-waste system is normally operated on a batch basis. The RWPB is sized to accumulate a number of containers (e.g., liners, drums, HICs) to permit the scheduling of offsite shipments (OPPD 2001b).

Solid wastes from Fort Calhoun Station are either shipped directly to an offsite, licensed disposal facility (e.g., spent resins) or consigned to a licensed processing facility for volume-reduction and decontamination activities (e.g., compactible trash). Any material that remains after volume reduction is transported by the processing facility to a final disposal facility, depending on the activity limits.

Disposal and transportation of solid wastes are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There are no releases to the environment from radioactive solid wastes generated at Fort Calhoun Station.

In 2001, Fort Calhoun Station made 1 shipment of Type A solid wastes (e.g., spent resins or filter sludges) and 34 shipments of Type B solid wastes (e.g., dry compressible, contaminated equipment, etc.) with a total volume of 21.8 m^3 (771 ft^3) and a total activity of 26.7 TBq (729 Ci) (OPPD 2002c). These shipments are representative of the shipments made in the past several years and are not expected to change appreciably during the license renewal period.

2.1.5 Nonradioactive-Waste Systems

The principal nonradioactive wastes from Fort Calhoun Station consist of chemical (hazardous and nonhazardous) wastes, lubrication-oil wastes, and sanitary wastes. Fort Calhoun Station operates its own sanitary-waste lagoons to collect and treat sanitary wastes generated at the plant. The lagoons are located southeast of the main plant complex. Treated waste water from the lagoons is land-applied onsite using a center-pivot irrigation system. Effluent discharges of

treated waste water, irrigation water from the center-pivot system, and overflow from the sanitary-waste lagoons are permitted by NPDES Permit NE0000418 issued by the Nebraska Department of Environmental Quality (NDEQ) for Fort Calhoun Station.

The sanitary-waste lagoons are lined with an impermeable 60-mm polyethylene geomembrane. The lining impedes the leaching of waste water in the lagoons into groundwater. Solid wastes from the sanitary-waste lagoons do not need to be removed regularly; however, if disposal becomes necessary, provisions for disposing solid wastes from the lagoons have been provided by the NDEQ in the NPDES Permit NE0000418.

The small quantities of chemical wastes that are produced at Fort Calhoun Station are disposed of properly according to State and Federal regulations. Other nonradioactive wastes are either recycled or disposed of under contract with waste-management companies. For example, spent batteries and fluorescent light bulbs are recycled, and lubrication oils used in the plant are taken to other OPPD facilities to be burned in fossil-fuel power plants.

A small landfill exists onsite just west of the sanitary-waste lagoons. This closed landfill (no longer in use) contains only materials from previous water-purification activities occurring at Fort Calhoun Station. When the water-purification facility was shut down, the material from two evaporation ponds was buried in the landfill. Groundwater-monitoring wells have been placed on each side of the landfill (four wells total) to monitor any leaching of the landfill into the groundwater. Data from the groundwater wells provides no evidence that groundwater chemistry has been influenced by the materials in the landfill (Hutchens 2001).

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear power plant. Maintenance activities conducted at Fort Calhoun Station, Unit 1 include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. The OPPD refuels Fort Calhoun Station, Unit 1 at 18-month intervals. During refueling outages, site employment increases by as many as 600 workers for temporary duty (typically, 30 to 40 days). The OPPD provided an appendix (Appendix A) in the *Updated Safety Analysis Report* (OPPD 2001b) regarding the aging management review to manage the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. The Fort Calhoun Station, Unit 1 license renewal application describes the programs and activities that will manage the effects of aging during the license renewal period. The OPPD expects to conduct the activities related to the

management of aging effects during plant operation or normal refueling and other outages, but the OPPD does not plan any outages specifically for the purpose of refurbishment. The OPPD has no plans to significantly add additional full-time staff (non-outage workers) at the plant during the period of the renewed licenses.

2.1.7 Power Transmission System

The transmission corridor of concern for license renewal is the corridor that was constructed between the plant switchyard and its connection to the existing transmission system. Thus, the only transmission line subject to review under this application for license renewal is Line 74S/74, which was originally constructed in connection with Fort Calhoun Station, Unit 1. According to the OPPD Environmental Report (ER; OPPD 2002a), three transmission lines were installed and connected to the Fort Calhoun Station, Unit 1 switchyard, which was designated by the OPPD as Substation 3451/1251 as a direct result of the construction, startup, and operation of Fort Calhoun Station, Unit 1. These transmission lines were evaluated by the U.S. Atomic Energy Commission (AEC) in its permit review for continued construction and operation of the plant (AEC 1972).

The first line is approximately 0.4 km (0.25 mi) of single-circuit 161-kV line from the Fort Calhoun Station Substation to the Fort Calhoun Station plant; the second line is approximately 0.8 km (0.5 mi) of 345-kV line from the Fort Calhoun Station generator/main transformer to the Fort Calhoun Station Substation. These transmission lines, which were installed for plant startup use and have not been modified since the initial plant construction, lie entirely on developed portions of Fort Calhoun Station. The third line is approximately 11 km (7 mi) of 161-kV line from the Fort Calhoun Station Substation westward to Substation 1226, approximately 5 km (3 mi) west of Blair, Nebraska (Line 74S, a 0.8-km-long [0.5-mi-long] single-circuit line on a 15-m-wide [50-ft-wide] right-of-way, connects to Line 74, a 10-km-long [6.5-mi-long] double-circuit line on a 30-m-wide (100-ft-wide) right-of-way to Substation 1226). This line was originally constructed in 1969 and provided a connection to the transmission grid once the plant became operational. The line was entirely reconstructed in February 1999 to single steel poles and to the 1997 National Electrical Safety Code (NESC) requirements that were in effect at the time. Leaving the Fort Calhoun Station Substation and leading west, this 161-kV line (Line 74S/74) traverses (for approximately 1.6 km [1 mi]) disturbed shrub lands and woodlands, primarily on the hilly upland terrain of the Missouri River bluffs in the vicinity of U.S. Highway 75. For the remaining 10 km (6 mi) or so to the Blair Substation, this line is routed across agricultural cropland. The line crosses several small intermittent streams, but no other surface waters or wetlands were encountered on the right-of-way when it was rebuilt in 1999. Land use adjacent to the right-of-way has undergone little change since initial construction; however, some additional development has occurred along U.S. Highway 30 near the line crossing, and new rural residential development has occurred along the north side of line for approximately 1.2 km (0.75 mi) in the bluff area just west of U.S. Highway 75 (OPPD 2002a).

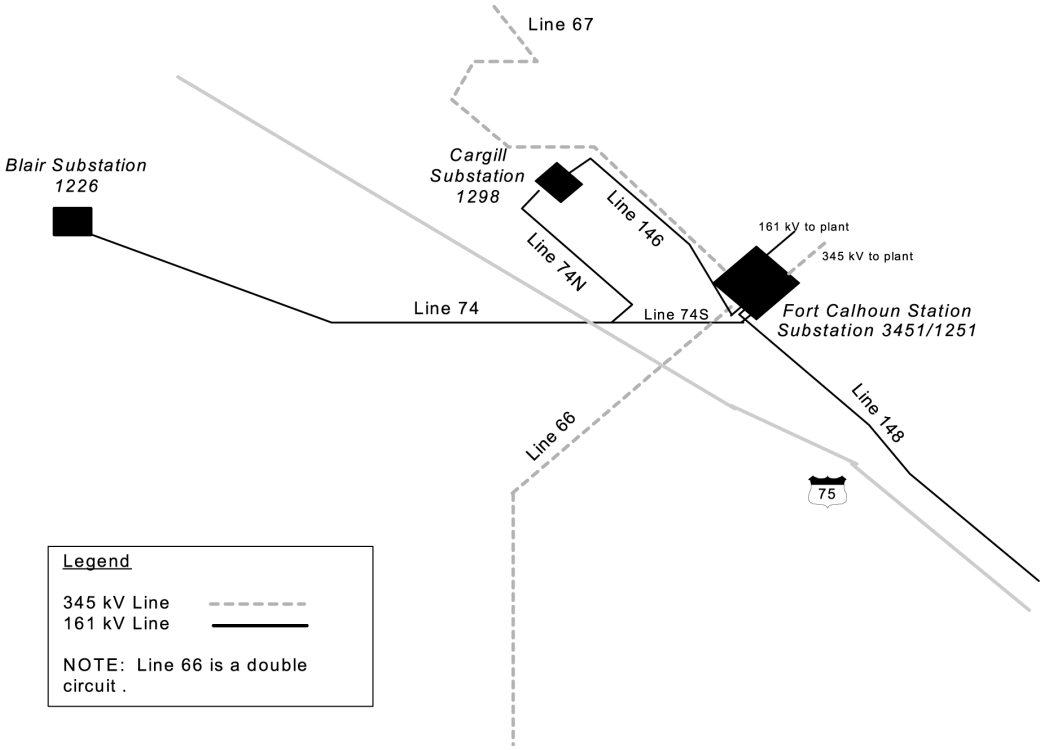
The transmission line originally constructed in connection with Fort Calhoun Station, Unit 1 (Line 74S/74) covers approximately 33 ha (82 ac) over a total corridor length of approximately 11 km (7 mi; Figure 2-4 and Table 2-1). The OPPD makes annual flight inspections of its transmission line right-of-way to ensure nonencroachment by vegetation. Vegetation control within the transmission line right-of-way is performed every three years to ensure the continued reliability of the lines. Vegetation control includes removing or trimming woody vegetation to ensure adequate line clearance and to allow vehicular access along the right-of-way. Large woody vegetation that can interfere with conductors is mechanically trimmed or removed, and stumps are treated with approved herbicides. Small woody vegetation is manually removed or controlled by basally applying approved herbicides. Low-growing woody vegetation, including sumac, chokecherry, and wild plum, that is important wildlife food is only trimmed or removed if needed for vehicular access. The OPPD does not mow vegetation or use broadcast herbicides. The OPPD also does not use herbicides in or near wetlands or stream crossings. All herbicide applicators must be certified in accordance with Nebraska Pesticide Regulations in the Nebraska Administrative Code, Title 25, Chapter 2 (OPPD 2002a).

Table 2-1. Fort Calhoun Station Transmission-Line Corridor

Substation	Number of Lines	kV	Approximate Distance		Right-of-Way Width		Right-of-Way Area	
			km	(mi)	m	(ft)	ha	(ac)
Fort Calhoun Station	1	161	10	(6.5)	30.5	(100)	32	79
Substation 3451/1251			1	(0.5)	15.2	(50)	1	3
Total	1	161	11	7			33	82

Source: OPPD 2002a

Figure 2-4. Fort Calhoun Station, Unit 1 Transmission Lines



2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Fort Calhoun Station as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts on other Federal project activities.

2.2.1 Land Use

Fort Calhoun Station is located in Washington County, Nebraska, on the southwestern bank of the Missouri River, approximately 31 km (19 mi) north-northwest of downtown Omaha, Nebraska; 16 km (10 mi) north of the Omaha metropolitan area; 10 km (6 mi) southeast of Blair, Nebraska; and 8 km (5 mi) north of Fort Calhoun, Nebraska. Blair is the county seat of Washington County.

Fort Calhoun Station consists of 267 ha (660 ac) of land. Approximately 55 ha (135 ac) of the site is occupied by plant facilities or is maintained as part of the plant operations, including the power-generation and ancillary facilities, switchyard, maintenance area, administration building, training building, firing range (for security staff), meteorological tower, closed water-treatment sludge landfill, parking areas, roadways, and sanitary-waste lagoons and associated areas used to land-apply treated effluent from the lagoons. All industrial facilities associated with the site are located in Washington County, Nebraska. Of the remaining land, approximately 140 ha (345 ac) is cropland, which is leased by the OPPD to local farmers, and the remaining land (approximately 73 ha [180 ac]) contains natural vegetation, drainage courses, and a railroad spur on a right-of-way easement to the Union Pacific Railroad. The OPPD also holds perpetual easements on an additional 244 ha (604 ac), which consists of cropland and natural vegetation. Most of this additional land is located across the Missouri River in Harrison County, Iowa (OPPD 2002a).

Fort Calhoun Station is not in an incorporated area of Washington County. There are no land-use or zoning restrictions applicable to land within unincorporated portions of Washington County.

2.2.2 Water Use

The maximum water withdrawal from the Missouri River into the intakes of the once-through cooling system during normal operation is approximately 23 m^3/s (827 ft^3/s). At the average lowest-flow conditions in the Missouri River from 1967 to 2000 (occurring in January), this would

amount to approximately 4 percent of the river flow. In the average highest-flow period (occurring in June), this intake volume accounts for 2 percent of the Missouri River flow. Aside from minor losses to evaporation, the entire volume of water that is withdrawn from the Missouri River at the intake structure is subsequently returned to the river at a small distance downstream. In addition, the once-through cooling water system at Fort Calhoun Station does not have cooling towers, so any water losses through evaporation are minimal.

Fort Calhoun Station uses approximately 38 million L (10 million gal) per month of filtered, chlorinated water from the City of Blair Municipal Water System for potable water, service water, and other uses. The principal uses of this water include the following:

- Potable water and water for the fire-protection system in the administration building and training center.

- Feed water to the vendor-owned reverse-osmosis unit in the old warehouse building. This system replaced the plant's original deionized-water system and supplies demineralized water for various plant uses, including makeup water to the reactor's primary and secondary water systems, spent fuel pool, stator cooling-water system, and auxiliary boiler. Brine generated from reverse osmosis is pumped to the circulating-water-system discharge tunnel and is discharged in accordance with the NPDES permit.

- Makeup water to the plant's potable-water-storage tank in the auxiliary building. Water from this tank supplies potable water to buildings in the protected area and the old warehouse building and provides a backup source of seal water to the circulating-water and raw-water systems.

- Supply to the service water system, which provides seal water to the circulating-water, raw-water, and screen-wash pumps in the intake structure; water for the vacuum-priming pumps in the turbine building; and water for pressurizing the fire main header via the fire-protection jockey pump.

2.2.3 Water Quality

In a noncontact cooling system such as the one in place at Fort Calhoun Station, the cooling water is self-contained and does not come into direct contact with the reactor core. In addition, this type of cooling system does not discharge water that has been in contact with contaminants. Therefore, potential sources of pollution from a noncontact cooling system include high-temperature water discharges; heavy metal leaching from condenser piping; and biocides, which are added to cooling water to control the buildup of microbial biomass. At Fort Calhoun Station, the use of biocide has been unnecessary so far. In addition, the general potential for heavy metal leaching from condenser piping has been examined in the GEIS and

has been deemed to be a small Category 1 impact. Therefore, the applicable issue to Fort Calhoun Station is the change in temperature of the receiving waters that is caused by discharges from the once-through cooling system.

Additional water-quality issues may arise from the discharge of cooling water. The energy from the discharges can potentially mobilize sediments that can then negatively impact water quality. In addition, because the water source of Fort Calhoun Station is the highly managed Missouri River, additional issues related to channel dredging and bank stability are potential sources of sediment resuspension and are discussed in Chapter 4.

The cooling-water circulation system is operated in compliance with provisions of NPDES Permit NE0000418 for Fort Calhoun Station. The permit currently limits discharge temperatures to 43.3 °C (110 °F) and allows a conditional discharge temperature of 44.4 °C (112 °F) under the terms of a Consent Order that was entered into by the OPPD and the NDEQ (OPPD 2002a). The terms of the Consent Order allow for continued full-power operation of Fort Calhoun Station during the unusually high ambient river temperatures that have been experienced in the Missouri River in recent years. The NPDES permit also limits the use and discharge of chlorine for biofouling control in the once-through cooling-water systems. However, as mentioned previously, the relatively high background suspended-sediment levels in the river water have been effective in preventing biofouling, and, to date, no biocide applications have been necessary. The OPPD may require chlorination or other methods of control in the future if biofouling organisms, such as zebra mussels, become established in the Missouri River at Fort Calhoun Station and interfere with plant operations.

The temperature of the cooling water flowing through the main condensers is increased by approximately 13 °C (23 °F) at the current, authorized maximum power level of 1500 MW(t). Therefore, at the maximum water withdrawal and temperature changes discussed in Section 2.2.2 of this supplemental environmental impact statement (SEIS) and at discharge temperatures below the permitted 44.4 °C (112 °F) (NPDES Permit NE0000418), the maximum change in the temperature of the Missouri River receiving waters would be on average approximately 0.5 °C (0.9 °F) in a turbulent mixing system. During the winter, the total change in temperature may be greater as the upstream discharge of cooling water is performed to prevent icing of the intake structure. Under normal winter operating conditions, the total change in temperature may be as high as 18 °C (32 °F) between the intake and discharge of the cooling waters.

There are 10 discharges and monitoring points of compliance permitted by the NDEQ under NPDES Permit NE0000418 for Fort Calhoun Station. These include cooling-water intake and outfall (effluent point), low-volume waste from the water-treatment plant, effluent from the screen-backwash and surface-spray system, the upstream warm-water recirculation system for deicing, the condensation tank, the sanitary-waste lagoons, lagoon discharges, discharges from

the land-application system, and storm-water runoff discharges. Specific monitoring and reporting requirements are listed in the NPDES permit for Fort Calhoun Station and are regulated by the NDEQ.

The impacts of sediment scouring at cooling-system discharge structures have been examined in the GEIS and have been determined to be of small to moderate impact. The reach of the Missouri River in the vicinity of Fort Calhoun Station is regularly dredged by the USACE as required to maintain the depth needed for navigating large ships. The OPPD occasionally obtains permission from the USACE to dredge sand and other accumulated riverbed materials from the front of the intake structure. This was last performed in approximately 1990. As a result, the small amount of disturbed material that is taken from the front of the Fort Calhoun Station intake structure is considered to have a negligible impact on water quality.

2.2.4 Air Quality

Fort Calhoun Station, which has a continental climate, is located midway between the humid eastern and dry western climatic zones. The weather at any time may be typical of either of these zones, or it may represent a combination of the zones. Rapid changes in the weather are common, especially during the winter. Climatological records for Omaha (North), Nebraska, which is about 18 km (11 mi) south-southeast, are generally representative of Fort Calhoun Station. These records indicate that the normal daily maximum temperatures for Omaha range from about –1 °C (30 °F) in January to a high of about 31 °C (87 °F) in July. Normal minimum temperatures range from about –12 °C (11 °F) in January to about 19 °C (66 °F) in July.

The average precipitation is about 74 cm (29 in.) per year. Of this total, about 60 cm (24 in.) falls in evening showers or thundershowers during the growing season (March through September). Although thunderstorms have occurred in all months in the area, almost 90 percent of the thunderstorms occur from April through September, with thunderstorms on an average of more than 8 days per month in June, July, and August (OPPD 2002a). Based on statistics for the 30 years from 1954 through 1983 (Ramsdell and Andrews 1986), the probability of a tornado striking the site is expected to be about 9×10^{-4} per year.

Wind-energy potential is generally rated on a scale of 1 through 7. Areas suitable for wind-turbine applications have a rating of 3 or higher. The wind-energy potential in the immediate vicinity of Fort Calhoun Station, which has a rating of 2, may not be suitable for wind-energy applications. However, the annual average wind-energy resource in most of Nebraska and Iowa is rated 3 (Elliott et al. 1986) and is generally suitable for generating electricity.

Fort Calhoun Station is located within the Nebraska Intrastate Air Quality Control Region (AQCR). In addition, portions of the Metropolitan Omaha–Council Bluffs Interstate AQCR, the Metropolitan Sioux City Interstate AQCR, the Lincoln–Beatrice–Fairbury Intrastate AQCR, and

the Southwest Iowa Intrastate AQCR are found within 80 km (50 mi) of Fort Calhoun Station. The air quality in these regions is designated as better than national standards, in attainment, or unclassified for all criteria pollutants in 40 CFR 81.316 and 40 CFR 81.328. There are no mandatory Class I Federal areas in which visibility is an important value designated in 40 CFR Part 81 within 160 km (100 mi) of Fort Calhoun Station.

Diesel generators, boilers, and other activities and facilities associated with Fort Calhoun Station emit various pollutants. Emissions from these sources are lower than emission thresholds in Nebraska and Federal air-quality regulations. Therefore, Fort Calhoun Station is not required to have any air-quality permits.

2.2.5 Aquatic Resources

The aquatic resources in the vicinity of Fort Calhoun Station are associated with the Missouri River. The species composition of the fish community in this reach of the river has changed significantly (due to channelization) from the 1973 to 1977 fish studies associated with the initial licensing of Fort Calhoun Station and its operations.

Fort Calhoun Station is located on the Missouri River approximately at river kilometer (rkm) 1040 (rmi 646). The river at the site is approximately 182 m (600 ft) wide and 4.5m (15 ft) deep. A continuous rock revetment protects the cutting bank for several kilometers (miles) upstream of the plant and approximately 1.6 km (1 mi) downstream. Filling dikes are spaced along the inside of the river bend opposite the plant, providing the only shallow riverine habitat at the site. Habitat is limited for many species due to the channelization of this river reach. As noted by the NRC, slack-water areas behind wing dams, filling dams, and sloughs and stable structures, such as dikes and revetments, probably constitute the majority of suitable habitat for aquatic biota in the site vicinity (NRC 1978).

Average Missouri River flow rates taken at the gaging station in Omaha, Nebraska, for the period between 1967 and 2000 provide an approximation of river-flow conditions at Fort Calhoun Station. River flows for the month of August were used to calculate the maximum percentage of water intake of Fort Calhoun Station, Unit 1 during a period when spawning and larvae migration is most likely (i.e., summer). August has the lowest average river flows of the summer months and provides a conservative estimate. The lowest average river flows during the year occur in January; therefore, the percentage of water intake calculated for this month represents the maximum Fort Calhoun Station, Unit 1 intake that potentially may occur.

The monthly average river flow rate in August is 1209 m^3/s (42,679 ft^3/s) with a minimum flow rate of 861 m^3/s (30,409 ft^3/s). The maximum water intake by Fort Calhoun Station, Unit 1 during normal plant operations is 23 m^3/s (827 ft^3/s) and occurs during the summer due to higher river temperatures. This maximum water intake represents approximately 2 percent of

the monthly average and 2.8 percent of the minimum river flow in August. During January, the month with the lowest average river flows annually, the monthly average river flow rate is 594 m^3/s (20,982 ft^3/s) with a minimum river flow rate of 313 m^3/s (11,060 ft^3/s). The normal water intake for Fort Calhoun Station, Unit 1 represents approximately 3.9 percent of the average and 7 percent of the minimum monthly river flow during this winter month (OPPD 2002a).

The lower reaches of Long Creek downstream from U.S. Highway 75 and the North and South Sloughs, which are hydraulically connected to the Missouri River, provide slack-water areas on and adjacent to the site during high-water periods. These areas offer some spawning, nursery, and resting habitat for fish from the Missouri River. Fish Creek, a small tributary that outfalls into the Missouri River on the Fort Calhoun Station site, provides little available aquatic habitat due to channelization, small size, and intermittent flow. Portions of the North and South Sloughs support wetland vegetation (OPPD 2002a).

Fish monitoring in the Missouri River, which was conducted in the 1970s by the OPPD and others as part of a comprehensive examination of the effects of power plants (including Fort Calhoun Station), showed that the primary recruitment sources of larval fish to the channelized Missouri River are Lewis and Clark Lake; the unchannelized Missouri River from Yankton, South Dakota, to Sioux City, Iowa; and tributaries. Freshwater drum (*Aplodinotus grunniens*), catostomids, cyprinids, and carp (*Cyprinus carpio*) dominated (greater than 94 percent) the larval drift. Other taxa collected and considered common were the gizzard shad (*Dorosoma cepedianum*), goldeye (*Hiodon alsoides*), and *Stizostedion* sp. (sauger and walleye) (Hergenrader et al. 1982). Field studies conducted at Fort Calhoun Station and the Cooper Nuclear Station indicate that the seasonal highest abundance of fish larvae in the Missouri River occurs from May to July.

Larvae from 13 species were collected from the Missouri River at Fort Calhoun Station. Of the collected larvae, 69 percent were freshwater drum and river carpsucker (*Carpiodes carpio*) (NRC 1978, Section 2.7.2.7). Results of studies reported by the OPPD in connection with the proposed Fort Calhoun Station Unit 2 in the mid-1970s indicated the presence of 64 species of fish in the Missouri River and tributaries near Fort Calhoun Station (NRC 1978, Section 2.7.2.6). Of these species, 23 (36 percent) were selected as important because of their commercial or recreational value; dominance in the ecosystem; or status determination as a rare, endangered, or otherwise threatened species. As the NRC summarized in the *Unit 2 Final Environmental Statement*, common carp, freshwater drum, gizzard shad, and river carpsucker were consistently the most abundant species collected (NRC 1978, Section 2.7.2.6). Hesse et al. (1982) reported the collection of 57 species of fish from the Missouri River (Sioux City, Iowa, to Rulo, Nebraska), of which 17.8 percent were game species, 33.9 percent were nongame species, and 48.3 percent were forage species. The 10 most abundant species collected near Fort Calhoun Station by electroshocking and seining were the gizzard shad, goldeye, carp,

western silvery minnow (*Hybognathus argyritis*), silver chub (*Macrhybopsis storeriana*), emerald shiner (*Notropis atherinoides*), river shiner (*N. blennius*), red shiner (*Cyprinella lutrensis*), river carpsucker, and freshwater drum (Hesse et al. 1982).

Independent of the above studies, an Environmental Assessment issued in 2001 by the U.S. Fish and Wildlife Service (FWS) for the DeSoto National Wildlife Refuge, which is immediately downriver from Fort Calhoun Station, reports that 54 species may be found in the DeSoto Bend reach of the Missouri River based on 30 years of survey data obtained from the Nebraska Game and Parks Commission (FWS 2001a). All but five of the species reported by the FWS were also collected during the monitoring studies of the 1970s discussed above (NRC 1978). The five species not collected as part of Fort Calhoun Station studies were either introduced, difficult to sample for, or unsuited to riverine habitats available in the site vicinity.

Notable recent investigations of lower Missouri River fish populations include those Hesse reported in 1993 and 1994 (Hesse 1993; Hesse and Mestl 1993; Hesse 1994a; Hesse 1994b; Hesse 1994c; Hesse 1994d). The investigators assessed the status of 13 selected fish species in the entire Missouri River reach bordering Nebraska, including the paddlefish (*Polydon spathula*), burbot (*Lota lota*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), blue catfish (*I. furcatus*), sicklefin chub (*M. meeki*), sturgeon chub (*M. gelida*), silver chub (*M. storeriana*), speckled chub (*M. aestivalis*), flathead chub (*Platygobio gracilis*), plains minnow (*H. placitus*), western silvery minnow, and sauger (*Stizostedion canadense*). Twenty-two years of sampling data in the Missouri River (1971 to 1992) were evaluated and presented for the selected species. The focus of the research centered on data regarding the absolute and relative abundance and commercial and recreational harvest.

In the 1993 to 1994 studies, Hesse reports that the decline in the abundance of five of the species investigated—the channel catfish, flathead catfish, blue catfish, sauger, and paddlefish—was evident in historical commercial-harvest records, creel surveys, and fishery survey data collected from 1971 to 1992. Commercial and recreational harvest of these five species was one of the factors cited in the studies as responsible for the observed decline in their populations. However, the studies also characterized all of these fish species as being adapted for survival in large unaltered rivers, and the predominant factor for their decline was identified as the loss of suitable habitat, primarily due to channelization and impoundment of the river with the consequent loss of seasonal flood pulses, altered temperature regimes, and loss of nutrient loadings from bordering floodplains.

The remaining eight species investigated by Hesse (the burbot, sicklefin chub, sturgeon chub, silver chub, speckled chub, flathead chub, plains minnow, and western silvery minnow) also exhibited declines in abundance upon examination of the 22 years of Missouri River fishery survey data (Hesse 1993; Hesse 1994c). Only the burbot was subject to a minor recreational fishery and was generally considered an incidental catch to the targeted fish species. All of

these species are representative and indigenous to large unchannelized rivers. Again, the decline in abundance, as found in the fishery surveys, was attributed to the loss of habitat resulting from channelization, impoundment of the river, loss of seasonal flood pulses, altered temperature regimes due to impoundment, and loss of nutrient loading from the floodplains.

The commercial harvest of channel catfish, flathead catfish, and blue catfish from the Missouri River was banned in 1992 due to the overharvest of recruitment-size individuals. However, the commercial harvest of the common carp and buffalo fish (*Ictiobus* spp.) from the Missouri River still continues, with the State of Nebraska issuing 80 to 90 Missouri River Commercial Seining Vendor Permits annually for nonbanned species (OPPD 2002a). In 2001, 96 of these permits were issued.[(a)] The recreational harvest of the three species of catfish from the Missouri River also continues to represent a valuable resource to the State of Nebraska.

Aquatic species that have been listed; that have been proposed for listing; or that are candidates for listing by the FWS, the State of Iowa, or the State of Nebraska and that have the potential to occur in the vicinity of Fort Calhoun Station are presented in Table 2-2.

Table 2-2. Federally Listed and Nebraska and Iowa State-Listed Aquatic Species Potentially Occurring in Washington, Douglas, Harrison, and Pottawattamie Counties

Scientific Name	Common Name	Federal Status	Nebraska Status	Iowa Status
Scaphirhynchus albus	pallid sturgeon	E	E	E
Acipenser fulvescens	lake sturgeon	—	T	E
Macrhybopsis gelida	sturgeon chub	—	T	—
Lota lota	burbot	—	—	T
Ichthyomyzon castaneus	chestnut lamprey	—	—	T
Etheostoma spectabile	orangethroat darter	—	—	T

E = Endangered; T = Threatened; — = Not listed or protected (or does not occur in the state)

Source: Brandrup (2002); Godberson (2002)

There are six listed fish species that could occur in the vicinity of Fort Calhoun Station. Of these species, the pallid sturgeon (endangered) is Federally listed and is protected under the Endangered Species Act (ESA). No designated critical habitat exists for any of the listed species on or in the vicinity of Fort Calhoun Station. No aquatic species in the area is proposed for listing or is a candidate for listing.

(a) Personal communication with Nebraska Game and Parks Commission, November 22, 2002.

Of all of the designated endangered or threatened species currently listed for Nebraska and Iowa (NGPC 2000; IDNR 2001b), only six fish species are considered to be representative of species indigenous to the Missouri River. However, because of channelization and main-stem dam construction, their habitat requirements have not been adequately met in the middle Missouri River. The NGPC specifically cites alterations to the natural hydrography, channelization, and flow depletions as reasons for the decline of all three of these species (OPPD 2002a). The FWS has issued a Biological Opinion that includes recommendations for changing the flow regime in the Missouri River (FWS 2000). These FWS recommendations are included as options by the USACE (2001) in its *Missouri River Master Water Control Manual Review and Update Revised Draft Environmental Impact Statement*. If implemented, these recommendations may improve the status of these species in the river. The six representative species are discussed in more detail as follows:

The pallid sturgeon was originally listed as endangered throughout its entire range by the FWS in 1990 due to a rapidly declining population (55 FR 36641 [FWS 1990]). The species continues to decline and is nearly extirpated from large segments of its former range and is only occasionally observed (FWS 2000). The pallid sturgeon's historic range encompassed 5633 rkm (3500 rmi) and was comprised of the Yellowstone, Missouri, middle and lower Mississippi Rivers, and the lower reaches of their major tributaries (i.e., the Platte and Kansas Rivers) (55 FR 36641 [FWS 1990]; FWS 2000). It is one of the largest fish species in the Missouri River, and grows to a length of over 1.8 m (6 ft), attains a weight of 45 kg (100 lbs), and has a lifespan of 60 years (55 FR 36641 [FWS 1990]; FWS 2000). This slow-growing and late-maturing species has a flattened shovel-shaped snout, bony plates, and a long reptile-like tail (FWS 2002).

This fish is often found near confluences, islands, and at the downstream end of sandbars (Harms 2001). It is believed that this fish spends some time in the Missouri River and returns to the Platte River annually to spawn or possibly overwinter. Approximately 511 pallid sturgeons were stocked in the Platte River in 1997 and 1998. The Platte River joins the Missouri River approximately 81 rkm (50 rmi) downstream of Fort Calhoun Station.

Human activities have modified or eliminated most of the habitat and ecosystem conditions in the Missouri River to which the pallid sturgeon is adapted. The Missouri River underwent extensive modification resulting in 36 percent of its habitat inundated with reservoirs, 40 percent channelized, and 24 percent altered due to dam operations (FWS 2000). The FCS site is located within a reach of the Missouri River that has been channelized, with a relatively uniform width and swift current. This channel degradation results in a reduction of sediment and organic matter, flow modifications, and channel narrowing. These conditions result in unfavorable habitat for the pallid sturgeon. With the current overall water management regime of the Missouri River (i.e., without increased flows and with warmer water temperatures,

between June and July), it is believed that the cues for spawning are no longer present (FWS 2000).

Like the pallid sturgeon, the lake sturgeon was once common in the Missouri River. The lake sturgeon is now rare in Nebraska (threatened) and Iowa (endangered), but it is common in parts of its historic range. The lake sturgeon is not Federally listed. It is believed that the lake sturgeon occupies habitats similar to those of the pallid sturgeon but spends a greater portion of its time in the Missouri River than in the Platte River (OPPD 2002a). Similar to the pallid sturgeon, the paucity of suitable habitats in the vicinity of Fort Calhoun Station makes occurrence of the lake sturgeon in the Missouri River at Fort Calhoun Station unlikely. Neither the pallid sturgeon nor the lake sturgeon was collected during monitoring studies conducted at Fort Calhoun Station in the 1970s (Hesse et al. 1982).

The sturgeon chub is associated with fast-flowing water and a gravel riverbed but has been collected in side chutes and backwaters, which are thought to provide spawning habitat (OPPD 2002a). In the 1970s, Hesse et al. (1982) collected 1 sturgeon chub out of 90,379 fish sampled from the Missouri River in Nebraska during monitoring studies, which included the vicinity of Fort Calhoun Station. However, the sturgeon chub was collected in the vicinity of Cooper Nuclear Station, approximately 183 rkm (114 rmi) downstream from Fort Calhoun Station. The sturgeon chub was a recent candidate for Federal listing but was not approved by the FWS because it was found to be common in 50 percent of its historical home range (66 FR 19910 [FWS 2001b]). However, the sturgeon chub remains listed as endangered by the State of Nebraska.

Three additional species are State-listed as threatened in Iowa[(a)(b)] and may possibly occur in the reach of the Missouri River that runs past Fort Calhoun Station and through DeSoto National Wildlife Refuge (FWS 2001a). The refuge straddles the Missouri River and is located downstream but near Fort Calhoun Station (i.e., within a 10-km [6-mi] radius). These State-listed threatened species include the burbot, chestnut lamprey, and the orangethroat darter.

After the Gavins Point Dam was closed in the late 1950s, burbot density quickly decreased downstream in the Nebraska portion of the Missouri River, and by 1961 the burbot was no longer routinely caught in this river reach. In 1993, Hesse considered the burbot's presence to be very rare in this portion of the Missouri River and recommended that the burbot be listed as endangered in Nebraska (Hesse 1993). The burbot was already State-listed as threatened in Iowa at that time. The burbot is a northern fish; its range is primarily restricted to the Missouri

(a) Personal communication with K. Dohrmann, State of Iowa, Department of Natural Resources, Conservation and Recreation Division, November 22, 2002.
(b) Personal communication with J. Godberson, Nebraska Game and Parks Commission, Nebraska Natural Heritage Program, November 22, 2002.

River and the lower ends of larger tributaries (e.g., the burbot has been reported in the Platte River). Nebraska is located on the southern edge of the burbot's range. The Burbot requires habitat with underwater structure (e.g., large rocks, snags, aquatic vegetation, erosional banks) that can be used as cover during daylight. For the burbot, foraging occurs at night, with larvae subsisting on amphipods and adults on fish, crawfish, and crustaceans (Hesse 1993).

Although a sedentary species, the burbot may have lengthy upstream migrations during breeding periods. The burbot tends to prefer turbid and glacial rivers. Burbot spawning occurs during winter, in water that is 1 m (3.3 ft) or less deep and over gravel or compacted sand. Weed beds with gravel bottoms and in swift current provide young burbot habitat (Hesse 1993).

The burbot is likely to occur in the Missouri River (OPPD 2002a; FWS 2001a). Sport fishermen harvested six burbots (1 percent by composition) downstream of Omaha, Nebraska, in 1972 (Hesse 1993). Hesse et al. (1982) reported collecting 18 burbots out of 90,379 adult fish collected from the Missouri River (1971 through 1977) in Nebraska, with 8 of these collected near Fort Calhoun Station (the other 10 were collected near Cooper Nuclear Station). In 1977, a single larval burbot was taken at Fort Calhoun Station (Hesse 1982). Based on 30 years of survey data from the NGPC, there have been no records of the burbot's occurrence in the DeSoto Bend reach of the Missouri River (FWS 2001a).

The chestnut lamprey is also a State-listed threatened species in Iowa[(a)] and may possibly occur in the Missouri River in the vicinity of Fort Calhoun Station (FWS 2001a). The chestnut lamprey spawns in small streams during the spring, and the larvae require several years to reach the adult stage. At that time, the fish returns to larger streams and remains there until spring spawning the following year. This parasitic fish is usually found attached to a host fish, subsisting on the host blood. Adults reach a length of 20–33 cm (8–13 in.) (IDNR 2002a).

The chestnut lamprey occurs largely in the Mississippi River, yet it is rarely found. The Upper Mississippi River Conservation Committee has reported occurrences of the chestnut lamprey in the Mississippi River throughout Iowa but not in any other Iowa location (IDNR 2002a). The FWS (2001a) states that the chestnut lamprey may possibly occur in the reach of the Missouri River that runs past Fort Calhoun Station and through DeSoto National Wildlife Refuge. However, 30 years of survey data from the NGPC have not provided any reports of the chestnut lamprey in the DeSoto Bend reach of the Missouri River (FWS 2001a).

The orangethroat darter is State-listed as threatened in Iowa.[(a)] The distribution of the orangethroat darter is extremely limited in Iowa (IDNR 2002b). The orangethroat darter is generally found in small, clear, spring-fed streams with sand, gravel, or rock substrates.

(a) Personal communication with K. Dohrmann, State of Iowa, Department of Natural Resources, Conservation and Recreation Division, November 22, 2002.

However, it is sometimes tolerant of warmer, more turbid environments. Spawning occurs in the spring and summer (CSU 2002; ILDNR 2002). Larvae reach the adult stage in two to three years (ILDNR 2002). Adults reach a maximum length of 6.5 cm (2.5 in.) (CSU 2002). The orangethroat darter feeds on chironomids, tiny crustaceans, and small insect larvae (IDNR 2002b). Based on 30 years of survey data from the NGPC, this species has not been found in the DeSoto Bend reach of the Missouri River (FWS 2001a).

Although not occurring in the vicinity of Fort Calhoun Station, an additional 14 species of fish are listed as either threatened or endangered at the State level in either Nebraska or Iowa (NGPC 2000; IDNR 2001b). The distribution of 7 of these 14 State-listed species (American brook lamprey, black redhorse, weed shiner, freckled madtom, bluntnose darter, least darter, and western sand darter) is limited to the Mississippi River drainage or the lower Missouri River within the Missouri state boundary (Lee et al. 1980). Therefore, these species are not considered to have a reasonable likelihood of occurring within the vicinity of Fort Calhoun Station. The remaining State-listed species (grass pickerel, Topeka shiner, pugnose shiner, blacknose shiner, northern redbelly dace, finescale dace, and the pearl dace) would not be expected in the main-stem Missouri River or lower portions of tributary streams on the basis of their habitat requirements. These species are restricted to small- to medium-sized streams that are characterized as being clear and silt-free with no turbidity, conditions that are more common in the headwater reaches of tributaries than in the middle Missouri River (Pflieger 1975). Therefore, these species are not considered to have a reasonable likelihood of occurring within the vicinity of Fort Calhoun Station. None of these 14 species are included in the NGPC list of species collected near Fort Calhoun Station in the DeSoto Bend reach of the Missouri River, based on 30 years of survey data (FWS 2001a).

No mussels or other aquatic organisms that have threatened or endangered status are expected to occur in the vicinity of Fort Calhoun Station. No mussels are listed as endangered or threatened by the State of Nebraska (OPPD 2002a). The State of Iowa lists 14 species of mussels as being either threatened or endangered, one of which (the Higgin's eye pearly mussel) is also considered to be endangered at the Federal level. However, the Higgin's eye pearly mussel's habitat is the Mississippi River and some of its larger northern tributaries, in gravel or sand (Cummings and Mayer 1992). The State of Iowa could not confirm that any of the listed identified mussels inhabit portions of Iowa in the vicinity of Fort Calhoun Station or have ever been collected from the Missouri River (IDNR 2001a). However, the habitat in the area of Fort Calhoun Station on the outside (cutting) bank of the river is not conducive to colonization by mussels because of the channelization, swift current, high turbidity, and unstable substrates.

2.2.6 Terrestrial Resources

Most (75 percent) of the 267-ha (660-ac) Fort Calhoun Station consists of agricultural land, station facilities, and other developed land (OPPD 2002a). The developed areas are mostly paved or graveled areas and are devoid of natural vegetation. The agricultural land is devoted primarily to corn and soybean production. Much of the remaining developed area is planted in nonnative grasses that are periodically cut for hay. The remaining 25 percent of Fort Calhoun Station supports mostly natural vegetation, including upland forest on slopes in the southern part of the site and floodplain forest and wetlands on the Missouri River floodplain associated with onsite streams and sloughs. The upland forest is dominated by cottonwood, black locust, red mulberry, Siberian elm, and hackberry; poison ivy and stinging nettle are abundant in the understory. Narrow bands of floodplain forest border the bank of the Missouri River, the North and South Sloughs, and Long Creek. The floodplain forest is dominated by green ash, cottonwood, box elder, silver maple, and hackberry; understory species include false indigo, rough dogwood, giant ragweed, goldenrod, and milkweed. Wetland communities (less than 5 percent of Fort Calhoun Station) are associated with the North and South Sloughs, Fish Creek, and Long Creek. Wetland plants on Fort Calhoun Station include narrow-leaved cattail, reed canary grass, sedges, rushes, spikerush, milkweed, rough dogwood, and black willow.

Transmission lines used by Fort Calhoun Station primarily cross agricultural land or are within the U.S. Highway 75 right-of-way. Line 74S/74, which is of particular concern to this SEIS, crosses agricultural land for approximately 10 km (6 mi). The remainder of this line occupies a 15- to 30-m (50- to 100-ft) right-of-way through disturbed old-field and upland forest on the Missouri River bluffs.

Terrestrial species that have been listed, that have been proposed for listing, or that are candidates for listing by the FWS or the States of Iowa or Nebraska and that have the potential to occur in the vicinity of Fort Calhoun Station and Line 74S/74 are presented in Table 2-3.

The bald eagle was originally listed as endangered by the FWS in 1978, but population increases prompted downlisting to threatened status in 1995, and the species is currently proposed for delisting (64 FR 36453 [FWS 1999]). The bald eagle is a common visitor to DeSoto National Wildlife Refuge, which is approximately 3 km (2 mi) to the east of Fort Calhoun Station, in the spring and fall but has never successfully nested there (FWS 2001b). Bald eagles nest along the Missouri River. There is some potential for the occurrence of nests along the river in Washington County, but no bald eagle nests exist on Fort Calhoun Station, and no nests are known to occur in the vicinity (OPPD 2002a). Bald eagles were observed in the vicinity of Fort Calhoun Station during field surveys conducted in 1975 (OPPD 2002a), and migrants or winter visitors are occasionally observed on and near Fort Calhoun Station. Occurrence of this species along Line 74S/74 is unlikely because the line crosses mostly agricultural land and is near U.S. Highway 75 and residential development.

Table 2-3. Terrestrial Species Listed as Endangered or Threatened or Candidates for Listing by the FWS or the States of Iowa and Nebraska That Occur or Potentially Occur Within Washington County, Nebraska, and Harrison County, Iowa

Scientific Name	Common Name	Federal Status	Nebraska Status	Iowa Status
Mammals				
Perognathus flavescens	plains pocket mouse	—	—	E
Synaptomys cooperi	southern bog lemming	—	—	T
Birds				
Haliaeetus leucocephalus	bald eagle	T	T	E
Sterna antillarum	least tern	E	E	E
Charadrius melodus	piping plover	T	T	E
Circus cyaneus	northern harrier	—	—	E
Buteo lineatus	red-shouldered hawk	—	—	E
Asio otus	long-eared owl	—	—	T
Asio flammeus	short-eared owl	—	—	T
Ammodramus henslowii	Henslow's sparrow	—	—	T
Reptiles				
Sistrurus catenatus	massasauga	—	T	—
Plants				
Cypripedium candidum	small white lady's-slipper	—	T	—
Panax quinquifolium	American ginseng	—	T	—
Plantanthera praeclara	western prairie fringed orchid	T	T	T
Penstemon gracilis	slender penstemon	—	—	T
Sphaeralcea coccinea	red-globe mallow	—	—	T

T = Threatened; E = Endangered; — = Not listed or protected (or does not occur in the state)

Source: Brandrup (2002); State of Iowa (2002); Godberson (2002); OPPD (2002a)

Least terns and piping plovers nest on riverine sandbars within the central United States, including those present along the Missouri River. The loss of sandbar nesting habitat due to river channelization and changes in flow from the construction and operation of main-stem dams have resulted in population declines for both the least tern and the piping plover along the

Missouri River (FWS 2001a). Both species once nested in the nearby DeSoto National Wildlife Refuge, but no nests have been observed since the 1970s (FWS 2001a). Least terns are occasionally observed at the refuge, but the last piping plover observation was made there in 1977. The lack of exposed sandbars in the vicinity of Fort Calhoun Station reduces the likelihood of occurrence of either species, and neither species was observed on or near the site during field surveys in 1975 (OPPD 2002a). The recent FWS Biological Opinion on operations of the Missouri River reservoir and navigation system calls for increasing spring flow and lowering summer flow to improve nesting and foraging habitat for these species (FWS 2000).

The western prairie fringed orchid (Federally listed as threatened) is found most often on unplowed, calcareous prairies and sedge meadows (FWS 1996). It potentially occurs in Washington County based on historic observations, but no populations are known to occur in the county (FWS 1996), and the potential for occurrence on or near Fort Calhoun Station or along Line 74S/74 is low given the lack of prairie habitat in these areas.

Two mammal species listed only by the State of Iowa could occur on or in the vicinity of Fort Calhoun Station: the plains pocket mouse (endangered) and the southern bog lemming (threatened). The plains pocket mouse prefers habitats with sparse vegetation and sandy soil; the southern bog lemming prefers bogs and wet meadows with abundant vegetation. Neither species has been documented on Fort Calhoun Station.

Five bird species that are listed only by the State of Iowa could occur in the vicinity of Fort Calhoun Station based on their potential occurrence at DeSoto National Wildlife Refuge (Table 2-3; FWS 2001a). These species include the red-shouldered hawk (endangered), the northern harrier (endangered), the long-eared owl (threatened), the short-eared owl (endangered), and Henslow's sparrow (threatened). Fort Calhoun Station is outside the normal range of the red-shouldered hawk, and the hawk's occurrence in the area is considered accidental. The northern harrier inhabits grassland and wetlands during the spring, summer, and fall and is considered uncommon in the area; the northern harrier was observed on Fort Calhoun Station during surveys in 1975 (OPPD 2002a). The long-eared owl is rare in the vicinity of Fort Calhoun Station where it occupies woodlands in the winter. The short-eared owl also is considered rare in the area where it inhabits open grassland and wetlands in the winter. The Henslow's sparrow occupies grassland and wetlands and has been observed only rarely in the area in the fall. Of these species, the most likely to occur on Fort Calhoun Station is the northern harrier.

The historic range of the massasauga (listed by the State of Nebraska as threatened) included eastern Nebraska and Washington County, but there are no recent records within 80 km (50 mi) of Fort Calhoun Station. In the last 20 years, extant populations of the massasauga have been documented only in Colfax and Pawnee counties (Godberson 2002). This small rattlesnake prefers wet prairie habitat.

Four plant species are listed by either the State of Nebraska or the State of Iowa, but not by the Federal government. These include small white lady's-slipper (Nebraska-listed as threatened; occurs in wet meadows), American ginseng (Nebraska-listed as threatened; occurs in high-quality upland forest), slender penstemon (Iowa-listed as threatened; occurs in dry prairies), and red-globe mallow (Iowa-listed as threatened; occurs in dry prairies). None of these species are known to occur on Fort Calhoun Station.

2.2.7 Radiological Impacts

The OPPD conducts an annual radiological environmental monitoring program (REMP) around Fort Calhoun Station. This program was initiated prior to plant operation in 1973 (OPPD 2002b). The primary function of the REMP is to ensure the overall safety of the general public by monitoring plant liquid and gaseous discharges to the environment. The accumulated data is used to assess the overall impact of plant operation on the environment and to determine whether adjustments to plant operations or the REMP are needed.

Program objectives are accomplished by monitoring the potential radiation-exposure pathways to the public, including adsorption, inhalation, ingestion, and direct exposure. Both grab samples and composite samples are collected and analyzed to represent these exposure pathways, including air, water, milk, vegetation, fish, sediment, and food crops. Direct exposure is monitored by using thermoluminescent dosimeters (TLDs) that are installed in the field at several locations, including air-monitoring stations. Samples are collected at both control (background) and indicator locations, which are selected based on radiological, meteorological, and geographical factors that are obtained from the *Annual Radiological Effluent Release Report* (OPPD 2002c) and the Environmental Land Use Survey (OPPD 2001a). Most monitoring is conducted within a 8-km-radius (5-mi-radius) circle centered on Fort Calhoun Station, Unit 1. However, some samples, typically control samples, are collected outside the 8-km (5-mi) radius.

Radiological releases are summarized in two annual reports: the *Fort Calhoun Station Radiological Environmental Operating Report* (OPPD 2002b) and the *Annual Radiological Effluent Release Report* (OPPD 2002c). The limits for all radiological releases are specified in the Fort Calhoun Station ODCM, and these limits are designed to meet Federal standards and requirements (OPPD 1999).

A review of the historical data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of Fort Calhoun Station were a small fraction of the design objectives of 10 CFR Part 50, Appendix I, and the limits specified in the U.S. Environmental Protection Agency's environmental radiation standards in 40 CFR Part 190, as required by 10 CFR 20.1301(d). On April 4, 2003, OPPD informed the NRC that they had corrected the data submitted in the 2001 annual report (OPPD 2003). The corrected data is

used below. The corrected data change was minor and did not change any staff conclusions. For 2001 the dose estimates were calculated based on the corrected actual liquid and gaseous effluent-release data (OPPD 2003). Calculations were performed using the plant effluent-release data, onsite meteorological data, and appropriate pathways identified in the ODCM as corrected by OPPD letter dated April 4, 2003. A breakdown of the maximum dose to an individual located at the Fort Calhoun Station boundary from liquid and gaseous effluents released during 2001 is summarized as follows:

- The total body dose from liquid effluents at the site discharge was 4.41×10^{-3} mSv (4.41×10^{-1} mrem), which is about 14.7 percent of the 0.03-mSv (3-mrem) dose limit. The critical organ dose due to the liquid effluents at the site discharge was 5.94×10^{-3} mSv (5.94×10^{-1} mrem). This dose was about 5.94 percent of the respective 0.10-mSv (10-mrem) dose limit (OPPD 2002c).

- The air dose due to noble gases in gaseous effluents was 3.24×10^{-3} mSv (3.24×10^{-1} mrad) gamma (3.24 percent of the 0.10-mGy [10-mrad] gamma dose limit) and 1.19×10^{-2} mGy (1.19 mrad) beta (5.95 percent of the 0.20-mGy [20-mrad] beta dose limit) (OPPD 2002c, OPPD 2003).

- The critical organ dose from gaseous effluents due to iodine-131, tritium, and particulates with half-lives greater than eight days was 4.83×10^{-2} mSv (4.83 mrem), which is 32.2 percent of the 0.15-mSv (15-mrem) dose limit (OPPD 2002c, OPPD 2003).

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Fort Calhoun Station operations during the renewal period, and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the applicant's ER (OPPD 2002a) and information obtained from several county, city, and economic-development staff during a site visit to Washington, Douglas, and Sarpy counties from June 17 to June 20, 2002. The following information describes the economy, population, and communities near Fort Calhoun Station.

2.2.8.1 Housing

Approximately 772 employees work at Fort Calhoun Station, Unit 1 (about 140 contract employees and approximately 632 permanent employees). Approximately 23 percent of these employees live in Washington County; 56 percent live in Douglas County; 7 percent live in Sarpy County, and the rest live in other locations (see Table 2-4). Given the predominance of OPPD employees living in Washington, Douglas, and Sarpy counties and the absence of the likelihood of significant socioeconomic effects in other locations, the focus of the analyses undertaken in this SEIS is on these three counties.

Table 2-4. Fort Calhoun Station, Unit 1—Employee Residence Information by County

County	Number of Personnel	Percent of Total Personnel
Washington	177	23
Douglas	432	56
Sarpy	54	7
Other	109	14
Total Plant Personnel	772	100

Source: OPPD 2002a

The OPPD refuels Fort Calhoun Station, Unit 1 on an 18-month cycle. During these refueling outages, site employment increases by as many as 600 temporary workers for 30 to 40 days. Most of these temporary workers are assumed to be located in the same geographic areas as the permanent OPPD staff.

Table 2-5 provides the number of housing units and housing unit vacancies for Washington, Douglas, and Sarpy counties for 1990 and 2000, the latest years for which information is available. Washington, Douglas, and Sarpy counties have developed comprehensive growth-management plans that characterize current conditions and set standards, regulations, and goals for land development in order to manage future growth.

Table 2-5. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990[a]	2000[b]	Approximate Percentage Change 1990 to 2000
WASHINGTON COUNTY			
Housing Units	6378	7408	16
Occupied Units	6017	6940	15
Vacant Units	361	468	30
DOUGLAS COUNTY			
Housing Units	172335	192672	12
Occupied Units	161113	182194	13
Vacant Units	11222	10478	–7
SARPY COUNTY			
Housing Units	35994	44981	25
Occupied Units	33960	43426	28
Vacant Units	2034	1555	–24

(a) Source: ESRI 1990
(b) Source: USBC 2000

2.2.8.2 Public Services

- **Water Supply**

This discussion of public water systems focuses on Washington, Douglas, and Sarpy counties because approximately 86 percent of Fort Calhoun Station employees reside in these counties. Local municipalities and private water companies provide public potable-water service to residents who do not have individual onsite wells. These providers are subject to regulation under the Federal Safe Drinking Water Act, as implemented by the Nebraska Department of Health.

According to Nebraska Department of Natural Resources estimates for 1995, approximately 42 percent of Washington County residents use onsite wells to obtain potable water, while only 13 percent and 21 percent of residents use onsite wells in Douglas and Sarpy counties, respectively. Additionally, water use for irrigation is substantially greater in Washington County than in Douglas and Sarpy counties. The total domestic water use in 1995, from both public water-supply systems and private

groundwater wells, equaled an estimated 252.2 million L/d (66.63 million gpd) in the combined-county region of Washington, Douglas, and Sarpy counties (OPPD 2002a).

The lack of a public water-supply system in unincorporated portions of Washington County has hindered development in the county. The largest public water supplier in Washington County is the City of Blair's Department of Utilities. The City of Blair Municipal Water Plant services approximately 8500 residents in Blair and its surrounding areas in Washington County. In addition, the city serves industrial customers, such as Fort Calhoun Station and the neighboring Cargill agricultural-product plant. Fort Calhoun Station acquires potable water through the City of Blair's Department of Utilities. Current plant usage averages 3.8 million L (10 million gal) per month (an average of approximately 1.2 million L/d [321,000 gpd]) for Fort Calhoun Station with no restrictions on supply (OPPD 2002a). The water-treatment plant expanded its capacity from 30 million L/d (8 million gpd) to 53 million L/d (14 million gpd) in August 2001.[(a)] Source water is obtained from the Missouri River. The plant is operating near capacity, as the actual daily demand averages 28 million L/d (7.5 million gpd) with a peak demand of approximately 30 million L/d (8 million gpd) (OPPD 2002a).

The Omaha Metropolitan Utilities District (the District) serves more than 170,000 customers in Douglas and Sarpy counties, including Omaha, Bellevue, Offutt Air Force Base, Elkhorn, Waterloo, LaVista, and Carter Lake. The District also supplies water to the Papio–Missouri River Natural Resources District, which provides potable-water supplies to the township of Fort Calhoun. The District operates two water plants with a combined average daily demand of approximately 360 million L/d (95 million gpd) of water. The combined permitted capacity of the two plants is 887 million L/d (234 million gpd). Source water for the plants is obtained from the Missouri and Platte Rivers, as well as several groundwater peaking wells. The District estimates that peak demand could approach or reach the permitted capacity levels in the summer. In 1998, the Nebraska Department of Water Resources approved the first two in a series of permits to begin construction of a third water-treatment plant that will use groundwater wells for source water. This third water-treatment plant is projected to increase the permitted capacity of the water system to 379 million L/d (100 million gpd), thereby meeting the water demands of the service area until at least 2030 (OPPD 2002a).

The City of Papillion Public Works Department is the other primary public potable-water-service provider in Sarpy County. The Department serves approximately 17,000 customers in Papillion and its surrounding areas in Sarpy County. The water-treatment plant has a

(a) Personal communication with A. Schomaker, Director of Public Works, City of Blair, November 13, 2002.

permitted capacity of 45 million L/d (12 million gpd). The actual daily demand averages 21 million L/d (5.5 million gpd) during the winter and 28 million L/d (7.5 million gpd) during the summer, with a peak demand of approximately 34 million L/d (9 million gpd) (OPPD 2002a).

- **Education**

In 2000, there was a total enrollment of 100,246 students attending mainstream public schools in Washington, Douglas, and Sarpy counties. Although the region's 16 school districts do not keep track of Fort Calhoun Station, Unit 1 employee children, Table 2-6 shows the total enrollment for those school districts that likely serve most of these children.

Table 2-6. School District Enrollment in Counties with Significant Numbers of Fort Calhoun Station Employees

County	Enrollment
Washington	3397
Douglas	77448
Sarpy	19401
Total	100246

Source: National Center for Educational Statistics 2001

- **Transportation**

Washington County is served by U.S. Highway 75, which runs north-south towards Omaha and is also the largest-capacity highway in the immediate vicinity of Fort Calhoun Station. Highway 30 (U.S. 30) is the major east-west highway that traverses across the middle of the county to Iowa. It is located within 16 km (10 mi) of Fort Calhoun Station.

Road access to Fort Calhoun Station is via U.S. Highway 75, a two-lane highway running north-south near the Nebraska–Iowa state boundary. In the vicinity of the site, from Blair to Fort Calhoun, the Nebraska Department of Roads estimates that U.S. Highway 75 carries a level-of-service designation of "B," based on 1998 data (OPPD 2002a). In 2000, the estimated traffic volume passing Fort Calhoun Station was 7400 per day (MAPA 2000). The only other access to Fort Calhoun Station is via the Missouri River or by railway.

Employees commuting to and from work use U.S. Highway 75. Local residents and OPPD employees agree that the area is extremely rural and that there are no traffic-related issues.

2.2.8.3 Offsite Land Use

The area within 10 km (6 mi) of Fort Calhoun Station includes part of Washington County in Nebraska and sections of Harrison and Pottawattamie counties in Iowa, with the channelized Missouri River defining the boundary between Nebraska and Iowa in this area. However, this section will focus on the Nebraska counties of Washington, Douglas, and Sarpy because approximately 86 percent of the permanent Fort Calhoun Station workforce live in these communities. Blair, which has a population of 7512 (USBC 2000), is the nearest municipality and is located northwest of Fort Calhoun Station. Fort Calhoun, which has a population of 856 (USBC 2000), is located south of Fort Calhoun Station. No major metropolitan areas occur within 10 km (6 mi) of Fort Calhoun Station. However, one urban area, the Omaha Metropolitan Statistical Area (MSA), which has a population of 100,000 or more, is approximately 16 km (10 mi) south-southeast of Fort Calhoun Station (OPPD 2002a).

Washington, Douglas, and Sarpy counties have developed comprehensive growth-management plans that characterize current conditions and set standards, regulations, and goals for land development in order to manage future growth. Planning agencies in these counties encourage growth in existing urban areas and limit business activities in agricultural areas to those supporting agricultural production. Zoning regulations restrict growth in areas susceptible to flooding. Each county planning agency supports the goal of protecting environmentally sensitive lands, natural resources, rural and agricultural land uses, historic and archaeological resources, and habitats for threatened and endangered species. There are currently no growth-control measures in place to restrict development (OPPD 2002a).

Residential and commercial land uses are predominant in the eastern and central portions of both Douglas and Sarpy counties. Development is strong along the Missouri River and has largely spread out from Omaha. By comparison, land uses in the western portions of both counties are largely rural and agricultural. Washington County is more rural in character, with a larger emphasis on agricultural and open land uses. More than 59 percent of Washington County's population live in rural areas, while only 4 percent of Douglas County's population and 14 percent of Sarpy County's population live in rural areas. Commercial and urban development in Washington County centers on the City of Blair and smaller municipalities where public services are available (OPPD 2002a).

Washington County has a total land area of 101,008 ha (249,600 ac); of this area, 88,691 ha (219,165 ac), or 88 percent, is used for agriculture and open land. Sarpy County covers approximately 62,418 ha (154,240 ac). Like Washington County, the predominant land use in Sarpy County is agricultural; approximately 41,148 ha (101,682 acres), or 66 percent of the land, is used for agriculture (USDA 1997b). Douglas County has a total land area of 87,727 ha (211,840 ac); agriculture uses only occupy 53 percent, or 45,634 ha (112,765 ac), of the land in Douglas County (USDA 1997b).

Industrial development is limited in the site vicinity. The Cargill facility is located on property adjacent to Fort Calhoun Station to the northeast, and several small industrial facilities are located near the Blair Industrial Park between the Cargill facility and the City of Blair (OPPD 2002a).

The area of the Missouri River bottomlands within 10 km (6 mi) of Fort Calhoun Station consists primarily of sparsely populated agricultural cropland and public lands dedicated to wildlife management, recreation, and historical preservation. Notable among these public lands in Nebraska are the DeSoto and Boyer Chute National Wildlife Refuges and the Fort Atkinson State Park. In Iowa, notable public lands include the Wilson Island State Recreation Area and Nobles Lake Wildlife Management Area southward from the site and the California Bend and Tyson Island Wildlife Management Areas northward from the site. One commercial marina operates on the Missouri River approximately 8 rkm (5 rmi) upstream from Fort Calhoun Station (OPPD 2002a).

2.2.8.4 Visual Aesthetics and Noise

Fort Calhoun Station, Unit 1 and its supporting structures can be seen from the immediate surrounding area, from U.S. Highway 75, and by recreational users on the Missouri River; however, only the steam plume is visible from the Cargill facility, which is located on adjacent property to the northeast. The most visible features of Fort Calhoun Station are the meteorological tower, Auxiliary buildings, the containment structure, and the transmission lines connecting to the Fort Calhoun Station Substation. Approximately 85 percent of the site is on relatively level ground on the river bottomlands, with the southern portion of the site rising sharply by approximately 18 m (60 ft) to U.S. Highway 75. Fort Calhoun Station is also completely visible from the Missouri River and U.S. Highway 75 at night because both the Fort Calhoun Station, Unit 1 emission stacks and the meteorological tower have outside lighting. Noise from Fort Calhoun Station is usually not noticeable by recreational users of the Missouri River and facilities upstream of Fort Calhoun Station.

2.2.8.5 Demography

Population was estimated from Fort Calhoun Station out to a distance of 80 km (50 mi). The OPPD used 1990 U.S. Bureau of the Census (USBC) tract data and 2000 USBC Census data for other areas of its ER because 2000 Census tract data was not available at the time the OPPD completed the ER. NRC guidance calls for the use of the most recent USBC decennial census data, which in the case of Fort Calhoun Station, was the 1990 Census at the time of publication of the ER (OPPD 2002a). Updated information was presented after the ER was completed (USBC 1991 and 2001). The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information. Section 2.11 (Minority and Low-Income Populations) of the ER used 1990 minority and low-income

population demographic information because updated projections were not available by census tract. The OPPD also chose to use 1990 data in discussing total population so that the data sets would be consistent throughout the Fort Calhoun Station ER. The NRC staff used 2000 Census data in this section and in discussing minority populations.

As derived from USBC 2000 information, at least 339,911 people live within 32 km (20 mi) of Fort Calhoun Station (Geolytics Software 2000). Applying the GEIS sparseness measures, Fort Calhoun Station has a population density of 104 persons/km^2 (270 persons/mi^2) within 32 km (20 mi) and falls into the least sparse category, Category 4 (having greater than or equal to 46 persons/km^2 [120 persons/mi^2] within 32 km [20 mi]). As estimated from USBC 2000 information, at least 852,717 people live within 80 km (50 mi) of Fort Calhoun Station (Geolytics Software 2000). This equates to a population density of 42 persons/km^2 (109 persons/mi^2) within 80 km (50 mi). Applying the GEIS sparseness and proximity matrix, Fort Calhoun Station ranks as sparseness Category 4 and proximity Category 3, resulting in the conclusion that Fort Calhoun Station is located in a high-population area. All or parts of 22 counties are located within 80 km (50 mi) of Fort Calhoun Station (see Figure 2-1). Of these 22 counties, 12 are in Nebraska, and 10 are in Iowa.

The Omaha MSA is the largest metropolitan area within 80 km (50 mi) of Fort Calhoun Station. Approximately 86 percent of Fort Calhoun Station employees live in Washington, Douglas, and Sarpy counties. The remaining 14 percent are distributed across 19 counties.

The populations of Washington, Douglas, and Sarpy counties are growing at faster rates than those of the State of Nebraska as a whole. Between 1990 and 2000, Nebraska's population increased by 8.4 percent, while the population in Washington, Douglas, and Sarpy counties increased by 13.1, 11.3, and 19.5 percent, respectively. Projections for the period from 2000 through 2030 show increases of 29, 20, and 55 in Washington, Douglas, and Sarpy counties, respectively.

The largest town near Fort Calhoun Station is Omaha, which is 24 km (15 mi) away in Douglas County. Between 1990 and 2000, Douglas County experienced a population growth from 416,444 (in 1990) to 463,585 (in 2000), an 11.3 percent increase over the decade (USBC 2000). The greatest relative population growth within the 80-km (50-mi) radius around Fort Calhoun Station between 1990 and 2000 occurred in Washington County (13.1 percent).

Table 2-7 shows estimated populations and annual growth rates for the three counties with the greatest potential to be affected by license renewal activities.

Table 2-7. Regional Demographies

	Estimated Populations and Average Annual Growth Rates in Washington, Douglas, and Sarpy Counties from 1980 to 2030					
	Washington County		Douglas County		Sarpy County	
Year	Population	Percent	Population	Percent	Population	Percent
1980	15508	1.6	397038	0.2	86015	3.5
1990	16607	0.7	416444	0.5	102583	1.9
2000	18780	1.3	463585	1.1	122595	2
2010	20829	1.1	482765	0.4	145494	1.9
2020	22653	0.9	513449	0.6	171386	1.5
2030	24239	0.7	554525	0.8	190239	1.1

Source: OPPD 2002a

- **Resident Population Within 80 km (50 mi)**

  Table 2-8 presents the population distribution within 80 km (50 mi) of Fort Calhoun Station for the year 2000.

  Table 2-8. Population Distribution in 2000 Within 80 km (50 mi) of Fort Calhoun Station

0 to 16 km (0 to 10 mi)	16 to 32 km (10 to 20 mi)	32 to 48 km (20 to 30 mi)	48 to 64 km (30 to 40 mi)	64 to 80 km (40 to 50 mi)	Total
17672	322239	392219	73120	47467	852717

Source: Geolytics Software 2000

The population centers within the 16-km (10-mi) area are the towns of Fort Calhoun and Blair. The populations of these settlements in 2000 were respectively, 856 and 7512 (USBC 2000). Most of the new residential development within the 16-km (10-mi) radius has been in Blair.

The county planning departments for Washington, Douglas, and Sarpy counties project low to medium population growth for the area (0.4 to 1.9 percent for the next decade). There are several residential developments that have recently been completed in the vicinity of Blair.

- **Transient Population**

  The transient population in the vicinity of Fort Calhoun Station can be identified as daily or seasonal. Daily transients are associated with places where a large number of people gather regularly, such as local businesses, industrial facilities, and schools. Seasonal transients result from part-time residents who may reside in the Omaha metropolitan area to pursue recreational activities there throughout the year. The major seasonal population associated within 16 km (10 mi) of Fort Calhoun Station for recreational activities includes the DeSoto National Wildlife Refuge, Fort Atkinson State Park, and Boyer Chute National Wildlife Refuge. Their combined average annual visitors is approximately 405,000 people per year (OPPD 2002a). The largest employer within 16 km (10 mi) of Fort Calhoun Station is Cargill, Incorporated, with approximately 1000 employees.[(a)]

- **Agricultural Labor**

  There are over 32,376 ha (80,000 ac) of farmland in Washington County.[(b)] The main agricultural crops grown within the 80-km (50-mi) radius of Fort Calhoun Station are corn and soybeans. Almost all of the laborers on farms in the area are believed to be residents in the area.

  Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These employees may or may not have a permanent place of residence. Migrant labor is not used in this part of the country. Little to no migrant workers are employed within a 80-km (50-mi) radius of Fort Calhoun Station, Unit 1.[(b)]

2.2.8.6 Economy

The Omaha MSA has experienced steady growth in recent years. The employed workforce in Omaha increased 25.7 percent between 1990 and 1999, which compares favorably to the national growth rate of 17.6 percent (OPPD 2002a). Services is the largest employment sector, accounting for 33.1 percent of total employment in the Omaha MSA. Trade accounts for approximately 24.1 percent of total employment, while the government and manufacturing sectors account for approximately 12.1 percent and 9.5 percent, respectively (OPPD 2002a).

In 2000, the Omaha MSA had an estimated labor force of 400,049 and an unemployment rate of 2.5 percent. For the past decade, unemployment rates in the region have been much lower than the national average and have been comparable to the Nebraska average. The median

(a) Personal communication with R. Storm, City Administrator, City of Blair, June 18, 2002.
(b) Personal communication with J. Peterson, University of Nebraska, Cooperative Extension Office, June 18, 2002.

household in Omaha in 2000 had an estimated effective buying income of $46,575. In comparison, the estimated effective buying income of the median household in the nation was $37,233 (OPPD 2002a).

U.S. Interstates 80 and 29, as well as 12 other U.S. and State highways, intersect in the Omaha MSA. This extensive highway network gives the region access to east-west and north-south corridors. The region's transportation network also includes rail and trucking terminals, the Eppley airfield and four other local airports, and two barge lines that are capable of transporting large volumes of commodities on the Missouri River (OPPD 2002a).

Agriculture contributes significantly to the regional economy, particularly in more rural Washington County. Principal crops in the region include corn, soybeans, and hay (OPPD 2002a). According to the U.S. Department of Agriculture's 1997 Census of Agriculture, receipts from all agricultural products contributed $92.5 million to Washington County's economy (USDA 1997a). Livestock sales alone accounted for 51 percent of the market value of agricultural-product sales. By comparison, agricultural sales contributed only $44.1 million and $57.2 million to the economies in Douglas and Sarpy counties, respectively (OPPD 2002a).

The Nebraska State Constitution Article VIII, Section 11, (1958) stipulates:

> Every corporation and political subdivision organized primarily to provide electricity shall annually make the same payments in lieu of taxes as it made in 1957, which payments shall be allocated in the same proportion to the same public bodies or their successors as they were in 1957. The legislature may require each such public corporation to pay to the treasurer of any county in which may be located any incorporated city or village, within the limits of which such public corporation sells electricity at retail, a sum of five percent of the annual gross revenue (OPPD 2002a).

The OPPD is a publicly owned electric utility with a total generation capability as of July 31, 2001, of 2,203,000 kW from its five power stations. The OPPD leases an additional 6600 MW from the Tecumseh Municipal Utility (OPPD 2002a). As a political subdivision responsible for the production and distribution of electricity within its 13-county service area, the OPPD is exempt from paying State-occupational, personal-property, and real-estate taxes. Instead, the OPPD makes six payments in lieu of taxes each year to the municipalities and 12 Nebraska counties (Burt, Cass, Colfax, Dodge, Douglas, Johnson, Nemaha, Otoe, Richardson, Sarpy, Saunders, and Washington) in which the OPPD sold power in 1957. In addition, each county receives 5 percent of the total gross revenues the OPPD receives from electricity sales from within the county, minus the amount already paid to the incorporated area of the county.

Payments are made to the counties and municipalities within the service area irrespective of whether the power is purchased from another generator or produced at OPPD power plants. The counties and municipalities then distribute the money to the appropriate cities, school districts, and agencies.

From 1996 to 2000, approximately 80 percent of the OPPD's total annual in lieu payments have been paid to Douglas County, the largest consumer of OPPD electricity. In 2000, the OPPD's in lieu payments totaled $17.6 million, $15.0 million of which was paid to Douglas County and its constituent municipalities. In comparison, the OPPD made in lieu payments totaling approximately $1.79 million and $330,000 to the county governments and constituent municipalities in Sarpy and Washington counties, respectively (see Table 2-9).

Table 2-9. Fort Calhoun Station, Unit 1 Contributions to County Operating Budgets

Year	Washington County In Lieu Revenues	Douglas County In Lieu Revenues	Sarpy County In Lieu Revenues
2000	$330,000	$15,000,000	$1,790,000

Source: OPPD 2002a

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at Fort Calhoun Station and in the surrounding area.

2.2.9.1 Cultural Background

The area around Fort Calhoun Station is rich in prehistoric and historic Native American and historic Euro-American resources. This is due, in large part, because of the plant's location adjacent to the Missouri River, a focal point of human occupation and travel throughout prehistoric and historic times.

- **Prehistoric Period**

  Archaeologists commonly divide the Great Plains into several cultural subareas, based primarily on a particular set of ecological conditions that is somewhat reflected in the cultural systems that occupied those areas over time. Fort Calhoun Station is located in the "Central Plains" subarea, which includes all of eastern Nebraska and adjoining parts of South Dakota, Iowa, Missouri, and Kansas (Wood 1998). The prehistoric Native American occupation of the region that includes Fort Calhoun Station has four general periods: the Paleo-Indian period (about 10,000 B.C. to 7000 B.C.), the Archaic period (about 7000 B.C.

to A.D. 1), the Plains Woodland period (about A.D. 1 to A.D. 1100), and the Plains Village (about A.D. 1100 to A.D. 1700). Toward the end of the Plains Village period, about A.D. 1700, a transitional episode known as the Protohistoric period began in which initial contacts with Europeans and cultural changes associated with subsequent White exploration and settlement of the region took place.

The prehistoric periods were marked by an initial reliance on big-game hunting subsistence, followed by an increased use of smaller game animals and plant foods in the Archaic era. Major environmental changes late in the Archaic period led to an increasingly more sedentary lifestyle in the Plains Woodland period that followed. Late in the Plains Woodland era, more sedentary villages and an increasing reliance on cultivated crops became the norm. The subsequent Plains Village period was characterized by substantial earth-covered lodges in semipermanent villages in the river valleys, with subsistence based on agriculture, hunting and gathering, and intergroup trade. In the Central Plains, Plains Village groups focused their activities along the Missouri River and the lower reaches of its immediate tributaries.

- **Historic Period Native American**

At the time of European contact and subsequent intrusion into the area surrounding Fort Calhoun Station, the lands on the west side of the Missouri River (in what would become the state of Nebraska) were occupied principally by the Omaha Indian Nation (Fletcher and La Flesche 1911; O'Shea and Ludwickson 1992; Smith 1974), although nearby to the west were the Pawnee (Hyde 1951) and immediately to the east, south, and north were other Siouan-speaking tribes such as the Ponca (Howard 1965), Otoe and Missouria (Chapman 1965), Ioway (Blaine 1979), Sac & Fox (Hagan 1958), and Kansa (Unrau 1971). In 1854, the Omaha Tribe ceded the land on which Fort Calhoun Station is located to the United States, and the tribe was settled on a reservation about 80 km (50 mi) northwest of Fort Calhoun Station. Another tribe, the Winnebago, was relocated from Wisconsin to the Omaha Reservation in the 1860s to 1870s and eventually was granted a separate reservation immediately north of the Omaha (Radin 1923; Jones and Smith 1974). Legal work by the U.S. Indian Claims Commission to judicially establish the lands of original tribal occupancy found that all of northeastern Nebraska south to the Platte River was occupied by the Omaha, with adjacent tribes being the Otoe and Missouria south of the Platte River, the Pawnee to the west and southwest, and the Ponca to the northwest (U.S. Indian Claims Commission 1979). To the east, lands immediately on the other side of the Missouri River in present-day Iowa were found to have been occupied by several tribes, including the Otoe and Missouria, Ioway, Omaha, and Sac & Fox.

- **Historic Period Euro-American**

  The historic period in the area where Fort Calhoun Station is located was particularly eventful, especially with regard to activities associated with the early exploration and settlement of the western United States. Most notable was the Corps of Discovery expedition of 1804 to 1806, which was led by Captains Meriwether Lewis and William Clark. In the vicinity of the project area, Lewis and Clark held a council on August 3, 1804, with six leaders of the Otoe and Missouria at a bluff on the west side of the Missouri River near the present-day town of Fort Calhoun, about 8 km (5 mi) southeast of the plant. Leaving this locale, the party traveled upriver on August 3, camping for the night within what is today the DeSoto National Wildlife Refuge. The following day, the Lewis-and-Clark party continued upriver past the location of the current Fort Calhoun Station, although the channel of the river was not then in the same position as its current location.

  In 1819, Fort Atkinson was established on the same bluff where Lewis and Clark met in council with the American Indian leaders as one of the line of forts established to guard the western frontier and to protect U.S. fur trade from English competition (Ney 1978). The fort was abandoned in 1827, and only archaeological remains survive (Carlson 1979). Today, the fort exists in reconstructed form as the Fort Atkinson State Historic Park.

  The next significant historical event to occur in the vicinity of the nuclear plant was the establishment in 1847 of the “Summer Quarters” or “Brigham Young’s Farm” by Mormon settlers at a locale about 3 km (1.75 mi) southeast of the present plant site. This farming venture was begun in an area that had been formerly cultivated by personnel from the earlier Fort Atkinson. The farm was intended to provide food and grain for any Mormon immigrants who might be stalled in the “Winter Quarters” (in the northern part of Omaha) while traveling west. Because of hardships (troubles with the both Omaha and Otoe Indians and an epidemic that killed 18 people in the camp), the Mormons abandoned the farm on April 26, 1848.

  White settlement of the area occurred rapidly following a treaty with the Omaha Tribe in 1854 that ceded lands to the United States (Bell 1985; Washington County Historical Association 1980). Washington County was established the same year and was reorganized the following year. Adjacent to the site of the current Fort Calhoun Station, the town of DeSoto was laid out in the fall of 1854 and was incorporated in March 1855. Located on the then-channel of the Missouri River, DeSoto quickly became one of the primary population centers of the area and was designated as the county seat between 1858 and 1866. Prosperity in DeSoto ended, however, in the late 1860s, mainly because of the construction of an east-west rail line that crossed the Missouri River about 6.5 km (4 mi) north of DeSoto and the associated founding of the town of Blair.

Throughout the last half of the 1800s, use of the Missouri River as a thoroughfare for commerce and passenger transport was common. As discussed in the next section, one result of these activities was the loss of many steamships and other watercraft to accidents along the river channel. The most notable of these wrecks is the steamship *Bertrand* (Petsche 1974), which is located in the FWS DeSoto National Wildlife Refuge, about 4 km (2.5 mi) east of Fort Calhoun Station.

2.2.9.2 Historic and Archaeological Resources at Fort Calhoun Station

To assess both known and potential cultural resource sites at Fort Calhoun Station, several existing literature and database sources were consulted, along with contacts at several organizations (see Appendix D). In addition to the sources included in Appendix D, electronic database searches were conducted at the National Park Service's National Register of Historic Places Information System, the National Historic Landmarks Program, and the Historic American Buildings Survey/Historic American Engineering Record listings. Finally, a number of historical maps ranging in age from 1855 to 1948 were examined to identify cultural sites and transportation routes that may have once existed in the vicinity of Fort Calhoun Station, as well as the historical movements of the Missouri River channel.

Several previous cultural-resources investigations have been conducted near Fort Calhoun Station. When combined, these investigations provide an overview of the cultural-resources picture in the immediate vicinity of Fort Calhoun Station. The principal cultural resource in proximity to the plant is the Old DeSoto town site. Essentially abandoned since 1870, the property has been impacted by three activities: (1) the construction of the Chicago and Northwestern rail line, (2) an earlier realignment of U.S. Highway 73 (now known as U.S. Highway 75), and (3) construction of Fort Calhoun Station, Unit 1 (Carlson and Steinacher 1996, p. 5). The first two activities impacted the property by relocating transportation routes from the floodplain to closer to the base of the bluffs. The Old DeSoto town site was further impacted during the construction of Fort Calhoun Station, Unit 1 when a large amount of fill was removed from the center of the former town site. Following the removal of fill, personnel from the Nebraska State Historical Society examined locations that had already been disturbed by earth-moving activities and made a small collection of artifactual materials.

After the initial construction of Fort Calhoun Station, Unit 1, two archaeological surveys were conducted in 1975 as part of the proposal to construct Fort Calhoun Station Unit 2. These surveys included the proposed plant site (Henning 1975) and two borrow areas (Carlson and Steinacher 1996). The results of these two surveys, along with the assumption that significant impacts had already taken place at the DeSoto town site, led the 1975 investigators to conclude that the site was ineligible for listing on the National Register of Historic Places. As noted below, however, subsequent fieldwork and assessment have reversed this evaluation.

More intensive archaeological survey and excavation within the DeSoto site took place in 1976 as part of the reconstruction and upgrading of U.S. Highway 73 (now known as U.S. Highway 75) between the towns of Fort Calhoun and Blair (Steinacher 1976). Excavations within the highway right-of-way located adjacent to Fort Calhoun Station yielded important archaeological data and provided information that significant subsurface data remained at the town site. Accordingly, the former town of DeSoto was evaluated as being potentially eligible for nomination to the National Register of Historic Places in January 1989.

Apart from the town of DeSoto, a review of the National Register listings did not disclose any Register-listed or -eligible historic properties in immediate proximity to Fort Calhoun Station. Fort Atkinson, about 8 km (5 mi) southeast of the plant, is both listed on the National Register and designated as a National Historic Landmark. Seven historic buildings in the town of Blair, about 6.5 km (4 mi) north of the plant, are listed on the National Register, as is the steamship *Bertrand*.

Another officially designated historic site in the vicinity of Fort Calhoun Station is the Lewis and Clark National Historic Trail. Designated in March 1978, the trail receives oversight from the National Park Service, although there are no Park Service lands involved. Aside from the location of the 1804 council at Fort Atkinson, there are no known historic sites specifically related to this historic trail in the immediate vicinity of Fort Calhoun Station.

A review of the site files at the Nebraska State Historical Society Archaeology Division and the State Historic Preservation Office yielded a total of 22 recorded historic and archaeological sites within 8 km (5 mi) of Fort Calhoun Station on the Nebraska side of the Missouri River. These sites range from prehistoric village and burial sites, primarily located on the higher bluffs above the Missouri River floodplain, to historic properties such as farmsteads and mills in the lower area of the floodplain. Of these sites, three (including the DeSoto site and the *Bertrand*) are eligible for the National Register, and two have been evaluated as being ineligible. The remaining 17 sites have not been evaluated. On the Iowa side of the river, an archaeological survey of the DeSoto National Wildlife Refuge recorded 13 sites, all historic Euro-American (Blakeslee and King 1978).

Steamboat wrecks in the vicinity of Fort Calhoun Station, which date back to the 1860s for the most part, deserve mention because the precise location of only one (the *Bertrand*) is known. According to various sources (Chittenden 1897; McDonald 1927; Bowers, Muessig, and Soike 1990; and the Nebraska State Historical Society site files), there are at least six wrecks within 3 to 5 km (2 to 3 mi) of Fort Calhoun Station. Because of historic changes, both natural and engineered, to the channel of the Missouri River, none of these wrecks lie in the current channel; instead, all of the wrecks are buried in floodplain deposits away from the present watercourse. Four of these wrecks—the *Bertrand* (1865), the *E. O. Stanard* (1865), the *Cora* (1865), and the *Susan* (1907)—occurred along the former DeSoto Bend and are located either

within the DeSoto National Wildlife Refuge or just downriver from the refuge. The *Anderson* (date of wreck unknown) is thought to be located about 0.4 km (1 mi) west of Fort Calhoun Station, between Fish Creek and the Chicago and Northwestern rail line. The location of the *Benton* (1869) is problematic and has been thought to be in a variety of locations, ranging from 13 km (8 mi) north of DeSoto to 3 km (2 mi) south of the town. The most recent investigators believe that the remains of the *Benton* "probably lie in the immediate vicinity of the Ft. Calhoun Nuclear Power Plant" (Bowers, Muessig, and Soike 1990, p. 32).

Although prehistoric-period villages and human burials have been recorded within 3 km (2 mi) of the plant, a review of the existing literature and site files has not revealed any sites, areas, or resources in the immediate vicinity of Fort Calhoun Station that have been identified as having significant cultural values for modern American Indian tribes. To date, contacts with the Omaha Tribe by the OPPD and six tribes by NRC staff, including the Iowa Tribe of Kansas and Nebraska, the Omaha Tribe, the Ponca Tribe of Nebraska, the Sac & Fox Tribe of Missouri in Kansas and Nebraska, the Santee Sioux Tribe, and the Winnebago Tribe, have not yielded information about known or potential traditional properties or other important American Indian resources that could exist at Fort Calhoun Station. Similarly, no such issues have been raised during the public scoping period.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that the activities of other Federal agencies might impact the renewal of the OL for Fort Calhoun Station, Unit 1. Any such activities could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency for the preparation of the SEIS.

The FWS is currently examining the impact of six alternatives for regulating flows in the Missouri River Main Stem Reservoir System, which was constructed and is operated by the USACE. Issuance of the final environmental impact statement (EIS) and the revised Master Manual is expected by the end of 2003.

The Reservoir System is operated using guidelines published in the *Missouri River Main Stem Reservoir System Master Manual* (USACE 1979). The Master Manual, which has been subject to only minor revisions—the last in 1979, prescribes implementation protocols for Reservoir System storage and release functions to accommodate the multiple purposes described below. Although hydropower and water supply provide about 70 percent of the economic benefits, the release criteria for Gavins Point Dam are currently influenced most by navigation considerations. The navigation considerations are overridden by the need to either cut back releases for downstream flood control or to evacuate flood-control storage space in the reservoirs (OPPD 2002a).

Based on prior experience and requirements that address Federal legislation, long-term adjustments have been made in Reservoir System operations. The most significant long-term adjustment in Reservoir System operations involved the modification of summertime peak-power releases from Fort Peck, Garrison, Fort Randall, and Gavins Point Dams to limit adverse impacts to two Federally protected bird species, the piping plover (*Charadrius melodus*) (designated threatened) and the least tern (*Sterna antillarum*) (designated endangered), which have historically depended on exposed sandbars in the river for nesting (FWS 2000).

The navigation industry on the lower river has not grown as expected, while the recreation industry associated with the river reaches and reservoirs in the upper basin has grown significantly. In addition, the ecological impacts of the USACE's Missouri River projects have become better known, and several affected species—most notably the least tern, the piping plover, and the pallid sturgeon (*Scaphirhynchus albus*)—have been listed as threatened or endangered under the Federal ESA. These and other changes since the Main Stem Reservoir System was first authorized have prompted the USACE to undertake a review and update of the Master Manual. The objectives of the revision are to determine what best meets the current needs of the basin and to incorporate controls to appropriately meet those needs. These activities, which began in 1989, include the development of an EIS. In a revised draft EIS, which was issued in August 2001 (USACE 2001), the FWS examines the impact of six alternatives for regulating flows in the Reservoir System. The issuance of the final EIS and the revised Master Manual is expected in 2003.

Regulation of the flow in the Missouri River Main Stem Reservoir System is a matter that affects the current operation of Fort Calhoun Station, Unit 1, and therefore, is not a consideration for the staff's review of the license renewal application for the facility. Therefore, after reviewing Federal activities in the vicinity of Fort Calhoun Station, the staff determined that there were no Federal project activities that would make it desirable for another Federal agency (NRC) to become a cooperating agency for the preparation of this SEIS.

The NRC is required under Section 102 of the National Environmental Policy Act of 1969 to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. The NRC is consulting with the FWS. Consultation correspondence is included in Appendix E.

2.3 References

10 CFR Part 20. Code of Federal Regulations, Title 10*, Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 61. Code of Federal Regulations, Title 10, *Energy,* Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy,* Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

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