CHAPTER 2

ENVIRONMENTAL DESCRIPTION

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µgm/m^3	micrograms per cubic meter
/Q	relative air concentration
AADT	annual average daily traffic
A/B	auxiliary building
ac	acre
AC	alternating current
ac-ft	acre-feet
ACFT	acre-feet
ACRS	advisory committee on reactor safeguards
ACSR	aluminum-clad steel reinforced
ADFGR	Alaska Department of Fish and Game Restoration
AEA	Atomic Energy Act
AEC	U.S. Atomic Energy Commission
AHD	American Heritage Dictionary
agl	above ground level
ALA	American Lifelines Alliance
ALARA	as low as reasonably achievable
AMUD	Acton Municipal Utility District
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
AOO	anticipated operational occurrences
APE	areas of potential effect
APWR	Advanced Pressurized Water Reactor

ACRONYMS AND ABBREVIATIONS

ARLIS	Alaska Resources Library and Information Services
ARRS	airborne radioactivity removal system
AS	ancillary services
ASCE	American Society of Civil Engineers
AVT	all volatile treatment
AWG	American wire gauge
BAT	best available technology
bbl	barrel
BC	Business Commercial
BDTF	Blowdown Treatment Facility
BEA	U.S. Bureau of Economic Analysis
BEG	U.S. Bureau of Economic Geology
bgs	below ground surface
BLS	U.S. Bureau of Labor Statistics
BMP	best management practice
BOD	Biologic Oxygen Demand
BOP	Federal Bureau of Prisons
BRA	Brazos River Authority
bre	below reference elevation
BRM	Brazos River Mile
BSII	Big Stone II
BTI	Breakthrough Technologies Institute
BTS	U.S. Bureau of Transportation Statistics
BTU	British thermal units
BUL	Balancing Up Load

ACRONYMS AND ABBREVIATIONS

BW	Business Week
BWR	boiling water reactor
CAA	Clean Air Act
CBA	cost-benefit analysis
CBD	Central Business District
CCI	Chambers County Incinerator
CCTV	closed-circuit television
CCW	component cooling water
CCWS	component cooling water system
CDC	Centers for Disease Control and Prevention
CDF	Core Damage Frequency
CDR	Capacity, Demand, and Reserves
CEC	California Energy Commission
CEDE	committed effective dose equivalent
CEED	Center for Energy and Economic Development
CEQ	Council on Environmental Quality
CESQG	conditionally exempt small quantity generator
CFC	chlorofluorocarbon
CFE	Comisin Federal de Electricidad
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFS	chemical treatment system
CG	cloud-to-ground
CGT	Cogeneration Technologies
CHL	Central Hockey League

ACRONYMS AND ABBREVIATIONS

CO	carbon monoxide
CO_2	carbon dioxide
COD	Chemical Oxygen Demand
COL	combined construction and operating license
COLA	combined construction and operating license application
CORMIX	Cornell Mixing Zone Expert System
CPI	Consumer Price Index
CPP	continuing planning process
CPS	condensate polishing system
CPNPP	Comanche Peak Nuclear Power Plant
CPSES	Comanche Peak Steam Electric Station
CRDM	control rod drive mechanism cooling system
CRP	Clean Rivers Program
CS	containment spray
Cs-134	cesium-134
Cs-137	cesium 137
CST	Central Standard Time
CST	condensate storage tank
CT	completion times
CT	cooling tower
cu ft	cubic feet
C/V	containment vessel
CVCS	chemical and volume control system
CVDT	containment vessel coolant drain tank
CWA	Clean Water Act

ACRONYMS AND ABBREVIATIONS

CWS	circulating water system
DAW	dry active waste
dBA	decibels
DBA	design basis accident
DBH	diameter at breast height
DC	direct current
DCD	Design Control Document
DDT	dichlorodiphenyltrichloroethane
DF	decontamination factor
DFPS	Department of Family and Protective Services
DFW	Dallas/Fort Worth
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOL	Department of Labor
DOT	U.S. Department of Transportation
DPS	Department of Public Safety
D/Q	deposition
DSHS	Department of State Health Services
DSM	Demand Side Management
DSN	discharge serial numbers
DSWD	Demand Side Working Group
DVSP	Dinosaur Valley State Park
DWS	demineralized water system
DWST	demineralized water storage tank
E	Federally Endangered

ACRONYMS AND ABBREVIATIONS

EA	Environmental Assessment
EAB	exclusion area boundary
E. coli	Escherichia coli
EDC	Economic Development Corp.
EDE	effective dose equivalent
EEI	Edison Electric Institute
EERE	Energy Efficiency and Renewable Energy
EFH	Energy Future Holdings Corporation
EFW	energy from waste
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EJ	environmental justice
ELCC	Effective Load-Carrying Capacity
EMFs	electromagnetic fields
EO	Executive Order
EOF	emergency operation facility
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ER	Environmental Report
ERA	Environmental Resource Associates
ERCOT	Electric Reliability Council of Texas
ESA	Endangered Species Act
ESP	Early Site Permit
ESRP	Environmental Standard Review Plan

ACRONYMS AND ABBREVIATIONS

ESW	essential service cooling water
ESWS	essential service water system
F&N	Freese & Nicholas, Inc.
FAA	U.S. Federal Aviation Administration
FAC	flow-accelerated corrosion
FBC	fluidized bed combustion
FCT	Fuel Cell Today
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFCA	Federal Facilities Compliance Act
FLMNH	Florida Museum of Natural History
FM	farm-to-market
FP	fire protection
FPL	Florida Power and Light
FPS	fire protection system
FPSC	Florida Public Service Commission
FR	Federal Register
FSAR	Final Safety Analysis Report
FSL	Forecast Systems Laboratory
ft	feet
FWAT	flow weighted average temperature
FWCOC	Fort Worth Chamber of Commerce
FWS	U.S. Fish and Wildlife Service
gal	gallon
GAM	General Area Monitoring

ACRONYMS AND ABBREVIATIONS

GAO	U.S. General Accountability Office
GDEM	Governor’s Division of Emergency Management
GEA	Geothermal Energy Association
GEIS	Generic Environmental Impact Statement
GEOL	overall geological
GFD	ground flash density
GIS	gas-insulated switchgear
GIS	Geographic Information System
GMT	Greenwich Mean Time
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
gps	gallons per second
GRCVB	Glen Rose, Texas Convention and Visitors Bureau
GST	gas surge tank
GTC	Gasification Technologies Conference
GTG	gas turbine generators
GWMS	gaseous waste management system
H-3	radioactive tritium
HC	Heavy Commercial
HCl	Hydrochloric Acid
HCP	Ham Creek Park
HEM	hexane extractable material
HEPA	high efficiency particulate air
HIC	high integrity container

ACRONYMS AND ABBREVIATIONS

HL	high-level
HNO_3	Nitric Acid
hr	hour(s)
HRCQ	highway route-controlled quantity
H_2SO_4	Sulfuric Acid
HT	holdup tank
HTC	Historic Texas Cemetery
HUC	hydrologic unit code
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilating, and air-conditioning
I	Industrial
I-131	iodine-131
IAEA	International Atomic Energy Agency
I&C	instrumentation and control
IEC	Iowa Energy Center
IGCC	Integrated Gasification Combined Cycle
IH	Interim Holding
in	inch
INEEL	Idaho National Engineering and Environmental Laboratory
IOUs	investor-owned electric utilities
IPE	individual plant examination
ISD	Independent School District
ISFSI	independent spent fuel storage installation
ISO	independent system operator
ISO rating	International Standards Organization rating

ACRONYMS AND ABBREVIATIONS

ISU	Idaho State University
JAMA	Journal of the American Medical Association
K-40	potassium-40
KC	Keystone Center
JRB	Joint Reserve Base
km	kilometer
kVA	kilovolt-ampere
kWh	kilowatt hour
L	LARGE
LaaR	Load Acting as a Resource
LANL	Los Alamos National Laboratory
lb	pounds
LC	Light Commercial
LG	Lake Granbury
LL	low-level
LLD	lower limits of detection
LLMW	low-level mixed waste
LNG	liquid natural gas
LOCA	loss of coolant accident
LPSD	low-power and shutdown
LPZ	low population zone
LQG	large-quantity hazardous waste generators
LRS	load research sampling
LTSA	long term system assessment
Luminant	Luminant Generation Company LLC

ACRONYMS AND ABBREVIATIONS

LVW	low volume waste
LWA	Limited Work Authorization
LWMS	liquid waste management system
LWPS	liquid waste processing system
LWR	light water reactor
M	MODERATE
ma	milliamperes
MACCS2	Melcor Accident Consequence Code System
MCES	Main Condenser Evacuation System
Mcf	thousand cubic feet
MCPE	Market Clearing Price for Energy
MCR	main control room
MD-1	Duplex
MDA	minimum detected activity
MDCT	mechanical draft cooling tower
MEIs	maximally exposed individuals
MF	Multi-Family
mG	milliGauss
mg/l	milligrams per liter
mg/m^3	milligrams per cubic meter
MH	Manufactured Housing
MHI	Mitsubishi Heavy Industries
mi	mile
mi^2	square miles
MIT	Massachusetts Institute of Technology

ACRONYMS AND ABBREVIATIONS

MMbbl	million barrels
MMBtu	million Btu
MNES	Mitsubishi Nuclear Energy Systems Inc.
MOU	municipally-owned utility
MOV	motor operated valve
MOX	mixed oxide fuel
mph	miles per hour
MSDS	Materials Safety Data Sheets
msl	mean sea level
MSR	maximum steaming rate
MSW	municipal solid waste
MT	Main Transformer
MTU	metric tons of uranium
MW	megawatts
MW	monitoring wells
MWd	megawatt-days
MWd/MTU	megawatt–days per metric ton uranium
MWe	megawatts electrical
MWh	megawatt hour
MWS	makeup water system
MWt	megawatts thermal
NAAQS	National Ambient Air Quality Standards
NAPA	Natural Areas Preserve Association
NAP	National Academies Press
NAR	National Association of Realtors

ACRONYMS AND ABBREVIATIONS

NARM	accelerator-produced radioactive material
NAS	Naval Air Station
NASS	National Agricultural Statistics Service
NCA	Noise Control Act
NCDC	National Climatic Data Center
NCDENR	North Carolina Department of Environmental and Natural Resources
NCES	National Center for Educational Statistics
NCI	National Cancer Institute
NCTCOG	North Central Texas Council of Governments
ND	no discharge
NDCT	natural draft cooling towers
NEI	Nuclear Energy Institute
NELAC	National Environmental Laboratory Accreditation Conference
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation/Council
NESC	National Electrical Safety Code
NESDIS	National Environmental Satellite, Data, and Information Service
NESW	non-essential service water cooling system
NESWS	non-essential service water system
NETL	National Energy Technology Laboratory
NHPA	National Historic Preservation Act
NHS	National Hurricane Center
NINI	National Institute of Nuclear Investigations
NIOSH	National Institute for Occupational Safety and Health

ACRONYMS AND ABBREVIATIONS

NIST	U.S. National Institute of Standards and Technology
NJCEP	NJ Clean Energy Program
NLDN	National Lightning Detection Network
NOAA	National Oceanic and Atmospheric Administration
NOAEC	no observable adverse effects concentration
NOI	Notice of Intent
NOIE	non-opt-in entities
NO_x	oxides of nitrogen
NP	Nacogdoches Power
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NR	not required
NRC	U.S. Nuclear Regulatory Commission
NREL	U.S. National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NRRI	National Regulatory Research Institute
NSPS	New Source Performance Standards
NSSS	nuclear steam supply system
NTAD	National Transportation Atlas Database
NVLAP	National Voluntary Laboratory Accreditation Program
NWI	National Wetlands Inventory
NWS	National Weather Service
NWSRS	National Wild and Scenic Rivers System
O_2	Oxygen
O_3	Ozone

ACRONYMS AND ABBREVIATIONS

ODCM	Off-site Dose Calculation Manual
OECD	Organization for Economic Co-operation and Development
O&M	operations and maintenance
ORNL	Oak Ridge National Laboratory
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Act
OW	observation well
P&A	plugging and abandonment
PAM	primary amoebic meningoencephalitis
PD	Planned Development
PDL	Proposed for Delisting
PE	probability of exceedances
percent g	percent of gravity
PET	Potential Evapotranspiration
PFBC	pressurized fluidized bed combustion
PFD	Process Flow Diagram
PGA	peak ground acceleration
PGC	power generation company
PH	Patio Home
P&ID	piping and instrumentation diagram
PM	particulate matter
PM_{10}	particulate matter less than 10 microns diameter
$PM_{2.5}$	particulate matter less than 2.5 microns diameter
PMF	probable maximum flood
PMH	probable maximum hurricane

ACRONYMS AND ABBREVIATIONS

PMP	probable maximum precipitation
PMWP	probable maximum winter precipitation
PMWS	probable maximum windstorm
PPE	plant parameter envelope
ppm	parts per million
PPS	preferred power supply
PRA	probabilistic risk assessment
PSD	Prevention of Significant Deterioration (permit)
PSWS	potable and sanitary water system
PUC	Public Utility Commission
PUCT	Public Utility Commission of Texas
PURA	Public Utilities Regulatory Act
PWR	pressurized water reactors
QA	quality assurance
QC	quality control
QSE	qualified scheduling entities
R10	Single-Family Residential
R12	Single-Family Residential
R7	Single-Family Residential
R8.4	Single-Family Residential
RAT	Reserve Auxiliary Transformer
RB	reactor building
R/B	reactor building
RCDS	reactor coolant drain system
RCDT	reactor coolant drain tank

ACRONYMS AND ABBREVIATIONS

RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
RDA	Radiosonde Database Access
REC	renewable energy credit
REIRS	Radiation Exposure Information and Reporting System
RELFRC	release fractions
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
REP	retail electric providers
REPP	Renewable Energy Policy Project
RFI	Request for Information
RG	Regulatory Guide
RHR	residual heat removal
RIMS II	regional input-output modeling system
RMR	Reliability Must-Run
Rn_{222}	Radon-222
RO	reverse osmosis
ROI	region of interest
ROW	right of way
RPG	regional planning group
RRY	reactor reference year
RTHL	Recorded Texas Historic Landmarks
RTO	regional transmission organization
Ru-103	ruthenium-103
RW	test well

ACRONYMS AND ABBREVIATIONS

RWSAT	refueling waste storage auxiliary tank
RWST	refueling water storage tank
RY	reactor-year
S	SMALL
SACTI	Seasonal/Annual Cooling Tower Impact Prediction Code
SAL	State Archaeological Landmark
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SB	Senate Bill
SCR	Squaw Creek Reservoir
SCDC	Somervell County Development Commission
scf	standard cubic feet
SCWD	Somervell County Water District
SDS	sanitary drainage system
SECO	State Energy Conservation Office
SER	Safety Evaluation Report
SERC	SERC Reliability Corporation
SERI	System Energy Resources, Inc.
SFPC	spent fuel pool cooling and cleanup system
SG	steam generator
SGBD	steam generator blow-down
SGBDS	steam generator blow-down system
SGs	steam generators
SGTR	steam generator tube rupture
SH	State Highway

ACRONYMS AND ABBREVIATIONS

SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMP	State Marketing Profiles
SMU	Southern Methodist University
SOP	Standard Operations Permit
SO_2	sulfur dioxide
SO_x	sulfur
SPCCP	Spill Prevention Control and Countermeasures Plan
SPP	Southwest Power Pool
SQG	small-quantity generators
sq mi	square miles
SRCC	Southern Regional Climate Center
SRP	Standard Review Plan
SRST	spent resin storage tank
SSAR	Site Safety Analysis Report
SSC	structures, systems, and components
SSI	Safe Shutdown Impoundment
SSURGO	Soil Survey Geographic
SWATS	Surface Water and Treatment System
SWMS	solid waste management system
SWPC	spent fuel pool cooling and cleanup system
SWP3	Storm Water Pollution Prevention Plan
SWS	service water system
SWWTS	sanitary wastewater treatment system
T	Federally Threatened

ACRONYMS AND ABBREVIATIONS

t	ton
TAC	technical advisory committee
TAC	Texas Administrative Code
TB	turbine building
Tc_{99}	Technetium-99
TCEQ	Texas Commission on Environmental Quality
TCPS	Texas Center for Policy Studies
TCR	transmission congestion rights
TCS	turbine component cooling water system
TCWC	Texas Cooperative Wildlife Collection
T&D	transmission and distribution utility
TDCJ	Texas Department of Criminal Justice
TDOH	Texas Department of Health
TDOT	Texas Department of Transportation
TDPS	Texas Department of Public Safety
TDS	total dissolved solids
TDSHS	Texas Department of State Health Services
TDSP	transmission and distribution service provider
TDWR	Texas Department of Water Resources
TEDE	total effective dose equivalent
TGLO	Texas General Land Office
TGPC	Texas Groundwater Protection Committee
TH	Townhome
THC	Texas Historical Commission
THPOs	tribal historic preservation officers

ACRONYMS AND ABBREVIATIONS

TIS	Texas Interconnected System
TLD	Thermoluminescence Dosemeter
TMDLs	total maximum daily loads
TMM	Texas Memorial Museum
TOs	Transmission Owners
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TRAGIS	Transportation Routing Analysis Geographic Information System
TRB	Transportation Research Board
TRC	total recordable cases
TRE	Trinity Railway Express
TSC	technical support center
TSD	thunderstorm days per year
TSD	treatment, storage, and disposal
TSDC	Texas State Data Center
TSHA	Texas State Historical Association
TSP	transmission service provider
TSWQS	Texas Surface Water Quality Standards
TSS	total suspended sediment
TTS	The Transit System (Glen Rose)
TUGC	Texas Utilities Generating Company
TUSI	Texas Utilities Services Inc.
TWC	Texas Workforce Commission
TWDB	Texas Water Development Board

ACRONYMS AND ABBREVIATIONS

TWR	Texas Weather Records
TWRI	Texas Water Resources Institute
TxDOT	Texas Department of Transportation
TXU	Texas Utilities Corporation
TXU DevCo	TXU Generation Development Company LLC
UC	University of Chicago
UFC	uranium fuel cycle
UHS	Ultimate Heat Sink
UIC	Uranium Information Center
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
US-APWR	(MHI) United States-advanced pressurized water reactor
USC	U.S. Census
USCA	United States Court of Appeals
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
USHCN	United States Historical Climatology Network
USHR	U.S. House of Representatives
USNPS	U.S. National Park Service
UTC	Universal Time Coordinated
UV	ultra-violet
VCIS	Ventilation Climate Information System

ACRONYMS AND ABBREVIATIONS

VCT	volume control tank
VERA	Virtus Energy Research Associates
VFD	Volunteer Fire Department
VOC	volatile organic compound
VRB	variable
WB	Weather Bureau
WBR	Wheeler Branch Reservoir
WDA	work development area
WDFW	Washington Department of Fish and Wildlife
weight percent	wt. percent
WHT	waste holdup tank
WMT	waste monitor tank
WNA	World Nuclear Association
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan
WRE	Water Resource Engineers, Inc.
WWS	wastewater system
WWTP	wastewater treatment plant
yr	year

CHAPTER 2

ENVIRONMENTAL DESCRIPTION

2.0 ENVIRONMENTAL DESCRIPTION

Chapter 2 describes the existing environmental conditions at the Comanche Peak Nuclear Power Plant (CPNPP) site, site vicinity, and region. The environmental descriptions provide sufficient detail to identify those environmental resources that have the potential to be affected by the construction, operation, or decommissioning of the new units. This chapter is divided into eight sections:

- Station Location (Section 2.1).
- Land (Section 2.2).
- Water (Section 2.3).
- Ecology (Section 2.4)
- Socioeconomics (Section 2.5).
- Geology (Section 2.6).
- Meteorology and Air Quality (Section 2.7).
- Related Federal Project Activities (Section 2.8).

The figures listed below supplement the scope of the discussions provided throughout this Environmental Report:

- CPNPP region – the area within approximately the 50-mi radius from the centerpoint of CPNPP Units 3 and 4. (Figure 1.1-1).
- CPNPP vicinity – the area within approximately the 6-mi (Figure 1.1-2) band from the CPNPP Units 3 and 4 site boundary.
- CPNPP site – the 7950-acre (ac) area identified by the site boundary. (Figure 1.1-3).

2.1 STATION LOCATION

Luminant Generation Company LLC (Luminant) proposes to construct and operate two Mitsubishi Heavy Industries (MHI) US-APWR reactors (Units 3 and 4) at Luminant's CPNPP 7950-ac site located in rural Somervell and Hood counties, in north central Texas. Luminant is the applicant, owner, and operator of the new units. Current assets at this site include two Westinghouse 4-loop pressurized water reactor (PWR) units (CPNPP Units 1 and 2) and supporting infrastructures. The site plot plan is shown in Figure 2.1-1; regional and vicinity maps are shown as Figures 1.1-1, 1.1-2 and an aerial view as Figure 1.1-3.

The coordinates of the centers of the new reactors (Units 3 and 4) are:

LATITUDE AND LONGITUDE NAD83 (degrees/minutes/seconds)

	Latitude	Longitude
UNIT 3:	32° 18' 08.9" N	97° 47' 30.1" W
UNIT 4:	32° 18' 07.5" N	97° 47' 41.8" W

UNIVERSAL TRANSVERSE MERCATOR ZONE 14 NAD83 (Meters)

	Northing	Easting
UNIT3:	3574606	613759
UNIT4:	3574559	613453

The center point of the CPNPP Units 3 and 4 site is located at 3574584N and 613606E.

There are six population centers (as defined by 10 CFR 100.3) within 50 mi of the reactors: Fort Worth, population 653,320; North Richland Hills, population 62,306; Haltom City, population 39,987; Mansfield, population 41,564; Burleson, population 31,660; Cleburne, population 29,689; Watauga, population 23,685; Weatherford, population 24,630; and Benbrook with a population of 22,307. (US Census 2006)

The site is approximately 40 mi southwest of Fort Worth, Texas; 46 mi southwest of Haltom City; 32 mi west of Burleson; and 24 mi west of Cleburne. The nearest population center to the CPNPP site is Cleburne. The closest communities to the CPNPP center point are the cities of Glen Rose and Granbury. The site is 5.2 mi north of Glen Rose and 9.6 mi south of Granbury. Granbury is the largest city within a 10-mi radius of the CPNPP (USGS 2007 and US Census 2006).

The property boundary of the CPNPP site encompasses approximately 7950 ac. The site is accessible by a rail spur, which connects to the Fort Worth and Western Railroad Company main line at Tolar, Texas, by a plant access road which connects to Farm to Market Road 56 (FM 56), and by County Road 213 (also known as Coates Road) that connects to Texas State Highway 144 (SH 144) (TXU 2007).

Squaw Creek Reservoir (SCR), located entirely within the site boundary, has an approximate pool elevation of 775 ft msl and is owned by the applicant (TWDB 2003). The reservoir does not provide access to the site.

2.1.1 REFERENCES

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(US Census 2006) U.S. Census Bureau. “American FactFinder - Texas By Place GTC - Population Estimates.” U.S. Census Bureau, Washington, D.C. Available URL: http://factfinder.census.gov/servlet/home/en/official_estimated.html, Accessed July 24, 2008.

(TWDB 2003) Volumetric Survey Report of Squaw Creek Reservoir, March 2003. Texas Water Development Board. http://www.twdb.state.tx.us/home/index.asp. Accessed November 2007.

(TXU 2007) Texas Generation Company LP. “Final Safety Analysis Report (FSAR)” Amendment 101. Comanche Peak Steam Electric Station. Glen Rose, Texas (February 1, 2007).

2.2 LAND

The CPNPP is located on the Squaw Creek Reservoir (SCR) approximately 5.2 mi north of Glen Rose in Hood and Somervell Counties, Texas. CPNPP is accessible by rail and road. The CPNPP rail spur connects the site to the main line that runs through Tolar, approximately 9.3 mi northwest (BTS 2006). A farm to market road (FM 56) connects the site to U.S. Highway 67 (US 67) and FM 51. US-67 connects Cleburne to Stephenville after passing through Glen Rose. FM-51 connects Granbury to Paluxy. Access to the site and to SCR is limited to those persons granted access rights by Luminant.

This section describes, in general terms, the CPNPP site, the land in the vicinity of the site, and the land in the region of the site. The terms site, vicinity, and region are defined in Section 2.0.

2.2.1 THE SITE AND VICINITY

2.2.1.1 The Site

The 7950-ac site boundary parallels the shoreline of SCR to the north, east, and south. The west side of the property boundary is bordered by FM 56, and the remaining sides of the property are a mix of farmland and residential properties. The majority of the site is surrounded by chain link fencing and access to the site is restricted to authorized persons only.

Luminant owns the property and a portion of the mineral rights at the CPNPP site, directs land management activities, and is the named applicant for the CPNPP site. Some subsurface mineral rights on the CPNPP site are not owned by Luminant; however, deed restrictions prevent mineral owners within the perimeter of the exclusion area boundary (EAB) (Figure 2.1-1) from placing drilling rigs. Luminant has absolute authority to control ingress rights for mineral rights exploration in the site.

Neither Hood nor Somervell counties have zoning laws outside city limits. The CPNPP site is located outside the city limits of Glen Rose and Granbury, the only two cities that have zoning laws. The CPNPP is also outside the land-use plans of Glen Rose and Granbury. Hood and Somervell counties do not have comprehensive land-use plans.

Luminant’s land-use plans for CPNPP are shown in Figure 2.1-1. There are existing structures and roadways at the CPNPP site (e.g. containment buildings, switchyard, and auxiliary buildings); some of which are utilized in support roles for the new reactors. Construction details are addressed in Chapter 4.

Based on U.S. Geological Survey (USGS) land categories and the latest data from the National Land Cover Dataset, the land-use designation within the site is shown in Table 2.2-1 and Figure 2.2-1. Approximately 1346.6 ha (3327.5 ac) of the site have been designated as open water and another 445.4 ha (1100.6 ac) are designated as grassland/herbaceous (USGS 2001).

According to the 2005 U.S. Department of Agriculture (USDA) soil survey data, approximately 1064 ac of prime farmland are located within the CPNPP site boundary, however the prime farmland is not utilized (USDA 2005). Figure 2.2-1 shows the location of prime farmland on-site.

Approximately 7 ac of prime farmland extend into areas to be disturbed by the construction and operation of CPNPP Unit 3 and Unit 4. The prime farmland is currently herbaceous grassland and sits adjacent to the lands previously developed for commercial purposes.

The CPNPP site is situated on a peninsula located on the southwestern bank of the SCR. The reservoir is contained completely within the bounds of the CPNPP site.

Four pipelines cross the CPNPP site. Sunoco Pipeline LP operates a 26-in crude oil pipeline that crosses the western and southern portions of the site. Atmos Energy operates a 36-in natural gas pipeline passing through the northern portion of the site and a 6.63-in natural gas pipeline crossing the northern and western portions of the site. Enterprise operates a 30-in natural gas pipeline that passes through the northern portion of the site. Pipelines found in the vicinity are described in Subsection 2.2.1.2.

2.2.1.2 The Vicinity

There are no major roads located within 6 mi of the site. The nearest interstate highway (I-20) is approximately 28 mi northwest (BTS 2006). I-20 connects the Dallas-Ft. Worth Metroplex with Abilene, Texas. The nearest rail line, the Fort Worth and Western Railroad, (not including the CPNPP spur) is approximately 9 mi to the northwest (Figure 1.1-2) (BTS 2006). There are no federal lands in the vicinity of CPNPP (Figure 2.2-2) (National Atlas 2006).

Nine major pipelines are located within the vicinity including four that cross the site: eight contain natural gas, one contains crude oil (Railroad Commission of Texas 2007).

Atmos Energy operates three natural gas pipelines: (1) one 36-in pipeline passing through the northern portion of the site, (2) one 6.63-in pipeline crossing the northern and western portions of the site, and (3) one 16-in pipeline located northeast of the site. Quicksilver Resources operates a 20-in natural gas pipeline to the northeast of the site and a 12-in natural gas pipeline to the east of the site. Enterprise operates two natural gas pipelines: (1) one 30-in pipeline that passes through the northern portion of the site and (2) one 14-in pipeline located northeast of the site. Sunoco Pipeline LP operates a 26-in crude oil pipeline that crosses the western and southern portions of the site. Worsham-Steed Gas Storage LP operates a 24-in natural gas pipeline that is located to the northwest of the site.

In addition to these major pipelines, there are numerous lines delivering natural gas to residential, commercial, and industrial units. These are mainly operated by Meg Texas Gas Services LP and have diameters ranging from 2.38 to 16 in.

A new 36-in pipeline operated by Energy Transfer Partners is being added near the north end of SCR near the existing pipelines.

Three major industrial sites are within the vicinity: (1) DeCordova Compressor Station; (2) Wolf Hollow 1 LP; and (3) DeCordova Steam Electric Station. The DeCordova Compressor station is operated by Enterprise and is located 3.1 mi northeast of the site. Wolf Hollow 1 LP is a 730-MW gas-fired power plant located 4.9 mi northeast of the site (The Shaw Group Inc. 2007). The De Cordova Steam Electric Station is a four-turbine conventional steam generating plant located 3.6 mi northeast of the site.

Three private airports and one public airport are located within the CPNPP site vicinity. Five more private airports and one private heliport are also located within 10.5 mi of CPNPP (Airnav 2007). All previously mentioned airports and the heliport are listed below. The distance to each is calculated from the CPNPP center point.

Airport	Distance and Direction	Description
Parker Airport	3.5 mi north	Private
Running M Ranch Airport	5 mi southwest	Private
Wyatt 3-Rivers Airport	5.5 mi southeast	Private
Circle P Ranch Airport	6.7 mi southwest	Private
Circle Eight Ranch Airport	7.6 mi southwest	Private
Pecan Plantation Airport	7.7 mi east-northeast	Private
Nassau Bay Airport	9.3 mi north-northeast	Private
Wright Ranch Airport	9.6 mi south-southwest	Private
Granbury Municipal	9.9 mi north	Public
Shelton Private Heliport	10.5 mi west-northwest	Private

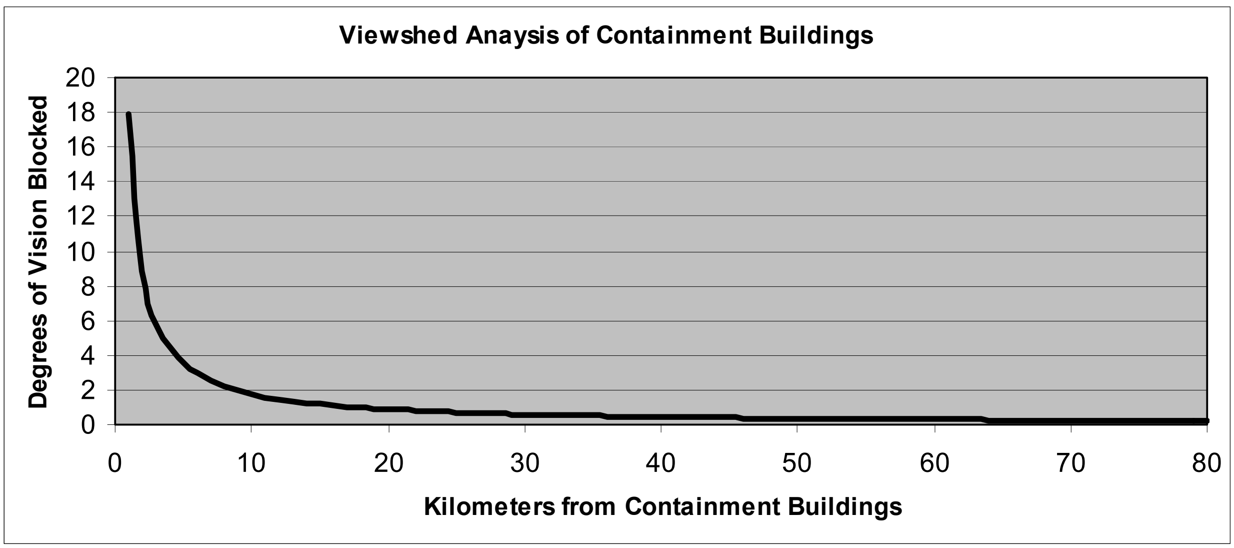
The closest airport is Parker Airport, located 3.5 mi north of the site. Parker is home to one, single-engine airplane and has a 200-ft turf runway and a 610-ft turf runway. The closest public airport is Granbury Municipal Airport, located approximately 9.9 mi north. Granbury Municipal Airport has one 3603-ft asphalt runway (USDOT 2007). The airport is home to 54 single-engine aircraft, three multi-engine aircraft, and two helicopters (Airnav 2007). Granbury Municipal Airport averages 33 aircraft operations a day (USDOT 2007). There are plans to begin construction on a new 5300-ft runway in 2008.

The nearest state park to the site is Dinosaur Valley State Park, located 3.3 mi southwest (USGS 2007). Numerous parks and venues provide camping and recreational opportunities within the vicinity of CPNPP. The Glen Lake Camp and Retreat Center is located 5.3 mi southeast and hosts various retreats, summer camps, and events (Glen Lake 2007). Oakdale Park located 5.2 mi southeast and Tres Rios Park located 5.7 mi southeast host outdoor events throughout the year and provide camping facilities (Oakdale Park 2007), (Tres Rios River Ranch 2007). The Texas Amphitheatre, located 3.7 mi east, hosts outdoor events (Glen Rose 2006). Additional parks and venues in the surrounding areas of CPNPP include: (1) Squaw Creek Golf Course 5 mi to the southeast, (2) Pecan Plantation Country Club 7.5 mi to the northeast, and (3) Nutcracker Golf Club 8.2 mi to the northeast (Golf Link 2007). Lake Granbury, located approximately 7 mi northeast, has seven public use areas, marinas, and a riverboat that provide recreational facilities to the public (Brazos River Authority 2006), (Granbury Riverboat 2007), (Glen Rose Network 2007).

The vicinity of the site is primarily rural consisting of grasslands, deciduous and evergreen forests, and some agricultural cropland (USGS 2001). The site and vicinity are located entirely within Hood and Somervell counties (BTS 2006). Based upon USGS land-use categories and data from the USGS, the land-uses designation within the vicinity are shown in Table 2.2-1 and Figure 2.2-3 (USGS 2001).

CPNPP Units 3 and 4 reactor domes are 226 ft high. With CPNPP Unit 1 and Unit 2 in operation since 1990 and 1993, respectively, any effect on local viewsheds has already occurred. According to viewshed analysis, the reactor domes are visible from Dinosaur Valley State Park and Oakdale Park.

The following graph illustrates the effect of the buildings as a function of distance and angle of vision occupied by the containment buildings. As the distance from the containment buildings increases, the angle of vision occupied by the containment buildings decreases significantly and has minimal visual effect beyond 20 mi.



According to the 2002 Agriculture Census, 84,262 ac of Somervell County are farmland and 202,131 ac of Hood County are farmland (USDA 2002a), (USDA 2002). Of the lands considered by USDA as farmland in Somervell County, 64.6 percent are pasture, 25.8 percent are cropland, 7.6 percent are woodland, and 1.9 percent are other uses (USDA 2002a). Of the lands considered by USDA as farmland in Hood County, 55 percent are pasture, 37.5 percent are cropland, 5.2 percent are woodland, and 2.3 percent are other uses (USDA 2002). There is a total of 144,425 ac of prime farmland in Somervell and Hood counties (USDA 2005). The annual crop yield of Hood County is 12,298 bushels of wheat grain, 26,870 bushels of oat grain, and 59,730 tons of dry forage (USDA 2002). The annual crop yield of Somervell County is 13,743 tons of dry forage (USDA 2002a). Table 2.2-2 shows the primary agricultural products in Hood and Somervell counties.

The largest city in the vicinity of CPNPP is Granbury, which is also the county seat of Hood County (BTS 2006). This city has a zoning plan and supporting zoning laws in place for land inside the city limits (Granbury 2007). The zoning designation of approximately 8987 ac of land inside city limits is shown in Table 2.2-3 (Granbury 2007).

Land use around Lake Grandbury consists primarily of developed land with residential development located close to the shore and commercial development located along the US 377 corridor. Undeveloped land consists of grasslands and agricultural cropland. Eleven smaller towns and unincorporated communities are located within the vicinity of CPNPP and are listed below. The distance to each is calculated from the CPNPP center point. Pecan Plantation is a census designated place (CDP), which is an area delineated to provide census data for settled concentrations of population that are identifiable by name but are not legally incorporated. The CDP boundaries may change from one census to the next.

City	Distance and Direction
Hill City	3.3 mi west
Rainbow	5.3 mi southeast
Neri	4.4 mi northeast
Glen Rose	5.2 mi south
Paluxy	7.0 mi south-southeast
Tolar	9.6 mi north-northwest
Brushy	6.1 mi north
Mambrino	5.7 mi north
Pecan Plantation CDP	7.9 mi east
Fort Spunky	8.8 mi east
Nemo	8.8 mi east-southeast

Glen Rose has zoning laws in place for all land inside city limits. The other listed towns and communities do not have zoning laws limiting development. Somervell and Hood counties do not have zoning laws limiting development in unincorporated areas.

2.2.2 TRANSMISSION CORRIDORS AND OFF-SITE AREAS

Three single-circuit transmission lines are located on existing ROWs and use existing tower structures (Figure 1.1-5). Two double circuit expansions require the construction of new towers on new or expanded transmission line ROW 160 ft wide. The first is a 45-mi line to Whitney and the second is a 17-mi line to DeCordova. No land-use impacts are anticipated from the transmission line construction activity located on existing ROWs as vegetation maintenance is already performed. Land use along the DeCordova ROW consists mainly of grassland, while the land use along the Whitney ROW consists of primarily grassland with some deciduous and evergreen forest. Table 2.2-4 shows the land-use acreages in transmission line ROW.

Additional water intake and discharge pipelines are expected to be constructed for CPNPP Units 3 and 4 extending from the plant to Lake Granbury (Figure 1.1-4). The pipelines are expected to occupy an existing 50-ft row and are expected to run parallel to the existing water pipelines. Table 2.2-5 shows the land-use acreages in the pipeline ROW. Additional intake and discharge structures are expected to be placed to the north and adjacent to the existing intake and discharge structures on Lake Granbury. As discussed in Subsection 2.4.1.2.2, no wetlands or habitat for threatened or endangered species are located on the pipeline ROW. Vegetation consists mainly of grassland and ashe juniper. Land-use impacts to the ROW during construction are discussed in Subsection 4.1.2.

2.2.3 THE REGION

There are 19 counties completely or partially within the 50-mi radius of the site center point, all of which are located in Texas. These counties include: (1) Dallas, (2) Stephens, (3) McLennan, (4) Ellis, (5) Hood, (6) Johnson, (7) Eastland, (8) Erath, (9) Somervell, (10) Hill, (11) Comanche, (12) Bosque, (13) Hamilton, (14) Jack, (15) Wise, (16) Palo Pinto, (17) Parker, (18) Tarrant, and (19) Coryell counties (BTS 2006). The largest cities in the region are Fort Worth (624,067 people), Haltom City (39,875 people), Burleson (29,613 people), and Cleburne (29,184 people) (US Census 2005).

There are five interstate highways within the region of CPNPP: (1) I-20 (approximately 28 mi northwest); (2) I-35W (approximately 33 mi east); (3) I-35E (approximately 44 mi east); (4) I-30 (approximately 32 mi northeast); and (5) I-820 (approximately 33 mi northeast). I-35W and I-35E combine as I-35 north of Denton, Texas, and south of Dallas, Texas. I-35 connects Oklahoma City, Oklahoma to the cities of Dallas and San Antonio, Texas. I-820 is part of Loop 820 that navigates around Fort Worth, Texas (BTS 2006). Major transportation routes in the region are shown in Figure 1.1-1.

The Paluxy River runs from northern Erath County southeast to Somervell County where it joins the Brazos River. The Brazos River runs from northern Texas to the Gulf of Mexico, and passes through Hood and Somervell counties (BTS 2006). The Brazos River is not designated as a National Wild and Scenic River, and is only navigable downstream of the Lake Whitney Dam located 39 mi southeast (USGS 2007), (NWSRS 2007), (USACE 1999). However, 115 river mi of the river in Palo Pinto and Parker counties are designated the John Graves Scenic Riverway by the state of Texas (Reed ACP 2007). There are no ports within the 50-mi region (BTS 2006).

Based on USGS land-use categories and data, the land-uses designation within the 50-mi region are shown in Table 2.2-1 and Figure 2.2-4 (USGS 2001). The principle crops produced in the region according to the 2002 agricultural census are corn (4 million bu), sorghum and sorghum silage (3.4 million bu), and wheat (2.5 million bu). In addition, 5.8 million lb of peanuts are produced in the region.

Within the region of CPNPP, there are five separate federal land holdings as shown in Figure 2.2-2 (US Census 2000). Four of these federal land holdings are lakes developed by the Army Corps of Engineers: (1) Benbrook Lake at 5169 ac; (2) Aquilla Lake at 17,294 ac; (3) Lake Whitney at 21,841 ac; and (4) Proctor Lake at 6505 ac. The remaining federal land holding is Naval Air Station (NAS) Fort Worth, Joint Reserve Base at Carswell. Commissioned on October 1, 1994, the base was previously known as Carswell Air Force Base and became NAS Fort

Worth, Joint Reserve Base at Carswell. Covering 3240 ac, the base served as a training facility since 1994 for a Joint Reserve Base (US Census 2000). There are no Native American lands within 50 mi of the site (National Atlas 2006).

One federal land holding that has been recently deactivated is Fort Wolters. Fort Wolters was established in 1925 as Camp Wolters for use as a training ground for the 56th Brigade of the National Guard and covers 4160 ac. The camp was deactivated six months after the end of World War II. However, it was reopened in 1951 by the U.S. Air Force as a home for Aviation Engineer Force. The base was deactivated in 1975. The land is now utilized for the Education Center of Weatherford College, Lake Mineral Wells State Park, the City of Mineral Wells and private interests (Globalsecurity 2006), (TSHA 2001).

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TABLE 2.2-1
USGS LAND USE

USGS Description	Area in Hectares of the Site	Area in Hectares of the Vicinity	Area in Hectares of the Region
Open Water	1346.6	2816.3	38126.3
Developed Open Space	202.6	3464.0	79375.5
Developed Low Intensity	51.4	899.6	52625.5
Developed Medium Intensity	47.0	230.4	19845.8
Developed High Intensity	41.2	96.5	11396.9
Bare Rock/Sand/Clay	0.0	63.4	1540.4
Deciduous Forest	296.3	7467.5	209659.8
Evergreen Forest	756.7	10556.3	215202.0
Mixed Forest	0.0	5.0	132.8
Shrub/Scrub	0.0	0.0	140927.3
Grasslands/Herbaceous	445.4	29660.4	1018826.3
Pasture/Hay	0.1	2379.5	113820.9
Cultivated Crops	14.1	579.2	110460.1
Woody Wetlands	40.5	1092.6	31355.6
Emergent Herbaceous Wetland	0.0	1.0	473.9
Total	3241.9	59311.6	2043796.1

(USGS 2001)

TABLE 2.2-2
AGRICULTURAL PRODUCTS IN HOOD AND SOMERVELL COUNTIES

Products	Hood	Somervell
Wheat Grain (bu)	12,298	0
Corn Grain (bu)	D	0
Corn Silage (T)	D	0
Oat Grain (bu)	26,870	0
Sorghum Grain (bu)	100	D
Sorghum Silage (bu)	D	0
Forage (T, dry)	59,730	13,743
Peanuts (lb)	D	0
Cows	30,059	6876
Hogs and Pigs	123	17
Sheep and Lambs	606	489
Chickens	1596	421

D = Data withheld to avoid disclosing data for individual farms

TABLE 2.2-3
ACRES OF ZONED LAND IN GRANBURY

Zoning Description	Hectares	Acres
Business Commercial (BC)	40.8	100.7
Central Business District (CBD)	13.8	34.2
Heavy Commercial (HC)	142.6	352.3
Industrial (I)	85.1	210.4
Interim Holding (IH)	1743.3	4307.8
Light Commercial (LC)	451.9	1116.6
Duplex (MD-1)	4.2	10.3
Multi-Family (MF)	74.6	184.3
Manufactured Housing (MH)	15.4	38.0
Planned Development (PD)	325.5	804.3
Patio Home (PH)	17.6	43.5
Single-Family Residential (R10)	212.3	524.7
Single-Family Residential (R12)	79.2	195.7
Single-Family Residential (R7)	46.2	114.1
Single-Family Residential (R8.4)	235.3	581.5
Townhome (TH)	6.3	15.6
No Zoning	142.9	353.2
Total:	3636.9	8987.1

(Granbury 2007)

TABLE 2.2-4
TRANSMISSION LINE LAND USE

	DeCordova		Whitney		Parker		Johnson		Everman	
Vegetation Type	Acreage	Percent	Acreage	Percent	Acreage	Percent	Acreage	Percent	Acreage	Percent
Water	11.0	7.4	3.1	0.3	3.3	0.4	1.6	0.4	0.0	0.0
Developed, Open	11.0	7.4	19.8	2.1	28.4	3.6	4.0	1.1	46.4	10.5
Developed, Low Intensity	0.2	0.2	0.9	0.1	8.4	1.1	0.2	0.1	9.6	2.2
Developed, Medium Intensity	0.4	0.3	0.0	0.0	0.9	0.1	0.0	0.0	0.2	0.1
Developed, High Intensity	1.3	0.9	0.0	0.0	1.1	0.1	0.0	0.0	0.9	0.2
Barren Land	0.9	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	10.1	6.8	176.1	18.5	116.5	14.9	28.9	8.0	47.8	10.8
Evergreen Forest	3.1	2.1	137.0	14.4	55.2	7.1	29.4	8.1	0.2	0.1
Mixed Forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scrub/Shrub	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.7
Grassland	107.5	72.3	550.0	57.7	520.2	66.7	266.4	73.5	262.9	59.4
Pasture	1.3	0.9	35.8	3.8	31.9	4.1	22.5	6.2	63.8	14.4
Cropland	0.0	0.0	7.6	0.8	3.1	0.4	5.8	1.6	7.1	1.6
Woody Wetlands	1.6	1.1	22.9	2.4	10.4	1.3	3.8	1.0	0.9	0.2
Total	148.7	100.0	953.6	100.0	779.6	100.0	362.6	100.0	442.7	100.0

TABLE 2.2-5
PIPELINE CORRIDOR LAND USE

Land Use Type	Acreage	Percent
Water	0.2	0.4
Developed, Open	6.2	12.4
Developed, Low Intensity	1.2	2.3
Developed, Medium Intensity	0.3	0.5
Barren Land	0.2	0.4
Deciduous Forest	6.3	12.6
Evergreen Forest	3.7	7.5
Grassland	31.4	63.1
Cropland	0.4	0.7
Woody Wetlands	0.1	0.1
Total	49.7	100.0

(USGS 2001)

2.3 WATER

This section of the Environmental Report (ER) describes the physical, chemical, biological, and hydrological characteristics of surface waters and groundwater in the vicinity of the CPNPP. ER Sections 4.2, 5.2, and 5.3 address potential impacts to water quality by the construction and operation of two new Mitsubishi Heavy Industries (MHI) US-APWR reactors (Units 3 and 4). Section 2.3 subsections descriptions are presented below:

- Subsection 2.3.1 provides a detailed description of the surface water bodies and groundwater aquifers in the vicinity of CPNPP Units 3 and 4 water supply and effluent disposal.
- Subsection 2.3.2 describes surface water and groundwater uses in the vicinity of the facility as well as plant water use for the construction and operation of CPNPP Units 3 and 4.
- Subsection 2.3.3 provides detailed water quality information regarding the surface water and groundwater in the vicinity of the CPNPP site.

2.3.1 HYDROLOGY

A detailed and thorough description of the hydrologic environment, considering both present and known future water uses, is essential for evaluating potential impacts to the environment. The following information provides a detailed and complete description of the surface water bodies and groundwater aquifers that could affect the CPNPP water supply and effluent disposal, or that could be affected by construction or operation of CPNPP Units 3 and 4, including transmission and water pipeline corridors.

The information presented in this section is supported by numerous maps, including digital databases such as a Geographic Information System (GIS), of sufficient detail to show the relationship of the site location in relation to major hydrological systems that could affect or be affected by plant construction and operation. The specific hydrology data assembled, analyzed, and presented in this section are based on information presented in the Units 1 and 2 ER and Final Safety Analysis Report (FSAR), data from recent site investigations, and information from credible and citable sources.

This section describes surface water bodies and groundwater resources that could be affected by the construction and operation of CPNPP Units 3 and 4. The site-specific and regional data on the physical and hydrologic characteristics of these water resources are summarized in the following sections.

2.3.1.1 Surface Water

CPNPP Units 3 and 4 are located in rural Somervell and Hood counties in north central Texas (Figure 1.1-1). The CPNPP site is situated on the western end of a peninsula formed by land between the southern shore of Squaw Creek Reservoir (SCR) and the CPNPP Units 1 and 2 Safe Shutdown Impoundment (SSI). The cooling water source for CPNPP Units 3 and 4 is Lake Granbury, an impoundment of the Brazos River, located approximately 7 mi northeast of the

CPNPP site. Surface water features for both the CPNPP site vicinity, and cooling water intake and discharge areas on Lake Granbury are discussed.

2.3.1.1.1 Hydrologic Setting

The Brazos River Basin has the largest drainage area of all basins between the Rio Grande and the Red River in Texas. Total basin drainage area is approximately 45,700 sq mi, of which approximately 43,000 sq mi are in Texas, the remainder in New Mexico. As shown on Figure 2.3-1, the headwaters of the Brazos are formed by three forks: the Double Mountain Fork, the Salt Fork, and the Clear Fork. Principal tributaries to the Brazos downstream of the Clear Fork are Yegua Creek, Bosque River, Little River, formed by the confluence of the Leon, Lampasas, and San Gabriel rivers, and the Navasota River (TCEQ 2002). The CPNPP site and Lake Granbury are located within the Brazos River Basin, a portion of U.S. Geological Survey (USGS) Region 12 (Texas Gulf - Region) that is described as the drainage that discharges into the Gulf of Mexico from and including Sabine Pass to the Rio Grande Basin, and includes parts of Louisiana, Texas, and New Mexico (USGS 2007). Within Region 12, the Brazos River Basin is divided into three subregions: the Brazos Headwaters, Middle Brazos, and Lower Brazos basins (Figure 2.3-2). The CPNPP site is located in the Middle Brazos basin.

The Brazos Headwaters Basin encompasses approximately 14,600 sq mi, and includes the Brazos River Basin above the confluence of and including the Double Mountain Fork Brazos River and the Salt Fork Brazos River basins. The Middle Brazos Basin encompasses approximately 15,500 sq mi, and includes the Brazos River Basin below the confluence of the Double Mountain Fork Brazos River and the Salt Fork Brazos River basins to and including the Castleman Creek Basin. The Lower Brazos Basin encompasses approximately 7960 sq mi and includes the Brazos River Basin below the Castleman Creek Basin (USGS 2007).

The Brazos River Basin is further divided by the USGS into 25 hydrologic cataloging units each of which is assigned a hydrologic unit code (HUC). The CPNPP site lies within the Middle Brazos-Lake Whitney Watershed USGS HUC 12060202, and Lake Granbury lies within the Middle Brazos-Palo Pinto Watershed USGS HUC 12060201 (USGS 2007). Surrounding the Middle Brazos-Lake Whitney and Middle Brazos-Palo Pinto watersheds within the Brazos River Basin are the Middle Brazos-Millers, Lower Clear Fork Brazos, Hubbard, Leon, North Bosque, Bosque, Lower Brazos-Little Brazos, and Navasota watersheds (Table 2.3-1 and Figure 2.3-2).

As shown on Figure 2.3-3, the Brazos River Basin crosses through three distinct physiographic provinces: the Great Plains, Central Lowland, and Coastal Plain (USGS 2007a). Watershed elevations range from about 4700 ft near the headwaters in eastern New Mexico to sea level near Freeport (CPSES 1974).

2.3.1.1.2 Regional Surface Water Net Loss

A review of Brazos River Authority (BRA) and Luminant Generation Company LLC (Luminant) data does not indicate that referenceable evaluations of leakage or seepage from either Lake Granbury or SCR have been performed. Lake Granbury and SCR are formed in the Glen Rose Formation, a predominately limestone sequence, which is relatively impermeable, and free of sinkholes and solutioning.The Glen Rose limestones are essentially impermeable due to slight amounts of argillaceous impurities present. These limestones are resistent to solution effects:

open voids, caverns, joints, collapse features, and fractures, which are frequent in some limestone formations but are notably absent in the Glen Rose Formation near the site (CPSES 2007). Significant loss of water from seepage is improbable. The majority of the regional surface water loss is expected to be from evaporation as presented below.

Mean monthly pan evaporation for Lake Granbury for the years 1993 – 2006 was evaluated using data from the U. S. Army Corps of Engineers (USACE) (USACE 2007). Monthly conversion factors provided by the BRA were applied to the monthly pan evaporation data to estimate reservoir evaporation. The estimated average evaporation on Lake Granbury is approximately 61.74 in/yr. The monthly data and evaporation calculation information are presented in Table 2.3-2.

2.3.1.1.3 Middle Brazos – Palo Pinto Watershed

The CPNPP site is located in the Middle Brazos-Palo Pinto Watershed that incorporates portions of Archer, Young, Jack, Stephens, Palo Pinto, Parker, Eastland, Erath, Hood, Somervell, and Johnson counties. The Middle Brazos Palo Pinto Watershed has a drainage area of approximately 3160 sq mi, which represents approximately 20 percent of subregion 1206, Middle Brazos, or about 7 percent of the entire Brazos River Basin (USGS 2007).

2.3.1.1.4 Middle Brazos – Lake Whitney Watershed

The cooling water intake and discharge structures for CPNPP Units 3 and 4 on Lake Granbury are located in the Middle Brazos-Lake Whitney Watershed that incorporates portions of Erath, Hood, Somervell, Johnson, Hill, Bosque, McLennan, Falls, and Limestone counties. The Middle Brazos-Lake Whitney Watershed has a drainage area of approximately 2500 sq mi which represents approximately 16 percent of subregion 1206, Middle Brazos, or about 5 percent of the entire Brazos River Basin (USGS 2007).

USGS 7.5-minute topographic maps are available for the entire Middle Brazos – Palo Pinto and Lake Whitney watersheds. Figure 2.3-4 provides an index map showing identification numbers and the outline of each USGS quadrangle superimposed on a line map of the watersheds. The map name and identification number is listed with its reference coordinates in Table 2.3-3, ordered from upper left to lower right throughout the coverage area.

2.3.1.1.5 Local Site Drainage

The CPNPP site covers approximately 7950-ac, which generally consists of gently to steeply rolling topography. Within the Squaw Creek drainage basin, approximately 64 sq mi at the SCR Dam site, elevations vary from over 1100 ft msl near the origin of Squaw Creek to about 650 ft msl near the dam site. The topography is influenced by the underlying geology, which consists of sedimentary rocks of Lower Cretaceous age (poorly cemented sandstones, limestones, and shales) that dip gently to the east (CPSES 1974).

The current on-site drainage system for CPNPP Units 1 and 2 consists of engineered and natural drainage systems. The power block including all safety-related buildings are located at a high point, with the surrounding grounds sloping towards SCR to the north and the south. The ground east and west of the buildings slopes towards drainage ditches that discharge into the reservoir on both sides of the peninsula. Six outfalls are listed on the current CPNPP Texas Pollution Discharge Elimination System (TPDES) permit; however, there are currently discharges through only three of the six discharge points. There are separate stormwater outfalls that discharge separately from wastewater outfalls covered by the TPDES permit. The three active discharge points, Outfalls 001, 003, and 004, are active process discharges that flow into SCR. Subsection 2.3.3.3.1 discusses water quality information for active process discharges that flow into SCR. Construction of Units 3 and 4 is expected to result in permanent structures occupying about 275 ac west and northwest of CPNPP Units 1 and 2. An additional 400 ac, located southwest of SCR Dam and due south of existing CPNPP Units 1 and 2 facilities, is expected to be disturbed for construction of a cooling tower blowdown treatment facility (BDTF) for CPNPP Units 3 and 4 (Figure 1.1-4). The grading and drainage plan for CPNPP Units 3 and 4 is provided in the CPNPP Units 3 and 4 FSAR Subsection 2.4.2. The site is graded such that runoff drains away from the safety-related structures via drainage channels or sheet flow and subsequently to SCR through catch basins or as unobstructed overland flow.

2.3.1.1.6 Local Wetland Areas

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Cowardin, Carter, Golet, and LaRoe 1979). A wetland typically demonstrates the following three characteristic components (Mitsch and Gosselink 2000):

- Water, either at the surface or within the root zone.
- Unique soil conditions differing from adjacent uplands.
- Hydrophytic vegetation and the absence of flood-intolerant species.

Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands at the CPNPP site are dominated by macrophytic plants that include cattails, black willow, button bush, sedges, and grasses. The herbaceous layer is dominated by southern cattail and broadleaf cattail, along with Rooseveltweed, bushy bluestem, and spikerush. The tree and shrub layers are dominated by black willow, buttonbush, cottonwood, and salt cedar.

Littoral wetlands are found along the edges of lakes and reservoirs. Although a limited acreage of wetland was lost due to the impoundment of Squaw Creek to form SCR, numerous littoral wetlands have since established. Forty-eight littoral wetlands occur along the shores of SCR (Figure 2.4-2). These wetlands have a cumulative area of approximately 53 ac or less than one percent of the site. Dominant plant species and approximate acreage of each wetland were recorded.

One littoral wetland currently exists at the mouth of an intermittent stream (shown as Stream 2 on Figure 4.3-1)along the southwest shoreline of the peninsula where the proposed cooling tower structures are to be located (Figure 4.3-1). This littoral wetland (Figure 4.3-1) is approximately 0.78 ac and has black willow, salt cedar, and Texas ash in the tree and shrub layers. The herbaceous layer comprises southern and broadleaf cattails, bushy bluestem, and Rooseveltweed. The Munsell soil matrix color is 2.5Y 3/1. The Munsell notation order is hue

(2.5Y), value (3) and chroma (1). Soils ending with a chroma of 1 are always designated as hydric soils (USACE 1987).

The northwest wetland is approximately 0.5 ac and comprises black willow, buttonbush, cottonwood, and hackberry in the tree and shrub layers. Cattails dominate the herbaceous layer of this wetland. The Munsell soil matrix color is 10YR 2/1, also indicating hydric soil. The functionality of these wetlands is further discussed in Subsection 2.4.1.1.2.

Wetlands have not been identified along the western bank of Lake Granbury near the CPNPP Units 3 and 4 intake or discharge structures.

A small wetland (≤ 0.5 ac) occurs at the headwaters of a unnamed intermittent tributary to Squaw Creek just below an approximate 1-ac stock pond. The stock pond and wetland area are located southwest of the Squaw Creek Dam within the footprint of the proposed CPNPP Units 3 and 4 cooling tower Blowdown Treatment Facility (BDTF). The characteristics of the identified wetland are further discussed in Subsection 2.4.1.1.2.

2.3.1.2 Freshwater Streams

The principal tributaries of the Brazos River above the Morris-Sheppard Dam that impounds Possum Kingdom Lake are the Salt, Double Mountain, and Clear forks of the Brazos River. The drainage basin area above Morris-Sheppard Dam is about 22,550 sq mi, of which about 9240 sq mi are probably non-contributing. Of the contributing area, nearly half is in the Clear Fork Basin (CPSES 1974).

Principal streams that enter the 145-mi segment of the Brazos River between Morris-Sheppard Dam and DeCordova Bend Dam include Palo Pinto and Rock creeks. Along this segment, the Brazos River has a slope of 0.04 percent, and a gradient of 2.117 ft/mi. The additional drainage basin area between the two dams is about 2140 sq mi, all of which contribute to flow in the Brazos River (CPSES 1974). Approximate lengths and slopes of these streams are presented in Table 2.3-4.

There are six intermittent streams (i.e. flow only during and after rain events) that flow into Lake Granbury within a 6-mi radius of the Units 3 and 4 intake and discharge structures upstream of the DeCordova Bend Dam (Figure 2.3-5). These streams include Lusk Branch, Walnut Creek, Contrary Creek, Rough Creek, Lambert Branch, and Rucker Creek. Approximate lengths and slopes of these streams are presented in Table 2.3-5.

There are six intermittent streams that flow into SCR within a 6-mi radius of CPNPP Units 3 and 4 upstream of the Squaw Creek Dam (Figure 2.3-5). These streams include Squaw Creek, Panter Branch, Lollar Branch, Panther Branch, Million Branch, and an unnamed stream branch. Approximate lengths and slopes of these streams are presented in Table 2.3-5.

One unnamed intermittent stream channel was identified within the cooling tower BDTF area located on the southern portion of the site. The headwaters of this stream consist of broad grass-covered swale areas, and stream channels become defined downstream near the confluence with Squaw Creek (Figure 2.3-5). The stream channel is approximately 1.25 mi in length, and elevations range from approximately 820 ft msl at the headwaters to 650 ft msl at the Squaw Creek confluence.

2.3.1.2.1 Brazos River Description

The Brazos River Basin originates in eastern New Mexico and extends about 640 mi southeasterly across Texas to the Gulf of Mexico south of Houston (Figure 2.3-1). The upper basin is about 70 mi wide in the northwestern part of Texas, expands to a maximum width of 110 mi near Waco, and constricts to about 10 mi wide near Richmond in the lower basin. The Brazos River and its tributaries drain an area of about 45,700 sq mi. About 9570 sq mi of the upper part of the basin, including all of the area in New Mexico, does not contribute to downstream flows. The Brazos River can be characterized as an incised, meandering, sand-bed channel with unstable banks. Frequent, near-vertical cut banks 20 to 35 ft high are prominent along much of its length. In the lower 300 river mi of the Brazos River, the channel slopes 0.7 ft/mi (USGS 2007b).

For this ER, the most significant portion of the Brazos River drainage basin is between Possum Kingdom Lake and Lake Whitney. Near the site, the Brazos River Channel is located in incised meanders formed by the river. These meanders may be the result of uplift of the area and sea level fluctuations after a mature meandering drainage pattern is attained. The meanders eroded through and are flanked by rock slopes confining the river within a relatively narrow channel. Immediately adjacent to the channel within the meanders is a narrow flood plain. Although accretion and erosion occur within the channel, as is typical of a meandering river, the well-defined meanders indicate that the channel location is closely confined. The geometry of the banks is governed closely by their location with respect to the meander pattern. The bank on the outside of a bend generally is steep; whereas, the bank on the inside of the bend usually has a gentler slope (CPSES 2007).

2.3.1.2.2 Brazos River Characteristics

Stream flow in the Brazos River basin has been altered since the 1940s by the construction of dams either on the Brazos River or on its major tributaries. Flow series data considered in this study were collected from BRA DeCordova Bend Dam release records, and USGS stream gauges that characterize the water supply and flood hazard characteristics of the CPNPP Units 3 and 4 site vicinity, and the Brazos River up and down-stream of the CPNPP Units 3 and 4 cooling water intake and discharge structures on Lake Granbury. The location of DeCordova Bend Dam and each of the four selected gauges are shown on Figure 2.3-5 and gauge information is provided in Table 2.3-6.

<u>Brazos River near Dennis</u>

The nearest gauge on the Brazos River, upstream of DeCordova Bend Dam, is USGS Gauge 08090800 (Brazos River near Dennis). The Brazos River Dennis station is located approximately 45 river mi northwest of DeCordova Bend Dam and has a drainage area of 15,671 sq mi. Based upon flow records for the years 1968 - 2006, the average, of the reported mean monthly flows, is estimated at 975 cfs. Table 2.3-7 presents USGS reported monthly mean streamflows as well as the average, average maximum, and average minimum, of the reported mean monthly flows, at the Brazos River Dennis station for the period of record (USGS 2007c).

The maximum recorded streamflow is 96,640 cfs at a gauge height of 31.88 ft, recorded on October 14, 1981. The flood frequency distributions are shown on Figures 2.3-6 and 2.3-7 and annual peak streamflow for the period of record is presented in Table 2.3-8 (USGS 2007c).

The minimum daily streamflow is 1.2 cfs recorded on August 2, 1978; however, no gauge height was recorded. Table 2.3-9 presents the annual minimum daily streamflow at the Brazos River Dennis station for the period of record (USGS 2007c).

The calculated 7Q10 flow is defined as the lowest average flow over a 7 consecutive day period that occurs once every 10 years on average. The calculated 7Q10 flow rate for the Brazos River Dennis station is approximately 14.7 cfs (CPNPP Units 3 and 4 FSAR Subsection 2.4.11). The Brazos River Dennis station was established after the construction of Morris Sheppard Dam (Possum Kingdom Lake). The 7Q10 flow rate for the Dennis station accounts for reservoir releases from Possum Kingdom Lake. Table 2.3-10 presents low flow volumes, in cfs, for 1, 7, and 30 days for selected return periods for the Brazos River Dennis station.

<u>DeCordova Bend Dam</u>

The daily flow rate of the Brazos River at the cooling water and discharge lines for CPNPP Units 3 and 4 on Lake Granbury is regulated by releases through DeCordova Bend Dam. Historical release data from the BRA for the years 1969 - 2006 indicate the average of the reported mean monthly discharges is 1031 cfs. Table 2.3-11 presents the mean monthly discharges at DeCordova Bend Dam as well as the average, average maximum, and average minimum of the reported mean monthly discharges for the period of record.

The maximum recorded discharge is 72,585 cfs, recorded on October 15, 1981. Table 2.3-12 presents the annual peak discharges at DeCordova Bend Dam for the period of record.

According to information from the BRA, there are no official reservoir operating rules, and there is no required minimum flow release at DeCordova Bend Dam. The BRA voluntarily makes a minimum flow release of 28 cfs under normal operating conditions. The BRA releases additional water during flood conditions and/or in circumstances where BRA customers downstream request additional water. When the reservoir is full, the BRA passes inflow as it comes into the lake by adjusting gate openings as frequently as every couple of hours. The BRA calculates inflow to the lake based on change in reservoir elevation (storage) over a given period of time. In cases where there is no local runoff, releases would be similar to the USGS Brazos River Dennis gauging station hydrograph, with some lag (Figure 2.3-8). The BRA does not always base release decisions on the Dennis gauge. There can also be significant inflow to Lake Granbury from rainfall downstream of the Dennis gauge; in which cases, releases can be significantly higher than the Dennis gauge readings. A review of BRA dam release data from 1969 to 2006 indicates several days where flow through DeCordova Bend Dam was reported at less than 28 cfs. These days, often times consecutive, are likely associated with dam maintenance activities.

<u>Brazos River near Glen Rose</u>

The nearest gauge on the Brazos River downstream of DeCordova Bend Dam is USGS Gauge 08091000 (Brazos River near Glen Rose). The Brazos River Glen Rose station is located approximately 35 river mi south of DeCordova Bend Dam and has a drainage area of 16,252 sq mi. Based upon flow records for the years 1940 - 2006, the average, of the reported mean monthly flows, is estimated at 1234 cfs. Table 2.3-13 presents USGS reported monthly mean streamflows as well as the average, average maximum, and average minimum, of the reported mean monthly flows, at the Brazos River Glen Rose station for the period of record (USGS 2007c).

The maximum recorded streamflow prior to construction of the Morris-Sheppard Dam on Possum Kingdom Lake in 1941 is 97,600 cfs at a gauge height of 23.68 ft, recorded on May 18, 1935. The maximum recorded streamflow from 1942 to 1969, the year DeCordova Bend Dam on Lake Granbury was completed, is 87,400 cfs at a gauge height of 33.89 ft, recorded on May 27, 1957. The maximum recorded streamflow from 1970 to 2006, is 89,600 cfs at a gauge height of 34.00 ft, recorded on December 21, 1991. Table 2.3-14 presents the yearly peak streamflow at the Brazos River Glen Rose station for the period of record (USGS 2007c).

Minimum daily flow data reviewed indicates several days of zero or minimal streamflows at the Brazos River Glen Rose station for the period of record. The calculated 7Q10 flow rate for the Brazos River Glen Rose station is approximately 6.3 cfs. To account for the construction of Lake Granbury and DeCordova Bend Dam releases, the 7Q10 flow rate was calculated using flow data since 1969. The BRA has voluntary made a release of approximately 28 cfs from DeCordova Bend Dam since 1998. Reported Lake Granbury reservoir releases since 1998 correlate with flow at the Brazos River Glen Rose station with some lag; however, there are instances where flow at the downstream gauging station can be higher than the corresponding reservoir release because of rainfall in the watershed below DeCordova Bend Dam. Table 2.3-15 presents low flow volumes, in cfs, for 1, 7, and 30 days for selected return periods for the Brazos River Glen Rose station.

<u>Panter Branch near Tolar</u>

The nearest upstream gauge measuring naturally contributing water to SCR is USGS Gauge 08091700 (Panter Branch near Tolar). The Panter Branch station has a drainage area of 7.82 sq mi. Peak streamflow at this station was recorded for the years 1966 – 1974, and the maximum daily flow rate is approximately 3750 cfs recorded on September 16, 1972. Table 2.3-16 presents the annual peak streamflow of the Panter Branch Tolar station for the period of record (USGS 2007c). Mean monthly streamflow and minimum daily streamflow were not recorded at this station.

<u>Squaw Creek near Glen Rose</u>

The nearest gauge downstream of SCR and the CPNPP site is USGS Gauge 08091750 (Squaw Creek near Glen Rose). The gauging station (removed in September 2006) was located downstream of the SCR Dam site at the Texas State Highway 144 (SH 144) bridge and lists a drainage area of 70.3 sq mi. Based upon flow records for the years 1977 - 2006, the average, of the reported mean monthly flows is estimated at 21 cfs. Table 2.3-17 presents USGS reported monthly mean streamflows as well as the average, average maximum, and average minimum, of the reported mean monthly flows, at the Squaw Creek Glen Rose station for the period of record (USGS 2007c).

The maximum recorded streamflow is 9030 cfs at a gauge height of 11.9 ft, recorded on April 8, 1974. Table 2.3-18 presents the annual peak streamflow at the Squaw Creek Glen Rose station for the period of record (USGS 2007c).

The minimum daily streamflow is 0.54 cfs at a gauge height of 2.18 ft, recorded on August 15, 1996. Table 2.3-19 presents the annual minimum daily streamflow at the Squaw Creek Glen Rose station for the period of record (USGS 2007c).

2.3.1.2.3 Current Patterns and Channel Velocities

Travel times between Morris Sheppard Dam and DeCordova Bend Dam cannot be determined with accuracy because of such factors as incidence of rain and runoff accumulation within the reach. There are some data regarding water movement on the river. Information from the BRA indicates a travel time of 3.8 days at a flow rate of 500 cfs. The travel time between the dams decreases to 2.1 days for flow rates between 10,000 and 20,000 cfs, and further decreases to 1.5 days for a flow rate of 30,000 cfs. Travel time is greatest for low flows and least for small floods, and then increases again as flows become very large. Figure 2.3-9 shows the streamflow travel time for the 145-mi segment of the Brazos River between Morris Sheppard Dam and De Cordova Bend Dam, and the time calculations are provided in Table 2.3-20.

Short-duration flow fluctuations in the Brazos River in the 145-mi segment of the Brazos River between Morris Sheppard Dam and DeCordova Bend Dam occur during peaking operations at the hydroelectric facility on Possum Kingdom Lake. Leakage from the dam maintains minimum instream flows of between 15 and 25 cfs. When water is released for power generation, flows typically reach about 2600 cfs and can reach as high as 18,000 cfs; such releases occur only periodically given the secondary nature of hydropower at the project (USFWS 2007). Possum Kingdom Lake minimum flow requirements obtained from the BRA are provided in Table 2.3-21.

Several small channels for recreational boat slip access exist along the shores of Lake Granbury. DeCordova Bend Dam impounds the Brazos River to form Lake Granbury. No diversion dams have been identified on Lake Granbury.

2.3.1.2.4 Sediment Transport and Erosional Characteristics

USGS, BRA, Texas Water Development Board (TWDB), Texas Parks and Wildlife (TPW), and the Texas Commission on Environmental Quality (TCEQ) on-line databases were accessed for information regarding sediment transport and erosional characteristics of the Brazos River and Lake Granbury. Published information specifically regarding sediment transport, including rate, bed and suspended load fractions, and graduation analyses, and erosion studies in the CPNPP vicinity is not readily accessible or has not been performed.

The 2003 Volumetric Survey of Lake Granbury indicates little or no change in surface area and a 2-percent reduction in total volume at top of conservation pool compared to the previous survey performed in 1993. The survey report indicates that most of this reduction appears to be in an area of continued deltaic accretion in the upper reaches of Lake Granbury where the Brazos River enters the main body of the reservoir (TWDB 2005).

The BRA collected a total of 176 water samples from 2001 to 2006 at three locations in the main body of Lake Granbury (Figure 2.3-10) to estimate the suspended sediment load. The mean total suspended sediment (TSS) concentration is 24 milligrams per liter (mg/l) with a range of results from 2 to 164 mg/l in the northern reaches of the lake; 24 mg/l with a range of results from 2 to 255 mg/l near the center of the lake; and 11.21 mg/l with a range of results from 2 to 120 mg/l near DeCordova Bend Dam near the south end of the lake (BRA 2007). Additional water quality information for Lake Granbury is provided in Subsection 2.3.3.

Elevated levels of chloride and total dissolved solids (TDS) have been detected in the segment of the Brazos River between Morris Sheppard Dam and Lake Granbury (Segment 1206) (Figure 2.3-27). This condition is relatively widespread throughout the upper basin and is mostly the result of natural salt-bearing formations in the Salt and Double Mountain forks of the Brazos River coupled with chronic drought conditions that result in a concentration effect on the salt content of surface water. There is also a potential for elevated chloride levels in the Brazos River at two monitoring stations within Segment 1206 (Figure 2.3-27). The Farm to Market 4 (FM 4) – Brazos River crossing (Station 11864) and the FM 1189 – Brazos River crossing (Station 13543) have shown increases in chloride concentration; however, due to a 6-yr gap in the data set, no statistical trend can be confirmed. While Stations 11864 and 13543 have concerns related to TDS and chloride, data from the end of 2005 to the fall of 2006 show declining concentrations (Figure 2.3-11). This observed decline in chloride concentrations is most likely a result of watershed flushing from large-scale flood releases from Possum Kingdom Lake. Station 11864 and 13543 both show a decreasing trend in TSS. Station 13543 has increasing trends for specific conductance, TDS, chloride, and orthophosphate. The decreasing TSS trend is important to note as there is concern that rock quarry operations located along this segment could cause increased sedimentation and negatively impact both the water quality and biological communities (BRA 2007).

A special study performed by the BRA in 2006 assessed potential impacts of stone quarry mining operations located in the watershed (BRA 2006). The study involved routine stormwater and biological data collections in the Brazos River between Possum Kingdom Lake and Lake Granbury. The results of the study were inconclusive due to the lack of significant rainfall events during the study period diminishing conclusions, specifically without an event which results in comparable data between upstream and downstream sites of targeted operations. While short-term increases in TSS concentrations are observed in the stormwater data, the data are limited because of the location of the two monitoring units, specifically one unit located on the Palo Pinto tributary and one unit on the Brazos River upstream of targeted rock quarry operations.

Stormwater monitoring data continued to indicate that while TSS concentrations increased during hours following rainfall events, water quality conditions quickly returned to baseline conditions. These data suggest that changes to the stream that may occur due to TSS loadings from nonpoint source runoff in the watershed are not detected with routine water quality monitoring of TSS concentrations. It is also difficult to draw conclusions regarding impacts of mining operations on the biota of the river because habitat and biological monitoring results are not available prior to the introduction of mining in the segment. The biological results are good for the fish and intermediate for the macroinvertebrates with habitat being the major limiting factor. Without historical habitat data to compare these results to, it is difficult to determine the impact of the mining activities on the habitat and biota. This study does create a baseline of information that can be used in the future to assess the impact of the John Graves Scenic Waterway Act (2005) on Segment 1206 of the Brazos River.

The John Graves Scenic Waterway Act was established in response to complaints from citizens and local property owners that certain quarry operations in and near the Brazos River, primarily downstream of Possum Kingdom Lake in Parker and Palo Pinto counties, had encroached close to the Brazos River or its tributaries and that significant sedimentation from uncontrolled stormwater runoff had resulted in increased turbidity and negative effects to the streambeds and watercourses from sediment loading. The 79th Texas Legislature enacted Senate Bill 1354, designating a segment of the Brazos River as the John Graves Scenic Riverway, and establishing a pilot program for enhanced protection of the watershed threatened by the effects of quarry activities (TCEQ 2006a).

Assessing the siltation on a river is a particularly daunting task, and one that traditional data collection methodology is poorly equipped to do. This task is compounded by both the lack of historical data and the ephemeral nature of streams. Water motion and watershed geology are the factors that make assessments of siltation difficult. A river is rarely considered by itself; the role of the adjacent land is always crucial. In the immediate vicinity of the Brazos River, the soils are dominated by sandy clay loams, silt loam, and very fine sandy loam; all of which are easily eroded by both storm runoff and high flow events. High flow events usually result in three occurrences that affect siltation: (1) increased sediment entering the water via runoff; (2) increased sediment in the water due to bank erosion; and (3) increased sediment in the water due to scouring of the bottom of the river. Scouring events are of major importance because they can uproot vegetation, can kill large numbers of organisms, can completely denude streams of benthic habitat, and can transport sediment long distances. High flow events, like the one that occurred in the summer of 2005 in the Brazos River, make determining siltation rates over long periods of time very difficult.

Eventually, the sediment transported by stream waters is deposited. This deposition can occur in a variety of environments including the stream channel, the floodplains adjacent to the stream, and in the headwaters of lakes. The Brazos River is a meandering stream with a single, sinuous channel with broadly looping curves. The outer bank of these curves is called the cut bank, because flow velocity and turbulence are greatest on that side of the river channel where it is frequently eroded. As a consequence of the unequal distribution of flow velocity across the looping curve, the cut bank is eroded, and deposition occurs along the opposite side of the channel creating a point bar. Over time, sediment is deposited as sand and gravel bars and point bars, which during wet years may be submerged and during drought years exposed. The extreme effects of variable stream flow on sedimentation and the difficulty of evaluating changes in siltation over time because of these flow related impacts make assessment from runoff very difficult and, in many cases, not possible.

Assessing siltation would be much easier in a steady-state environment without flow extremes. The Brazos River is not a steady-state environment and is highly susceptible to large swings in flow. The best way to ensure that sedimentation is not occurring at unmanageable levels is to ensure that mining operations, industry and land developers are properly managing runoff from their facilities. Existing stormwater regulations control industry and construction practices, and the new John Graves Scenic Waterway would result in regulations to reduce sediment runoff from mining operations in the Brazos River by controlling development along this stream segment. These regulations are designed to result in reduced sediment reaching the Brazos River; however, due to natural flow events, the Brazos River is expected to still be subject to periods of intermittent increased sedimentation (BRA 2006).

2.3.1.2.5 Temperature and Bathymetry Surveys

As part of the CPNPP Units 3 and 4 hydrological characterization, temperature and bathymetric surveys were conducted during April and May 2007 on Lake Granbury in the vicinity of the CPNPP Units 3 and 4 cooling water system intake and discharge structures and on SCR in the vicinity of the CPNPP site. As part of the aquatic ecology characterization, seasonal temperature data were collected on Lake Granbury and SCR in 2007 and are provided in Table 2.4-12.

Lake Granbury Temperature Measurements

On May 2, 2007, water temperature readings were taken at 30 locations on the lower portion of Lake Granbury near the planned location for the CPNPP Units 3 and 4 cooling water intake and discharge structures. Water temperature profile readings were taken at the surface, then at 10-ft increments to a total depth of 50 ft, where allowable. Figure 2.3-12 shows the locations of waypoints on Lake Granbury that were used for temperature measurements, and Table 2.3-22 provides the measurement data. Figure 2.3-13 depicts the water depth obtained from the bathymetric survey. The data reveal an approximate 8°F difference in water temperature between surface and bottom measurements.

Lake Granbury Historical Temperature Measurements

Lake Granbury is anticipated to be the surface water body used as a heat sink (not as the ultimate heat sink) for CPNPP Units 3 and 4. Monthly surface water temperatures on Lake Granbury at the DeCordova Bend Dam were obtained from the BRA for the years 1998 – 2007. Due to irregular measurement intervals, the temperature data are sporadic. This data source was utilized for this investigation because it provides the most accurate assessment of monthly temperature conditions in the vicinity of the CPNPP Units 3 and 4 cooling water intake and discharge lines on Lake Granbury. The data collected from 1998 through 2007 are provided in Table 2.3-23 and include maximum, average-maximum, average, average-minimum, and minimum monthly temperatures.

Lake Granbury Bathymetry

The mapped portion of Lake Granbury for the bathymetry survey (Boss 2007) is in the vicinity of the CPNPP Units 3 and 4 cooling water system intake and discharge structures, and included approximately 507 ac (Figure 2.3-13). Dual frequency echo sounder profiles and publicly available digital terrain data were merged to generate a detailed bathymetric map of lower Lake Granbury, Hood County. The final bathymetric map was derived from 508,408 individual soundings processed from 74.3 mi of echo sounder profiles merged with digital terrain data from a USGS 30-m DEM of Acton, 7.5-minute quadrangle within the 507-ac study area.

The final map shows the former main channel of the Brazos River as well as several well-developed river terraces along the point bar comprising the northern shore of this area of the lake. A bathymetric anomaly near the DeCordova Bend Dam (southeastern edge of mapped area) abruptly truncates the main Brazos River channel. This bathymetric anomaly appears to be a man-made structure of unknown history or origin. It is known that there was an extensive attempt to establish a lock and dam system along the Brazos River during the early 20th Century for the purpose of promoting river commerce. It is not known if one of these sites existed within the mapped area. Alternatively, the bathymetric anomaly could represent remains of a temporary coffer dam that may have diverted the Brazos River during construction of the DeCordova Bend Dam during the 1960s.

Within the mapped area, depths ranged from 0 to 67 ft (average = 32.3 ft). Total volume storage within the mapped area was calculated from areas between 1-ft contours to be 16,182 ac-ft at an elevation of 693.53 ft msl. At the top of the conservation pool of 693.0 ft, the 2003 TWDB Lake Granbury Volumetric Survey calculated 7945 surface ac and reported a volume of 129,011 ac-ft (TWDB 2005). Figure 2.3-14 shows the elevation-area-capacity curves for the mapped area of Lake Granbury and Figure 2.3-15 shows the 2003 elevation-area-capacity curves for the entire lake.

The CPNPP Units 3 and 4 cooling water intake structure is expected to be located on the southwest bank of Lake Granbury, adjacent northwest of the current makeup water intake for SCR, and approximately 1.31 mi upstream from the DeCordova Bend Dam. At the conservation pool elevation of 693.0 ft, water depth in this area is approximately 50 ft. The discharge structure is anticipated to be located approximately 1.14 mi downstream from the intake structure. Outlet works at the De Cordova Bend Dam consist of two 84-in by 96-in openings, motor-controlled by sluice gates with invert elevations at 652.0 and 640.0 ft msl (TWDB 2003a).

<u>SCR Temperature Measurements</u>

On April 17, 2007, water temperature readings were taken at 80 locations on portions of SCR surrounding the CPNPP site. The temperature measurements were taken near the CPNPP Units 1 and 2 intake and discharge areas and in two cove areas located adjacent to CPNPP Units 3 and 4. Water temperature profile readings were taken at the surface, then at 10-ft increments to a depth of 50 ft, where allowable, due to the total depth of the water at that location. Figure 2.3-16 shows the locations of waypoints on SCR that were used for temperature measurements, and Table 2.3-24 provides the measurement data. Figure 2.3-17 depicts the water depth obtained from the bathymetric survey. The data reveal that the temperature varied approximately 5°F from the surface to the bottom in the discharge area. Water temperatures did not vary substantially with increased depth in the cove areas or around the CPNPP Units 1 and 2 intake.

<u>SCR Bathymetry</u>

The mapped portion of SCR for the bathymetry survey (Boss 2007a) is approximately 1057 ac adjacent to the CPNPP site and includes the lower half of the reservoir (Figure 2.3-17). Dual frequency echo sounder profiles and publicly available digital terrain data were merged to generate a detailed bathymetric map of lower SCR, Hood and Somervell counties. The final bathymetric map was derived from 1,215,381 individual soundings processed from 97.4 mi of echo sounder profiles over 1057 ac merged with digital terrain data obtained from USGS 30-m DEMs of Hill City and Nemo quadrangles.

The final map shows the former main channel of Squaw Creek and its tributaries. No unusual bathymetric anomalies are noted within the mapped area. Within the mapped area, depths ranged from 0 to 123 ft (average = 56.4 ft). Total volume storage within the mapped area was calculated from areas between 1-ft contours to be 129,821 ac-ft at an elevation of 775 ft msl.

At the top of the conservation pool of 775 ft msl, the 1997 TWDB volumetric survey of SCR calculated 3297 surface ac and reported a volume of 151,418 ac-ft (TWDB 2003). Figure 2.3-18 shows the elevation-area-capacity curve for the mapped area of SCR and Figure 2.3-19 shows the 1997 elevation-area-capacity curve for the entire lake.

2.3.1.2.6 Flood Profile

Historical floods in the Brazos River basin area pertinent to the CPNPP site have been due to precipitation runoff into streams and rivers. CPNPP Units 3 and 4 safety-related facilities are designed to safely withstand all floods and flood waves which are remotely possible at the site. The grade elevation for both units is set at 822.0 ft. msl. A summary of the design-basis flood elevation for the CPNPP site (including dam failure information) is presented in CPNPP Units 3 and 4 FSAR Subsection 2.4.4.

Seven floods with discharges greater than 40,000 cfs were recorded at the Brazos River Dennis Station (USGS 08090800) from 1969 to 2006 (USGS 2007c). Four floods resulting in stream level increases above the National Weather Service flood stage (25 ft) were recorded at the Brazos River Dennis Station from July 1987 to September 2007 (USGS 2007c). Data from September 1995 to September 1998 were not available. The flood frequency distributions are shown on Figures 2.3-6 and 2.3-7 and annual peak streamflow for the period of record is presented in Table 2.3-8. One uncertified flood control levee was identified on the Brazos River between Morris Sheppard Dam and Lake Granbury. The levee is within the limits of the City of Granbury and provides flood protection for a park area. No other flood control levees were identified between Possum Kingdom Lake and Lake Granbury. Flow through DeCordova Bend Dam during flood conditions is based upon inflow into the reservoir and is monitored at the Brazos River Dennis Gauging Station. In cases where there is no local runoff, releases would be similar to the USGS Brazos River Dennis gauging station hydrograph. There can also be significant inflow to Lake Granbury from rainfall downstream of the Dennis gauge in which cases releases can be significantly higher than the Dennis gauge readings.

The primary flood control reservoir in the Brazos River Basin is Lake Whitney. Whitney Dam impounds Lake Whitney, approximately 100 river mi downstream of DeCordova Bend Dam, and is the largest flood control reservoir in the Brazos River Basin. The reservoir was built by the USACE in the 1950s specifically to hold flood water and provides 1.3 million ac-ft of flood storage minimizing the effects of flooding on downstream communities. In addition to Lake Whitney, there are eight other flood control lakes in the Brazos River basin that were built and are operated by the USACE. These reservoirs are located on tributaries of the Brazos River (BRA 2007a).

2.3.1.2.7 Water Quality Implication from Reservoir Operations

Lake Granbury is currently a much studied reservoir with well publicized issues related to both golden algae and Escherichia coli (E. coli) levels. The reservoir is an important source of drinking water and recreation to the surrounding communities. The Draft 2008 Texas Water Quality

Inventory (TCEQ 2008) identifies segment 1205, Lake Granbury, as an impaired candidate for exceeding the water quality standard for chloride. Historical data indicate increasing trends throughout the reservoir for chloride and decreasing trends in TSS (Table 2.3-25). The increasing chloride trend is most likely a result of drought conditions that concentrate dissolved ions in the water. Data collected during the last 5 years indicate elevated levels of chlorophyll-a throughout the reservoir; however, there are not enough data available to identify any long-term changes in chlorophyll-a concentrations in the reservoir. Lake Granbury may be subject to new chlorophyll-a, and nutrient standards being developed by the TCEQ. Potential causes of increasing nutrients are upstream inputs and infiltration from the septic systems that are present in many of the canals. Long-term routinely monitored stations on the main body of the lake (Figure 2.3-10) do not indicate elevated levels of bacteria. Individual property owners septic systems located along the many canals and coves of Lake Granbury may be a significant source of bacteria and nutrients to cove areas of the reservoir. The canals are backwater areas that have little or no circulation and mix slowly with the main body of the reservoir. The result can mean stagnant conditions where pollution problems have the potential to persist. In May 2002, a study began to assess water quality in the canals and coves. The BRA, TCEQ and interested stakeholders have developed a Draft Watershed Protection Plan (WPP) to address the concerns that these canals present. The study and plan implementation is expected to take 3 – 4 years to complete (BRA 2007).

2.3.1.2.8 Thermal Stratification

One of the factors that affect water quality in reservoirs is thermal stratification. Some reservoirs become thermally stratified in the summer when solar energy warms the surface water, leaving the bottom portions of the reservoir cooler. A study (WRE 1973) performed in the vicinity of the cooling water intake and discharge structures for Units 3 and 4 indicated that Lake Granbury is stratified during the summer and early fall months, and unstratified during the late fall and winter. During the spring and for certain periods during the winter, the lake is weakly stratified with the weak stratification during the winter resulting from extended warm periods (WRE 1973). Field temperature measurements were collected at sample locations (Figure 2.3-20) in the main channel of the Brazos River on the lower portion of Lake Granbury during surface water sampling events in April, July, and October 2007 and January 2008. As shown on Table 2.3-26, water temperature differences between the surface and bottom measurements varied approximately 5°F in April, approximately 3°F in July, less than 1°F in October, and approximately 1°F in January. As shown on Table 2.3-22, temperature measurements collected in May 2007 during the bathymetric survey of Lake Granbury indicated an approximate 8°F difference in water temperature between surface and bottom measurements.

An operational study of temperature distribution in SCR was performed in August of 1993 (Geo-Marine 1994). The study showed that past operational surveys of SCR indicated a thermocline characterized by a slightly varying temperature (generally less than 4°F) to a depth of 40.0 – 50.0 ft, followed by a sharp temperature decrease to about 60.0 ft and then a gradual temperature decrease to bottom. Areas around the Units 1 and 2 discharge also showed influence of the thermal plume with only a 2.0 – 4.0°F decrease in temperature down to 15.0 ft. The deeper profiles, over 50.0 ft deep, generally showed a gradually decreasing temperature, 6.0 – 10.0°F, to 50.0 ft, followed by a steady decrease of about 34°F to bottom. Warmer water and vertical mixing with depth, below 20.0 ft, have been observed in SCR since CPNPP Unit 1 became operational. In the first year that CPNPP Units 1 and 2 were operational, temperatures below the thermocline down to 70.0 ft averaged about 4°F warmer than in 1991 when the CPNPP Unit 2 effect was minimal. The average of all deep water areas surveyed at 50.0 ft were 3.8°F more than in 1991, while average temperatures at 60.0 ft and 70.0 ft were 6.4°F and 1.0°F warmer, respectively, than 1991. Temperatures at 80.0 ft, however, remained about 57°F since Unit 1 went on-line. The study concluded that the decreased thermocline and increased heat budget down to 70.0 ft appears to be the result of CPNPP Unit 2 operation.

2.3.1.2.9 Description of Major Tributaries

The principal tributaries of the Brazos River above Morris-Sheppard Dam that impounds Possum Kingdom Lake are the Salt, Double Mountain, and Clear Forks of the Brazos River. The locations of these tributaries are provided in Figure 2.3-1.

Salt Fork of the Brazos River

The Salt Fork of the Brazos River rises at an elevation of about 3000 ft, 2 mi southwest of the Caprock Escarpment in south central Crosby County. The upper stretches of the river are intermittent. On its eastward-tending journey of 175 mi, the Salt Fork travels through thinly settled country and passes through no communities. Numerous oilfields are located along the river's path. The Salt Fork runs through south central Crosby, northeast Garza, central Kent, and northern Stonewall counties before joining the Brazos River 2 mi west of the Stonewall-Haskell county line and about 12 mi northeast of Old Glory. The river descends some 1500 ft from its headwaters to its mouth, passing through flat to moderately steep terrain. Along its course, clay, silt, and sandy loams support mesquite, grasses, and conifers. The Salt Fork is approximately 178 mi long. The Salt Fork is measured from the confluence of the Double Mountain Fork of the Brazos River at Brazos River Mile (BRM) 923.2 in Stonewall County to the most upstream crossing of SH 207 in Crosby County (TSHA 2007).

Double Mountain Fork of the Brazos River

The main stream of the Double Mountain Fork of the Brazos River rises in the break in the Caprock Escarpment of the Llano Estacado known as Double Mountain Canyon in eastern Lynn County and runs east across southern Garza County, southern Kent County, northwestern Fisher County, southern Stonewall County, and western Haskell County, before turning back westward into eastern Stonewall County. It extends 145 mi to its mouth, on the Salt Fork of the Brazos near Old Glory oilfield, northeast of Aspermont. At this confluence, the Brazos River proper is formed. The North Fork of the Double Mountain Fork rises in Lubbock, central Lubbock County, and runs roughly 85 mi through Crosby and Garza counties to its mouth, on the Double Mountain Fork of the Brazos River, southwest of Clairemont in western Kent County (TSHA 2007).

Clear Fork of the Brazos River

The Clear Fork of the Brazos River rises east of Snyder in eastern Scurry County and runs east for 37 mi, through Fisher, Jones, Shackelford, Throckmorton, Stephens, and Young counties, to its mouth on the Brazos River, near South Bend in southern Young County. It passes near Fort Griffin in Shackelford County. It is dammed in Jones and Stephens counties and twice in Young County to form reservoirs for municipal water supply to nearby towns. A principal tributary, Hubbard Creek, joins the Clear Fork 9 mi north of Breckenridge. Other tributaries include Spring, Buffalo, Noodle, Bitter, and Fish creeks. The surrounding flat terrain with local shallow depressions is surfaced by clay and sandy loam that supports water-tolerant hardwoods, conifers, and grasses (TSHA 2007).

For this ER, the most significant portions of the Brazos River drainage basin are those between Possum Kingdom Lake and Lake Whitney, including Lake Granbury (Figure 2.3-21). The most significant tributaries contributing flow to the Brazos River between Morris-Sheppard and De Cordova Bend dams are Palo Pinto and Rock creeks. Characteristics of these tributaries are provided in Table 2.3-4.

Palo Pinto Creek

Palo Pinto Creek rises at the confluence of the North and South forks of Palo Pinto Creek 2 mi east of Strawn in southern Palo Pinto County and runs northeast for 35 mi to its mouth on the Brazos River, 11 mi south of Mineral Wells. The North Fork of Palo Pinto Creek rises just east of Ranger in northeastern Eastland County and runs east 1 mi, to where it is dammed to form Hagaman Lake, and then eastward for 24 mi, through the southeastern corner of Stephens County, to its confluence with the South Fork of Palo Pinto Creek. Modern topographical maps show the North Fork as Palo Pinto Creek proper, but highway maps identify it as the North Fork. The South Fork rises 4 mi north of Desdemona in extreme eastern Eastland County and runs 20 mi northeast. The upper reaches of the North Fork pass through rolling hills surfaced by clay and sandy loams that support scrub brush, mesquite, cacti, live oak, juniper, and grasses; the upper reaches of the South Fork traverse an area of steep slopes surfaced by sand that supports juniper, scattered oak, and grasses; the confluence of the forks occurs in a flat, flood-prone area with local shallow depressions, surfaced by clay and sandy loams that support water-tolerant hardwoods, conifers, and grasses. Palo Pinto Creek is dammed to form Lake Palo Pinto in the south central part of Palo Pinto County. The uneven terrain around the lake is surfaced by stony clay loam in which grasses and live oak trees grow (TSHA 2007).

Rock Creek

Rock Creek rises in southeastern Jack County near the Parker county line and runs south for 24 mi to its mouth on the Brazos River, 4 mi southwest of Millsap in western Parker County. It crosses gently undulating to steep terrain surfaced with shallow to deep sand and clay that support grass and timber. For most of the county's history, the area of mixed timber and open prairie has been used as rangeland and for local mineral production. In 1918, a dam was built on Rock Creek to form Lake Mineral Wells (TSHA 2007).

2.3.1.2.10 Description of Local Tributaries

In addition to the Brazos River and its major tributaries, there are several smaller streams in the vicinity of the CPNPP site and CPNPP Units 3 and 4 cooling water intake and discharge structures on Lake Granbury. Table 2.3-5 presents characteristics of these water bodies which are identified on Figure 2.3-5. The tributaries have large surface water areas, embayment areas, near their inlets to Lake Granbury and SCR that were formed by the increased stream pool elevation from construction of the DeCordova Bend Dam in 1969 and Squaw Creek Dam in 1977. Squaw Creek and its branches, Panter Branch, Lollar Branch, Panther Branch, Million Branch, and an unnamed branch are intermittent streams that contribute flow to SCR near the

CPNPP site. Lusk Branch, Walnut Creek, Contrary Creek, Rough Creek, Lambert Branch, and Rucker Creek are intermittent streams that contribute flow to Lake Granbury near the CPNPP Units 3 and 4 intake and discharge structures.

2.3.1.3 Lakes and Impoundments

In 1923, the Texas State Legislature appropriated funds for a survey of all rivers of the state and analysis of flood and water problems. The study established the need for an agency with the necessary power to harness the Brazos River. In 1929, The Brazos River Conservation and Reclamation District was created under Article XVI, Section 59 of the Texas Constitution. The District was directed to conserve, control, and utilize to beneficial service the storm and floodwaters of the Brazos River and its tributaries. In 1933, the U.S. Congress passed the National Industrial Recovery Act. Title II created the Public Works Administration to provide funding through loans and grants to stimulate construction.

In 1935, the District completed its master plan calling for 13 dams on the Brazos River and its tributaries. Construction of the District's first dam and reservoir project, Possum Kingdom Lake, began on May 29, 1938. On March 21, 1941, construction was complete and deliberate impoundment began. In 1955, the District was officially given a new name, the BRA (TWDB 2006).

The TWDB lists 44 major reservoirs within the watershed of the Brazos River Basin (TWDB 2007b). These reservoirs and their associated dams (Figure 2.3-22) are utilized for water supply, recreation, flood control, cooling, and power generation. For this ER, the most significant portions of the Brazos River basin are those between Possum Kingdom Lake and Lake Whitney, including Lake Granbury. As shown on Figure 2.3-21 there are seven large manmade impoundments located within 150 stream mi of the DeCordova Bend Dam on Lake Granbury that could potentially affect or be affected by plant operations. These impoundments (shown on Figure 2.3-2) include:

- Possum Kingdom Lake, on-channel, upstream reservoir located approximately 145 stream mi northwest of DeCordova Bend Dam, in Hydrologic Unit 12060201.
- Lake Palo Pinto, off-channel, upstream reservoir located approximately 80 stream mi northwest of DeCordova Bend Dam, in Hydrologic Unit 12060201.
- Lake Mineral Wells, off-channel, upstream reservoir located approximately 70 stream mi northwest of DeCordova Bend Dam, in Hydrologic Unit 12060201.
- Lake Granbury, the primary cooling water source for CPNPP Units 3 and 4, on-channel reservoir located approximately 7 mi northeast of the CPNPP site, in Hydrologic Unit 12060201.
- SCR, off-channel reservoir located adjacent north and east of CPNPP Units 3 and 4, in Hydrologic Unit 12060202.
- Wheeler Branch Reservoir, off-channel reservoir located approximately 2 mi south of CPNPP Units 3 and 4, in Hydrologic Unit 12060202.

- Lake Whitney, on-channel, downstream reservoir located approximately 70 stream mi south of DeCordova Bend Dam Lake Granbury, in Hydrologic Unit 12060202.

Possum Kingdom Lake and Lake Granbury are operated by the BRA, Lake Whitney by the USACE, Lake Palo Pinto by the Palo Pinto Water District No. 1, Lake Mineral Wells by the City of Mineral Wells, SCR by Luminant, and Wheeler Branch Reservoir by the Somervell County Water District. Table 2.3-27 provides information on dam and reservoir specifications for these impoundments.

The USACE maintains water flow rates on its website (http://www.swf-wc.usace.army.mil/cgi-bin/rcshtml.pl?page=Reports) for each day of the year for the major impoundments on the Brazos River, including Possum Kingdom Lake, Lake Granbury, and Lake Whitney. Additional reservoir hydrologic and flood profile information is presented in Subsection 2.3.1.3 of this report and Section 2.4 in the CPNPP Units 3 and 4 FSAR. Reservoir yields for 2000 and 2060 were obtained from the 2006 Brazos G Regional Water Plan (Brazos G 2006). Firm yield, also known as dependable yield, is the amount of water, that the reservoir could have produced annually if it had been in place during the worst drought of record. The drought or record is the historic period of record for a watershed in which the lowest flows were known to have occurred based on naturalized streamflow (TCEQ 2008a). Safe yield is defined as the amount of water that can be diverted from a reservoir during a repeat of the worst drought of record while still maintaining a reserve capacity equal to a 1-year supply. Utilization of safe yield versus firm yield is a common practice in west Texas where droughts are frequent and severe, and water managers are acutely aware that a drought more severe than recent recorded history could occur. Safe yield provides additional assurance of supply in an area where water resource alternatives are limited. Reservoir yields were limited to authorized diversions, and the period of record for the firm yield analyses was 1940 through 1997 (Brazos G 2006).

2.3.1.3.1 Possum Kingdom Lake and Morris Sheppard Dam

Morris Sheppard Dam impounds Possum Kingdom Lake on the Brazos River approximately 145 stream mi northwest of DeCordova Bend Dam at BRM 687.5. The reservoir inundates parts of several counties, including Palo Pinto, Stephens, and Young (Figure 2.3-21). The reservoir was built to provide hydroelectric power during peak usage, and control the floodwaters of the Brazos River.

Morris Sheppard Dam is a reinforced concrete dam, Ambursen-type, massive buttress with flat-slab deck, a controlled spillway, two bulkhead sections, and an earthen-dike section. Total length of dam is 2740 ft long. The dam, owned by the BRA, was completed and storage began on March 21, 1941. The spillway has nine roof-weir gates (modified bear-trap type) that are 73.66 ft x 13 ft each and are designed to discharge about 100,000 cfs at a gauge height of 1000 ft msl. The outlet works consist of one controlled 54-in diameter conduit. Two generators located in the powerhouse at the dam can produce 22,500 kW at a 1000-ft gauge height. Power generation began on April 17, 1941. Eleven major reservoirs, with a combined capacity of 607,800 ac-ft, largely regulate the inflow. Flow is affected at times by discharge from the flood-detention pools of 12 floodwater-retarding structures with a combined detention capacity of 24,710 ac-ft. These structures control runoff from 108 sq mi (USGS 2007d).

The results of the TWDB 2004-2005 volumetric survey (TWDB 2006) indicate Possum Kingdom Lake has a volume of 540,340 ac-ft, and extends across 16,716 surface ac at the conservation pool elevation of 1000 ft msl. This represents an estimated 25 percent decrease from the reservoir's original design volume of 724,739 ac-ft and a 16 percent decrease from the original surface area of 19,800 ac.

Water Rights Permit No. 1262 (Application No. 1351) of May 9, 1938 allowed for construction of a dam to impound 750,000 ac-ft of water and the appropriation of 1,500,000 ac-ft of water annually for municipal, industrial, mining, irrigation, recreational, and power generation uses. A Texas Water Commission System Order, effective July 23, 1964, and amended July 23, 1968, February 1, 1977, and January 31, 1983, to include future reservoirs, requires Possum Kingdom and all other reservoirs on the Brazos River and its tributaries to operate as one system for more effective conservation and beneficial utilization of the available water resources. An Amendment to Permit to Appropriate State Water, No. 1262A, November 7, 1986, authorizes an inter-basin transfer to the Trinity River Basin of up to 5240 ac-ft/yr of water from the municipal authorization from Possum Kingdom Lake. Prior to transfer the water is released from Possum Kingdom, and conveyed to Lake Granbury via the Brazos River, where it is diverted to the Trinity River Basin. Certificate of Adjudication 12-5155, authorizes the BRA to maintain an existing dam and reservoir on the Brazos River (Possum Kingdom Lake) and impound therein no more than 724,739 ac-ft of water.

The BRA is authorized a priority right to divert and use not to exceed 230,750 ac-ft/yr of water for municipal, industrial, irrigation and mining purposes. For the purposes of system operation the BRA is authorized to exceed the priority right, and annually divert and use up to 175,000 ac-ft of water for municipal purposes, of which no more than 5240 ac-ft of the municipal authorization may be transferred to the Trinity River Basin; 250,000 ac-ft of water for irrigation purposes, and 49,800 ac-ft for mining purposes. Any diversions and use of water from Possum Kingdom exceeding 230,750 ac-ft annually is charged against the sum of the amounts designated as priority rights in other reservoirs included in the System Operation Order. The BRA may also use the impounded water for non-consumptive recreational purposes and is further authorized an additional non-priority right for the non-consumptive use of water released for hydroelectric power generation (TWDB 2006). Yield analysis for Possum Kingdom Lake indicates a firm yield of 230,750 ac-ft in 2000 and 2060 (Brazos G 2006).

2.3.1.3.2 Lake Palo Pinto and Palo Pinto Creek Dam

Lake Palo Pinto is on Palo Pinto Creek in the Brazos River basin 15 mi southwest of Mineral Wells in Palo Pinto County. The drainage area above the dam is 471 sq mi (TWDB 2007b). The project, owned by the Palo Pinto Municipal Water District No. 1, impounds 34,250 ac-ft of water annually primarily for municipal use. The reservoir has a conservation storage capacity of 27,650 ac-ft and a surface area of 2498 ac at the conservation pool elevation of 867 ft msl.

Construction of Palo Pinto Creek Dam began on March 21, 1963. Water storage began on April 16, 1964, and the dam was completed on November 13, 1965 (TSHA 2007). The dam is a rock-faced earthfill structure 1300 ft long with a 550-ft uncontrolled ogee-crested emergency spillway at the right end of dam. During the summer of 1965, the dam was raised 2 ft and the spillway crest was raised 4 ft and lengthened from 500 to 550 ft. Water is released to the downstream channel through a 30-in gated concrete pipe. It then flows 15 mi downstream to a diversion lake where it is then pumped to the City of Mineral Wells. In addition, water is circulated through a steam generating power plant owned by the Brazos River Electric Power Cooperative, Inc. (USGS 2007d). Yield analysis for Palo Pinto Lake indicates a safe yield of 8500 ac-ft in 2000 and 6660 ac-ft in 2060 (Brazos G 2006).

2.3.1.3.3 Lake Mineral Wells and Mineral Wells Dam

Lake Mineral Wells is on Rock Creek in the Brazos River basin 4 mi east of Mineral Wells in far western Parker County. The project is owned and operated by the City of Mineral Wells and was completed in 1920. From 1943 to 1944, storage capacity was increased by raising the height of the spillway 2 ft. Lake Mineral Wells was designed for flood control, conservation storage, and recreational use.

The lake covers a surface area of 440 ac, and the drainage area above the dam is 63 sq mi. Lake Mineral Wells has a storage capacity of 7065 ac-ft at the conservation pool elevation of 863 ft msl. Mineral Wells Dam is a rolled earthfill structure 1760 ft long with a 1145 ft wide uncontrolled spillway. The crest of the spillway is 863 ft msl (TWDB 2007b). Yield analysis for Lake Mineral Wells indicates a firm yield of 2520 ac-ft in 2000 and 2430 ac-ft in 2060 (Brazos G 2006).

2.3.1.3.4 Lake Granbury and DeCordova Bend Dam

DeCordova Bend Dam impounds Lake Granbury on the Brazos River approximately 145 stream mi southeast of Morris Sheppard Dam and approximately 7.5 mi southeast of Granbury, at BRM 542.5. The lake was built by the BRA for the conservation of water for irrigation, municipal, and industrial uses and was completed in 1969. Lake Granbury and associated DeCordova Bend Dam are owned by the BRA. Lake Granbury inundates approximately 33 mi of the original Brazos river bed and has a contributing drainage area of 16,113 sq mi.

Ambursen Engineering Corp. of Houston designed the dam and the H. B. Zachry Company was the contractor. Construction began in December 1966 and deliberate impoundment commenced September 15, 1969. The earth-rolled embankment is 2200 ft long with a maximum height of 84 ft at elevation 706.5 ft msl. The service spillway is a gate-controlled ogee crest. There are 16 tainter gates, each 36 ft long by 35 ft high have a crest elevation of 658.0 ft msl. Outlet works consist of two 84-in x 96-in openings, motor-controlled by sluice gates with invert elevations at 652.0 and 640.0 ft msl (TWDB 2003a).

The results of the 2003 TWDB Volumetric Survey indicate Lake Granbury has a volume of 129,011 ac-ft, and extends across 7945 surface ac at the conservation pool elevation of 693.0 ft msl. The revised TWDB 1994 survey report (1993 field survey) found 7949 surface ac and a total volume of 131,593 ac-ft. Comparison of the 1993 survey to the current 2003 survey of Lake Granbury show little or no change in surface area and a 2 percent reduction in total volume at the top of the conservation pool. Most of this reduction appears to be in the area of continued deltaic accretion in the upper reaches of Lake Granbury where the Brazos River enters the main body of the reservoir (TWDB 2005).

Water Rights Permit No. 2111, issued July 24, 1964, authorized the BRA to construct and maintain a dam and reservoir (Lake Granbury) on the Brazos River, to impound and not exceed 155,000 ac-ft of water. The BRA was permitted to divert and use no more than 10,000 ac-ft/yr of water for municipal purposes, 70,000 ac-ft/yr for industrial purposes, 20,000 ac-ft/yr for irrigation and 350,000 ac-ft/yr for hydroelectric power generation. Several amendments were made to Permit 2111 in the following years. On September 28, 1966, the authorization to divert 350,000 ac-ft/yr of water for hydroelectric power generation was deleted and on September 13, 1979 the impounded waters of Lake Granbury was approved for recreational purposes. A change in water use resulted in another amendment to the Permit that was approved on November 25, 1980. It allowed the permittee to use 500 ac-ft of the 20,000 ac-ft of water designated for irrigation to be used for mining purposes.

The Certificate of Adjudication, No. 12-5156, was issued to the Brazos River Authority on December 14, 1987. It grants the BRA the right to impound and use the waters of Lake Granbury as previously described along with several "Special Conditions" concerning the "Systems Operations Order." The priority rights of Lake Granbury also fall under the order of Certificate of Adjudication 5167 for the purpose of system operation as authorized by Commission Order of July 23, 1964, as amended and as modified, by the Commission's final determination of all claims of water rights in the Brazos River Basin and the San Jacinto-Brazos Coastal Basin maintained by the BRA, the Fort Bend County W.C.I.D. No. 1 and the Galveston County Water Authority on June 26,1985 (TWDB 2005).

A review of USGS reservoir gauge data indicates the surface water elevation at Lake Granbury is kept at approximately 692.5 ft msl (USGS 2007c). Graphs of daily reservoir elevation and storage from October 2002 to September 2007 for Lake Granbury are shown on Figure 2.3-23. Constant water level at Lake Granbury is maintained by an open spillway and retention time has been estimated at 260 days (TPWD 2005). Yield analysis for Lake Granbury indicates a firm yield of 64,712 ac-ft in 2000 and 63,212 ac-ft in 2060 (Brazos G 2006).

2.3.1.3.5 SCR and Squaw Creek Dam

SCR, the cooling water source for CPNPP Units 1 and 2 is located on Squaw Creek in Hood and Somervell counties, approximately 4.3 mi north of the creek’s confluence with the Paluxy River (CPSES 1974). At the conservation pool elevation (775.0 ft msl), the lake has approximately 36 mi of shoreline and is 5 mi long. At the dam site the reservoir has a drainage area of 64 sq mi. Squaw Creek Dam and Reservoir are owned and operated by Luminant.

Records indicate the construction for Squaw Creek Dam began on November 17, 1974, and was completed on June 16, 1977. Freese and Nichols Consulting Engineers of Fort Worth designed the facility, and Brown and Root Inc. managed the construction project. Squaw Creek Dam and appurtenant structures consist of an earthfill embankment 4360 ft in length with a maximum height of 159 ft and a crest elevation of 796.0 ft msl. The service spillway is an uncontrolled concrete ogee type located between the right (southwest) end of the embankment and abutment. The crest of the spillway is 100 ft in width at elevation 775.0 ft msl. The emergency spillway is an earthcut channel through bedrock located at the left abutment, northeast of the embankment. The width of the channel is 2200 ft with a crest elevation of 783.0 ft msl. The service outlet structure consists of a concrete tower housing three gate-controlled outlets with invert elevations of 764.0 ft, 715.0 ft and 666.5 ft msl. The 30-in diameter low-flow outlet has an invert elevation of 653.0 ft msl. Provisions for emergency discharges are provided that can discharge from the outlet tower through a 6-ft emergency gate and concrete encased conduit to be released downstream of the embankment. Routine discharges to maintain minimum Squaw Creek stream flow (1.5 cfs) pass through either of these discharges via three roto-cone valves (2-12 in and 1-6 in).

Contained within SCR, is a smaller reservoir known as the SSI. The smaller reservoir is designed to provide cooling water during an emergency situation to safely shutdown CPNPP Units 1 and 2. The SSI Dam is located on Panther Branch, a tributary of Squaw Creek. The safety-related dam is composed of a rock-fill embankment, approximately 1520 ft long. The maximum height of the embankment is 70 ft above the natural streambed. The 40 ft wide crest is at elevation 796.0 ft msl. The service/emergency spillway is a 40 ft wide by 400 ft long earthcut channel connecting the SSI facility to the main reservoir. This ingress/egress channel, located to the right (south) of the SSI Dam, is also referred to as the equalization channel for the two reservoirs. The flow of water between the two reservoirs is controlled by a 3 ft x 3 ft concrete submerged weir that extends the width of the channel with a flowline elevation of 769.5 ft msl is provided to ensure suffieient emergency water is available in the event of SCR Dam failure.

The results of the 1997 TWDB volumetric survey indicate SCR has a volume of 151,418 ac-ft, and extends across 3297 surface ac at the conservation pool elevation of 775.0 ft msl. Within the lake, the survey determined that the Squaw Creek SSI held 701 ac-ft, spread over a surface area of 53 ac (TWDB 2003).

The Texas Water Commission issued Water Rights Permit No. 2871 on September 11, 1973, to Dallas Power and Light Company, Texas Electric Service Company, Texas Power and Light Company, and Texas Utilities Services Inc., Agent. This original permit authorized the permitees to construct a dam and reservoir on Squaw Creek having an impoundment capacity of 151,500 ac-ft of water. Permitees were also granted the right to construct a dam and reservoir (safe shutdown impoundment) on Panther Branch. Permitees were authorized to maintain the reservoirs with available waters from Squaw Creek and to divert supplemental water from Lake Granbury (TWDB 2003). A water supply contract between Luminant and the BRA provides up to 48,300 ac-ft/yr of supplemental water to SCR from Lake Granbury for CPNPP Units 1 and 2 operation.

Yield analysis for SCR indicates a firm yield of 8830 ac-ft in 2000 and 8710 ac-ft in 2060 (Brazos G 2006).

2.3.1.3.6 Wheeler Branch Reservoir and Wheeler Branch Dam

Wheeler Branch Reservoir is an off-channel storage reservoir of the Paluxy River, located approximately 2 mi south of the CPNPP site. The reservoir was constructed to provide water supply to the City of Glen Rose, other smaller Somervell County communities, and some private users in Somervell County. The reservoir is filled by diverted water from the Paluxy River and runoff from the Wheeler Branch drainage area. The reservoir has a conservation storage capacity of 4118 ac-ft and plans indicate a yield of up to 2000 ac-ft/yr from the reservoir for municipal, industrial, and irrigation use within Somervell County Water District (Freese 2007). Wheeler Branch Reservoir is expected to be the source of potable and service water (other than cooling water) for the CPNPP site.

Wheeler Branch Dam impounds the Wheeler Branch Reservoir approximately 2 mi south of the CPNPP site on Wheeler Branch, a tributary to the Paluxy River. The dam is a 1750 ft long, 90 ft high, earthen embankment with a morning glory intake structure consisting of a 48-in conduit with a stilling basin on the downstream end. The spillway discharge capacity is 250 cfs. Conservation storage capacity is 4118 ac-ft at pool elevation of 785 ft msl (Freese 2007).

2.3.1.3.7 Lake Whitney and Whitney Dam

Whitney Dam impounds Lake Whitney on the Brazos River approximately 100 stream mi southeast of DeCordova Bend Dam at BRM 442.4. Lake Whitney is located in Bosque and Hill counties on the main stem of the Brazos River in Central Texas. The primary purpose of Lake Whitney is flood control. Secondarily the lake supports the production of hydroelectric power and recreation. Construction of Whitney Dam began on May 12, 1947, and deliberate impoundment began on December 10, 1951.

The lake is formed by a concrete-gravity and rolled earthfill dam 17,695 ft long, including spillway. The concrete spillway is 680 ft long and includes 17 tainter gates 38 ft x 40 ft each. Outlet works consist of 16 gate-operated conduits that are 5 ft x 9 ft each. The space between elevations 522 ft and 571 ft msl is reserved for flood-control storage. At maximum design elevation of 573.0 ft msl the spillway is designed to discharge 684,000 cfs.

Construction of the powerhouse began in April 1951 and power generation began on June 25, 1953. Whitney Dam powerhouse uses two 13,000 volt generators that produce 15,000 kW/hr and have a turbine capacity of 20,700 horsepower, each. Average annual power production is 73,100,000 kW/hr. Lake Whitney is owned by the U.S Government and operated by the USACE.

The results of the TWDB 2005 volumetric survey indicate Lake Whitney has a capacity of 554,203 ac-ft and encompasses 23,220 ac at the conservation pool elevation of 533.0 ft msl. The Report of Sedimentation, Resurvey, Whitney Reservoir, in 1959 by the USACE indicated Lake Whitney had a volume of 627,100 ac-ft and encompassed 23,560 ac at conservation pool elevation. It appears that between 2005 and 1959, Lake Whitney lost 72,897 ac-ft or 11.6 percent of its capacity and experienced a 1.4 percent decrease in area (TWDB 2006a).

The water rights to Lake Whitney are appropriated to the BRA by Certificate of Adjudication 12-5157, with a priority date of August 30, 1982. The BRA is authorized to impound 50,000 ac-ft of water, between elevations 520 ft and 533 ft msl, in Lake Whitney. The certificate authorizes a priority right to divert and use not to exceed 18,336 ac-ft/yr of water from the reservoir for municipal and industrial purposes. The amount of this priority right may be used in computing the sum of priority rights for the purpose of system operation as authorized by Commission Order of July 23, 1964. For purposes of system operation, the BRA is authorized to exceed the priority right and annually divert and use from Lake Whitney not to exceed 25,000 ac-ft/yr of water for municipal purposes and 25,000 ac-ft of water for industrial purposes. All diversions and use of water exceeding 18,336 ac-ft in any calendar year shall be charged against the sum of the amounts designated as priority rights in other reservoirs included in the System Operation Order. The owner is also authorized to use the water impounded for non-consumptive recreational uses. This certificate is junior in priority rights to any rights which may be granted by the Texas Water Commission to the City of Stephenville pursuant to Application No. 4237. Additionally, the BRA has subordinated their Lake Whitney rights to Somervell County Water District's Permit 5744 (TWDB 2006a).

Yield analysis for Lake Whitney indicates a firm yield of 18,336 ac-ft in 2000 and 2060 (Brazos G 2006). There are no other dams on the main channel of the Brazos River downstream of Whitney Dam.

2.3.1.3.8 Site Surface Water Impoundments

Current site surface water impoundments include the SCR (discussed in Subsection 2.3.1.3.5), the CPNPP Units 1 and 2 SSI, the CPNPP Units 1 and 2 low volume wastewater ponds, and scattered cattle ponds. The SSI is formed by the channel of Panther Branch on the southwest side of CPNPP Units 1 and 2, and is utilized as a safe shutdown impoundment, holding water for normal and emergency cooling use for CPNPP Units 1 and 2. The SSI has a surface area of 53 ac and a capacity of 701 ac-ft (TWDB 2003). The secondary reservoir is separated from the main body of the reservoir by a rock-fill seismic designed dam. An open channel was excavated through the narrow ridge to the southwest of the SSI Dam to connect the SSI with the main body of the SCR. The top of the submerged concrete weir is at elevation 769.5 ft msl, 6-in below the normal minimum operating level, and under normal operating conditions water equalizes between the large and small reservoir surfaces at the same elevation. If the level in the main reservoir should drop due to failure of the main SCR Dam, the SSI Dam holds back reserve water to allow continued cooling and safe shutdown of the plant (CPSES 1974).

Six wastewater process impoundments are located on the approximate center of the CPNPP peninsula, west of the existing switchyard facilities. The impoundments occupy approximately 6 ac and consist of a surge basin and three low volume wastewater flow-thru ponds, an oil-water separator, and metal cleaning waste impoundment. The impoundments are double-lined with 60 mil high-density polyethylene lining and utilize a leachate collection system. Low volume wastewater from CPNPP Units 1 and 2 operations is monitored within three of the ponds prior to discharge into SCR through a TPDES permitted active process outfall. The metal cleaning waste impoundment, also permitted through the current CPNPP TPDES permit, has no installed discharge and has reportedly been used once to support Unit 1 steam generator cleaning.

Topographic maps prepared by the USGS show a number of small man-made ponds in the drainage basin, some of which are in creek channels and others which are off-channel (Figure 2.3-5). The total volume of the on-channel and off-channel storage in these ponds has been estimated to be about 1150 ac-ft. There are three retaining ponds in the drainage basin for the purpose of mitigating potential releases to the SSI from a petroleum pipeline that crosses the CPNPP site. Other than these small ponds, there are no known control structures, weirs, or canals (CPSES 2007).

2.3.1.4 Estuaries and Ocean

There are no estuaries or oceans in the vicinity or region that could affect station effluents and water supply, or could be affected by future construction or operational activities.

2.3.1.5 Groundwater

This subsection discusses regional and local groundwater conditions and their influence on groundwater characteristics in the vicinity of CPNPP Units 3 and 4. To gather the required site specific information, a detailed hydrological investigation was conducted on CPNPP Units 3 and

4 from November 2006 through December 2007. (Additional details from this investigation are presented in CPNPP Units 3 and 4 FSAR Subsection 2.4.12). The objective of this investigation was to collect groundwater information, including the following:

- Aerial extent of aquifers, recharge and discharge areas, elevation and depths of geological formations, and aquifer characteristics (transmissivity, hydraulic conductivity).
- Piezometric contour maps, historical and current hydraulic gradients, and flow directions.
- Estimated flow travel times.
- Soil properties, including hydraulic conductivity or transmissivities, storage coefficients or specific yields, total and effective porosities, clay content, and bulk densities.
- Site surface and groundwater interactions.
- Historical and seasonal trends in groundwater elevation or piezometric levels.
- Hydraulic interactions between different aquifers.
- Recharge rates, soil moisture characteristics, and moisture content in the vadose zone.
- Local aquifers designated or proposed to be designated as “sole source aquifers.”

2.3.1.5.1 Physiographic Setting

The CPNPP site lies within the Comanche Plateau subdivision of the Central Texas Section of the Great Plains Physiographic Province. The relationship of the site to these features and to other physiographic units in the region is shown on Figure 2.3-3. To the north is the Central Lowland Physiographic Province, and to the east is the Coastal Plain Physiographic Province. The boundary separating the Great Plains Province from the Coastal Plain Province coincides with the contact of the upper and lower Cretaceous formations.

The Central Texas Section lies northeast of the Edwards Plateau. It differs from the Edwards Plateau in that it has been stripped, in varying degrees, of its cover of resistant Cretaceous limestone. The section is subdivided on the basis of two factors: the extent to which the topography has been dissected; and the nature of the rocks exposed on removal of the Edwards limestone. The Comanche plateau subdivision is a belt of submaturely dissected plateau land which slopes east at a rate determined by the dip of the lower Cretaceous rocks.

CPNPP Units 3 and 4 are located in the Squaw Creek drainage area on the western end of a peninsula formed by land between the southern shore of SCR and the CPNPP Units 1 and 2 SSI, approximately 0.49 mi west-northwest of CPNPP Units 1 and 2 in Somervell County. Maximum relief in the CPNPP site area is approximately 220 ft, with elevations ranging from 640 ft to 860 ft msl, with slopes that are typically steep, ranging from 15 to 30 degrees or more, and generally exhibiting a stair-stepped appearance. Rock outcrops of limestone and claystone comprise approximately 40 to 60 percent of these slopes. The remaining areas, including the higher flat-topped plateau remnants, are mantled by a thin cover of soil which at the surface generally consists of silt and sand (CPSES 1974).

2.3.1.5.2 Regional and Local Geology

In the vicinity of the CPNPP site, the Great Plains province of Texas is subdivided on the degree of erosion of the resistant Lower Cretaceous limestone cover and on the nature of the older rocks thereby exposed. The Comanche plateau subdivision in which the CPNPP site is located is a sub-maturely dissected area which slopes eastward at a gradient conforming the dip of the lower Cretaceous rocks. The eastern boundary of the Comanche plateau, from a point near Waco southward, is formed by the Balcones escarpment (CPSES 2007).

The Palo Pinto Country adjoins the Comanche Plateau to the Northwest. Palo Pinto Country is the locality in which Pennsylvanian rocks have been exposed by stripping away of the Edwards limestone (Upper Cretaceous). It is characterized by steep sided mesas cut by canyons, the mesas being remnants of strong sandstone beds.

The geologic formations forming the Comanche Peak Plateau and the outlier remnants of the Callahan Divide to the west are principally limestones of Lower Cretaceous age. These more resistant rocks are grouped with associated sands and calcareous clay or marl units into three subdivisions: the Trinity, Fredericksburg, and Washita groups. South and west of the Brazos River, the youngest (Washita) rocks are thin and have a small extent of a real outcrop. This group is absent in the site vicinity. The Fredericksburg group of formations, Edwards and Comanche Peak Limestones and underlying Walnut Clay, are confined to the major drainage divides. The only complete section in the site vicinity is at Comanche Peak, the prominent landmark a little more than 5 mi north of the plant site. The Trinity rocks are roughly equal in aerial extent to those of the Fredericksburg. They crop out in the western marginal area of the plateau and in the valley areas projecting southeastward. Classic exposures are present in the valleys of the Brazos River, Paluxy River, and Squaw Creek in the site area. The CPNPP dams and reservoirs are all within the Glen Rose bedrock outcrop with the overlying Paluxy Sand on the adjacent divides. The underlying basal Trinity sands, the Twin Mountains Formation that is unexposed in the Squaw Creek drainage, crop out about 8 mi to the southwest of the site in the Paluxy River Valley.

The Trinity formations exhibit characteristic terrain aspects. The outcrop area of the Paluxy Sand is confined to the summit regions of the drainage divides and forms gently rolling hills of red, sandy soil which supports deciduous trees and native grasses. Areas underlain by the Glen Rose Formation are typically prairies having relatively steep, stair-stepped slopes developed on limestone alternating principally with claystone, siltstone and/or shale. The residual soil derived from the Glen Rose beds supports cedar and sparse grassland vegetation.

In the vicinity of the CPNPP site, and north, the Travis Peak Formation is known as the Twin Mountains Formation (Brazos G 2006). A flat, broadly undulating plain lying to the west of the site characterizes the outcrop area of the Twin Mountains Formation, and its vegetation cover closely resembles that described for the Paluxy Sand. Topographic elevations in the site region range from about 550 ft to 1000 ft msl (CPSES 2007).

2.3.1.5.3 Regional Hydrogeology

Most of the groundwater in the site region occurs in bedrock. Some groundwater does exist in the shallow floodplain alluvium along stream valleys but is not withdrawn for use. In the order of increasing age, bedrock aquifers in the site vicinity include the Paluxy Formation, the Glen Rose Formation, the Twin Mountains Formation, and all of the Comanche series, Cretaceous age (Figure 2.3-24). Locally, CPNPP and SCR are situated on the Glen Rose Formation outcrop, which in turn, is underlain by the Twin Mountains Formation. The Paluxy Formation is absent at the CPNPP location and within the limits of SCR (CPSES 2007).

The three formations are regional in extent; their outcrops form a strip of land tens of miles wide that extends south from central Oklahoma, strikes westward in Central Texas and extends into Mexico. In the site region, the formations dip gently eastward.

The Twin Mountains and Paluxy formations are principally sandstone, but also have shale, limestone, claystone, and siltstone inclusions. Limestone is the dominant rock type in the Glen Rose Formation, but the stratum also contains significant quantities of shale, siltstone, and claystone. In these formations, groundwater percolates slowly along bedrock joints and fractures, and through interstices in the rock fabric.

The Twin Mountains Formation is the only moderately productive bedrock zone in the site vicinity, though the Paluxy Formation has nominal pumpage near the site. The Glen Rose Formation yields very little water in the site area and is usually less productive than the others. At distances of 20 – 50 mi, down-dip from the outcrop, the groundwater becomes saline, and the formations lose their importance as sources of fresh water. The three water-bearing formations are discussed individually in succeeding sections.

The principal origins of groundwater in the Twin Mountains Formation are rainfall and streamflow occurring in the outcrop area. Down-dip from the outcrop, groundwater in the Twin Mountains Formation is confined by fine-grained materials of the overlying Glen Rose Formation. Hydrostatic pressure in the Twin Mountains is great enough to create static water levels that rise above the formation and, sometimes, to cause flowing wells (CPSES 2007).

The piezometric level, at an observation well located approximately 1.5 mi north of Units 1 and 2, is approximately 539.23 ft msl, about 71 ft below the formation surface (TWDB 2007).

Groundwater loss occurs in the outcrop area by evapotranspiration, localized springs, and seepage into drainage channels incised below the water table. Down-dip from the outcrop area where the formation is confined, the natural discharge is limited to a small upward movement into overlying formations.

Although the Twin Mountains Formation is a moderately productive stratum in the site area, packer-pressure tests of 60 ft of this rock in a boring at CPNPP Units 1 and 2 did not result in water take. These data indicate there are essentially impermeable rock zones within this formation (CPSES 2007).

The principal origins of groundwater in the Glen Rose Formation are rainfall in the outcrop area, and minor seepage from both the overlying Paluxy Formation and underlying Twin Mountains

Formation (CPSES 2007). The Glen Rose Formation outcrop area is shown on Figure 2.3-24. To assist in determining permeability of the formation, 40 packer-pressure tests were performed in five test borings at 5-ft intervals of varying depth at CPNPP Units 3 and 4 in 2007. The results of these packer tests indicated little to no water take into the Glen Rose Formation (Fugro 2007). These results indicate that this formation is essentially impermeable. The Glen Rose Formation is predominately limestone, but significant amounts of shale, siltstone, and claystone are also present.

CPNPP Units 3 and 4 are expected to be constructed on the Glen Rose Formation; therefore, the character and rate of groundwater movement in this formation is of special interest. The Glen Rose limestones are essentially impermeable due to slight amounts of argillaceous impurities present. These limestones are resistant to solution effects: open voids, caverns, joints, collapse features, and fractures, which are frequent in some limestone formations but are notably absent in the Glen Rose Formation near the site. Groundwater, therefore, moves very slowly into and through the formation; entrance is afforded principally through existing joints and fractures. Occasional isolated sand lenses also contain groundwater (CPSES 2007).

Detailed examination of cores from test borings revealed minor solutioning features and minimal fractures. Packer-pressure tests in the Glen Rose Formation, prior to construction of CPNPP Units 1 and 2, incurred essentially no water take in rock beneath the upper, usually thin, weathered zone. Drill water occasionally was lost while drilling through the upper weathered zone. Northwest of the site, where the formation is covered by outliers of the Paluxy, a few domestic water wells are completed in the Glen Rose Formation. These wells produce potable water and are reliable during droughts, generally due to the slow release of groundwater to the Glen Rose Formation from the overlying Paluxy Formation. Elsewhere, wells completed in the Glen Rose are often unreliable during droughts (CPSES 2007).

The Glen Rose Formation ranges from 217 ft to 271 ft thick. Under CPNPP Units 3 and 4, the thickness is approximately 230 ft. The Glen Rose Formation discharges water naturally through springs and seeps. In confined portions of the formation, there is little transfer of water into overlying or underlying formations when differential pressures occur (CPSES 2007).

The Paluxy Formation is predominately sandstone, but shale, siltstone, claystone, and limestone are also present. The top of the Twin Mountains Formation is determined to be at approximately 230 ft below the CPNPP Units 3 and 4 plant grade elevation. In the vicinity of the CPNPP site, the Twin Mountains Formation is more than 220 ft thick. Recharge to the Paluxy Formation occurs in the outcrop areas from infiltration of rainfall and seepage from streams. It also receives water from water-bearing units under greater hydraulic heads which adjoin the Paluxy Formation. South of the CPNPP site, the formation is confined by overlying fine-grained strata (CPSES 2007).

Groundwater discharges from the Paluxy Formation as springs and seeps in some outcrop areas. Where the Paluxy Formation is confined, there is a limited water movement into overlying or underlying confining units when those units are at a lower hydraulic head (CPSES 2007).

2.3.1.5.4 Groundwater Occurrence and Usage

Groundwater in Texas is managed locally by groundwater conservation districts. There are 91 such districts established in Texas, each having its own rules, permitting program, and permit records. As of March 2008, the Upper Trinity Groundwater Conservation District that includes Hood County was identified as created. Somervell County was not identified as part of a Groundwater Conservation District (TWDB 2008).

The Trinity aquifer, composed of Cretaceous-aged Trinity Group formations, is characterized as a major aquifer by the TWDB. The Paluxy, Glen Rose, and Twin Mountains make up the Trinity aquifer in the CPNPP site vicinity. TWDB data indicate pumpage from the Trinity aquifer in 2003 was approximately 5729 ac-ft/yr in Hood County and 1726 ac-ft/yr in Somervell County (TWDB 2008a).

A sole source aquifer is an aquifer designated by the U.S. Environmental Protection Agency (EPA) as the "sole or principal source" of drinking water for a given service area; that is, an aquifer that is needed to supply 50 percent or more of the drinking water for that area and for which there are no reasonably available alternative sources should the aquifer become contaminated (EPA 2007). Based upon review of EPA information, the Trinity aquifer has not been designated as a sole source aquifer. Additionally, there are no sole source aquifers in the vicinity of the CPNPP site.

Paluxy and Glen Rose Formations

A review of TWDB data (TWDB 2007c) indicates that groundwater is pumped from the Paluxy and Glen Rose formations by small-capacity wells mainly for livestock and rural domestic use. An inventory of water wells in Hood and Somervell counties is provided in Table 2.3-28, and locations are shown on Figure 2.3-25. Pumpage is not metered within the region, and withdrawals from both formations are estimated to be less than 100 ac-ft/yr. Water extraction from these formations has no identifiable effect on regional piezometric levels. Groundwater use is not expected to increase significantly in the future because these formations are poor aquifers and would probably not be developed for water supply by either cities or industries, or for large scale irrigation. More favorable water supplies are available from surface sources or from the Twin Mountains Formation (CPSES 2007).

Regional movement of water in the Paluxy and Glen Rose formations is down-dip to the east. The hydraulic gradient in the Paluxy is about 20 ft/mi in down-dip areas. The rate of regional groundwater movement is estimated to be on the order of 1 ft/day or less in the Paluxy Formation (CPSES 2007).

Because groundwater in the Paluxy is used only for domestic and livestock purposes in rural areas, wells are usually of small pumping capacity, typically less than 10 gpm. It is estimated that maximum potential well yield in the region is under 50 gpm (CPSES 2007).

There are few wells withdrawing water from the Glen Rose Formation. This formation typically is not capable of supplying more than about 10 gpm to wells. Water levels in the Glen Rose fluctuate in response to precipitation, and some wells in the Glen Rose are reported to have failed during certain droughts (CPSES 2007).

Generally, in the CPNPP site vicinity water use from the Paluxy and Glen Rose formations is small and individual wells are of very limited capacity. The recharge areas (outcrop areas) of the Paluxy and Glen Rose formations are shown on Figure 2.3-24. The aquifers are variable in their hydraulic characteristics and also in the quality of water they yield. As a result, no significant development of these sources of groundwater is anticipated (CPSES 2007).

Twin Mountains Formation

Prior to 1880, there was relatively little groundwater development from this formation. Since the early 1900s, pumpage has increased to include wells from municipal, industrial, and irrigation purposes. The Twin Mountains Formation is the primary source of groundwater used in the region. An inventory of water wells in Hood and Somervell counties is provided in Table 2.3-28, and locations are shown on Figure 2.3-25.

The groundwater movement is down-dip to the east, at a rate of approximately 2 ft/day. Permeability of the formation ranges from 90 to 240 gallons/day/sq ft (CPSES 2007). The recharge area (outcrop area) of the Twin Mountains Formation is shown on Figure 2.3-24. Because the site is near the recharge area, and because of the groundwater conservation efforts at the CPNPP site, no significant change in groundwater level from plant operations is expected.

2.3.1.5.5 Site Hydrogeology

The majority of surface drainage from CPNPP Units 3 and 4 discharges to SCR as sheet flow or via drainage ditches. Infiltration of rainwater into shallow regolith and undifferentiated fill material in the vicinity of Units 3 and 4 was observed in groundwater monitoring wells during a 2006 to 2007 groundwater investigation at the site.

No aquifer test data have been found that address aquifer characteristics in the regolith/undifferentiated fill or the Glen Rose Formation or as to vertical conductivity between the connected zones and geologic formations. In November 2006, a groundwater investigation program was initiated as part of a subsurface study to evaluate current geologic and hydrogeologic conditions at CPNPP Units 3 and 4. The high density of wells shown within and surrounding the proposed reactor areas in Figure 2.3-26 were placed to determine and confirm the groundwater conditions in the immediate vicinity, and to provide sufficient information for the performance of an aquifer pump test. The groundwater investigation did not include an evaluation of the Paluxy or Twin Mountains formations.

Twenty monitoring well clusters (47 wells total) were installed in October and November 2006, and one aquifer pump test well and three aquifer pump test observation wells were installed in February 2007. A list of monitoring wells and relevant installation data are presented in Table 2.3-29. Due to the highly variable nature of the reported Glen Rose zones, the well clusters were installed across CPNPP Units 3 and 4 from west to east of the proposed reactor areas to define the groundwater bearing capabilities and properties of the zones likely to be affected, and to identify the hydraulic connectivity between the zones, if any. Monitoring wells were designated as follows, where X denotes the well or cluster number:

a. Regolith/undifferentiated fill monitoring wells (MW-12XXa) were installed if greater than 10 ft of soil was encountered above hollow stem auger refusal.

b. Shallow bedrock monitoring wells (MW-12XXb) were generally completed in the upper 40 - 60 ft of bedrock in an apparent zone of alternating stratigraphy; i.e., claystone, mudstone, limestone, and shale sequences.

c. Bedrock monitoring wells (MW-12XXc) were generally completed in deeper bedrock zones consisting of alternating stratigraphy and competent bedrock.

d. Aquifer pump test well (RW-X) was installed on the northeast portion of CPNPP Units 3 and 4 to investigate hydraulic communication with lake water and undifferentiated fill material that was placed within a former drainage swale.

e. Aquifer pump test observation wells (OW-X) were completed adjacent and surrounding the aquifer pump test well and generally completed in the same depth as the associated pump test well.

Groundwater elevation measurements were collected during well gauging activities from November of 2006 to November 2007 and are presented in Table 2.3-30. November 2006 groundwater levels were determined to be unusable, because groundwater gauging data showed evidence of non-equilibrium conditions in the majority of the groundwater monitoring wells. The circumstance was apparently due to insufficient time for groundwater equilibration and concurrent geotechnical drilling operations.

Regolith/Undifferentiated Fill Monitoring Wells

Of the 16 groundwater monitoring wells screened in the regolith and/or undifferentiated fill (MW-12XXa), 15 wells exhibited steady water level increases from December 2006 to July 2007. Water levels remained constant or decreased slightly from August 2007 to November 2007 in these wells. Overall, the water level trend in the regolith/undifferentiated fill monitoring wells appeared to coincide with rainfall totals at the site.

Monitoring well MW-1211a was installed on the northeast portion of CPNPP Units 3 and 4 in undifferentiated fill material that was placed within a former drainage swale during construction of CPNPP Units 1 and 2. Water levels in this monitoring well were consistent with the surface water elevation of SCR (775 ft msl) over the monitoring period indicating hydraulic communication between the former drainage swale and SCR.

Monthly potentiometric surface maps were developed using the groundwater level evaluations presented in Table 2.3-30 with representative maps for the quarter presented in Figure 2.3-27 (Sheets 1 through 4). The potentiometric surface maps show that the general shallow groundwater movement in the vicinity of CPNPP Units 3 and 4 mimics the surface topography with an apparent groundwater divide along the long axis of the site peninsula. On the northern portion of the peninsula, a northerly flow toward SCR is observed, and a southerly flow toward the SSI is observed on the south side of the site peninsula.

Shallow Bedrock Monitoring Wells

Of the 16 groundwater monitoring wells screened in shallow bedrock (MW-12XXb), nine contained no, or negligible, amounts of water for up to eight months before exhibiting measurable water (greater than 1 ft). These wells exhibited a slow to steady recharge with no indication of reliable equilibrium conditions over the monitoring period.

Six monitoring wells screened in shallow bedrock exhibited no, or slight, changes in water level over the monitoring period. One of these wells (MW-1211b) was installed on the northeast portion of CPNPP Units 3 and 4 in the previously discussed undifferentiated fill material. During installation, an effort was made to install this well in bedrock; however, due to the thickness and nature of the undifferentiated fill material, the boring was terminated at the bedrock surface (approximately 75 ft bgs). Water level measurements for this well were consistent with those of regolith monitoring well MW-1211a and the surface water elevation of SCR over the monitoring period.

One monitoring well screened in the shallow bedrock exhibited variable water levels with no indication of reliable equilibrium conditions when compared to other wells with similar screened zones. Monitoring well MW-1217b, located near the center point of CPNPP Unit 3 exhibited an approximate 15 ft increase in water level from December 2006 to March 2007 followed by a decline of 5 ft through May 2007. From May 2007 to November 2007, this well exhibited a water level increase of approximately 7 ft.

Monthly potentiometric surface maps were developed using the groundwater level evaluations presented in Table 2.3-30 with representative maps for the quarter presented in Figure 2.3-27 (Sheets 5 through 8). The potentiometric surface maps prepared for the shallow bedrock zone show that the groundwater movement in the vicinity of CPNPP Units 3 and 4 flows to the east in the general direction of the dip of the Glen Rose Formation.

Bedrock Monitoring Wells

Of the13 groundwater monitoring wells screened in bedrock (MW-12XXc) eight contained no, or negligible, amounts of water over the monitoring period and five exhibited a slow to steady recharge with no indication of reliable equilibrium conditions.

Monthly potentiometric surface maps were developed using the groundwater level evaluations presented in Table 2.3-30 with representative maps for the quarter presented in Figure 2.3-27 (Sheets 9 through 12). The potentiometric surface maps prepared for the deep bedrock zone show that the groundwater movement in the vicinity of CPNPP Units 3 and 4 flows to the east in the general direction of the dip of the Glen Rose Formation.

Aquifer Pump Test and Observation Wells

One aquifer test well (RW-1) and three pump test observation wells (OW-1, OW-2, and OW-3) were installed at the site in February 2007 to investigate hydraulic communication with lake water and undifferentiated fill material that was placed within a former drainage swale during construction of CPNPP Units 1 and 2 on the northeast portion of CPNPP Units 3 and 4. Monthly water level measurements collected from March to November 2006 in these wells consistently exhibited water levels of approximately 775 ft msl over the monitoring period indicating direct communication with SCR. These wells were not included in the development of potentiometric surface maps.

2.3.1.5.6 Groundwater Velocity

The rate of flow (velocity) of groundwater depends on the hydraulic conductivity and porosity of the medium through which it is moving and the hydraulic gradient. Higher groundwater velocities occur with greater hydraulic conductivity and hydraulic gradient. Hydraulic conductivity is greatest in the soil zone (undifferentiated fill material and regolith); therefore, this zone typically has a higher rate of flow than other parts of the system. Based on information from the field investigation, the bedrock formation in the area of the CPNPP site is poorly developed in that groundwater flow within the bedrock is dominated by isolated layers of claystone, mudstone, limestone, and shale. Movement of water in a granular aquifer can be characterized by use of Darcy's Law; therefore, application of Darcy's Law calculations is appropriate for the regolith and shallow bedrock systems found at CPNPP Units 3 and 4. Average interstitial groundwater flow velocity for the regolith and shallow bedrock units was determined using a form of the Darcy equation as follows:

$V = (Kh \times (EH – EL)/L)/\eta$ (Driscoll 1986)
Where: V = groundwater flow velocity, ft/day
Kh = hydraulic conductivity, ft/day
EH = highest groundwater elevation, ft msl
EL = lowest groundwater elevation, ft msl
L = pathway length, ft
η = formation porosity, unitless

Travel time to the nearest water body is calculated using the following equation:

$t = L/V$

Where: t = groundwater travel time, days
V = groundwater flow velocity, ft/day
L = pathway length, ft

Single well slug tests were performed on six monitoring wells using the Bouwer & Rice method in April of 2007 at the CPNPP Units 3 and 4 site. Of the six wells tested, three were screened in the regolith/undifferentiated fill zone, and three were screened in the shallow bedrock zone. Hydraulic conductivity for the wells screened in the regolith/undifferentiated fill zone ranged from 2.93×10^{-5} cm/s to 5.00×10^{-4} cm/s. Hydraulic conductivity for the wells screened in the shallow bedrock zone ranged from 6.29×10^{-6} cm/s to 1.37×10^{-5} cm/s.

A step test and 72-hr pumping test were performed on aquifer pump test well RW-1 in April of 2007. To investigate groundwater communication with SCR, pump test well RW-1 was installed in an area of undifferentiated fill within a former drainage swale on the northeast portion of CPNPP Units 3 and 4. The step test was performed to determine the pumping rate for the 72-hr pumping test. Data for the step test and 72-hr pumping test were analyzed using the Cooper-Jacob Step Test and Theis Recovery Test methods. The results of the 72-hr pump test estimated hydraulic conductivity at 1.70×10^{-3} cm/s during pumping and 3.5×10^{-3} cm/s during recovery.

Based on the grain size distribution of the on-site soils (Fugro 2007a), the total porosity was determined by averaging the porosity range for sand, silt, and clay. The average total porosity of the on-site regolith/undifferentiated fill (soils) is assumed to be 0.45. To estimate the effective porosity of the on-site soils, the arithmetic mean of the effective porosities for fine grained sand, silt, and clay were averaged (ANL 1993). The average effective porosity of the on-site regolith/undifferentiated fill (Scenarios 1 and 2) is assumed to be 0.20. To calculate the travel time in the regolith/undifferentiated fill material from each of the units to SCR, the highest measured hydraulic conductivity of 5.00 X 10^{-4} cm/s was used.

The bedrock is comprised of limestone from the Glen Rose Formation. The shallow bedrock porosity values from geotechnical borings B-1007 and B-1029 were used to estimate the porosity in the vicinity of the Unit 3 Auxiliary Building A/B and groundwater monitoring well MW-1215b. The porosity values from geotechnical borings B-2000, B-2008, and B-2029 were used to estimate the porosity values in the vicinity of the Unit 4 A/B and groundwater monitoring well MW-1217b.

The results of the geotechnical analysis performed at the CPNPP Units 3 and 4 site indicated that an average porosity of the shallow bedrock (limestone and shale) is 25.6 percent and the average total porosity of limestone is 11.9 percent. The Argonne National Laboratory publication, “Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil,” dated April 1993 (ANL 1993) references an arithmetic mean of the effective porosity for limestone of 14 percent. Consequently, the most conservative approach when determining velocity and travel time is to use the measured 11.9 percent porosity value which provides a higher calculated velocity through the shallow bedrock.

Groundwater pathways are considered from the Units 3 and 4 Auxiliary Buildings, where the Boric Acid Tank (BAT) is located, to SCR, which is the nearest potential receptor. Postulated groundwater pathway scenarios include, Unit 3 A/B to SCR through the regolith and the undifferentiated fill; Unit 3 A/B to SCR through the Glen Rose Limestone; Unit 4 A/B to SCR through the undifferentiated fill and regolith; and Unit 4 A/B to SCR through the Glen Rose Limestone. Due to the planned removal of all overburden material down to the plant grade elevation of 822-ft, and the sub-grade elevation of the BAT of 793 ft, the pathway scenarios through the undifferentiated fill and regolith are considered not plausible and are not discussed further. For the post construction groundwater pathways the two remaining pathway scenarios, Unit 3 A/B to SCR through the Glen Rose Limestone and Unit 4 A/B to SCR through the Glen Rose Limestone, are considered to represent the most conservative pathways from a two reactor site where groundwater flow is possible in different directions from each unit. Using the most conservative straight line approach, two flow paths are considered from Unit 3 A/B to SCR and two flow paths are considered from Unit 4 A/B to SCR. These flow paths consider the most plausible straight line groundwater flow direction from the release points to SCR and the highest measured Hydraulic Conductivity (Kh). A straight line flow path would be considered the most conservative as the actual groundwater pathways are expected to be tortuous, resulting in longer transport times, and Kh of the fractures/joints would be (or are) expected to be lower than the highest measured on-site.

To estimate groundwater travel time through the Glen Rose Formation, the average porosity of limestone of 0.119, the highest Kh measured at the site (1.37 X 10-5 cm/s), and the steepest hydraulic gradient measured from the monthly gauging events of the nearest groundwater monitoring wells to the Unit 3 and 4 Reactor Buildings (Table 2.3-30) were used for the pathway analysis (FSAR Figure 2.4.12-212).

For groundwater pathway 3a, it is assumed that an instantaneous release from the BAT would travel out of the Unit 3 A/B northeast towards SCR where it would encounter a minimum of 100 lateral feet of Glen Rose Formation followed by the fill material of the Unit 3 Ultimate Heat Sink (UHS) and then by post construction engineered fill material before reaching SCR. Since the physical properties of the engineered fill material may change as the design is finalized and the potential exists for groundwater flow through the fill material of the Unit 3 UHS, it is conservatively estimated that an instantaneous release to SCR will occur once the Unit 3 UHS is encountered. The travel time from the Unit 3 A/B through a minimum of 100 feet of Glen Rose Formation to the Unit 3 UHS is 3146 days. Therefore, a very conservative estimate of the time it would take a release to travel from the Unit 3 A/B to SCR along pathway 3a is more than 3146 days.

For groundwater pathway 3b, it is assumed that an instantaneous release from the BAT would travel out of the Unit 3 A/B through the fill material of the Unit 3 Reactor Building (R/B) due east towards SCR where it would encounter a minimum of 80 lateral feet of Glen Rose Formation followed by the fill material of the Unit 3 Essential Service Water (ESW) Pipe Tunnel and an undetermined lateral distance of Glen Rose Formation followed by post construction engineered fill and undifferentiated fill material before reaching SCR. Since the physical properties of the engineered fill material may change as the design is finalized and the physical properties of the undifferentiated fill material are estimated, and the potential exists for groundwater flow through the fill material of the Unit 3 ESW Pipe Tunnel, it is conservatively estimated that an instantaneous release to SCR will occur once the ESW Pipe Tunnel is encountered. The travel time from the Unit 3 A/B and R/B through a minimum of 80 feet of Glen Rose Formation to the Unit 3 ESW Pipe Tunnel is 2516 days. Therefore, a very conservative estimate of the time it would take a release to travel from the Unit 3 A/B to SCR along pathway 3b is more than 2516 days.

For groundwater pathway 4a, it is assumed that an instantaneous release from the BAT would travel out of the Unit 4 A/B north-northwest towards SCR where it would encounter a minimum of 60 lateral feet of Glen Rose Formation followed by the fill material of the Unit 4 UHS and then by post construction engineered fill material before reaching SCR. Since the physical properties of the engineered fill material may change as the design is finalized and the potential exists for groundwater flow through the fill material of the Unit 4 UHS, it is conservatively estimated that an instantaneous release to SCR will occur once the Unit 4 UHS is encountered. The travel time from the Unit 4 A/B through a minimum of 60 feet of Glen Rose Formation to the Unit 4 UHS is 1916 days. Therefore, a very conservative estimate of the time it would take a release to travel from the Unit 4 A/B to SCR along pathway 4a is more than 1916 days.

For groundwater pathway 4b, it is assumed that an instantaneous release from the BAT would travel out of the Unit 4 A/B northeast towards SCR where it would encounter a minimum of 120 lateral feet of Glen Rose Formation followed by the fill material of the Unit 4 UHS and undocumented fill and engineered fill before reaching SCR. Since the physical properties of the undocumented fill are estimated and the physical properties of the engineered fill material may change as the design is finalized, and the potential exists for groundwater flow through the fill material of the Unit 4 UHS and through the undocumented fill, it is conservatively estimated that an instantaneous release to SCR will occur once the Unit 4 UHS is encountered. The travel time from the Unit 4 A/B through a minimum of 100 feet of Glen Rose Formation to the Unit 4 UHS is 3834 days. Therefore, a very conservative estimate of the time it would take a release to travel from the Unit 4 A/B to SCR along pathway 4b is more than 3834 days.

Table 2.3-31 provides the calculated travel times based on monthly measured gradients. The locations of Units 3 and 4 and groundwater monitoring wells MW-1215a, MW-1215b, MW-1217a, and MW-1217b are shown on Figure 2.3-26. Additional information on groundwater flow characteristics are provided in CPNPP Units 3 and 4 FSAR Subsection 2.4.12.

2.3.1.5.7 Surface Soil Profiles

The site is underlain by a sedimentary rock sequence which, at the surface, has been weathered to a clayey, silty, sandy overburden soil with some rock fragments. No alluvium sediments were encountered during the 2006 and 2007 geotechnical drilling program in the vicinity of the CPNPP Units 3 and 4 build area, although they may exist in other portions of the site. Drilling and excavation experience at the site shows that the residual soil transition through weathered rock to hard, unweathered bedrock can be gradual in the natural shallow subsurface profile in some places, or can consist of soil in direct contact with hard bedrock in other places. Most of the CPNPP site is situated in areas disturbed by previous construction activities associated with the construction of the existing CPNPP Units 1 and 2 structures. Those areas are covered with undifferentiated and engineered fill, gravel roadways and parking areas, and concrete building foundation pads.

The soils occurring on the CPNPP site are described in the Hood and Somervell counties soil survey information provided by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service's on-line Soil Data Mart website (USDA 2007). A total of 18 soil mapping phases representing 17 soil series occur within the CPPNP site boundary. Descriptions of each soil series are provided in Table 2.3-32, and the location of the soil mapping phases are shown on Figure 2.3-28.

The two soil types mapped in the vicinity of the CPNPP Units 3 and 4 build areas include the Tarrant – Bolar association and Tarrant – Purves association. Physical properties for these soil types indicate clay content ranges of 20 to 60 percent, moist bulk densities of 1.10 to 1.55 g/cc, saturated hydraulic conductivities between 4.2 x 10^{-5} cm/sec and 1.4 x 10^{-3} cm/sec, and available water capacities of 0.05 to 0.18 In/In (USDA 2007a).

Hydraulic conductivities calculated during the 2006 to 2007 groundwater investigation ranged from 2.93 x 10^{-5} cm/sec in regolith soils to 3.5 x 10^{-3} cm/sec in undifferentiated fill material. Recharge rates, soil moisture characteristics, and moisture content in the vadose zone are discussed in CPNPP Units 3 and 4 FSAR 2.4.12.

2.3.2 WATER USE

This section describes surface water and groundwater in the vicinity of the CPNPP site that could affect or be affected by the construction and operation of CPNPP Units 3 and 4. Information provided in this section includes descriptions of the types of consumptive and non-consumptive water uses, identification of their locations, and qualification of water withdrawals and returns. A detailed assessment of local area facility water use is discussed in this section.

2.3.2.1 Surface Water

CPNPP Units 3 and 4 are located in rural Somervell and Hood counties in north central Texas. The site is situated on the western end of a peninsula formed by land between the southern shore of SCR and the CPNPP Units 1 and 2 SSI. The cooling water source for CPNPP Units 3 and 4 is Lake Granbury, an impoundment of the Brazos River, located approximately 7 mi northeast of the CPNPP site.

These surface water features are briefly discussed below. A more detailed discussion of these water bodies is presented in Subsection 2.3.1 of this report, and Water Quality information related to this report is presented in Subsection 2.3.3.

2.3.2.1.1 Surface Water Features

The Brazos River Basin has the largest drainage area of all basins between the Rio Grande and the Red River in Texas (TCEQ 2002). Total basin drainage area is approximately 45,700 sq mi, of which approximately 43,000 sq mi are in Texas with the remainder being in New Mexico. The USGS divides the Brazos River Basin into three subregions: the Brazos Headwaters, Middle Brazos, and Lower Brazos basins (Figure 2.3-2). The CPNPP site and Lake Granbury are located in the Middle Brazos subregion.

The Middle Brazos Basin encompasses approximately 15,500 sq mi and includes the Brazos River Basin below the confluence of the Double Mountain Fork Brazos River and the Salt Fork Brazos River Basins (Figure 2.3-2).

Within the Middle Brazos subregion, the CPNPP site is located in the Middle Brazos-Palo Pinto Watershed that incorporates portions of Archer, Young, Jack, Stephens, Palo Pinto, Parker, Eastland, Erath, Hood, Somervell, and Johnson counties. The Middle Brazos-Palo Pinto Watershed has a drainage area of approximately 3160 sq mi that represents approximately 20 percent of the Middle Brazos subregion (1206) or about 7 percent of the entire Brazos River Basin.

The Lake Granbury cooling water intake and discharge structures for CPNPP Units 3 and 4 are located in the Middle Brazos-Lake Whitney Watershed that incorporates portions of Erath, Hood, Somervell, Johnson, Hill, Bosque, McLennan, Falls, and Limestone counties. The Middle Brazos Lake Whitney Watershed has a drainage area of approximately 2500 sq mi that represents approximately 16 percent of the Middle Brazos subregion (1206) or about 5 percent of the entire Brazos River Basin (USGS 2007).

For this ER, the most significant portion of the Brazos River drainage basin is that between Possum Kingdom Lake and Lake Whitney, and includes the CPNPP site and Lake Granbury (Figure 2.3-21). Under TWDB authority, Texas is divided into 16 regional water planning areas, each of which is responsible for developing a regional water plan (Brazos G 2006). Water planning activities between Possum Kingdom Lake and Lake Whitney are under the authority of the TWDB that has designated the area as Region G, a 37-county planning area that extends generally along the Brazos River from Kent, Stonewall, and Knox counties in the Northwest to Washington and Lee counties in the Southeast (Figure 2.3-29). Current water use information and future water use estimates discussed in this section were obtained from current TWDB database information as well as the 2006 Brazos G Regional Water Plan.

Principal streams that enter the 145-mi segment of the Brazos River between the Morris-Sheppard Dam at Possum Kingdom Lake and DeCordova Bend Dam at Lake Granbury include Palo Pinto and Rock creeks. Along this segment, the Brazos River has a slope of 0.04 percent, and a gradient of 2.117 ft/mi. The additional drainage basin area between the two dams is about 2140 sq mi, all of which contribute to flow in the Brazos River (CPSES 1974).

There are six intermittent streams that flow into Lake Granbury within a 6-mi radius of the CPNPP Units 3 and 4 intake and discharge structures upstream of the DeCordova Bend Dam (Figure 2.3-5). These streams include Lusk Branch, Walnut Creek, Contrary Creek, Rough Creek, Lambert Branch, and Rucker Creek.

There are six intermittent streams that flow into the SCR within a 6-mi radius of CPNPP Units 3 and 4 upstream of the Squaw Creek Dam (Figure 2.3-5). These streams include Squaw Creek, Panter Branch, Lollar Branch, Panther Branch, Million Branch, and an unnamed stream branch.

One unnamed intermittent stream channel was identified within the cooling tower BDTF area located on the southern portion of the CPNPP site. The headwaters of this stream consist of broad grass-covered swale areas, and stream channels become defined downstream near the confluence with Squaw Creek (Figure 2.3-5). The stream channel is approximately 1.25 mi in length, and elevations range from approximately 820 ft msl at the headwaters to 650 ft msl at the Squaw Creek confluence.

As shown on Figure 2.3-21, there are seven large manmade impoundments located within 150 stream-mi of the DeCordova Bend Dam on Lake Granbury that could affect or be affected by plant operations. These impoundments include Possum Kingdom Lake, Lake Palo Pinto, Lake Mineral Wells, Lake Granbury, which is the primary cooling water source for CPNPP Units 3 and 4, the on-channel reservoir located approximately 7 mi northeast of the CPNPP site, SCR, the off-channel reservoir located adjacent north and east of CPNPP Units 3 and 4, Wheeler Branch Reservoir, and Lake Whitney (Subsection 2.3.1.3). Due to their off-channel location, additional large manmade impoundments depicted on Figure 2.3-21 were not included in this discussion.

2.3.2.2 Basin Wide Water Use

Each year, the TWDB conducts an annual survey of ground and surface water use by municipal and industrial entities within Texas for water resource planning purposes (TWDB 2007a). Water use estimates are subject to revision as additional data and corrections are made available to the TWDB and as a result, the water use estimates are initially posted by the TWDB as “draft.” The

TWDB may consider the posted water use estimates "draft" for a period of 3 to 4 years. The most recent water use estimates posted by the TWDB are for year 2006 and are posted as "draft." The 2006 water use estimates (TWDB 2009) will most likely remain as "draft" until September 2009 when the TWDB expects to post the "draft" 2007 water use estimates. The TWDB consumptive water use estimates for municipal, manufacturing, and steam-electric power categories come from an annual survey of public water suppliers and major manufacturing and power entities. Response to this survey is mandatory, according to Section 16.012(m) of the Texas Water Code, as amended by the 78th Texas Legislature in spring 2003.

The TWDB separates water use into these categories.

- Municipal water use: city-owned, districts, water supply corporations, or private utilities supplying residential, commercial, and institutional water.
- Manufacturing water use: industrial process water used by large manufacturing plants.
- Steam-electric power water use: consumptive use of water used by large power generation plants that sell power on the open market, generally not co-generation plants that generate power for manufacturing or mining processes. Water that is diverted and not consumed, i.e., return flow, is not included in the power-generation total.
- Mining water use: fuel (oil or gas) and non-fuel mining operations. Mining water-use estimates are based on the annual water-use survey and an estimate of the water used in secondary recovery processes for oil and gas recovery.
- Livestock water use based on population data from Texas A & M University. Livestock water-use estimates are derived from annual livestock population estimates produced by the Texas Agricultural Statistics Service.
- Irrigated Agriculture water use from Potential Evapotranspiration (PET) calculations. Irrigated agriculture water-use estimates are based on annual crop acreage amounts from the Natural Resources Conservation Service, prior to 2001, and the Farm Service Administration, 2001 and later.

Non-consumptive water uses, such as navigation, hydroelectric generation, environmental flows, and recreation, are not reported by the TWDB. The water use reported by the TWDB annual survey covers consumptive withdrawals only and does not include net use by category or water return information. Additionally, the TWDB reports water use by category on an annual basis and monthly use rates are not provided in the data.

The TWDB estimates total water use within the Brazos River Basin in 2004 was 3,544,885 ac-ft (TWDB 2007a). Approximately 75 percent of this annual use was for irrigation, 11 percent for municipal use, 6 percent for steam electric use, 5 percent for manufacturing use, 2 percent for livestock use, and 1 percent for mining use. Table 2.3-33 provides 2004 water use estimates by category for the Brazos River Basin.

The portion of the Brazos River drainage basin between Possum Kingdom Lake and Lake Whitney encompasses portions of Palo Pinto, Parker, Hood, Somervell, Bosque, and Hill counties. Surface water use estimates for users with allocated water rights of 500 ac-ft or more in these counties were obtained from the TCEQ. The 2006 monthly withdrawal data for users in this area are provided in Table 2.3-34, and the locations of major water rights in the Brazos River Basin are shown on Figure 2.3-29.

In Palo Pinto County in 2006, the BRA reported diversions from the Brazos River, Possum Kingdom Lake area, of 160,311 ac-ft for municipal, hydroelectric, mining, irrigation, industrial, and other uses. Also in Palo Pinto County, the Palo Pinto Municipal Water District reported a diversion from Palo Pinto Creek, Lake Palo Pinto area, of 4800 ac-ft for municipal use, and the Rocking W Ranch reported a diversion of 647 ac-ft from the Brazos River for irrigation use.

In Parker County, the City of Mineral Wells reported a diversion of 54 ac-ft from Rock Creek, Lake Mineral Wells area, for municipal use. No diversion amount was reported in 2006 by TXI Operations for industrial and irrigation use.

In Hood County, the BRA reported diversions of 56,815 ac-ft from the Brazos River, Lake Granbury area, for municipal, industrial, irrigation, and mining uses.

In Somervell County, a diversion of 3,367,805 ac-ft was reported from SCR, Panther Branch, and Lake Granbury. This total includes diversion from Lake Granbury as well as circulation water estimates through the once through cooling system at the CPNPP steam electric station. In 2006, no diversion amount from the Paluxy River was reported by the Somervell County Water District for municipal use.

In Bosque County in 2006, Chisholm Trails Adventures reported a diversion of 3621 ac-ft from the Brazos River, downstream of Lake Granbury, for irrigation use. The cities of Meridian and Clifton were identified as having significant water rights in Bosque County; however, diversions for these municipalities are on the North Bosque River and cannot affect or be impacted by CPNPP operations.

In Hill County, the BRA reported diversions of 7302 ac-ft from the Brazos River, Lake Whitney area, for municipal and industrial uses.

2.3.2.2.1 Local Water Use

The TWDB has published the draft 2006 annual water use estimates (TWDB 2009). The 2006 draft estimates contain the most recent water use values by county and category, but does not break-down the estimates by groundwater and surface water use. For Hood County, the 2006 draft estimated water use is listed as 16,100 acre-feet. For Somervell County, the 2006 total draft estimated water use is listed as 48,931 acre-feet. Annual water use estimates for year 2004 by use category for Hood and Somervell counties were also obtained from the TWDB (TWDB 2007a). The 2004 data estimate total water use in Hood County at 11,857 ac-ft, of which 62 percent was reported as surface water use and 38 percent groundwater use. Somervell County estimated water use was reported at 46,611 ac-ft in 2004, of which 96 percent was reported as surface water use and 4 percent groundwater use. Total water use for Hood and Somervell counties represents 1.65 percent of the total reported water use in the Brazos River Basin.

Surface water withdrawals for Hood County were estimated at 7306 ac-ft in 2004 (TWDB 2007a). Approximately 76 percent of this use was for irrigation use, 15 percent for municipal use, 5 percent for steam electric use, and 4 percent for livestock use. Surface water withdrawals for Somervell County were estimated at 44,693 ac-ft in 2004. Approximately 99 percent of this withdrawal was for steam electric use with less than 1 percent for irrigation, mining and livestock uses. Table 2.3-35 provides annual water use estimates by use category for Hood and Somervell counties.

2.3.2.2.2 Recreational and Navigational Use

Non-consumptive use is water that is diverted and then returned to the river basin with minimal change in volume and temperature, or is used but never leaves the river system. The majority of non-consumptive water use in the CPNPP site vicinity is associated with recreational use and the return flow from power generation (Brazos G 2006). Water-related recreational activities include boating, camping, fishing, and swimming. Recreational use in the vicinity is supported by numerous state parks and by public facilities for boating and camping at various lakes and reservoirs. Navigation is another form of non-consumptive use. Other than small watercraft used primarily for recreation, Lake Granbury and the Brazos River in the vicinity of Lake Granbury are not used for navigational purposes. Lake Granbury has five public access areas for picnicking and fishing, four of which have primitive camping sites. A boating capacity study was performed on Lake Granbury in 2005 (BRA 2006a). The survey identified 6000 private boat slips and boat ramp access at 12 launch ramps. The survey indicated that the majority of Lake Granbury boaters appear to spend most of their time on the lake waterskiing (26.7 percent), cruising (21.8 percent), fishing (21.6 percent), on personal watercraft (10.1 percent), or swimming (9.9 percent).

SCR, owned by Luminant, is used as a cooling water reservoir for CPNPP Units 1 and 2. The reservoir is closed to the public and is not used for recreation or navigation.

2.3.2.2.3 Lake Granbury Surface Water Withdrawal

Surface water withdrawal data for Lake Granbury was obtained from the BRA. The BRA data indicate that approximately 59,816 ac-ft of water was withdrawn from Lake Granbury in 2006. It should be noted that the location of use for the majority of this water was Somervell County as diversion water from Hood County (Lake Granbury). Approximately 83 percent of this use was for industrial use including steam electric use, 11 percent for municipal use, 6 percent for irrigation use, and less than one percent for mining use. The BRA records did not provide water return volumes. Table 2.3-36 provides monthly surface water use estimates by use category for Lake Granbury.

2.3.2.2.4 Plant Surface Water Use

A constant pool elevation of 775 ft msl is maintained at SCR by diverting water from Lake Granbury, the makeup water source to SCR for CPNPP Units 1 and 2 operation. Surface water use records submitted to the TCEQ for Units 1 and 2 facilities indicate 46,746.5 ac-ft of water was diverted from Lake Granbury in 2006 (TCEQ 2006).Consumptive water use (forced evaporation) in 2006 for Units 1 and 2 was reported at 19,905.2 ac-ft, and return flow through the SCR dam spillway to Squaw Creek was reported at 21,161.1 ac-ft (TCEQ 2006). The 2006 values indicate that more water was diverted from Lake Granbury than was lost through forced evaporation and spillage flow through the SCR dam spillway. The apparent gain or in some instances loss of water volume in SCR is variable from year to year because environmental inflows and natural evaporation are not considered in the forced evaporation value which is calculated using the generation output of CPNPP Units 1 and 2. Monthly 2006 surface water use data for CPNPP Units 1 and 2 are provided in Table 2.3-37.

Luminant selected the MHI US-APWR plant design for CPNPP Units 3 and 4. The location designated for CPNPP Units 3 and 4 is northwest of the existing reactor containment structures for CPNPP Units 1 and 2 (Figure 1.1-3). The US-APWR is rated at 4451 MWt with an optimum output of 1700 MWe (average summer time output is expected to be 1625 MWe). Four banks of mechanical draft wet cooling towers are planned to be utilized for the service water cooling system with makeup water coming from the Brazos River, Lake Granbury. The grade elevation for both units is set at 822.0 ft msl. A permanent stormwater drainage system replaces the construction stormwater drainage system at the completion of construction.

Plant water consumption and water treatment for CPNPP Units 3 and 4 are determined based on plant characteristics and engineering evaluations in the design control document (DCD). An existing water supply pipeline between Lake Granbury and SCR supplies water to SCR, the makeup water source to SCR for CPNPP Units 1 and 2 operation. A return water pipeline from SCR to Lake Granbury also exists, but has reportedly never been used. Because Lake Granbury is the water source for CPNPP Units 3 and 4, additional pipelines and new intake and discharge structures are planned in the vicinity of the existing SCR makeup water intake and discharge structures (Figure 2.3-20).

The estimated water withdrawal for the operation of CPNPP Units 3 and 4 from Lake Granbury is 65,400 gpm (94,176,000 gpd) during maximum operations (Table 2.3-38). The water discharge rate to Lake Granbury during maximum operations, including loss estimates from the conceptual cooling tower BDTF of 1,200 gpm (1,728,000 gpd), is estimated at 23,700 gpm (34,128,000 gpd) (Table 2.3-39). Consumptive water use for Units 3 and 4 is estimated at 60,048,000 gpd (184 ac-ft/day). At this rate, the expected time to drawdown Lake Granbury from a normal pool elevation of 693.0 ft msl to the minimum operating elevation of 675.0 ft msl is approximately 508 days (Table 2.3-38). This estimate is based on current Lake Granbury elevation-volume data and the CPNPP Units 3 and 4 daily consumptive water use estimate. This estimate does not account for inflow, outflow, evaporation, or other water users that may draw upon Lake Granbury. Figure 3.3-1 presents a water use diagram showing flow rates to and from the various water systems. Points of consumption, and sources and discharge locations are included as part of the discussion in this section. Section 3.3 provides a narrative on the water use diagram, including maximum water consumption, water consumption during periods of minimum water availability, and average operation by month and by plant operating status. A description of the BDTF is provided Subsection 3.6.1.1. Additional information related to the CPNPP Units 3 and 4 water withdrawal and return, including withdrawal and return rates for each diversion by use is presented in Section 3.4.

2.3.2.3 Groundwater

Portions of six major and nine minor aquifers extend into the Brazos Region G Area (Brazos G 2006). The CPNPP site and Lake Granbury are located on outcrops of the Trinity Group aquifer, which occurs mostly in Callahan, Eastland, Erath, Hood, Somervell, Comanche, Hamilton, Coryell, and Lampasas counties. The confined aquifer area is mostly in Johnson, Hill, Bosque, McLennan, Coryell, Bell, and Williamson counties (Figure 2.3-25).

The Trinity Group aquifer, a major aquifer that occurs in a north-south-trending band that extends from Williamson County to the south to Hood and Johnson counties to the north, in the Brazos Region G Area. The aquifer supplies drinking water to numerous communities, homes, and farms in Central Texas, and irrigation water to many farms, especially in Comanche and Erath counties. The aquifer is composed of the Paluxy, Glen Rose, and Travis Peak Formations. In the vicinity of the CPNPP site, and north, the Travis Peak Formation is known as the Twin Mountains Formation. South of the CPNPP site, the formation retains the Travis Peak name. Up dip where the Glen Rose thins or is missing, the Paluxy and Travis Peak Formations coalesce to form the Antlers Formation. The uppermost water-bearing zone is the Paluxy Formation. The lower water-bearing zone consists of the Travis Peak Formation and is divided into the Hensell and Hosston Members in much of the eastern part of Brazos Region G Area (Brazos G 2006).

A sole source aquifer is an aquifer designated by EPA as the "sole or principal source" of drinking water for a given service area; that is, an aquifer that is needed to supply 50 percent or more of the drinking water for that area and for which there are no reasonably available alternative sources should the aquifer become contaminated (EPA 2007). Based upon review of EPA information, the Trinity aquifer has not been designated as a sole source aquifer. Additionally, there are no sole source aquifers in the vicinity of the CPNPP site.

Groundwater withdrawal from the Trinity aquifer in 2003 is estimated at 172,098 ac-ft, of which approximately 64 percent was reported as municipal use, 20 percent irrigation use, 10 percent livestock use, 3 percent mining use, 3 percent manufacturing use, and less than one percent steam electric use (TWDB 2007a). The primary groundwater source for Hood and Somervell counties is the Trinity aquifer in which a majority is obtained from the Twin Mountains Formation. Groundwater well information obtained from the TWDB indicates a total of 394 wells in the 2-county area (TWDB 2007c). Of the 394 wells listed, 43 are listed as unused, and no use is given for nine of the wells. Information regarding these wells is provided in Table 2.3-28. The well locations, use category, and recharge area are shown on Figure 2.3-25. A review of the well database indicates that of the 342 wells with identified uses, 52 percent are for public supply use, 27 percent are for domestic use, 8 percent are for industrial use, 7 percent are for stock use, and 6 percent are for irrigation use.

2.3.2.3.1 Local Groundwater Use

Groundwater use information for Hood and Somervell counties was obtained from the TWDB historical water use database (TWDB 2008a). The 2003 data set provides the most recent complete data for groundwater withdrawal from the Trinity Aquifer.

The estimated 2003 groundwater withdrawal in Hood County is 5729 ac-ft, which is approximately 3.33 percent of the total withdrawals from the Trinity aquifer. Approximately 91 percent of this withdrawal was reported as municipal use, 5 percent livestock use, 3 percent mining use, and less than 1 percent steam electric use.

The estimated 2003 groundwater withdrawal in Somervell County is 1726 ac-ft, which is approximately 1 percent of the total withdrawals from the Trinity aquifer. Approximately 55 percent of this withdrawal was reported as municipal use, 41 percent mining use, 2 percent steam electric use, 2 percent livestock use, and less than 1 percent manufacturing use. Table 2.3-40 shows 2003 groundwater withdrawals by use category for Hood and Somervell counties.

2.3.2.3.2 Plant Groundwater Use

Twelve existing water wells were identified on the CPNPP site. The wells include seven active potable water wells that support CPNPP Units 1 and 2 operations, one inactive potable water well associated with Squaw Creek Park, and four observation wells. Information regarding these wells is provided in Table 2.3-41, and the well locations are shown on Figure 2.3-25. On-site groundwater withdrawal information for 2006 was obtained from an annual report provided by Luminant (TCEQ 2006). The report indicates on-site withdrawals of 27.90 ac-ft (9,092,700 gal) from five active wells in 2006 which is a use rate of 24,911.5 gpd or approximately 17.3 gpm. Monthly use data for 2006 are provided in Table 2.3-42. Luminant is not anticipating using groundwater as an operational or safety-related source of water for CPNPP Units 3 and 4, and has implemented a conservation plan for future groundwater withdrawals at the CPNPP site. During construction of CPNPP Units 3 and 4, and during operation of CPNPP Units 1 through 4, potable water is planned to be supplied by the Somervell County Water District's water supply system. Water for temporary fire protection, concrete batching, and other construction uses is expected to be supplied by the Somervell County Water District. Groundwater conservation at CPNPP has voluntarily been an environmental commitment with the TCEQ, Clean Texas Program, since 2003 and with the EPA Performance Track Program since 2005. CPNPP has reduced groundwater use from approximately 50 gpm in mid-1990s to approximately 16 gpm during 2007.

2.3.2.4 Future Water Use

Future consumptive water use information was obtained from the 2006 Brazos Region G Water Plan, which forecasts water demands by category for the years 2010 – 2060 (Brazos G 2006). The water demand estimates compiled for each type of water use do not specify future ground or surface water demand. Estimated demand surpluses or shortages are based on projected surface and groundwater supplies. Additionally, projections for non-consumptive water uses, such as navigation, hydroelectric generation, environmental flows, and recreation are not presented. As shown in Table 2.3-43, total water use for the region is projected to increase from 835,691 ac-ft in 2010 to 1,150,973 ac-ft in 2060, a 38 percent increase. The projections indicate that municipal, manufacturing, and steam-electric water use as percentages of the total water use increase from 2000 to 2060, while mining, irrigation, and livestock water use are projected to decrease or remain constant as percentages of the total.

As shown on Table 2.3-44, water demands in Hood and Somervell counties are projected to increase from 44,939 ac-ft in 2010 to 62,600 ac-ft in 2060, a 39 percent increase (Brazos G 2006). It should be noted that the Somervell County steam-electric water user group demands identified in the 2006 Brazos Region G Water Plan do no account for CPNPP Units 3 and 4 water demands, subsequently the additional demands for CPNPP Units 3 and 4 are not included in the regional water demand projections provided in Table 2.3-43 nor the county water demands provided in Table 2.3-44. The revised projected regional and county water demands are to be included in the 2011 Brazos G Water Plan.

The 2006 Brazos Region G Water Plan identifies ten water user groups within Hood County and seven water user groups within Somervell County (Brazos G 2006). Table 2.3-45 identifies each water user group and their corresponding water surplus or shortage in the years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed to mitigate the shortage. Projected shortages for the Somervell County steam-electric water user group were identified for the years 2030 and 2060 in a July 2008 amendment to the 2006 Brazos Region G Water Plan. The Somervell County steam-electric water user group obtains its water supply from SCR and from the BRA from Lake Granbury. The July 2008 amendment, which has been approved by the Brazos Region G Board and is awaiting approval by the TWDB, identifies the purchase of surface water from the BRA as a planning strategy to overcome the identified shortages and provide adequate net diversions to CPNPP Units 3 and 4. The additional supply is expected to be available upon the approval of the BRA System Operations Permit (SOP) which is currently being considered by the TCEQ. Extensive third party water availability modeling has been performed for the Brazos River drainage basin and the modeling supports the availability of sufficient unallocated water for CPNPP Units 3 and 4, without impacting other users.

Average annual surface water withdrawal (diversion) from Lake Granbury to SCR for CPNPP Units 1 and 2 operations is estimated at 34,128 ac-ft/yr from 1994 to 2006. Average forced evaporation from Units 1 and 2 operations is 17,391 ac-ft/yr, and average reservoir discharge flow through Squaw Creek Dam is 21,678 ac-ft/yr for the same time period (TCEQ 2006). Considering the average gain from Lake Granbury with the average losses from forced evaporation and releases to Squaw Creek, an average loss of 4,941 ac-ft/yr from SCR is realized. As discussed in Subsection 2.3.2.2.4, water use records for 2006 indicate that more water was diverted from Lake Granbury than was lost through forced evaporation and spillage through the SCR dam spillway. This hypothetical water loss or gain is driven by the variability of environmental in-flows and natural evaporation which are not accounted for in the water use reports submitted to the TCEQ. An existing agreement between Luminant and the BRA provides 48,300 ac-ft/yr of make-up water from Lake Granbury to SCR for Units 1 and 2 operation. Consequently, adequate water is available to compensate for possible net losses and adverse environmental variability.

Projected maximum water use estimates are outlined in the previously mentioned amendment to the 2006 Region G Water Plan. These water use estimates include a maximum annual water withdrawal from Lake Granbury of 103,717 ac-ft/yr for the operation of CPNPP Units 3 and 4 with a maximum return flow of 42,100 ac-ft/yr. Net consumptive water use for the operation of Units 3 and 4 is estimated to be 61,617 ac-ft/yr; however, an in-line water treatment system for CPNPP Units 3 and 4 cooling tower blowdown is in the design phase and may decrease the annual discharge into Lake Granbury. Figure 2.3-30 provides a simplified water use diagram for CPNPP Units 1 and 2 and Units 3 and 4 showing all inputs and outputs of the system.

An existing agreement between Luminant and the BRA identifies 27,447 ac-ft/yr of water from Possum Kingdom Lake currently under contract to Luminant. This water is expected to be reallocated to CPNPP for normal use by CPNPP Units 3 and 4, while the remaining 76,270 ac-ft/yr needed for CPNPP Units 3 and 4 is being negotiated. Any new contract with the BRA is expected to provide for minimum flow conditions so that downstream water users should not be impacted as discussed in Section 5.2. The firm yield of Lake Granbury has been evaluated as at least 64,712 ac-ft/yr, exclusive of the additional yield which could be made available by releases from Possum Kingdom Lake (Brazos G 2006). Yield analysis for Possum Kingdom Lake indicates a firm yield of 230,750 ac-ft in 2000 and 2060 (Brazos G 2006). Reservoir yields are discussed further in Subsection 2.3.1.3.

Regional water demands for the development of the Barnett Shale, one of the largest and most active natural gas fields in the United States, are not addressed or included in regional water plans (TCEQ 2007b). Water use for the development of natural gas wells in the Barnett Shale is relatively new. A recent assessment performed by the TWDB (TWDB 2007d) estimates that, out of the total water used in 2005 for Barnett Shale development, approximately 60 percent was groundwater from the Trinity and Woodbine aquifers. The report further estimates that groundwater used for Barnett Shale development accounted for approximately 3 percent of groundwater withdrawn for consumption use in the entire study area in 2005. The TWDB report makes predictions of future water needs for all purposes, including Barnett Shale development. The low estimate for Barnett Shale development predicts a decrease of about 2,000 ac-ft by the year 2025 and the high estimate predicts an increase from an estimated 7,200 ac-ft in 2005 to about 10,000 – 25,000 ac-ft/yr by 2025, which corresponds to an estimated potential increase in groundwater used from 3 percent in 2005 to 7 – 13 percent in 2025. As with the development of any estimate of future conditions, the TWDB and its contractors used educated assumptions to develop reasonable low and high estimates in light of the unpredictability of the natural gas market, which would drive future drilling activity in the area. The TWDB’s Groundwater Availability Model (GAM) utilized to support the findings of the report, simulates both the low and high demand scenarios. the high demand scenario projections indicate an average pressure decline ranging from less than 10 feet in the westernmost areas, to up to 150 feet in all Trinity aquifer zones. The majority of the simulated reduction in aquifer water levels can be attributed to increased municipal and rural domestic use and to increased mining use for Barnett Shale frac operations. Historically, the Trinity and Woodbine aquifers have supported widespread groundwater production for over a century. As use has increased, aquifer water levels declined in direct response to the pumpage. Locally, greater uncertainty exists as to whether all supplies can be practically obtained. The report indicates that this is likely a case-by-case situation, which depends upon site-specific aquifer conditions, alternative source availability, and cost. If increased use occurs, some areas will require a greater number of smaller capacity wells to obtain the supplies, and existing wells may need to be lowered or be drilled to deeper depths to accommodate reduced aquifer water levels. The report concludes that as population increases, the Trinity/Woodbine aquifers will not provide a sole-source supply for all users. Similarly, if population increases in areas now solely served by Trinity/Woodbine supplies, then development of supplemental water supply sources and regional distribution systems will likely become a necessity (TWDB 2007d).

2.3.2.5 Legal Restrictions

In Texas, surface water is owned and managed by the state. Surface water is currently allocated by the TCEQ for the use and benefit of all people of the state. Therefore, all surface waters users must obtain a water rights permit from the TCEQ. Individuals or groups seeking a water right must submit an application to the TCEQ. The TCEQ determines if the water right is issued and under what conditions. The water rights grant a certain quantity of water to be diverted and stored, a priority date, and often come with some restrictions on when and how the right may be utilized. Restrictions may include a maximum diversion rate and/or an instream flow restriction to protect existing water rights and provide environmental protection (Brazos G 2006).

A total of 1123 water rights exist in the Brazos River Basin, with a total authorized diversion of 2,664,000 ac-ft/yr. It is important to note that a small percentage of the water rights make up a large percentage of the authorized diversion volume. In the Brazos River Basin, 39 water rights (3.4 percent) make up 2,372,000 ac-ft/yr (89 percent) of the authorized diversion volume. The remaining 1084 water rights primarily consist of small irrigation rights distributed throughout the river basin (Brazos G 2006).

Region G includes the majority of the water rights in the Brazos River Basin. A total of 992 water rights (88 percent) exist in Region G, making up 1,379,000 ac-ft/yr (52 percent) of the total authorized diversion in the river basin (Brazos G 2006). Major water rights are defined as having an authorized diversion of greater than 10,000 ac-ft/yr or 5000 ac-ft of authorized storage. Figure 2.3-29 shows the location of major water rights in the Brazos River Basin.

The total authorized storage in the Brazos River Basin is approximately 4,057,000 ac-ft, with 3,550,000 ac-ft (88 percent) located in Region G (Brazos G 2006). The large quantity of reservoir storage in Region G provides for a firm supply of water during drought conditions, when streamflows are low and the need to pass water downstream is necessary.

The BRA owns several reservoirs in the Brazos River Basin that provide municipal, industrial, and irrigation water supply, including Possum Kingdom Lake and Lake Granbury. For purposes of water supply, the USACE has contracted conservation storage in each of its reservoirs within the basin to the BRA. The BRA owns the water right permit for each USACE reservoir and manages the water supply conservation storage in each reservoir (Brazos G 2006).

A number of interbasin transfer permits exist in the Brazos River Basin. These permits include authorizations for diversions both to and from the Brazos River Basin to adjacent river basins (Brazos G 2006).

Many entities within Region G obtain surface water through water supply contracts. These supplies are usually obtained from entities that own surface water rights, and the contracts specify the quantity of water each year to a buyer for an established unit price. The BRA is the largest provider of water supply contracts in Region G, and has contracted to sell 600,640 ac-ft/yr from its system of reservoirs in the Brazos River Basin. The BRA contracts raw water to various entities for long-term supply as well as short-term supply for municipal, industrial, and irrigation uses (Brazos G 2006). An existing agreement between Luminant and the BRA identifies 27,447 ac-ft/yr of water from Possum Kingdom Lake currently under contract to Luminant. This water is expected to be reallocated to CPNPP for normal use by CPNPP Units 3 and 4, while the remaining 76,270 ac-ft/yr needed for CPNPP Units 3 and 4 is being negotiated. Any new contract with the BRA for Units 3 and 4 operation is expected to provide for minimum flow conditions so that downstream water users should not be impacted.

The TWDB Groundwater Resources Division is responsible for all aspects of groundwater studies in the state. The TWDB monitors water levels and quality in the state's aquifers, conducts regional-scale aquifer modeling, and houses and maintains water well records. Groundwater resources in Texas are managed through groundwater conservation districts. A groundwater conservation district is a local unit of government authorized by the Texas Legislature and ratified at the local level to manage and protect groundwater. The TWDB is the agency charged with the approval of groundwater management plans prepared by groundwater conservation districts. All confirmed groundwater conservation districts in Texas are required to develop and implement a management plan for the effective management of their groundwater resources. The TWDB provides a wide range of assistance to districts in the development of their management plan from education to technical assistance with water-planning data. As of March 2008, Hood County was identified as part of the Upper Trinity Groundwater Conservation District. Somervell County was not identified as part of a Groundwater Conservation District (TWDB 2008).

The EPA has promulgated regulations that implement Section 316(b) of the Federal Water Pollution Control Act, also known as the Clean Water Act (CWA) for new and existing electric power producing facilities. For lakes and reservoirs, regulations indicate that intake flow may not disrupt natural thermal stratification or turnover patterns (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency (ies). Section 125.83 of the CWA defines a lake or reservoir as any inland body of open water with some minimum surface area free of rooted vegetation and with an average hydraulic retention time of more than 7 days. Lakes or reservoirs might be natural water bodies or impounded streams, usually fresh, surrounded by land or by land and a man-made retainer (e.g., a dam). Lakes or reservoirs might be fed by rivers, streams, springs, and/or local precipitation. Flow-through reservoirs with an average hydraulic retention time of 7 days or less should be considered a freshwater river or stream. By EPA definition Lake Granbury is classified as a lake or reservoir as retention time has been estimated at 260 days (TPWD 2005) by the Texas Parks and Wildlife Department. Additional information is provided in Section 5.3 about how the CPNPP meets the performance standards specified in the EPA regulations implementing Section 316(b).

Any facility that discharges into waters of the United States is required to obtain a valid National Pollutant Discharge Elimination System (NPDES) permit. NPDES is a federal regulatory program to control discharges of pollutants to surface waters of the United States. In Texas, the TCEQ TPDES program has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas (TCEQ 2007a). The current CPNPP TPDES permit (TCEQ 2004) is further discussed in Section 5.2. The impacts of the cooling water intake structures on Lake Granbury would be regulated by the TCEQ, under Sections 316(b) of the CWA, through the NPDES permit for the facility. Separately, annual water use reporting is mandatory (according to Section 16.012(m) of the Texas Water Code) (TWDB 2007a).

As presented in Subsection 2.2.3, there are no Native American lands in the region based upon a review of the National Atlas information.

2.3.3 WATER QUALITY

The quality of surface water and groundwater in Texas is regulated by the TCEQ, a source of water quality information for this report. Water quality information provided by the BRA and Luminant was also reviewed. The following sections provide detailed water quality information regarding the surface water and groundwater in the vicinity of the CPNPP site.

2.3.3.1 Surface Water Quality

Surface water withdrawn from Lake Granbury is expected to be the primary source of cooling water for CPNPP Units 3 and 4. Details on regional and site-specific hydrologic features are presented in Subsection 2.3.1. Subsection 2.3.2 provides the details concerning local and site water use.

2.3.3.1.1 Historical Water Quality Evaluation

Lake Granbury is currently a much studied reservoir with well publicized studies related to both golden algae and E. coli levels. This reservoir is an important source of drinking water and recreation to the surrounding communities. Historical water quality data from 2001 to 2006 at three long term sampling stations (stations 11860, 11861, and 11862) on the main body of Lake Granbury indicate increasing trends throughout the reservoir for chloride and decreasing trends in TSS. The increasing chloride trend is most likely a result of drought conditions which concentrate dissolved ions in the water. The Draft 2008 Texas Water Quality Inventory (TCEQ 2008) identifies segment 1205, Lake Granbury, as an impaired candidate for exceeding the water quality standard for chloride. Data collected during the last 5 years indicate a concern for elevated levels of chlorophyll-a throughout the reservoir; however, there are not enough data available to identify any long-term changes in chlorophyll-a concentrations in the reservoir. Potential causes of increasing nutrients are upstream inputs and infiltration from the septic systems that are present in many of the canals. Long-term routinely monitored stations on the main body of the lake do not indicate elevated levels of bacteria. However, residential septic systems located along the many canals and coves of Lake Granbury may be a significant source of bacteria and nutrients to the reservoir. The canals are backwater areas that have little or no circulation and mix slowly with the main body of the reservoir. The result can mean stagnant conditions where pollution problems have the potential to persist. The BRA, TCEQ and interested stakeholders are currently developing a WPP to address the concerns that these canals present (BRA 2007).

The BRA collected surface water samples from 2001 to 2006 at three points along the main body of Segment 1205, Lake Granbury, upstream and downstream of the CPNPP Unit 3 and 4 intake and discharge structures. The data were collected at FM 51 (BRA station 11862) in the northern reaches of the reservoir, at U.S. Highway 377 (US 377) (BRA station 11861) near the reservoir midpoint, and at DeCordova Bend Dam (BRA station 11860) at the southern end of the lake (Figure 2.3-10). General water quality characteristics from these sampling points were summarized to determine the range and average parameter values and are provided in Table 2.3-25.

2.3.3.1.2 Local Surface Water Quality

As part of the hydrological characterization, surface water samples were collected from the CPNPP vicinity and analyzed quarterly for a period of 1 year (January 2007 – October 2007). As a part of a baseline water quality study, seven surface water samples were collected from SCR, one sample from Squaw Creek, one sample from the Brazos River below the confluence of the Paluxy River, and one sample from the existing makeup water intake on Lake Granbury. Additionally, nine surface water samples were collected quarterly for a period of 1 year (April 2007 through January 2008) from Lake Granbury in the immediate vicinity of the CPNPP Unit 3 and 4 service water intake and cooling water discharge. The sampling locations in the CPNPP vicinity are presented in Figure 2.3-31, and the locations of the Lake Granbury sampling locations are presented in Figure 2.3-20. Analytical results for each sample location on Lake Granbury are presented in Table 2.3-26 and sample results for each sample collected in the CPNPP vicinity are presented in Table 2.3-46. Additionally, as part of the aquatic ecology characterization, seasonal water quality data were collected on Lake Granbury and SCR in 2007 and are provided in Table 2.4-12.

2.3.3.1.3 Regional Surface Water Quality

Several federal and state regulatory agencies monitor surface water quality in the waters of the Brazos River Basin watershed. Three principal entities have responsibility for monitoring water quality within the Brazos River Basin:

- BRA
- TCEQ
- TWDB

Water quality information from these organizations was evaluated, and conclusions based on documents and information from these entities are presented in the following subsections.

2.3.3.1.4 Texas Water Quality Monitoring

The TCEQ is responsible for the Texas water quality program. The TCEQ monitors the quality of surface water to evaluate physical, chemical, and biological characteristics of aquatic systems with reference to human health concerns, ecological condition, and designated uses. The TCEQ administers a number of programs related to the state's surface water quality. These regulatory programs include:

- Water Quality Standards – Standards that include both the designated uses of surface waters and the criteria intended to protect those uses. Designated uses are listed in Texas Administrative Code (TAC) Title 30, Part 1, Chapter 30, Rule §307.7 and the criteria are found in Rule §307.4.
- Water Quality Report to Congress, 305(b) Report – Biennial report submitted to the EPA as part of the national water quality assessment required by the CWA. This report provides a summary of activities related to surface water quality and an assessment of surface water quality conditions in Texas.
- List of Impaired Waters, 303(d) List – List of water bodies in Texas that do not fully support their designated uses based on a review of water quality data and information. The list is submitted to the EPA for approval after an opportunity for public comment. The list includes the causes and sources of water quality impairment for each water body listed and a schedule for development of total maximum daily loads (TMDLs) for each pollutant causing impairment.

- TMDL Development – Determination of amount of each pollutant causing water quality impairment for water bodies included on the 303(d) list. A state must determine the amount of each pollutant causing water quality impairment that can be allowed such that the water quality standards for the water body are maintained. TMDLs are developed according to a specified schedule and must be approved by the EPA after an opportunity for public comment.

- Water Quality Management Plan (WQMP) – Requirement in Section 303(e) of the CWA that each state establish and maintain a continuing planning process (CPP) consistent with the CWA. The Water Quality Division of the TCEQ updates the WQMP on a quarterly basis with projected effluent limits that may be used for water quality planning purposes in TPDES permit actions (TCEQ 2007f).

- Texas Clean Rivers Program (CRP) – is a state fee–funded program for water quality monitoring, assessment, and public outreach. The CRP is a collaboration of 15 partner agencies and the TCEQ. The CRP provides the opportunity to approach water quality issues within a watershed or river basin locally and regionally through coordinated efforts among diverse organizations (TCEQ 2007g).

2.3.3.1.5 Texas Water Quality Standards

Water quality standards are the foundation of the water quality-based control program mandated by the CWA. The Water Quality Standards program defines the goals for a water body by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants. A water quality standard consists of four basic elements:

1. Designated uses of the water body (e.g., recreation, water supply, aquatic life, agriculture).

2. Water quality criteria to protect designated uses (e.g., numeric pollutant concentrations and narrative requirements).

3. An antidegradation policy to maintain and protect existing uses and high quality waters.

4. General policies addressing implementation issues (e.g., low flows, variances, mixing zones) (EPA 2007a).

The State of Texas has established standards that protect the purposes for which the water bodies in the state are used and defines measurements that assure the water quality is good enough to attain those uses. Based on these standards, the TCEQ in concert with other federal, regional, and local agencies carries out a regular program of monitoring and assessment to determine which water bodies are meeting the standards for their use, and which are not. The state produces a periodic report, The Texas Water Quality Inventory and 303(d) List (TCEQ 2006b), that compares water quality conditions to established standards, as required by Federal CWA Sections 305 (b) and 303(d). The Texas Water Quality Standards are rules that:

- Designate the uses, or purposes, for which a state's water bodies should be suitable.

- Establish numerical and narrative goals for water quality throughout the state.
- Provide a basis on which TCEQ regulatory programs can establish reasonable methods to implement and attain the state's goals for water quality.

All standards are protective; that is, they signal a situation where there is some possibility that water quality may be inadequate to meet its designated uses. Four general categories for water use are defined in the Texas Surface Water Quality Standards:

- Aquatic life use.
- Contact recreation.
- Public water supply.
- Fish consumption.

Aquatic Life Use

The standards associated with this use are designed to protect aquatic species. They establish optimal conditions for the support of aquatic life and define indicators used to measure whether these conditions are met. Some pollutants or conditions that may violate this standard include low levels of dissolved oxygen, or toxics such as metals or pesticides dissolved in water.

Contact Recreation

The standard associated with this use measures the level of certain bacteria in water to estimate the relative risk of swimming or other water sports involving direct contact with the water. It is possible to swim in water that does not meet this standard without becoming ill; however, the probability of becoming ill is higher than it would be if bacteria levels were lower.

Public Water Supply

Standards associated with this use indicate whether water from a lake or river is suitable for use as a source for a public water supply system. Source water is treated before it is delivered to the tap. A separate set of standards governs treated drinking water. Indicators used to measure the safety or usability of surface water bodies as a source for drinking water include the presence or absence of substances such as metals or pesticides. Concentrations of salts, such as sulfate or chloride, are also measured, because treatment to remove high levels of salts from drinking water may be expensive.

Fish Consumption (fresh and salt water)

The standards associated with this use are designed to protect the public from consuming fish or shellfish that may be contaminated by pollutants in the water. The standards identify levels at which there is a significant risk that certain toxic substances dissolved in water may accumulate in the tissue of aquatic species. Because toxic substances in water may exceed these levels while no accumulation in fish tissue is observable, the state conducts tests on fish and shellfish tissue to determine if there is a risk to the public from consuming fish caught in state waters. The standards also specify bacterial levels in marine waters to assure that oysters or other shellfish subject to commercial harvest and marketing are safe for public sale and consumption.

Indicators of water quality that are not tied to specific uses—such as dissolved solids, nutrients, and toxic substances in sediment—are also described in the standards (TCEQ 2007).

2.3.3.1.6 Water Quality of the Brazos River Basin

The Brazos River basin spans 42,000 sq mi and an overall length of approximately 640 mi across Texas. Its width varies from about 70 mi on the High Plains in the upper basin to a maximum of 120 mi in the vicinity of Waco to about 10 mi near the City of Richmond in the lower basin. The Brazos River Basin is divided into 14 BRA sub-watersheds and 25 USGS cataloging units with a variety of environmental conditions unique to each one. Within the Brazos River Basin, 164 surface water bodies or stream segments were evaluated for the Draft 2008 Texas Water Quality Inventory and 303(d) List (TCEQ 2008).

Surface water segments are evaluated for pollutant concerns and monitoring sites are selected based on their representation of the segment as a whole. Monthly monitoring has been conducted on many of these sites since the inception of the CRP in 1992. In 2004, routine monitoring continued on a quarterly cycle for sites lacking identifiable concerns, and monthly monitoring continued for locations with potential concerns for water quality issues. Also, sampling for priority pollutants continued throughout the basin. Priority pollutants, as listed by TCEQ, include metals, carbamates, and volatile organic compounds (VOCs). Samples are collected from monitoring stations for priority pollutant analyses, at least once annually from routine monitoring locations. BRA field scientists conduct biological assessments in selected watersheds each year. Trends in biological conditions are determined using benthic macroinvertabrate and fish community studies (BRA 2007b).

<u>Texas Water Quality Inventory and 303(d) List</u>

The Texas Water Quality Inventory and 303(d) Lists (TCEQ 2006b) identifies segments of rivers, streams, reservoirs, and estuaries within Texas that do not fully support their designated uses.

<u>Brazos River Basin: 2006 Assessment</u>

The 2006 Texas 303(d) list identifies 74 surface water segments in Texas within the Brazos River Basin that do not fully support their designated uses. Of these 74 segments, 69 are freshwater streams and 5 are reservoirs. There are 63 fresh water stream segments cited for bacteria impairment, 5 cited for depressed dissolved oxygen impairment, 4 cited for chloride impairment, 2 cited for sulfate impairment, 2 cited for TDS impairment, 1 cited for an impaired fish community, and 1 cited for an impaired fish habitat (Table 2.3-47). In addition to the previously listed freshwater stream segments, there are 2 reservoirs cited for TDS impairment, 2 cited for toxicity in sediment, 1 cited for pH impairment, 1 cited for chloride impairment, and 1 cited for sulfate impairment (Table 2.3-48). Freshwater stream segments and reservoirs may have multiple impairment citations (TCEQ 2006b).

<u>Brazos River Basin: Draft 2008 Assessment</u>

The Draft 2008 Texas 303(d) list identifies 75 surface water segments in Texas within the Brazos River Basin that do not fully support their designated uses. Of these 75 segments, 70 are freshwater streams and 5 are reservoirs. There are 62 fresh water stream segments cited for bacteria impairment, 7 cited for depressed dissolved oxygen impairment, 6 cited for chloride impairment, 3 cited for sulfate impairment, 2 cited for TDS impairment, 1 cited for an impaired fish community, and 1 cited for an impaired macrobenthic community (Table 2.3-47). In addition to the previously listed freshwater stream segments, there are 2 reservoirs cited for toxicity in sediment impairment, 2 cited for chloride impairment, 1 cited for TDS impairment, and 1 cited for depressed dissolved oxygen impairment (Table 2.3-48). Freshwater stream segments and reservoirs may have multiple impairment citations (TCEQ 2008).

2.3.3.1.7 Middle Brazos-Palo Pinto Watershed

Within the Middle Brazos-Palo Pinto Watershed, the Draft 2006 Texas Water Quality Inventory (TCEQ 2006b) identifies one impaired water body upstream of the CPNPP Units 3 and 4 cooling water intake and discharge on Lake Granbury. The Brazos River below Possum Kingdom Lake (Segment 1206) was identified on the Draft 2006 303(d) list as an impaired stream segment. Segment 1206 represents the majority of the Brazos River between Morris Sheppard Dam (Possum Kingdom Lake) and Lake Granbury (Figure 2.3-10). Segment 1206 is an 109-mi stream segment from a point 110 yds upstream of FM 2580 in Parker County to Morris Sheppard Dam in Palo Pinto County and is listed as impaired by naturally occurring chloride concentrations.

The Draft 2008 Texas Water Quality Inventory (TCEQ 2008) identifies the Brazos River above Possum Kingdom Lake (Segment 1208) as being impaired by bacteria and the Brazos River below Possum Kingdom Lake (Segment 1206) as being impaired by naturally occurring chloride concentrations (Figure 2.3-10). Segment 1206 was also identified as having an impaired macrobenthic community. Lake Granbury (Segment 1205), downstream of segment 1206, was identified on the Draft 2008 303(d) List as impaired by naturally occurring chloride concentrations. Segment 1205 represents all of Lake Granbury from DeCordova Bend Dam in Hood County to a point 110 yards upstream of FM 2580 in Parker County, up to normal pool elevation of 693 ft msl (Figure 2.3-10).

According to BRA data, two monitoring stations within Segment 1206, the FM 4 - Brazos River crossing (Station 11864) and the FM 1189 – Brazos River crossing (Station 13543), have shown increases in chloride concentration; however, due to a 6-year gap in the data set, no statistical trend can be confirmed. While Stations 11864 and 13543 have concerns related to TDS and chloride, data from the end of 2005 to the fall of 2006 show declining concentrations (Figure 2.3-11). This observed decline in chloride concentrations is most likely a result of watershed flushing from large-scale flood releases from Possum Kingdom Lake. Station 11864 and 13543 both show a decreasing trend in TSS. Station 13543 has increasing trends for specific conductance, TDS, chloride, and orthophosphate. The locations of Stations 11864 and 13543 are shown on Figure 2.3-10, and historical water quality data are presented in Table 2.3-49.

2.3.3.1.8 Middle Brazos-Lake Whitney Watershed

Within the Middle Brazos-Lake Whitney Watershed, the 2006 Texas Water Quality Inventory (TCEQ 2006b) does not identify any 303(d) listed segments downstream of DeCordova Bend Dam or the CPNPP site, including SCR (Segment 1229A), the Paluxy River (Segment 1229), the

Brazos River below Lake Granbury (Segment 1204), Lake Whitney (Segment 1203), and the Brazos River below Lake Whitney (Segment 1257).

The Draft 2008 Texas Water Quality Inventory (TCEQ 2008) identifies the Paluxy River (Segment 1229) as exceeding the water quality standards for TDS, sulfate, and chloride. Segment 1229 extends from the confluence with the Brazos River in Somervell County to the confluence of Rough Creek in Erath County. A small portion of the Paluxy River receives water released from SCR (the cooling water source for CPNPP Units 1 and 2) by way of Squaw Creek before discharging into the Brazos River east of Glen Rose. No other impaired water bodies were identified downstream of DeCordova Bend Dam or the CPNPP site on the Draft 2008 303(d) List.

2.3.3.1.9 Ecological Health Rating

Lake Granbury, the CWS supply and cooling tower blowdown discharge reservoir for CPNPP Units 3 and 4, was identified on the Draft 2008 303(d) List as being impaired by naturally occurring chloride concentrations. A total of 873 samples were assessed at five locations for the 2008 assessment. The mean chloride concentration of the assessed samples was 1,082 mg/l which exceeds the current Lake Granbury water quality standard of 1,000 mg/l. The impairment of Lake Granbury, identified as a general use impairment, is listed a 303(d) category 5c which indicates that additional data and information would be collected before a TMDL or review of the water quality standard is scheduled. According to the TCEQ, the TMDL schedule is a plan that is subject to change. Factors that may affect the completion of TMDLs include, but are not limited to: the severity of the pollution, the designated use for the water bodies, complexity encountered while developing the TMDL assessment, available funding, agency priorities and other factors. The TCEQ is committed to completing TMDLs within 8 – 13 years of an original listing and thus the number of years on the list is a factor affecting the TMDL schedule. Prior to the Draft 2008 303(d) listing, concerns for screening levels were identified on Lake Granbury for naturally occurring chloride, sulfate, and TDS concentrations. Historical data indicate increasing trends throughout the reservoir for chloride and decreasing trends in TSS. The increasing chloride trend is most likely a result of recent drought conditions which concentrate dissolved ions in the water (BRA 2007).

Swimming advisories have not been issued for Lake Granbury and currently there are no fish consumption bans (TPWD 2007) or fish consumption advisories within the CPNPP site area (DSHS 2007).

2.3.3.2 Groundwater Quality

This section discusses historical and local groundwater quality and regional groundwater quality studies conducted by regulatory agencies in Texas. Current groundwater monitoring activities and analytical results are also discussed. Groundwater characterization information is presented in Subsection 2.3.1.5 and FSAR Subsection 2.4.12. Local and on-site use of groundwater is discussed in Subsection 2.3.2.3.

2.3.3.2.1 Historical Groundwater Quality

During the preliminary work at the CPNPP Unit 1 and 2 site, 17 piezometers were installed and water levels were monitored for a period of 1 year. Each of these piezometers was installed in the upper zone of the Glen Rose Formation. The water levels in the upper zone of the Glen Rose Formation were attributed to surface run-off and were not a true measure of permanent groundwater in the formation (CPSES 2007). Groundwater samples were not collected from the soil zone or from the upper zone of the Glen Rose Formation for chemical analysis. During the original environmental study, groundwater samples were collected from wells drawing water from the Twin Mountains, Glen Rose, and Paluxy Formations and analyzed for general water chemistry parameters (CPSES 2007).

In late 2005, a groundwater monitoring program was initiated to monitor potential radionuclide releases in the immediate vicinity of CPNPP Units 1 and 2. Of the 17 existing piezometers, five to eight were used to monitor and collect groundwater samples for analysis to determine possible presence of gamma-emitting radionuclides and tritium. The results from the radionuclide monitoring program indicate all parameters are reported below detection limits or below minimum detected activity (MDA) levels. Groundwater samples were not collected from these existing piezometers for general water chemistry analysis or organic/inorganic parameter analysis.

2.3.3.2.2 Local Groundwater Quality

Potable groundwater in the area occurs in the Paluxy, Glen Rose, and Twin Mountains Formations of the Trinity Group Aquifer. The Paluxy Formation is tapped by some domestic water wells south of the Paluxy River, where the water is typically hard calcium bicarbonate type. Further down dip, the water becomes a progressively softer, sodium bicarbonate type (CPSES 2007). In the CPNPP site area the Paluxy Formation is present only on ridge tops and is not a source of groundwater.

The quality of water obtained from the Glen Rose Formation is variable; in localized areas it is not potable. Northwest of the CPNPP site, water is drawn from this formation where it is capped by an outlier of Paluxy (CPSES 2007). In the CPNPP site area, the Glen Rose Formation does not produce sufficient water for development.

Water in the Twin Mountains Formation is a sodium bicarbonate type with a dissolved solids content varying generally from 200-900 mg/l. In and near the outcrop areas, Twin Mountains water is used for irrigation. At the CPNPP site, the water is unsuitable for irrigation because of local soil conditions and the higher sodium content of the water (CPSES 2007). In the CPNPP Unit 3 and 4 site area, the Twin Mountains Formation is determined to be approximately 230 ft below plant grade elevation.

Groundwater samples were collected and analyzed from 10 monitoring wells at the CPNPP Unit 3 and 4 site on a quarterly basis for a period of approximately 1 year (January 2007 – October 2007) as part of the baseline water quality study. The monitoring wells were installed in October and November 2006. The 10 monitoring wells sampled include six wells completed in the regolith (MW-12XXa) and four wells completed in the shallow bedrock (MW-12XXb). Due to the absence of sustainable groundwater in the bedrock wells (MW-12XXc), these wells were not sampled during the baseline water quality study. Groundwater monitoring well construction details are presented in Subsection 2.3.1 and CPNPP Unit 3 and 4 FSAR Subsection 2.4.12. Each groundwater monitoring well was developed by over-pumping, and each of the 10 wells sampled on a quarterly basis was purged prior to each sampling event. Following sample collection, groundwater samples were submitted according to strict chain-of-custody protocol to

TTI Laboratories in Arlington, Texas (January and April 2007) and Oxidor Laboratories in Plano, Texas (July and October 2007). Analytical results from the baseline quarterly groundwater sampling events are summarized in Table 2.3-50.

Previous groundwater monitoring at the CPNPP site did not include the same parameters analyzed during the current baseline water quality study.

2.3.3.2.3 Regional Groundwater Quality

Nine state agencies and an association of groundwater districts make up the Texas Groundwater Protection Committee (TGPC). The TGPC manages different aspects of groundwater in Texas. The nine state agencies include:

- Texas Commission on Environmental Quality (Chair).
- Texas Water Development Board (Vice Chair).
- Railroad Commission of Texas (Member).
- Department of State Health Services (Member).
- Texas Department of Agriculture (Member).
- Texas State Soil and Water Conservation Board (Member).
- Texas Agricultural Experimental Station (Member).
- The Bureau of Economic Geology (Member).
- Texas Department of Licensing and Registration (Member).
- Texas Alliance of Groundwater Districts (Member).

The Texas Water Code gives the TGPC its mission. Section 26.401 sets non-degradation of the state's groundwater resources as the goal for all state programs and asserts that groundwater be kept reasonably free of contaminants that interfere with its present and potential uses. The TGPC implements the state's groundwater protection policy which:

- Calls for non-degradation of groundwater.
- Requires that pollution discharges, waste disposal, and other regulated activities not harm public health, or impair current or potential groundwater use.
- Recognizes the variability between aquifers.
- Acknowledges the importance of water quality.

- Balances the protection of the environment and the long-term economic health of the state.

- Recognizes the use of the best professional judgment of the responsible state agencies to implement the policy (TGPC 2007).

TCEQ holds the chair for the TGPC. The TCEQ is the state's lead agency for water resources and environmental protection. The TCEQ administers both state and federally mandated programs related to groundwater. Chapter IV of the Texas Groundwater Protection Strategy gives an overview of the groundwater programs in Texas (TCEQ 2007c).

2.3.3.3 Factors Affecting Water Quality

Wastewater and other waste streams discharges to local surface waters could potentially affect both water quality and aquatic communities in the vicinity of the CPNPP site. In addition, an impact to water quality could affect plant operations. Potential pollution sources in the Middle Brazos-Palo Pinto Watershed (HUC 12060201) have been identified by the TCEQ and EPA, and are divided into three categories: (1) those regulated by TCEQ under its TPDES permit program, (2) those regulated by TECQ under its nonpoint source management program and (3) other potential pollution sources identified by the EPA.

Several water quality studies of the Brazos River Basin watershed have been conducted. Under TWDB authority, Texas is divided into 16 regional water planning areas, each of which is responsible for developing a regional water plan. Water planning activities between Possum Kingdom Lake and Lake Whitney are under the authority of the TWDB who has designated the area as Region G, a 37-county planning area, which extends generally along the Brazos River from Kent, Stonewall, and Knox counties in the Northwest, and to Washington and Lee counties in the Southeast (Figure 2.3-29). In 1998, a water assessment of the Brazos G Region was initiated, and the findings from this study were published in a 2006 report entitled 2006 Brazos G Regional Water Plan (Brazos G 2006). This study provided detailed water quality information for the planning area and included the following information:

- General watershed description and background information.

- Socioeconomic highlights.

- Water quality status and issues.

- Management objectives and strategies.

2.3.3.3.1 NPDES Program

The state of Texas assumed the authority to administer the NPDES program in Texas on September 14, 1998. NPDES is a federal regulatory program to control discharges of pollutants to surface waters of the United States. The TCEQ TPDES program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. According to information obtained from the EPA, there are 16 TPDES permits issued within a 6-mi radius of the CPNPP site and a 6-mi radius of the CPNPP Unit 3 and 4 intake and discharge structures on Lake Granbury. Information regarding these discharges is presented in Table 2.3-51, and the locations of the discharges are shown on Figure 2.3-32.

2.3.3.3.2 Nonpoint Source Management

Nonpoint source (NPS) pollution results when small amounts of contaminants from a large number of sources are carried by rainfall runoff into streams, lakes, or bays. For example, pollutants may be washed off lawns, construction areas, farms, or highways during a heavy rain and carried to a nearby creek. NPS pollution is difficult to control because it comes from the everyday activities of many different people, such as fertilizing a lawn, using a pesticide, or constructing a road or building (TCEQ 2007d). The Texas Nonpoint Source Management Program (SFR-068/04), December 2005, outlines Texas' comprehensive and integrated strategy to protect and restore waters impacted by NPS pollution. Section 319(b) of the CWA requires this report to be updated every 5 years (TCEQ 2007e).

Several potential pollution sources are located in the vicinity of the CPNPP site and cooling water intake and discharges lines on Lake Granbury that can affect the water quality of SCR, the Brazos River, and their respective tributaries. These potential sources include dams, power plants, pipelines, oil and gas well pad sites, bulk petroleum and agricultural storage facilities, gasoline stations (i.e., underground storage tanks), livestock farms, quarries, and industrial/manufacturing facilities, as well as other public and private operations. A detailed review of public records, Internet sources, USGS topographic and other reference maps, aerial photographs, and notes from several visits to areas surrounding the vicinity 6-mi band around the CPNPP site and cooling water intake and discharges lines on Lake Granbury has been completed. Based on information gathered during the review process, several major pollution sources were noted to have a potentially significant effect on the CPNPP during plant operations. These potential pollution sources are (1) dams and reservoirs, (2) power plants, (3) hazardous waste generators, and (4) toxic release inventory facilities.

Table 2.3-51 provides detailed information on other potential pollution sources that can affect water quality in the vicinity of the CPNPP site, as identified in the EPA Envirofacts Data Warehouse search. No Superfund sites (active or archived) were identified in the Envirofacts Data Warehouse search.

2.3.3.3.3 Dams and Reservoirs

A total of 44 dams and reservoirs are located within the Brazos River Basin. Seven of these dams and associated reservoirs are identified on Figure 2.3-21. Eighteen of these dams are located upstream from Lake Granbury, which is impounded by DeCordova Bend Dam. Other than small cattle ponds, there are no surface water impoundments upstream from SCR and Squaw Creek dam. Of these 18, there are seven large manmade impoundments located within 150 stream mi of the DeCordova Bend Dam on Lake Granbury that could affect or be affected by plant operations (Figure 2.3-21). These impoundments include Possum Kingdom Lake, Palo Pinto Lake, Mineral Wells Lake, Lake Granbury, SCR, Wheeler Branch Reservoir, and Lake Whitney.

Morris Sheppard Dam impounds Possum Kingdom Lake and is the only upstream lake located on the main stem of the Brazos River. Palo Pinto Creek Dam and Mineral Wells Dam impound the upstream off channel Palo Pinto Lake and Mineral Wells Lake, respectively. Lake Granbury is impounded by DeCordova Bend Dam and Squaw Creek Dam impounds SCR. Wheeler Branch Dam impounds Wheeler Branch Reservoir and is downstream and off channel of the CPNPP site. The only downstream lake on the Brazos River is Lake Whitney, which is impounded by Whitney Dam.

Possum Kingdom Lake and Lake Granbury are operated by the BRA, Lake Palo Pinto by the Palo Pinto Water District No. 1, Lake Mineral Wells by the City of Mineral Wells, SCR by Luminant, Wheeler Branch Reservoir by the Somervell County Water District, and Lake Whitney by the USACE.

Of these seven impoundments, only Lake Whitney was constructed for the express purpose of flood control. The remaining six impoundments were created primarily for water supply with secondary uses that include recreation, flood control, cooling, and power generation.

Operations at these seven dams are not expected to have a direct impact on the water quality in the vicinity of the CPNPP site. A detailed discussion of these dams and their associated reservoirs is presented to Subsection 2.3.1.

2.3.3.3.4 Power Plants

Three power plants are located within a 10-mi radius of the CPNPP site. These plants include the following:

<u>Comanche Peak Nuclear Power Plant (CPNPP)</u>

CPNPP, formerly known as Comanche Peak Steam Electric Station, is a two-unit nuclear-fueled power plant located 4.5 mi northwest of Glen Rose in Somervell County and about 80 mi southwest of downtown Dallas. The plant is owned and operated by Luminant and has an operating capacity of 2300 megawatts (two 1150 megawatt units). The plant has approximately 1300 employees (TXU 2007).

<u>Wolf Hollow</u>

Wolf Hollow is 720 MW natural gas fired, combined cycle power plant that employs two gas turbines. It is located approximately 3.5 mi northeast of CPNPP and supplies 350 MWe capacity to Exelon Generation Company, pursuant to a 20-year power purchase agreement, and 330 MWe to J. Aron & Company under a 5-year supply agreement. Wolf Hollow began operation in 2003 and is currently owned by a private investment partnership and operated by Flour-Mitsubishi (F-M) Operating Company. Wolf Hollow has approximately 30 employees.

<u>DeCordova Steam Electric Station</u>

DeCordova Steam Electric Station consists of a conventional gas/oil steam generating unit and four combustion turbines. The DeCordova plant gas/oil unit began operating in 1975, and the four combustion turbines went into operation in 1990 (TXU 2007a). DeCordova Steam Electric Station is currently used only during peak electrical demand.

2.3.3.3.5 Hazardous Waste Generators

Other than CPNPP Units 1 and 2, no pollutant sources with discharges to SCR that may interact with the CPNPP Units 3 and 4 site were identified within a 6-mi radius. One conditionally exempt small quantity generator (CESQG) was identified within a 6-mi radius of the CPNPP Unit 3 and 4 service water intake on Lake Granbury. DeCordova Power Plant is located approximately 1.56 mi upstream from the CPNPP service water intakes and is listed as a CESQG with no reported violations.

The EPA Envirofacts Data Warehouse list (EPA 2007b) was reviewed to determine how many registered hazardous waste generators/handlers exist within a 6-mi radius of the CPNPP Units 3 and 4 site proper and the service water intake and discharge structures on Lake Granbury (Figure 2.3-32). The Envirofacts Data Warehouse list reports 21 registered hazardous waste generators/handlers within the 6-mi radius. Of these 21 generators/handlers, 6 are listed as CESQG, 3 are listed as small-quantity generators (SQG), and the remaining 12 are listed as inactive. None of the facilities identified in the search had any reported violations nor were listed as large-quantity hazardous waste generators (LQG).

2.3.3.3.6 Plant Waste Water

Waste water from a nuclear power plant is primarily process waste and heated cooling water. Six outfalls are listed on the current CPNPP TPDES permit; however, drainage from the existing plant site is discharged through only three of the six discharge points (Figure 2.3-33). The three active discharge points (Outfalls 001, 003, and 004) are active process discharges that flow into SCR (EPA 2008). Table 2.3-52 provides water quality information for active process discharges that flow into SCR. Section 3.5 discussed the disposition of radioactive process waste from CPNPP Units 3 and 4. Section 3.6 discusses the disposition of nonradioactive process waste. Section 3.6 addresses plant waste water handling relative to American Water Works Association 1990 industry standards. The disposition of steam and heated cooling water are discussed in Section 3.3.

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TABLE 2.3-1
USGS HYDROLOGIC UNIT CODES FOR REGION 12 - BRAZOS RIVER BASIN

Hydrologic Unit Code	Watershed Name	Surface Area (mi^2)	State(s)	Flow Gradient to CPNPP
	Subregion 1205 - Brazos Headwaters. New Mexico, Texas			
12050001	Yellow House Draw	3780	NM, TX	Upstream
12050002	Blackwater Draw	1560	NM, TX	Upstream
12050003	North Fork Double Mountain Fork Brazos	1050	TX	Upstream
12050004	Double Mountain Fork Brazos	2740	TX	Upstream
12050005	Running Water Draw	1620	NM, TX	Upstream
12050006	White	1690	TX	Upstream
12050007	Salt Fork Brazos	2150	TX	Upstream
	Subregion 1206 - Middle Brazos. Texas			
12060101	Middle Brazos-Millers	2490	TX	Upstream
12060102	Upper Clear Fork Brazos	2730	TX	Upstream
12060103	Paint	1080	TX	Upstream
12060104	Lower Clear Fork Brazos	620	TX	Upstream
12060105	Hubbard	1300	TX	Upstream
12060201	Middle Brazos-Palo Pinto	3160	TX	Both
12060202	Middle Brazos-Lake Whitney	2500	TX	Both
12060203	Bosque	418	TX	Downstream
12060204	North Bosque	1240	TX	Downstream
	Subregion 1207 - Lower Brazos. Texas			
12070101	Lower Brazos-Little Brazos	2720	TX	Downstream
12070102	Yegua	1330	TX	Downstream
12070103	Navasota	2260	TX	Downstream
12070104	Lower Brazos	1650	TX	Downstream
12070201	Leon	3000	TX	Downstream
12070202	Cowhouse	743	TX	Downstream
12070203	Lampasas	1510	TX	Downstream
12070204	Little	1000	TX	Downstream
12070205	San Gabriel	1360	TX	Downstream
	Total Area	45,701		

Note: mi^2 - square miles
(USGS 2007)

TABLE 2.3-2
MEAN MONTHLY EVAPORATION DATA FOR LAKE GRANBURY

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	1.85	2.26	3.56	4.70	5.56	6.83	11.67	10.51	7.99	4.99	2.70	2.54	65.16
1994	2.04	1.96	3.37	4.91	4.75	7.88	9.35	9.45	5.90	4.70	3.05	1.77	59.11
1995	1.24	0.94	2.41	4.51	5.22	7.02	8.91	7.45	6.19	6.32	3.96	1.99	56.16
1996	1.19	1.27	3.59	6.04	8.40	7.94	9.14	7.12	5.35	4.75	2.81	1.40	59.01
1997	1.19	0.94	2.44	3.88	5.00	6.77	9.61	8.68	8.31	5.61	2.91	2.56	57.89
1998	2.44	1.97	3.97	5.52	7.13	9.31	11.56	9.37	7.34	4.95	2.63	1.84	68.03
1999	1.19	0.94	3.10	6.91	5.86	6.56	10.18	11.76	8.47	6.19	4.15	3.08	68.39
2000	1.19	0.97	1.89	4.81	6.97	5.78	10.63	11.77	8.99	4.01	1.68	1.13	59.83
2001	1.48	2.00	2.63	3.87	6.11	7.85	10.56	8.90	5.98	5.43	3.08	2.71	60.62
2002	2.49	2.37	3.19	4.01	6.12	7.09	7.52	9.52	7.17	3.80	3.64	2.33	59.24
2003	2.26	1.59	3.44	5.36	5.39	6.95	9.67	9.07	5.82	5.06	3.65	3.62	61.87
2004	2.09	1.97	3.52	3.60	5.84	5.51	7.99	7.65	6.34	4.49	3.27	2.54	54.81
2005	2.40	2.23	3.35	4.92	5.09	7.56	8.35	7.33	7.94	5.44	4.71	2.98	62.31
2006	3.83	2.87	4.28	5.48	7.13	8.64	9.57	10.35	7.54	5.31	4.17	2.77	71.94
Average	1.92	1.73	3.20	4.89	6.04	7.26	9.62	9.21	7.10	5.07	3.31	2.38	61.74

Note:
Evaporation measured in inches
Averages calculated from raw pan evaporation data provided by USACE and BRA monthly conversion factor to offset solar and other related factors that result in higher evaporation from the pan than actually is occurring at the lake surface

(USACE 2007)

TABLE 2.3-3 (Sheet 1 of 4)
USGS TOPOGRAPHIC MAPS FOR THE MIDDLE BRAZOS - PALO PINTO AND LAKE WHITNEY WATERSHEDS

Map ID	7.5-minute Quad Sheet Name	State	N. Latitude	W. Longitude
1	Lake Olney	TX	33.375	-98.750
2	Bobcat Bluff	TX	33.375	-98.625
3	Olney	TX	33.250	-98.750
4	True	TX	33.250	-98.625
5	Loving	TX	33.250	-98.500
6	Markley	TX	33.250	-98.375
7	Newcastle	TX	33.125	-98.625
8	Lake Eddleman	TX	33.125	-98.500
9	Bryson	TX	33.125	-98.375
10	Senate	TX	33.125	-98.250
11	Jacksboro	TX	33.125	-98.125
12	South Bend	TX	33.000	-98.625
13	Graham	TX	33.000	-98.500
14	Ross Mountain	TX	33.000	-98.375
15	Long Hollow	TX	33.000	-98.250
16	Bartons Chapel	TX	33.000	-98.125
17	Perrin	TX	33.000	-98.000
18	Gibtown	TX	33.000	-97.875
19	Eliasville	TX	32.875	-98.750
20	Ivan North	TX	32.875	-98.625
21	Cove Creek	TX	32.875	-98.500
22	Costello Island	TX	32.875	-98.375
23	Graford West	TX	32.875	-98.250
24	Graford East	TX	32.875	-98.125
25	Whitt	TX	32.875	-98.000
26	Adell	TX	32.875	-97.875
27	Poolville	TX	32.875	-97.750
28	Grand Lake	TX	32.750	-98.750
29	Ivan South	TX	32.750	-98.625
30	Brad	TX	32.750	-98.500
31	Fortune Bend	TX	32.750	-98.375
32	Palo Pinto	TX	32.750	-98.250
33	Mineral Wells West	TX	32.750	-98.125
34	Mineral Wells East	TX	32.750	-98.000

TABLE 2.3-3 (Sheet 2 of 4)
USGS TOPOGRAPHIC MAPS FOR THE MIDDLE BRAZOS - PALO PINTO AND LAKE WHITNEY WATERSHEDS

Map ID	7.5-minute Quad Sheet Name	State	N. Latitude	W. Longitude
35	Garner	TX	32.750	-97.875
36	Weatherford North	TX	32.750	-97.750
37	Necessity	TX	32.625	-98.750
38	Caddo	TX	32.625	-98.625
39	Caddo NE	TX	32.625	-98.500
40	Metcalf Gap	TX	32.625	-98.375
41	Lone Camp	TX	32.625	-98.250
42	Brazos West	TX	32.625	-98.125
43	Brazos East	TX	32.625	-98.000
44	Brock	TX	32.625	-97.875
45	Weatherford South	TX	32.625	-97.750
46	Annetta	TX	32.625	-97.625
47	Wayland	TX	32.500	-98.750
48	La Casa	TX	32.500	-98.625
49	Strawn West	TX	32.500	-98.500
50	Strawn East	TX	32.500	-98.375
51	Gordon	TX	32.500	-98.250
52	Santo	TX	32.500	-98.125
53	Lipan	TX	32.500	-98.000
54	Dennis	TX	32.500	-97.875
55	Tin Top	TX	32.500	-97.750
56	Chapin	TX	32.500	-97.625
57	Cresson	TX	32.500	-97.500
58	Ranger	TX	32.375	-98.625
59	Bear Mountain	TX	32.375	-98.500
60	Reddy Mountain	TX	32.375	-98.375
61	Turkey Creek	TX	32.375	-98.250
62	Morgan Mill	TX	32.375	-98.125
63	Bluff Dale NE	TX	32.375	-98.000
64	Tolar	TX	32.375	-97.875
65	Granbury	TX	32.375	-97.750
66	Acton	TX	32.375	-97.625
67	Godley	TX	32.375	-97.500
68	Joshua	TX	32.375	-97.375
69	Keene	TX	32.375	-97.250

TABLE 2.3-3 (Sheet 3 of 4)
USGS TOPOGRAPHIC MAPS FOR THE MIDDLE BRAZOS - PALO PINTO AND LAKE WHITNEY WATERSHEDS

Map ID	7.5-minute Quad Sheet Name	State	N. Latitude	W. Longitude
70	Desdemona	TX	32.250	-98.500
71	Huckabay SW	TX	32.250	-98.375
72	Huckabay	TX	32.250	-98.250
73	Knob Hill	TX	32.250	-98.125
74	Bluff Dale	TX	32.250	-98.000
75	Paluxy	TX	32.250	-97.875
76	Hill City	TX	32.250	-97.750
77	Nemo	TX	32.250	-97.625
78	Bono	TX	32.250	-97.500
79	Cleburne West	TX	32.250	-97.375
80	Cleburne East	TX	32.250	-97.250
81	Stephenville	TX	32.125	-98.125
82	Johnsville	TX	32.125	-98.000
83	Chalk Mountain	TX	32.125	-97.875
84	Glen Rose West	TX	32.125	-97.750
85	Glen Rose East	TX	32.125	-97.625
86	Brazos Point	TX	32.125	-97.500
87	Blum	TX	32.125	-97.375
88	Covington	TX	32.125	-97.250
89	Itasca	TX	32.125	-97.125
90	Files Valley	TX	32.125	-97.000
91	Camp Branch	TX	32.000	-97.875
92	Walnut Springs West	TX	32.000	-97.750
93	Walnut Springs East	TX	32.000	-97.625
94	Morgan	TX	32.000	-97.500
95	Lakeside Village	TX	32.000	-97.375
96	Blanton	TX	32.000	-97.250
97	Hillsboro West	TX	32.000	-97.125
98	Hillsboro East	TX	32.000	-97.000
99	Meridian	TX	31.875	-97.625
100	Pilot Knob	TX	31.875	-97.500
101	Allen Bend	TX	31.875	-97.375
102	Whitney	TX	31.875	-97.250
103	Peoria	TX	31.875	-97.125
104	Abbott	TX	31.875	-97.000

TABLE 2.3-3 (Sheet 4 of 4)
USGS TOPOGRAPHIC MAPS FOR THE MIDDLE BRAZOS - PALO PINTO AND LAKE WHITNEY WATERSHEDS

Map ID	7.5-minute Quad Sheet Name	State	N. Latitude	W. Longitude
105	Malone	TX	31.875	-96.875
106	Clifton	TX	31.750	-97.500
107	Laguna Park	TX	31.750	-97.375
108	Smiths Bend	TX	31.750	-97.250
109	Aquilla	TX	31.750	-97.125
110	West	TX	31.750	-97.000
111	Penelope	TX	31.750	-96.875
112	Hubbard	TX	31.750	-96.750
113	Mosheim	TX	31.625	-97.500
114	Valley Mills	TX	31.625	-97.375
115	China Springs	TX	31.625	-97.250
116	Gholson	TX	31.625	-97.125
117	Elm Mott	TX	31.625	-97.000
118	Axtell	TX	31.625	-96.875
119	Prairie Hill	TX	31.625	-96.750
120	Waco West	TX	31.500	-97.125
121	Waco East	TX	31.500	-97.000
122	Elk	TX	31.500	-96.875
123	Mart	TX	31.500	-96.750
124	Lorena	TX	31.375	-97.125
125	Robinson	TX	31.375	-97.000
126	Riesel	TX	31.375	-96.875

Source: Compiled from Data, ESRI 2004
USGS Maps are available from numerous sources. The reference below was used for the table above.
All Topo Maps: Texas V6 Professional Map Reference Set, igage Mapping Corp.
See Figure 2.3-4 for the index map of topographic maps.

TABLE 2.3-4
MAJOR TRIBUTARIES CONTRIBUTING FLOW TO BRAZOS RIVER BETWEEN MORRIS SHEPHERD DAM AND DE CORDOVA BEND DAM

Contributing Flow	Drainage Area (mi^2)	Gradient (ft/mi)	Slope Percentage	Length (mi)	Brazos River Mile (BRM)	Tributaries
Palo Pinto Creek	461	12.17	0.23	60.0	609.5	Palo Pinto Creek - South Fork, Lake, Gibson, Barton, Little Sunday, Big Sunday, Lost, and Buck Creeks
Rock Creek	63	21.67	0.41	24.0	599.7	Wilson Creek, Dry Creek, Moreland Creek, Rippy Branch, and Grassy Branch

Note:
Location, length, and slopes of streams calculated from USGS Topographic Maps and information from the TSHA (CPNPP_ER_SOF_2.3-002_Palo Pinto and Rock Creeks.pdf)

TABLE 2.3-5
LOCAL STREAM TRIBUTARIES

Contributing Flow	Drainage Area (mi^2)	Gradient (ft/mi)	Slope Percentage	Length (mi)	Reservoir Fed
Lusk Branch	Unknown	65.55	1.241	2.38	Lake Granbury
Walnut Creek	Unknown	46.94	0.889	7.84	Lake Granbury
Contrary Creek	Unknown	76.83	1.455	5.87	Lake Granbury
Rough Creek	Unknown	74.65	1.414	3.67	Lake Granbury
Lambert Branch	Unknown	48.02	0.909	4.79	Lake Granbury
Rucker Creek	461	33.95	0.643	12.49	Lake Granbury
Squaw Creek	64	25.23	0.478	12.96	Squaw Creek Reservoir
Panter Branch	Unknown	42.44	0.804	7.47	Squaw Creek Reservoir
Lollar Branch	Unknown	46.03	0.872	4.91	Squaw Creek Reservoir
Panther Branch	Unknown	60.08	1.138	2.43	Squaw Creek Reservoir
Million Branch	Unknown	51.92	0.983	2.08	Squaw Creek Reservoir

Note:
Stream lengths and gradients measured from headwaters to normal pool elevation of the receiving reservoir
using: All Topo Maps: Texas V6 Professional Map Reference Set, iGage Mapping Corp.

TABLE 2.3-6
SELECTED USGS GAUGING STATIONS

Location	Drainage Area (mi^2)	Location	Start / Stop Date
Brazos River near Dennis, Texas (USGS 08090800)	15,671	32°36'56" 97°55'32"	1968 / 2006
Lake Granbury near Granbury, Texas (USGS 08090900)[a]	16,113	32°22'27" 97°41'20"	1969 / 2006[b]
Brazos River near Glen Rose, Texas (USGS 08091000)	16,252	32°16'18" 97°39'48"	1923 / 2006
Panter Branch near Tolar, Texas (USGS 08091700)	7.82	32°20'59" 97°51'25"	1966 / 1973
Squaw Creek near Glen Rose, Texas (USGS 08091750)	70.3	32°16'12" 97°43'56"	1973 / 2006
Squaw Creek Reservoir near Glen Rose, Texas (USGS 08091730)	64.0	32°18'00" 97°47'12"	2001 / 2006

a) The Lake Granbury reservoir gauging station (USGS 08090800) was selected as a reference point for gated flow at DeCordova Bend Dam.

b) Dates are for BRA dam releases at DeCordova Bend Dam

(USGS 2007c)

TABLE 2.3-7 (Sheet 1 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR DENNIS, TEXAS
USGS GAUGE STATION NO. 08090800

YEAR	Monthly mean in cfs (Calculation Period From: May 1968 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1968	---	---	---	---	1984	1554	1644	955	235	74	111	73	829
1969	79	187	1455	1910	8391	1412	1312	968	2569	1812	852	835	1815
1970	889	942	3074	843	575	555	603	975	875	491	221	183	852
1971	97	34	27	27	110	62	41	450	2666	2039	836	511	575
1972	472	78	33	249	612	206	93	1979	2175	418	2759	745	818
1973	610	740	1151	1385	696	1302	1405	266	61	561	90	592	738
1974	286	34	105	173	87	200	299	435	367	3300	5000	480	897
1975	768	2357	960	623	631	2948	460	815	629	115	81	116	875
1976	227	136	35	120	724	377	357	423	692	1378	1556	249	523
1977	606	386	2126	1570	2040	345	282	91	162	163	171	132	673
1978	146	122	64	388	136	73	37	7600	370	513	252	110	818
1979	199	157	468	1063	2030	1289	135	184	399	231	79	134	531
1980	155	248	87	75	616	934	613	436	731	4184	319	780	765
1981	673	272	657	291	1066	1932	571	334	198	17,690	1612	280	2131
1982	288	534	290	141	10,020	13,490	4376	470	124	70	259	240	2525
1983	185	278	620	565	1026	561	684	394	348	455	159	754	502
1984	552	221	130	145	60	336	183	73	15	422	219	678	253
1985	1694	563	1731	1569	1804	1768	627	545	345	809	471	237	1014
1986	290	485	219	95	194	2071	965	348	1416	5476	1442	1176	1181
1987	1081	1658	3150	3385	1507	6044	728	166	205	92	103	185	1525

TABLE 2.3-7 (Sheet 2 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR DENNIS, TEXAS
USGS GAUGE STATION NO. 08090800

YEAR	Monthly mean in cfs (Calculation Period From: May 1968 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1988	243	61	110	63	30	390	61	57	46	79	101	179	118
1989	129	583	453	145	5073	4401	366	1091	1587	269	121	484	1225
1990	237	192	2009	13,320	12,090	4489	290	583	1276	601	349	282	2977
1991	447	356	429	227	1055	6571	1073	1195	1177	3032	1232	12,240	2420
1992	2835	9530	5970	1165	1456	8517	1434	796	647	232	345	412	2778
1993	327	721	1093	629	574	791	574	336	337	1538	152	180	604
1994	136	126	113	97	2976	475	399	277	374	525	1217	599	609
1995	326	249	294	673	1415	930	619	2938	954	260	272	243	764
1996	267	176	200	126	60	198	61	659	3680	1055	1792	1495	814
1997	337	8095	3179	2593	3118	3201	1330	699	424	294	123	176	1964
1998	224	253	2229	364	522	341	272	203	146	90	120	100	405
1999	49	29	505	179	200	521	420	568	155	86	36	36	232
2000	33	27	66	94	187	611	123	162	160	55	169	136	152
2001	279	2926	4153	806	449	135	158	280	105	28	42	57	785
2002	149	216	788	384	348	114	631	359	330	470	189	282	355
2003	160	200	211	169	152	253	291	217	181	118	204	138	191
2004	104	245	235	222	255	677	771	950	330	199	3360	840	682
2005	589	544	644	425	287	200	120	3994	856	322	181	188	696
2006	93	108	241	261	774	256	274	198	89	---	---	---	255

TABLE 2.3-7 (Sheet 3 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR DENNIS, TEXAS
USGS GAUGE STATION NO. 08090800

YEAR	Monthly mean in cfs (Calculation Period From: May 1968 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Average of Mean Streamflows by month	428	897	1034	962	1675	1808	633	858	703	1304	700	699	Average of Monthly Mean Streamflows 975
Maximum of Mean Streamflows by Month	2835	9530	5970	13,320	12,090	13,490	4376	7600	3680	17,690	5000	12,240	Average of Maximum Mean Monthly Streamflows 8985
Minimum of Mean Streamflows by Month	33	27	27	27	30	62	37	57	15	28	36	36	Average of Minimum Mean Monthly Streamflows. 34

Notes:
Average of Monthly Mean Streamflows from 1968 to 2006 was approximately 975 cfs.
Average of Maximum Mean Monthly Streamflows from 1968 to 2006 was approximately 8985 cfs.
Average of Minimum Mean Monthly Streamflows from 1968 to 2006 was approximately 34 cfs.

--- - no data collected

(USGS 2007c)

TABLE 2.3-8
MAXIMUM STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR DENNIS, TEXAS
USGS GAUGE STATION NO. 08090800

Water Year	Date	Gage Height	Discharge (cfs)	Water Year	Date	Gauge Height	Discharge (cfs)
1969	May 8, 1969	19.37	41,700	1988	Jun. 04, 1988	8.38	4410
1970	Mar. 03, 1970	15.75	18,000	1989	May 17, 1989	22.4	36,400
1971	Sep. 30, 1971	13.83	12,700	1990	Apr. 27, 1990	31.46	82,300
1972	Aug. 17, 1972	12.7	10,400	1991	Jun. 08, 1991	19.28	22,600
1973	Nov. 03, 1972	16.03	19,100	1992	Dec. 21, 1991	28.06	65,800
1974	Oct. 14, 1973	11.89	8820	1993	Feb. 25, 1993	8.89	4310
1975	Oct. 31, 1974	24	57,100	1994	Oct. 20, 1993	17.9	21,100
1976	May 26, 1976	13.42	11,300	1995	Aug. 02, 1995	18.12	19,000
1977	Mar. 27, 1977	20.59	35,000	1996	Sep. 17, 1996	18.67	23,300
1978	Aug. 10, 1978	25.86	59,300	1997	Feb. 21, 1997	27.86	64,500
1979	May 23, 1979	14.29	13,400	1998	Mar. 17, 1998	17.91	21,600
1980	Sep. 30, 1980	7.12	2910	1999	Mar. 20, 1999	11.9	9940
1981	Oct. 06, 1980	18.09	22,100	2000	Jun. 04, 2000	11.71	8640
1982	Oct. 14, 1981	31.88	96,640	2001	Feb. 16, 2001	18.03	21,500
1983	May 23, 1983	15.15	14,700	2002	Mar. 20, 2002	13.08	11,300
1984	Jun. 06, 1984	9.78	5630	2003	Oct. 19, 2002	8.5	4710
1985	Jan. 01, 1985	13.71	11,700	2004	Jul. 01, 2004	12.36	10,100
1986	Jun. 10, 1986	11.98	8670	2005	Aug. 24, 2005	19.04	22,800
1987	May 29, 1987	17.1	19,500	2006	May 7, 2006	7.68	3370

Notes:
Water Year is recorded from October 1 to September 30
Discharge affected by Regulation or Diversion from 1969 to 2006
(USGS 2007c)

TABLE 2.3-9
MINIMUM DAILY STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR DENNIS, TEXAS
USGS GAUGE STATION NO. 08090800

Water Year	Date	Discharge (cfs)	Water Year	Date	Discharge (cfs)
1969	October 31, 1968	36	1988	August 12, 1988	2.3
1970	July 30, 1970	78	1989	October 11, 1988	17
1971	May 28 and July 20, 1971	3.5	1990	November 18, 1989	60
1972	March 16, 1972	13	1991	April 21, 1991	69
1973	August 28, 1973	18	1992	October 24, 1991	137
1974	July 15, 1974	9.7	1993	September 12, 1993	68
1975	July 24, 1975	42	1994	April 19, 1994	27
1976	April 3, 1976	22	1995	October 16, 1994	112
1977	September 26, 1977	13	1996	August 8, 1996	16
1978	August 2, 1978	1.2	1997	September 29, 1997	120
1979	January 2, 1979	20	1998	September 16, 1998	51
1980	April 9 and 10, 1980	26	1999	March 3, 1999	9.4
1981	April 21, 1981	42	2000	February 11, 2000	16
1982	September 29, 1982	42	2001	September 30, 2001	26
1983	October 21 and 30, 1982	27	2002	October 18, 24, 26, 2001	13
1984	September 12, 1984	6.1	2003	May 17, 2003	31
1985	October 2 to 5, 1984	13	2004	February 11, 13, 21, 2004	31
1986	April 19, 1986	13	2005	August 1 and 2, 2005	47
1987	August 26, 1987	37	2006	September 30, 2006	35

Notes:
Water Year is recorded from October 01 to September 30
Discharge affected by Regulation or Diversion from 1969 to 2006
(USGS 2007c)

TABLE 2.3-10
LOW FLOW VALUES (CFS) FOR 1, 7, AND 30 DAYS FOR SELECTED RETURN PERIODS FOR THE BRAZOS RIVER NEAR DENNIS, TEXAS

	Return Period, Years			
Duration, Days	5	10	100	1000
1	16.5	11.8	5.1	2.7
7	20.4	14.7	6.5	3.5
30	31.6	22.4	9.7	5.2

Source: Low flow based on statistical analysis of data for USGS gauge on the Brazos River near Dennis, Texas (USGS 08090800) from 1968 to 2007. U.S. Geological Survey, National Water Information System: Web Interface, USGS Surface-Water Data for the Nation, Website, http://waterdata.usgs.gov/usa/nwis/sw, accessed November 2007.

(USGS 2007c)

TABLE 2.3-11 (Sheet 1 of 3)
MONTHLY MEAN DISCHARGE (CFS) AT DECORDOVA BEND DAM - LAKE GRANBURY
FROM OCTOBER 1969 TO SEPTEMBER 2006

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average of Monthly Mean Discharges
1969	---	---	---	---	---	---	---	---	---	865.4	973.2	1007.7	948.8
1970	875.5	1065.1	3495.7	952.6	604.2	360.3	475.81	722.6	677.17	310.3	303.60	199.7	836.9
1971	37.46	29.88	31.09	51.5	191.0	256.5	325.97	48.6	2021.77	2188.7	809.8	828.3	568.4
1972	274.5	124.07	127.45	214.00	592.03	150.77	48.13	1605.48	2688.77	472.26	2741.37	727.87	813.9
1973	523.65	803.64	1231.84	1672.20	749.71	1164.97	1133.29	550.98	94.00	806.45	133.77	492.61	779.8
1974	292.26	49.93	30.45	17.23	190.29	366.28	453.74	81.92	327.50	2732.69	6715.65	451.72	975.8
1975	811.70	3130.81	1063.22	1025.04	836.75	3884.35	431.38	1007.18	820.51	72.05	58.15	58.01	1099.9
1976	216.32	170.42	61.28	224.31	1001.00	551.10	459.45	414.60	867.34	1722.11	2179.87	468.82	694.7
1977	860.23	512.56	2692.79	1428.87	2046.93	291.55	61.93	59.59	73.44	78.01	79.14	78.45	688.6
1978	77.25	78.38	78.50	122.76	191.62	348.10	31.17	7229.27	232.62	423.66	167.99	72.83	754.5
1979	228.55	97.61	411.35	1645.11	3879.64	1302.37	66.81	182.61	308.25	274.57	59.39	195.53	721.0
1980	182.54	242.70	116.72	70.58	658.45	884.86	569.59	313.00	179.91	3860.88	293.00	809.92	681.8
1981	692.86	287.30	770.48	465.17	886.76	1809.49	492.40	192.20	126.33	16379.87	1890.27	334.00	2027.3
1982	359.45	623.13	400.72	159.67	10089.29	19268.71	4455.67	288.81	72.01	31.15	143.33	222.30	3009.5
1983	155.26	228.67	552.86	503.78	1168.32	567.63	537.81	278.79	164.53	317.09	115.49	729.92	443.3
1984	533.31	30.73	138.22	218.02	410.30	164.70	23.37	29.22	24.37	81.44	311.10	630.15	216.2
1985	2062.99	681.06	2283.51	2315.75	1942.29	1915.27	600.62	518.61	291.10	944.68	402.22	168.19	1177.2
1986	211.85	570.20	191.43	88.76	347.56	2663.97	986.13	252.46	1658.79	5499.86	1430.82	1095.68	1249.8
1987	1033.98	1897.19	3237.07	3531.09	1932.13	6697.55	638.55	62.73	101.44	31.69	88.25	107.66	1613.3
1988	246.90	30.63	97.96	31.66	31.66	447.29	30.26	18.93	15.45	20.19	22.14	25.06	84.8
1989	23.12	549.98	846.72	176.74	6179.43	5495.33	167.23	910.80	1694.97	264.68	67.53	376.87	1396.1
1990	127.35	259.06	2748.29	14737.37	14123.59	5215.10	243.64	537.17	1343.81	616.85	353.19	356.73	3388.5
1991	760.45	433.46	492.21	360.87	1558.60	7598.82	818.22	1526.41	1641.98	4644.75	1797.15	13347.76	2915.1

TABLE 2.3-11 (Sheet 2 of 3)
MONTHLY MEAN DISCHARGE (CFS) AT DECORDOVA BEND DAM - LAKE GRANBURY
FROM OCTOBER 1969 TO SEPTEMBER 2006

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average of Monthly Mean Discharges
1992	4189.06	12001.27	7682.89	1921.37	1976.54	9215.62	1565.21	716.64	571.82	81.15	300.22	523.40	3395.4
1993	383.08	1136.64	1409.87	748.82	637.32	782.62	315.70	107.01	246.80	1801.20	129.22	258.13	663.0
1994	176.61	143.97	95.49	104.84	3477.63	576.56	323.50	152.62	610.41	745.43	1766.83	977.32	762.6
1995	528.21	341.71	646.80	753.11	2216.13	1191.79	730.44	3467.40	1110.47	145.06	227.36	250.62	967.4
1996	281.50	176.29	114.71	94.53	27.87	27.95	27.78	641.77	4201.56	1015.53	2339.47	1743.67	891.1
1997	624.67	9308.43	3865.24	3344.86	4409.56	3471.11	1174.64	940.47	490.56	361.34	193.85	349.80	2377.9
1998	608.34	689.83	3439.85	557.98	661.94	367.39	257.59	53.25	27.82	27.76	27.88	102.39	568.5
1999	27.94	27.88	424.13	166.55	98.25	515.26	250.56	400.50	28.00	27.95	27.87	27.72	168.5
2000	27.59	27.49	27.49	27.58	27.61	1013.45	63.90	27.72	27.62	27.42	27.78	28.15	112.8
2001	456.76	4494.03	5293.12	825.57	364.62	29.87	44.86	44.84	45.10	44.75	44.54	32.63	976.7
2002	27.49	27.78	1328.33	606.57	672.63	101.44	642.59	132.26	148.11	538.11	104.98	257.96	382.4
2003	84.58	445.19	344.85	108.51	100.55	174.65	119.13	96.12	225.10	183.89	139.88	58.38	173.4
2004	27.97	396.08	287.50	253.94	402.18	1965.59	957.97	1070.03	290.62	177.59	4053.13	1126.81	917.5
2005	783.09	799.49	964.45	517.50	220.68	77.37	72.32	3897.03	862.34	218.34	154.33	120.88	724.0
2006	90.00	81.27	531.60	209.41	863.94	140.60	184.92	102.71	74.31	27.54	62.99	27.79	199.8

TABLE 2.3-11 (Sheet 3 of 3)
MONTHLY MEAN DISCHARGE (CFS) AT DECORDOVA BEND DAM - LAKE GRANBURY
FROM OCTOBER 1969 TO SEPTEMBER 2006

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average of Monthly Mean Discharges
													Average of Mean Monthly Discharges
Average of monthly Mean Discharges	497	1105	1251	1059	1686	2078	507	735	625	1264	807	754	1031
													Average of Maximum Mean Monthly Discharges
Maximum of Mean Discharges by Month	4189	12,001	7683	14,737	14,124	19,269	4456	7229	4202	16,380	6716	13,348	10,361
													Average of Minimum Mean Monthly Discharges.
Minimum of Mean Discharges by Month	23	27	27	17	28	28	23	19	15	20	22	25	23

Notes:
Average of Monthly Mean Discharges from 1968 to 2006 was approximately 1031 cfs.
Average of Maximum Mean Monthly Discharges from 1969 to 2006 was approximately 10,361cfs.
Average of Minimum Mean Monthly Discharges from 1969 to 2006 was approximately 23 cfs.
--- - no data collected

TABLE 2.3-12
MAXIMUM DISCHARGES (CFS) AT DECORDOVA BEND DAM - LAKE GRANBURY

Water Year[(a)]	Date	Discharge (cfs)	Water Year[(a)]	Date	Discharge (cfs)
1969			1988	June 2, 1988	3970
1970	March 5, 1970	16,753	1989	May 17, 1989	38,363
1971	September 2, 1971	8510	1990	April 27, 1990	72,501
1972	October 1, 1971	8611	1991	June 10, 1991	23,794
1973	November 5, 1972	11,728	1992	December 21, 1991	60,734
1974	October 15, 1973	7979	1993	February 25, 1993	5060
1975	November 1, 1974	45,692	1994	October 20, 1993	20,573
1976	May 27, 1976	10,699	1995	August 2, 1995	24,546
1977	March 28, 1977	44,637	1996	September 17, 1996	19,363
1978	August 10, 1978	40,551	1997	February 22, 1997	51,355
1979	May 4, 1979	21,899	1998	March 16, 1998	28,708
1980	May 31, 1980	3167	1999	March 20, 1999	5374
1981	October 5, 1980	15,948	2000	June 4, 2000	13,458
1982	October 15, 1981	72,585	2001	February 17, 2001	22,619
1983	May 23, 1983	12,195	2002	March 21, 2002	11,374
1984	January 26, 1984	2401	2003	October 19, 2002	4198
1985	January 1, 1985	10,148	2004	June 9, 2004	22,557
1986	June 10, 1986	7923	2005	August 24, 2005	20,617
1987	March 1, 1987	17,456	2006	March 19, 2006	6228

a) Water Year is recorded from October 1 to September 30

TABLE 2.3-13 (Sheet 1 of 4)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Year	Monthly mean in cfs (Calculation Period From: October 1940 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1940	---	---	---	---	---	---	---	---	---	102	3217	2284	1868
1941	517.4	3487	1128	703.9	15,840	13,050	1032	1804	1562	12,500	3784	598.2	4667
1942	678.1	235.6	172.1	13,440	6378	4634	406.1	366.8	2918	7253	1069	510.6	3172
1943	664.7	1268	1688	1501	837.9	1124	872.5	700.6	310.5	123.5	52.5	96.8	770
1944	221.1	719.3	577.3	225.3	2200.0	388.8	393.9	596.7	713.1	341.4	487.9	480.4	612
1945	721.5	1845	2943	2498	973.9	820.5	2374	651.7	403.1	1218	219.8	338.3	1251
1946	1237	1259	395.4	449.8	1016	743.9	608.2	810.9	1865	2962	2858	2521	1394
1947	1240.0	731.7	933.5	686	4654	1649	685.4	641.9	671.3	463.8	280.7	948.7	1132
1948	726.9	1295	658.9	442.4	805.8	744.9	785.3	908.6	597.6	190.5	212.6	211.3	632
1949	249.8	739.5	896.5	421.6	5985	4522	996.4	909.4	1171	1666	635.9	340.2	1544
1950	308.9	647.1	355.5	888.5	1230.0	1387	3500.0	2192	2745	1070.0	357.5	407.1	1257
1951	602.6	541.9	179.8	190.4	671.7	1447	1296	1080.0	702	331.9	256.7	217.9	626
1952	274.4	131.7	64.8	250	890.5	369.6	828.3	771.2	64.8	7.42	201.8	94.6	329
1953	61.2	16.7	53.1	116.6	587	145.6	719.9	540.2	568.6	1515	1077	360	480
1954	238.7	168.9	317.1	737.2	5627	2139	856.8	935.2	123.2	162.8	117.3	44.5	956
1955	179.3	126.8	97.2	116.9	2019	3549	875.1	700.5	4830.0	8704	438.6	200.8	1820
1956	453.6	627.9	798.9	556.2	2005	394	1103	604.9	58.8	156.5	150.2	699.4	634
1957	313.7	789.5	297.8	6811	44,800	9221	1078	448.4	543.2	2831	2816	1070.0	5918
1958	873.6	694	931.9	895.9	6944	1012	4464	1001	486.8	557.5	402.8	298.6	1547
1959	215.1	156.2	84	135.6	157.5	990.8	2181	367.1	141.5	8162	458.5	477.2	1127
1960	1437	1260.0	432.2	418.4	563.7	222.4	2024	555.7	414.9	2495	1288	676.5	982
1961	1173	840	1150.0	745	254.5	3087	3675	1505	833.8	1013	332.6	499.1	1259
1962	422.5	346	360	330.2	98.5	2438	4066	2377	7263	1663	922.6	1192	1790

TABLE 2.3-13 (Sheet 2 of 4)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Year	Monthly mean in cfs (Calculation Period From: October 1940 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1963	861.1	405.4	282.2	1,009	1,205	3,780.0	1,095	638.2	288.7	128.4	115.7	99	826
1964	125.6	343.3	236.5	215.8	107.4	289	546.3	590	881.6	170.1	1,099	144.2	396
1965	371.5	789.7	238.7	453.7	5,723	587.8	498.1	526.1	794.6	308.8	308.1	321.3	910
1966	203.6	310.4	412.8	1,308	7,354	1,024	504.8	408.9	9,994	1,150.0	102.7	308.2	1,923
1967	179.7	132.8	85.1	443	234.6	1,601	2,585	791.3	462.3	245.9	300.6	217.8	607
1968	3,180.0	1,583	4,235	2,970.0	3,385	1,658	1,784	1,028	269.6	104.7	139	105.5	1,703
1969	85.8	223.8	1,229	2,254	9,840.0	1,724	1,185	1,048	1,163	539	808.2	980.3	1,757
1970	805.9	950.4	2,921	946.6	714.9	255.4	398	594.3	736.9	283.5	268.1	233	759
1971	49.7	39.4	40.8	65.6	192.6	225.6	308.8	48	2,228	2,432	893.8	1,272	650
1972	429.5	168.3	139	218.3	590.1	144.8	51.3	1,911	2,957	522.5	2,883	782.9	900
1973	687.5	975.1	1,445	2,412	999.2	1,739	1,660.0	510.5	96.3	710.1	134.9	623.6	999
1974	307.9	50.5	34.3	9.99	135.4	349.1	443	98.3	402.9	3,268	6,209	428.4	978
1975	791.9	3,262	1,138	1,170.0	871.7	3,928	432.1	1,001	830.2	90.8	78.1	81.1	1,140
1976	227.9	147	77.4	315.4	1,072	508.1	401.8	364.3	735.2	1,534	1,629	433.6	620
1977	645.2	442.5	2,941.0	1,315	1,678	231.1	23.9	21.4	36	56	56.5	68.4	626
1978	68.8	78.3	78.1	111.4	133.4	336.6	12.1	6,621	385.8	393.9	118.6	61	700
1979	237.2	77.8	565.6	1,572	4,170.0	1,460.0	58.1	151	309.4	262.5	55.7	179.2	758
1980	192.1	268.7	114.9	87.3	577.5	762.2	541.5	280.3	88.9	4,214	280.5	808.8	685
1981	709.8	296	741.1	424.3	940.6	2,048	463.8	195.9	99.8	17,860	2,222	337.1	2,195
1982	354.9	650.1	444.8	165.2	11,290	13,660	4,873	285	69.8	60.4	171.3	230.5	2,688
1983	169.2	242.1	539.5	452.6	1195	580.7	449.5	204.9	180.9	349	87.8	973.6	452
1984	682.7	15.9	157.9	171.9	410.4	208.8	21.6	17.2	20.7	108.3	293.7	540.5	221
1985	1956	572.8	2053	1927	1905	1954	559.5	541	471.6	879.9	380	196.2	1116

TABLE 2.3-13 (Sheet 3 of 4)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Year	Monthly mean in cfs (Calculation Period From: October 1940 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1986	241.5	562.6	225.4	109	429.9	2818	1035	313.8	1691	5477	1487	1188	1298
1987	1223	1952	3727	3616	2036	6815	720.4	72.4	109.1	34.8	115.2	169.3	1716
1988	267	58.2	143.5	45	30.5	430.6	45	22.7	22.2	22.3	13.7	25.1	94
1989	34.4	564.6	1016	235.7	6824	5856	178	914	1389	275.5	116.9	313	1476
1990	170.4	348.6	2554	14,360	13,920	4813	229.7	690	1203	533.9	360.4	283.3	3289
1991	646.8	428	388.1	481.8	1241	7841	678.8	1186	1337	4564	1869	14,960	2968
1992	3099	11,290	6684	956.9	1200.0	8111	1259	782.9	691.9	95.2	396.7	601.8	2931
1993	412.1	1138	1306	759	609.6	762.3	274.5	97.6	218	1793	128.8	233.2	644
1994	182.5	119.3	148.8	106.1	3246	612.7	354.8	125.6	577	760.7	1603	1142	748
1995	550.4	224	665.8	855.7	746.4	1007	339.3	3404	1043	181.2	237.7	254.8	792
1996	327.2	210.9	124.1	107	15.7	17.5	21.9	558.4	3828	1101	2160.0	2012	874
1997	508.4	9825	4851	4084	3707	2994	1524	705.6	464.7	312	107.1	336.3	2452
1998	567.9	822.4	3778	514.6	725.7	371	228.5	53.5	15.9	30.7	89.4	198.2	616
1999	52.1	42.9	357.9	117.5	77.6	599.4	246	504.6	25.9	30.4	21.6	32.8	176
2000	32.1	29.1	34.7	21.6	18.3	1196	44.6	12.3	17.8	48.5	64.8	77.9	133
2001	393	4336	5462	1690.0	803.2	116	58.1	42.8	42.5	28.7	12.6	25.6	1084
2002	27.1	55.1	1092	963.4	867.8	67	516.5	87.7	142.5	357.9	86.4	188.2	371
2003	96.4	323.9	348.1	116.2	62.5	177	71.3	58.6	161.6	159.8	157.6	63.5	150
2004	32.7	353	353.2	269.6	386.8	1924	919.7	821.9	253.8	152.4	3327	1052	821
2005	776.5	738.4	1013	479	156.5	93.4	64.3	3149	800.4	196.5	128.9	101.9	641
2006	77.5	86.2	601.3	179.4	874.7	91.6	128.9	68.9	59.3	---	---	---	241

TABLE 2.3-13 (Sheet 4 of 4)
MONTHLY MEAN STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Year	Monthly mean in cfs (Calculation Period From: October 1940 to September 2006)												Average of Monthly Mean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
													Average of Mean Monthly Streamflows
Average of Mean Streamflows by Month	543	962	1054	1252	2989	2119	949	788	1009	1626	799	716	1234
													Average of Maximum Mean Monthly Streamflows.
Maximum of Mean Streamflows by Month	3180	11,290	6684	14,360	44,800	13,660	4873	6621	9994	17,860	6209	14,960	12,874
													Average of Minimum Mean Monthly Stramflows Min.
Minimum of Mean Streamflows by Month	27	16	34	10	16	18	12	12	16	7	13	25	17

Notes:
Average of Mean Monthly Streamflows from 1940 to 2006 was approximately 1234 cfs.
Average of Maximum Mean Monthly Streamflows from 1940 to 2006 was approximately 12,874 cfs.
Average of Minimum Mean Monthly Streamflows from 1940 to 2006 was approximately 17 cfs.
--- - no data collected
(USGS 2007c)

TABLE 2.3-14 (Sheet 1 of 2)
MAXIMUM STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Water Year[(a)]	Date	Gage Height	Discharge	Water Year[(a)]	Date	Gage Height	Discharge	Water Year[(a)]	Date	Gage Height	Discharge
1924	Oct. 17, 1923	13	37,500	1952	May 24, 1952	14.19	27,900	1980	Sep. 30, 1980	8.28	2990
1925	May 8, 1925	15.1	45,700	1953	May 17, 1953	5.21	5920	1981	Oct. 05, 1980	16.56	18,100
1926	Jun. 21, 1926	13.2	38,300	1954	May 15, 1954	17.34	25,600	1982	Oct. 15, 1981	35.19	86,400
1927	Oct. 19, 1926	14	41,400	1955	Sep. 30, 1955	19.74	42,300	1983	May 24, 1983	16.4	17,700
1928	May 20, 1928	10.4	27,700	1956	Oct. 09, 1955	15.78	30,600	1984	Jan. 26, 1984	8.14	3220
1928	Sep. 12, 1929	13.42	38,400	1957	May 27, 1957	33.89	87,400	1985	Jan. 02, 1985	14.44	14,200
1930	Jun. 17, 1930	19.6	68,300	1958	May 2, 1958	21	36,100	1986	Sep. 02, 1986	12.65	10,600
1931	Oct. 07, 1930	12.18	31,700	1959	Jul. 08, 1959	11.5	8900	1987	May 29, 1987	17.25	20,900
1932	Sep. 10, 1932	16.37	49,300	1960	Oct. 05, 1959	28.1	65,500	1988	Jun. 02, 1988	8.49	3790
1933	May 27, 1933	13.19	36,600	1961	Jun. 19, 1961	16.8	21,700	1989	May 18, 1989	27.08	53,300
1934	Mar. 04, 1934	4.11	5240	1962	Jul. 29, 1962	25.32	50,500	1990	Apr. 28, 1990	35.76	79,800
1935	May 18, 1935	23.68	97,600	1963	Apr. 30, 1963	13.37	13,100	1991	Jun. 10, 1991	19.17	28,300
1936	Sep. 27, 1936	19.42	67,300	1964	Sep. 22, 1964	11.01	8110	1992	Dec. 21, 1991	34	89,600
1937	Jun. 09, 1937	9.93	22,200	1965	May 20, 1965	17.43	23,500	1993	Dec. 14, 1992	11.5	7800
1938	Mar. 29, 1938	15.12	45,200	1966	May 3, 1966	25.9	49,800	1994	Oct. 20, 1993	18.1	23,400
1939	Jun. 23, 1939	9.85	22,600	1967	Jul. 22, 1967	14.19	15,000	1995	Aug. 03, 1995	21.21	32,200
1940	Aug. 19, 1940	13.62	38,300	1968	Mar. 21, 1968	19.01	28,400	1996	Sep. 17, 1996	17.65	22,100
1941	Nov. 25, 1940	14.9	44,200	1969	May 9, 1969	21.2	35,700	1997	Feb. 22, 1997	28.99	61,300
1942	Apr. 26, 1942	19.23	66,400	1970	Dec. 30, 1969	16.65	21,300	1998	Mar. 16, 1998	25.8	48,200
1943	Oct. 18, 1942	17.47	54,100	1971	Sep. 02, 1971	12.66	11,400	1999	Mar. 21, 1999	11.41	7650
1944	May 2, 1944	10.21	24,100	1972	Oct. 20, 1971	13.05	12,200	2000	Jun. 04, 2000	17.46	21,600
1945	Mar. 30, 1945	13.85	39,200	1973	Apr. 23, 1973	13.61	13,600	2001	Feb. 17, 2001	18.47	24,400
1946	Sep. 27, 1946	8.24	11,500	1974	Oct. 15, 1973	11.94	9190	2002	Mar. 21, 2002	15.18	15,100
1947	Dec. 12, 1946	16.89	38,900	1975	Nov. 01, 1974	25.42	46,800	2003	Sep. 19, 2003	11.73	5170

TABLE 2.3-14 (Sheet 2 of 2)
MAXIMUM STREAMFLOW (CFS) OF THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091000

Water Year[(a)]	Date	Gage Height	Discharge	Water Year[(a)]	Date	Gage Height	Discharge	Water Year[(a)]	Date	Gage Height	Discharge
1948	Feb. 25, 1948	8.68	12,500	1976	May 26, 1976	15.2	16,000	2004	Jun. 09, 2004	25.71	42,700
1949	May 17, 1949	26.7	74,000	1977	Mar. 27, 1977	25.88	48,500	2005	Aug. 25, 2005	18	18,100
1950	Jul. 28, 1950	11.92	20,700	1978	Aug. 11, 1978	24.7	41,200	2006	Mar. 19, 2006	14.88	11,200
1951	Jun. 18, 1951	5.05	5680	1979	May 4, 1979	27.6	55,400				

a) Water Year is recorded from October 1 to September 30
Discharge affected by Regulation or Diversion for Water Years 1941 - 2006, Source: USGS website, (USGS 2007c)

TABLE 2.3-15
LOW FLOW VALUES (CFS) FOR 1, 7, AND 30 DAYS FOR SELECTED RETURN PERIODS FOR THE BRAZOS RIVER NEAR GLEN ROSE, TEXAS

	Return Period, Years			
Duration, Days	5	10	100	1000
1	4.9	3.3	1.2	0.5
7	8.9	6.3	2.7	1.4
30	16.9	11.4	4.7	2.6

Source: Low flow based on statistical analysis of data for USGS gauge on the Brazos River near Glen Rose, Texas (USGS 08091000) from 1969 to 2007.
U.S. Geological Survey, National Water Information System: Web Interface, USGS Surface-Water Data for the Nation, Website, http://waterdata.usgs.gov/usa/nwis/sw, accessed November 2007.

(USGS 2007c)

TABLE 2.3-16
MAXIMUM STREAMFLOW (CFS) OF PANTER BRANCH NEAR TOLAR, TEXAS
USGS GAUGE STATION NO. 08091700

Water Year[a]	Date	Gauge Height	Discharge (cfs)
1966	Apr. 29, 1966	14.49	880
1967	20-May-67	16.9	1650
1968	9-May-68	21.7	3650
1969	7-May-69	13.5	610
1970	Oct. 11, 1969	13.61	640
1971	Jul. 29, 1971	14.53	890
1972	Sep. 16, 1972	21.88	3750
1973	Apr. 23, 1973	17.72	1990
1974	Oct. 30, 1973	10.2	5

a) Peak streamflow data only was available for this USGS station.

(USGS 2007c)

TABLE 2.3-17 (Sheet 1 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF SQUAW CREEK NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091750

Year	Monthly mean in cfs (Calculation Period From: October 1977 to September 2006)												Average of MonthlyMean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1977	---	---	---	---	---	---	---	---	---	2.44	3.9	2.36	3
1978	2.56	2.46	1.61	1.78	2.39	1.28	1.59	1.62	2.2	2.16	2.47	4.18	2
1979	5.79	3.79	6.59	4.59	56.9	34.2	3.89	5.03	4.39	4.04	3.72	3.83	11
1980	3.56	2.99	3.73	3.81	6.07	5.83	2.93	5.12	3.83	3.5	3.28	3.46	4
1981	6.82	6.79	4.86	4.14	4.1	5.06	5.91	5.49	3.67	7.25	4.17	4.39	5
1982	4.67	3.82	3.95	4.87	111.6	77.6	29.5	3.92	3.91	3.47	3.64	3.55	21
1983	4.23	4.49	4.11	3.92	5.73	4.65	3.69	3.01	3.19	4.51	4.03	3.78	4
1984	3.61	5.1	7.27	3.84	4.39	4.2	3.27	3	3.85	5.37	3.65	5.77	4
1985	4.45	5.48	5.07	5.05	4.1	4.43	3.86	5.57	5.75	7.99	4.38	4.4	5
1986	3.69	4.77	4.44	3.79	9.9	60.7	4.76	4.27	14.8	4.94	4.94	5.59	11
1987	6.72	19.7	71.1	3.84	97.7	170.7	8.81	4.34	3.9	3.62	4.24	4.76	33
1988	4.31	4.08	4.61	5.41	6.52	9.28	4.97	6.67	10	7.79	3.22	5.42	6
1989	8.01	10.2	124.1	129.7	336	361.8	12.6	10.7	12.4	12.2	13.6	13.5	87
1990	13.5	14	64.8	168.7	312.9	19.5	4.69	5.33	3.77	4.8	4.02	4.29	52
1991	4.21	4.14	3.23	3.88	4.4	26.3	3.9	9.76	3.52	109.8	81.5	416	56
1992	66	161.6	132.4	32.3	32.1	36.3	2.19	1.47	4.72	1.54	1.95	2.79	40
1993	2.83	5.55	7.78	13.9	12	10.5	3.7	4.25	4.12	4.04	6.73	4.42	7
1994	2.3	3.08	2.56	2.08	3.75	2.48	3.09	2.55	1.91	3.16	3.51	2.87	3
1995	3.26	2.96	3.89	4.04	7.14	35.5	36	142.6	4.81	4.41	4.46	3.81	21
1996	4.16	2.96	1.84	2.53	2.9	3.44	3.05	13.9	31.1	3.95	4.21	3.9	6
1997	3.85	123.4	82.2	44	75.9	4.35	2.99	2.29	2.54	2.72	2.68	2.68	29
1998	1.62	9	86.8	7.53	4.25	3.68	3.43	2.6	2.84	3.38	5.96	5.43	11
1999	3.06	2.42	3.19	7.96	22.8	13.2	5.72	5.77	6.08	3.27	3.42	4.41	7

TABLE 2.3-17 (Sheet 2 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF SQUAW CREEK NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091750

Year	Monthly mean in cfs (Calculation Period From: October 1977 to September 2006)												Average of MonthlyMean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2000	4.92	4.71	4.84	4.86	4.56	136.3	3.95	6.37	5.77	18.4	37.9	14	21
2001	48	42.1	54.7	10.9	5.89	19.3	21.1	16.5	37.8	25.2	37.2	28.5	29
2002	23.2	9.08	27.3	35.8	31.6	16.3	34.6	18.9	30.4	61.9	57.4	68.9	35
2003	49	7.82	5.84	6.62	13.3	43.6	15.7	43.5	41.2	19.2	6.31	12.1	22
2004	32.6	35.1	66.8	76.6	61.4	190	32.8	25	32.4	26.6	40.5	38.4	55
2005	15.1	5.59	5.03	4.78	4.69	4.56	5.04	14.6	22.5	25.8	32.7	4.65	12
2006	6.97	8.33	14.4	15.3	25.4	24.5	12.3	6.51	19	---	---	---	15

TABLE 2.3-17 (Sheet 3 of 3)
MONTHLY MEAN STREAMFLOW (CFS) OF SQUAW CREEK NEAR GLEN ROSE, TEXAS
USGS GAUGE STATION NO. 08091750

Year	Monthly mean in cfs (Calculation Period From: October 1977 to September 2006)												Average of MonthlyMean Streamflows
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
													Average of Mean Monthly Streamflows
Average of Mean Streamflows by Month	12	18	28	21	44	46	10	13	11	13	13	24	21
													Average of Maximum Mean Monthly Streamflows
Maximum of Mean Streamflows by Month	66	162	132	169	336	362	36	143	41	110	82	416	171
													Average of Minimum Mean Monthly Streamflows
Minimum of Mean Streamflows by Month	2	2	2	2	2	1	2	1	2	2	2	2	2

Notes:
Average Mean Streamflow from 1977 to 2006 was approximately 21 cfs
Average Maximum Stream Discharge from 1977 to 2006 was approximately 171 cfs
Average Minimum Stream Discharge from 1977 to 2006 was approximately 2 cfs
--- - no data collected
(USGS 2007c)

TABLE 2.3-18
MAXIMUM STREAMFLOW (CFS) OF SQUAW CREEK NEAR GLEN ROSE, TEXAS USGS GAUGE STATION NO. 08091750

Water Year[(a)]	Date	Gage Height	Discharge (cfs)	Water Year[(a)]	Date	Gauge Height	Discharge (cfs)
1974	Oct. 12, 1973	5.42	730	1991	Aug. 14, 1991	6.52	1470
1975	Apr. 08, 1975	11.9	9030	1992	Dec. 20, 1991	11.79	8820
1976	May 25, 1976	10.53	3170	1993	Jun. 26, 1993	3.03	71
1977	Mar. 27, 1977	6.16	1200	1994	May 12, 1994	3.11	76
1978	May 11, 1978	3.9	108	1995	Jul. 31, 1995	6.95	1670
1979	May 3, 1979	9.1	4290	1996	Aug. 30, 1996	5.2	561
1980	May 14, 1980	3.89	65	1997	Feb. 20, 1997	6.02	953
1981	Jul. 04, 1981	4.44	220	1998	Mar. 16, 1998	9.54	5000
1982	Apr. 15, 1982	5.23	486	1999	Nov. 13, 1998	4.87	441
1983	May 23, 1983	5.17	520	2000	Jun. 04, 2000	9.09	4280
1984	Mar. 23, 1984	5.31	619	2001	Oct. 29, 2000	4.93	403
1985	Oct. 20, 1984	4.75	373	2002	Mar. 19, 2002	7.02	1730
1986	May 8, 1986	6.3	1350	2003	Sep. 19, 2003	3.8	145
1987	Jun. 12, 1987	7.42	2230	2004	Jun. 09, 2004	10.47	2640
1988	Jun. 01, 1988	4.54	309	2005	Nov. 24, 2004	3.2	149
1989	Jun. 13, 1989	11.85	8940	2006	May 6, 2006	2.87	111
1990	May 3, 1990	9.9	5630				

a) Discharge is an Estimate for Water Years 1974 - 1978
Discharge affected by Regulation or Diversion for Water Years 1978 - 2006

(USGS 2007c)

TABLE 2.3-19
MINIMUM DAILY STREAMFLOW (CFS) OF SQUAW CREEK NEAR GLEN ROSE USGS GAUGE STATION NO. 08091750

Water Year[a]	Date	Gauge Height	Discharge (cfs)	Water Year[a]	Date	Gauge Height	Discharge (cfs)
1977	--	--	--	1992	July 30, 1992	--	0.89
1978	Jun 23,25,30-1978	--	0.89	1993	October 26, 1992	--	0.64
1979	Dec 11,12,13-1978	--	1.10	1994	August 19, 1994	--	0.74
1980	Feb 19,21 & Jul 17,21,1980	--	2.20	1995	August 1-2, 1994	2.22	1.90
1981	Nov 3-5 & Dec 4-5, 1980	--	2.70	1996	August 5, 1996	2.18	0.54
1982	October 15, 1981	--	2.50	1997	July 29, 1997	1.92	1.20
1983	SEP 1-6, 1983	--	2.20	1998	December 25, 1997	2.03	0.69
1984	August 15, 1984	--	1.60	1999	July 25, 1999	1.96	1.20
1985	May 4-5, 1985	--	1.70	2000	November 21, 1999	2.14[b]	2.70
1986	July 16, 1986	--	2.60	2001	October 12-13, 2000	2.08[b]	2.50
1987	Apr 27 - May 3, 1987	--	1.70	2002	June 12, 2002	2.07[b]	2.00
1988	October 16, 1987	--	1.90	2003	May 21, 2003	2.00	1.90
1989	November 27, 1988	--	1.90	2004	December 1, 2003	2.02	3.10
1990	August 28-31, 1990	--	3.20	2005	May 18, 2005	1.70	0.59
1991	August 16-18 & 29, 1991	--	1.40	2006	December 14, 2005	1.75	1.30

a) Water Year is recorded from October 1 to September 30

b) Provisional Data

-- no data

(USGS 2007c)

TABLE 2.3-20
STREAMFLOW RETENTION TIME CALCULATIONS BETWEEN
MORRIS SHEPPARD DAM AND DECORDOVA BEND DAM

Flow Conditions	Travel Time (days) to River Mile 0	Travel Time (Days) to River Mile 20.2	Travel Time (Days) to River Mile 97.7	Travel Time (Days) to River Mile 145
500 cfs	0	0.54	2.8	3.8
10 - 20 K cfs	0	0.5	1.7	2.1
30 K cfs	0	0.3	1.2	1.5

TABLE 2.3-21
MINIMUM RELEASES AT MORRIS SHEPPARD DAM (POSSUM KINGDOM LAKE)

Reservoir Elevation (ft)	March 1 through June 30 (cfs)	July 1 through September 30 (cfs)	October 1 through February 28/29 (cfs)
1000 – 994.5	100	75	50
994.5 – 990.0	50	37.5	25
below 990.0	[a]20	[a]20	[a]20

a) This quantity is the assumed leakage through the dam and its appurtenant structures.

TABLE 2.3-22 (Sheet 1 of 2)
TEMPERATURE MEASUREMENTS FOR LAKE GRANBURY

Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
117	69.3	68.2	65.3	63.3	61.7	61.6
118	69.7	68.2	65.7	64.1	61.9	61.2
119	69.8	67.7	66.2	64.7	62.4	60.9
120	68.4	67.3	67	U/O	U/O	U/O
121	69.5	67.1	66.6	U/O	U/O	U/O
122	69.4	67.2	65.9	64.8	62.2	61.1
123	69.2	67.9	65.7	63.5	62.5	61.9
124	69.8	69	65.8	64	U/O	U/O
125	69.8	67.7	65.8	63.7	62	U/O
126	69.7	67.4	65.9	65.4	62.4	61.2
127	69.2	66.7	U/O	U/O	U/O	U/O
128	69.8	67.2	65.7	65.1	62.6	U/O
129	70	67.8	65.8	65.1	62.8	61.3
130	69.8	68	65.5	64	U/O	U/O
131	69.8	67.8	65.6	65.4	62.7	61.3
132	69.7	67.3	65.8	U/O	U/O	U/O
133	69.1	66.8	66.2	U/O	U/O	U/O
134	69.8	67.8	65.6	65	63.1	61.1
135	70.1	69.5	65.7	64.1	U/O	U/O
136	70.2	68.7	65.7	65.3	63	61.8
137	69.2	67.2	65.5	U/O	U/O	U/O

TABLE 2.3-22 (Sheet 2 of 2)
TEMPERATURE MEASUREMENTS FOR LAKE GRANBURY

Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
138	69.9	68.5	65.5	65.2	63.1	61.2
139	70.2	68.8	65.7	65.5	64.1	61.8
140	70.2	68.9	65.5	65.6	U/O	U/O
141	70.1	67.7	U/O	U/O	U/O	U/O
142	70	68.8	66.4	U/O	U/O	U/O
143	71.1	69.2	65.9	66.4	63.4	61.8
144	71.1	66.8	65.5	65.2	U/O	U/O
145	71.4	70.2	U/O	U/O	U/O	U/O
146	71.5	69.3	66	66.8	63.1	62.1
Average Temperature	69.89	68.02	65.83	64.87	62.69	61.45

Notes:
Waypoint locations illustrated on Figure 2.3-12
U/O - unobtainable due to shallow depth or water velocity
Temperature measurements acquired using a Cline Finder Digital Thermometer from the surface to 50 feet (ft) with an accuracy range of ±0.5° Fahrenheit (°F) over the operating range
Average Temperature 66.23550725 (°F)
Temperature measured May 2, 2007

TABLE 2.3-23 (Sheet 1 of 2)
LAKE GRANBURY HISTORICAL SURFACE WATER TEMPERATURES

YEAR	Monthly Temperature Readings in °F (Calculation Period From: September 1997 to June 2007)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1997	---	---	---	---	---	---	---	---	83.95	---	---	---	
1998	51.84	---	63.09	---	78.66	85.89	86.34	85.15	83.93	69.78	60.78	57.79	
1999	49.14	55.56	---	---	---	---	85.66	---	79.88	76.10	67.73	52.63	
2000	55.53	---	64.63	70.47	81.64	80.55	86.02	85.15	77.13	69.82	56.30	48.90	
2001	45.21	---	56.88	69.12	75.69	81.90	89.24	87.10	79.88	69.26	32.00	55.94	
2002	49.10	49.33	56.77	71.24	74.73	---	83.61	85.35	---	---	59.88	---	
2003	---	32.00	---	---	---	---	85.93	---	---	---	64.87	---	
2004	---	48.56	---	73.83	75.49	81.61	---	---	80.47	---	---	53.13	
2005	---	---	56.98	---	---	80.24	---	---	82.58	---	---	---	
2006	---	---	52.68	---	81.00	---	---	---	81.01	76.57	64.90	54.82	
2007	51.58	---	57.58	66.60	74.32	78.69	---	---	---	---	---	---	
													Monthly Average
Mean of Monthly Temperature	50.40	61.82	58.37	70.25	77.36	81.48	86.13	85.69	81.10	72.31	67.74	53.87	70.54
													Average Maximum
Maximum	55.53	55.56	64.63	73.83	81.64	85.89	89.24	87.10	83.93	76.57	67.73	57.79	73.29

TABLE 2.3-23 (Sheet 2 of 2)
LAKE GRANBURY HISTORICAL SURFACE WATER TEMPERATURES

YEAR	Monthly Temperature Readings in °F (Calculation Period From: September 1997 to June 2007)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Minimum
Minimum	45.21	32.00	52.68	66.60	74.32	78.69	83.61	85.15	77.13	69.26	32.00	48.90	62.13

Note:
Monthly Average Temperature for Lake Granbury was 70.54°F
Average Maximum Temperature for Lake Granbury was 73.29°F
Average Minimum Temperature for Lake Granbury was 62.13°F
-- - no data collected

TABLE 2.3-24 (Sheet 1 of 4)
TEMPERATURE MEASUREMENTS FOR SQUAW CREEK RESERVOIR

Discharge Area

Discharge Area Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
30	75.1	75.1	75.1	75.3	75.2	71.9
31	75.4	75.2	75.3	78.9	70.9	70.2
32	75.5	75.4	75.6	74.5	71.4	70.6
33	78.6	78.5	78.8	72.8	70.3	69.9
34	76	75.6	75.4	71.8	70.4	70
35	75.4	75.3	75	74.5	70.9	70.3
36	75.3	75.3	75.2	75	73	70.3
37	75.5	75.3	74.7	74.4	71	U/O
38	75.4	75.2	74.8	72.5	71	U/O
39	77.9	76.3	76	74.5	70.8	U/O
40	75.6	75.5	75.2	73.6	U/O	U/O
41	75.2	75.2	75.1	U/O	U/O	U/O
42	75.1	75.1	75	U/O	U/O	U/O
43	75.6	75.2	74.6	U/O	U/O	U/O
44	77	76.8	74.8	U/O	U/O	U/O
Average	75.91	75.67	75.37	74.35	71.49	70.46

TABLE 2.3-24 (Sheet 2 of 4)
TEMPERATURE MEASUREMENTS FOR SQUAW CREEK RESERVOIR

Cove #1

Cove #1 Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
45	71.4	71.6	71.5	71.6	72	71.6
46	71.6	71.5	71.5	71.6	71.8	71.4
47	71.7	71.6	71.5	71.7	71.4	71.4
48	71.5	71.5	71.5	71.5	71.3	71.4
49	71.4	71.5	71.5	71.5	71.3	71.3
50	71.6	71.5	71.4	71.4	71.2	U/O
51	71.5	71.5	71.4	71.4	71.2	U/O
52	71.5	71.5	71.4	71.5	U/O	U/O
53	71.5	71.4	71.4	71.4	U/O	U/O
54	71.4	71.4	71.5	71.3	U/O	U/O
55	71.6	71.4	71.3	71.1	U/O	U/O
56	71.5	71.4	71.3	71.3	U/O	U/O
57	71.3	71.3	71.2	71.1	U/O	U/O
58	71.4	71.3	71.2	U/O	U/O	U/O
59	71.2	71.3	71.1	U/O	U/O	U/O
60	71.3	71.3	71.3	U/O	U/O	U/O
61	71.3	71.3	71.1	U/O	U/O	U/O
62	71.5	71.3	70.9	U/O	U/O	U/O
63	71.3	71.2	71.2	U/O	U/O	U/O
64	71.4	71.2	70.8	U/O	U/O	U/O
65	71.4	71.2	70.8	U/O	U/O	U/O
66	71.3	71.1	70.6	U/O	U/O	U/O
67	71.1	70.9	71.1	U/O	U/O	U/O
68	71.2	71	U/O	U/O	U/O	U/O
69	71.1	71.2	U/O	U/O	U/O	U/O
Average	71.40	71.34	71.24	71.42	71.46	71.42

TABLE 2.3-24 (Sheet 3 of 4)
TEMPERATURE MEASUREMENTS FOR SQUAW CREEK RESERVOIR

Cove #2

Cove #2 Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
70	71.3	71.3	71.3	71.5	71.4	71.5
71	71.4	71.5	71.2	71.5	71.5	71.3
72	71.6	71.5	71.4	71.7	71.7	70.8
73	71.5	71.6	71.6	71.8	71.6	70.9
74	71.4	71.7	71.6	71.7	71.7	71.7
75	71.5	71.6	71.5	71.7	71.7	71.6
76	71.7	71.6	71.7	71.7	71.7	71.6
77	71.7	71.7	71.7	71.8	71.7	70.9
78	71.7	71.7	71.7	71.8	71.7	71.4
79	71.8	71.8	71.7	71.7	71.7	71
80	71.7	71.7	71.7	71.8	71.6	70.8
81	71.7	71.6	71.7	71.8	71.5	U/O
82	71.7	71.7	71.7	71.8	71.4	U/O
83	71.6	71.7	71.7	71.8	71.7	U/O
84	71.8	71.7	71.8	71.8	71.5	U/O
85	71.6	71.8	71.8	U/O	U/O	U/O
86	71.8	71.8	71.7	U/O	U/O	U/O
87	71.8	71.8	71.8	U/O	U/O	U/O
88	71.6	71.8	71.8	U/O	U/O	U/O
89	71.7	71.7	71.8	U/O	U/O	U/O
90	71.6	71.8	71.8	U/O	U/O	U/O
91	71.7	71.8	71.8	U/O	U/O	U/O
92	71.9	71.8	71.8	U/O	U/O	U/O
93	71.8	71.7	71.8	U/O	U/O	U/O
94	71.7	71.8	71.8	U/O	U/O	U/O
Average	71.65	71.69	71.68	71.73	71.61	71.23

TABLE 2.3-24 (Sheet 4 of 4)
TEMPERATURE MEASUREMENTS FOR SQUAW CREEK RESERVOIR

Intake Area

Intake Area Waypoints	Surface Temperature (°F)	1-10 ft Temperature (°F)	11-20 ft Temperature (°F)	21-30 ft Temperature (°F)	31-40 ft Temperature (°F)	41-50 ft Temperature (°F)
95	71.9	71.9	71.9	71.9	71.6	69.4
96	71.8	71.8	71.8	71.9	71.7	69.4
97	71.7	71.9	71.9	71.8	71.1	69.8
98	71.8	71.8	71.9	71.8	71.8	70.1
99	71.9	71.9	71.9	71.7	71.7	U/O
100	71.9	71.8	71.7	71.9	U/O	U/O
101	71.8	71.8	71.8	71.9	U/O	U/O
102	71.8	71.6	72	71.9	U/O	U/O
103	71.8	71.8	71.9	U/O	U/O	U/O
104	71.7	72	71.8	U/O	U/O	U/O
105	71.8	71.8	71.9	U/O	U/O	U/O
106	72	71.9	71.9	U/O	U/O	U/O
107	72	71.9	71.9	U/O	U/O	U/O
108	71.9	71.9	U/O	U/O	U/O	U/O
109	71.9	71.9	U/O	U/O	U/O	U/O
Average	71.85	71.85	71.87	71.85	71.58	69.68

Notes:
U/O - unobtainable due to shallow depth or water velocity
Temperature measurements acquired using a Cline Finder Digital Thermometer from the surface to 50 feet (ft) with an accuracy range of ±0.5°F over the operating range
Average Temperature 72.13 (°F)
Temperature measured April 17, 2007
Waypoint locations illustrated on Figure 2.3-16

TABLE 2.3-25 (Sheet 1 of 3)
LAKE GRANBURY (SEGMENT 1205) HISTORICAL SURFACE WATER QUALITY RESULTS (2001 - 2006)

11862 - Lake Granbury at FM 51 (01/01-09/06)

Analysis	Units	N	Minimum	Maximum	Mean	Median	Water Quality Standard/ Screening Level	N Exceeding	% Exceeding
Water Temperature	°C	253	5.55	32.06	20.77	23.08	34	0	0%
Specific Conductance	uS/cm2	252	525	4668	2474	2468	N/A		
Dissolved Oxygen	mg/L	235	0.39	12.35	7.79	7.57	5.0	5	2%
pH		252	7.33	8.72	8.1	8.14	6.5 - 9.0	0	0%
Salinity	ppt	253	0.27	2.56	1.33	1.32	N/A		
Total Suspended Solids	mg/L	67	2	164	24	15	N/A		
Ammonia	mg/L N as NH4	2	0.01	0.06	0.04	0.04	N/A		
Nitrite nitrogen	mg/L N as NO2	59	0.01	0.04	0.02	0.01	N/A		
Nitrate nitrogen	mg/L N as NO3	56	0.01	0.43	0.05	0.01	0.37		
Nitrite + Nitrate nitrogen	mg/L N	59	0.01	0.46	0.06	0.02	0.32	3	5%
Total Kjeldahl Nitrogen	mg/L	13	0.1	4.44	1.62	1.27	N/A		
Total Phosphorus	mg/L	13	0.03	0.76	0.13	0.08	0.18	1	8%
Orthophosphate phosphorus	mg/L P as OPO4	20	0.02	0.02	0.02	0.02	0.05	0	0%
Chlorophyll a	µg/L	30	1.5	55.4	20.9	20.5	21.4	13	43%
Escherichia coli	mpn/100mls	17	1	17	2	3	126	0	0%
Chloride	mg/L	65	95	1611	823	830	1000		
Sulfate	mg/L	65	44	525	275	274	600		
Total Dissolved Solids	mg/L	252	341	3034	1608	1604	2500		

TABLE 2.3-25 (Sheet 2 of 3)
LAKE GRANBURY (SEGMENT 1205) HISTORICAL SURFACE WATER QUALITY RESULTS (2001 - 2006)

11861 - Lake Granbury at US 377 (01/01-09/06)

Analysis	Units	N	Minimum	Maximum	Mean	Median	Water Quality Standard/ Screening Level	N Exceeding	% Exceeding
Water Temperature	°C	292	7.64	30.81	19.68	20.63	34	0	0%
Specific Conductance	uS/cm2	292	653	4665	2581	2547	N/A		
Dissolved Oxygen	mg/L	223	0.5	12.28	7.92	7.8	5.0	14	6%
pH		292	6.97	8.68	8.02	8.16	6.5 - 9.0	0	0%
Salinity	ppt	292	0.34	2.55	1.39	1.37	N/A		
Total Suspended Solids	mg/L	56	2	255	24	11	N/A		
Nitrite nitrogen	mg/L N as NO2	46	0.01	0.08	0.01	0.01	N/A		
Nitrate nitrogen	mg/L N as NO3	42	0.01	0.28	0.02	0.01	0.37		
Nitrite + Nitrate nitrogen	mg/L N	46	0.01	0.29	0.03	0.02	0.32	0	0%
Total Kjeldahl Nitrogen	mg/L	13	0.1	2.53	1.37	1.34	N/A		
Total Phosphorus	mg/L	13	0.03	0.17	0.08	0.08	0.18	0	0%
Orthophosphate phosphorus	mg/L P as OPO4	46	0.02	0.14	0.02	0.02	0.05	1	2%
Chlorophyll a	µg/L	27	1.5	38.5	23.1	23.2	21.4	17	63%
Fecal coliform	cfu/100mls	18	1	60	4	4	200	0	0%
Escherichia coli	mpn/100mls	17	1	23	3	4	126	0	0%
Chloride	mg/L	54	172	1686	866	852	1000		
Sulfate	mg/L	54	61	546	277	273	600		
Total Dissolved Solids	mg/L	292	424	3032	1677	1655	2500		

TABLE 2.3-25 (Sheet 3 of 3)
LAKE GRANBURY (SEGMENT 1205) HISTORICAL SURFACE WATER QUALITY RESULTS (2001 - 2006)

11860 - Lake Granbury DeCordova Dam (01/01-09/06)

Analysis	Units	N	Minimum	Maximum	Mean	Median	Water Quality Standard/ Screening Level	N Exceeding	% Exceeding
Water Temperature	°C	372	9.2	29.96	19.2	19.9	34	0	0%
Specific Conductance	uS/cm2	372	1047	4712	2678	2572	N/A		
Dissolved Oxygen	mg/L	245	1.4	11.4	8.02	8.2	5.0	15	6%
pH		372	6.9	8.59	7.93	8.06	6.5 - 9.0	0	0%
Salinity	ppt	372	0.81	2.58	1.45	1.4	N/A		
Total Suspended Solids	mg/L	53	2	120	11.21	6	N/A		
Nitrite nitrogen	mg/L N as NO2	47	0.01	0.03	0.01	0.01	N/A		
Nitrate nitrogen	mg/L N as NO3	43	0.01	0.11	0.02	0.01	0.37		
Nitrite + Nitrate nitrogen	mg/L N	47	0.01	0.12	0.03	0.02	0.32	0	0%
Total Kjeldahl Nitrogen	mg/L	13	0.1	4.23	1.38	1.38	N/A		
Total Phosphorus	mg/L	13	0.03	0.2	0.07	0.03	0.18	2	15%
Orthophosphate phosphorus	mg/L P as OPO4	21	0.02	0.05	0.02	0.02	0.05	0	0%
Chlorophyll a	µg/L	25	7.6	78.6	22.8	17.9	21.4	10	40%
Fecal coliform	cfu/100mls	18	1	16	3	2	200	0	0%
Escherichia coli	mpn/100mls	17	1	24	2	2	126	0	0%
Chloride	mg/L	52	409	1783	925	867	1000		
Sulfate	mg/L	52	146	595	295	279	600		
Total Dissolved Solids	mg/L	27	836	2734	1590	1494	2500		

(BRA 2007)
(TCEQ 2008b)
(BRA 2007c)

TABLE 2.3-26 (Sheet 1 of 3)
SAMPLE RESULTS FROM LAKE GRANBURY SURFACE WATER MONITORING EVENTS (2007 – 2008)

Parameter		Color	Odor	Temperature	Field Dissolved Oxygen	Field pH	Field Conductivity	Field Turbidity	Chlorophyll a	Total Suspended Solids	Total Dissolved Solids	Hardness	Turbidity	Biochemical Oxygen Demand	Chemical Oxygen Demand	Total Phosphorus	Orthophosphate	Ammonia Nitrogen	Nitrate as N	Nitrite	Total Kjeldahl Nitrogen	Bicarbonate Alkalinity	Chloride
Units		N/A	N/A	Deg F	mg/L	S.U.	mS/cm	NTU	mg/m3	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Screening Level		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.027	45.0	2500	N/A	N/A	45.0	N/A	0.200	N/A	0.110	0.37	N/A	N/A	N/A	1000
Sample Description	Date																						
LG-101 (0.3 ft.)	4/25/2007	Clear	None	65.05	6.79	7.70	1.513	60.6	35.000	19.0	903	195	65.00	3.0	16.0	0.086	<0.40	0.134	<1.00	<1.0	<0.125	48	348
	7/26/2007	Cloudy	None	83.78	10.33	8.75	1.620	193.6	29.000	6.0	1020	283	4.80	6.8	65.0	0.190	<0.01	0.520	<0.10	<0.1	0.920	164	338
	10/23/2007	Clear	None	71.15	7.19	8.18	1.076	12.1	45.000	6.0	671	216	6.72	<2.0	26.0	0.050	<0.01	0.140	<0.10	<0.1	0.610	124	210
	1/15/2008	Clear	None	49.77	7.52	9.73	0.880	1059.5*	27.000	7.6	698	238	5.88	2.3	<25.0	0.030	<0.01	<0.100	<0.10	<0.1	0.580	144	222
LG-102 (40 ft.)	4/25/2007	Cloudy Brown	None	60.21	9.50	8.11	0.835	67.6	260.000	672.0	1480	347	210.00	<3.0	10.0	2.460	<0.40	0.117	<1.00	<1.0	<0.125	102	594
	7/26/2007	Clear	None	80.42	3.99	7.43	1.619	266.7	10.000	9.0	1120	297	8.31	3.1	49.0	0.150	0.03	0.340	<0.10	<0.1	0.730	152	388
	10/23/2007	Clear	None	70.97	4.00	8.07	1.078	170.0	42.000	10.0	665	217	7.32	<2.0	<25.0	0.060	<0.01	0.150	<0.10	<0.1	0.520	126	219
	1/15/2008	Clear	None	49.48	6.44	9.85	0.878	1058.9*	29.00	10.5	685	240	8.32	2.2	31.1	0.030	0.01	<0.100	<0.10	<0.1	0.550	144	229
LG-103 (0.3 ft.)	4/25/2007	Clear	None	64.54	9.50	8.24	0.875	71.0	34.900	19.0	878	210	77.00	5.0	25.0	0.120	4.40	0.097	<1.00	<1.0	<0.125	82	357
	7/26/2007	Clear	None	82.98	9.42	8.72	1.597	28.9	33.000	13.7	1010	281	10.20	7.7	56.0	0.190	0.02	0.300	<0.10	<0.1	0.870	124	346
	10/23/2007	Clear	None	71.65	7.33	8.09	1.085	21.6	41.000	9.5	645	223	9.52	<2.0	<25.0	0.040	<0.01	0.120	<0.10	<0.1	0.470	130	210
	1/15/2008	Clear	None	50.13	9.48	9.53	0.885	8.8	30.000	7.0	679	238	5.53	3.0	<25.0	0.030	<0.01	<0.100	<0.10	<0.1	0.470	160	222
LG-104 (10 ft.)	4/25/2007	Clear	None	64.53	11.43	8.25	0.875	72.8	101.000	64.0	862	211	85.00	<3.0	19.0	0.298	<0.40	0.162	<1.00	<1.0	<0.125	76	324
	7/26/2007	Clear	None	82.89	9.25	8.66	1.594	36.1	31.000	13.7	984	282	14.10	6.3	62.0	0.060	0.02	0.210	<0.10	<0.1	0.920	128	343
	10/23/2007	Clear	None	71.65	5.73	8.16	1.085	36.2	41.000	67.0	663	217	31.80	<2.0	<25.0	0.050	<0.01	0.110	<0.10	<0.1	0.560	124	210
	1/15/2008	Clear	None	48.85	8.09	9.54	0.804	11.0	32.000	8.8	690	240	5.85	3.1	<25.0	0.020	0.01	<0.100	<0.10	<0.1	0.670	140	230
LG-105 (0.3 ft.)	4/25/2007	Clear	None	64.42	8.97	8.24	0.908	66.7	23.900	17.0	934	213	93.00	<3.0	6.0	0.085	<0.40	0.129	<1.00	<1.0	<0.125	76	359
	7/26/2007	Clear	None	83.46	10.02	8.80	1.607	15.0	33.000	5.7	1010	279	5.64	4.2	40.0	0.050	<0.01	0.200	<0.10	<0.1	0.670	136	343
	10/23/2007	Clear	None	71.04	7.35	8.01	1.079	14.8	38.000	8.5	667	216	7.56	<2.0	47.0	0.060	<0.01	0.110	<0.10	<0.1	0.520	130	209
	1/15/2008	Clear	None	50.65	7.48	9.47	0.893	8.2	27.000	7.3	710	240	5.06	2.6	<25.0	0.030	<0.01	<0.100	<0.10	<0.1	0.690	140	222
LG-106 (35 ft.)	4/25/2007	Cloudy Brown	None	59.86	7.59	8.08	1.645	66.7	129.000	230.0	1120	261	250.00	<3.0	11.0	0.934	<0.40	0.133	<1.00	<1.0	<0.125	90	448
	7/26/2007	Clear	None	80.49	1.78	7.59	1.558	47.1	8.000	9.7	1010	302	14.20	3.5	45.0	0.070	0.03	0.260	<0.10	<0.1	0.820	128	355
	10/23/2007	Clear	None	71.01	6.06	8.02	1.077	27.8	36.000	8.0	657	217	8.54	<2.0	<25.0	0.070	<0.01	0.130	<0.10	<0.1	0.400	130	212
	1/15/2008	Clear	None	49.60	8.80	9.36	0.877	18.4	28.000	9.5	704	237	7.52	2.0	<25.0	0.030	<0.01	<0.100	<0.10	<0.1	0.640	130	229
LG-107 (0.3 ft.)	4/25/2007	Clear	None	64.58	8.89	8.26	0.883	70.1	28.100	21.0	936	209	82.00	3.0	21.0	0.116	<0.40	0.149	<1.00	<1.0	<0.125	74	384
	7/26/2007	Clear	None	83.52	6.79	8.24	1.638	16.3	28.000	5.3	1010	289	6.82	4.7	40.0	0.050	0.01	0.350	<0.10	<0.1	0.820	128	343
	10/23/2007	Clear	None	71.44	7.62	8.13	1.083	19.7	42.000	8.0	685	220	8.58	<2.0	<25.0	0.040	<0.01	0.100	<0.10	<0.1	0.520	126	207
	1/15/2008	Clear	None	50.64	9.09	9.41	0.892	8.5	26.000	6.7	684	236	5.52	3.8	<25.0	0.020	<0.01	<0.100	<0.10	<0.1	0.450	136	229
LG-108 (0.3 ft.)	4/25/2007	Clear	None	64.35	8.74	8.30	0.926	70.3	25.000	26.0	908	222	75.00	<3.0	7.0	0.094	<0.40	0.178	<1.00	<1.0	<0.125	76	371
	7/26/2007	Clear	None	83.37	5.58	8.00	1.629	15.0	24.000	5.7	7010*	287	6.88	3.3	42.0	0.040	0.01	0.260	<0.10	<0.1	0.890	136	348
	10/23/2007	Clear	None	71.31	7.68	7.96	1.081	11.6	33.000	6.5	666	216	6.28	<2.0	<25.0	0.040	<0.01	0.120	<0.10	<0.1	0.540	124	217
	1/15/2008	Clear	None	50.61	9.10	9.42	0.892	8.2	25.000	7.3	703	239	5.65	2.7	<25.0	0.020	<0.01	<0.100	<0.10	<0.1	0.620	138	219
LG-109 (50 ft.)	4/25/2007	Cloudy Brown	None	59.45	6.11	8.15	1.795	89.4	25.600	625.0	1040	263	350.00	<3.0	15.0	0.948	2.60	0.081	<1.00	<1.0	<0.125	90	410
	7/26/2007	Clear	None	79.57	2.74	7.52	1.559	56.7	6.000	5.0	1000	292	14.30	3.3	45.0	0.060	0.03	0.180	<0.10	<0.1	0.610	116	333
	10/23/2007	Clear	None	70.93	6.64	8.00	1.076	26.7	32.000	7.0	656	214	9.96	<2.0	<25.0	0.040	<0.01	0.140	<0.10	<0.1	0.400	124	208
	1/15/2008	Clear	None	49.55	9.56	9.29	0.878	21.6	21.000	8.3	674	238	6.41	2.0	<25.0	0.030	<0.01	<0.100	<0.10	<0.1	0.630	134	224
AVERAGE				66.61	7.30	8.14	1.274	61.2	40.542	54.7	841	245	42.34	2.7	24.0	0.186	0.24	0.149	0.08	0.2	0.490	120	296
MAX				83.78	11.43	8.80	1.795	266.7	260.000	672.0	1480	347	350.00	7.7	65.0	2.460	4.40	0.520	0.19	0.5	0.920	164	594
MIN				48.85	1.78	7.43	0.835	11.6	6.000	5.0	645	195	4.80	1.0	6.0	0.020	0.01	0.050	0.05	0.1	0.063	48	207
STANDARD DEVIATION				12.07	2.34	0.34	0.322	60.2	43.560	151.2	196	35	76.67	1.7	17.1	0.443	0.83	0.104	0.06	0.2	0.284	27	90

TABLE 2.3-26 (Sheet 2 of 3)
SAMPLE RESULTS FROM LAKE GRANBURY SURFACE WATER MONITORING EVENTS (2007 – 2008)

Parameter		Sulfate	Total Mercury	Dissolved Mercury	pH	Total Coliform	Fecal Coliform	Fecal Streptococci	Total Sodium	Total Potassium	Total Calcium	Total Magnesium	Total Arsenic	Total Barium	Total Cadmium	Total Chromium	Total Lead	Total Selenium	Total Silver	Total Nickel	Total Zinc	Silica	Total Copper
Units		mg/L	mg/L	mg/L	S.U.	col/100mL	col/100mL	col/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Mg/L
Screening Level		600.0	0.0013	N/A	N/A	N/A	400	N/A	N/A	N/A	N/A	N/A	0.190	2.000	0.0021	0.373	0.008	0.005	N/A	0.338	0.225	N/A	0.507
Sample Description	Date																						
	4/25/2007	168.0	<0.0002	<0.0002	6.95	320	28	40	232	5.99	58.0	12.3	<0.005	0.096	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.023	14.0	0.013
LG-101	7/26/2007	143.0	<0.0002	<0.0002	8.31	3300	<10	<1	229	6.75	82.8	18.5	<0.005	0.114	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	10.6	0.010
(0.3 ft.)	10/23/2007	86.5	<0.0002	<0.0002	8.30	11000	10	<1	142	6.10	63.6	13.9	<0.005	0.101	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	15.3	0.007
	1/15/2008	99.8	<0.0002	<0.0002	8.31	560	<1	<1	151	6.28	69.4	15.6	<0.005	0.108	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.010	10.1	0.007
	4/25/2007	232.0	<0.0002	<0.0002	7.14	20000	600	80	368	7.30	99.7	23.7	<0.005	0.164	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.024	17.1	0.018
LG-102	7/26/2007	151.0	<0.0002	<0.0002	7.96	6500	500	<1	240	6.74	86.5	19.7	<0.005	0.124	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.018	11.9	0.010
(40 ft.)	10/23/2007	94.1	<0.0002	<0.0002	8.31	5000	100	<1	138	6.16	63.7	14.0	<0.005	0.101	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.008	15.1	0.006
	1/15/2008	104.0	<0.0002	<0.0002	8.28	300	20	<1	150	6.34	70.6	15.5	<0.005	0.109	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	12.9	0.007
	4/25/2007	120.0	<0.0002	<0.0002	7.36	240	<10	<10	227	5.61	62.0	<0.5	<0.005	0.103	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.022	13.3	0.015
LG-103	7/26/2007	139.0	<0.0002	<0.0002	8.32	5800	750	6	228	6.84	82.0	18.6	<0.005	0.117	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.013	14.5	0.010
(0.3 ft.)	10/23/2007	88.7	<0.0002	<0.0002	8.29	23000	600	<1	141	6.26	65.8	14.3	<0.005	0.105	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.007	14.6	0.007
	1/15/2008	103.0	<0.0002	<0.0002	8.41	220	10	<1	157	6.23	70.2	15.3	<0.005	0.109	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.010	9.3	0.007
	4/25/2007	123.0	<0.0002	<0.0002	7.43	1600	36	24	213	5.62	62.3	13.5	<0.005	0.105	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.019	15.0	0.012
LG-104	7/26/2007	141.0	<0.0002	<0.0002	8.30	3200	1100	5	227	6.85	81.8	18.9	<0.005	0.120	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.014	17.6	0.010
(10 ft.)	10/23/2007	87.8	<0.0002	<0.0002	8.28	19000	300	<1	140	6.20	63.8	13.9	<0.005	0.105	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	14.9	0.007
	1/15/2008	103.0	<0.0002	<0.0002	8.40	560	<10	<1	152	6.38	70.4	15.7	<0.005	0.100	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	9.8	0.007
	4/25/2007	131.0	<0.0002	<0.0002	7.54	5000	16	<10	231	5.56	63.0	13.6	<0.005	0.105	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.019	15.2	0.012
LG-105	7/26/2007	143.0	<0.0002	<0.0002	8.44	3500	<10	4	228	6.71	80.7	18.7	<0.005	0.116	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.012	14.1	0.010
(0.3 ft.)	10/23/2007	91.2	<0.0002	<0.0002	8.27	20000	90	<1	142	6.14	64.0	13.7	<0.005	0.104	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	13.6	0.007
	1/15/2008	108.0	<0.0002	<0.0002	8.43	430	40	<1	152	6.38	70.7	15.3	<0.005	0.109	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	9.8	0.007
	4/25/2007	160.0	<0.0002	<0.0002	7.43	2500	225	60	288	6.12	76.5	17.1	<0.005	0.124	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.014	18.3	0.013
LG-106	7/26/2007	147.0	<0.0002	<0.0002	7.96	4100	20	1	248	6.61	82.9	20.4	<0.005	0.129	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.013	13.9	0.010
(35 ft.)	10/23/2007	90.4	<0.0002	<0.0002	8.27	25000	<10	<1	135	6.20	63.8	14.0	<0.005	0.103	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.008	15.7	0.007
	1/15/2008	99.9	<0.0002	<0.0002	8.34	1000	30	<1	152	6.34	69.1	15.6	<0.005	0.109	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.008	9.7	0.007
	4/25/2007	127.0	<0.0002	<0.0002	7.51	2000	16	12	245	5.58	61.7	13.5	<0.005	0.104	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.015	17.0	0.012
LG-107	7/26/2007	138.0	<0.0002	<0.0002	7.98	4600	700	6	232	6.79	84.0	19.2	<0.005	0.118	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.011	13.9	0.010
(0.3 ft.)	10/23/2007	91.0	<0.0002	<0.0002	8.32	18000	20	<1	138	6.19	65.0	14.1	<0.005	0.104	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	14.0	0.007
	1/15/2008	102.0	<0.0002	<0.0002	8.44	180	10	<1	153	6.33	69.5	15.1	<0.005	0.107	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	10.0	0.006
	4/25/2007	131.0	<0.0002	<0.0002	7.54	1400	40	<10	235	5.68	65.2	14.4	<0.005	0.109	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.014	15.6	0.013
LG-108	7/26/2007	139.0	<0.0002	<0.0002	7.81	6400	80	1	232	6.74	83.5	19.1	<0.005	0.118	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.013	14.5	0.009
(0.3 ft.)	10/23/2007	87.7	<0.0002	<0.0002	8.25	22000	20	<1	139	6.06	63.8	13.8	<0.005	0.103	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.008	14.0	0.006
	1/15/2008	103.0	<0.0002	<0.0002	8.41	460	<10	<1	148	6.32	70.3	15.5	<0.005	0.107	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.010	10.0	0.007
	4/25/2007	166.0	<0.0002	<0.0002	7.49	1200	25	<10	260	6.22	78.2	16.5	<0.005	0.130	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.017	17.7	0.015
LG-109	7/26/2007	143.0	<0.0002	<0.0002	7.82	8000	40	<1	227	6.86	85.0	19.4	<0.005	0.122	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.014	17.1	0.009
(50 ft.)	10/23/2007	92.1	<0.0002	<0.0002	8.25	20000	<10	<1	134	6.04	63.3	13.6	<0.005	0.102	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.009	13.8	0.006
	1/15/2008	103.0	<0.0002	<0.0002	8.23	260	<10	<1	156	6.36	69.8	15.4	<0.005	0.107	<0.0010	<0.005	<0.005	<0.005	<0.001	<0.005	0.012	12.6	0.007
AVERAGE		121.6	0.0001	0.0001	8.03	6851	152	7	195	6.30	71.7	15.6	0.003	0.112	0.0005	0.003	0.003	0.003	0.001	0.003	0.012	13.8	0.009
MAX		232.0	0.0001	0.0001	8.44	25000	1100	80	368	7.30	99.7	23.7	0.003	0.164	0.0005	0.003	0.003	0.003	0.001	0.003	0.024	18.3	0.018
MIN		86.5	0.0001	0.0001	6.95	180	1	1	134	5.56	58.0	0.3	0.003	0.096	0.0005	0.003	0.003	0.003	0.001	0.003	0.003	9.3	0.006
STANDARD DEVIATION		31.4	0.0000	0.0000	0.42	8063	271	17	56	0.41	9.6	3.7	0.0000	0.012	0.0000	0.000	0.000	0.000	0.000	0.000	0.005	2.5	0.003

TABLE 2.3-26 (Sheet 3 of 3)
SAMPLE RESULTS FROM LAKE GRANBURY SURFACE WATER MONITORING EVENTS (2007 – 2008)

Parameter		Total Boron	Total Iron	Total Manganese	Total Alkalinity
Units		mg/L	mg/L	mg/L	mg/L
Screening Level		N/A	1.00	N/A	N/A
Sample Description	Date				
LG-101 (0.3 ft.)	4/25/2007	0.135	0.52	0.010	137
	7/26/2007	<5.000	<0.50	0.014	N/A
	10/23/2007	<5.000	<0.50	0.031	N/A
	1/15/2008	<5.000	<0.50	0.036	N/A
LG-102 (40 ft.)	4/25/2007	0.490	2.16	0.034	121
	7/26/2007	<5.000	0.53	0.151	N/A
	10/23/2007	<5.000	<0.50	0.031	N/A
	1/15/2008	<5.000	<0.50	0.044	N/A
LG-103 (0.3 ft.)	4/25/2007	0.131	0.50	0.009	134
	7/26/2007	<5.000	0.60	0.025	N/A
	10/23/2007	<5.000	0.51	0.042	N/A
	1/15/2008	<5.000	<0.50	0.035	N/A
LG-104 (10 ft.)	4/25/2007	0.138	0.59	0.011	141
	7/26/2007	<5.000	0.70	0.026	N/A
	10/23/2007	<5.000	<0.50	0.043	N/A
	1/15/2008	<5.000	<0.50	0.037	N/A
LG-105 (0.3 ft.)	4/25/2007	0.128	0.52	0.010	135
	7/26/2007	<5.000	<0.50	0.014	N/A
	10/23/2007	<5.000	<0.50	0.035	N/A
	1/15/2008	<5.000	<0.50	0.034	N/A
LG-106 (35 ft.)	4/25/2007	0.232	0.79	0.017	131
	7/26/2007	<5.000	0.68	0.163	N/A
	10/23/2007	<5.000	<0.50	0.037	N/A
	1/15/2008	<5.000	<0.50	0.041	N/A
LG-107 (0.3 ft.)	4/25/2007	0.138	0.69	0.014	123
	7/26/2007	<5.000	<0.50	0.020	N/A
	10/23/2007	<5.000	<0.50	0.038	N/A
	1/15/2008	<5.000	<0.50	0.034	N/A
LG-108 (0.3 ft.)	4/25/2007	0.137	0.62	0.013	136
	7/26/2007	<5.000	<0.50	0.017	N/A
	10/23/2007	<5.000	<0.50	0.034	N/A
	1/15/2008	<5.000	<0.50	0.035	N/A
LG-109 (50 ft.)	4/25/2007	0.259	1.19	0.022	131
	7/26/2007	<5.000	0.69	0.133	N/A
	10/23/2007	<5.000	<0.50	0.038	N/A
	1/15/2008	<5.000	<0.50	0.039	N/A
AVERAGE		1.925	0.47	0.038	132
MAX		2.500	2.16	0.163	141
MIN		0.128	0.25	0.009	121
STANDARD DEVIATION		1.012	0.37	0.036	7

Notes: * - Anomalous Field Reading/Lab Result
N/A - Not Applicable
To calculate the min, max, mean, and standard deviation with nondetects, if a screening limit was available, either 1/2 the nondetect value or 1/2 the screening limit was used (whichever was less). The screening limits are based on: DRAFT: 2008 Guidance for Assessing and Reporting Surface Water Quality in Texas (December 21, 2007).

TABLE 2.3-27 (Sheet 1 of 2)
DAM AND RESERVOIR INFORMATION

Reservoir Name	Possum Kingdom Lake	Palo Pinto Lake	Mineral Wells Lake	Granbury Lake	Squaw Creek Reservoir	Wheeler Branch Reservoir	Whitney Lake
Dam Name	Morris Sheppard Dam	Palo Pinto Creek Dam	Mineral Wells Dam	DeCordova Bend Dam	Squaw Creek Dam	Wheeler Branch Dam	Whitney Dam
Owner	Brazos River Authority	Palo Pinto MWD No. 1	City of Mineral Wells	Brazos River Authority	TXU Generation Co. LP	Somervell County Water District	Corps of Engineers-SWF
Dam Length (Feet)	2740	1255	1650	2200	4360	1750	17,695
Dam Top Elevation (Feet MSL)	1024	898	873.9	706.5	796.0	NR	584
Elevation at Top of Flood Pool (Feet MSL)	NA	NA	NA	NA	NA	NA	571
Elevation at Top of Conservation Pool (Feet MSL)	1000	867	863	693	775	785	533
Dead Pool Elevation (Feet MSL)	874.8	835	NR	640	653	NR	448.83
Elevation at Bottom of Lake (Feet MSL)	870	815	817	628	648.2	NR	429
Flood Pool Capacity (Acre-Feet)	NA	NA	NA	NA	NA	NA	2,000,204
Conservation Pool Capacity Original (Acre-Feet)	724,700	27,650	6760	153,500	151,047	4118	627,100
Conservation Pool Storage Survey (Acre-Feet)	540,340	NR	7065	129,011	151,418	NR	554,203
Storage at Dead Pool Capacity (Acre-Feet)	236	1900	NR	965	51	NR	4270
Surface Area at Top of Conservation Pool Original (Acre)	19,800	2498	646	8700	3228	180	23,560
Surface Area at Top of Conservation Pool Survey (Acre)	17,624	NR	440	8310	3297	NR	23,220
Last Survey Date	Jun 1994	NR	Jul 1992	Jan 1994	May 1997	NR	June 2005
Drainage Area (Square Miles)	13,310	471	63	16,113	64	NR	26,606
Main Purposes	water supply, hydroelectric, irrigation, Mining, Industrial	water supply	water supply	water supply, irrigation, Industrial, Mining	industrial, recreation	water supply	flood control, water supply, hydroelectric
Year of Completion	1941	1964	1920	1969	1977	2007	1951

TABLE 2.3-27 (Sheet 2 of 2)
DAM AND RESERVOIR INFORMATION

Stream	Brazos River	Palo Pinto Creek	Rock Creek	Brazos River	Squaw Creek	Wheeler Branch	Brazos River
County	Palo Pinto	Palo Pinto	Parker	Hood	Somervell & Hood	Somervell	Hill, Bosque
Nearest Town	Graham	Mineral Wells	Mineral Wells	Granbury	Glen Rose	Glen Rose	Whitney
Direction to Nearest Town	11.3 miles NE	15 miles SW	4 miles E	8 miles NW	4 miles N	2 miles south-southeast	5.5 miles SW
Water Planning Region	G	G	G	G	G	G	G
Dam Central Latitude	32.87	32.6467	32.8167	32.3733	32.2883	NR	NR
Dam Central Longitude	-98.425	-98.2683	-98.0417	-97.6883	-97.76	NR	NR
Reservoir Gage	8088500	8090300	8090700	8090900	8091730	NR	8092500
Upstream USGS Streamflow Gage	8088000	NR	NR	8090800	8091730	NR	8091000
Downstream USGS Streamflow Gage	8088610	NR	NR	8091000	8091750	NR	8093100
Major Water Rights	C5155	C4031	C4039	C5156	C4097	NR	C5157

Notes:
NA - Not Applicable
NR - Not Reported

Sources:
(TWDB 2003)
(TWDB 2005)
(TWDB 2006)
(TWDB 2006a)
(TWDB 2007b)

TABLE 2.3-28 (Sheet 1 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3132601	Hood	F.C. Spencer	Domestic	21	Twin Mountains Formation	323312	980025	Withdrawal of Water
3132602	Hood	Signal & Loffland	Unused	5278	Aquifer Code Not Applicable	323314	980151	Oil or Gas
3132901	Hood	Herman D. Howard	Stock	46	Twin Mountains Formation	323027	980215	Withdrawal of Water
3132902	Hood	Northern Natural Gas	Industrial	184	Twin Mountains Formation	323022	980056	Withdrawal of Water
3132903	Hood	Shane Butler	Domestic	56	Trinity Group	323026	980214	Withdrawal of Water
3140201	Hood	Lipan Water Works	Public Supply	120	Twin Mountains Formation	322950	980313	Withdrawal of Water
3140301	Hood	City of Lipan	Public Supply	95	Twin Mountains Formation	322925	980227	Withdrawal of Water
3225402	Hood		Not Listed	0	Twin Mountains Formation	323230	975731	Spring
3225501	Hood	N.B. Brewer	Domestic	70	Twin Mountains Formation	323316	975506	Withdrawal of Water
3225701	Hood	T.L. Compton	Domestic	100	Twin Mountains Formation	323053	975830	Withdrawal of Water
3225801	Hood	Intrastate Gathering	Industrial	140	Twin Mountains Formation	323001	975625	Withdrawal of Water
3226501	Hood	L.H. Thomas	Unused	140	Twin Mountains Formation	323246	974937	Withdrawal of Water
3226502	Hood	L.H. Thomas	Domestic	140	Twin Mountains Formation	323251	974947	Withdrawal of Water
3226701	Hood	O.P. Leonard	Domestic	80	Twin Mountains Formation	323028	975017	Withdrawal of Water
3226702	Hood	Rolling Hills Water	Public Supply	100	Twin Mountains Formation	323204	975004	Withdrawal of Water
3226703	Hood	Resort Water Services	Public Supply	150	Twin Mountains Formation	323056	975047	Withdrawal of Water
3226704	Hood	Resort Water Services	Public Supply	92	Twin Mountains Formation	323033	975045	Withdrawal of Water
3226705	Hood	Rolling Hills Water	Unused	84	Twin Mountains Formation	323150	975054	Withdrawal of Water
3226706	Hood	Rolling Hills Water	Public Supply	84	Twin Mountains Formation	323204	975004	Withdrawal of Water
3226707	Hood	Resort Water Services	Public Supply	200	Twin Mountains Formation	323049	975111	Withdrawal of Water
3226801	Hood	C.A. Cassity	Irrigation	170	Twin Mountains Formation	323034	974934	Withdrawal of Water
3226802	Hood	Hood County Water Co.	Public Supply	240	Twin Mountains Formation	323016	974808	Withdrawal of Water
3226803	Hood	Long Creek Water Co.	Public Supply	200	Twin Mountains Formation	323123	974842	Withdrawal of Water
3226804	Hood	Long Creek Water Co.	Public Supply	268	Twin Mountains Formation	323101	974824	Withdrawal of Water

TABLE 2.3-28 (Sheet 2 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3226805	Hood	Lakeside MHP	Public Supply	110	Twin Mountains Formation	323048	974941	Withdrawal of Water
3226901	Hood	James B. Robinson	Domestic	193	Twin Mountains Formation	323213	974647	Withdrawal of Water
3226902	Hood	R.F. Parkinson	Irrigation	420	Twin Mountains Formation	323220	974526	Withdrawal of Water
3227402	Hood	Kenneth Marczak	Stock	75	Paluxy Sand	323318	974400	Withdrawal of Water
3227403	Hood	Albert W. Hall	Domestic	358	Twin Mountains Formation	323318	974358	Withdrawal of Water
3227404	Hood	D.O. Tankersley	Industrial	140	Paluxy Sand	323244	974350	Withdrawal of Water
3227405	Hood	Kenneth Marczak	Domestic	440	Twin Mountains Formation	323320	974401	Withdrawal of Water
3227503	Hood	Spring Valley Water	Public Supply	240	Twin Mountains Formation	323256	974134	Withdrawal of Water
3227601	Hood	L.W.B. Construction	Unused	360	Paluxy Sand	323253	973901	Withdrawal of Water
3227701	Hood	Earl Porter	Domestic	70	Paluxy Sand	323130	974322	Withdrawal of Water
3227702	Hood	X.A. Myer	Domestic	34	Paluxy Sand	323011	974342	Withdrawal of Water
3227703	Hood	R.L. Tankersley	Irrigation	415	Twin Mountains Formation	323223	974436	Withdrawal of Water
3227704	Hood	R.L. Tankersley	Irrigation	387	Twin Mountains Formation	323222	974439	Withdrawal of Water
3227705	Hood	Doug Crough	Domestic	408	Twin Mountains Formation	323021	974353	Withdrawal of Water
3227706	Hood	Scott Parkinson	Irrigation	425	Twin Mountains Formation	323218	974500	Withdrawal of Water
3227707	Hood		Not Listed	0	Paluxy Sand	323200	974445	Spring
3228704	Hood	Hughie Long	Domestic	353	Paluxy Sand	323147	973709	Withdrawal of Water
3233201	Hood	A.B. Clapp	Domestic	55	Twin Mountains Formation	322937	975556	Withdrawal of Water
3233401	Hood	V.H. Musick	Domestic	342	Twin Mountains Formation	322559	975858	Withdrawal of Water
3233402	Hood	Dan Knouf	Domestic	380	Twin Mountains Formation	322521	975737	Withdrawal of Water
3233403	Hood	Dan Knouf	Domestic	25	Paluxy Sand	322516	975737	Withdrawal of Water
3233404	Hood	Dan Knouf	Irrigation	347	Twin Mountains Formation	322514	975734	Withdrawal of Water
3233801	Hood	C.W. Bridler	Domestic	317	Twin Mountains Formation	322350	975715	Withdrawal of Water
3233802	Hood	Doris Baker	Unused	297	Twin Mountains Formation	322344	975526	Withdrawal of Water
3233803	Hood	Doris Baker	Unused	310	Twin Mountains Formation	322344	975521	Withdrawal of Water

TABLE 2.3-28 (Sheet 3 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3233804	Hood	Vera Brooks	Domestic	307	Twin Mountains Formation	322329	975508	Withdrawal of Water
3233805	Hood	City of Tolar	Public Supply	535	Twin Mountains Formation	322339	975516	Withdrawal of Water
3233806	Hood	City of Tolar	Public Supply	422	Twin Mountains Formation	322341	975518	Withdrawal of Water
3233807	Hood	City of Tolar	Public Supply	0	Twin Mountains Formation	322343	975508	Withdrawal of Water
3233808	Hood	City of Tolar	Public Supply	450	Twin Mountains Formation	322341	975506	Withdrawal of Water
3233901	Hood	George Chrane	Domestic	348	Twin Mountains Formation	322353	975327	Withdrawal of Water
3233902	Hood	Leonard Leito	Domestic	405	Twin Mountains Formation	322450	975236	Withdrawal of Water
3234101	Hood	Steve Bird	Domestic	120	Twin Mountains Formation	322820	975010	Withdrawal of Water
3234102	Hood	City of Granbury	Public Supply	115	Twin Mountains Formation	322730	975027	Withdrawal of Water
3234103	Hood	Boswell Water Co.	Public Supply	132	Twin Mountains Formation	322730	975024	Withdrawal of Water
3234104	Hood	Oak Trail Shores	Public Supply	190	Twin Mountains Formation	322915	975024	Withdrawal of Water
3234105	Hood	Oak Trail Shores	Public Supply	231	Twin Mountains Formation	322913	975100	Withdrawal of Water
3234106	Hood	Oak Trail Shores	Public Supply	0	Twin Mountains Formation	322916	975017	Withdrawal of Water
3234107	Hood	Oak Trail Shores	Public Supply	206	Twin Mountains Formation	322909	975019	Withdrawal of Water
3234108	Hood	Oak Trail Shores	Public Supply	188	Twin Mountains Formation	322912	975014	Withdrawal of Water
3234109	Hood	Oak Trail Shores	Public Supply	155	Twin Mountains Formation	322903	975008	Withdrawal of Water
3234112	Hood	Dr. Roger Nunnalee	Irrigation	122	Twin Mountains Formation	322738	975034	Withdrawal of Water
3234113	Hood	Oak Trail Shores	Public Supply	190	Twin Mountains Formation	322917	975003	Withdrawal of Water
3234114	Hood	Oak Trail Shores	Public Supply	0	Twin Mountains Formation	322910	975005	Withdrawal of Water
3234201	Hood	C.E. Reese	Stock	114	Twin Mountains Formation	322922	974857	Withdrawal of Water
3234202	Hood	C.E. Reese	Domestic	171	Twin Mountains Formation	322851	974907	Withdrawal of Water
3234203	Hood	Oak Trail Shores	Public Supply	190	Twin Mountains Formation	322908	974947	Withdrawal of Water
3234206	Hood	Oak Trail Shores	Public Supply	80	Twin Mountains Formation	322830	974906	Withdrawal of Water
3234207	Hood	Don Kennon	Irrigation	220	Twin Mountains Formation	322936	974733	Withdrawal of Water
3234208	Hood	Laguna Vista	Public Supply	170	Twin Mountains Formation	322950	974811	Withdrawal of Water

TABLE 2.3-28 (Sheet 4 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3234209	Hood	Laguna Vista	Public Supply	220	Twin Mountains Formation	322957	974753	Withdrawal of Water
3234210	Hood	Live Oak Water Co.	Public Supply	216	Twin Mountains Formation	322811	974734	Withdrawal of Water
3234211	Hood	Summerlin Estates	Public Supply	258	Twin Mountains Formation	322807	974753	Withdrawal of Water
3234212	Hood	Laguna Vista	Public Supply	205	Twin Mountains Formation	322944	974750	Withdrawal of Water
3234213	Hood		Not Listed	0	Glen Rose Limestone	322830	974931	Spring
3234301	Hood	Laguna Tres	Public Supply	155	Twin Mountains Formation	322858	974716	Withdrawal of Water
3234302	Hood	Community Water Co.	Public Supply	188	Twin Mountains Formation	322738	974528	Withdrawal of Water
3234303	Hood	Sky Harbor Water	Public Supply	500	Twin Mountains Formation	322931	974610	Withdrawal of Water
3234304	Hood	Tri-County Electric	Industrial	140	Twin Mountains Formation	322749	974701	Withdrawal of Water
3234305	Hood	Mesa Grande Water	Public Supply	220	Twin Mountains Formation	322810	974650	Withdrawal of Water
3234306	Hood	First Baptist Church -	Public Supply	240	Twin Mountains Formation	322757	974702	Withdrawal of Water
3234307	Hood	Sky Harbour WSC	Public Supply	215	Twin Mountains Formation	322938	974628	Withdrawal of Water
3234308	Hood	Mallard Pointe on Lake	Public Supply	400	Twin Mountains Formation	322738	974503	Withdrawal of Water
3234309	Hood	Sky Harbour WSC	Public Supply	310	Twin Mountains Formation	322946	974601	Withdrawal of Water
3234401	Hood	City of Granbury	Public Supply	120	Twin Mountains Formation	322727	975034	Withdrawal of Water
3234402	Hood	Rolling Hills Mobil	Unused	244	Twin Mountains Formation	322530	975037	Withdrawal of Water
3234403	Hood	Rolling Hills Mobil	Public Supply	250	Twin Mountains Formation	322529	975039	Withdrawal of Water
3234404	Hood	Boswell Water Co.	Public Supply	105	Twin Mountains Formation	322727	975059	Withdrawal of Water
3234405	Hood	Countryside Trailer	Public Supply	220	Twin Mountains Formation	322543	975005	Withdrawal of Water
3234501	Hood	City of Granbury	Public Supply	202	Twin Mountains Formation	322624	974746	Withdrawal of Water
3234502	Hood	City of Granbury	Public Supply	186	Twin Mountains Formation	322634	974805	Withdrawal of Water
3234503	Hood	City of Granbury	Unused	193	Twin Mountains Formation	322645	974813	Withdrawal of Water
3234504	Hood	Texas Highway Dept.	Industrial	200	Twin Mountains Formation	322543	974740	Withdrawal of Water
3234505	Hood	Hood County Feeders	Industrial	260	Twin Mountains Formation	322637	974946	Withdrawal of Water
3234506	Hood	Hood County Feeders	Industrial	258	Twin Mountains Formation	322637	974946	Withdrawal of Water

TABLE 2.3-28 (Sheet 5 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3234507	Hood	Mooreland Water Co.	Public Supply	270	Twin Mountains Formation	322535	974902	Withdrawal of Water
3234508	Hood	Mooreland Water Co.	Public Supply	270	Twin Mountains Formation	322536	974900	Withdrawal of Water
3234509	Hood	Mooreland Water Co.	Public Supply	280	Twin Mountains Formation	322534	974904	Withdrawal of Water
3234510	Hood	Mooreland Water Co.	Public Supply	270	Twin Mountains Formation	322537	974858	Withdrawal of Water
3234511	Hood	Mooreland Water Co.	Public Supply	280	Twin Mountains Formation	322516	974857	Withdrawal of Water
3234512	Hood	Mooreland Water Co.	Public Supply	260	Twin Mountains Formation	322539	974914	Withdrawal of Water
3234513	Hood	Mooreland Water Co.	Public Supply	225	Twin Mountains Formation	322556	974916	Withdrawal of Water
3234514	Hood	S & W Water Co.	Public Supply	200	Twin Mountains Formation	322557	974743	Withdrawal of Water
3234515	Hood	Hood County Jail	Industrial	225	Twin Mountains Formation	322640	974814	Withdrawal of Water
3234601	Hood	City of Granbury	Public Supply	175	Twin Mountains Formation	322643	974704	Withdrawal of Water
3234602	Hood	City of Granbury	Public Supply	225	Twin Mountains Formation	322705	974712	Withdrawal of Water
3234603	Hood	City of Granbury	Public Supply	200	Twin Mountains Formation	322658	974700	Withdrawal of Water
3234604	Hood	City of Granbury	Public Supply	205	Twin Mountains Formation	322655	974656	Withdrawal of Water
3234605	Hood	City of Granbury	Unused	685	Twin Mountains Formation	322650	974704	Withdrawal of Water
3234606	Hood	City of Granbury	Public Supply	175	Twin Mountains Formation	322647	974709	Withdrawal of Water
3234607	Hood	City of Granbury	Public Supply	175	Twin Mountains Formation	322648	974706	Withdrawal of Water
3234608	Hood	City of Granbury	Unused	160	Twin Mountains Formation	322649	974704	Withdrawal of Water
3234609	Hood	City of Granbury	Public Supply	250	Twin Mountains Formation	322627	974551	Withdrawal of Water
3234610	Hood	City of Granbury	Public Supply	256	Twin Mountains Formation	322631	974522	Withdrawal of Water
3234611	Hood	City of Granbury	Public Supply	300	Twin Mountains Formation	322639	974503	Withdrawal of Water
3234612	Hood	City of Granbury	Unused	677	Twin Mountains Formation	322647	974705	Withdrawal of Water
3234613	Hood	City of Granbury	Public Supply	211	Twin Mountains Formation	322653	974650	Withdrawal of Water
3234614	Hood	City of Granbury	Public Supply	225	Twin Mountains Formation	322704	974653	Withdrawal of Water
3234615	Hood	Southwest Water	Public Supply	379	Twin Mountains Formation	322559	974510	Withdrawal of Water
3234616	Hood	Stum's Wholesale	Industrial	185	Twin Mountains Formation	322633	974655	Withdrawal of Water

TABLE 2.3-28 (Sheet 6 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3234617	Hood	Joe Noah	Industrial	176	Twin Mountains Formation	322605	974647	Withdrawal of Water
3234618	Hood	Ingram Enterprises	Industrial	300	Twin Mountains Formation	322620	974511	Withdrawal of Water
3234619	Hood	Southwest Water	Public Supply	330	Twin Mountains Formation	322614	974514	Withdrawal of Water
3234620	Hood	Thrift Mart Co-op	Public Supply	320	Twin Mountains Formation	322626	974516	Withdrawal of Water
3234621	Hood	City of Granbury	Public Supply	208	Twin Mountains Formation	322622	974600	Withdrawal of Water
3234622	Hood	The Shores Utility	Public Supply	200	Twin Mountains Formation	322558	974644	Withdrawal of Water
3234623	Hood	The Shores Utility	Public Supply	200	Twin Mountains Formation	322552	974640	Withdrawal of Water
3234624	Hood	Southwest Water	Public Supply	386	Twin Mountains Formation	322600	974511	Withdrawal of Water
3234625	Hood	Southwest Water	Unused	370	Twin Mountains Formation	322558	974529	Withdrawal of Water
3234701	Hood	William L. Schomers	Domestic	317	Twin Mountains Formation	322240	975045	Withdrawal of Water
3234702	Hood	City of Granbury	Public Supply	425	Twin Mountains Formation	322445	975021	Withdrawal of Water
3234801	Hood	Ned Davis	Domestic	300	Twin Mountains Formation	322341	974859	Withdrawal of Water
3234803	Hood	Bob Westvold	Domestic	130	Paluxy Sand	322235	974836	Withdrawal of Water
3234804	Hood	Resort Water Services	Public Supply	280	Twin Mountains Formation	322435	974808	Withdrawal of Water
3234805	Hood	Jerry Barrett	Domestic	350	Twin Mountains Formation	322257	974929	Withdrawal of Water
3234806	Hood	Jerry Barrett	Unused	44	Paluxy Sand	322254	974929	Withdrawal of Water
3234807	Hood	Warren Massey	Domestic	365	Twin Mountains Formation	322251	974939	Withdrawal of Water
3234808	Hood	J. Benefield	Domestic	380	Twin Mountains Formation	322236	974926	Withdrawal of Water
3234809	Hood	James Reed	Domestic	354	Twin Mountains Formation	322249	974949	Withdrawal of Water
3234810	Hood	Jesse Martin	Unused	27	Paluxy Sand	322250	974946	Withdrawal of Water
3234811	Hood	Lewis Allen	Domestic	400	Twin Mountains Formation	322312	974857	Withdrawal of Water
3234812	Hood	Forrest Carter	Domestic	375	Twin Mountains Formation	322327	974939	Withdrawal of Water
3234901	Hood	Acton MUD #13	Public Supply	430	Twin Mountains Formation	322414	974633	Withdrawal of Water
3234902	Hood	Southwest Water	Public Supply	320	Twin Mountains Formation	322421	974724	Withdrawal of Water
3234903	Hood	Southwest Water	Public Supply	317	Twin Mountains Formation	322431	974630	Withdrawal of Water

TABLE 2.3-28 (Sheet 7 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3234904	Hood	Southwest Water	Public Supply	365	Twin Mountains Formation	322424	974627	Withdrawal of Water
3234905	Hood	Tarrant Utility Co.	Unused	265	Twin Mountains Formation	322442	974538	Withdrawal of Water
3234906	Hood	Acton Mun. Util. Dist.	Unused	398	Twin Mountains Formation	322441	974540	Withdrawal of Water
3234907	Hood	Acton Mun. Util. Dist.	Public Supply	535	Twin Mountains Formation	322441	974540	Withdrawal of Water
3234908	Hood	Hood County Water Co.	Public Supply	557	Twin Mountains Formation	322352	974658	Withdrawal of Water
3234909	Hood	Hood County Water Co.	Public Supply	505	Twin Mountains Formation	322353	974702	Withdrawal of Water
3234910	Hood	Hood County Water Co.	Public Supply	378	Twin Mountains Formation	322354	974700	Withdrawal of Water
3234911	Hood	Western Resort Prop.	Public Supply	364	Twin Mountains Formation	322441	974545	Withdrawal of Water
3234912	Hood	Western Resort Prop.	Public Supply	572	Twin Mountains Formation	322411	974648	Withdrawal of Water
3234913	Hood	Rock Harbor Estates	Public Supply	265	Twin Mountains Formation	322444	974639	Withdrawal of Water
3234914	Hood	Scenic View Estates	Public Supply	123	Twin Mountains Formation	322452	974710	Withdrawal of Water
3235101	Hood	Ed Lawrence	Industrial	384	Twin Mountains Formation	322814	974316	Withdrawal of Water
3235102	Hood	A.V. Almy	Domestic	329	Twin Mountains Formation	322902	974346	Withdrawal of Water
3235103	Hood	J.C. Terrell	Domestic	335	Twin Mountains Formation	322757	974325	Withdrawal of Water
3235104	Hood	G.H. Chase	Domestic	292	Twin Mountains Formation	322754	974302	Withdrawal of Water
3235105	Hood	Granbury Water Service	Public Supply	425	Twin Mountains Formation	322735	974300	Withdrawal of Water
3235106	Hood	Lewis Byers	Industrial	380	Twin Mountains Formation	322742	974307	Withdrawal of Water
3235107	Hood	Jean Davis	Irrigation	445	Twin Mountains Formation	322907	974313	Withdrawal of Water
3235108	Hood	Jean Davis	Irrigation	385	Twin Mountains Formation	322908	974333	Withdrawal of Water
3235109	Hood	Jean Davis	Domestic	405	Twin Mountains Formation	322904	974312	Withdrawal of Water
3235110	Hood	Sands Butane Co.	Domestic	380	Twin Mountains Formation	322744	974307	Withdrawal of Water
3235111	Hood	Gran-Tex Land and	Industrial	390	Twin Mountains Formation	322743	974305	Withdrawal of Water
3235112	Hood	Granbury Water Service	Public Supply	425	Twin Mountains Formation	322734	974256	Withdrawal of Water
3235113	Hood	Hood County Water Co.	Public Supply	398	Twin Mountains Formation	322850	974354	Withdrawal of Water
3235114	Hood	Hood County Water Co.	Public Supply	400	Twin Mountains Formation	322850	974422	Withdrawal of Water

TABLE 2.3-28 (Sheet 8 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3235115	Hood	Hood County Water Co.	Public Supply	420	Twin Mountains Formation	322924	974326	Withdrawal of Water
3235116	Hood	H2M Water Services	Public Supply	408	Twin Mountains Formation	322810	974312	Withdrawal of Water
3235117	Hood	Waples Baptist Church	Public Supply	390	Twin Mountains Formation	322849	974321	Withdrawal of Water
3235118	Hood	Nolan Creek Estates	Public Supply	410	Twin Mountains Formation	322828	974355	Withdrawal of Water
3235119	Hood	Mallard Pointe on Lake	Public Supply	390	Twin Mountains Formation	322742	974459	Withdrawal of Water
3235120	Hood	Mallard Pointe on Lake	Public Supply	370	Twin Mountains Formation	322742	974453	Withdrawal of Water
3235121	Hood	Mallard Pointe on Lake	Public Supply	370	Twin Mountains Formation	322745	974449	Withdrawal of Water
3235201	Hood	Acton Mun. Util. Dist.	Public Supply	540	Twin Mountains Formation	322838	974116	Withdrawal of Water
3235202	Hood	Acton Mun. Util. Dist.	Public Supply	160	Paluxy Sand	322838	974116	Withdrawal of Water
3235203	Hood	Acton Mun. Util. Dist.	Public Supply	90	Paluxy Sand	322807	974155	Withdrawal of Water
3235204	Hood	Acton Mun. Util. Dist.	Public Supply	440	Twin Mountains Formation	322807	974155	Withdrawal of Water
3235205	Hood	Acton Mun. Util. Dist.	Public Supply	640	Twin Mountains Formation	322804	974107	Withdrawal of Water
3235206	Hood	Acton Mun. Util. Dist.	Public Supply	113	Paluxy Sand	322804	974107	Withdrawal of Water
3235401	Hood	Hanco Inc.	Public Supply	387	Twin Mountains Formation	322532	974351	Withdrawal of Water
3235402	Hood	El Brazos Apartments	Public Supply	312	Twin Mountains Formation	322657	974433	Withdrawal of Water
3235403	Hood	Boy Scouts of America	Public Supply	397	Twin Mountains Formation	322558	974456	Withdrawal of Water
3235404	Hood	L.E. Massengale	Domestic	324	Twin Mountains Formation	322614	974424	Withdrawal of Water
3235405	Hood	R.E. Stephens	Industrial	290	Twin Mountains Formation	322654	974428	Withdrawal of Water
3235406	Hood	Hanco Inc.	Public Supply	350	Twin Mountains Formation	322648	974342	Withdrawal of Water
3235407	Hood	Hanco Inc.	Public Supply	415	Twin Mountains Formation	322532	974351	Withdrawal of Water
3235408	Hood	Hood County Water Co.	Public Supply	445	Twin Mountains Formation	322708	974351	Withdrawal of Water
3235409	Hood	Shady Oak Estates	Public Supply	350	Twin Mountains Formation	322626	974418	Withdrawal of Water
3235410	Hood	Charlie & Georges	Public Supply	360	Twin Mountains Formation	322653	974431	Withdrawal of Water
3235411	Hood	Hood County Water Co.	Public Supply	328	Twin Mountains Formation	322508	974318	Withdrawal of Water
3235501	Hood	Acton MUD	Public Supply	395	Twin Mountains Formation	322520	974021	Withdrawal of Water

TABLE 2.3-28 (Sheet 9 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3235502	Hood	Hanco Inc.	Public Supply	330	Twin Mountains Formation	322538	974216	Withdrawal of Water
3235503	Hood	Acton MUD	Public Supply	379	Twin Mountains Formation	322613	974203	Withdrawal of Water
3235504	Hood	Green Meadows Mobile	Public Supply	435	Twin Mountains Formation	322659	974107	Withdrawal of Water
3235505	Hood	Acton Mun. Util. Dist.	Public Supply	620	Twin Mountains Formation	322645	974004	Withdrawal of Water
3235601	Hood	C.T. Sharp	Domestic	155	Paluxy Sand	322640	973928	Withdrawal of Water
3235602	Hood	Acton Mun. Util. Dist.	Public Supply	520	Twin Mountains Formation	322552	973948	Withdrawal of Water
3235701	Hood	Woddy Oliver	Domestic	250	Twin Mountains Formation	322433	974306	Withdrawal of Water
3235702	Hood	Jackson Heights Mobile	Public Supply	342	Twin Mountains Formation	322432	974407	Withdrawal of Water
3235703	Hood	C.F. Sealey	Public Supply	356	Twin Mountains Formation	322256	974257	Withdrawal of Water
3235704	Hood	Hood Co. Utilities	Public Supply	340	Twin Mountains Formation	322312	974319	Withdrawal of Water
3235705	Hood	Hood County Water Co.	Public Supply	452	Twin Mountains Formation	322249	974406	Withdrawal of Water
3235706	Hood	Canyon Creek Estates	Public Supply	355	Twin Mountains Formation	322341	974429	Withdrawal of Water
3235707	Hood	Canyon Creek Estates	Public Supply	320	Twin Mountains Formation	322336	974435	Withdrawal of Water
3235708	Hood	Canyon Creek Estates	Public Supply	509	Twin Mountains Formation	322334	974418	Withdrawal of Water
3235709	Hood	Boynton Water Supply	Public Supply	365	Twin Mountains Formation	322431	974410	Withdrawal of Water
3235801	Hood	- -Henslee	Stock	0	Paluxy Sand	322357	974138	Spring
3235802	Hood	Texas Power and Light	Industrial	325	Twin Mountains Formation	322409	974205	Withdrawal of Water
3235803	Hood	Texas Power and Light	Industrial	335	Twin Mountains Formation	322415	974155	Withdrawal of Water
3235804	Hood	Hood Co. Utilities	Public Supply	367	Twin Mountains Formation	322317	974146	Withdrawal of Water
3235805	Hood	Hood Co. Utilities	Unused	380	Twin Mountains Formation	322331	974156	Withdrawal of Water
3235806	Hood	Acton Mun. Util. Dist.	Public Supply	600	Twin Mountains Formation	322457	974004	Withdrawal of Water
3235901	Hood	A.J. Purselley	Domestic	457	Twin Mountains Formation	322334	973815	Withdrawal of Water
3235902	Hood	R.A. Massey	Domestic	45	Paluxy Sand	322438	973808	Withdrawal of Water
3235903	Hood	Camp El Tesoro	Unused	348	Twin Mountains Formation	322328	973901	Withdrawal of Water
3235904	Hood	Acton MUD	Public Supply	413	Twin Mountains Formation	322343	973929	Withdrawal of Water

TABLE 2.3-28 (Sheet 10 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3235905	Hood	Hood Co. Utilities	Public Supply	390	Twin Mountains Formation	322307	973936	Withdrawal of Water
3241101	Hood	P.W. Gage	Domestic	108	Twin Mountains Formation	322107	975916	Withdrawal of Water
3241102	Hood	Stanley Allen	Domestic	140	Twin Mountains Formation	322024	975913	Withdrawal of Water
3241201	Hood	B.E. Wood	Domestic	45	Paluxy Sand	322059	975557	Withdrawal of Water
3241301	Hood	Rufus Vest	Domestic	285	Twin Mountains Formation	322106	975354	Withdrawal of Water
3241402	Hood	Steve Griffith	Irrigation	180	Twin Mountains Formation	321951	975839	Withdrawal of Water
3241501	Hood	R.B. Caraway	Domestic	0	Twin Mountains Formation	321811	975709	Spring
3241601	Hood	J.H. Woods	Domestic	260	Twin Mountains Formation	321831	975303	Withdrawal of Water
3241602	Hood	A. Heathington	Domestic	310	Twin Mountains Formation	321808	975252	Withdrawal of Water
3241801	Hood	F.A. Troutman	Domestic	250	Twin Mountains Formation	321622	975653	Withdrawal of Water
3241802	Hood	J.C. Manley	Domestic	165	Twin Mountains Formation	321720	975649	Withdrawal of Water
3241803	Hood	H.L. Seale Ranch	Domestic	343	Twin Mountains Formation	321510	975607	Withdrawal of Water
3241901	Hood	Paluxy Baptist Church	Domestic	169	Twin Mountains Formation	321616	975428	Withdrawal of Water
3241903	Hood	De Soto Oil Co.	Unused	5082	Aquifer Code Not Applicable	321545	975414	Oil or Gas
3242101	Hood	J.R. Gauntt	Domestic	331	Twin Mountains Formation	322212	975021	Withdrawal of Water
3242202	Hood	Mid-Continent Pet. Co.	Unused	5577	Aquifer Code Not Applicable	322120	974957	Oil or Gas
3242203	Hood	Elsie Holden	Domestic	344	Twin Mountains Formation	322221	974916	Withdrawal of Water
3242301	Hood	- -	Domestic	300	Travis Peak Formation	322204	974637	Withdrawal of Water
3242302	Hood	J.L. Wiggins	Domestic	396	Twin Mountains Formation	322151	974629	Withdrawal of Water
3242303	Hood	A.J. Kiesling	Unused	350	Twin Mountains Formation	322218	974510	Withdrawal of Water
3242401	Hood	J.T. Parker	Domestic	352	Twin Mountains Formation	321830	975052	Withdrawal of Water
3242402	Hood	T.W. Couch	Domestic	335	Twin Mountains Formation	321852	975107	Withdrawal of Water
3242403	Hood	A.L. Hurley	Domestic	355	Twin Mountains Formation	321917	975216	Withdrawal of Water
3242502	Hood	J.C. Ice	Domestic	352	Twin Mountains Formation	321807	974853	Withdrawal of Water
3242604	Hood	Texas Utilities	Unused	470	Twin Mountains Formation	321910	974655	Observation

TABLE 2.3-28 (Sheet 11 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3243101	Hood	J.J. Purselley	Domestic	335	Twin Mountains Formation	322222	974452	Withdrawal of Water
3243102	Hood	B.W. Fitzgerald	Unused	4503	Aquifer Code Not Applicable	322133	974449	Oil or Gas
3243103	Hood	V. D. Wheeler	Domestic	360	Twin Mountains Formation	322009	974425	Withdrawal of Water
3243104	Hood	David Wheeler	Irrigation	500	Twin Mountains Formation	322004	974427	Withdrawal of Water
3243105	Hood	McKee Water Services	Public Supply	376	Twin Mountains Formation	322112	974308	Withdrawal of Water
3243201	Hood	H. Zweifel	Stock	185	Twin Mountains Formation	322150	974140	Withdrawal of Water
3243202	Hood	Acton MUD	Public Supply	371	Twin Mountains Formation	322207	974129	Withdrawal of Water
3243203	Hood	Acton Mun. Util. Dist.	Public Supply	393	Twin Mountains Formation	322157	974033	Withdrawal of Water
3243204	Hood	Acton Mun. Util. Dist.	Public Supply	560	Twin Mountains Formation	322158	974045	Withdrawal of Water
3243205	Hood	Acton Mun. Util. Dist.	Unused	572	Twin Mountains Formation	322158	974045	Test Hole
3243206	Hood	Acton MUD	Public Supply	500	Twin Mountains Formation	322047	974037	Withdrawal of Water
3243207	Hood		Not Listed	0	Alluvium	322031	974031	Spring
3243301	Hood	Acton Mun. Util. Dist.	Public Supply	570	Twin Mountains Formation	322159	973928	Withdrawal of Water
3243302	Hood	Acton MUD	Public Supply	530	Twin Mountains Formation	322222	973956	Withdrawal of Water
3243303	Hood	Acton MUD	Public Supply	588	Twin Mountains Formation	322127	973801	Withdrawal of Water
3249201	Hood	H.L. Seale Ranch	Domestic	252	Twin Mountains Formation	321459	975636	Withdrawal of Water
3241902	Somervell	N. B. Sanderson	Domestic	288	Twin Mountains Formation	321518	975314	Withdrawal of Water
3242501	Somervell	Bert Willie	Unused	300	Twin Mountains Formation	321738	974930	Withdrawal of Water
3242503	Somervell	Texas Utilities	Industrial	517	Twin Mountains Formation	321802	974826	Withdrawal of Water
3242504	Somervell	Texas Utilities	Public Supply	400	Twin Mountains Formation	321802	974822	Withdrawal of Water
3242601	Somervell	Texas Utilities	Industrial	466	Twin Mountains Formation	321745	974723	Withdrawal of Water
3242602	Somervell	Texas Utilities	Industrial	490	Twin Mountains Formation	321751	974649	Withdrawal of Water
3242603	Somervell	Texas Utilities	Industrial	471	Twin Mountains Formation	321858	974656	Withdrawal of Water
3242701	Somervell	- - Matheny	Domestic	130	Glen Rose Limestone	321521	975109	Withdrawal of Water
3242801	Somervell	L. P. Jones	Domestic	352	Twin Mountains Formation	321642	974845	Withdrawal of Water

TABLE 2.3-28 (Sheet 12 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3242802	Somervell	Oak Grove Sub-div.	Public Supply	360	Twin Mountains Formation	321725	974835	Withdrawal of Water
3242803	Somervell	Oak Grove Sub-div.	Public Supply	360	Twin Mountains Formation	321725	974835	Withdrawal of Water
3242804	Somervell	Scruggs Mobile Home Pk	Public Supply	420	Twin Mountains Formation	321656	974832	Withdrawal of Water
3242901	Somervell	G. A. Jackson	Stock	350	Twin Mountains Formation	321714	974522	Withdrawal of Water
3242902	Somervell	Texas Utilities	Unused	318	Twin Mountains Formation	321709	974513	Withdrawal of Water
3242903	Somervell	Texas Utilities	Unused	479	Twin Mountains Formation	321651	974623	Withdrawal of Water
3242904	Somervell	City of Glen Rose	Public Supply	500	Twin Mountains Formation	321545	974512	Withdrawal of Water
3242905	Somervell	Texas Ampitheater	Public Supply	340	Twin Mountains Formation	321546	974510	Withdrawal of Water
3243401	Somervell	D. Trembly	Domestic	330	Hensell Sand Member of Travis Peak Formation	321830	974409	Withdrawal of Water
3243402	Somervell	B. B. Halbert	Stock	200	Hensell Sand Member of Travis Peak Formation	321857	974339	Withdrawal of Water
3243403	Somervell	F. E. Miller	Domestic	140	Hensell Sand Member of Travis Peak Formation	321848	974238	Withdrawal of Water
3243404	Somervell	I. W. Keller	Stock	200	Hensell Sand Member of Travis Peak Formation	321838	974332	Withdrawal of Water
3243405	Somervell	I. W. Keller	Stock	0	Alluvium	321815	974248	Spring
3243406	Somervell	J. D. Hardy	Unused	212	Twin Mountains Formation	321918	974241	Withdrawal of Water
3243407	Somervell	Ri-Mac Development	Public Supply	383	Twin Mountains Formation	321813	974425	Withdrawal of Water
3243408	Somervell	Harston Gravel Co.	Industrial	340	Twin Mountains Formation	321824	974240	Withdrawal of Water
3243409	Somervell	Harston Gravel Co.	Industrial	450	Twin Mountains Formation	321824	974240	Withdrawal of Water
3243410	Somervell	Alton May	Public Supply	420	Twin Mountains Formation	321744	974305	Withdrawal of Water
3243411	Somervell	Harston Gravel Co.	Industrial	260	Twin Mountains Formation	321828	974251	Withdrawal of Water
3243412	Somervell	Happy Hills Home	Public Supply	378	Twin Mountains Formation	321738	974414	Withdrawal of Water
3243413	Somervell	Happy Hills Home	Public Supply	400	Twin Mountains Formation	321738	974414	Withdrawal of Water

TABLE 2.3-28 (Sheet 13 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3243414	Somervell	Happy Hills Home	Public Supply	517	Twin Mountains Formation	321738	974414	Withdrawal of Water
3243415	Somervell	H2M Water Services	Public Supply	383	Twin Mountains Formation	321831	974432	Withdrawal of Water
3243501	Somervell	Arrowhead Camp	Public Supply	270	Twin Mountains Formation	321828	974219	Withdrawal of Water
3243601	Somervell	Capital Silica Co.	Industrial	285	Hensell Sand Member of Travis Peak Formation	321747	973736	Withdrawal of Water
3243701	Somervell	W. H. Howth	Domestic	230	Travis Peak Formation	321633	974356	Withdrawal of Water
3243702	Somervell	Squaw Creek Cemetary	Irrigation	359	Travis Peak Formation	321547	974310	Withdrawal of Water
3243703	Somervell	W. B. Stewart	Domestic	374	Glen Rose Limestone and Twin Mountains Formation	321605	974259	Withdrawal of Water
3243704	Somervell	Mark Dodson	Irrigation	390	Twin Mountains Formation	321522	974307	Withdrawal of Water
3243705	Somervell	Tres Rios Estates	Public Supply	360	Twin Mountains Formation	321513	974305	Withdrawal of Water
3243801	Somervell	George Day	Stock	260	Twin Mountains Formation	321655	974115	Withdrawal of Water
3243802	Somervell	Shackelford Est.	Stock	256	Twin Mountains Formation	321631	974012	Withdrawal of Water
3243803	Somervell	F. Williams	Stock	260	Twin Mountains Formation	321601	974007	Withdrawal of Water
3243804	Somervell	J. M. West	Unused	260	Twin Mountains Formation	321544	974050	Withdrawal of Water
3243805	Somervell	E. J. Doughty	Domestic	464	Twin Mountains Formation	321520	974136	Withdrawal of Water
3243806	Somervell	Mrs.W. H. White	Not Listed	0	Glen Rose Limestone	321536	974203	Spring
3243807	Somervell	K-B Oil Co.---	Unused	4213	Aquifer Code Not Applicable	321634	974210	Oil or Gas
3243808	Somervell	J. H. Shook	Domestic	200	Glen Rose Limestone	321544	974222	Withdrawal of Water
3243809	Somervell	Derbie Schackleford	Unused	253	Twin Mountains Formation	321631	974055	Withdrawal of Water
3243810	Somervell	M & W Ranch	Irrigation	420	Twin Mountains Formation	321514	974222	Withdrawal of Water
3243811	Somervell	Tres Rios	Domestic	380	Twin Mountains Formation	321602	974207	Withdrawal of Water
3243812	Somervell	Oak River Ranch	Public Supply	500	Twin Mountains Formation	321536	974023	Withdrawal of Water
3243813	Somervell	John Pugh	Domestic	302	Twin Mountains Formation	321613	974021	Withdrawal of Water
3243901	Somervell	Texas Cedar Oil Co.	Industrial	380	Hensell Sand Member of Travis Peak Formation	321637	973906	Withdrawal of Water

TABLE 2.3-28 (Sheet 14 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3243902	Somervell	Georges Creek Church	Public Supply	147	Paulxy Sand	321729	973806	Withdrawal of Water
3243903	Somervell	Stevens Ranch on Brazo	Unused	470	Twin Mountains Formation	321545	973928	Withdrawal of Water
3243904	Somervell	Stevens Ranch on Brazo	Public Supply	645	Twin Mountains Formation	321547	973929	Withdrawal of Water
3249301	Somervell	J. P. Morrow	Irrigation	298	Twin Mountains Formation	321442	975326	Withdrawal of Water
3249601	Somervell	J. W. Tottenham	Stock	345	Hensell Sand Member of Travis Peak Formation	321203	975355	Withdrawal of Water
3249901	Somervell	C. A. Rogers	Stock	281	Paulxy Sand	320959	975347	Withdrawal of Water
3250101	Somervell	D. H. Smith	Stock	273	Twin Mountains Formation	321446	975102	Withdrawal of Water
3250102	Somervell	Gene Ratliff	Domestic	275	Twin Mountains Formation	321417	975004	Withdrawal of Water
3250103	Somervell	Roy Kenedy and E. H.	Irrigation	300	Travis Peak Formation	321456	975006	Withdrawal of Water
3250201	Somervell	L. H. Daniels	Stock	176	Glen Rose Limestone	321421	974941	Withdrawal of Water
3250202	Somervell	W. A. Wood	Unused	297	Twin Mountains Formation	321425	974942	Withdrawal of Water
3250203	Somervell	Travis Wooley	Unused	284	Travis Peak Formation	321418	974927	Withdrawal of Water
3250204	Somervell	J. O. Pruitt	Stock	135	Twin Mountains Formation	321437	974834	Withdrawal of Water
3250205	Somervell	C. C. Moss	Domestic	143	Twin Mountains Formation	321350	974842	Withdrawal of Water
3250206	Somervell	J. O. Pruitt	Domestic	120	Twin Mountains Formation	321351	974813	Withdrawal of Water
3250207	Somervell	W. M. Spoonmore	Stock	125	Twin Mountains Formation	321401	974743	Withdrawal of Water
3250208	Somervell	Tx Parks and Wildlife	Public Supply	354	Twin Mountains Formation	321448	974858	Withdrawal of Water
3250209	Somervell	American Legion	Public Supply	170	Glen Rose Limestone	321347	974747	Withdrawal of Water
3250301	Somervell	W. M. Spoonmore	Stock	317	Twin Mountains Formation	321404	974721	Withdrawal of Water
3250302	Somervell	W. M. Spoonmore	Domestic	567	Twin Mountains Formation	321434	974722	Withdrawal of Water
3250303	Somervell	City of Glen Rose	Public Supply	325	Hosston Formation	321410	974524	Withdrawal of Water
3250304	Somervell	City of Glen Rose	Public Supply	352	Travis Peak Formation	321401	974508	Withdrawal of Water
3250305	Somervell	T. K. Blalock	Domestic	120	Glen Rose Limestone	321348	974510	Withdrawal of Water
3250306	Somervell	Mrs. Nix	Not Listed	186	Glen Rose Limestone	321406	974541	Withdrawal of Water

TABLE 2.3-28 (Sheet 15 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3250307	Somervell	J. B. Young	Not Listed	177	Glen Rose Limestone	321359	974525	Withdrawal of Water
3250308	Somervell	T. W. Garner	Domestic	140	Glen Rose Limestone	321342	974513	Withdrawal of Water
3250309	Somervell	City of Glen Rose	Public Supply	472	Hosston Formation	321421	974558	Withdrawal of Water
3250310	Somervell	Glen Rose Public	Irrigation	370	Twin Mountains Formation	321350	974603	Withdrawal of Water
3250311	Somervell	Kirk Estates	Public Supply	280	Glen Rose Limestone	321320	974639	Withdrawal of Water
3250312	Somervell	Kirk Estates	Public Supply	280	Glen Rose Limestone	321320	974637	Withdrawal of Water
3250313	Somervell	Kirk Estates	Public Supply	260	Glen Rose Limestone	321347	974626	Withdrawal of Water
3250314	Somervell	Paluxy Estates	Public Supply	280	Glen Rose Limestone	321329	974517	Withdrawal of Water
3250315	Somervell	Paluxy Estates	Public Supply	400	Glen Rose Limestone	321318	974517	Withdrawal of Water
3250316	Somervell	Somervell Co. Courthos	Public Supply	200	Glen Rose Limestone	321405	974521	Withdrawal of Water
3250317	Somervell	Sunset Park	Public Supply	320	Twin Mountains Formation	321406	974657	Withdrawal of Water
3250401	Somervell	W. A. Schmidt	Unused	328	Twin Mountains Formation	321201	975026	Withdrawal of Water
3250402	Somervell	Otis Shipman	Domestic	372	Twin Mountains Formation	321121	975208	Withdrawal of Water
3250501	Somervell	J. E. Jackson	Domestic	297	Twin Mountains Formation	321152	974833	Withdrawal of Water
3250502	Somervell	Whitaker and Whitaker	Unused	2421	Aquifer Code Not Applicable	321116	974816	Oil or Gas
3250503	Somervell	Kelley Lewellen	Domestic	347	Twin Mountains Formation	321154	974822	Withdrawal of Water
3250504	Somervell	Cedar Ridge	Public Supply	530	Twin Mountains Formation	321153	974826	Withdrawal of Water
3250505	Somervell	Fossil Rim Wildlife	Public Supply	500	Twin Mountains Formation	321028	974739	Withdrawal of Water
3250506	Somervell	Fossil Rim Wildlife	Public Supply	76	Paulxy Sand	321036	974803	Withdrawal of Water
3250601	Somervell	- -Shelton	Domestic	110	Paulxy Sand	321149	974503	Withdrawal of Water
3250701	Somervell	Cedar Valley Ranch	Domestic	510	Hensell Sand Member of Travis Peak Formation	320959	975111	Withdrawal of Water
3250801	Somervell	C. D. Montgomery	Domestic	225	Paulxy Sand	320755	974926	Withdrawal of Water
3250802	Somervell	Fossil Rim Wildlife	Domestic	321	Paulxy Sand	320924	974741	Withdrawal of Water
3250803	Somervell	Fossil Rim Wildlife	Public Supply	714	Hosston Formation	320939	974743	Withdrawal of Water

TABLE 2.3-28 (Sheet 16 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3250804	Somervell	Fossil Rim Wildlife	Public Supply	560	Hosston Formation	320948	974834	Withdrawal of Water
3250805	Somervell	Fossil Rim Wildlife	Public Supply	820	Hosston Formation	320938	974741	Withdrawal of Water
3250901	Somervell	Benedum Trees Oil Co.	Unused	3625	Aquifer Code Not Applicable	320912	974643	Oil or Gas
3251101	Somervell	Camp Tres Rios	Public Supply	277	Hensell Sand Member of Travis Peak Formation	321452	974312	Withdrawal of Water
3251102	Somervell	M. E. Davis	Unused	6505	Aquifer Code Not Applicable	321254	974435	Oil or Gas
3251103	Somervell	- -Bartlett	Not Listed	128	Glen Rose Limestone	321434	974447	Withdrawal of Water
3251104	Somervell	Bill Walker	Domestic	376	Twin Mountains Formation	321231	974455	Withdrawal of Water
3251105	Somervell	City of Glen Rose	Public Supply	484	Twin Mountains Formation	321341	974449	Withdrawal of Water
3251106	Somervell	Glen Lake Methodist	Irrigation	348	Twin Mountains Formation	321418	974435	Withdrawal of Water
3251107	Somervell		Not Listed	0	Aquifer Not Listed	321438	974429	Spring
3251108	Somervell	City of Glen Rose	Public Supply	410	Hensell Sand Member of Travis Peak Formation	321453	974357	Withdrawal of Water
3251201	Somervell	W. L. Lilly	Stock	187	Hensell Sand Member of Travis Peak Formation	321428	974215	Withdrawal of Water
3251202	Somervell	C. L. Oldham	Domestic	240	Hensell Sand Member of Travis Peak Formation	321440	974128	Withdrawal of Water
3251203	Somervell	J. E. Turner	Unused	221	Hensell Sand Member of Travis Peak Formation	321408	974059	Withdrawal of Water
3251204	Somervell	Harry Dennis	Stock	125	Glen Rose Limestone	321353	974049	Withdrawal of Water
3251205	Somervell	V. M. Reeves	Domestic	425	Travis Peak Formation	321330	974119	Withdrawal of Water
3251206	Somervell	Sandlin Est.	Stock	240	Twin Mountains Formation	321259	974107	Withdrawal of Water
3251207	Somervell	G. T. Stevens	Domestic	431	Hosston Formation	321241	974145	Withdrawal of Water
3251208	Somervell	M & W Ranch	Irrigation	410	Twin Mountains Formation	321456	974209	Withdrawal of Water
3251209	Somervell	M & W Ranch	Irrigation	410	Twin Mountains Formation	321447	974229	Withdrawal of Water
3251301	Somervell	Clark Hedrick	Unused	91	Paulxy Sand	321435	973922	Withdrawal of Water

TABLE 2.3-28 (Sheet 17 of 17)
HOOD AND SOMERVELL COUNTY WATER WELL INFORMATION

Well Number	County	Owner	Primary Use	Well Depth (ft)	Aquifer	Latitude	Longitude	Well Type
3251302	Somervell	T. T. Mullins	Stock	211	Twin Mountains Formation	321246	973919	Withdrawal of Water
3251501	Somervell	H. C. Polley	Unused	370	Hensell Sand Member of Travis Peak Formation	321104	974129	Withdrawal of Water
3251502	Somervell	Tarrant Baptist	Public Supply	475	Twin Mountains Formation	321212	974144	Withdrawal of Water
3251503	Somervell	Tarrant Baptist	Public Supply	550	Twin Mountains Formation	321211	974143	Withdrawal of Water
3251601	Somervell	A. E. Smith	Unused	375	Hensell Sand Member of Travis Peak Formation	321220	973739	Withdrawal of Water
3251701	Somervell	D. A. Odom	Unused	119	Paulxy Sand	320906	974456	Withdrawal of Water
3258101	Somervell	W. F. Long	Stock	283	Paulxy Sand	320713	975220	Withdrawal of Water

Source: (TWDB 2007c)

TABLE 2.3-29 (Sheet 1 of 2)
MONITORING WELL INSTALLATION DATA

Monitoring Point	Reference Elevation	Ground Elevation	Well Depth	Screen Length	Top of Screen	Bottom of Screen[a]	Boring Depth
	(ft msl)	(ft msl)	(ft bre)	(ft)	(ft msl)	(ft msl)	(ft bgs)
MW-1200b	851.44	848.91	57.92	20.00	813.97	793.97	55.39
MW-1200c	851.32	848.97	97.39	20.00	774.38	754.38	95.04
MW-1201a	866.02	863.19	21.78	10.00	854.69	844.69	18.95
MW-1201b	865.91	863.15	57.97	20.00	828.39	808.39	55.21
MW-1201c	865.76	863.08	87.89	20.00	798.32	778.32	85.21
MW-1202b	855.62	853.57	67.41	20.00	808.66	788.66	65.36
MW-1202c	856.17	853.86	102.64	20.00	773.98	753.98	100.33
MW-1203a	862.18	862.44	16.69	5.00	850.94	845.94	16.95
MW-1203b	861.87	862.08	50.51	20.00	831.81	811.81	50.72
MW-1203c	862.16	862.42	75.67	20.00	806.94	786.94	75.93
MW-1204a	844.31	841.87	27.77	10.00	826.99	816.99	25.33
MW-1204b	845.35	841.87	57.18	25.00	813.62	788.62	53.70
MW-1204c	844.68	842.18	93.06	20.00	772.07	752.07	90.56
MW-1205a	860.07	857.61	15.71	5.00	849.81	844.81	13.25
MW-1205b	860.25	857.97	62.71	20.00	817.99	797.99	60.43
MW-1205c	859.73	857.45	93.03	20.00	787.15	767.15	90.75
MW-1206a	835.37	833.12	27.65	10.00	818.17	808.17	25.40
MW-1206b	835.40	833.20	52.7	20.00	803.15	783.15	50.50
MW-1206c	836.05	833.08	88.95	20.00	767.55	747.55	85.98
MW-1207a	851.30	848.95	17.69	15.00	849.06	834.06	15.34
MW-1207b	851.00	848.40	48.44	20.00	823.01	803.01	45.84
MW-1207c	851.16	848.57	73.25	20.00	798.36	778.36	70.66
MW-1208a	820.08	817.43	47.60	20.00	792.93	772.93	44.95
MW-1209a	811.88	809.21	42.93	20.00	789.40	769.40	40.26
MW-1209b	811.69	808.66	68.59	20.00	763.55	743.55	65.56
MW-1209c	811.41	808.45	103.32	20.00	728.54	708.54	100.36
MW-1210b	830.64	827.97	48.18	20.00	802.91	782.91	45.51
MW-1210c	830.58	827.92	82.73	20.00	768.30	748.30	80.07
MW-1211a	813.03	810.38	52.93	20.00	780.55	760.55	50.28
MW-1211b	813.24	810.57	77.23	25.00	761.46	736.46	74.56
MW-1212a	822.59	820.04	38.24	15.00	799.80	784.80	35.69

TABLE 2.3-29 (Sheet 2 of 2)
MONITORING WELL INSTALLATION DATA

Monitoring Point	Reference Elevation (ft msl)	Ground Elevation (ft msl)	Well Depth (ft bre)	Screen Length (ft)	Top of Screen (ft msl)	Bottom of Screen[(a)] (ft msl)	Boring Depth (ft bgs)
MW-1212b	822.96	820.27	58.23	15.00	780.18	765.18	55.54
MW-1212c	822.57	819.93	88.25	20.00	754.77	734.77	85.61
MW-1213b	848.63	845.92	67.97	20.00	801.11	781.11	65.26
MW-1213c	848.31	845.55	92.92	20.00	775.84	755.84	90.16
MW-1214a	824.16	821.36	47.78	15.00	791.83	776.83	44.98
MW-1215a	850.63	847.97	18.69	5.00	837.39	832.39	16.03
MW-1215b	851.05	848.47	42.89	20.00	828.61	808.61	40.31
MW-1215c	850.34	847.77	73.33	20.00	797.46	777.46	70.76
MW-1216a	846.39	843.74	20.63	5.00	831.21	826.21	17.98
MW-1216b	846.92	844.36	48.20	20.00	819.17	799.17	45.64
MW-1216c	846.65	844.04	68.39	20.00	798.71	778.71	65.78
MW-1217a	846.98	844.35	17.75	5.00	834.68	829.68	15.12
MW-1217b	847.38	844.83	48.21	20.00	819.62	799.62	45.66
MW-1217c	846.89	844.30	72.99	20.00	794.35	774.35	70.40
MW-1218a	838.06	835.48	18.05	5.00	825.46	820.46	15.47
MW-1219a	838.72	836.35	55.74	25.00	808.43	783.43	53.37
RW-1	818.69	816.19	64.23	30.00	784.91	754.91	61.73
OW-1	819.07	816.57	60.10	25.00	784.42	759.42	57.60
OW-2	818.88	816.33	54.21	20.00	785.12	765.12	51.66
OW-3	818.30	815.80	66.50	30.00	782.25	752.25	64.00

a) Bottom of screen includes 0.45 foot (5.4 inches) for bottom cap and threads.
Bottom of Screen Elevation = Reference Elevation - Well Depth + 0.45 ft

bre - below reference elevation
bgs - below ground surface
msl - mean sea level
ft - feet

TABLE 2.3-30 (Sheet 1 of 3)
GROUNDWATER AND SURFACE WATER ELEVATION MEASUREMENTS

Monitoring Point	November 29, 2006	December 27, 2006	January 23, 2007	February 20, 2007	March 19, 2007	April 10, 2007	May 16, 2007	June 13, 2007	July 16, 2007	August 13, 2007	September 13, 2007	October 16, 2007	November 15, 2007
MW-1200b	Dry	Dry	Dry	Dry	794.34	794.80	795.56	796.08	796.55	796.87	797.22	797.47	797.66
MW-1200c	Dry	Dry	Dry	Dry	Dry	Dry	Dry	754.00	754.07	754.06	754.06	754.06	754.04
MW-1201a	845.34	849.60	850.58	849.89	854.22	855.66	856.23	857.50	858.64	857.57	856.86	856.01	855.42
MW-1201b	813.31	830.41	830.63	830.77	830.93	831.12	830.70	830.95	830.95	830.32	830.75	830.9	830.35
MW-1201c	778.13	778.14	778.14	778.58	779.11	779.54	780.23	780.75	781.37	781.85	782.38	782.96	783.45
MW-1202b	788.69	788.74	789.16	789.74	790.36	790.84	791.62	792.27	792.97	793.56	795.21	794.84	795.52
MW-1202c	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW-1203a	846.36	848.08	849.03	849.63	851.43	854.84	855.01	855.18	857.18	856.26	854.64	853.12	852.95
MW-1203b	Dry	813.23	816.09	819.29	822.47	825.16	828.23	830.10	832.20	833.64	834.43	835.11	835.57
MW-1203c	Dry	Dry	Dry	Dry	788.35	788.96	789.94	790.71	791.65	792.45	793.32	794.19	794.96
MW-1204a	819.96	822.86	823.35	823.58	823.41	824.15	824.17	825.01	825.04	824.96	824.69	824.38	824.17
MW-1204b	789.68	789.74	790.07	790.63	791.16	791.65	792.54	793.25	794.20	794.93	795.65	796.57	797.23
MW-1204c	Dry	752.33	752.44	752.63	752.75	752.84	753.08	753.30	753.68	754.07	754.33	754.54	754.74
MW-1205a	845.03	845.23	845.22	845.15	845.09	845.07	845.52	847.53	850.13	850.09	850.16	849.54	848.40
MW-1205b	Dry	Dry	Dry	798.24	798.58	798.84	799.26	799.57	799.98	800.28	800.6	800.95	801.25
MW-1205c	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW-1206a	808.40	808.49	808.56	808.57	808.58	808.58	808.56	808.59	815.07	814.80	814.61	814.46	814.34
MW-1206b	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	783.16	783.32	783.47	783.58
MW-1206c	Dry	747.16	747.15	747.15	747.15	Dry	747.97	748.23	748.53	748.80	749.1	749.41	749.70
MW-1207a	835.00	837.24	841.20	840.08	840.34	840.99	840.33	840.34	840.54	839.89	839.95	839.75	839.61
MW-1207b	809.15	828.68	830.16	829.17	829.35	831.55	828.29	829.45	830.48	828.01	827.66	826.95	826.49
MW-1207c	Dry	779.27	780.53	781.91	783.23	784.34	786.08	787.44	788.89	790.05	791.34	792.62	793.74
MW-1208a	781.82	780.85	781.89	781.93	781.92	781.97	781.94	783.48	785.35	785.56	784.95	784.34	783.88
MW-1209a	Dry	Dry	769.39	770.47	771.62	772.51	774.12	783.28	785.45	785.58	784.93	784.3	783.79
MW-1209b	750.61	773.18	774.68	775.16	775.36	775.37	775.19	775.14	775.09	774.97	775.13	775.17	775.11
MW-1209c	Dry	709.85	711.91	714.05	716.16	717.89	720.64	722.70	725.05	726.92	729.24	731.96	734.24

TABLE 2.3-30 (Sheet 2 of 3)
GROUNDWATER AND SURFACE WATER ELEVATION MEASUREMENTS

Monitoring Point	November 29, 2006	December 27, 2006	January 23, 2007	February 20, 2007	March 19, 2007	April 10, 2007	May 16, 2007	June 13, 2007	July 16, 2007	August 13, 2007	September 13, 2007	October 16, 2007	November 15, 2007
MW-1210b	Dry	Dry	Dry	783.38	784.05	784.50	785.08	785.44	785.74	785.95	786.09	786.19	786.25
MW-1210c	Dry	748.31	748.31	748.33	748.33	748.33	748.34	748.34	748.36	748.38	748.38	748.37	748.37
MW-1211a	775.33	775.09	775.36	775.25	775.28	775.27	775.17	775.07	775.06	775.03	775.12	775.21	775.16
MW-1211b	775.31	774.06	775.35	775.23	775.25	775.24	775.14	775.05	775.03	775.02	775.10	775.19	775.13
MW-1212a	785.79	787.11	787.34	787.55	787.48	787.75	787.29	787.89	788.49	787.33	787.27	787.21	786.86
MW-1212b	785.22	785.04	785.27	784.85	784.54	784.94	785.09	784.50	784.55	784.08	784.75	785.33	783.73
MW-1212c	735.07	735.65	736.08	736.55	736.99	737.34	737.88	738.29	738.78	739.18	739.64	740.16	740.59
MW-1213b	Dry	Dry	Dry	781.40	782.27	783.02	784.21	785.22	786.42	787.44	788.52	789.61	790.58
MW-1213c	756.60	756.36	756.37	756.41	756.41	756.45	756.48	756.51	756.54	756.56	756.59	756.63	756.66
MW-1214a	777.79	777.95	779.90	780.72	779.32	782.06	783.37	784.14	783.81	782.51	780.37	778.47	777.80
MW-1215a	834.26	833.79	835.25	835.93	836.21	837.27	837.26	839.70	841.18	841.41	841.89	841.81	841.42
MW-1215b	808.52	831.35	831.27	831.64	831.60	832.10	831.80	832.91	833.74	833.55	833.54	833.84	833.12
MW-1215c	Dry	Dry	Dry	Dry	Dry	777.46	777.99	778.40	778.89	779.28	779.69	780.14	780.52
MW-1216a	827.19	827.79	828.10	828.57	828.35	828.59	828.99	829.62	830.69	830.82	830.47	830.18	829.87
MW-1216b	Dry	800.52	802.43	804.16	805.51	806.37	807.42	808.10	808.83	809.62	810.71	812.11	813.73
MW-1216c	Dry	Dry	Dry	Dry	Dry	Dry	778.73	778.96	779.20	779.37	779.6	779.82	780.00
MW-1217a	830.28	829.52	829.45	829.45	829.45	829.45	829.45	829.44	830.31	829.70	829.57	829.54	829.54
MW-1217b	800.55	810.94	820.76	824.72	825.06	823.82	820.08	820.38	821.13	822.28	823.83	825.64	827.00
MW-1217c	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	774.04	774.36	774.58	774.75
MW-1218a	823.41	824.06	827.35	826.24	825.62	830.78	830.97	831.32	831.23	828.84	826.36	823.96	823.53
MW-1219a	788.91	788.99	789.22	789.47	789.52	790.96	791.58	793.14	794.04	793.50	792.25	790.66	789.73
RW-1	--[a]	--[a]	--[a]	--[a]	775.18	775.17	775.07	774.97	774.97	774.94	775.03	775.10	775.05
OW-1	--[a]	--[a]	--[a]	--[a]	775.23	775.21	775.12	775.01	775.01	774.97	775.07	775.16	775.10
OW-2	--[a]	--[a]	--[a]	--[a]	775.18	775.16	775.07	774.98	774.97	774.94	775.03	775.13	775.06
OW-3	--[a]	--[a]	--[a]	--[a]	775.60	775.59	775.50	775.40	775.39	775.37	775.46	775.56	775.48

TABLE 2.3-30 (Sheet 3 of 3)
GROUNDWATER AND SURFACE WATER ELEVATION MEASUREMENTS

Monitoring Point	November 29, 2006	December 27, 2006	January 23, 2007	February 20, 2007	March 19, 2007	April 10, 2007	May 16, 2007	June 13, 2007	July 16, 2007	August 13, 2007	September 13, 2007	October 16, 2007	November 15, 2007
Brazos River Glen Rose Station (USGS 08091000[b])	569.37	569.34	569.68	569.37	569.40	572.33	574.01	573.03	574.41	571.54	572.51	571.35	570.58
Squaw Creek Reservoir (USGS 08091730[b])	775.40	775.23	775.42	775.19	--[a]	775.36	775.39	775.31	775.33	775.40	775.46	775.48	775.38
Lake Granbury (USGS 08090900[b])	691.14	691.53	692.15	692.32	692.37	692.37	692.54	692.48	692.30	692.38	692.29	692.44	691.90
USGS 08091000	4.37	4.34	4.68	4.37	4.40	7.33	9.01	8.03	9.41	6.54	7.51	6.35	5.58
Gauge Datum - 565' asl	569.37	569.34	569.68	569.37	569.40	572.33	574.01	573.03	574.41	571.54	572.51	571.35	570.58

a) No Data Available

b) Provisional Data

Notes:
Elevations provided are in ft msl.
Monitoring Points illustrated on Figure 2.3-26
(USGS 2007c)

TABLE 2.3-31 (Sheet 1 of 3)
GROUNDWATER VELOCITY AND TRAVEL TIMES

Scenario 1, Pathway 3a (Unit 3/MW-1217a to SCR)

Date	**12/27**	**1/23**	**2/20**	**3/19**	**4/10**	**5/16**	**6/13**	**7/16**	**8/13**	**9/13**	**10/16**	**11/15**
MW-1217a (ft amsl)	810.94	820.76	824.72	825.06	823.82	820.08	820.38	821.13	822.28	823.83	825.64	827.00
SCR (ft amsl)	775.23	775.42	775.19	775.00 [(a)]	775.36	775.39	775.31	775.33	775.40	775.46	775.48	775.38
Hydraulic Gradient	0.0674	0.0855	0.0935	0.0945	0.0914	0.0843	0.0850	0.0864	0.0885	0.0913	0.0946	0.0974
Velocity (V) (ft/day)	0.0220	0.0279	0.0305	0.0308	0.0298	0.0275	0.0277	0.0282	0.0289	0.0298	0.0308	0.0318
Travel Time (T) (days)	4,550	3,587	3,280	3,246	3,356	3,638	3,608	3,550	3,466	3,359	3,242	3,149

Scenario 1, Pathway 3b (Unit 3/MW-1217b to SCR)

Date	**12/27**	**1/23**	**2/20**	**3/19**	**4/10**	**5/16**	**6/13**	**7/16**	**8/13**	**9/13**	**10/16**	**11/15**
MW-1217b (ft amsl)	810.94	820.76	824.72	825.06	823.82	820.08	820.38	821.13	822.28	823.83	825.64	827.00
SCR (ft amsl)	775.23	775.42	775.19	775.00 [(a)]	775.36	775.39	775.31	775.33	775.40	775.46	775.48	775.38
Hydraulic Gradient	0.0674	0.0855	0.0935	0.0945	0.0914	0.0843	0.0850	0.0864	0.0885	0.0913	0.0946	0.0974
Velocity (V) (ft/day)	0.0220	0.0279	0.0305	0.0308	0.0298	0.0275	0.0277	0.0282	0.0289	0.0298	0.0308	0.0318
Travel Time (T) (days)	3,640	2,870	2,624	2,596	2,684	2,911	2,887	2,840	2,772	2,687	2,594	2,519

Scenario 2, Pathway 4a (Unit 4/MW-1215a to SCR)

Date	**12/27**	**1/23**	**2/20**	**3/19**	**4/10**	**5/16**	**6/13**	**7/16**	**8/13**	**9/13**	**10/16**	**11/15**
MW-1215a (ft amsl)	831.35	831.27	831.64	831.60	832.10	831.80	832.91	833.74	833.55	833.54	833.84	833.12
SCR (ft amsl)	775.23	775.42	775.19	775.00 [(a)]	775.36	775.39	775.31	775.33	775.40	775.46	775.48	775.38
Hydraulic Gradient	0.0925	0.0920	0.0930	0.0932	0.0935	0.0929	0.0949	0.0962	0.0958	0.0957	0.0961	0.0961
Velocity (V) (ft/day)	0.0302	0.0300	0.0303	0.0304	0.0305	0.0303	0.0309	0.0314	0.0312	0.0312	0.0313	0.0313
Travel Time (T) (days)	1,989	2,000	1,979	1,974	1,968	1,981	1,939	1,913	1,921	1,923	1,915	1,915

TABLE 2.3-31 (Sheet 2 of 3)
GROUNDWATER VELOCITY AND TRAVEL TIMES

Scenario 2, Pathway 4b (Unit 4/MW-1215b to SCR)

Date	**12/27**	**1/23**	**2/20**	**3/19**	**4/10**	**5/16**	**6/13**	**7/16**	**8/13**	**9/13**	**10/16**	**11/15**
MW-1215b (ft msl)	831.35	831.27	831.64	831.60	832.10	831.80	832.91	833.74	833.55	833.54	833.84	833.12
SCR (ft msl)	775.23	775.42	775.19	775.00 [a]	775.36	775.39	775.31	775.33	775.40	775.46	775.48	775.38
Hydraulic Gradient	0.0925	0.0920	0.0930	0.0932	0.0935	0.0929	0.0949	0.0962	0.0958	0.0957	0.0961	0.0961
Velocity (V) (ft/day)	0.0302	0.0300	0.0303	0.0304	0.0305	0.0303	0.0309	0.0314	0.0312	0.0312	0.0313	0.0313
Travel Time (T) (days)	3,979	4,000	3,957	3,949	3,936	3,962	3,878	3,826	3,842	3,846	3,830	3,830

Assumptions:

Scenario 1, Pathway 3a

The hydraulic gradient between MW-1217b and SCR is the nearest known hydraulic gradient to the Unit 3 A/B. The highest hydraulic gradient between MW-1217B and SCR was used for this pathway.

Pathway Distance (L) = 100 lateral feet of Glen Rose Formation

Hydraulic Conductivity (Kη) = 1.37 x 10-5 cm/s = 0.0388 ft/day

Porosity (η) = 0.119

Scenario 1, Pathway 3b

The hydraulic gradient between MW-1217b and SCR is the nearest known hydraulic gradient to the Unit 3 A/B. The highest hydraulic gradient between MW-1217B and SCR was used for this pathway.

Pathway Distance (L) = 80 lateral feet of Glen Rose Formation

Hydraulic Conductivity (Kη) = 1.37 x 10-5 cm/s = 0.0388 ft/day

Porosity (η) = 0.119

Scenario 2, Pathway 4a

The hydraulic gradient between MW-1215b and SCR is the nearest known hydraulic gradient to the Unit 4 A/B. The highest hydraulic gradient between MW-1215B and SCR was used for this pathway

Pathway Distance (L) = 60 lateral feet of Glen Rose Formation

Hydraulic Conductivity (Kη) = 1.37 x 10-5 cm/s = 0.0388 ft/day

Porosity (η) = 0.119

TABLE 2.3-31 (Sheet 3 of 3)
GROUNDWATER VELOCITY AND TRAVEL TIMES

Scenario 2, Pathway 4b

The hydraulic gradient between MW-1215b and SCR is the nearest known hydraulic gradient to the Unit 4 A/B. The highest hydraulic gradient between MW-1215B and SCR was used for this pathway

Pathway Distance (L) = 120 lateral feet of Glen Rose Formation

Hydraulic Conductivity ($K\eta$) = 1.37 x 10-5 cm/s = 0.0388 ft/day

Porosity (η) = 0.119

(a) - 775.00 ft was used as surface water elevation for SCR on 3/19 as USGS elevation data was unavailable

Conversions: 1day = 86,400 seconds; 1 foot = 30.48 centimeters

TABLE 2.3-32 (Sheet 1 of 3)
CHARACTERISTICS OF SOIL AREAS AT THE CPNPP SITE

Soil Name	Description
Aledo Series	The Aledo series consists of shallow, calcareous, gently sloping to rolling soils on uplands. In a representative profile, the surface layer is dark grayish-brown gravelly clay loam, about 4 inches thick. Below the surface and to a depth of 16 inches is grayish-brown very gravelly clay loam that rests abruptly on coarsely fractured limestone.
Bolar Series	The Bolar series consists of moderately deep well drained soils on uplands. The soil formed in interbedded limestone, marl and marly clay. The surface layer is dark brown clay loam 16 inches thick. From 16 to 32 inches is brown clay loam. It is yellowish brown very stony clay loam from 32 to 36 inches. Below is fractured limestone bedrock interbedded with marly clay. The soil is calcareous throughout.
Bosque Series	The Bosque series consists of very deep well drained moderately permeable nearly level soils of the bottomlands. The soil formed in calcareous loamy sediments. In a representative profile, the surface layer is dark grayish brown loam 20 inches thick. The next layer is clay loam 30 inches thick that is dark brown in the upper part and brown in the lower part. The substratum, below 50 inches, is dark grayish brown clay.
Bunyan Series	The Bunyan series consists of deep, well drained, nearly level soils of the bottomlands. The soil formed in stratified loamy alluvium. In a representative profile, the surface layer is light brownish gray fine sandy loam about 10 inches thick. Below the surface layer and to a depth of 16 inches is very dark grayish brown clay loam. The next layer is grayish brown to pale brown sandy clay loam about 30 inches thick. The next layer is gray clay loam that extends to 62 inches depth.
Chaney Series	The Chaney series consists of very deep, moderately well drained nearly level to moderately sloping soils of uplands. The soil formed in clayey deposits. In a representative profile, the surface layer is loamy sand 14 inches thick, dark grayish brown in the upper part and light gray in the lower part. The subsoil is dark red and red mottled sandy clay 20 inches thick. The next layer is sandy clay loam 18 inches thick, brownish yellow in the upper part and light brownish gray in the lower part. Below 52 inches is olive gray shale that has clay texture.
Duffau Series	The Duffau series consists of very deep, well drained, nearly level to sloping soils of uplands. The soil formed in sandy and loamy deposits. In a representative profile, the surface layer is fine sandy loam 10 inches thick and is dark grayish brown in the upper part and pale brown in the lower part. The subsoil is yellowish red sandy clay loam 60 inches thick. The substrata, below 70 inches depth, is reddish yellow sandy clay loam.

TABLE 2.3-32 (Sheet 2 of 3)
CHARACTERISTICS OF SOIL AREAS AT THE CPNPP SITE

Soil Name	Description
Frio Series	The Frio series consists of very deep, well drained, nearly level soils of the bottomlands. The soil formed in calcareous alluvium. In a representative profile, the surface layer is very dark grayish brown silty clay loam about 8 inches thick. Below the surface layer and to a depth of 40 inches is very dark grayish brown silty clay loam and clay loam. The next layer extends to 80 inches and is dark grayish brown silty clay with soft masses of calcium carbonate.
Hassee Series	The Hassee series consists of very deep, moderately well drained, nearly level to very gently sloping soils of uplands. The soil formed in clayey sediments. In a representative profile, the surface layer is fine sandy loam 11 inches thick and is brown in the lower part and dark grayish brown in the lower part. The subsoil to 36 inches is clay that is grayish brown. Below 36 inches is grayish brown and light brownish gray clay loam.
Krum Series	The Krum series consists of very deep, well drained, nearly level to moderately sloping soils of uplands. The soil formed in calcareous clayey sediments. In a representative profile the surface layer is dark grayish brown to very dark grayish brown silty clay about 26 inches thick. The next lower layer is brown silty clay about 18 inches thick. The underlying sediments are reddish yellow silty clay.
Nimrod Series	The Nimrod series consists of very deep, moderately well drained, nearly level to sloping sandy soils of uplands. The soil formed in sandy and loamy deposits. In a representative profile, the surface layer is grayish brown fine sand 4 inches thick. From 4 to 27 inches is very pale brown fine sand. The next layer is mottled light gray. Reddish yellow and yellowish brown sandy clay loam 13 inches thick. The next layer is light gray sandy clay loam 28 inches thick. Below 68 inches is red and light gray sandy loam.
Perdenales Series	The Perdenales series consists of very deep, well drained, nearly level to moderately sloping soils of uplands. This soil formed in loamy calcareous materials. In a representative profile, the surface layer is a reddish brown fine sandy loam about 11 inches thick. The subsoil is red sandy clay from 11 to 37 inches and yellowish red sandy clay loam from 37-43 inches. Below 43 inches is light reddish brown sandy clay loam.
Purves Series	The Purves series consists of shallow, well drained, moderately slowly permeable, gently sloping to moderately sloping upland soils. The soil formed in interbedded limestone and calcareous marls. In a representative profile, the surface layer is very dark grayish brown clay about 8 inches thick. The next layer is brown clay about 4 inches thick. The next lower layer is brown very gravelly clay about 2 inches thick. The substrata below 14 inches is limestone bedrock.

TABLE 2.3-32 (Sheet 3 of 3)
CHARACTERISTICS OF SOIL AREAS AT THE CPNPP SITE

Soil Name	Description
Sunev Series	The Sunev series consists of very deep, well drained, moderately permeable, nearly level to sloping limy soils of uplands. The soil formed in loamy alluvial sediments. In a representative profile, the surface layer is dark grayish brown loam about 12 inches thick. The next layer is brown loam about 9 inches thick. The lower layer is very pale brown loam extending to 72 inches.
Tarrant Series	The Tarrant series consists of very shallow and shallow, well drained, moderately slowly permeable, nearly level to steep soils on uplands. The soil formed in residuum over limestone bedrock. In a representative profile, the soil is very dark grayish brown calcareous stony clay about 13 inches thick. The substratum from 13 to 30 inches is fractured platy limestone bedrock.
Thurber Series	The Thurber series consists of very deep, moderately well drained, nearly level to gently sloping soils of uplands. The soil formed in clayey sediments. In a representative profile, the surface layer is dark grayish brown clay loam 8 inches thick. The subsoil is brown clay from 8 to 38 inches and from 38 inches to 93 inches is brown clay in the upper part and yellowish brown clay loam in the lower part.
Venus Series	The Venus series consists of very deep, well drained, nearly level to strongly sloping calcareous soils of uplands. The soil formed in calcareous loamy sediments. In a representative profile, the surface layer is dark grayish brown loam about 14 inches thick. Below the surface layer and to a depth of 50 inches is loam that is grayish brown in the upper party and very pale brown in the lower part. Below 50 inches is very pale brown fine sandy loam.
Windthorst Series	The Windthorst series consists of very deep, gently sloping to strongly sloping soils on uplands. The soil formed in stratified clayey and loamy materials. In a representative profile the surface layer is fine sandy loam 10 inches thick and is grayish brown in the upper part and light yellowish brown below. The subsoil is sandy clay 28 inches thick and is red in the upper part and yellowish red below. The next layer is mottled sandy clay loam 12 inches thick. Below 50 inches is light gray sandy clay loam that grades to weakly cemented packsand. Source: (USDA 2007)

TABLE 2.3-33
ANNUAL WATER USE - BRAZOS RIVER BASIN (ACRE-FEET)

Year	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
2004	399,847	228,739	160,944	2,661,345	24,718	69,292	3,544,885

Note:
All values are in acre feet (ACFT).

(TWDB 2007a)

TABLE 2.3-34 (Sheet 1 of 2)
2006 AREA SURFACE WATER WITHDRAWALS (ACRE-FEET)

County	User Name	Stream Name	Use Type	January	February	March	April	May	June	July	August	September	October	November	December	Total
Palo Pinto	Brazos River Authority	Brazos River	1,2,3, 4,5,6	4,852	1761	4657	7436	32,815	12,630	24,703	21,601	1298	30,973	11,882	5703	160,311
Palo Pinto	Palo Pinto MWD 1	Palo Pinto Creek	1	365	288	322	366	416	497	561	577	385	377	323	324	4800
Palo Pinto	Rocking W Ranch, LP	Brazos River	3	0	0	0	0	18	0	217	231	133	47	0	0	647
Palo Pinto	W.J. Rhodes	Brazos River	3	0	0	0	0	0	8	10	5	0	0	0	0	23
Parker	City of Mineral Wells	Rock Creek	1	0	2	0	0	0	6	19	27	0	0	0	0	54
Parker	TXI Operations, LP	Brazos River	2,3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hood	Brazos River Authority	Brazos River	1,2,3, 4	1542	2769	2966	5399	5410	6775	7155	7710	6771	5574	4123	610	56,815
Somervell	TXU Electric	Squaw Creek Reservoir, Panther Branch, Lake Granbury	2	227,102	210,025	269,807	296,577	305,253	297,050	306,579	306,898	297,130	253,082	295,190	303,111	3,367,805
Somervell	Somervell County Water District	Paluxy River	1,2,3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bosque	City of Clifton	North Bosque River	1	63	8	65	38	0	26	0	0	0	9	28	21	256
Bosque	City of Meridian	North Bosque River	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bosque	Chisholm Trails Ventures, LP	Brazos River	3	141	141	345	345	576	576	576	435	345	141	0	0	3621
Bosque	Lakeview Recreation Association Inc.	Brazos River, Rock Branch	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

TABLE 2.3-34 (Sheet 2 of 2)
2006 AREA SURFACE WATER WITHDRAWALS (ACRE-FEET)

County	User Name	Stream Name	Use Type	January	February	March	April	May	June	July	August	September	October	November	December	Total
Bosque	John McPherson	Brazos River	3	0	0	0	0	0	35	35	35	35	0	0	0	140
Bosque	Smith Bend Ranch, Ltd.	Brazos River	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hill	Brazos River Authority	Brazos River	1,2	109	107	122	113	120	140	184	229	5854	137	69	118	7302

Notes:
Total 2006 reported surface water withdrawals for the six county area is 3,601,774 acre-feet.
Use Types
1 - Municipal
2 - Industrial
3 - Irrigation
4 - Mining
5 - Hydroelectric
6 - Other
NR - Not Reported
Source: TCEQ

TABLE 2.3-35
2004 SURFACE AND GROUNDWATER USE - HOOD AND SOMERVELL COUNTIES, TEXAS (ACRE-FEET)

County	Source	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total	Percent of Total
	GW	4089	17	3	0	167	275	4551	38%
Hood	SW	1134	0	351	5540	0	281	7306	62%
	Total	5223	17	354	5540	167	556	11,857	
	GW	1070	4	24	0	756	64	1918	4%
Somervell	SW	0	0	44,537	81	11	64	44,693	96%
	Total	1070	4	44,561	81	767	128	46,611	

Note:
All values are in acre feet (ACFT)

(TWDB 2007a)

TABLE 2.3-36 (Sheet 1 of 2)
2006 LAKE GRANBURY SURFACE WATER WITHDRAWALS (ACRE-FEET)

User Name	Use Type	Annual Amount	January	February	March	April	May	June	July	August	September	October	November	December	Total
Crown Valley Construction, Inc.	Industrial	1.53							1.40	0.70	0.08				2.17
L & W Paving	Industrial	1.53								0.31	0.31	0.31	0.31	0.31	1.53
TXU Electric	Industrial	0.00	806.90	2228.01	2431.45	4764.29	4336.34	5235.52	5192.56	5511.72	5404.31	4663.48	3526.15	1724.72	45,825.46
TXU Electric	Industrial	0.00	0.00	0.00	0.00	0.00	36.00		0.00	0.00	0.00	0.00	0.00	0.00	36.00
TXU Electric, Gb	Industrial	40,000.00													0.00
Wolf Hollow I, L.P.	Industrial	10,000.00	262.44	90.48	90.48	413.30	431.23	373.98	481.35	550.95	372.55	337.35	262.66	320.32	3987.06
Industrial Total															**49,852.23**
Bluegreen Southwest One, L.P.	Irrigation	200.00													0.00
Decordova Bend States Owners	Irrigation	100.00	0.02	0.01	0.01	0.03	0.03	0.07	0.08	0.09	0.03	0.04	0.01	0.01	0.42
Decordova Bend States Owners	Irrigation	300.00	7.17	3.71	5.62	13.21	22.51	38.66	53.55	53.87	12.18	15.41	7.13	1.77	234.79
Granbury Recreational Assoc.	Irrigation	50.00	2.32	1.72	1.41	5.13	5.18	4.89	4.87	7.19	6.09	3.72	2.21	3.27	48.00
Harbor Lakes Golf Club L.P.	Irrigation	420.00				0.00	0.00	0.00	52.33						52.33
Lumbermens Investment Corp.	Irrigation	420.00													0.00
Jason & Tori Proctor	Irrigation	10.00													0.00
Jack Karnes	Irrigation	1.53													0.00
Lenmo Inc.	Irrigation	200.00													0.00
Lenmo Inc.	Irrigation	1650.00	12.73	2.15	2.08	3.08	32.15	358.63	660.89	788.20	377.23	83.61	33.19	22.09	2376.02
Lenmo Inc.	Irrigation	350.00													0.00
Lenmo Inc.	Irrigation	300.00													0.00
Pecan Plantation Owners Assoc.	Irrigation	250.00													0.00
Pecan Plantation Owners Assoc.	Irrigation	500.00	0.00	0.00	0.00	0.00	0.00	54.00	0.00	42.57	29.48	13.88	12.00	14.21	166.14
Pecan Plantation	Irrigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larry Stewart	Irrigation	200.00							4.84	60.08	73.97	40.33	14.85	0.00	194.07
Turfgrass America, L.P.	Irrigation	1300.00	6.50	0.90	2.90	3.80	0.00	3.50	16.20	6.00	67.80	49.50	12.60	19.80	189.50
Rex R. Worrell	Irrigation	300.00	9.05	0.00	7.56	0.00	12.58	39.86	38.58	51.83	9.54	10.79	12.35	3.14	195.28
Irrigation Total															**3456.55**

TABLE 2.3-36 (Sheet 2 of 2)
2006 LAKE GRANBURY SURFACE WATER WITHDRAWALS (ACRE-FEET)

User Name	Use Type	Annual Amount	January	February	March	April	May	June	July	August	September	October	November	December	Total
Carrizo Oil & Gas	Mining	13.00									8.12		0.00	0.00	8.12
Carrizo Oil & Gas	Mining	13.00								0.00	8.28	0.00	0.00	0.00	8.28
Mike Byrd Casing	Mining	9.21													0.00
Encana Corporation	Mining	17.00													0.00
Eog Resources, Inc.	Mining	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.93
Eog Resources, Inc.	Mining	300.00	0.28	0.56	0.19	0.84	1.02	0.90	1.67		1.17		0.36	0.25	7.24
Eog Resources, Inc.	Mining	90.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Granbury Exploration & Devl	Mining	10.00													0.00
Triad Exploration Ltd.	Mining	13.00							0.00	3.22					3.22
Xto Energy Inc.	Mining	13.00									1.56				1.56
Xto Energy	Mining	10.00					0.00		0.00	0.00					0.00
Mining Total															**29.36**
Acton Municipal Utility Dist.	Municipal	1000.00	0.40	0.76	1.33	1.74	3.29	2.19	2.98	1.15	1.20	0.71	0.72	0.81	17.27
Acton Municipal Utility Dist.	Municipal	4000.00	5.80	0.03	8.93	33.39	78.32	142.56	203.92	236.54	73.58	45.07	2.61	0.36	831.09
Acton Municipal Utility Dist.	Municipal	2000.00													0.00
Granbury, City of	Municipal	10,800.00	8.90	9.62	6.71	15.81	18.92	26.63	26.52	39.80	27.52	12.08	12.93	9.77	215.19
Lsf Development Corp.	Municipal	190.00	0.00	0.00	0.00	0.00	109.06	8.88	9.65	11.10		0.00	0.00	24.40	163.09
Lsf Development Corp.	Municipal	90.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Johnson Co Fresh Wsd#1 2 Tier	Municipal	1665.00	58.88	36.75	34.84	35.68	43.88	58.34	70.88	83.67	50.96	32.60	26.98	46.62	580.07
Johnson County Rwsc	Municipal	13,210.00	346.05	303.13	250.07	308.46	381.64	430.50	453.65	441.74	311.06	338.67	290.13	309.83	4164.93
Keene, City of	Municipal	2040.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.33	0.00	3.77	3.51	14.61
Laguna Vista Ltd.	Municipal	50.00	11.95	4.61	5.76	10.66	15.00	25.38	25.79	11.63		9.22	5.18	3.50	128.66
Monarch Utilities I, L.P.	Municipal	600.00	29.99	22.81	25.99	36.13	43.91	40.97	36.70	37.55	31.66		27.36	29.94	363.01
Sky Harbour Water Supply Corp.	Municipal	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Total															**6477.93**
Lake Granbury Total Withdrawal															**59,816.06**

Source: BRA

TABLE 2.3-37
2006 CPNPP MONTHLY SURFACE WATER USE

Month	Max. Diversion Rate (GPM)		Monthly Diverted Amount (acre-feet)			Monthly Consumed Amount (acre-feet)		Monthly Return Flow (acre-feet)		
	[a]From Squaw Creek Lake (Circ.)	[b]From L. Granbury (Misc wtr)	[c] From Lake (circ wtr)	[d]From SC Lake (Misc)	[e] From Lake Granbury	[f]Water Evap.	[g] Misc. Water	[h] To Sq.Cr.Lake	[i] To Lake Granbury	[j] Through Dam/Spillway to Creek
January	1,670,833	18,750	226,134.00	0	967.9	1756.30	0	224,377.80	0	464.3
February	1,925,000	18,750	207,797.40	0	2228.00	1588.10	0	206,209.30	0	419.3
March	2,200,000	39,583	266,996.30	0	2811.10	1758.40	0	265,237.80	0	464.3
April	2,200,000	40,278	291,667.10	0	4910.20	1692.30	0	289,974.70	0	2080.10
May	2,200,000	38,889	300,925.90	0	4327.10	1747.60	0	299,178.30	0	3117.10
June	2,200,000	43,750	291,667.10	0	5382.80	1682.00	0	289,985.00	0	2092.40
July	2,200,000	43,056	301,389.30	0	5189.50	1730.20	0	299,659.10	0	1499.90
August	2,200,000	43,056	301,389.30	0.2	5508.70	1730.70	0	299,658.60	0	905.9
September	2,200,000	43,056	291,667.10	0.1	5462.60	1678.60	0	289,988.50	0	2522.00
October	2,200,000	42,361	248,368.10	0	4713.80	1081.70	0	247,286.50	0	3547.60
November	2,200,000	28,472	291,667.10	0	3523.10	1701.40	0	289,965.60	0	2703.90
December	2,200,000	27,083	301,389.30	0	1721.70	1758.00	0	299,631.30	0	1343.80
		Subtotal	3,321,057.80	0.3	46,746.50	19,905.20	0	3,301,152.60	0	21,161.10

	Annual Diverted Amount (acre-feet)	Annual Consumed Amount (acre-feet)	Annual Return Flow (acre-feet)
Total	3,367,804.60	19,905.20	3,322,313.70

a) Maximum pump rate from Squaw Creek Reservoir through Plant condensers.

b) Maximum pump rate from Lake Granbury to Squaw Creek Reservoir.

c) Amount pumped from Squaw Creek Reservoir through Plant condensers and back to Squaw Creek Reservoir.

d) Amount pumped from Squaw Creek Reservoir for Miscellaneous uses (fire, service water, etc.).

e) Amount Pumped from Lake Granbury to Squaw Creek Reservoir.

f) Amount consumed by industrial cooling (forced evaporation) estimated by: 1 acre-foot/1,000 megawatt-Hours Net Generation.

g) Amount of miscellaneous use water consumed.

h) Water returned to Squaw Creek Reservoir. (Water pumped minus forced evaporation)

i) Water returned to Lake Granbury via pipeline.

j) Water released or spilled through dam or spillway to Squaw Creek.

Source: (TCEQ 2006)

TABLE 2.3-38 (Sheet 1 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
693.0	129,011	42,038,363,361		55,690,560	0.13%	0.00
692.9	128,246	41,789,087,346	249,276,015	55,690,560	0.13%	4.48
692.8	127,482	41,540,137,182	248,950,164	55,690,560	0.13%	4.47
692.7	126,721	41,292,164,571	247,972,611	55,690,560	0.13%	4.45
692.6	125,962	41,044,843,662	247,320,909	55,690,560	0.14%	4.44
692.5	125,206	40,798,500,306	246,343,356	55,690,560	0.14%	4.42
692.4	124,452	40,552,808,652	245,691,654	55,690,560	0.14%	4.41
692.3	123,700	40,307,768,700	245,039,952	55,690,560	0.14%	4.40
692.2	122,951	40,063,706,301	244,062,399	55,690,560	0.14%	4.38
692.1	122,204	39,820,295,604	243,410,697	55,690,560	0.14%	4.37
692.0	121,460	39,577,862,460	242,433,144	55,690,560	0.14%	4.35
691.9	120,718	39,336,081,018	241,781,442	55,690,560	0.14%	4.34
691.8	119,978	39,094,951,278	241,129,740	55,690,560	0.14%	4.33
691.7	119,242	38,855,124,942	239,826,336	55,690,560	0.14%	4.31
691.6	118,507	38,615,624,457	239,500,485	55,690,560	0.14%	4.30
691.5	117,775	38,377,101,525	238,522,932	55,690,560	0.15%	4.28
691.4	117,045	38,139,230,295	237,871,230	55,690,560	0.15%	4.27
691.3	116,318	37,902,336,618	236,893,677	55,690,560	0.15%	4.25
691.2	115,593	37,666,094,643	236,241,975	55,690,560	0.15%	4.24

TABLE 2.3-38 (Sheet 2 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
691.1	114,871	37,430,830,221	235,264,422	55,690,560	0.15%	4.22
691.0	114,151	37,196,217,501	234,612,720	55,690,560	0.15%	4.21
690.9	113,435	36,962,908,185	233,309,316	55,690,560	0.15%	4.19
690.8	112,720	36,729,924,720	232,983,465	55,690,560	0.15%	4.18
690.7	112,008	36,497,918,808	232,005,912	55,690,560	0.15%	4.17
690.6	111,299	36,266,890,449	231,028,359	55,690,560	0.15%	4.15
690.5	110,595	36,037,491,345	229,399,104	55,690,560	0.15%	4.12
690.4	109,900	35,811,024,900	226,466,445	55,690,560	0.16%	4.07
690.3	109,214	35,587,491,114	223,533,786	55,690,560	0.16%	4.01
690.2	108,536	35,366,564,136	220,926,978	55,690,560	0.16%	3.97
690.1	107,863	35,147,266,413	219,297,723	55,690,560	0.16%	3.94
690.0	107,195	34,929,597,945	217,668,468	55,690,560	0.16%	3.91
689.9	106,532	34,713,558,732	216,039,213	55,690,560	0.16%	3.88
689.8	105,875	34,499,474,625	214,084,107	55,690,560	0.16%	3.84
689.7	105,222	34,286,693,922	212,780,703	55,690,560	0.16%	3.82
689.6	104,573	34,075,216,623	211,477,299	55,690,560	0.16%	3.80
689.5	103,928	33,865,042,728	210,173,895	55,690,560	0.16%	3.77
689.4	103,288	33,656,498,088	208,544,640	55,690,560	0.17%	3.74
689.3	102,652	33,449,256,852	207,241,236	55,690,560	0.17%	3.72

TABLE 2.3-38 (Sheet 3 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
689.2	102,022	33,243,970,722	205,286,130	55,690,560	0.17%	3.69
689.1	101,395	33,039,662,145	204,308,577	55,690,560	0.17%	3.67
689.0	100,773	32,836,982,823	202,679,322	55,690,560	0.17%	3.64
688.9	100,155	32,635,606,905	201,375,918	55,690,560	0.17%	3.62
688.8	99,540	32,435,208,540	200,398,365	55,690,560	0.17%	3.60
688.7	98,930	32,236,439,430	198,769,110	55,690,560	0.17%	3.57
688.6	98,322	32,038,322,022	198,117,408	55,690,560	0.17%	3.56
688.5	97,719	31,841,833,869	196,488,153	55,690,560	0.17%	3.53
688.4	97,118	31,645,997,418	195,836,451	55,690,560	0.18%	3.52
688.3	96,521	31,451,464,371	194,533,047	55,690,560	0.18%	3.49
688.2	95,928	31,258,234,728	193,229,643	55,690,560	0.18%	3.47
688.1	95,338	31,065,982,638	192,252,090	55,690,560	0.18%	3.45
688.0	94,752	30,875,033,952	190,948,686	55,690,560	0.18%	3.43
687.9	94,170	30,685,388,670	189,645,282	55,690,560	0.18%	3.41
687.8	93,592	30,497,046,792	188,341,878	55,690,560	0.18%	3.38
687.7	93,019	30,310,334,169	186,712,623	55,690,560	0.18%	3.35
687.6	92,449	30,124,599,099	185,735,070	55,690,560	0.18%	3.34
687.5	91,884	29,940,493,284	184,105,815	55,690,560	0.19%	3.31
687.4	91,324	29,758,016,724	182,476,560	55,690,560	0.19%	3.28

TABLE 2.3-38 (Sheet 4 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
687.3	90,767	29,576,517,717	181,499,007	55,690,560	0.19%	3.26
687.2	90,216	29,396,973,816	179,543,901	55,690,560	0.19%	3.22
687.1	89,668	29,218,407,468	178,566,348	55,690,560	0.19%	3.21
687.0	89,125	29,041,470,375	176,937,093	55,690,560	0.19%	3.18
686.9	88,586	28,865,836,686	175,633,689	55,690,560	0.19%	3.15
686.8	88,051	28,691,506,401	174,330,285	55,690,560	0.19%	3.13
686.7	87,519	28,518,153,669	173,352,732	55,690,560	0.20%	3.11
686.6	86,990	28,345,778,490	172,375,179	55,690,560	0.20%	3.10
686.5	86,464	28,174,380,864	171,397,626	55,690,560	0.20%	3.08
686.4	85,942	28,004,286,642	170,094,222	55,690,560	0.20%	3.05
686.3	85,422	27,834,844,122	169,442,520	55,690,560	0.20%	3.04
686.2	84,906	27,666,705,006	168,139,116	55,690,560	0.20%	3.02
686.1	84,393	27,499,543,443	167,161,563	55,690,560	0.20%	3.00
686.0	83,883	27,333,359,433	166,184,010	55,690,560	0.20%	2.98
685.9	83,377	27,168,478,827	164,880,606	55,690,560	0.20%	2.96
685.8	82,873	27,004,249,923	164,228,904	55,690,560	0.21%	2.95
685.7	82,374	26,841,650,274	162,599,649	55,690,560	0.21%	2.92
685.6	81,877	26,679,702,327	161,947,947	55,690,560	0.21%	2.91
685.5	81,384	26,519,057,784	160,644,543	55,690,560	0.21%	2.88

TABLE 2.3-38 (Sheet 5 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	Lake Granbury Volume		Lake Granbury Volume Change per 0.1 ft	CPNPP Units 3 and 4 Consumptive Use	CPNPP Units 3 and 4 Percentage Withdrawal	Time to Drawdown 0.1 ft
ft msl	ac-ft	gal	gal	gpd	%	days
685.4	80,895	26,359,716,645	159,341,139	55,690,560	0.21%	2.86
685.3	80,408	26,201,027,208	158,689,437	55,690,560	0.21%	2.85
685.2	79,925	26,043,641,175	157,386,033	55,690,560	0.21%	2.83
685.1	79,444	25,886,906,844	156,734,331	55,690,560	0.22%	2.81
685.0	78,967	25,731,475,917	155,430,927	55,690,560	0.22%	2.79
684.9	78,492	25,576,696,692	154,779,225	55,690,560	0.22%	2.78
684.8	78,020	25,422,895,020	153,801,672	55,690,560	0.22%	2.76
684.7	77,550	25,269,745,050	153,149,970	55,690,560	0.22%	2.75
684.6	77,083	25,117,572,633	152,172,417	55,690,560	0.22%	2.73
684.5	76,619	24,966,377,769	151,194,864	55,690,560	0.22%	2.71
684.4	76,157	24,815,834,607	150,543,162	55,690,560	0.22%	2.70
684.3	75,697	24,665,943,147	149,891,460	55,690,560	0.23%	2.69
684.2	75,239	24,516,703,389	149,239,758	55,690,560	0.23%	2.68
684.1	74,784	24,368,441,184	148,262,205	55,690,560	0.23%	2.66
684.0	74,331	24,220,830,681	147,610,503	55,690,560	0.23%	2.65
683.9	73,880	24,073,871,880	146,958,801	55,690,560	0.23%	2.64
683.8	73,431	23,927,564,781	146,307,099	55,690,560	0.23%	2.63
683.7	72,985	23,782,235,235	145,329,546	55,690,560	0.23%	2.61
683.6	72,541	23,637,557,391	144,677,844	55,690,560	0.24%	2.60

TABLE 2.3-38 (Sheet 6 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
683.5	72,100	23,493,857,100	143,700,291	55,690,560	0.24%	2.58
683.4	71,660	23,350,482,660	143,374,440	55,690,560	0.24%	2.57
683.3	71,223	23,208,085,773	142,396,887	55,690,560	0.24%	2.56
683.2	70,788	23,066,340,588	141,745,185	55,690,560	0.24%	2.55
683.1	70,355	22,925,247,105	141,093,483	55,690,560	0.24%	2.53
683.0	69,925	22,785,131,175	140,115,930	55,690,560	0.24%	2.52
682.9	69,496	22,645,341,096	139,790,079	55,690,560	0.25%	2.51
682.8	69,070	22,506,528,570	138,812,526	55,690,560	0.25%	2.49
682.7	68,646	22,368,367,746	138,160,824	55,690,560	0.25%	2.48
682.6	68,224	22,230,858,624	137,509,122	55,690,560	0.25%	2.47
682.5	67,805	22,094,327,055	136,531,569	55,690,560	0.25%	2.45
682.4	67,388	21,958,447,188	135,879,867	55,690,560	0.25%	2.44
682.3	66,973	21,823,219,023	135,228,165	55,690,560	0.26%	2.43
682.2	66,560	21,688,642,560	134,576,463	55,690,560	0.26%	2.42
682.1	66,150	21,555,043,650	133,598,910	55,690,560	0.26%	2.40
682.0	65,741	21,421,770,591	133,273,059	55,690,560	0.26%	2.39
681.9	65,335	21,289,475,085	132,295,506	55,690,560	0.26%	2.38
681.8	64,930	21,157,505,430	131,969,655	55,690,560	0.26%	2.37
681.7	64,528	21,026,513,328	130,992,102	55,690,560	0.26%	2.35

TABLE 2.3-38 (Sheet 7 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
681.6	64,127	20,895,847,077	130,666,251	55,690,560	0.27%	2.35
681.5	63,728	20,765,832,528	130,014,549	55,690,560	0.27%	2.33
681.4	63,331	20,636,469,681	129,362,847	55,690,560	0.27%	2.32
681.3	62,936	20,507,758,536	128,711,145	55,690,560	0.27%	2.31
681.2	62,543	20,379,699,093	128,059,443	55,690,560	0.27%	2.30
681.1	62,152	20,252,291,352	127,407,741	55,690,560	0.27%	2.29
681.0	61,763	20,125,535,313	126,756,039	55,690,560	0.28%	2.28
680.9	61,376	19,999,430,976	126,104,337	55,690,560	0.28%	2.26
680.8	60,990	19,873,652,490	125,778,486	55,690,560	0.28%	2.26
680.7	60,607	19,748,851,557	124,800,933	55,690,560	0.28%	2.24
680.6	60,226	19,624,702,326	124,149,231	55,690,560	0.28%	2.23
680.5	59,846	19,500,878,946	123,823,380	55,690,560	0.29%	2.22
680.4	59,469	19,378,033,119	122,845,827	55,690,560	0.29%	2.21
680.3	59,094	19,255,838,994	122,194,125	55,690,560	0.29%	2.19
680.2	58,721	19,134,296,571	121,542,423	55,690,560	0.29%	2.18
680.1	58,350	19,013,405,850	120,890,721	55,690,560	0.29%	2.17
680.0	57,981	18,893,166,831	120,239,019	55,690,560	0.29%	2.16
679.9	57,614	18,773,579,514	119,587,317	55,690,560	0.30%	2.15
679.8	57,249	18,654,643,899	118,935,615	55,690,560	0.30%	2.14

TABLE 2.3-38 (Sheet 8 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
679.7	56,887	18,536,685,837	117,958,062	55,690,560	0.30%	2.12
679.6	56,526	18,419,053,626	117,632,211	55,690,560	0.30%	2.11
679.5	56,167	18,302,073,117	116,980,509	55,690,560	0.30%	2.10
679.4	55,811	18,186,070,161	116,002,956	55,690,560	0.31%	2.08
679.3	55,457	18,070,718,907	115,351,254	55,690,560	0.31%	2.07
679.2	55,105	17,956,019,355	114,699,552	55,690,560	0.31%	2.06
679.1	54,755	17,841,971,505	114,047,850	55,690,560	0.31%	2.05
679.0	54,407	17,728,575,357	113,396,148	55,690,560	0.31%	2.04
678.9	54,062	17,616,156,762	112,418,595	55,690,560	0.32%	2.02
678.8	53,718	17,504,064,018	112,092,744	55,690,560	0.32%	2.01
678.7	53,377	17,392,948,827	111,115,191	55,690,560	0.32%	2.00
678.6	53,039	17,282,811,189	110,137,638	55,690,560	0.32%	1.98
678.5	52,702	17,172,999,402	109,811,787	55,690,560	0.32%	1.97
678.4	52,368	17,064,165,168	108,834,234	55,690,560	0.33%	1.95
678.3	52,035	16,955,656,785	108,508,383	55,690,560	0.33%	1.95
678.2	51,706	16,848,451,806	107,204,979	55,690,560	0.33%	1.93
678.1	51,378	16,741,572,678	106,879,128	55,690,560	0.33%	1.92
678.0	51,053	16,635,671,103	105,901,575	55,690,560	0.33%	1.90
677.9	50,730	16,530,421,230	105,249,873	55,690,560	0.34%	1.89

TABLE 2.3-38 (Sheet 9 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
677.8	50,409	16,425,823,059	104,598,171	55,690,560	0.34%	1.88
677.7	50,090	16,321,876,590	103,946,469	55,690,560	0.34%	1.87
677.6	49,773	16,218,581,823	103,294,767	55,690,560	0.34%	1.85
677.5	49,458	16,115,938,758	102,643,065	55,690,560	0.35%	1.84
677.4	49,144	16,013,621,544	102,317,214	55,690,560	0.35%	1.84
677.3	48,833	15,912,281,883	101,339,661	55,690,560	0.35%	1.82
677.2	48,523	15,811,268,073	101,013,810	55,690,560	0.35%	1.81
677.1	48,214	15,710,580,114	100,687,959	55,690,560	0.35%	1.81
677.0	47,908	15,610,869,708	99,710,406	55,690,560	0.36%	1.79
676.9	47,603	15,511,485,153	99,384,555	55,690,560	0.36%	1.78
676.8	47,300	15,412,752,300	98,732,853	55,690,560	0.36%	1.77
676.7	46,999	15,314,671,149	98,081,151	55,690,560	0.36%	1.76
676.6	46,699	15,216,915,849	97,755,300	55,690,560	0.37%	1.76
676.5	46,401	15,119,812,251	97,103,598	55,690,560	0.37%	1.74
676.4	46,105	15,023,360,355	96,451,896	55,690,560	0.37%	1.73
676.3	45,810	14,927,234,310	96,126,045	55,690,560	0.37%	1.73
676.2	45,518	14,832,085,818	95,148,492	55,690,560	0.38%	1.71
676.1	45,226	14,736,937,326	95,148,492	55,690,560	0.38%	1.71
676.0	44,936	14,642,440,536	94,496,790	55,690,560	0.38%	1.70

TABLE 2.3-38 (Sheet 10 of 10)
LAKE GRANBURY VOLUME VS CPNPP UNITS 3 AND 4 CONSUMPTIVE WATER USE

Lake Granbury Elevation	**Lake Granbury Volume**		**Lake Granbury Volume Change per 0.1 ft**	**CPNPP Units 3 and 4 Consumptive Use**	**CPNPP Units 3 and 4 Percentage Withdrawal**	**Time to Drawdown 0.1 ft**
ft msl	ac-ft	gal	gal	gpd	%	days
675.9	44,648	14,548,595,448	93,845,088	55,690,560	0.38%	1.69
675.8	44,361	14,455,076,211	93,519,237	55,690,560	0.39%	1.68
675.7	44,075	14,361,882,825	93,193,386	55,690,560	0.39%	1.67
675.6	43,791	14,269,341,141	92,541,684	55,690,560	0.39%	1.66
675.5	43,508	14,177,125,308	92,215,833	55,690,560	0.39%	1.66
675.4	43,227	14,085,561,177	91,564,131	55,690,560	0.40%	1.64
675.3	42,947	13,994,322,897	91,238,280	55,690,560	0.40%	1.64
675.2	42,668	13,903,410,468	90,912,429	55,690,560	0.40%	1.63
675.1	42,391	13,813,149,741	90,260,727	55,690,560	0.40%	1.62
675.0	42,115	13,723,214,865	89,934,876	55,690,560	0.41%	1.61
Total Days						508.44

Note:

Consumptive water use for Units 3 and 4 is estimated at 55,690,560 gpd (approximately 171 ac-ft/day). At this rate, the expected time to drawdown Lake Granbury from a normal pool elevation of 693.0 ft msl to the minimum operating elevation of 675.0 ft msl is approximately 508 days. This estimate is based on current Lake Granbury elevation-volume data and the CPNPP Units 3 and 4 daily consumptive water use estimate. This estimate does not account for inflow, outflow, evaporation, or other water users that may draw upon Lake Granbury.

(TWDB 2005)

TABLE 2.3-39
CPNPP UNITS 3 AND 4 COOLING TOWER BLOWDOWN DISCHARGE ESTIMATES

Average Water Discharge to Lake Granbury CPNPP Units 3 and 4

Discharge Rate	Conversion Calculations				Discharge Flow
gpd	gph	gpm	gps	ft^3/gal	cfs
37,584,000	1,566,000	26,100	435.0	7.48	58.16

Average Water Discharge to Lake Granbury CPNPP Units 3 and 4 with BDTF[(a)]

Discharge Rate	Conversion Calculations				Discharge Flow
gpd	gph	gpm	gps	ft^3/gal	cfs
34,128,000	1,422,000	23,700	395.0	7.48	52.81

a) BDTF – Blowdown Treatment Facility for CPNPP Units 3 and 4

Notes:

gpm flow rates provided in Figure 3.3-1 were used as a source of the water discharge calculations
Dischagre rates assume 2 US-APWR Units
gpd = gallons per day
gph = gallons per hour
gpm = gallons per minute
gps = gallons per second

TABLE 2.3-40
2003 GROUNDWATER WITHDRAWAL FROM THE TRINITY AQUIFER BY USE CATEGORY - HOOD AND SOMERVELL COUNTIES, TEXAS

	Average Withdrawal Values in Acre Feet								
County	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	County Total Withdrawal	Trinity Total Withdrawal	Percentage of Total Withdrawal
Hood	5,195	15	43	0	167	309	5,729	172,098	3.33%
Somervell	941	4	28	0	715	38	1,726	172,098	1.00%
Total	6,136	19	71	0	882	347	7,455	172,098	4.33%

Note:
All values are in acre feet (ac-ft)

(TWDB 2008a)

TABLE 2.3-41
CPNPP WATER WELL INFORMATION

CPNPP Well ID	State Well Number	Location	Primary Use	Well Depth (ft)	Latitude	Longitude	Well Type
1	3242903	Ball Bark Road	Not Used	479	321651	974623	Observation
2	3242902	Training Center	Not Used	318	321707	974515	Observation
3	3242901	Training Center	Public Supply	350	321707	974516	Withdrawal of Water
4	3242601	Batch Plant	Public Supply	466	321748	974733	Withdrawal of Water
5	3242602	Met Tower	Public Supply	490	321750	974650	Withdrawal of Water
6	N/A	Plant Entrance	Not Used	>280(1)	321749	974859	Observation
7	3242503	NOSF - North	Public Supply	517	321760	974828	Withdrawal of Water
8	3242504	NOSF - South	Public Supply	400	321757	974826	Withdrawal of Water
9	3242603	Squaw Creek Park	Public Supply	471	321905	974659	Withdrawal of Water
10	3242604	Squaw Creeak Park	Not Used	470	321905	974660	Observation
11	N/A	Squaw Creek Park Office	Public Supply	Unknown(2)	321946	974648	Withdrawal of Water
12	N/A	Rifle Training Facility	Public Supply	485	321905	974659	Withdrawal of Water

Notes:

Onsite water wells are owned by Luminant and completed in the Twin Mountains (Trinity) Aquifer
(1) Total depth of well is unknown due to obstruction. Static water level has been measured at approximately 280 ft below top of casing.
(2) Inactive public supply well, total depth of well is unknown.
NOSF Nuclear Operations Support Facility
N/A Not Assigned

TABLE 2.3-42
2006 CPNPP MONTHLY GROUNDWATER USE

Month	Self Supplied (Gallons)
January	835,600
February	759,800
March	1,050,700
April	904,400
May	688,300
June	762,600
July	697,500
August	679,000
September	628,500
October	930,000
November	568,800
December	587,500
Total	9,092,700

Source: (TCEQ 2006)

TABLE 2.3-43
PROJECTED WATER DEMANDS FOR 2010 - 2060 IN BRAZOS REGION G

Water Use Category	Projections					
	2010	2020	2030	2040	2050	2060
Municipal	347,389	397,090	444,820	491,312	542,172	595,482
Manufacturing	19,787	23,201	25,077	26,962	30,191	31,942
Steam-Electric	147,734	158,789	171,489	191,968	219,340	242,344
Mining	36,664	37,591	38,037	27,251	20,744	21,243
Irrigation	232,541	227,697	222,691	217,859	213,055	208,386
Livestock	51,576	51,576	51,576	51,576	51,576	51,576
Total for Region	835,691	895,944	953,690	1,006,928	1,077,078	1,150,973

Notes: Demands are in ac-ft/yr
Source: (Brazos G 2006)

TABLE 2.3-44
PROJECTED WATER DEMANDS FOR 2010 - 2060 IN HOOD AND SOMERVELL COUNTIES

County	Year						Use
	2010	2020	2030	2040	2050	2060	
Hood	9,135	10,666	12,077	13,616	15,557	17,897	Municipal
Somervell	1,071	1,145	1,202	1,229	1,238	1,245	
Hood	25	28	30	32	34	37	Manufacturing
Somervell	6	7	8	9	10	11	
Hood	6,594	8,098	9,467	11,137	13,172	15,653	Steam Electric
Somervell	23,200	23,200	23,200	23,200	23,200	23,200	
Hood	162	161	160	159	158	157	Mining
Somervell	304	287	278	270	263	257	
Hood	3,179	3,120	3,062	3,005	2,948	2,893	Irrigation
Somervell	474	471	468	467	464	461	
Hood	623	623	623	623	623	623	Livestock
Somervell	166	166	166	166	166	166	
Hood and Somervell Total	44,939	47,972	50,741	53,913	57,833	62,600	All Uses

Notes: Demands are in ac-ft/yr
Source: (Brazos G 2006)

TABLE 2.3-45
2030 AND 2060 WATER SURPLUS AND SHORTAGE ESTIMATES FOR HOOD AND SOMERVELL COUNTIES

Water User Group	County	Surplus/(Shortage) in ac-ft		Comment
		2030	2060	
Acton MUD	Hood	2347	484	Projected surplus
City of Granbury	Hood	4888	3252	Projected surplus
Oak Trail Shores Subdivision	Hood	(114)	(101)	Projected shortage
City of Tolar	Hood	58	62	Projected surplus
County-Other	Hood	(1195)	(3543)	Projected shortage
Manufacturing	Hood	(8)	(15)	Projected shortage
Steam-Electric	Hood	33,980	27,794	Projected surplus
Mining	Hood	(25)	(24)	Projected shortage
Irrigation	Hood	10,346	10,628	Projected surplus
Livestock	Hood	0	0	No projected surplus/shortage
City of Glen Rose	Somervell	38	37	Projected surplus
County-Other	Somervell	(231)	(260)	Projected shortage
Manufacturing	Somervell	(4)	(7)	Projected shortage
Steam-Electric	Somervell	(36,047)[a]	(36,107)[a]	Projected shortage
Mining	Somervell	(94)	(85)	Projected shortage
Irrigation	Somervell	945	953	Projected surplus
Livestock	Somervell	0	0	Supply equals demand

a) Projected shortage for Sommervell County Steam-Electric reported in Amendment to 2006 Region G Water Plan

Source: (Brazos G 2006)

TABLE 2.3-46 (Sheet 1 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Color	Odor	Temperature	Field Dissolved Oxygen	Field pH	Field Conductivity	Field Turbidity	Chlorophyll a	Total Suspended Solids	Total Dissolved Solids	Hardness	Turbidity	Biochemical Oxygen Demand	Chemical Oxygen Demand	Total Phosphorus	Orthophosphate	Ammonia Nitrogen	Nitrate as N	Nitrite	Total Kjeldahl Nitrogen	Bicarbonate Alkalinity	Chloride
Units		N/A	N/A	Deg F	mg/L	S.U.	mS/cm	NTU	mg/m3	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Mg/L
Screening Level		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.027	45.0	2500	N/A	N/A	45.0	N/A	0.200	N/A	0.110	0.370	N/A	N/A	N/A	1000
Sample Description	Date																						
SW-101 (0.3 ft)	1/25/2007	Clear	None	46.42	8.05	9.58	3.152	6.6	453.000	92.0	2620	127	2.00	<3.0	34.4	0.776	0.411	0.036	1.020	<0.03	<0.125	50.9	3000.0
	4/17/2007	Clear	None	62.26	5.09	8.24	2.083	6.5	13.300	180.0	1620	327	3.00	8.0	13.0	0.155	<0.400	0.030	<0.030	<0.03	<0.125	59.4	489.0
	7/24/2007	Clear	None	77.13	6.47	7.96	0.590	4.8	8.000	<5.0	391	281	2.54	<2.0	<25.0	0.020	<0.010	0.230	<0.100	<0.10	0.250	240.0	36.3
	10/24/2007	Clear	None	63.72	7.52	8.48	3.257	6.8	14.000	<5.0	2210	638	1.64	<2.0	41.2	0.710	0.140	0.150	<0.100	<0.10	0.660	180.0	826.0
SW-102 (0.3 ft)	1/25/2007	Clear	None	62.73	10.25	9.64	4.037	5.0	<5.100	88.0	3130	138	1.00	<3.0	33.9	0.806	0.187	0.058	0.580	<0.03	<0.125	48.8	3060.0
	4/17/2007	Clear	None	69.92	6.03	9.10	4.756	7.0	25.300	13.0	3320	405	3.00	13.0	43.0	0.670	<0.400	0.201	<0.030	<0.03	<0.125	60.4	1410.0
	7/24/2007	Clear	None	93.74	8.51	8.97	4.766	5.6	24.000	5.0	2700	678	3.47	28.0	62.7	0.500	0.280	0.160	<0.100	<0.10	0.470	154.0	1160.0
	10/24/2007	Clear	None	79.72	9.27	8.83	4.470	0.9	22.000	<5.0	2780	733	<1.00	3.0	36.9	0.430	0.270	0.180	<0.100	<0.10	0.630	130.0	1100.0
SW-103 (20 ft)	1/25/2007	Clear	None	59.95	5.46	9.52	3.880	N/A	<5.100	108.0	3180	130	2.00	<3.0	30.2	1.200	0.291	<0.030	0.840	<0.03	<0.125	42.9	3060.0
	4/17/2007	Clear	None	69.87	6.13	8.96	4.749	8.9	26.100	112.0	3360	401	25.00	19.0	49.0	0.758	<0.400	0.088	<0.030	<0.03	<0.125	62.8	1320.0
	7/24/2007	Clear	None	93.07	8.47	8.97	4.739	14.3	15.000	<5.0	2680	688	3.93	27.0	56.0	0.500	0.280	0.220	<0.100	<0.10	0.480	142.0	1160.0
	10/24/2007	Clear	None	77.92	9.10	8.81	4.657	0.8	21.000	<5.0	2780	724	<1.00	5.0	58.6	0.510	0.280	0.130	<0.100	<0.10	0.700	156.0	1090.0
SW-104 (0.3 ft)	1/25/2007	Clear	None	67.08	7.16	9.41	4.940	N/A	119.000	72.0	2900	137	2.00	<3.0	55.2	0.768	0.342	0.091	0.670	<0.03	<0.125	55.5	3060.0
	4/17/2007	Clear	None	70.79	5.30	8.77	4.808	4.0	25.900	9.0	3220	395	2.00	11.0	45.0	0.610	<0.400	<0.030	<0.030	<0.03	<0.125	61.7	1420.0
	7/24/2007	Clear	None	96.40	7.70	8.90	4.898	1.0	15.000	<5.0	2790	697	1.84	22.0	60.4	0.510	0.280	0.200	<0.100	<0.10	0.300	148.0	1180.0
	10/25/2007	Clear	None	83.86	6.89	8.75	4.901	6.8	23.000	<5.0	2750	730	1.96	5.0	<25.0	0.480	0.290	0.130	<0.100	<0.10	0.800	142.0	1100.0
SW-105 (48 ft)	1/25/2007	Clear	None	63.52	5.06	9.52	4.068	N/A	<5.100	100.0	2920	162	1.00	<3.0	54.7	1.020	0.153	0.071	3.980	<0.03	<0.125	51.4	3050.0
	4/17/2007	Cloudy Brown	None	70.61	5.26	9.23	4.792	4.5	66.100	598.0	3360	388	130.00	23.0	55.0	0.769	<0.400	0.243	<0.030	<0.03	<0.125	58.7	1380.0
	7/24/2007	Clear	None	90.46	5.12	8.82	4.700	1.5	13.000	<5.0	2670	690	1.97	<5.0	67.2	0.500	0.290	0.220	<0.100	<0.10	0.430	150.0	1170.0
	10/25/2007	Clear	None	86.32	5.80	8.86	4.786	1.9	23.000	<5.0	2470	738	1.98	<2.0	<25.0	0.440	0.290	0.130	<0.100	<0.10	0.710	176.0	1090.0
SW-106 (0.3 ft)	1/25/2007	Clear	None	70.74	8.17	9.39	4.432	N/A	42.200	92.0	3040	150	1.00	<3.0	52.8	0.822	0.271	0.055	0.900	<0.03	<0.125	41.4	3060.0
	4/17/2007	Clear	None	72.36	4.91	9.05	4.892	4.1	35.300	10.0	3280	335	2.00	29.0	56.0	0.570	<0.400	0.172	<0.030	<0.03	<0.125	50.7	1400.0
	7/24/2007	Clear	None	97.41	7.05	8.84	4.961	1.2	20.000	<5.0	2640	689	3.73	26.0	53.7	0.460	0.290	0.280	<0.100	<0.10	0.310	170.0	1150.0
	10/24/2007	Clear	None	77.92	8.53	8.76	5.079	1.4	24.000	<5.0	2730	728	<1.00	4.0	65.1	0.530	0.290	0.180	<0.100	<0.10	0.650	108.0	1090.0
SW-107 (95 ft)	1/25/2007	Clear	None	62.35	3.62	9.77	4.019	N/A	<5.100	136.0	3100	143	1.00	<3.0	<1.0	0.854	0.199	<0.030	0.660	<0.03	<0.125	57.4	3060.0
	4/17/2007	Clear	None	62.76	0.77	8.49	4.490	4.2	28.200	77.0	3180	293	29.00	19.0	50.0	0.590	<0.400	0.133	<0.030	<0.03	<0.125	52.8	1390.0
	7/24/2007	Clear	None	63.95	4.86	7.84	4.289	2.4	21.000	<5.0	2810	694	1.83	28.0	58.2	0.530	0.290	0.320	<0.100	<0.10	0.460	166.0	1200.0
	10/24/2007	Clear	None	64.33	14.26	6.73	4.921	2.6	21.000	<5.0	2770	730	1.13	5.0	65.1	0.490	0.290	0.180	<0.100	<0.10	0.730	214.0	1090.0

TABLE 2.3-46 (Sheet 2 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Color	Odor	Temperature	Field Dissolved Oxygen	Field pH	Field Conductivity	Field Turbidity	Chlorophyll a	Total Suspended Solids	Total Dissolved Solids	Hardness	Turbidity	Biochemical Oxygen Demand	Chemical Oxygen Demand	Total Phosphorus	Orthophosphate	Ammonia Nitrogen	Nitrate as N	Nitrite	Total Kjeldahl Nitrogen	Bicarbonate Alkalinity	Chloride
Units		N/A	N/A	Deg F	mg/L	S.U.	mS/cm	NTU	mg/m3	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Mg/L
Screening Level		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.027	45.0	2500	N/A	N/A	45.0	N/A	0.200	N/A	0.110	0.370	N/A	N/A	N/A	1000
Sample Description	Date																						
SW-108 (0.3 ft)	1/26/2007	Clear	None	58.98	16.79	9.36	3.822	4.0	<5.100	17.5	3020	145	3.00	<3.0	<1.0	0.702	0.058	0.074	0.156	<0.03	<0.125	44.3	3110.0
	4/16/2007	Clear	None	62.49	5.46	7.92	4.189	4.8	19.800	7.0	6650	356	2.00	5.0	27.0	0.623	<0.400	0.144	<0.030	<0.03	<0.125	53.4	1220.0
	7/23/2007	Clear	None	82.17	8.02	8.00	4.060	13.6	16.000	7.7	2610	725	4.36	18.0	76.4	0.360	0.220	0.220	0.510	<0.10	0.260	242.0	1070.0
	10/22/2007	Clear	None	76.87	7.14	8.46	4.294	10.5	6.000	12.5	2630	701	5.50	<2.0	29.0	0.440	0.260	<0.100	<0.100	<0.10	0.520	198.0	945.0
SW-109 (0.3 ft)	1/26/2007	Clear	None	46.54	18.09	9.30	1.547	7.8	<5.100	12.5	1460	126	1.00	<3.0	<1.0	0.217	0.214	0.091	0.219	<0.03	<0.125	51.9	1910.0
	4/16/2007	Clear	None	61.38	5.20	7.75	0.809	68.7	3.900	35.5	562	250	43.00	<3.0	4.0	0.262	<0.400	0.334	<0.030	<0.03	<0.125	47.2	185.0
	7/23/2007	Clear	None	83.37	8.55	7.99	1.568	27.8	42.000	14.3	968	291	3.87	8.0	40.4	0.380	<0.010	0.200	0.280	<0.10	0.380	184.0	348.0
	10/22/2007	Clear	None	68.54	8.24	8.33	1.920	38.4	25.000	15.0	1270	423	13.70	2.0	<25.0	0.160	0.020	<0.100	<0.100	<0.10	0.500	180.0	436.0
SW-110 (0.3 ft)	1/26/2007	Clear	None	47.41	14.90	9.38	1.770	9.80	<5.100	15.5	1680	138	1.00	<3.0	<1.0	0.112	0.155	0.094	0.354	<0.03	<0.125	53.2	2100.0
	4/16/2007	Clear	None	62.51	4.48	7.47	0.756	63.4	4.800	24.0	525	207	40.00	<3.0	7.0	0.101	<0.400	0.422	<0.030	<0.03	<0.125	62.2	73.0
	7/23/2007	Clear	None	86.07	9.30	8.52	1.649	11.1	37.000	6.8	983	275	10.00	9.0	38.2	0.020	<0.010	0.160	<0.100	<0.10	0.500	110.0	370.0
	10/22/2007	Clear	None	72.97	7.58	8.07	1.100	16.1	31.000	11.0	645	222	9.80	<2.0	<25.0	0.030	<0.010	0.120	<0.100	<0.10	0.490	122.0	208.0
AVERAGE				71.67	7.61	8.72	3.690	10.8	32.100	47.6	2510	421	9.22	8.6	37.1	0.510	0.209	0.147	0.280	0.03	0.287	109.5	1414.4
MAX				97.41	18.09	9.77	5.079	68.7	453.000	598.0	6650	738	130.00	29.0	76.4	1.200	0.411	0.422	3.980	0.05	0.800	242.0	3110.0
MIN				46.42	0.77	6.73	0.590	0.8	0.013	2.5	391	126	0.50	1.0	0.5	0.020	0.005	0.015	0.015	0.02	0.063	41.4	36.3
STANDARD DEVIATION				13.05	3.41	0.67	1.440	15.8	71.477	100.2	1110	239	22.07	9.6	22.6	0.274	0.099	0.094	0.661	0.02	0.254	62.8	943.8

TABLE 2.3-46 (Sheet 3 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Sulfate	Total Mercury	Dissolved Mercury	pH	Total Coliform	Fecal Coliform	Fecal Streptococci	Total Sodium	Total Potassium	Total Calcium	Total Magnesium	Total Arsenic	Total Barium	Total Cadmium	Total Chromium	Total Lead	Total Selenium	Total Silver	Total Nickel	Total Zinc	Silica	Total Copper
Units		mg/L	mg/L	mg/L	S.U.	col/100mL	col/100mL	col/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Screening Level		600.0	0.0013	N/A	N/A	N/A	400	N/A	N/A	N/A	N/A	N/A	0.190	2.0000	0.00210	0.373	0.008	0.00500	N/A	0.33800	0.22500	N/A	0.50700
Sample Description	Date																						
SW-101 (0.3 ft)	1/25/2007	722.0	<0.0002	<0.0002	7.81	260	51	<10	398.10	32.10	59.3	52.8	<0.002	0.1920	<0.00100	<0.003	<0.004	0.00318	0.0120	<0.00200	0.01460	N/A	<0.00800
	4/17/2007	345.0	<0.0002	<0.0002	6.72	944	20	10	222.80	17.90	66.8	46.4	<0.002	1.3400	<0.00100	<0.003	0.056	<0.00200	<0.0010	<0.00200	0.04900	1.740	<0.00800
	7/24/2007	34.7	<0.0002	<0.0002	8.02	3800	170	28	26.50	4.06	77.4	21.4	<0.005	0.0790	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01400	11.300	<0.00500
	10/24/2007	344.0	<0.0002	<0.0002	8.54	60000	<10	<1	546.00	12.90	172.0	50.6	0.005	0.1960	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00900	6.200	0.02300
SW-102 (0.3 ft)	1/25/2007	688.0	<0.0002	<0.0002	7.16	200	10	<10	305.40	33.50	59.1	53.0	<0.002	0.2040	<0.00100	0.003	<0.004	<0.00200	<0.0010	<0.00200	0.00777	N/A	<0.00800
	4/17/2007	523.0	<0.0002	<0.0002	7.43	160	12	<10	851.00	18.60	231.0	64.8	<0.002	0.2010	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	<0.00300	1.460	<0.00800
	7/24/2007	404.0	<0.0002	<0.0002	8.78	40	<10	1	706.00	15.10	173.0	59.9	<0.005	0.2090	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01300	7.100	0.02500
	10/24/2007	441.0	<0.0002	<0.0002	8.86	51000	<10	<1	696.00	15.70	198.0	58.0	0.007	0.2110	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00900	6.900	0.02900
SW-103 (20 ft)	1/25/2007	693.0	<0.0002	<0.0002	7.34	220	15	<10	216.50	31.40	59.6	51.8	<0.002	0.2170	0.00116	0.007	<0.004	<0.00200	0.0250	0.00296	0.01210	N/A	<0.00800
	4/17/2007	546.0	<0.0002	<0.0002	7.51	416	32	<10	942.40	48.10	75.2	61.7	<0.002	0.2030	<0.00100	<0.003	0.021	<0.00200	<0.0010	0.00263	0.00448	2.260	<0.00800
	7/24/2007	391.0	<0.0002	<0.0002	8.80	40	<10	3	720.00	15.30	174.0	61.4	0.006	0.2120	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01300	6.700	0.02400
	10/24/2007	442.0	<0.0002	<0.0002	8.87	48000	<10	<1	686.00	15.80	193.0	58.8	0.007	0.2100	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00700	6.400	0.02900
SW-104 (0.3 ft)	1/25/2007	794.0	<0.0002	<0.0002	7.77	360	21	<10	237.50	33.40	58.7	52.1	<0.002	0.2080	0.00104	<0.003	<0.004	0.00580	<0.0010	0.01400	0.02440	N/A	0.07100
	4/17/2007	512.0	<0.0002	<0.0002	7.22	256	<10	<10	852.00	18.90	233.0	60.6	<0.002	0.1820	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	<0.00300	1.260	<0.00800
	7/24/2007	400.0	<0.0002	<0.0002	8.79	90	<10	<1	732.00	15.40	178.0	61.6	0.006	0.2110	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01200	5.600	0.02400
	10/25/2007	445.0	<0.0002	<0.0002	8.74	59000	300	<1	696.00	16.20	193.0	60.2	0.007	0.2110	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01500	7.300	0.03000
SW-105 (48 ft)	1/25/2007	792.0	<0.0002	<0.0002	7.49	820	91	<10	194.70	33.00	58.7	52.2	0.006	0.2300	<0.00100	<0.003	<0.004	<0.00200	<0.0010	0.05500	0.03850	0.039	0.06500
	4/17/2007	522.0	<0.0002	<0.0002	7.61	1660	160	<10	832.00	18.50	232.0	58.4	<0.002	0.1880	<0.00100	<0.003	<0.004	<0.00200	<0.0010	0.00787	0.18900	1.520	0.01140
	7/24/2007	400.0	<0.0002	<0.0002	8.77	80	<10	<1	734.00	15.20	177.0	60.3	0.006	0.2080	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01200	5.200	0.02400
	10/25/2007	439.0	<0.0002	<0.0002	8.76	70000	<10	<1	710.00	16.30	196.0	60.4	0.007	0.2100	<0.00100	<0.005	<0.005	0.00500	<0.0010	<0.00500	0.00800	5.400	0.03000
SW-106 (0.3 ft)	1/25/2007	795.0	<0.0002	<0.0002	7.62	300	37	<10	275.60	34.00	59.5	53.2	0.005	0.2310	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	0.00862	N/A	0.01620
	4/17/2007	513.0	<0.0002	<0.0002	7.39	224	<10	<10	855.00	18.90	232.0	48.5	<0.002	0.1880	<0.00100	0.003	<0.004	<0.00200	<0.0010	0.00337	0.08970	0.816	0.02640
	7/24/2007	392.0	<0.0002	<0.0002	8.72	230	<10	<1	714.00	15.20	178.0	59.3	0.006	0.2080	<0.00100	0.007	<0.005	<0.00500	<0.0010	<0.00500	<0.00500	5.000	0.02500
	10/24/2007	443.0	<0.0002	<0.0002	8.81	132000	20	<1	686.00	15.80	195.0	58.6	0.007	0.2140	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00700	9.000	0.02900
SW-107 (95 ft)	1/25/2007	794.0	<0.0002	<0.0002	7.52	960	113	<10	327.10	35.20	59.4	53.2	0.002	0.2370	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	0.00822	N/A	<0.00800
	4/17/2007	506.0	<0.0002	<0.0002	7.46	820	32	<10	852.00	18.70	231.0	43.3	<0.002	0.1860	0.00118	0.012	0.053	<0.00200	<0.0010	0.00432	<0.00300	0.958	<0.00800
	7/24/2007	405.0	<0.0002	<0.0002	8.64	180	10	<1	727.00	15.30	178.0	60.5	0.006	0.2090	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01200	4.800	0.02400
	10/24/2007	449.0	<0.0002	<0.0002	8.80	96000	<10	<1	681.00	15.80	197.0	57.8	0.007	0.2110	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00900	8.600	0.02900

TABLE 2.3-46 (Sheet 4 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Sulfate	Total Mercury	Dissolved Mercury	pH	Total Coliform	Fecal Coliform	Fecal Streptococci	Total Sodium	Total Potassium	Total Calcium	Total Magnesium	Total Arsenic	Total Barium	Total Cadmium	Total Chromium	Total Lead	Total Selenium	Total Silver	Total Nickel	Total Zinc	Silica	Total Copper
Units		mg/L	mg/L	mg/L	S.U.	col/100mL	col/100mL	col/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Screening Level		600.0	0.0013	N/A	N/A	N/A	400	N/A	N/A	N/A	N/A	N/A	0.190	2.0000	0.00210	0.373	0.008	0.00500	N/A	0.33800	0.22500	N/A	0.50700
Sample Description	Date																						
SW-108 (0.3 ft)	1/26/2007	327.0	<0.0002	<0.0002	7.12	2260	26	<10	225.48	31.00	59.4	52.8	0.006	0.2090	<0.00100	<0.003	<0.004	<0.00200	0.0470	<0.00200	0.01720	N/A	0.01790
	4/16/2007	484.0	<0.0002	<0.0002	7.23	240	72	70	943.80	34.00	63.6	57.2	<0.002	0.1800	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	<0.00300	2.120	0.00829
	7/23/2007	412.0	<0.0002	<0.0002	8.15	9600	3200	450	658.00	14.00	192.0	59.7	0.007	0.1850	<0.00100	<0.005	<0.005	<0.00500	<0.0050	<0.00500	0.01400	7.100	0.02100
	10/22/2007	397.0	<0.0002	<0.0002	8.55	200000	3000	100	648.00	15.40	188.0	56.2	0.006	0.1990	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00800	8.000	0.02800
SW-109 (0.3 ft)	1/26/2007	419.0	<0.0002	<0.0002	7.24	<10	<10	<10	219.71	13.80	58.4	43.0	0.004	0.1320	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	0.02470	N/A	0.02180
	4/16/2007	101.0	<0.0002	<0.0002	7.10	1600	16	23	141.50	12.10	64.4	25.8	<0.002	0.1040	<0.00100	0.005	<0.004	<0.00200	<0.0010	<0.00200	0.03450	4.450	0.02060
	7/23/2007	137.0	<0.0002	<0.0002	8.17	7000	1000	22	219.00	6.27	83.3	20.0	<0.005	0.1160	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01300	11.900	0.00800
	10/22/2007	181.0	<0.0002	<0.0002	8.46	30000	600	56	275.00	8.02	115.0	33.1	0.005	0.1370	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01000	10.500	0.01200
SW-110 (0.3 ft)	1/26/2007	447.0	<0.0002	<0.0002	7.71	<10	<10	<10	199.53	15.70	57.2	42.6	0.002	0.5120	<0.00100	<0.003	0.045	<0.00200	0.0010	<0.00200	0.02210	N/A	0.02230
	4/16/2007	50.0	<0.0002	<0.0002	7.68	840	20	<10	133.60	11.70	52.9	21.7	<0.002	0.0869	<0.00100	<0.003	<0.004	<0.00200	<0.0010	<0.00200	<0.00300	6.140	<0.00800
	7/23/2007	139.0	<0.0002	<0.0002	8.57	5400	200	<1	237.00	6.63	79.6	18.5	<0.005	0.1140	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.01200	10.000	0.00900
	10/22/2007	88.2	<0.0002	<0.0002	8.22	11400	<10	<1	140.00	6.30	65.4	14.3	<0.005	0.1060	<0.00100	<0.005	<0.005	<0.00500	<0.0010	<0.00500	0.00700	16.000	0.00600
AVERAGE		433.9	0.0001	0.0001	8.00	19910	231	21	511.58	19.28	131.8	49.6	0.004	0.2222	0.00055	0.003	0.006	0.00199	0.0026	0.00383	0.01897	5.863	0.01881
MAX		795.0	0.0001	0.0001	8.87	200000	3200	450	943.80	48.10	233.0	64.8	0.007	1.3400	0.00118	0.012	0.056	0.00580	0.0470	0.05500	0.18900	16.000	0.07100
MIN		34.7	0.0001	0.0001	6.72	5	5	1	26.50	4.06	52.9	14.3	0.001	0.0790	0.00050	0.002	0.002	0.00100	0.0005	0.00100	0.00150	0.039	0.00250
STANDARD DEVIATION		202.2	0.0000	0.0000	0.66	42031	701	72	280.59	9.89	68.5	14.1	0.002	0.1930	0.00017	0.002	0.013	0.00110	0.0083	0.00859	0.03176	3.778	0.01515

TABLE 2.3-46 (Sheet 5 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Total Boron	Total Iron	Total Manganese	Total Alkalinity
Units		mg/L	mg/L	mg/L	mg/L
Screening Level		N/A	1.0000	N/A	N/A
Sample Description	Date				
SW-101 (0.3 ft)	1/25/2007	0.765	0.1670	0.0496	143
	4/17/2007	0.206	0.2530	0.0599	131
	7/24/2007	<5.000	<0.5000	0.0370	N/A
	10/24/2007	<5.000	0.6300	0.0360	N/A
SW-102 (0.3 ft)	1/25/2007	0.790	0.0724	0.0553	156
	4/17/2007	0.529	0.0495	0.0242	117
	7/24/2007	<5.000	<0.5000	0.0120	N/A
	10/24/2007	<5.000	0.6200	0.0330	N/A
SW-103 (20 ft)	1/25/2007	0.746	1.0100	0.2150	167
	4/17/2007	0.480	1.6200	0.0934	140
	7/24/2007	<5.000	0.5200	0.0150	N/A
	10/24/2007	<5.000	0.6400	0.0330	N/A
SW-104 (0.3 ft)	1/25/2007	0.770	0.0786	0.0513	160
	4/17/2007	0.439	1.2600	0.0227	131
	7/24/2007	<5.000	<0.5000	0.0100	N/A
	10/25/2007	<5.000	0.5800	0.0510	N/A
SW-105 (48 ft)	1/25/2007	0.774	0.6320	0.0949	127
	4/17/2007	0.424	0.2720	0.0908	139
	7/24/2007	<5.000	<0.5000	0.0100	N/A
	10/25/2007	<5.000	0.6200	0.0500	N/A
SW-106 (0.3 ft)	1/25/2007	0.785	0.1540	0.0480	134
	4/17/2007	0.389	0.0491	0.0102	144
	7/24/2007	<5.000	<0.5000	0.0110	N/A
	10/24/2007	<5.000	0.6000	0.0570	N/A
SW-107 (95 ft)	1/25/2007	0.824	0.0690	0.0706	146
	4/17/2007	0.340	0.0965	0.0309	129
	7/24/2007	<5.000	<0.5000	0.0190	N/A
	10/24/2007	<5.000	0.5900	0.0640	N/A
SW-108 (0.3 ft)	1/26/2007	0.731	0.1270	0.1300	121
	4/16/2007	0.598	0.2210	0.0737	135
	7/23/2007	<5.000	0.6800	0.1010	N/A
	10/22/2007	<5.000	0.6600	0.0410	N/A

TABLE 2.3-46 (Sheet 6 of 6)
SAMPLE RESULTS FROM CPNPP VICINITY SURFACE WATER MONITORING EVENTS (2007)

Parameter		Total Boron	Total Iron	Total Manganese	Total Alkalinity
Units		mg/L	mg/L	mg/L	mg/L
Screening Level		N/A	1.0000	N/A	N/A
Sample Description	Date				
SW-109 (0.3 ft)	1/26/2007	0.323	0.1800	0.0357	128
	4/16/2007	0.137	1.0200	0.1180	127
	7/23/2007	<5.000	<0.5000	0.0490	N/A
	10/22/2007	<5.000	0.5900	0.0660	N/A
SW-110 (0.3 ft)	1/26/2007	0.339	0.2550	0.0400	139
	4/16/2007	0.130	2.5600	0.0973	122
	7/23/2007	<5.000	<0.5000	0.0110	N/A
	10/22/2007	<5.000	<0.5000	0.0390	N/A
AVERAGE		1.513	0.4782	0.0539	137
MAX		2.500	2.5600	0.2150	167
MIN		0.130	0.0491	0.0100	117
STANDARD DEVIATION		1.013	0.4847	0.0406	13

Notes:
N/A - Not Applicable
To calculate the min, max, mean, and standard deviation with nondetects, if a screening limit was available, either 1/2 the nondetect value or 1/2 the screening limit was used (whichever was less). The screening limits are based on: DRAFT: 2008 Guidance for Assessing and Reporting Surface Water Quality in Texas (December 21, 2007).

TABLE 2.3-47
SUMMARY OF BRAZOS RIVER BASIN NON-SUPPORT SURFACE WATERS
(FRESHWATER STREAMS)

	2006			2008		
Impairment	No. of Streams Cited	Basin Stream Miles Impaired	% Total Impaired Miles*	No. of Streams Cited	Basin Stream Miles Impaired	% Total Impaired Miles*
Bacteria	63	1286	78.03%	62	1358	69.57%
Chloride	4	328	19.90%	6	539	27.61%
Depressed Dissolved Oxygen	5	128	7.77%	7	181	9.27%
Impaired Fish Community	1	15	0.91%	1	15	0.77%
Impaired Fish Habitat	1	15	0.91%	0	0	0.00%
Impaired Macrobenthic Community	0	0	0.00%	1	109	5.58%
Sulfate	2	50	3.03%	3	107	5.48%
TDS	2	41	2.49%	2	73	3.74%

Notes:

*For 2006 total impaired stream mileage is 1648 mi. Multiple pollutants may impair a stream, thus percentages may not total 100. Percent of total impaired miles is basin stream miles for the given pollutant divided by the total impaired mileage of all listed streams (1648 mi), as a percent.
*For 2008 total impaired stream mileage is 1952 mi. Multiple pollutants may impair a stream, thus percentages may not total 100. Percent of total impaired miles is basin stream miles for the given pollutant divided by the total impaired mileage of all listed streams (1952 mi), as a percent.

Source:

Adapted from the "Texas 2006 and Draft 2008 Water Quality Reports to Congress, 303(d) Lists" http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html

(TCEQ 2006b)

(TCEQ 2008)

TABLE 2.3-48
SUMMARY OF BRAZOS RIVER BASIN NON-SUPPORT SURFACE WATERS
(RESERVOIRS)

	2006			2008		
Impairment	**No. of Reservoirs Impaired**	**Basin Reservoir Acres Impaired**	**% Total Impaired Acres***	**No. of Reservoirs Impaired**	**Basin Reservoir Acres Impaired**	**% Total Impaired Acres***
pH	1	8606	65.10%	0	0	0.00%
Chloride	1	2020	15.28%	2	10,720	72.01%
Sulfate	1	2020	15.28%	0	0	0.00%
TDS	2	4570	34.57%	1	2,020	13.57%
Toxicity in Sediment	2	43	0.33%	2	43	0.29%
Depressed Dissolved Oxygen	0	0	0.00%	1	4,123	27.70%

Note:

*For 2006 total impaired reservoir is 13,219 acres. Multiple pollutants may impair a reservoir, thus percents may not total 100. Percent of total impaired acres is basin reservoir acres for the given pollutant divided by the total impaired acreage of all listed reservoirs (13,219 acres), as a percent.

*For 2008 total impaired reservoir is 14,886 acres. Multiple pollutants may impair a reservoir, thus percents may not total 100. Percent of total impaired acres is basin reservoir acres for the given pollutant divided by the total impaired acreage of all listed reservoirs (14,886 acres), as a percent.

Source:

Adapted from the "Texas 2006 and Draft 2008 Water Quality Reports to Congress, 303(d) Lists" http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html

(TCEQ 2006b)

(TCEQ 2008)

TABLE 2.3-49 (Sheet 1 of 2)
BRAZOS RIVER (SEGMENT 1206) HISTORICAL SURFACE WATER QUALITY RESULTS (1998 – 2006)

11864 - Brazos River at FM 4 (3/98-08/06)

Analysis	Units	N	Minimum	Maximum	Mean	Median	Water Quality Standard/ Screening Level	N Exceeding	% Exceeding
Water Temperature	°C	29	7.49	33.21	21.59	24.49	32	2	7%
Specific Conductance	uS/cm2	29	1758	4695	3562	3165	NA		
Dissolved Oxygen	mg/L	29	4.53	12.6	9.04	8.75	5.0	2	7%
pH		29	7.5	8.91	8.14	8.17	6.5 - 9.0	0	0%
Salinity	ppt	29	0.9	2.57	1.93	1.71	NA		
Total Suspended Solids	mg/L	27	2	30	13	11	NA		
Nitrite nitrogen	mg/L N as NO2	27	0.01	0.03	0.01	0.01	NA		
Nitrate nitrogen	mg/L N as NO3	27	0.01	0.37	0.04	0.01	1.95		
Nitrite + Nitrate nitrogen	mg/L N	27	0.02	0.4	0.05	0.02	2.76	0	0%
Total Kjeldahl Nitrogen	mg/L	1	0.1	0.1	0.1	0.1	NA		
Total Phosphorus	mg/L	1	0.15	0.15	0.15	0.15	0.8		
Orthophosphate phosphorus	mg/L P as OPO4	21	0.02	0.02	0.02	0.02	0.5	0	0%
Fecal coliform	cfu/100mls	4	8	170	43	50	200		
Escherichia coli	mpn/100mls	22	1	345	12	12	126	0	0%
Chloride	mg/L	28	235	2566	1201	1079	1020		
Sulfate	mg/L	28	87	856	416	413	500		
Total Dissolved Solids	mg/L	29	1143	3052	2315	2057	2300		

TABLE 2.3-49 (Sheet 2 of 2)
BRAZOS RIVER (SEGMENT 1206) HISTORICAL SURFACE WATER QUALITY RESULTS (1998 – 2006)

13543 - Brazos River at FM1189 (09/01-09/06)

Analysis	Units	N	Minimum	Maximum	Mean	Median	Water Quality Standard/ Screening Level	N Exceeding	% Exceeding
Water Temperature	°C	44	6.97	30.88	20.21	22.54	32	0	0%
Specific Conductance	uS/cm2	44	784	4701	3344	3398	NA		
Dissolved Oxygen	mg/L	44	4.86	13.42	8.29	7.92	5.0	1	2%
pH		43	7.75	8.44	8.07	8.1	6.5 - 9.0	0	0%
Salinity	ppt	44	0.37	2.58	1.81	1.84	NA		
Total Suspended Solids	mg/L	43	4	770	36	18	NA		
Nitrite nitrogen	mg/L N as NO2	40	0.01	0.03	0.01	0.01	NA		
Nitrate nitrogen	mg/L N as NO3	37	0.01	0.41	0.04	0.01	1.95		
Nitrite + Nitrate nitrogen	mg/L N	40	0.01	0.42	0.05	0.02	2.76	0	0%
Total Kjeldahl Nitrogen	mg/L	1	0.1	0.1	0.1	0.1	NA		
Total Phosphorus	mg/L	1	0.18	0.18	0.18	0.18	0.8		
Orthophosphate phosphorus	mg/L P as OPO4	26	0.02	0.02	0.02	0.02	0.5	0	0%
Chlorophyll *a*	ug/L	1	18.3	18.3	18.3	18.3	11.6		
Fecal coliform	cfu/100mls	12	4	256	34	34	200	0	0%
							126		
Escherichia coli	mpn/100mls	26	4	2420	28	26		2	8%
Chloride	mg/L	42	152	1801	1129	1178	1020		
Sulfate	mg/L	42	71	550	379	405	500		
Total Dissolved Solids	mg/L	44	466	2624	1961	2028	2300		

Source: (BRA 2007)
(TCEQ 2008b)
(BRA 2007c)

TABLE 2.3-50 (Sheet 1 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Color	Odor	Temperature	Field Dissolved Oxygen	Field pH	Field Conductivity	Field Turbidity	Total Suspended Solids	Total Dissolved Solids	Hardness	Turbidity	Biochemical Oxygen Demand	Chemical Oxygen Demand	Total Phosphorus	Orthophosphate	Ammonia Nitrogen	Nitrate as N	Nitrite	Total Kjeldahl Nitrogen	Bicarbonate Alkalinity
Units		N/A	N/A	Deg F	mg/L	S.U.	mS/cm	NTU	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Description	Date																				
MW-1201a	01/25/07	Clear	None	67.91	6.71	8.25	0.657	75.0	37.5	364	156.0	13.00	<3.0	28.0	0.0620	0.048	<0.030	2.87	<0.03	<0.125	61.9
	04/18/07	Clear	None	67.01	3.67	7.05	0.756	15.4	286.0	564	322.0	2.00	<3.0	<1.0	<0.0500	<0.400	0.144	<0.03	<0.03	<0.125	61.8
	07/24/07	Clear	None	71.56	5.90	6.15	0.770	11.7	5.3	584	470.0	3.20	<2.0	<25.0	<0.0100	0.010	0.170	4.32	<0.10	0.120	396.0
	10/24/2007	Clear	None	74.19	6.67	6.67	0.919	12.2	10.6	538	467.0	23.20	<2.0	41.2	0.0200	<0.010	<0.100	3.67	<0.10	0.220	142.0
MW-1201b	01/25/07	Clear	None	67.75	2.44	8.68	2.104	68.8	97.5	1630	142.0	27.00	<3.0	33.6	0.2680	0.187	1.170	3.37	<0.03	<0.125	42.6
	04/18/07	Clear	None	70.27	2.77	7.97	2.407	30.1	25.0	783	193.0	5.00	<3.0	<1.0	0.0596	<0.400	1.280	<0.03	<0.03	<0.125	62.5
	07/24/07	Clear	None	72.25	2.79	7.11	2.303	11.7	200.0	1870	133.0	33.30	3.4	<25.0	0.0600	0.070	0.710	5.45	<0.10	0.690	438.0
	10/24/2007	Clear	None	70.16	1.21	7.28	2.530	5.2	49.0	1740	145.0	25.70	4.0	58.6	0.0400	0.020	0.420	5.84	<0.10	0.550	458.0
MW-1204a	01/25/07	Clear	None	69.76	0.46	8.00	1.998	140.9	70.0	1600	138.0	94.00	<3.0	39.2	0.0626	0.026	0.740	1.16	<0.03	<0.125	52.6
	04/19/07	Clear	None	69.31	1.67	6.74	2.185	71.0	127.0	1680	355.0	21.00	4.0	18.0	<0.0500	<0.400	1.300	<0.03	<0.03	<0.125	62.9
	07/25/07	Cloudy	None	69.40	3.84	6.05	3.119	11.7	169.0	3740	2090.0	202.00	<12.0	61.1	0.1400	<0.010	0.240	0.12	<0.10	0.460	432.0
	10/24/2007	Rusty Brown	None	69.89	0.99	6.21	3.204	135.1	98.0	2860	1750.0	175.00	4.0	49.9	0.2300	<0.010	0.210	0.18	<0.10	0.720	450.0
MW-1207b	01/25/07	Clear	None	71.13	0.85	9.41	1.096	78.0	28.0	1180	148.0	48.00	<3.0	29.4	0.1540	0.113	0.176	2.98	<0.03	<0.125	61.4
	04/19/07	Clear	None	71.24	1.18	7.94	1.583	165.0	382.0	794	77.7	910.00	7.0	16.0	0.0625	<0.400	0.615	<0.03	<0.03	<0.125	58.9
	07/24/07	Cloudy	None	72.01	1.02	7.57	1.524	11.7	468.0	997	184.0	612.00	8.7	42.5	0.0700	0.040	0.420	8.60	<0.10	0.350	520.0
	10/25/2007	Cloudy	None	71.38	1.19	7.68	1.266	38.6	7.0	971	207.0	45.20	3.9	43.1	0.1000	<0.010	0.160	5.60	<0.10	0.400	460.0
MW-1208a	01/25/07	Clear	None	68.27	0.23	9.34	1.238	102.6	40.0	888	151.0	89.00	<3.0	33.8	0.2710	0.279	0.078	1.16	<0.03	<0.125	51.3
	04/19/07	Clear	None	69.78	1.28	6.65	1.400	85.2	233.0	1220	266.0	280.00	<3.0	9.0	<0.0500	<0.400	0.424	<0.03	<0.03	<0.125	59.8
	07/25/07	Clear	None	70.36	1.69	6.04	1.323	11.7	77.0	1090	863.0	44.60	<2.0	<25.0	0.0400	<0.010	0.120	0.69	<0.10	0.180	520.0
	10/25/2007	Clear	None	70.72	1.01	7.10	1.367	29.9	35.8	1030	871.0	4.84	<2.0	<25.0	0.0300	<0.010	0.100	0.32	<0.10	0.430	454.0
MW-1209b	01/25/07	Cloudy	None	67.80	0.46	9.26	2.109	1356.2	64.0	1050	114.0	8.00	<3.0	35.2	0.0920	0.368	1.970	0.36	<0.03	<0.125	56.4
	04/19/07	Clear	None	68.68	0.63	7.51	2.372	290.3	131.0	1890	402.0	420.00	<3.0	<1.0	<0.0500	<0.400	1.840	<0.03	<0.03	<0.125	63.8
	07/25/07	Clear	None	69.17	3.15	6.91	2.213	11.7	14.5	1930	807.0	137.00	4.0	<25.0	0.1100	0.020	0.850	0.73	<0.10	0.930	284.0
	10/25/2007	Clear	None	69.09	1.06	7.37	2.501	20.0	236.0	1950	561.0	4.08	8.4	<25.0	0.0300	<0.010	0.970	0.96	<0.10	1.380	284.0

TABLE 2.3-50 (Sheet 2 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Color	Odor	Temperature	Field Dissolved Oxygen	Field pH	Field Conductivity	Field Turbidity	Total Suspended Solids	Total Dissolved Solids	Hardness	Turbidity	Biochemical Oxygen Demand	Chemical Oxygen Demand	Total Phosphorus	Orthophosphate	Ammonia Nitrogen	Nitrate as N	Nitrite	Total Kjeldahl Nitrogen	Bicarbonate Alkalinity
Units		N/A	N/A	Deg F	mg/L	S.U.	mS/cm	NTU	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Description	Date																				
MW-1211a	01/25/07	Clear	None	70.81	-0.10	9.00	1.917	6.9	84.0	1440	147.0	98.00	<3.0	31.1	0.0844	0.229	0.042	1.77	<0.03	<0.125	49.7
	04/19/07	Clear	None	71.04	1.10	7.55	2.272	4.1	292.0	1780	473.0	52.00	<3.0	9.0	<0.0500	<0.400	0.168	<0.03	<0.03	<0.125	61.0
	07/25/07	Clear	None	70.72	2.63	6.46	2.012	11.7	431.0	1740	989.0	131.00	<6.0	43.0	0.0500	<0.010	0.150	<0.10	<0.10	0.170	364.0
	10/25/2007	Clear	None	70.61	1.44	6.22	2.134	7.6	625.0	1480	1330.0	110.00	<2.0	<25.0	0.3400	<0.010	0.160	<0.10	<0.10	0.410	376.0
MW-1212a	01/25/07	Cloudy	None	69.30	0.40	9.06	1.259	484.6	712.0	1220	121.0	270.00	<3.0	32.1	0.1660	0.148	1.690	0.39	<0.03	<0.125	40.9
	04/18/07	Cloudy	None	70.43	2.16	6.83	1.520	298.8	1540.0	1080	394.0	41.00	<3.0	<1.0	0.2360	<0.400	<0.150	<0.03	<0.03	<0.125	63.4
	07/25/07	Clear	None	72.14	4.95	6.33	1.276	11.7	479.0	1260	825.0	436.00	<6.0	43.0	0.0300	0.230	<0.100	0.25	<0.10	0.180	432.0
	10/25/2007	Clear	None	70.58	1.14	7.48	1.673	258.3	108.0	1270	1050.0	61.40	7.0	<25.0	0.0900	0.010	<0.100	0.16	<0.10	0.420	338.0
MW-1212b	01/25/07	Clear	None	69.85	0.23	8.60	2.763	586.0	88.0	1450	136.0	34.00	<3.0	36.0	<0.0500	0.315	<0.030	3.90	<0.03	<0.125	41.4
	04/18/07	Cloudy	None	70.39	1.01	7.12	2.735	88.5	152.0	3280	322.0	4.00	6.0	22.0	<0.0500	<0.4	0.066	<0.03	<0.03	<0.125	58.9
	07/25/07	Cloudy	None	71.37	2.16	6.27	2.095	11.7	78.0	1200	497.0	42.40	<6.0	33.9	0.0700	<0.010	0.100	0.66	<0.10	0.130	206.0
	10/25/2007	Cloudy	None	74.04	1.07	7.16	2.268	89.6	186.0	1330	574.0	37.50	8.8	<25.0	0.1000	<0.010	0.120	0.99	<0.10	0.360	170.0
MW-1219a	01/25/07	Cloudy	None	72.21	1.26	8.37	0.946	1366.1	144.0	688	168.0	1100.00	<3.0	47.1	0.0596	0.297	1.180	1.55	<0.03	<0.125	62.8
	04/18/07	Cloudy Brown	Sulfur Odor	71.96	N/A	N/A	N/A	246.7	610.0	664	361.0	28.00	19.0	47.0	<0.0500	<0.400	1.840	<0.03	<0.03	<0.125	54.2
	07/24/07	Clear	Sulfur Odor	72.55	2.22	6.32	0.952	11.7	73.0	631	509.0	82.60	10.9	91.8	0.5000	0.090	3.580	<0.10	<0.10	3.900	492.0
	10/25/2007	Cloudy Brown	Sulfur Odor	72.64	2.39	6.91	1.011	21.5	1410.0	711	702.0	186.00	3.9	40.9	0.2700	<0.010	0.930	<0.10	<0.10	1.440	522.0
AVERAGE				70.49	1.97	7.40	1.789	157.4	247.6	1354	490	148.53	3.7	28.3	0.103	0.11	0.610	1.46	0.03	0.367	222
MAX				74.19	6.71	9.41	3.204	1366.1	1540.0	3740	2090	1100.00	19.0	91.8	0.500	0.37	3.580	8.60	0.05	3.900	522
MIN				67.01	-0.10	6.04	0.657	4.1	5.3	364	78	2.00	1.0	0.5	0.005	0.01	0.015	0.02	0.02	0.063	41
STANDARD DEVIATION				1.63	1.70	1.00	0.678	308.9	339.5	715	454	240.66	3.6	19.7	0.107	0.11	0.758	2.10	0.02	0.667	186

TABLE 2.3-50 (Sheet 3 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Chloride	Sulfate	Total Mercury	Dissolved Mercury	pH	Total Coliform	Fecal Coliform	Fecal Streptococci	Total Sodium	Total Potassium	Total Calcium	Total Magnesium	Total Arsenic	Total Barium	Total Cadmium	Total Chromium	Total Lead	Total Selenium	Total Silver	Total Nickel
Units		mg/L	mg/L	mg/L	mg/L	S.U.	col/100mL	col/100mL	col/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Description	Date																				
MW-1201a	01/25/07	27.1	63.7	<0.0002	<0.0002	7.19	1440	40	<10	35.88	4.93	53.6	49.4	<0.002	0.0607	<0.001	<0.003	<0.004	0.00353	<0.001	0.00622
	04/18/07	108.0	950.0	<0.0002	<0.0002	7.27	588	<10	<10	35.63	2.66	57.6	51.7	<0.002	0.0626	<0.001	<0.003	<0.004	<0.00200	<0.001	<0.00200
	07/24/07	40.1	55.8	<0.0002	<0.0002	7.17	500	250	<1	28.00	1.34	100.0	52.6	<0.005	0.0870	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
	10/24/2007	42.4	52.9	<0.0002	<0.0002	7.20	2000	<10	<1	26.50	1.94	103.0	51.0	<0.005	0.0830	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
MW-1201b	01/25/07	88.7	391.0	<0.0002	<0.0002	7.23	1220	300	<10	351.00	16.00	40.5	28.0	0.003	0.0591	<0.001	<0.003	0.004	<0.00200	<0.001	<0.00200
	04/18/07	136.0	1470.0	<0.0002	<0.0002	7.62	60	<10	<10	627.20	14.70	38.0	28.5	<0.002	0.0293	<0.001	<0.003	<0.004	<0.00200	<0.001	<0.00200
	07/24/07	76.8	851.0	<0.0002	<0.0002	7.93	200	<10	<1	590.00	7.58	26.6	16.1	<0.005	0.0330	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
	10/24/2007	61.1	737.0	<0.0002	<0.0002	7.83	200000	<10	<1	566.00	7.19	31.6	16.1	<0.005	0.0310	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
MW-1204a	01/25/07	166.0	382.0	<0.0002	<0.0002	7.46	1720	820	<10	129.20	13.50	61.5	56.0	0.006	0.0587	<0.001	0.003	<0.004	0.01130	<0.001	0.02400
	04/19/07	171.0	620.0	<0.0002	<0.0002	7.51	1280	44	<10	123.50	14.80	65.9	55.1	<0.002	0.0315	<0.001	<0.003	<0.004	<0.00200	<0.001	0.01700
	07/25/07	94.4	2090.0	<0.0002	<0.0002	6.84	3500	7400	<1	290.00	15.40	507.0	200.0	0.024	0.0760	<0.001	<0.005	<0.005	0.00500	<0.001	0.01900
	10/24/2007	89.8	1500.0	<0.0002	<0.0002	6.77	22000	150	<1	213.00	11.70	458.0	147.0	<0.005	0.0350	<0.001	<0.005	<0.005	<0.00500	<0.001	0.01700
MW-1207b	01/25/07	110.0	342.0	<0.0002	<0.0002	7.81	11100	980	<10	476.30	13.00	42.3	32.0	<0.002	0.0404	<0.001	0.003	<0.004	<0.00200	0.002	0.00648
	04/19/07	86.0	263.0	<0.0002	<0.0002	7.53	1000	<10	<10	309.60	13.40	14.1	12.3	<0.002	0.0216	<0.001	0.003	<0.004	<0.00200	<0.001	<0.00200
	07/24/07	72.0	237.0	<0.0002	<0.0002	7.69	1900	<10	2	324.00	6.34	42.7	18.9	<0.005	0.0320	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
	10/25/2007	58.0	227.0	<0.0002	<0.0002	7.69	150000	<10	<1	290.00	6.86	45.0	23.1	<0.005	0.0270	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
MW-1208a	01/25/07	115.0	257.0	<0.0002	<0.0002	7.80	4200	34	<10	42.16	4.76	64.4	54.3	<0.002	0.1100	<0.001	0.007	0.009	0.00494	<0.001	0.02600
	04/19/07	98.0	231.0	<0.0002	<0.0002	7.51	400	<10	<10	43.55	5.18	50.0	40.9	<0.002	0.0798	<0.001	<0.003	<0.004	<0.00200	<0.001	0.00724
	07/25/07	56.3	223.0	<0.0002	<0.0002	6.76	500	1900	1	24.90	1.98	223.0	74.6	<0.005	0.1370	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00700
	10/25/2007	70.2	253.0	<0.0002	<0.0002	6.64	3200	400	<1	25.10	1.50	227.0	65.6	<0.005	0.1170	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00600
MW-1209b	01/25/07	41.8	3130.0	<0.0002	<0.0002	7.86	1460	100	<10	247.80	17.10	57.0	52.2	<0.002	0.0328	<0.001	<0.003	0.005	0.00277	<0.001	0.01600
	04/19/07	70.0	902.0	<0.0002	<0.0002	7.37	200	20	<10	495.20	30.20	68.7	66.6	<0.002	0.0226	<0.001	<0.003	<0.004	<0.00200	<0.001	<0.00200
	07/25/07	36.6	1060.0	<0.0002	<0.0002	7.45	6500	>20,000	<1	476.00	9.66	80.8	64.8	<0.005	0.0810	<0.001	0.005	<0.005	<0.00500	<0.001	0.00600
	10/25/2007	37.1	1060.0	<0.0002	<0.0002	7.57	3600	<10	<1	457.00	9.26	82.8	57.2	<0.005	0.0360	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
MW-1211a	01/25/07	401.0	61.9	<0.0002	<0.0002	7.64	9420	970	<10	498.60	16.50	61.5	56.5	<0.002	0.0408	<0.001	<0.003	<0.004	0.00301	<0.001	0.00742
	04/19/07	396.0	567.0	<0.0002	<0.0002	7.18	200	<10	<10	189.06	30.90	83.3	76.8	<0.002	0.0312	<0.001	0.003	<0.004	<0.00200	<0.001	<0.00200
	07/25/07	257.0	570.0	<0.0002	<0.0002	6.81	18800	7500	1	196.00	10.00	238.0	95.6	<0.005	0.0370	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00700
	10/25/2007	206.0	548.0	<0.0002	<0.0002	6.83	3200	<10	<1	180.00	8.87	219.0	84.3	0.006	0.0630	<0.001	0.012	0.011	<0.00500	<0.001	0.01700

TABLE 2.3-50 (Sheet 4 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Chloride	Sulfate	Total Mercury	Dissolved Mercury	pH	Total Coliform	Fecal Coliform	Fecal Streptococci	Total Sodium	Total Potassium	Total Calcium	Total Magnesium	Total Arsenic	Total Barium	Total Cadmium	Total Chromium	Total Lead	Total Selenium	Total Silver	Total Nickel
Units		mg/L	mg/L	mg/L	mg/L	S.U.	col/100mL	col/100mL	col/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Description	Date																				
MW-1212a	01/25/07	88.2	645.0	<0.0002	<0.0002	7.91	12600	2300	<10	39.03	11.50	65.2	54.4	<0.002	0.0754	<0.001	0.004	<0.004	0.00424	<0.001	0.01700
	04/18/07	98.0	1410.0	<0.0002	<0.0002	7.20	22	<10	<10	33.46	15.90	72.4	61.8	<0.002	0.0791	<0.001	0.016	0.009	<0.00200	<0.001	0.01600
	07/25/07	51.1	415.0	<0.0002	<0.0002	7.25	3300	4300	<2	23.90	4.37	223.0	65.3	<0.005	0.0560	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00600
	10/25/2007	63.5	561.0	<0.0002	<0.0002	7.06	7000	<10	<1	27.20	4.60	264.0	75.4	<0.005	0.0510	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00900
MW-1212b	01/25/07	1770.0	558.0	<0.0002	<0.0002	7.71	7240	1620	<10	452.20	11.20	58.4	48.5	<0.002	<0.0070	<0.001	<0.003	0.004	<0.00200	<0.001	0.00510
	04/18/07	456.0	893.0	<0.0002	<0.0002	7.26	19	<10	<10	293.00	10.30	61.3	49.0	<0.002	0.0542	<0.001	<0.003	<0.004	<0.00200	<0.001	0.00291
	07/25/07	297.0	351.0	<0.0002	<0.0002	7.39	12000	>20,000	<1	224.00	4.86	128.0	42.7	<0.005	0.0560	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.005
	10/25/2007	356.0	308.0	<0.0002	<0.0002	7.38	13000	<10	<1	227.00	5.82	157.0	44.3	<0.005	0.0690	<0.001	<0.005	<0.005	<0.00500	<0.001	<0.00500
MW-1219a	01/25/07	69.1	48.0	<0.0002	<0.0002	7.59	2300	340	<10	27.94	5.08	61.5	47.8	0.003	0.4860	<0.001	0.003	0.004	0.00443	<0.001	0.00599
	04/18/07	77.0	351.0	<0.0002	<0.0002	6.98	120	<10	<10	30.35	3.75	68.9	54.8	<0.002	0.3880	<0.001	0.003	0.005	<0.00200	<0.001	0.00479
	07/24/07	55.2	7.4	<0.0002	<0.0002	6.76	>30000	10	2	26.20	1.85	149.0	33.2	0.015	0.2570	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00600
	10/25/2007	47.9	60.3	<0.0002	<0.0002	6.70	4300	260	<1	22.00	1.59	172.0	46.2	0.006	0.3630	<0.001	<0.005	<0.005	<0.00500	<0.001	0.00700
AVERAGE		166	617.6	0.0001	0.0001	7.33	13130	785	3	218	9.45	115.6	56.3	0.0030	0.087	0.0005	0.0031	0.0031	0.002	0.00054	0.0074
MAX		1770	3130.0	0.0001	0.0001	7.93	200000	20000	5	627	30.90	507.0	200.0	0.0240	0.486	0.0005	0.0160	0.0110	0.011	0.00200	0.0260
MIN		27	7.4	0.0001	0.0001	6.64	19	5	1	22	1.34	14.1	12.3	0.0010	0.004	0.0005	0.0015	0.0020	0.001	0.00050	0.0010
STANDARD DEVIATION		283	621.6	0.0000	0.0000	0.37	38919	1806	2	194	6.91	108.6	33.6	0.0042	0.104	0.0000	0.0028	0.0021	0.002	0.00024	0.0068

TABLE 2.3-50 (Sheet 5 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Total Zinc	Silica	Total Copper	Total Boron	Total Iron	Total Manganese	Total Alkalinity	Carbon Dioxide
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/m^3
Sample Description	Date								
MW-1201a	01/25/07	0.0375	0.021	0.01680	0.382	0.3930	0.0184	142	N/A
	04/18/07	<0.0030	8.140	<0.00800	0.114	0.0585	0.0101	146	N/A
	07/24/07	0.0140	16.200	<0.00500	<5.000	<0.5000	<0.0050	N/A	44
	10/24/2007	0.0120	21.100	<0.00500	<5.000	1.0800	0.0200	N/A	40
MW-1201b	01/25/07	0.0815	0.049	0.00903	2.330	1.2600	0.0708	129	N/A
	04/18/07	<0.0030	5.730	<0.00800	2.050	0.1210	0.0199	138	N/A
	07/24/07	0.0140	12.400	0.02000	<5.000	<0.5000	0.0130	N/A	<10
	10/24/2007	0.0100	29.700	0.02400	<5.000	<0.5000	0.0150	N/A	26
MW-1204a	01/25/07	0.0228	0.091	0.00928	0.637	1.8000	0.7330	133	N/A
	04/19/07	<0.0030	8.400	<0.00800	0.595	0.2440	1.3100	148	N/A
	07/25/07	0.0250	21.000	0.01400	<5.000	46.6000	2.9800	N/A	330
	10/24/2007	0.0130	23.700	0.01000	<5.000	2.5500	2.8500	N/A	140
MW-1207b	01/25/07	0.5010	0.088	0.00987	2.220	0.2840	0.0421	139	N/A
	04/19/07	<0.0030	3.480	<0.00800	0.893	0.0961	<0.0070	144	N/A
	07/24/07	0.0220	16.700	0.01300	<5.000	1.2600	0.0300	N/A	13
	10/25/2007	0.0160	17.000	0.01300	<5.000	0.6200	0.0180	N/A	18
MW-1208a	01/25/07	0.0468	<0.005	<0.00800	0.238	0.7100	0.4250	130	N/A
	04/19/07	0.0683	2.530	0.01020	0.234	0.0398	0.0851	137	N/A
	07/25/07	0.0190	18.600	<0.00500	<5.000	2.0700	0.4300	N/A	280
	10/25/2007	0.0110	19.800	<0.00500	<5.000	1.1100	0.3700	N/A	180
MW-1209b	01/25/07	0.0363	<0.005	0.01550	2.700	0.8460	0.0543	159	N/A
	04/19/07	<0.0030	6.140	<0.00800	1.450	0.4060	0.0204	140	N/A
	07/25/07	0.0140	17.300	0.01800	<5.000	3.6600	0.0920	N/A	22
	10/25/2007	0.0140	20.900	0.02000	<5.000	1.1500	0.0300	N/A	18
MW-1211a	01/25/07	0.0381	0.055	0.01060	0.506	1.6900	0.1410	141	N/A
	04/19/07	0.0347	4.210	0.01120	0.319	0.3560	0.0388	137	N/A
	07/25/07	0.0180	21.700	0.00800	<5.000	2.2800	0.1000	N/A	100
	10/25/2007	0.0310	17.200	0.01800	<50.000	11.1000	0.2990	N/A	92

TABLE 2.3-50 (Sheet 6 of 6)
SAMPLE RESULTS FROM GROUNDWATER MONITORING EVENTS (2007)

Parameter		Total Zinc	Silica	Total Copper	Total Boron	Total Iron	Total Manganese	Total Alkalinity	Carbon Dioxide
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/m^3
Sample Description	Date								
MW-1212a	01/25/07	0.0317	<0.005	0.00865	0.245	0.9150	0.2330	168	N/A
	04/18/07	0.0135	26.200	0.01400	0.221	6.4700	0.1860	124	N/A
	07/25/07	0.0160	19.100	<0.00500	<5.000	0.7400	0.0300	N/A	190
	10/25/2007	0.0170	22.000	<0.00500	<5.000	1.8500	0.0460	N/A	44
MW-1212b	01/25/07	0.0190	0.074	<0.00800	0.456	0.6050	0.0318	120	N/A
	04/18/07	0.0465	3.310	0.01210	0.359	0.0927	0.0194	121	N/A
	07/25/07	0.0140	12.800	0.00800	<5.000	0.5900	0.0080	N/A	22
	10/25/2007	0.0110	20.000	0.01000	<5.000	0.5500	0.0120	N/A	35
MW-1219a	01/25/07	0.0358	0.026	0.00981	0.246	6.3500	0.6590	158	N/A
	04/18/07	<0.0030	8.920	<0.00800	0.176	3.7400	0.6730	134	N/A
	07/24/07	0.0170	61.300	0.01300	<5.000	17.1000	0.6540	N/A	200
	10/25/2007	0.0140	17.900	<0.00500	<5.000	6.2900	0.7490	N/A	300
AVERAGE		0.0336	12.597	0.00939	2.222	3.1957	0.338	139	105
MAX		0.5010	61.300	0.02400	25.000	46.6000	2.980	168	330
MIN		0.0015	0.003	0.00250	0.114	0.0398	0.003	120	5
STANDARD DEVIATION		0.0778	12.110	0.00587	3.833	7.7873	0.666	12	106

Notes:
Minimum, maximum, average and standard deviation were calculated using 1/2 the non-detect value
N/A - Not Applicable

TABLE 2.3-51 (Sheet 1 of 4)
EPA REGULATED FACILITIES WITHIN A 6-MI RADIUS OF THE CPNPP SITE AND UNITS 3 AND 4 INTAKE AND DISCHARGE STRUCTURES ON LAKE GRANBURY

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?
CARLOS CLEANERS 901 NE BIG BEND TRAIL GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
CTY OF GLEN ROSE WWTP 2000' NE INTX USHWY 67/STATE H GLEN ROSE, TX 76043	YES	NO	NO	NO	NO
FOUR SEASONS CLEANERS[(a)] 507 SW BIG BEND TRAIL SUITE A GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
GLEN ROSE READY MIX PLANT[(a)] 1845 N FM 56 GLEN ROSE, TX 76043	YES	NO	NO	NO	NO
GLEN ROSE TRANSMISSION[(a)] COMANCHE BLVD 3 MI FROM FM 56 GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
OFFICE MASTER OF TEXAS[(a)] 310 GIBBS BLVD GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
PARTS HELPERS 3333 W HIGHWAY 67 E GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
SOMERVELL COUNTY HEALTH CARE AUTHORITY 1021 HOLDEN ST GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
TEXAS DEPARTMENT OF TRANSPORTATION 503 NE BIG BEND TRAIL GLEN ROSE, TX 76043	NO	NO	YES	NO	NO
TXU GENERATION COMPANY LP FARM ROAD 56 NORTH GLEN ROSE, TX 76043	YES	NO	YES	NO	YES

TABLE 2.3-51 (Sheet 2 of 4)
EPA REGULATED FACILITIES WITHIN A 6-MI RADIUS OF THE CPNPP SITE AND UNITS 3 AND 4 INTAKE AND DISCHARGE STRUCTURES ON LAKE GRANBURY

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?
WOLF HOLLOW I, LP 9201 WOLF HOLLOW COURT GRANBURY, TX 76048	YES	NO	NO	NO	YES
PECAN PLANTATION WWTP N BRAZOS RIVER,13.5M DE CORD- GRANBURY, TX 76049	YES	NO	NO	NO	NO
TREATY OAKS WWTF 4200' W OF FM 3210 & 2900' W O PFLUGERVILLE, TX 78660	YES	NO	NO	NO	NO
RIDGE UTILITIES WWTF 1700FT NE INTER OF HOOD CO RD GRANBURY, TX	YES	NO	NO	NO	NO
CANYON CREEK WWTP LAKE GRANBURY, 2M N. FM 2425 & MANSFIELD, TX 76063	YES	NO	NO	NO	NO
BLUE WATER SHORES 4704 BLUE WATER CIRCLE GRANBURY, TX	YES	NO	NO	NO	NO
WAL-MART STORES INC 735 E HIGHWAY 377 GRANBURY, TX 76048	NO	NO	YES	NO	NO
SOUTHEAST PLANT WWTP EAST BANK LAKE GRANBURY GRANBURY, TX 76048	YES	NO	NO	NO	NO
CITY OF TOLAR 1/5M E FMR 201 & 1/4M S USHWY TOLAR, TX 76476	YES	NO	NO	NO	NO
HIGHWAY EQUIPMENT PARTS 4400 HIGHWAY 377 GRANBURY, TX 76048	NO	NO	YES	NO	NO
UPS GRANBURY AUTO 2012 BOBBY LANE GRANBURY, TX 76048	NO	NO	YES	NO	NO

TABLE 2.3-51 (Sheet 3 of 4)
EPA REGULATED FACILITIES WITHIN A 6-MI RADIUS OF THE CPNPP SITE AND UNITS 3 AND 4 INTAKE AND DISCHARGE STRUCTURES ON LAKE GRANBURY

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?
HOOD COUNTY NEWS 1419 S MORGAN GRANBURY, TX 76048	NO	NO	YES	NO	NO
STAR ENTERPRISES INC 1001 S MORGAN GRANBURY, TX 76048	NO	NO	YES	NO	NO
HOME DEPOT USA INC 415 E HIGHWAY 377 GRANBURY, TX 76048	NO	NO	YES	NO	NO
GRANBURY READY MIX PLANT 1911 ACTION HIGHWAY GRANBURY, TX 76049	YES	NO	NO	NO	NO
DURANT CHEVROLET 1909 E HIGHWAY 377 GRANBURY, TX 76049	NO	NO	YES	NO	NO
DECORDOVA BEND ESTATES WWTP W BANK OF MCCARTY BR, 2.6 M S GRANBURY, TX 76049	YES	NO	NO	NO	NO
DURANT AUTO PLEX 4601 US HIGHWAY 377 E GRANBURY, TX 76049	NO	NO	YES	NO	NO
A-TECH AUTOMOTIVE MACHINING CO 2104A E HIGHWAY 377 GRANBURY, TX 76049	NO	NO	YES	NO	NO
ACTION AUTOMOTIVE REPAIR 1401 FALL CREEK HWY GRANBURY, TX 76049	NO	NO	YES	NO	NO
TXU ELECTRIC COMPANY OFF HWY 144 7M SW OF GRANBURY GRANBURY, TX 76048	YES	NO	YES	NO	YES
LAKE GRANBURY SURFACE WATER 5MI SE OF INTX FM 167 & USHWY GRANBURY, TX 76048	YES	NO	NO	NO	NO

TABLE 2.3-51 (Sheet 4 of 4)
EPA REGULATED FACILITIES WITHIN A 6-MI RADIUS OF THE CPNPP SITE AND UNITS 3 AND 4 INTAKE AND DISCHARGE STRUCTURES ON LAKE GRANBURY

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?
EVERETT HOOKS FORD INC 3925 E HIGHWAY 377 GRANBURY, TX 76049	NO	NO	YES	NO	NO
JANIE MORRIS TIRE REPAIR 105 E ELM TOLAR, TX 76476	NO	NO	YES	NO	NO

a) No location data provided Source: (EPA 2007b)

TABLE 2.3-52 (Sheet 1 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (°F)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
5/31/2004	001	3168	2745	101	94	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
6/30/2004	001	3168	3168	106	103	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
7/31/2004	001	3168	3168	110	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
8/31/2004	001	3168	3168	111	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
9/30/2004	001	3168	3168	108	106	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
10/31/2004	001	3168	3168	105	101	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
11/30/2004	001	3168	3168	102	94	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
12/31/2004	001	3168	2531	89	87	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
1/31/2005	001	2376	2376	88	86	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
2/28/2005	001	2376	2376	89	86	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
3/31/2005	001	2411	2247	91	88	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
4/30/2005	001	3168	1776	86	82	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
5/31/2005	001	3168	3168	102	95	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
6/30/2005	001	3168	3168	108	105	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
7/31/2005	001	3168	3168	110	109	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
8/31/2005	001	3168	3149	110	109	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
9/30/2005	001	3168	3168	110	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
10/31/2005	001	3168	2399	106	93	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
11/30/2005	001	3168	2988	91	87	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
12/31/2005	001	3168	2597	87	85	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
1/31/2006	001	2406	2377	87	85	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR

TABLE 2.3-52 (Sheet 2 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period	Monitoring	Flow (MGD)		Water Temperature (°F)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
End Date	Point	Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
2/28/2006	001	2772	2418	87	85	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
3/31/2006	001	3168	2806	91	87	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
4/30/2006	001	3168	3168	97	94	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
5/31/2006	001	3168	3168	102	100	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
6/30/2006	001	3168	3168	107	105	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
7/31/2006	001	3168	3168	110	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
8/31/2006	001	3168	3168	110	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
9/30/2006	001	3168	3168	109	105	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
10/31/2006	001	3168	2611	103	93	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
11/30/2006	001	3168	3168	91	89	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
12/31/2006	001	3168	3168	87	85	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
1/31/2007	001	3168	2442	86	84	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
2/28/2007	001	2376	2266	83	81	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
3/31/2007	001	1584	1288	82	79	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
4/30/2007	001	3168	2677	92	80	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
5/31/2007	001	3168	3168	100	98	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
6/30/2007	001	3168	3168	105	103	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
7/31/2007	001	3168	3168	109	106	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
8/31/2007	001	3168	3168	112	109	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
9/30/2007	001	3168	3168	109	108	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
10/31/2007	001	3168	3168	107	102	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR

TABLE 2.3-52 (Sheet 3 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (^oF)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
11/30/2007	001	3168	3012	96	93	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
12/31/2007	001	3168	2827	88	86	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
1/31/2008	001	2376	2376	86	84	NR	NR	NR	NR	NR	NR	0.00	0.00	NR	NR	NR
5/31/2004	003	0.0371	0.0195	NR	NR	7.3	7.1	11	5	NR	NR	NR	NR	2	2	1
6/30/2004	003	0.0789	0.0278	NR	NR	6.6	6.5	6	5	NR	NR	NR	NR	3	2	220
7/31/2004	003	0.0370	0.0268	NR	NR	7.1	6.7	3	2	NR	NR	NR	NR	2	2	57
8/31/2004	003	0.0440	0.0229	NR	NR	6.9	6.8	4	3	NR	NR	NR	NR	2	2	8
9/30/2004	003	0.0413	0.0214	NR	NR	6.9	6.8	2	2	NR	NR	NR	NR	4	3	2
10/31/2004	003	0.0323	0.0170	NR	NR	6.9	6.9	2	1	NR	NR	NR	NR	7	6	11
11/30/2004	003	0.0366	0.0139	NR	NR	6.9	6.9	5	3	NR	NR	NR	NR	12	9	1
12/31/2004	003	0.0158	0.0083	NR	NR	7.3	7.1	5	3	NR	NR	NR	NR	2	2	7
1/31/2005	003	0.0190	0.0090	NR	NR	7.2	7.1	6	5	NR	NR	NR	NR	14	6	1
2/28/2005	003	0.026	0.0114	NR	NR	7.1	6.9	3	2	NR	NR	NR	NR	3	3	3
3/31/2005	003	0.0305	0.0154	NR	NR	7.1	7.0	4	3	NR	NR	NR	NR	2	2	2
4/30/2005	003	0.0361	0.0233	NR	NR	7.3	7.0	2	2	NR	NR	NR	NR	10	7	5
5/31/2005	003	0.0300	0.0165	NR	NR	7.1	6.7	6	3	NR	NR	NR	NR	4	3	1
6/30/2005	003	0.0385	0.0164	NR	NR	7.1	7.1	3	3	NR	NR	NR	NR	2	2	1
7/31/2005	003	0.083	0.0201	NR	NR	7.1	7.0	3	3	NR	NR	NR	NR	0	5	54
8/31/2005	003	0.083	0.0275	NR	NR	7.0	7.0	8	6	NR	NR	NR	NR	2	2	7
9/30/2005	003	0.0345	0.0168	NR	NR	6.7	6.7	10	8	NR	NR	NR	NR	2	2	29
10/31/2005	003	0.0480	0.0190	NR	NR	7.1	6.6	7	5	NR	NR	NR	NR	4	3	3

TABLE 2.3-52 (Sheet 4 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (^{o}F)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
11/30/2005	003	0.0401	0.0123	NR	NR	7.5	7.0	1	1	NR	NR	NR	NR	9	6	10
12/31/2005	003	0.0151	0.0065	NR	NR	7.4	7.3	1	1	NR	NR	NR	NR	8	5	1
1/31/2006	003	0.0216	0.0081	NR	NR	7.4	7.3	12	6	NR	NR	NR	NR	8	7	18
2/28/2006	003	0.0188	0.008	NR	NR	7.3	7.3	2	2	NR	NR	NR	NR	9	7	1
3/31/2006	003	0.0162	0.0072	NR	NR	7.1	6.9	5	4	NR	NR	NR	NR	6	4	1
4/30/2006	003	0.0205	0.0097	NR	NR	6.6	6.5	16	11	NR	NR	NR	NR	4	4	6
5/31/2006	003	0.0211	0.0111	NR	NR	6.9	6.7	4	3	NR	NR	NR	NR	2	2	3
6/30/2006	003	0.0235	0.0133	NR	NR	6.9	6.7	2	1	NR	NR	NR	NR	2	2	21
7/31/2006	003	0.0245	0.0122	NR	NR	6.9	6.8	1	1	NR	NR	NR	NR	2	2	14
8/31/2006	003	0.0490	0.0167	NR	NR	6.7	6.5	6	3	NR	NR	NR	NR	2	2	10
9/30/2006	003	0.0305	0.0200	NR	NR	6.7	6.5	1	1	NR	NR	NR	NR	2	2	10
10/31/2006	003	0.0468	0.0219	NR	NR	6.5	6.4	7	5	NR	NR	NR	NR	2	2	3
11/30/2006	003	0.0336	0.0113	NR	NR	6.8	6.7	2	2	NR	NR	NR	NR	2	2	1
12/31/2006	003	0.0191	0.0083	NR	NR	6.9	6.8	3	2	NR	NR	NR	NR	3	3	1
1/31/2007	003	0.0236	0.0107	NR	NR	7.1	6.7	20	12	NR	NR	NR	NR	26	15	3
2/28/2007	003	0.0280	0.0158	NR	NR	6.9	6.5	22	18	NR	NR	NR	NR	12	11	13
3/31/2007	003	0.0493	0.0295	NR	NR	7.4	7.3	15	9	NR	NR	NR	NR	13	13	76
4/30/2007	003	0.0363	0.0202	NR	NR	7.5	7.2	6	4	NR	NR	NR	NR	13	9	1
5/31/2007	003	0.0439	0.0234	NR	NR	7.2	7.1	2	2	NR	NR	NR	NR	2	2	1
6/30/2007	003	0.0770	0.0298	NR	NR	7.1	7.0	2	2	NR	NR	NR	NR	2	2	1
7/31/2007	003	0.0468	0.0291	NR	NR	7.7	7.6	2	2	NR	NR	NR	NR	2	2	1

TABLE 2.3-52 (Sheet 5 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (^oF)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
8/31/2007	003	0.0506	0.0286	NR	NR	7.9	7.4	5	3	NR	NR	NR	NR	2	2	5
9/30/2007	003	0.0646	0.0290	NR	NR	7.0	7.0	2	2	NR	NR	NR	NR	2	2	1
10/31/2007	003	0.0455	0.0242	NR	NR	7.0	7.0	2	1	NR	NR	NR	NR	2	2	6
11/30/2007	003	0.0353	0.0190	NR	NR	7.3	7.3	14	7	NR	NR	NR	NR	2	2	1
12/31/2007	003	0.0431	0.0137	NR	NR	7.3	7.1	5	3	NR	NR	NR	NR	2	2	100
1/31/2008	003	0.0389	0.0143	NR	NR	7.6	7.1	10	9	NR	NR	NR	NR	8	7	2
5/31/2004	004	1	1	NR	NR	8.3	7.8	3	3	5	5	NR	NR	NR	NR	NR
6/30/2004	004	1	1	NR	NR	9.3	7.8	13	8	5	5	NR	NR	NR	NR	NR
7/31/2004	004	ND	ND	NR	NR	ND	ND	ND	ND	ND	ND	NR	NR	NR	NR	NR
8/31/2004	004	0.8210	0.4260	NR	NR	8.8	7.7	12	6	5	5	NR	NR	NR	NR	NR
9/30/2004	004	1	0.4380	NR	NR	8.3	7.6	5	3	5	5	NR	NR	NR	NR	NR
10/31/2004	004	1	0.5254	NR	NR	8.9	7.7	11	6	5	5	NR	NR	NR	NR	NR
11/30/2004	004	0.8210	0.4655	NR	NR	8.8	7.4	11	8	5	5	NR	NR	NR	NR	NR
12/31/2004	004	0.8210	0.5705	NR	NR	8.0	7.9	7	6	5	5	NR	NR	NR	NR	NR
1/31/2005	004	0.8210	0.5507	NR	NR	8.1	7.3	11	6	5	5	NR	NR	NR	NR	NR
2/28/2005	004	0.8210	0.6086	NR	NR	8.1	7.7	13	7	5	5	NR	NR	NR	NR	NR
3/31/2005	004	0.6270	0.1439	NR	NR	9.1	7.8	11	8	5	5	NR	NR	NR	NR	NR
4/30/2005	004	0.8410	0.5424	NR	NR	8.6	7.8	5	3	5	5	NR	NR	NR	NR	NR
5/31/2005	004	0.8390	0.5439	NR	NR	8.2	7.8	4	4	5	5	NR	NR	NR	NR	NR
6/30/2005	004	1	0.5850	NR	NR	8.2	7.3	9	5	5	5	NR	NR	NR	NR	NR
7/31/2005	004	0.8370	0.5055	NR	NR	8.1	7.9	8	6	5	5	NR	NR	NR	NR	NR

TABLE 2.3-52 (Sheet 6 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (^oF)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
8/31/2005	004	1	0.5065	NR	NR	8.2	7.2	8	5	5	5	NR	NR	NR	NR	NR
9/30/2005	004	2	0.4221	NR	NR	7.8	7.5	4	3	5	5	NR	NR	NR	NR	NR
10/31/2005	004	1	0.4216	NR	NR	7.8	7.7	5	4	5	5	NR	NR	NR	NR	NR
11/30/2005	004	1	0.4804	NR	NR	8.0	7.6	6	4	5	5	NR	NR	NR	NR	NR
12/31/2005	004	0.8410	0.4684	NR	NR	8.0	7.6	7	5	5	5	NR	NR	NR	NR	NR
1/31/2006	004	2	0.6008	NR	NR	8.4	7.5	9	5	5	5	NR	NR	NR	NR	NR
2/28/2006	004	0.8400	0.4634	NR	NR	7.5	7.4	5	4	5	5	NR	NR	NR	NR	NR
3/31/2006	004	1	0.6824	NR	NR	8.4	7.6	14	11	5	5	NR	NR	NR	NR	NR
4/30/2006	004	0.8210	0.4041	NR	NR	7.8	7.5	4	3	5	5	NR	NR	NR	NR	NR
5/31/2006	004	0.8390	0.5340	NR	NR	8.7	7.1	7	4	5	5	NR	NR	NR	NR	NR
6/30/2006	004	0.8400	0.4696	NR	NR	8.1	7.0	2	2	5	5	NR	NR	NR	NR	NR
7/31/2006	004	0.8120	0.5189	NR	NR	8.0	6.7	6	4	<5	<5	NR	NR	NR	NR	NR
8/31/2006	004	0.8380	0.6045	NR	NR	7.9	6.8	13	8	<5	<5	NR	NR	NR	NR	NR
9/30/2006	004	0.8400	0.4945	NR	NR	7.5	7.5	5	3	<5	<5	NR	NR	NR	NR	NR
10/31/2006	004	1	0.5205	NR	NR	8.4	6.7	4	3	<5	<5	NR	NR	NR	NR	NR
11/30/2006	004	1	0.5300	NR	NR	7.7	7.6	10	5	<5	<5	NR	NR	NR	NR	NR
12/31/2006	004	0.8380	0.5041	NR	NR	7.9	7.7	7	4	<5	<5	NR	NR	NR	NR	NR
1/31/2007	004	1	0.5537	NR	NR	8.0	7.3	7	3	<5	<5	NR	NR	NR	NR	NR
2/28/2007	004	1	0.4857	NR	NR	7.7	7.2	22	8	<5	<5	NR	NR	NR	NR	NR
3/31/2007	004	1	0.5181	NR	NR	8.9	7.2	12	7	<5	<5	NR	NR	NR	NR	NR
4/30/2007	004	1	0.5938	NR	NR	8.4	7.3	10	5	<5	<5	NR	NR	NR	NR	NR

TABLE 2.3-52 (Sheet 7 of 7)
WATER QUALITY DATA FOR CPNPP ACTIVE PROCESS DISCHARGES

Monitoring Period End Date	Monitoring Point	Flow (MGD)		Water Temperature (^oF)		pH		Total Suspended Solids (PPM)		Oil And Grease (PPM)		Total Residual Chlorine (PPM)		Biologic Oxygen Demand (BOD)		Fecal Coliform
		Max	Avg.	Max	Avg.	Max	Min	Max	Avg.	Max	Avg.	Max	Avg.	Max	Avg.	Max
5/31/2007	004	1	0.6571	NR	NR	7.8	7.3	29	11	<5	<5	NR	NR	NR	NR	NR
6/30/2007	004	1	0.7966	NR	NR	7.7	7.3	8	6	<5	<5	NR	NR	NR	NR	NR
7/31/2007	004	1	0.7232	NR	NR	8.1	7.3	39	11	<5	<5	NR	NR	NR	NR	NR
8/31/2007	004	1	0.6674	NR	NR	8.1	7.3	20	7	<5	<5	NR	NR	NR	NR	NR
9/30/2007	004	1	0.7134	NR	NR	8.0	7.4	12	8	<5	<5	NR	NR	NR	NR	NR
10/31/2007	004	1	0.5402	NR	NR	8.5	7.3	17	10	<5	<5	NR	NR	NR	NR	NR
11/30/2007	004	0.8380	0.5471	NR	NR	7.8	7.6	10	5	<5	<5	NR	NR	NR	NR	NR
12/31/2007	004	0.8210	0.5502	NR	NR	8.0	7.5	17	8	<5	<5	NR	NR	NR	NR	NR
1/31/2008	004	1	0.5578	NR	NR	7.9	7.5	20	12	<5	<5	NR	NR	NR	NR	NR

2.4 ECOLOGY

Most of the CPNPP site is located within Somervell County. The northern portion of Squaw Creek Reservoir (SCR) extends the site into neighboring Hood County (Figure 2.4-1). Somervell and Hood counties are in north central Texas, within the Western Cross Timbers subdivision of the Grand Prairie physiographic province (Wermund 1996). Each physiographic province or landscape reflects a unified geological history of depositional and erosional processes. Each province is also distinguished by characteristic geologic structure, rock and soil types, vegetation, and climate. The elevations and shapes of a province's landforms contrast significantly with those of landforms in adjacent regions.

This large province reaches its southernmost point in central Texas and stretches north through central Oklahoma into southern Kansas. The province is a transitional area between the vast prairies to the west and the forested hills or low mountains to the east. It is characterized by a mosaic of forest, woodland, savanna, and prairie with dominant vegetation that includes little bluestem with scattered stands of blackjack oak and post oak (Griffith, Bryce, Omernik, Comstock, Rogers, Harrison, Hatch, and Bezanson 2004). Please refer to Appendix A for a list of the scientific names of organisms discussed in this section.

The primary soil type in the Western Cross Timbers consists of very shallow, clayey soils over limestone bedrock. Other types include deep loamy and alluvial soils, especially along the river bottoms. The rich loam soils support agricultural croplands that produce cotton, corn, oats, wheat, sorghum, milo, and other crops. Much of the land in this region is also used for livestock ranching for cattle, sheep, and goats, and is also actively managed to produce wildlife.

The overall terrain is generally rough with outcroppings of limestone (Figure 2.4-1). The topographic elevations in the site region range from 550 to1100 ft msl (Subsection 2.3.1.5.2). Temperatures range from a July average maximum of 98°F to a January average minimum of 32°F. The average annual rainfall is approximately 32.65 in, and the growing season is 236 days.

Many habitat types in Texas are strongly associated with certain geographic areas or physiographic regions within the state. The Texas Parks and Wildlife Department (TPWD 2007) divides its eco-regions slightly differently than other authors such as Wermund (Wermund 1996). While the general area is referred to as the Cross Timbers and Prairie Eco-region. TPWD further divides this area into several sub-divisions, or vegetative sub-regions based upon the type, quality, and quantity of environmental resources. Somervell and Hood Counties, including CPNPP, are located in a border area between the Lampasas Cut Plain and Fort Worth Prairie eco-regions (TPWD 2007). Terrestrial ecology of the eco-region within the vicinity of CPNPP is more fully discussed in Subsection 2.4.1 below.

Exposed flat-topped buttes and escarpments capped by Edwards limestone have been eroded but cover most of the area. The Lampasas Cut Plain is more rugged than the neighboring Fort Worth Prairie to the east, being bisected by numerous low buttes and mesas formed by extensive erosion during its geologic formation. There are extensive areas of grasslands and valleys with higher, narrow, often wooded mesa-like divides. Soils at the surface, consequently, support the growth of plants adapted to higher alkalinity, such as live oak and juniper. Historical records indicate that much of this region existed as a grassland or open live oak savanna that supported herds of bison and other herbivores dependent on the tall grasses that dominated the region (TPWD 2007).

After the introduction of domestic livestock, farming operations, and control of wildfires, the landscape of much of the region changed. Land use practices associated with these ventures created a landscape that experienced invasion and domination in some areas by problematic brush species such as mesquite, Ashe juniper, and other native woody species. Overgrazing by livestock and elimination of naturally occurring fire also reduced native grass cover, and allowed the invasion of other less desirable annual grasses and forbs.

Management of habitat for white-tailed deer and other wildlife species such as quail, turkey, and doves in the region can be financially rewarding to landowners and land managers. In much of this region, white-tailed deer numbers, for example, commonly exist at or substantially above habitat potential or carrying-capacity; that is, the ability of native habitat to support deer without sustaining long-term degradation or loss of plant species. Farm and ranch size is relatively large, making wildlife and habitat management both productive and feasible.

Three major streams traverse Somervell County. The Brazos River winds through the eastern third, while the Paluxy River passes through the center and empties into the Brazos near its confluence with Squaw Creek. Damming the Squaw Creek in 1977 to form a water source and receiving water body for the CPNPP Units 1 and 2 once-through cooling condensers created SCR. Damming the Brazos River created existing Lake Granbury in 1969. Lake Granbury is to be used as a source of cooling water for the new CPNPP Units 3 and 4 cooling towers, and as the recipient of blowdown discharge from the new towers. The aquatic ecology of these impoundments is more fully discussed in Subsection 2.4.2 below.

The Brazos River Basin encompasses about 45,700 sq mi and extends from northeastern New Mexico through northwestern Texas and continues to the Gulf of Mexico (Figure 2.3-1). Major tributaries of the Brazos River include the Salt Fork Brazos River, Clear Fork Brazos River, Paluxy River, Nolan River, North Bosque River, Leon River, Lampasas River, San Gabriel River, Little River, and Navasota River.

2.4.1 TERRESTRIAL ECOLOGY

The primary references for historical information on terrestrial ecology at CPNPP are the Comanche Peak Steam Electric Station (CPSES) Environmental Report (ER) and construction phase annual monitoring report issued by Texas Utilities Generating Company in 1974 (TUGC 1974) and 1975 (TUGC 1975), respectively. CPSES has since been renamed the Comanche Peak Nuclear Power Plant (CPNPP). The Comanche Peak ER summarizes ecological field data collected at the site prior to the start of construction of the existing units, as well as the literature reviewed by its authors. The ER is supplemented by the 1975 report on ecological monitoring during the initial phase of construction.

In addition to reviewing the fieldwork for the original Comanche Peak ER and other pertinent literature, visits to the CPNPP site were made in October and December 2006, in January, February, April, May (PBS&J 2007), and July 2007, and in April, May (PBS&J 2008), and July 2008.

Unless characterized otherwise in the individual discussions below, the visits were for the purpose of ecological reconnaissance. Ecological reconnaissance refers to the examination or survey of the general ecological characteristics of a site or region, and usually results in a qualitative, not quantitative, overview of habitat and other features of ecological interest The visits occurred during daylight hours, generally between 8 a.m. and 5 p.m., and lasted the entire day unless terminated early due to inclement weather. The visits were made by professional terrestrial and aquatic ecologists. Additionally, subjective evaluation of wildlife habitat is based correctly on the assumptions that (a) the vegetation structure, including species composition and physiognomy (the outward appearance of a stand), is sufficient to define its suitability for wildlife; (b) a positive relationship exists between vegetation diversity and wildlife species diversity; and (c) the vegetation species composition and primary productivity directly influence wildlife population density.

- A walk-over reconnaissance in October 2006 of the Ashe juniper habitat on the SCR peninsula slated for construction of the CPNPP Units 3 and 4 cooling towers was followed by a return visit in January, 2007 to collect quantitative vegetation data there along 100-m line-intercept transects.

- An initial walk-over reconnaissance of the existing water pipeline right-of-way (ROW) between SCR and Lake Granbury in December, 2006 was followed by return reconnaissance visits in April and July, 2007 to characterize vegetation communities there, including any possible wetlands. The April visit also focused on evaluating emergent wetlands associated with on-site ponds and SCR, and tallying on-site species of birds with special attention to the golden-cheeked warbler and black-capped vireo by listening for their calls. The area was revisited during November 2007 to observe ecological conditions on three alternate routes for the expanded water pipeline on the CPNPP site (Subsection 2.4.1.2.2).

- Informal surveys for the golden-cheeked warbler and the black-capped vireo were conducted during April 2007 at various times of day over the course of three days. Recordings of the songs and calls of both species were studied prior to field survey. Survey for these species concentrated on the peninsula area proposed for construction of the new cooling towers. Survey methods consisted of walking transects on an east/west axes spaced approximately 100 m apart. Neither species was audibly or visually identified during the April survey.

- A habitat survey was performed in the area of the blowdown treatment facility (BDTF) November, 2007 and compared to a reference site where known golden-cheeked warbler populations exist. Additional site reconnaissance was performed February 4, 2009, which reconfirmed suitable golden-cheeked warbler habitat is absent from the area of the BDTF.

- Emergent wetland vegetation along the shore of the SCR peninsula was delineated using GPS point coordinates obtained while surveying the lake shoreline by boat in February and May, 2007. Additionally, a May visit identified harvester ant colonies on-site that were carefully examined for presence of the Texas horned lizard. None were found. These areas were also revisited during the July, 2007 visit, which also failed to note presence of the species. Also recorded during an early May visit was a woven, pendulous nest in a low tree branch. The nest might have been constructed by the golden-cheeked warbler, but was more likely constructed by an unidentified vireo species.

- Finding a possible but unlikely warbler nest in early May, 2007 was supplemented with a second visit in mid-May specifically focused again on the presence or absence of the warbler. Like the April visit, no warblers were audibly or visually identified during the visit. In addition, a survey for the warblers was conducted in the spring of 2008 and no warblers were observed. However, none of these visits complied with the U.S. Fish and Wildlife Service (USFWS) protocol for surveying the warbler. The USFWS survey season for the golden-cheeked warbler is the breeding season from March 15 to May 15, from 30 minutes before sunrise to 1:00 pm, during optimal weather conditions, with a minimum of four hours per 100 acres of habitat per visit. Accordingly, the earlier visits were supplemented with six visits to the site during the period from April 1 through May 15, 2008. The methodology and procedures used in 2008 followed the USFWS minimum procedures for presence/absence surveys. As during earlier visits, no warblers were seen or heard.

- A preliminary map of the distribution of vegetation and other ecological features of the CPNPP site was prepared between the October, 2006 and February, 2007 visits. This map was based on false color infrared aerial photographs taken in 1999, which were the most recent available. During the February, April and July visits, numerous vegetation communities were walked-over to verify the apparent signatures of cover types on the aerial photographs and ground-truth the draft map.

2.4.1.1 Site

Vegetation cover types found at CPNPP are common elements of the larger Cross Timbers physiographic province. Silver bluestem-Texas wintergrass grassland and oak-mesquite-juniper savanna and woodlands are two general vegetation cover types that currently dominate the CPNPP site. This is similar to the findings of the initial site assessment between 1972 and 1974 (TUGC 1974). Silver bluestem-Texas wintergrass cover type is characterized by little bluestem, sideoats grama, Texas grama, three-awn, hairy grama, tall dropseed, buffalograss, windmillgrass, hairy tridens, tumblegrass, western ragweed, broom snakeweed, Texas bluebonnet, live oak, post oak, and mesquite. Descriptions of the site’s vegetation from 1974 in comparison to the vegetation recorded and observed during 2007 field work allow for the conclusion that the natural cover types of the CPNPP site are relatively unchanged with respect to species composition.

However, stands of various cover types on the site have aged. While growing older, vegetative cover on the site has also been protected from fire, a normal component of savanna ecology in north-central Texas prior to European settlement of the area. Additionally, there was apparently no effort over the years to control the proliferation or decrease the density of Ashe juniper in savannas and woodlands by forest management. Some stands that demonstrated savanna physiognomy in the 1970s with widely scattered individual trees or clumps of trees and clumps of tall shrubs such as mesquite with intervening grasslands (including numerous forbs) have developed into think woodland where canopy closure in some cases is almost complete. In addition, the proportion of oak-dominated savanna has declined at the expense of juniper-dominated stands in which Ashe juniper is most common and often almost monotypic in the overstory.

Protecting on-site stands from wildfire created the current unnatural condition where Ashe juniper woodland replaced oak-juniper savanna and, in some cases, prairie grassland over time. This has resulted in lowering the overall wildlife habitat value of the site by decreasing both vertical structure within individual stands and species diversity across the site as a whole. Despite the habitat alterations, common wildlife species on the site as reported in the Cherokee ER, like the species lists of plants, have remained largely unchanged. However, many savanna and grassland species are probably now less abundant than they were in the 1970s while their woodland counterparts have increased in relative abundance in response to the changing habitat characteristics.

Oak-mesquite-juniper savanna and woodlands occur as a mixture of individual stands of woody species with interspersed grasses and forbs on uplands and prairies. Commonly associated plants include post oak, Ashe juniper, shin oak, Texas oak, blackjack oak, live oak, cedar elm, agarito, soapberry, sumac, hackberry, Texas pricklypear, Mexican persimmon, purple three-awn, hairy grama, Texas grama, sideoats grama, mesquite, and Texas wintergrass (Diggs, Lipscomb, and O’Kennon 2000) (Stubbendieck, Hatch, and Butterfield 1994) (McMahan, Frye, and Brown 1984).

2.4.1.1.1 Upland Cover Types

At CPNPP, the vegetation cover types described in Subsection 2.4.1.1 as oak-mesquite-juniper savanna and woodlands were further classified into more site-specific descriptions using 1999 infrared aerial photography and ground-truthing as described in Subsection 2.4.1. An ecological vegetation type map was created based on interpretation of aerial photographs showing the current spatial distribution of vegetation types and aquatic habitats (Figure 2.4-2). Coverage of the site is summarized by the total acres (ac) occupied by each cover type in Table 2.4-1. Figure 2.4-2 also shows that terrestrial cover of the site is predominantly juniper woodland and open fields.

2.4.1.1.1.1 Ashe Juniper Forest

Ashe juniper forests are stands dominated by mature Ashe juniper or a combination of mature and immature Ashe juniper trees. Mature Ashe juniper is defined as trees over 15 ft high with 5 in or more diameter at breast height (DBH), approximately 4.5 ft above the ground. Hardwood species occupy 10 percent or less of the canopy. This cover type is the most common terrestrial habitat type at CPNPP and occupies a total of about 3071 ac or approximately 39 percent of the site (Table 2.4-1). Transect data collected on the north peninsula show that Ashe juniper forest covers approximately 60 percent of the transect lines surveyed.

2.4.1.1.1.2 Mixed Hardwood Forest

Mixed hardwood forests are stands dominated by a combination of hardwood tree species including live oak, elms, mesquite, hackberry, Texas ash, chittamwood, and occasional persimmon trees. Ashe junipers comprise 30 percent or less of the tree canopy in mixed hardwood stands. Mixed hardwood forests are the most biologically diverse natural terrestrial communities on the CPNPP site. They are often found on south-facing slopes and along drainages within the site. The shrub layer includes buckbrush, agarito, lemon sumac, and Mexican buckeye.

This cover type occupies a total of about 528 ac at CPNPP or approximately 7 percent of the site (Table 2.4-1). Transect data collected on the north peninsula show that mixed hardwood forest covers approximately 16 percent of the transect lines surveyed.

2.4.1.1.1.3 Previously Disturbed

These are areas within the site that are either mechanically or naturally disturbed, and are dominated by either bare ground or weedy plant species that are indicators of disturbance. This cover type occupies a total of about 60 ac at CPNPP or less than 1 percent of the site (Table 2.4-1).

2.4.1.1.1.4 Developed Areas

Developed areas within the site are dominated by office buildings, reactors, and related facilities, switchyards, and storage facilities, as well as pavement or gravel for parking lots and roads. Also included within this type are the dam, spillway, structures related to the dam, and the Safe Shutdown Impoundment and its equalization channel. This cover type occupies a total of about 439 ac at CPNPP or approximately 6 percent of the site (Table 2.4-1).

2.4.1.1.1.5 Grassland

Grasslands within the site are dominated by either a variety of native grasses such as big and little bluestem, gramas, silver bluestem, and Texas wintergrass with some forbs, or by monocultures of turf grass such as bermuda or fescue. Bermuda lawns are common at the site near the facility entrance and around buildings. Fescue is a genus of more than 300 species of tufted grasses commonly planted to supplement native grass in pastures.

Native grasslands are found dotted across the site and are intermixed with the juniper forests. Forb species found in the native grasslands include Indian paintbrush, ragweeds, milkweeds, wild carrot, daisy fleabane, rose verbena, spiderwort, cut-leaf germander, trailing ratany, liatris, skullcap, black-eyed Susan, wooly vervain, yuccas, and prickly pear cactus. This cover type occupies a total of about 698 ac at CPNPP or approximately 9 percent of the site (Table 2.4-1). Transect data collected on the north peninsula show that grassy openings cover about 24 percent of the transect lines surveyed.

2.4.1.1.1.6 Open Water

The open water type at CPNPP consists primarily of SCR, the Safe Shutdown Impoundment, evaporation ponds for non-radioactive waste water, and an emergency spillway. Because of SCR, open water is a dominant cover type and occupies a total of about 3125 ac or approximately 39 percent of the site (Table 2.4-1). As an aquatic habitat, the ecology of SCR is discussed in more detail in Subsection 2.4.2 below.

2.4.1.1.2 Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions (Cowardin, Carter, Golet, and LaRoe 1979). Thus, a wetland typically demonstrates the following three characteristic components (Mitsch and Gosselink 2000):

- Water, either at the surface or within the root zone.
- Unique soil conditions differing from adjacent uplands.
- Hydrophytic vegetation and the absence of flood-intolerant species.

Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands at the CPNPP site are dominated by emergent macrophytic plants that include cattails, black willow, button bush, sedges, and grasses. The herbaceous layer is dominated by southern cattail and broadleaf cattail, along with Rooseveltweed, bushy bluestem, and spikerush. The tree and shrub layers are dominated by black willow, buttonbush, cottonwood, and salt cedar.

Emergent littoral wetlands are found along the edges of lakes and reservoirs. Although a limited acreage of wetland was lost due to the impoundment of Squaw Creek to form SCR, numerous littoral wetlands have since established. Forty-eight littoral wetlands occur along the shores of SCR (Figure 2.4-2). These wetlands have a cumulative area of approximately 53 ac or less than 1 percent of the site (Table 2.4-1).

Two areas of littoral wetlands currently exist at the mouth of intermittent streams along the northwest and southwest shorelines of the peninsula where the proposed cooling tower structures are to be located (Figure 2.4-2). The southwest wetland is approximately 0.78 ac and has black willow, salt cedar, and Texas ash in the tree and shrub layers. The herbaceous layer comprises southern and broadleaf cattails, bushy bluestem, and Rooseveltweed. The Munsell soil matrix color is 2.5Y 3/1. The Munsell notation order is hue (2.5Y), value (3) and chroma (1). Soils ending with a chroma of 1 are always designated as hydric soils in accord with the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (USACE 1987).

Field reconnaissance in the area of the proposed blowdown treatment facility identified a small wetland associated with seepage accumulating below the dam that formed an old stock pond. The herbaceous wetland totals about 0.25 ac in area. An unidentified rush, annual ragweed, and smartweed are the most common species in this area. The Munsell soil matrix color ranges from 10YR 4/3 at a depth of 2 in to 7.5YR 3/1 from 6 in to 16 in below the surface.

2.4.1.1.3 Wildlife

The mosaics of Ashe juniper, mixed hardwood (including bottomland) forest, open grassland, and wetland habitats at the CPNPP site result in a potentially high faunal diversity (Table 2.4-2).

The species compositions of upland vegetated areas within the CPNPP site have not significantly changed post-inundation (Subsection 2.4.1.1.1) although habitat type shifted significantly from savanna to woodland. Historical data on the inhabitants of these cover types from surveys conducted on-site during 1973 and 1974 are still applicable (TUGC 1974) (TUGC 1975). Although, as discussed above, many savanna and grassland species are now less abundant than they were while their woodland counterparts have increased in relative abundance.

Mixed hardwood woodlands provide habitat for a wide array of wildlife species including nesting birds, mammals, and numerous reptiles. Concurrent with habitat for resident wildlife, upland areas provide stop-over habitat for neotropical migrants and other short-range migratory birds. Mast from oak species is a staple of wildlife including white-tailed deer, wild turkey, and squirrels.

Mature Ashe juniper woodlands are an important habitat for the endangered golden-cheeked warbler. As discussed in more detail in Subsection 2.4.1.1.4.1, golden-cheeked warblers utilize the juniper trees as perches and nest sites, and the tree bark as material for nest construction.

Bottomland forests and wetlands are an important transition zone between xeric (drier) terrestrial areas and mesic (moist) or aquatic habitats. Numerous species can be found in this habitat type including many amphibians, furbearers, neotropical migrants, and nesting water birds.

Open grasslands are important habitats for many species including small mammals, grassland birds such as many sparrows and northern bobwhite, snakes, and lizards. In addition to providing nesting habitat, grasslands also provide habitat for numerous insect species such as grasshoppers, which serve as a major food source for wildlife.

2.4.1.1.3.1 Mammals

Fifty species of mammals representing eight orders may occur in the vicinity of CPNPP (Davis and Schmidly 1994) (Table 2.4-3). In the 1974 Cherokee ER and 1975 Monitoring Report for CPSES, 24 native and 2 non-native mammals were observed through surveys (TUGC 1975) (TUGC 1974) (Table 2.4-3). In part due to larger body size and resulting ease in observation, opossum, raccoon, coyote, bobcat, blacktail jackrabbit, white-tailed deer, and nine-banded armadillo were readily reported (TUGC 1974).

(Owen 1990) used a variety of techniques including ordination and TWINSPAN analyses to examine mammalian distribution in response to a known east-to-west decrease in precipitation (and therefore productivity) and a known south-to-north decrease in mean annual temperature. This work revealed that mammalian distributions are more affected by productivity (as a measure of precipitation) than temperature. Generally speaking, mammal species appear to be distributed in an individualistic manner according to the vicissitudes of history and their individual ecological tolerances. Results indicate that the area surrounding CPNPP should be expected to show higher mammalian richness than the more xeric and hotter regions of Texas to the west and south.

Grassland and improved pasture areas are important areas for small mammals, such as mice, gophers, and lagomorphs as well as larger mammals, such as skunks, raccoon, opossums, and foxes because of diverse food sources such as insects, grasses, and forbs (Davis and Schmidly 1994). Coyotes and bobcats utilize grasslands and thickets but tend to avoid improved pasture or other grazed areas because of decreased food resources in these areas (Bradley and Fagre 1988).

Mixed-hardwood woodlands provide excellent habitat for many mammal species such as deer, raccoons, opossums, and small mammals. These species utilize woodlands for forage (acorns and other mast), cover, and den sites in trees. Riparian areas provide a transition between water and hardwood areas, thereby blending essential life requirements, and are often occupied by a group of medium-sized mammals including raccoon, opossums, bobcats, and coyotes (Davis and Schmidly 1994).

White-tailed deer are the largest, and therefore, most readily visible mammals at CPNPP. White-tailed deer occur in all available vegetation types on the site. Hardwood forests are utilized for their hard mast of acorns as food and cover. Ashe juniper stands also provide cover from weather. Open areas like fields and maintained lawns also provide year-round foraging sites.

Small mammal trapping conducted during station construction in 1975 found 11 species of small mammals that were also sampled during pre-construction trapping in 1973 (TUGC 1974) (TUGC 1975). Small mammal trapping was primarily restricted to open sites in grasslands and improved pastures. Deer mice were the most abundant rodent (n=17) and were only found along fencerows or sandy upland areas. Cotton rats were next in abundance (n=10) and found in most of the sampled habitats (TUGC 1974). The least occupied habitat for small mammals was fencerow riparian (n=1) and grazed juniper, grama, and three awn grasslands (n=2). These habitats either offer little forage or have high risk due to observability and, therefore, selection by predators. No small mammal trapping was conducted during the 2007 field season.

Direct observation of numerous mammal species or species signs occurred during fieldwork during spring 2007 to delineate wetlands, assess vegetation, and other field efforts on the site. Observed mammals included white-tailed deer, bobcat, nine-banded armadillo, eastern cottontail, black-tailed jackrabbit, fox squirrel, and domestic cat. Signs of additional mammals indirectly indicating their occupation of the site included raccoon, opossum, striped skunk, beaver, and coyote were also recorded on the site.

2.4.1.1.3.2 Birds

A total of 421 species of birds potentially occur in Somervell and Hood counties (Table 2.4-4).

A number of these species are either at the southern or northern extreme of their range within central Texas. Most of these birds prefer specific habitat types and are not found throughout the entire eco-region (Freeman 2003). Many species of birds with specific habitat requirements for breeding are present on or near the site only during the breeding season. Other species are temporary residents on the CPNPP site as they migrate through the area twice each year. From August to December, 1972, a total of 118 species were observed at CPNPP during directed field surveys (TUGC 1974).

Censuses conducted in November 1972 resulted in highly variable data on bird density because of the seasonal flocking characteristics of many birds. It is noted in the original study that in southern climes, avian density is often greatest during the winter months when birds are flocked together. Because quantitative data were collected only for a short time period in early November 1972, those estimates of bird density are not reliable.

According to (TPWD 2007a) there are eight bird species listed as either endangered or threatened by the USFWS or Texas Parks and Wildlife Department (TPWD) that potentially occur in Somervell and Hood counties. These birds include the golden-cheeked warbler, black-capped vireo, whooping crane, American peregrine falcon, Arctic peregrine falcon, interior least tern, mountain plover, and the bald eagle. The black-capped vireo is not included in the Cherokee ER as a protected species because it was not listed by the USFWS until 1987. However, as discussed in Subsection 2.4.1.1.4.1, consultation with USFWS and TPWD reduced the number of possibilities to three species: (1) the vireo, (2) warbler, and (3) eagle. Similar to the directed surveys conducted in 1972, none of these species were observed during 2007 field reconnaissance or targeted presence/absence surveys performed in 2007 and 2008.

Whereas specific habitats for the golden-cheeked warbler and the black-capped vireo are not present at CPNPP, they are found in the vicinity. Located approximately 3.5 mi south-southwest of CPNPP is Dinosaur Valley State Park (DVSP), which has populations of both the golden-cheeked warbler and the black-capped vireo (TPWD 2007b). Unlike CPNPP, DVSP has a more varied and open landscape with a combination of Ashe juniper woodlands, savannas, and large riparian areas. A 100-m transect located in known golden-cheeked warbler habitat at DVSP had 79.9 percent mature Ashe juniper and 36.6 percent mixed hardwoods. Ten 100-m transects surveyed at CPNPP in 2007 averaged 59.6 percent mixed age Ashe juniper and only 15.7 percent hardwoods.

Table 2.4-4 provides a comparison between the number of bird species observed during general field surveys and the number that have the potential to occur at the site based on a field checklist by the TPWD titled, “Birds of the Oaks & Prairies and Osage Plains of Texas” (Freeman 2003). The diversity of species observed was lower than expected based on the 421 potentially occurring species (Freeman 2003). A combination of factors including habitat losses secondary to impoundment of SCR, lack of active Ashe juniper control, and the subsequent monoculture of this invasive, native tree species may contribute to the relatively low diversity of bird species (Yiming and Wilcove 2005) (Drake and Todd 2002).

2.4.1.1.3.2.1 Water Dependent Species

SCR provides habitat for a diverse array of shorebirds, wading birds, and waterfowl. Although a variety of water-dependent and colonial nesting birds have been observed at CPNPP during general field surveys in 2007, no colonial nesting sites occurred there. Observed water-dependent species included the great blue heron, green heron, black-crowned night heron, great egret, snowy egret, cattle egret, belted kingfisher, blue-wing teal, double crested and neotropic cormorants, eared grebe, American coot, spotted sandpiper, and killdeer. While the number for shorebirds and wading birds that have the potential to occur at CPNPP was 92, only 10 (11 percent) were observed during 2007 (Table 2.4-4).

Waterfowl also take advantage of aquatic habitat on site. Four of the potentially occurring 64 species (6 percent) of duck, geese, and other waterfowl were observed at CPNPP during 2007. These species included the blue-winged teal, wood duck, eared grebe, and American coot.

Texas lies within the Central migratory flyway. SCR would be expected to support significant numbers of waterfowl during migration.

2.4.1.1.3.2.2 Upland Game Birds

Of the four upland game bird species expected to occur at CPNPP, only the bobwhite and wild turkey were observed during 2007 (Table 2.4-4). The bobwhite quail ranges across much of the southern and eastern United States and into Mexico. It is a permanent resident of the CPNPP site.

A native of North America, the wild turkey is one of only two domesticated birds originating in the New World. The wild turkey ranges from southernmost Canada southward into Mexico and Florida; its occurrence in the western portion of its range is localized. Turkeys are found in hardwood forests with scattered openings, swamps, mesquite grassland, ponderosa pine, and chaparral (Cornell 2007).

2.4.1.1.3.2.3 Perching Birds

Generally considered birds of the field and forest, perching birds of the Order Passeriformes are typically medium to small land birds that occupy a wide range of habitat types. All perching birds are well adapted for perching, as the name suggests.

Of the 207 perching bird species expected to occur at CPNPP, only 41 species were observed at CPNPP during 2007 (Table 2.4-5).

2.4.1.1.3.2.4 Birds of Prey

Of the 41 birds of prey species expected to occur at the site, only the turkey vulture, black vulture, osprey, and the red-tailed hawk were observed at CPNPP during 2007 (Table 2.4-4).

The turkey vulture and black vulture are specialty hunters that survive mainly on carrion. They are both wide spread and very common. Both vulture species are common at the site year-round and were often observed soaring overhead.

One osprey was observed within a mile of the CPNPP site in March 1973 (TUGC 1974). During 2007 general field surveys, ospreys were observed flying over SCR and perching in trees along the shoreline.

One red-tailed hawk nest was reported in the uplands of CPNPP in the Cherokee ER (TUGC 1974). During 2007 general field surveys, red-tailed hawks were observed flying over the site and perching along power-line towers and taller trees.

2.4.1.1.3.2.5 Woodpeckers

Only two of 13 (15 percent) woodpecker species with the potential to occur at CPNPP were observed during 2007 (Table 2.4-4). The red-bellied woodpecker is a common species in the southeastern United States, but its range is expanding to the north. It can be found in both deciduous and pine forest, and at feeders in suburban neighborhoods.

The northern flicker is common in the east and north as the yellow-shafted form and to the west in the red-shafted form. Both species prefer open forested areas and woodlands, and were observed at CPNPP in hardwood woodlands.

2.4.1.1.3.3 Reptiles

Forty-four reptile species potentially reside within the CPNPP site (Table 2.4-6). Seven turtles, 12 lizards, and 25 snakes are listed as occurring in Somervell County (TCWC 1998).

A pre-construction survey for the existing facility reported four turtles, seven lizards, and six snakes (TUGC 1974) as shown in Table 2.4-7. Surveys conducted during construction of CPNPP found four turtles, three lizards, and seven snakes (Table 2.4-7) (TUGC 1975). During site visits in 2007, the only observed reptiles were the western diamond-backed rattlesnake, diamondback water snake, slider, and the American alligator that occurs at CPNPP outside its normal range (Table 2.4-7). Six of seven of the turtles potentially occurring within the CPNPP site are aquatic. The only terrestrial turtle, the ornate box turtle, is found primarily in prairie and open woodland habitats (Behler and King 1995).

A study conducted in Oklahoma reported lizards occupying a variety of habitats but showing preference for open hardwood forests, followed by open prairies, and lastly cedar forests (Jones, Fox, Leslie, Engle, and Lochmiller 2000). In the same study, snakes were primarily in prairies, intermediately in cedar forests, and least frequently in Cross Timbers vegetation (Jones, Fox, Leslie, Engle, and Lochmiller 2000). Habitat preference of CPNPP reptiles is listed in Table 2.4-6.

2.4.1.1.3.4 Amphibians

The smallmouth salamander and 14 frogs and toads reside within the vicinity of CPNPP (TCWC 1998), (Dixon 2000). Surveys conducted in 1973 found five species of amphibians. All species were frogs and toads. On the CPNPP site, the Woodhouse's toad and the gulf coast toad were collected. Along Squaw Creek (now inundated), cricket frogs, bullfrogs, and Rio Grande leopard frogs were captured. After onset of construction, only the gulf coast toad, bullfrog, and southern leopard frog were captured (Table 2.4-8). Site visits to delineate wetlands, assess vegetation, and other field efforts during 2007 also observed the bullfrog, leopard frog, cricket frog, and Woodhouse's toad.

Amphibians typically require environments with moderate to high moisture levels to minimize desiccation due to their porous skin. Most amphibians also require temporary or permanent water bodies for reproduction. However, 12 of 15 amphibians that may potentially occur at CPNPP are fully or partially terrestrial (Table 2.4-9) (TMM 1999b) (TMM 1999c). A herpetofaunal study conducted in the Oklahoma Cross Timbers, a habitat composition similar to CPNPP (Subsection 2.4.1.1.1), found that anurans occurred most frequently in cedar forests, followed by Cross Timbers vegetation, and lastly prairie (Jones, Fox, Leslie, Engle, and Lochmiller 2000).

2.4.1.1.4 Important Terrestrial Species

The USFWS and National Marine Fisheries Service are responsible for the conservation and protection of federally listed threatened and endangered species under the Endangered Species

Act (ESA) of 1973, as amended (16 U.S.C. 1531 - 1543). Migratory birds, freshwater, and terrestrial species are the sole responsibility of the USFWS.

The USFWS identified three threatened and endangered species as potentially occurring at CPNPP: (1) the endangered black-capped vireo, (2) the endangered golden-cheeked warbler, and (3) the candidate sharpnose shiner (Table 2.4-10). Whereas threatened or endangered species are afforded full protection under ESA, candidate species are not entitled to such protection.

At the state level, the TPWD is responsible for protection of endangered and threatened species. Laws and regulations pertaining to endangered or threatened animals are contained in Chapters 67 and 68 of the Texas Parks and Wildlife (TPW) Code and Sections 65.171 through 65.176 of Title 31 of the Texas Administrative Code (TAC). Laws and regulations pertaining to endangered or threatened plant species are contained in Chapter 88 of the TPW Code and Sections 69.01-69.9 of the TAC. Included in these categories are those not of special concern nationally that are in imminent danger of extirpation in the state (i.e., endangered) or that are likely to become endangered species in the state within the foreseeable future (i.e., threatened). In addition to the species listed by USFWS, TPWD listed the threatened bald eagle, the threatened Brazos water snake, the threatened Texas horned lizard, the threatened timber/canebrake rattlesnake, and the pistolgrip mussel (a species of concern). These species are also included in Table 2.4-10.

2.4.1.1.4.1 Rare Species

Discussed in the following subsections are the black-capped vireo, golden-cheeked warbler, bald eagle, Texas horned lizard, and timber (or canebreak) rattlesnake (Table 2.4-10). As aquatic species, the sharpnose shiner, Brazos water snake, and pistolgrip mussel populations are discussed in Subsection 2.4.2.5.1.

<u>Black-capped Vireo (Federally and State Listed as Endangered).</u> Black-capped vireos prefer patchy woodlands or shrublands. Black-capped vireos are small (+/-4.5 in) insectivorous songbirds found only in Oklahoma and Texas. Males are characterized by olive-green backs, white stomachs, and black caps with a white patch around a reddish eye. Females are more cryptic in color than males with dark coloration along their backs (Campbell 2003) (Grzybowski 1995) (USFWS 1991).

Black-capped vireos nest in areas with 30-60 percent cover of deciduous trees. Their preferred habitat contains trees in excess of 6 ft high with cover extending to the ground. Open grasslands play an important role in habitat, providing foraging areas for the vireos (Campbell 2003) (Graber 1961). Male vireos return to nesting areas starting in mid-March, and females arrive shortly thereafter. Home ranges vary from 3-10 ac (Campbell 2003) (Graber 1961). Males and females both contribute to nest building and site selection, which is often in a fork of a deciduous branch. Habitat modifications from range management practices and fire suppression, along with cowbird nest parasitism have probably led to their decline (Grzybowski 1995). This species was not observed on the site during an informal survey in April 2007, nor does the site contain suitable breeding habitat.

Golden-cheeked Warbler (Federally and State Listed as Endangered). Upland sites within CPNPP may provide appropriate habitat for the golden-cheeked warbler. Golden-cheeked warblers are endemic to Texas. They are small migratory songbird (>5 in long) and are characterized by yellow cheeks bisected by a black streak extending across the eye. Males and females are similar in appearance, although females are drabber in color (Campbell 2003) (Ladd and Gass 1999).

Golden-cheeked warblers are Ashe juniper obligates, but require stands mixed with oaks, elms, and other hardwoods in relatively moist (mesic) areas such as steep canyons and slopes, and adjacent uplands (USFWS 1992). (Kroll 1980) reported that occupied golden-cheeked warbler habitats had lower juniper-oak ratio (1.35:1), contained junipers over 40 years old, and had lower understory diversity than unoccupied areas. Older Ashe junipers have bark that is peeling, an important component of golden-cheeked warbler nest construction. Older Ashe junipers are utilized as calling sites during mating.

In March after females arrive, mating begins and extends until April or May. Decline of golden-cheeked warblers is attributed to habitat loss and fragmentation due to range improvement, rapid urban development, flood control, and construction of impoundments (Ladd and Gass 1999). Nest parasitism by the brown-headed cowbird and competition with blue jays has also contributed to population declines (Campbell 2003) (Engels and Sexton 1994). The USFWS along with TPWD have implemented land-owner management plans and Safe Harbor Agreements to protect and enhance existing and potential golden-cheeked warbler habitat (Campbell 2003) (Ladd and Gass 1999) (USFWS 1992). This species was not observed on the site during a survey in April 2007, or targeted presence or absence survey conducted in May 2007 and April-May 2008.

Bald Eagle (State Listed as Threatened). The bald eagle is a large predatory bird that occupies large trees along major water bodies such as lakes and rivers (Buehler 2000). Bald eagles nest in tall (40 – 120 ft) trees usually within 1 or 2 mi from large rivers and streams where fish are abundant. Therefore, SCR may provide appropriate habitat for the bald eagle. Bald eagles have dark body feathers, a distinctive white head, and a yellow beak at maturity. Adult female body size can reach three feet head to tail with an 8-ft wingspan. Males are slightly smaller (Campbell 2003) (Buehler 2000).

Over-wintering bald eagle range extends into central Texas, including Hood and Somervell counties (Campbell 2003). Fish are the main prey. Waterfowl, mammals, and carrion are other bald eagle food sources (Campbell 2003) (Buehler 2000).

Habitat loss, shooting, and use of the insecticides such as DDT are the primary factors contributing to the historic decline of the bald eagle (Campbell 2003) (Buehler 2000). Protection through laws and extensive conservation efforts had led to recovery of the bald eagle. In June 2007, the bald eagle was de-listed from threatened status under federal ESA protection. Bald eagles are still provided protection by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. This species was not observed on the site during field visits in 2006 and 2007.

Texas Horned Lizard (State Listed as Threatened). The Texas horned lizard is dorsoventrally flattened and cryptically colored with two occipital spines on the head (Pianka and Hodges 1998).

Texas horned lizards are found in arid to semi-arid sandy areas with bunchgrass and low vegetation cover of around 60 percent (Henke and Fair 1998). Adult Texas horned lizards are small (>68 mm long from snout to vent) and breed from March to July (Henke and Fair 1998) (Pianka and Parker 1975).

Harvester ants are the obligate forage for Texas horned lizards. Insecticide use and inter-specific competition from imported red fire ants reduce harvester ant density. Reduced prey availability may contribute to the decline of Texas horned lizard populations in Texas. Other factors that may contribute to population decline include habitat loss and over-collecting (Henke and Fair 1998). Harvester ant mounds were found on-site in 2007. No Texas horned lizards were observed.

<u>Timber (Canebreak) Rattlesnake (State Listed as Threatened).</u> The timber or canebreak rattlesnake is the second largest pit viper found in Texas. Adults range between 40 and 60 in long (TPWD 2007c) (Werler and Dixon 2000). They have lightly colored bodies with darker colored jagged stripes and solid black tails, culminating with a rattle. Though venomous, timber rattlesnakes rely on their cryptic coloration or avoidance when presented with danger, biting only when escape is not possible (TPWD 2007c) (Werler and Dixon 2000).

Timber rattlesnakes are most frequently associated with riparian and bottomland forest or in partially wooded hillsides. Timber rattlesnakes are sit-and-wait predators, sometimes waiting for several hours. They lie alongside fallen trees waiting for small mammals, their primary food source, to come along (TPWD 2007c) (Werler and Dixon 2000). Ground-nesting birds, frogs, and other small vertebrates are also eaten.

Population decline of timber rattlesnakes has been blamed on habitat destruction, hunting (market and round-ups), logging, and mortality induced while crossing roads (TPWD 2007c) (Werler and Dixon 2000). This species was not observed on the site during field visits in 2007.

Glen Rose Yucca (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The Glen Rose yucca (Yucca necopina) is found in the sandy soils of the Western Cross Timbers. It is easily distinguished by its white leaf margins bearing white curly threads and its branched flower stalk. The stalk may rise to nine feet with white to greenish white flowers. The Glen Rose yucca is on the Watch List as a rare species, having either low population in numbers or a restricted range in Texas (TNPD 2009). This yucca can be found in grasslands on sandy soils and limestone outcrops (TPWD 2009). This species was not observed during informal field surveys conducted in 2007 by Enercon Services, Inc. The only two documented occurrences of the Glen Rose yucca in Somervell and Hood counties, according to the Botanical Research Institute of Texas (BRIT), were approximately four miles from the project footprint (BRIT 2009).

Comanche Peak Prairie-clover (State Listed as Rare with no Regulatory Listing Status for Hood County (TPWD 2008a)). The Comanche Peak prairie-clover (Dalea reverchonii) is a low, spreading perennial, which appears as a dense, mat-forming rosette up to 16 inches in diameter. Numerous thick, 3-inch long spikes of rose-pink to magenta-purple flowers bloom in May and continue through June (CPC 2009). It is often found among sparse vegetation in barren, exposed sites, sometimes in roadway rights-of-way (TPWD 2008c). The Comanche Peak prairie-clover is restricted to shallow-soil prairies where the Western Cross Timbers meet the Grand Prairie of north-central Texas, occurring mostly where Goodland Limestone lies at or near the surface (Poole et al. 2007). There were no documented occurrences of the Comanche Peak prairie-clover in Somervell or Hood counties, according to the BRIT (BRIT 2009). This prairie-clover is only known from about 20 occurrences within a very small geographic area in north-central Texas and considered extirpated from Comanche Peak (NatureServe 2009).

The species discussed below are federally and/or state listed for Hood and/or Somervell County as rare, candidate, threatened, or endangered but were not included on the list of species provided by the USFWS and TPWD during consultation (USFWS Consultation Letter dated December 4, 2006 and TPWD Consultation Letter dated August 3, 2007). Therefore, construction of units 3 and 4 are not expected to impact these species or their associated habitat.

American Peregrine Falcon (State Listed as Threatened for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)) and Arctic Peregrine Falcon (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The adult American peregrine falcon (Falco peregrinus anatum) and Arctic peregrine falcon (Falco peregrinus tundrius) have long, pointed wings and a long rounded tail with narrow, black bands, ending with a broad, dark band tipped with white. Immature peregrines are similar, but the back and underparts are brown and the throat is heavily streaked with brown (DEP 2009). Peregrines migrate through Texas twice a year to and from their wintering areas in South America. They stop on the Texas Coast to feed before continuing their migration (TPWD 2009a). According to NatureServe, there are no existing natural heritage records of American peregrine falcon occurrences for Hood or Somervell counties (NatureServe 2009).

Interior Least Tern (Federally and State Listed as Endangered for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). Interior least terns (Sterna antillarum athalassos) are the smallest North American terns. Adults average 8 to 10 inches in length, with a 20 inch wingspan. The interior least tern is migratory, breeding along inland river systems in the United States and wintering along the Central American coast and the northern coast of South America. The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana. In Texas, interior least terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River into Arkansas (TPWD 2009b). According to NatureServe, there are no existing natural heritage records of interior least tern occurrences for Hood or Somervell counties (NatureServe 2009).

Whooping Crane (Federally and State Listed as Endangered for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The whooping crane (Grus americana) is the tallest bird in North America and have a wingspan of 7.5 feet. Whooping cranes are white with rust colored patches on top and on the back of their head. They lack feathers on both sides of the head, have yellow eyes, and long, black legs and bills. Whooping cranes breed in the wetlands of Wood Buffalo National Park in northern Canada and spends the winter on the Texas coast at Aransas National Wildlife Refuge near Rockport (TPWD 2009c). Although the whooping crane could possibly be a migrant over the proposed project location, no natural heritage records of occurrences exist for Hood or Somervell counties (NatureServe 2009).

Baird's Sparrow (State Listed as Rare with no Regulatory Listing Status for Hood County (TPWD 2008a)). Baird's Sparrow (Ammodramus bairdii) is a brown-streaked bird with an ochre-colored slash running down the back of its head. This sparrow lives almost exclusively in the native prairie of the northern Great Plains and winters in parts of Texas. This sparrow prefers mixed grass native prairie and forbs without excessive grass litter or heavy brush (USFWS 2009). According to NatureServe's Range Map, the Baird's sparrow only occurs as a non breeding resident in the far west part of Texas (NatureServe 2009) which is well outside the boundaries of the proposed project.

Mountain Plover (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The mountain plover (Charadrius montanus) resides in arid plains and prairies, rather than mountains. The summer range of the mountain plover stretches across the Great Plains region, from Canada to the northern part of the Texas panhandle. Up to 85 percent of the total population is thought to winter in California's Imperial and San Joaquin valleys, with smaller numbers wintering in Arizona, southern Texas and northern Mexico (NAS 2005). According to NatureServe's Range Map, the mountain plover only occurs as a non breeding resident in the southern tip of Texas and as a breeding resident in the northwest portion of the panhandle in Texas (NatureServe 2009) which is well outside the boundaries of the proposed project.

Western Burrowing Owl (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The burrowing owl (Athene cunicularia hypugaea) is a ground-dwelling bird with distinctive long legs and a short tail. The feathers are a sandy brown color above, while the breast area is beige with spotted bars. The burrowing owls do excavate their own homes but if available, they prefer to take use of other burrowing animals' dens. They typically nest in vacated prairie dog burrows. Burrowing owl habitat includes grasslands and deserts. They winter throughout Texas and commonly breed in the Panhandle and West Texas (TPWD 2009d). According to NatureServe, there are no existing natural heritage records of Western burrowing owl occurrences for Hood or Somervell counties (NatureServe 2009).

Plains Spotted Skunk (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The plains spotted skunk (Spilogale putorius interrupta) has jet black fur and distinct white spots in front of the ears and between the eyes. It has four to six broken white stripes extending from its neck along its back and sides. It has a white triangle on its forehead. The plains spotted skunk lives in open tallgrass prairies, forests, bushy areas and cultivated land (MDC, 2009). According to NatureServe, there are no existing natural heritage records of plains spotted skunk occurrences for Hood or Somervell counties (NatureServe 2009).

Texas Garter Snake (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The Texas garter snake (Thamnophis sirtalis annectens) has a greenish black back with a broad orange stripe down the center and yellowish stripes on either side of the body. They are usually found in marshy, flooded pastureland or meadows and grassy or brushy terrain near hill country streams and ponds in eastern and central Texas, with an isolated population in southwestern Kansas. According to NatureServe, there are no existing natural heritage records of Texas garter snake occurrences for Hood or Somervell counties (NatureServe 2009).

Gray Wolf (Federally and State Listed as Endangered for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The gray wolf (Canis lupus) is a close relative of domestic dogs. Its thick fur ranges in color from creamy white, reddish-brown, to shades of gray and black. Gray wolves are the largest species of wolf and range between 50 and 90 pounds. This species is considered extirpated in the state of Texas (TPWD 2009e).

Red Wolf (Federally and State Listed as Endangered for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The red wolf (Canis rufus) is a small, slender, long-legged wolf resembling the coyote in color. Formerly, red wolves ranged throughout the eastern half of Texas but today, they are thought to be extirpated from the state of Texas (TTU 2009).

Smalleye Shiner (Federally Listed as Candidate and State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The smalleye shiner (Notropis buccula) is straw color with black pigments outlining the dorsal scales. It is endemic to the Brazos River drainage but populations are likely extirpated in the middle Brazos River (Possum Kingdom Reservoir to Waco, Texas) (TSU 2009)).

Rock Pocketbook (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The rock pocketbook (Arcidens confragosus) has a stable listing status by the American Fisheries Society. This mollusk species is found in mud and sand bottom pools in medium to large rivers in standing or slow flowing water (NatureServe 2009). The extreme flow variability (USGS 2009) in the Brazos River below Lake Granbury does not provide preferential habitat for the rock pocketbook.

Texas Fawnsfoot (State Listed as Rare with no Regulatory Listing Status for Hood and Somervell Counties (TPWD 2008a and TPWD 2008b)). The Texas fawnsfoot mussel (Truncilla macrodon) is considered endangered by the American Fisheries Society. Approximately 40 to 50 specimens have been documented since 1980. Living or recently dead specimens have been found on the Clear Fork of the Brazos River and in the main channel of the Brazos River. Little is known about the habitat requirements for this species. The Texas fawnsfoot appears to prefer rivers and larger streams and have not been documented in reservoirs suggesting an intolerance of impoundment. It probably prefers sand, gravel, and perhaps sandy-mud bottoms in moderate flows (NatureServe 2009). The extreme flow variability (USGS 2009) in the Brazos River below Lake Granbury likely does not provide preferential habitat for the Texas fawnsfoot.

American Black Bear (Federally and State Listed as Threatened by Similarity of Appearance for Hood County (TPWD, 2008a)). The black bear (Ursus americanus) is one of the largest mammals in North America. Adults reach a length of 5 to 6 feet, height at the shoulder of 2 to 3 feet and weigh 200 to 300 pounds. Their colors can range from black to the occasional cinnamon brown. The black bear is found throughout North America in habitats ranging from swamps and forests, to desert scrub (TPWD 2009f). However, the black bear has been eliminated from most of the Midwest by intensive agriculture and human settlement and now occurs primarily in remaining large forested tracts (NatureServe 2009). Therefore, no suitable habitat for the American black bear is present within the proposed project boundaries.

2.4.1.1.4.2 Species of Commercial or Recreational Value

TPWD divides the state of Texas into eight wildlife districts. CPNPP is located within the Cross Timbers Wildlife District. Hunting regulations for the district are set by TPWD to determine the methods of harvest, bag limits, and other requirements for hunting on Wildlife Management Areas and private land (TPWD 2007d).

TPWD's regulations(TPWD 2007e) legally classify badger, beaver, fox, mink, nutria, opossum, otter, raccoon, ring-tailed cat, spotted skunk, and striped skunk as furbearers subject to commercial harvest by hunting and trapping. Coyotes and bobcats are not considered furbearers. Bobcat pelts require tagging with a TPWD-issued Convention on International Trade in Endangered Species tag. Most of these furbearer species are likely to inhabit the site, excluding otter and badger, based on the availability of suitable habitat (Davis and Schmidly 1994) Commercial trapping or hunting of furbearers is permitted in the district year-long.

CPNPP does not allow hunting or trapping within the site boundary. Legally protected game potentially occurring at the CPNPP site include bobcat, white-tailed deer, feral hog, gray and red fox, mink, muskrat, opossum, eastern cottontail, black-tailed jackrabbit, raccoon, striped and spotted skunk, squirrel, weasel, waterfowl (goose, brant and duck), bobwhite quail, mourning dove, rails, American coot, gallinule, American crow, and wild turkey (Freeman 2003) (Davis and Schmidly 1994).

2.4.1.1.4.3 Essential Species

NUREG-1555 also includes as important species those that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable. As discussed in Subsection 2.4.1.1.4.1 above, no rare terrestrial species potentially occurring at CPNPP were observed. The black-capped vireo and golden-cheeked warbler, both federally endangered, possibly occur there based on the availability of suitable habitat. Their presence was not confirmed by reconnaissance or targeted field observations.

None of the rare bird or snake species possibly occurring at CPNPP is known to have a clearly established and essential trophic relationship to any other specific species comparable to that of wolves and deer elsewhere in North America, with the exception of the Texas horned lizard. That species depends on the harvester ant. The black-capped vireo and golden-cheeked warblers are habitat specialists. The vireo requires patchy woodlands of 30 – 60 percent cover and trees higher than six feet. The warbler is an Ashe juniper obligate but also requires mixed hardwoods (Campbell 2003). Neither the Texas horned lizard nor the golden-cheeked warbler were observed on-site even though the essential species upon which they are notably dependent occur there.

Harvesting forest products and animals within CPNPP boundaries is not permitted. Commercial and recreational species of interest on-site are common to the region. The continued existence of any species on the site is not dependent on commercial timber harvest, recreational hunting, or fishing opportunities immediately adjacent to the site or elsewhere in the area.

2.4.1.1.4.4 Critical Species

NUREG-1555 also defines important species as those that are critical to the structure and function of the local terrestrial ecosystem. As discussed in Subsection 2.4.1.1.1.2, the western Cross Timbers eco-region is a mosaic of forest, woodland, savanna, and grasslands of highly variable floristic composition. Active and abandoned agricultural fields and pastures are also common.

Most species at CPNPP are common in southern plains and woodlands and associated streams that flow through them. Rare species potentially on-site are also more abundant elsewhere in the region. Regionally, the plant communities are highly variable and offer habitat for a wide variety of animal species that vary in abundance depending primarily on local physiography.

Because of the wide variety of ecological communities within the region, individual species abundance, especially plants, can vary significantly from location to location where different species serve similar ecological roles in the community. Accordingly, there is no evidence suggesting that any individual species is critical to structure or function at the ecosystem level.

2.4.1.1.4.5 Biological Indicators

The U.S. Environmental Protection Agency (EPA) describes biological indicators as groups or types of biological resources that can be used to assess environmental conditions (USEPA 2007). Typically, such organisms at or near a site, like but not limited to federally or state listed species and other rare species, can be selected to characterize the current ecological status of the site or to track or predict significant change in the future.

Terrestrial organisms that inhabit the CPNPP site are common inhabitants of southern plains and woodlands. There is little population information available for those that are less common to track possible changes in their status in the future. There are no species at the site that might function as true biological indicators.

2.4.1.1.4.6 Nuisance Species

NUREG-1555 describes nuisance species as those of concern because they are disease vectors or pests. There are a large number of terrestrial wildlife species that can be pests in urban/suburban or even rural settings. Included are raccoon, deer, bear, moles, voles, beaver, feral hog, gophers, snakes, crow, pigeons, starling, nutria, and others.

A portion of the site is contained within a chain-link fence. Therefore, large and medium size mammals such as deer and beaver that occur on-site at CPNPP have limited opportunity to move across CPNPP boundaries. Most of those outside of the site are essentially excluded. Unless controlled, populations of both can cause substantial damage, not only to landscaped plants but also to natural habitat. Deer reproduce rapidly and can over-browse shrub and herb layers. Other areas of the site have only a barbed-wire fence. In such areas, potential nuisance species range freely and are unlikely to over-populate the available habitat.

Beaver naturally dam flowing waterways and wetlands to create ponds in which they build lodges for over-wintering and breeding. In so doing, they plug culverts and can cause localized damage and roadway flooding. Should beaver and deer populations show substantial increases in the near future, biological control of these species at CPNPP may become necessary.

The nutria is an introduced rodent species from South America. Nutria are found in and around marshes and lakes. Rapid population growth due to year-round reproduction and a brood size of 2-11 young can exert detrimental impacts to wetlands. Wetland areas can become denuded in a short period of time if nutria populations are left unchecked.

Cowbirds are brood parasites, laying their eggs in nests of other birds. Cowbird nest parasitism contributes to the decline of numerous songbird populations, including the federally endangered black-capped vireo and golden-cheeked warbler (TPWD 2007f). Cowbird surveys conducted in Somervell County by (TPWD 2007g) reported 596 birds consisting of 278 males and 318 females. Biological control may be necessary in the future to maintain populations at a level that reduces impact to songbird populations.

Nuisance species or pests include insects such as mosquitoes, ticks, wasps, bees, and termites. Field reconnaissance failed to reveal any evidence of serious infestations of nuisance species such as mosquitoes or ticks or potential vectors for such diseases as West Nile virus and Lyme disease.

2.4.1.1.5 Important Terrestrial Habitats

Important terrestrial habitats in a 50-mi radius of CPNPP potentially include (1) wildlife sanctuaries, refuges, and preserves; (2) habitats identified by state or federal agencies as unique, rare, or of priority for protection; (3) land areas identified as critical habitat for species listed as threatened or endangered by USFWS, (4) wildlife travel corridors, (5) ecologically oriented recreational areas, and (6) environmentally sensitive areas as defined by NUREG-1555. Each applicable group is discussed further below.

2.4.1.1.5.1 Wildlife Sanctuaries, Refuges, and Preserves

Four wildlife protection areas occur within the 50-mi radius of CPNPP: (1) Dinosaur Valley State Park, (2) Glen Rose Bird Sanctuary, (3) Fossil Rim Wildlife Center, and (4) Quail Ridge Ranch/ Chalk Mountain Conservation Area. The construction and operation of the new generating facility at CPNPP is within the boundary of the existing CPNPP and is therefore unlikely to further impact these areas.

2.4.1.1.5.2 Unique and Rare Habitats or Habitats with Priority for Protection

Literature review, map review, and field reconnaissance revealed no unique or rare habitats with priority for protection on or in the vicinity of CPNPP (USFWS 2007).

2.4.1.1.5.3 Critical Habitat

Although there is the potential presence of federally listed species such as the black-capped vireo and golden-cheeked warbler, as discussed earlier in Subsection 2.4.1.1.4.1, within Somervell and Hood counties, no critical habitat has been designated for either of these species within a 50-mi radius of the site (USFWS 2007).

2.4.1.1.5.4 Travel Corridors

Travel corridors provide numerous essential functions needed for the survival of wildlife species. Corridors can be viewed at three scales: (1) local, (2) regional, and (3) migratory corridors. Local corridors are travel lanes linking daily resources needs such as food, water, and bedding sites. Local corridors exist within CPNPP for numerous species. High-perimeter fencing most likely diminishes travel off-site of mammalian species. Birds, reptiles, and amphibians, on the other hand, are not impeded by fencing and can move about more freely within the surrounding landscape. Localized fragmentation of the area surrounding CPNPP due to residential development is expected to act as a barrier to more habitat-specialized species. Overall, construction and operation of the new facility at CPNPP is not expected to significantly impact local movement patterns of wildlife.

Regional travel corridors, enabling travel of animals between core areas, helps to ensure genetic diversity of wildlife species by allowing new individuals into the populations, or be used for seasonal in habitat requirements. No known regional corridors exist for large mammals at CPNPP.

Migratory corridors are used as seasonal migration routes for large-ranging mammals and migratory birds. Migratory stop-over by bird species, especially waterfowl, occurs on the CPNPP site. Construction and operation of the new facility presents no significant impediment to use of the area by these species.

2.4.1.1.5.5 Recreational Areas

Table 2.4-11 lists ecologically oriented recreational areas within a 50-mi radius of the CPNPP site. These areas include outdoor recreation areas, campgrounds, public fishing and boating sites, heritage preserves, and wildlife viewing areas.

Within the 50-mi radius, the only state-owned recreational area is Dinosaur Valley State Park. Three city and county parks also occur: (1) Glen Rose Bird Sanctuary, (2) Glen Rose Heritage Park, and (3) Somervell County Park.

Although SCR is closed to the public for recreational fishing, employees and certain invited groups are allowed to fish from the banks. Special events are also held on the shore allowing for some daytime recreational access to the reservoir. Boating is not permitted.

2.4.1.1.5.6 Environmentally Sensitive Areas

Excluding areas listed in Table 2.4-11, there are no environmentally sensitive areas within a 50-mi radius of CPNPP.

2.4.1.2 Off-Site Facilities

Off-site facilities associated with the proposed expansion of CPNPP consist of one or more new or expanded electrical transmission line rights-of-way (ROW) and expansion of the existing water pipeline ROW connecting SCR to Lake Granbury. Each facility is described in detail in the following subsections.

2.4.1.2.1 Transmission Line Corridor(s)

Electric transmission lines originating from CPNPP cross forested and range habitats typical of north-central Texas as discussed in Subsection 2.4.1.1. Transmission corridors on and adjacent to CPNPP are maintained in an open grassland successional stage.

No designated USFWS critical habitat for endangered species exists within or adjacent to existing transmission corridors (USFWS 2007). No federally- or state-listed threatened or endangered species were detected during site surveys conducted in spring, summer, and fall 2007.

As discussed further in Subsection 9.4.3.1, operating the proposed project requires expanding four electrical transmission lines that connect the proposed project to switching stations in the area, and expanding the connection between two switching stations located off-site (Figure 1.1-5). These expansions would consist of either single or double 345-kV circuits. Three single circuit expansions would be installed on existing structures. Two double circuit expansions may require constructing new towers on new or expanded transmission line right-of-way (ROW) 160 ft wide. Transmission corridors, once constructed, need to be maintained in an early successional grassland stage, similar to current transmission corridors.

2.4.1.2.2 Water Pipeline Corridor

An existing 48-in water pipeline for Units 1 and 2 connects Lake Granbury to SCR. Water is drawn and pumped from Lake Granbury to SCR to provide makeup water to maintain the lake level in SCR because Lake Granbury is the only reliable source of water for SCR. Squaw Creek is seasonal only so it supplies very little inflow to SCR. The proposed pipeline for Units 3 and 4 would proceed generally to the southwest from Lake Granbury to CWS CT basin along the existing pipeline ROW.

The existing pipeline for Units 1 and 2 is located along the centerline of a ROW that is approximately 7 mi long and 50 ft wide. The entire length of the pipeline ROW was surveyed for potential wetlands and habitat for protected wildlife species in April and July 2007. No wetlands or habitat for threatened or endangered species were found.

Vegetation along the pipeline ROW is consistent with that of the Western Cross Timbers subdivision of the Grand Prairie physiographic province and consists of an interface of prairie and oak and Ashe juniper woodlands. The pipeline ROW vegetation is mainly grassland or Ashe juniper. Grasslands are especially prevalent wherever the water pipeline follows electrical transmission lines. Ashe juniper, or to a lesser extent mixed hardwoods, are the vegetation types associated with the pipeline ROW.

Three alternate routes to the new cooling tower location within the CPNPP property boundary were considered. They consist of (1) a route to the south of SCR, (2) a route underwater through SCR, and (3) a route primarily to the north of SCR that also requires crossing the reservoir. The proposed south route would follow existing transmission and water return pipeline ROWs, with vegetation consisting of grassland, mesquite, or previously disturbed areas. The middle proposed route passes through SCR from the existing water pipeline discharge to the proposed cooling towers. The proposed north route would follow an existing road along the property boundary. Vegetation along this route includes Ashe juniper forest, mixed hardwoods forest, and mowed grassland within Squaw Creek Park, owned by Luminant. From the edge of SCR within Squaw Creek Park, the pipeline would then pass under SCR to the proposed cooling towers. As discussed more fully in Subsection 4.3.2.1, the alternate routes that involved crossing SCR were rejected in favor of the route to the south of SCR in order to avoid any adverse impacts associated with construction activity within the reservoir.

2.4.2 AQUATIC ECOLOGY

Ecological studies on SCR were performed by Thomas Hellier in 1981 and 1987 prior to the start of operations of CPNPP. During February, May, September and November of 2007 and January 2008, sampling efforts specifically to characterize aquatic habitat and biota of SCR over four seasons were made (Bio-West 2008a). Three littoral and three pelagic sites were selected to ensure that both community types were well characterized within the reservoir (Figure 2.4-2). Fish were sampled in February and September 2007 and January 2008 using experimental gill nets comprised of varying mesh panels. Four seasons of invertebrate data were collected using a ponar grab sampler and kick nets where appropriate. Plankton was collected at each site across four seasons using a vertically towed Watermark simple plankton net with 80-micron mesh. Water quality data including temperature, pH, conductivity, dissolved oxygen, turbidity, hardness, alkalinity, and total dissolved solids were also collected at each site.

Lake Granbury is routinely surveyed as part of the Statewide Freshwater Fisheries Monitoring and Management Program (TPWD 2007m). Additional biotic sampling was performed in May, September, and November of 2007 and January of 2008 using identical techniques as in SCR (Bio-West 2008b). Four sites were chosen for Lake Granbury on the west side of the reservoir. Proper littoral areas don’t exist in that portion of the reservoir so two sites were at an approximate depth of 20 ft and two were at an approximate depth of 50 ft. However, the reservoir embankment is steep and all sites appear to be along the shore as shown in Figure 6.3-2 which depicts sampling locations. Fish, benthic, vegetation and plankton communities were sampled during each effort as well as the water quality parameters listed for SCR.

2.4.2.1 Aquatic Habitat

CPNPP is located adjacent to SCR and is approximately 7 mi from Lake Granbury. Both SCR and Lake Granbury are situated within the larger Brazos River Basin where they are estimated to drain 64 sq mi and 25,679 sq mi, respectively (USGS 2007).

Because SCR serves as the ultimate heat sink for existing units of CPNPP, it is essential that water level be maintained. Squaw Creek and five additional mapped intermittent streams discharge into the reservoir, but are minor contributors. Whenever the water level in SCR cannot be maintained by Squaw Creek and the other tributaries alone, a pipeline leading from Lake Granbury to SCR routinely brings additional water into the reservoir. CPNPP is authorized to use 48,300 acre-feet (ac-ft) from Lake Granbury annually. In 2006, 45,826 ac-ft was transported from Lake Granbury to SCR.

Lake Granbury was constructed in 1969 by damming the Brazos River in Hood County for the purposes of power plant cooling, recreation, water supply, and flood control (BRA 2008). In addition to providing make-up water to CPNPP, Lake Granbury is being investigated for use as the supply source for cooling water and the receiving water for cooling tower blowdown for CPNPP Units 3 and 4.

Water quality data were collected for SCR and Lake Granbury in June, August, and November of 2007. Surface samples were analyzed for dissolved oxygen, pH, conductivity, turbidity, hardness, total dissolved solids (TDS), and alkalinity (Table 2.4-12). The values in Table 2.4-12 indicate surface sample averages across all sites evaluated. Standard deviations are in parenthesis. The temperatures reported here are averages of six sampling locations in the vicinity of the discharge channel and as such were affected by the release of cooling water from the existing plant. Temperatures recorded during the spring were measured on May 9, 2007. Values reported in Table 2.3-24 include water column values from sites further north of Units 3 and 4 and were taken in early April, which explains the cooler temperatures reported in Table 2.3-24.

Measured TDS in SCR is much higher than in Lake Granbury. The average TDS concentration within SCR is normally over 3000 parts per million (ppm). Conductivity and hardness are also higher in SCR than Lake Granbury. Presumably, these values are higher in SCR because SCR is the heat sink for CPNPP. Circulating water exiting the main turbine condensers and discharged to SCR increases the temperature. It also increases evaporation to the atmosphere and concentrates solids within the reservoir.

2.4.2.1.1 Reservoirs

Lentic is a term that refers to still or standing water aquatic habitats; e.g., ponds and lakes, as opposed to lotic habitat that denotes flowing water; e.g., streams and rivers. Extensive historical manipulation has greatly influenced aquatic habitats surrounding CPNPP. In 1977, Squaw Creek was impounded 4.5 mi upstream from the confluence of Squaw Creek with the Paluxy River (Foster 1995), which created the primary on-site lentic habitat associated with CPNPP. The resulting reservoir crosses the county line between Hood and Somervell counties. It has a surface area of approximately 3272 ac and shoreline approximating 70 mi. Maximum depth of the reservoir is 135 ft in the primary reservoir basin while the mean depth is 46 ft (Hellier 1987).

River impoundments follow a typical pattern of large coves and bays that converge in the primary reservoir basin (Foster 1995). The shoreline is highly irregular, which increases the highly productive littoral habitat around the reservoir. Thermal loading from CPNPP associated with Unit 1 began in 1990. Unit 2 became operational in 1993. Increased temperature also increases primary productivity in lentic systems.

Lake Granbury is an 8700-ac reservoir created by the Brazos River Authority in 1969 by damming the Brazos River with the DeCordova Bend Dam (Hood County Texas Genealogical Society 2007). The lake is approximately 35.5 mi long with 103 mi of shoreline. Maximum depth is 74 ft while average depth is 18 ft (Mitchell 1993). TPWD has regularly stocked Lake Granbury to maintain a viable recreational bass fishery. Since 1993, only large numbers of stripped bass and Florida largemouth bass have been added to the lake (TPWD 2007n).

Golden algae is a type of algae identified in Lake Granbury that at certain times of the year reproduce rapidly causing extensive fish kills. Usually, fish kills are reported in winter and may be associated with high coliform and E. coli counts in the reservoir (TWRI 2007). In Granbury alone, millions of fish have been killed annually by golden algae blooms since year 2000 (TPWD 2007o).

2.4.2.1.2 Intermittent Streams

Intermittent streams are characterized by fluctuating hydrology. These waterways consist of intermittent pools of water at different periods annually. Intermittent streams are seasonally connected to constant hydrologic sources such as elevated groundwater tables or springs and seeps, and contain flowing water during storm events.

In addition to Squaw Creek, the USGS mapped five other intermittent streams within the CPNPP site boundary as partially depicted on the Hill City and Nemo quadrangle maps (USGS 1979, 1980). Panter Branch and Loller Branch are located on the northwest shore of SCR, Panther Branch on the southwest shore, and two unnamed streams flow into the reservoir from the north.

In addition, two intermittent streams are located in the area of the proposed blowdown treatment facility. They are unnamed tributaries to Squaw Creek that flow into the creek downstream of the dam (Figure 2.4-1). As waters of the United States, they are subject to the regulatory jurisdiction of USACE as discussed in Subsection 2.4.2.8.

2.4.2.2 Fisheries Resources

Lake Granbury and SCR both previously supported thriving recreational fisheries. In recent years, sport fishing on Lake Granbury has declined due to severe fish kills caused by golden algae. SCR is a small private reservoir owned by CPNPP that was closed to recreational fishing by the public in September 2001 for reasons of site security.

TPWD historically stocked SCR to promote recreational fishing. The reservoir was first stocked with hybrid striped bass, smallmouth bass and walleye in 1979. The most recent stocking event was hybrid striped bass in 1996. Between 1979 and 1996, additions of approximately 400,000 hybrid striped bass, 200,000 smallmouth bass, 4,800,000 walleye, 16,000 threadfin shad, 17,500 channel catfish and 300,000 Florida largemouth bass have been made to the reservoir (TPWD 2007p). Threadfin shad and other small fish serve as the forage base in the reservoir.

Studies of fish communities were performed in 1981 and 1987, prior to operation of the existing reactors. In 1981, 21 species of fish were sampled in SCR (Table 2.4-13) (Hellier 1981). At that time, the reservoir fish community indicated signs of being fairly young and still stabilizing. The dominant game fishes were hybrid striped bass and largemouth bass. Although smallmouth bass were stocked in the reservoir, they were not doing well. Further stocking of the species was not recommended (Hellier 1981).

A 1987 study of SCR revealed 26 species of fish (Table 2.4-13). Species composition changed slightly from 1981 with bluegill sunfish, green sunfish, black bullhead, redear sunfish, largemouth bass, longear sunfish, and yellow bullhead being the most abundant. Predominant predatory fishes in the reservoir were hybrid striped bass, channel catfish, walleye and largemouth bass. The fish collected in 1987 appeared to be in favorable health with regard to length-weight regression curves but internal inspection indicated a heavy incidence of nematode parasitism (Hellier 1987).

Summer and winter fish collection performed in SCR in 2007 predominantly used experimental monofilament gill nets placed perpendicular to the shoreline. Experimental gill nets are an accepted method of assessing fish populations in waterbodies. They are composed of a series of same-size panels of different sized mesh attached together to form a continuous sampling implement. High TDS measured in the reservoir prevented the use of a shock boat. Three pelagic and three littoral sites were chosen for the survey. Seining was also done in shallow areas of the littoral sites. Ten species were caught in the lake in 2007. The most common fish identified in the gill nets were channel catfish, largemouth bass, and freshwater drum. No smallmouth bass, walleye, or striped bass were found in 2007 (Table 2.4-13).

Many fish that were once identified in SCR failed detection in 2007 (Table 2.4-13). Water chemistry performed in 2007 determined TDS in SCR to be over 3000 ppm while TDS in Lake Granbury was approximately 880 ppm. Many studies indicate that as TDS increases above 1000 ppm, egg survival decreases (ADFGR 2001). Direct comparisons are difficult because most toxicology studies are performed in a laboratory setting using concentrations of a single solid rather than a natural setting where TDS includes many solids.

Many of the species absent from the 2007 survey were smaller fish more likely to be found in the streams that were inundated with the creation of SCR. It is likely that the majority of the minnows, darters, redhorse, shiners, and sunfish missing in the 2007 survey have simply become prey for other fish or failed to find acceptable spawning habitat. The absence of smallmouth bass and walleye is likely attributable to failed stocking due to unacceptable environmental conditions leading to a poor survival rate.

Another consideration in the differences between the 2007 and earlier fish samples is the different “unit of effort” being exercised between the 1987 and 2007 samplings. Initial efforts likely involved a more thorough assessment attempting to document everything present while more recent surveys focus on a “cross section” of the community to reduce stress and mortality in the community being sampled.

Millions of fish in Lake Granbury have been killed by golden algae blooms in recent years. In 1981, 29 fish species were identified in the lake. Species richness has decreased over time. A 2005 study identified only 13 species in Lake Granbury (Table 2.4-14). Although community structure appears to be healthy, fish densities are below levels recorded prior to golden algae infestation (TPWD 2007o).

In 2007 and 2008, fish were collected from four sites northwest of DeCordova Dam in Lake Granbury predominantly using experimental monofilament gill nets placed perpendicular to the shoreline. Sampling efforts were conducted in July and November 2007 and January of 2008 (Table 2.4-14). Striped bass, white bass, smallmouth buffalo and white crappie were collected but common carp, channel catfish, and gizzard shad were most common (Bio-West 2008b).

The aquatic community of the Brazos River downstream of Lake Granbury (starting approximately 1.8 miles (2.9 kilometers) downstream of DeCordova Bend Dam) was assessed for 246 feet (75 meters) longitudinally. Wetted widths of the river in this area ranged from 108 feet (33 meters) to 377 feet (115 meters). The aquatic habitats included side channels, backwaters, pools, runs, and riffles. The riparian vegetation community was highly diverse with several tree, shrub, and grass species dominating the banks. The river bottom substrates at the site ranged from silt (backwaters) to gravel, cobble, and bedrock in the main channel (Bio-West 2008b).

The most common fish captured at the Brazos River site was the inland silverside (Menidia beryllina), making up 57% of the total collection. Red shiners (Cyprinella lutrensis) were also relatively abundant at this site, totaling 17% (Bio-West 2008). The smalleye shiner (Notropis buccula) and the sharpnose shiner (Notropis oxyrhynchus) (federally listed candidate species and state listed rare but with no regulatory listing status species (TPWD 2008)), were not observed in the surveys conducted by Bio-West. These species are endemic to the Brazos River drainage but populations are likely extirpated in the middle Brazos River (Possum Kingdom Reservoir to Waco, Texas) (TSU 2009a and TSU 2009b). No other rare, candidate, threatened, or endangered fish species are federally or state listed by USFWS or TPWD as occurring in the middle Brazos River in Hood County (TPWD 2008).

Juvenile channel catfish (Ictalurus punctatus) were common in riffle habitat in the summer. Sunfish (Lepomis spp.) were especially common in the river during the fall and winter sampling. Longear sunfish (L. megalotis) and green sunfish (L. cyanellus) were the most common species captured. White bass (Morone chrysops) were relatively common (making up 3% of the total collection), while largemouth bass (Micropterus salmoides) were infrequently encountered (Bio-West 2008). No gar species (including alligator gar) were observed during these surveys although Zeug et al. (2005) reported collection of four alligator gar specimens in the middle Brazos River from 1993 to 1996.

The alligator gar (Atractosteus spatula) is not federally listed as a candidate, threatened, or endangered species nor is it state listed as rare, threatened, or endangered (TPWD 2008). The American Fisheries Society lists it as vulnerable due to the present or threatened destruction, modification, or reduction of habitat or range and over-exploitation for commercial, recreational, scientific, and/or educational purposes (TSU 2009c). Alligator gar are usually found in slow sluggish waters, although running water seems to be necessary for spawning (TPWD 2009). Springflow for the Brazos River from January 2007 to February 2008 ranged from approximately 20 cfs to 80,000 cfs (Bio-West 2008b). Because flows in this section of the Brazos River are extremely variable (USGS, 2009), it is unlikely that this would be preferred alligator gar habitat.

The total amount of water withdrawn from Lake Granbury by Units 3 and 4 totals 84.64 cfs (37,995 gpm) and of this, 34.28 cfs (15,388 gpm) will be discharged back into Lake Granbury (Table3.4-2 of the ER). Lake Granbury is approximately an 8,000-acre lake and maintained by an open spillway and retention time has been estimated at 260 days. Yield analysis for Lake Granbury indicates a firm yield of 64,712 ac-ft in 2000 and 63,212 ac-ft in 2060 (Subsection 2.3.1). The approximate 50 cfs lost to the new reactors will make very little difference in the extremely variable discharge (ranging from 300 cfs to 3,600 cfs in the past 68 years) for the Brazos River (USGS 2009). Changes in flow from the addition of the Units 3 and 4 should not be significant enough to adversely affect any imperiled species downstream. The Brazos River Authority (BRA), Texas Commission on Environmental Quality (TCEQ), and Texas Water Development Board (TWDB) will continue to monitor the ecological health of the water within the Brazos River watershed and Lake Granbury, including the area around the CPNPP intake and discharge (Subsections 2.3.3 and 4.2.2) to ensure there is no change in water quality that would adversely affect imperiled species downstream. The Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) limits will also be in place to ensure compliance with the Texas water quality standards and to protect downstream uses.

2.4.2.3 Macroinvertebrates

Macroinvertebrates are larger-than microscopic invertebrate animals including aquatic insects, crustaceans (crayfish and others), mollusks (clams and mussels), gastropods (snails), and oligochaetes (worms).

Invertebrates in SCR were sampled using a Ponar grab sampler and D-frame nets in four seasons of 2007. Sampling locations were identical to fish sampling locations (Subsection 2.4.2.2). In winter, midge fly larvae (93 percent of insect total) and aquatic amphipods dominated the samples. Midge fly larvae (93 percent of insect total) were also predominant in the spring. Aquatic snails were also prevalent. During the winter and spring, 13 and 18 families of invertebrates, respectively, were identified. Summer and fall sampling revealed 19 and 24 families, respectively (Table 2.4-15). Asiatic clam bivalves are also readily apparent along SCR banks and in the shallows (Bio-West 2008a).

Increased summer temperatures corresponded with an overall decrease in aquatic invertebrates in SCR. Mass emergences usually occur in spring and summer so decreased numbers in a summer sample are expected. Diptera far outnumbered other orders. In all seasons, over 50 percent of the individuals identified were members of the family chironimidae (Table 2.4-15).

Midge fly larva, amphipods and aquatic snails are all very hardy and able to withstand poor water quality conditions (USEPA 1999)(Hilsenhoff 1987). In SCR, conductivity, hardness, alkalinity and total dissolved solids and temperature are all elevated beyond levels found in Lake Granbury (Table 2.4-12). Conversely, dissolved oxygen measured in SCR is sometimes lower than levels measured in Lake Granbury but still above local levels needed to support a fish community.

Invertebrate sampling in Lake Granbury may be misleading. The sampling locations are near De Cordova Bend Dam where habitat is mainly pelagic. Littoral zones are slight as depth increases rapidly from shore. This particular stretch of the reservoir is also devoid of protective coves so aquatic plants are minimal. A sample from May, 2007 revealed only individuals from the family chironimidae. Richness increased in the summer with the addition of individuals from the orders Diplostraca (tiny crustaceans related to water fleas) and Anellida (worms). However, Diptera was again the only insect order represented (Table 2.4-16). Richness increased in fall and winter samples to include Ephemeroptera, Trichoptera, and Coleoptera. Brazos River habitat downstream from Lake Granbury contains a diverse array of insects totaling 30 represented genera in the summer sampling effort (Table 2.4-17)(Bio-West 2008b).

2.4.2.4 Planktonic Community

Plankton were sampled in both Lake Granbury (May, September and November 2007 and January 2008) and SCR (February, May, September and November 2007). Each sample was captured using a vertically towed 80-micron mesh plankton net. Summer samples were duplicated to look for golden algae.

Sampling results for SCR revealed rotifers to be the dominant organism followed by juvenile copepods in all seasons except summer. Summer samples revealed that juvenile copepods far outnumbered all other taxa. Other taxa found in the samples included two families of water fleas (Bosminidae and Daphniidae). No golden algae were found in the summer samples which may be attributable to the water temperature in SCR.

Sampling results for Lake Granbury revealed a greater number of juvenile copepods in all four seasons. Rotifers were the next most common taxon only in summer and winter samples. Collections appeared to be more evenly distributed in Lake Granbury than SCR across the taxa recorded including the same families of water fleas found in SCR. Although golden algae have been reported in Lake Granbury in large numbers, none were found in the summer sample.

The differences reported in the planktonic community structures between these two waterbodies were presumed to be attributable to water quality. No significant information about the plankton or its relationship to the overall aquatic community could be derived from these results because only planktonic crustaceans from the Order Cladocera were reported.

2.4.2.5 Important Aquatic Species

According to NUREG-1555, important aquatic species include (1) species listed, or proposed for listing, by a state or federal agency as threatened or endangered, (2) species identified as commercially or recreationally valuable, (3) species that are essential to the maintenance and survival of rare, or commercially or recreationally valuable species, (4) species that are critical to the structure and function of the local ecosystem, (5) species that may serve as biological indicators to monitor the effects of the proposed facilities on the aquatic environment, and (6) species identified as an aquatic nuisance. Each group is individually discussed in the following subsections.

2.4.2.5.1 Listed and Candidate Species

As discussed in Subsection 2.4.1.1.4.1, consultation with the USFWS revealed no federally listed aquatic organisms within Somervell or Hood counties. The Brazos water snake is the only state listed species known to reside in these counties. Federal candidates and aquatic species of concern include the sharpnose shiner and pistolgrip mussel, respectively (Table 2.4-10).

Pistolgrip Mussel (State Listed as a Species of Concern). Pistolgrip mussel populations are found in various substrates of medium to large river systems (USNPS 2006). Although distribution is widespread, individual populations are uncommon. Moving water is considered a habitat requirement and reservoir environments are unsuitable for pistolgrip mussel populations. Neither Lake Granbury nor SCR, including associated streams, provides habitat appropriate to sustaining populations of pistolgrip mussels.

Brazos Water Snake (State Listed as Threatened). Brazos water snake habitat occurs in the Brazos River near CPNPP. The snake is endemic to the Brazos River and was first discovered in 1938 in Palo Pinto County, Texas. It is primarily aquatic, found in shallow water (>1m deep) with rocky substrates or along rocky shorelines of the river (NatureServe 2007).

Though listed as occurring in the middle section of the Brazos River (NatureServe 2007), no specimens were found in a section of the Brazos River north of Lake Granbury. The Brazos water snake was found around Lake Granbury and at the junction of the Brazos and Paluxy Rivers in Somervell County. River impoundments and the resultant silting of the Brazos River have contributed to the population decline of the species (NatureServe 2007).

Sharpnose Shiner (Federally Listed as a Candidate Species). Sharpnose shiners were listed as a candidate for federal protection in 1982. They are endemic to the Brazos River and associated tributaries in Texas. Habitat for the shiner is characterized by shallow water in broad, open sandy channels with moderate to high current (USFWS 2002). Extensive river modification has reduced habitat area and the shiner has been extirpated from approximately 64 percent of its historical range. Sharpnose shiners are thought to be extirpated downstream of Possum Kingdom Reservoir, which is on the Brazos River north of CPNPP. They are not expected near Lake Granbury or SCR (USFWS 2002).

2.4.2.5.2 Species of Commercial or Recreational Value

Historically both SCR and Lake Granbury supported thriving bass fisheries. SCR has been closed to the public and fish populations in Lake Granbury have been devastated by golden algae blooms in recent years. Measures to mitigate the losses on Lake Granbury include stocking the lake with striped and largemouth bass. Although fish numbers are increasing, as of 2005 densities had not reached those recorded prior to golden algae infestation (TPWD 2005).

2.4.2.5.3 Essential Species

Important aquatic species also include those that are essential to the maintenance and survival of species that are rare, or commercially or recreationally valuable. As discussed above, rare aquatic species at CPNPP are limited to three species. None have been collected in Lake Granbury or SCR. Habitat requirements are such that the pistolgrip mussel and sharpnose shiner are unlikely inhabitants of the area. Suitable habitat does exist for the Brazos water snake. Positive identification in the vicinity of CPNPP has not been made. None of these species are known to have a clearly established and essential trophic relationship to any other specific species in the area. None of these species are of commercial or recreational importance.

Although recreational fishing does not occur in SCR and the fishery in Lake Granbury is struggling, recreational species are present in both reservoirs. Most sport fish are carnivorous and consume whatever will fit in their mouth. Common prey base includes bluegill and threadfin shad but any small fish can be considered prey in SCR and Lake Granbury.

2.4.2.5.4 Critical Species

Species that are critical to the structure and function of the local ecosystem are also included as important species. Most of the species identified at CPNPP are common in other lentic habitat in Texas. Aquatic habitats near CPNPP are locally important but not regionally significant. They support a variety of common aquatic species that vary in abundance depending primarily on local conditions. No evidence exists suggesting that any individual species is critical to structure or function at the ecosystem level.

2.4.2.5.5 Biological Indicator Species

The presence, condition, and numbers of the types of fish, insects, algae, plants, and other aquatic life can provide accurate information about the health of a specific water body such as a river, stream, lake, or wetland. No known biological indicators of water quality such as aquatic vegetation, macroinvertebrates, or fish have been systematically studied in SCR or Lake Granbury.

Because of their abundance and their sensitivity to environmental effects, macroinvertebrates are the most widely used species in bio-monitoring programs for assessing water quality. They are susceptible to degradation of water, sediment, and habitat because they cannot escape the immediate area where they occur. They serve as indicators of localized environmental conditions.

Insect populations in both SCR and Lake Granbury may indicate the absence of quality habitat at most sampling sites. Members of the family Chironomidae are hardy and larva survives in most aquatic environments. Family Chironimidae dominates other taxa at every sample site. Water quality in SCR is affected by high TDS and temperatures typical of a thermal heat sink (Table 2.4-12). Lake Granbury is not currently subjected to thermal loading but microinvertebrate diversity is very low presumably due to sampling locations near the dam in an exposed portion of the reservoir with little littoral habitat.

2.4.2.5.6 Nuisance Species

Occurrence of the common carp, a potential nuisance species, is documented throughout the Brazos River, including SCR and Lake Granbury (Table 2.4-13 and Table 2.4-14). It has not been listed as a nuisance species in Lake Granbury (USDA 2007).

Hydrilla, Brazilian waterweed, giant reed, giant salvinia and water hyacinth are considered nuisance species in Texas. These plants have a tendency to reproduce rapidly during summer months as a function of increased sunlight and temperature. Natural decline occurs when temperatures drop in the winter (USDA 2007).

While these vegetative species would produce valuable habitat for fish and invertebrates, they would eventually cause a community shift away from native species simply because of their reproductive rates and absence of natural controls (e.g. predators, competitors, limiting environmental influences, and others). These plants are also known to create mats dense enough to interfere with boat propellers and thereby prevent access and impede water flow through pipes. None of these species have been reported in the proximity of SCR or Lake Granbury but have been reported in numerous other locations across Texas.

Corbicula spp. is a nonnative Asiatic clam and an aquatic nuisance species. *Corbicula* exists throughout the Brazos River system. Field reconnaissance also revealed its presence in the SCR. There is no known effective mitigation or control of the species.

Golden algae have been documented throughout the Brazos River system since 1985. Scientists are unsure of the origin of golden algae. When the algae bloom, a toxin affecting gilled organisms is produced resulting in mass fish kills. Most fish kill events have been documented during winter months. At that time, green algae populations decrease which may lend a competitive edge to golden algae (TPWD 2007o).

Mud crabs are common inhabitants of estuary environments in Texas and Florida. Positive identifications have been made in both Lake Granbury and SCR. They migrate upstream from the coast. Fish stocking practices are suspected to have introduced mud crabs to reservoir environments. Reproduction in freshwater environments was questionable but evidence exists. Size distributions and the presence of gravid females and larvae indicate reproduction is occurring (Tarleton State 2007). Although they are not listed as nuisance species (USDA 2007), mud crabs have caused fouling problems at Possum Kingdom Lake (also within the Brazos watershed) and have been identified on CPNPP intake screens (Tarleton State 2007).

2.4.2.6 Recreation Areas

Table 2.4-11 lists ecologically oriented recreation areas in the vicinity of CPNPP, including those used for public fishing and other aquatic pursuits.

2.4.2.7 Environmentally Sensitive Areas

In October 1968, Congress established the National Wild and Scenic River System (NWSRS) by means of the Wild and Scenic Rivers Act to ensure that “outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, [are] preserved in free-flowing condition, and that they and their immediate environments [are] protected for the benefit and enjoyment of present and future generations.” The National Park System also maintains an inventory of free-flowing segments that may later be classified as wild and scenic. No wild and scenic rivers, or Nationwide Rivers Inventory streams or associated tributaries, are located on, or in the vicinity of CPNPP (National Wild and Scenic Rivers System 2007).

2.4.2.8 Waters of the United States

Waterbodies and waterways associated with CPNPP, including SCR and its tributaries and Lake Granbury, are Waters of the United States. Waters of the United States are broadly defined as waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; the territorial sea; interstate waters and wetlands; all other waters such as intrastate lakes, rivers, streams and wetlands if their use, degradation, or destruction could affect intrastate or foreign commerce; tributaries to waters or wetlands identified above; and wetlands adjacent to waters identified above. Waters of the United States are under the regulatory jurisdiction of the U.S. Army Corps of Engineers that regulates construction within them.

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TABLE 2.4-1
DISTRIBUTION OF COVER TYPES AND ACREAGE TOTALS AT CPNPP

Vegetation Type	Total Acres	Percent Cover
Open Water	3125	39
Ashe Juniper Woodland	3071	39
Grassland	698	9
Mixed Hardwood Woodland (Including Bottomlands)	528	7
Developed	439	6
Previously Disturbed	60	<1
Wetland	53	<1
Total	7974	

TABLE 2.4-2
NUMBER OF POTENTIALLY OCCURRING AND OBSERVED TERRESTRIAL WILDLIFE SPECIES AT CPNPP

Taxa	Number of Potentially Occurring Species	Number of Species Observed	Percent of Expected Actually Observed
Mammals	50[a]	26[b] [c]	52
Birds	421[d]	118[c]	28
Reptiles	44[e]	14[b]	32
Amphibians	15[e]	5[c]	33

a) (Davis and Schmidly 1994)

b) (TUGC 1975)

c) (TUGC 1974)

d) (Freeman 2003)

e) (Dixon 2000)

TABLE 2.4-3
NUMBER OF POTENTIALLY OCCURRING AND OBSERVED MAMMAL SPECIES AT CPNPP

Mammal Order	Number of Observed Species	Number of Expected Species	Percent of Expected Species Actually Observed
Marsupials	1	1	100
Moles and Shrews	1	2	50
Bats	0	6	0
Armadillos	1	1	100
Rabbits and Hares	3	3	100
Rodents	11	22	50
Carnivores	7	14	50
Deer	1	1	100

(Combination of 1973 and1974 survey data and 2007 field observations.)

TABLE 2.4-4
NUMBER OF OBSERVED AND EXPECTED BIRD SPECIES AT CPNPP

Bird Group	Number Observed	Number Expected	Percent of Expected Actually Observed
Water-Dependent			
Shore/Wading Birds	10	92	11
Ducks and Geese	4	64	6
Primarily Upland			
Upland Game Birds	2	4	50
Perching Birds	41	207	20
Birds of Prey	4	41	10
Woodpeckers	2	13	15

(Freeman 2003)

TABLE 2.4-5 (Sheet 1 of 3)
PERCHING BIRDS OBSERVED AT CPNPP DURING 2007 FIELD RECONNAISSANCE

Common Name	Habitat Preference	Occurrence, Timing, and Breeding Status
American Crow	Woodland, farmland	Abundant year-long; breeds locally
American Goldfinch	Deciduous and riparian woodland, fields	Abundant (Nov-Mar); breeds locally
American Robin	Habitat generalists	Abundant (Oct-Apr); breeds in area
Barn Swallow	Savannas and open areas near water	Common (Mar-Oct); breeds in area
Belted Kingfisher	Along watercourses	Common; breeds in north part of region
Bewick’s Wren	Open woodland and shrubland	Common year-long; breeds in area
Blue jay	Deciduous and mixed woodlands, and forests	Abundant year-long; breeds in area
Blue-gray Gnatcatcher	Deciduous forest, woodland, and shrubland	Common (Mar-Apr and Sept-Oct), locally breeds
Brown-headed Cowbird	Woodland, Deciduous forest, grasslands	Abundant (Oct-Mar); breeds in area
Carolina Chickadee	Deciduous woodland, riparian, thickets	Abundant year-long; breeds in area
Carolina Wren	Open deciduous woodland, suburbs	Abundant year-long; breeds in area
Chipping Sparrow	Oak woodlands, thickets	Common (Nov-Apr); breeds in area
Eastern Bluebird	Forest edges, open woodlands	Common (Oct-Mar); breeds in area
Eastern Phoebe	Open and riparian woodlands, ravines	Common (Oct-Apr); breeds in area
Eurasian Collared Dove[a]	Developed areas, around agriculture	Abundant year-long; breeds locally
European Starling[a]	Habitat generalist	Abundant year-long; breeds in area

TABLE 2.4-5 (Sheet 2 of 3)
PERCHING BIRDS OBSERVED AT CPNPP DURING 2007 FIELD RECONNAISSANCE

Common Name	Habitat Preference	Occurrence, Timing, and Breeding Status
Field Sparrow	Old field, brushy area	Common (Nov-Apr)
Great-tailed Grackle	Savannas, pastures, riparian thickets	Abundant year-long; breeds in area
Greater Roadrunner	Brushy areas and woodlands	Uncommon year-long; breeds in area
House Sparrow[(a)]	Cultivated areas, residential	Abundant year-long; breeds in area
Lark Sparrow	Grassland, Savanna	Common (Apr-Oct); breeds in area
Lincoln’s Sparrow	Riparian thickets	Common (Oct-Apr)
Loggerhead Shrike	Open fields with scattered trees	Common (Aug-Apr); breeds in area
Mourning Dove	Grassland to woodlands	Abundant year-long; breeds in area
Northern Cardinal	Thickets, residential	Abundant year-long; breeds in area
Northern Mockingbird	Habitat generalists	Abundant year-long; breeds in area
Orange-crowned Warbler	Deciduous and riparian woodlands	Common (Oct-Apr)
Painted Bunting	Thickets, scattered brush and tree areas	Common (Apr-Aug); breeds in area
Purple Martin	Open country, savannas, disturbed areas	Common (Mar-Sept); breeds in area
Red-winged Blackbird	Marshes and riparian areas	Abundant year-long; breeds in area
Rock Dove[(a)]	Urbanized areas	Abundant year-long; breeds locally
Ruby-crowned Kinglet	Conifer and conifer-deciduous forests	Abundant (Nov-Mar); breeds in area
Ruby-throated Hummingbird	Deciduous or mixed woodlands, parks	Common (Apr-Sept); breeds in area
Rufous-crowned Sparrow	Rocky slopes w/ shrubs	Uncommon year-round

TABLE 2.4-5 (Sheet 3 of 3)
PERCHING BIRDS OBSERVED AT CPNPP DURING 2007 FIELD RECONNAISSANCE

Common Name	Habitat Preference	Occurrence, Timing, and Breeding Status
Savannah Sparrow	Grasslands	Abundant (Nov-Apr)
Scissortail Flycatcher	Open prairie, savannas	Abundant (May-Oct); Breeds in area
Swainson's Thrush	Woodlands, riparian, and thickets	Uncommon (Apr-May)
Tufted Titmouse	Forest, woodland, oak-juniper scrub	Abundant year-long; breeds in area
White-winged Dove	Riparian woodlands and thickets	Common year-long; breeds in area
White-crowned Sparrow	Conifer and mixed forest, thickets	Common (Nov-Apr)
White-eyed Vireo	Brushy, riparian areas, thickets	Common (Apr-Sept); Breeds in area
Yellow-rumped Warbler	Conifer-deciduous Forest	Abundant (Oct-Mar)

a) Introduced

(Ehrlich, Dobkin, and Wheye 1988)
(Freeman 2003)

TABLE 2.4-6 (Sheet 1 of 2)
HABITAT PREFERENCE OF REPTILES POTENTIALLY OCCURRING AT CPNPP

Taxa	Common Name	Habitat Preference
Turtles	Ornate box Turtle	Terrestrial, prairies, open woodlands
	River cooter	Lakes, ponds, rivers
	Slider	Lakes, ponds, rivers
	Snapping turtle	Lakes, ponds, rivers
	Smooth softshell	Lakes and rivers, sand or mud bottoms
	Spiny softshell	Lakes and rivers, sand or mud bottoms
	Yellow mud turtle	Muddy bottomed waters
Lizards	Eastern collared lizard	Rock piles, arid and semi-arid areas
	Fence lizard	Rocky areas
	Five-lined skink	Damp, wooded areas
	Great plains skink	Grasslands
	Greater earless lizard	Rocky flats, streambeds, rock outcrops
	Ground skink	Moist environments
	Northern prairie skink	Moist environments
	Six-lined racerunner	Open areas, wooded areas, outcrops
	Slender glass lizard	Dry grasslands and woodlands
	Texas horned lizard	Sandy, arid environments
	Texas spiny lizard	Arboreal, mesquite trees, fences
	Texas spotted whiptail	Rocky slope and prairies
Snakes	Brown snake	Grasslands, juniper breaks, floodplains
	Bullsnake	Sandy prairies, rocky areas
	Coachwhip	Prairies, rocky outcrops
	Copperhead	Post oak woodlands
	Corn snake	Post oak savannas, grasslands
	Diamondback water snake	Calm waters of wetlands, lakes, ponds
	Eastern coral snake	Tallgrass prairie, hardwood woodlands

TABLE 2.4-6 (Sheet 2 of 2)
HABITAT PREFERENCE OF REPTILES POTENTIALLY OCCURRING AT CPNPP

Taxa	Common Name	Habitat Preference
	Eastern hognose snake	Open wooded areas, near water
	Eastern racer	Open woodlands, rocky outcrops
	Eastern rat snake	Brushy or wooded areas
	Flathead snake	Oak-hickory forest
	Ground snake	Grasslands, oak-juniper savannas
	Harter's water snake	Swift, rocky stream riffles
	Lined snake	Prairies and open woodlands
	Longnose snake	Prairies, grasslands, rocky slopes
	Mountain patchnose snake	Cross timbers, prairies
	Night snake	Oak-juniper savannas
	Plainbelly water snake	In slow moving water with vegetation
	Plains blackhead snake	Rocky grasslands
	Ringneck snake	Open sparse wooded moist areas
	Rough earth snake	Hardwood forests, grasslands
	Rough green snake	Arboreal, savannas, riparian areas
	Texas blind snake	Sandy or loamy soils in various vegetation types
	Western diamondback rattlesnake	Sparsely vegetated areas
	Western ribbon snake	Grassy edges of watercourses

(Werler and Dixon 2000)
(TMM 1999a)
(Behler and King 1995)

TABLE 2.4-7
REPTILES OBSERVED AT CPNPP IN 1973, 1974, AND 2007

Common Name	1973[a] Pre-Construction Survey	1974[b] Construction Survey	2007 Reconnaissance Visits
Turtles			
Common snapping turtle	X	X	
Ornate box turtle	X	X	
Pond slider	X		X
River cooter		X	
Spiny softshell	X	X	
Lizard			
Collared lizard	X	X	
Eastern fence lizard	X		
Greater earless lizard	X	X	
Ground skink	X		
Six-lined racerunner	X		
Texas horned lizard	X		
Texas spiny lizard	X	X	
Snakes			
Coachwhip	X	X	
Copperhead	X		
Eastern racer		X	
Eastern rat snake		X	
Plain-bellied water snake	X	X	
Rough green snake	X		
Western ribbon snake	X	X	
Western diamondback rattlesnake	X	X	X
Western diamondback water snake		X	X

a) (TUGC 1974)

b) (TUGC 1975)

TABLE 2.4-8
AMPHIBIANS OBSERVED AT CPNPP IN 1973, 1974, AND 2007

Common Name	1973[(a)] Pre-Construction Survey	1974[(b)] Construction Survey	2007 Site Visits
Bullfrog	X	X	X
Cricket frog		X	X
Gulf coast toad	X	X	
Rio Grande leopard frog	X	X	X
Woodhouse's toad		X	X

a) (TUGC 1974)

b) (TUGC 1975)

TABLE 2.4-9
AMPHIBIANS ENDEMIC TO CPNPP

Taxa	Common Name	Habitat Preference
Salamanders	Smallmouth salamander	Bottomland forests, streamsides, prairie
Frogs	Bullfrog	Lakes, ponds, slow streams
	Cricket Frog	Shallow ponds
	Gray tree frog	Wooded areas along rivers and creeks
	Plains leopard frog	Along streams in arid areas and prairies
	Rio Grande leopard frog	Along brooks and streams in arid regions
	Southern leopard frog	Shallow water habitats
	Spotted chorus frog	Grasslands and prairies
Toads	Couch's spadefoot	Prairies and mesquite savannas.
	Great plains narrowmouth toad	Moist areas, prairies, rocky slopes
	Green toad	Open plains, arid areas
	Gulf coast toad	Prairies, roadsides
	Red-spotted toad	Deserts, rocky areas, grasslands
	Texas toad	Grasslands and open woodlands
	Woodhouse's toad	Sandy areas near wetlands or riverbottoms

(TMM 1999b)
(TMM 1999c)

TABLE 2.4-10
ENDANGERED AND THREATENED SPECIES POTENTIALLY OCCURRING IN THE CPNPP AREA

Species Group	Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Birds	Black-capped vireo	*Vireo atricapillus*	E	E
	Golden-cheeked (=Wood) warbler	*Dendroica chrysoparia*	E	E
	Bald eagle	*Haliaeetus leucocephalus*		T
Fish	Sharpnose shiner	*Notropis oxyrhynchus*	C	
Reptiles	Texas horned lizard	*Phrynosoma cornutum*		T
	Timber (Canebreak) Rattlesnake	*Crotalus horridus*		T
	Brazos water snake	*Nerodia harteri*		T
Mussel	Pistolgrip	*Tritogonia verrucosa*		SC

a) Federal Status: E = Endangered; C = Candidate.

b) State Status: E = Endangered; T = Threatened; SC = Species of Concern

TABLE 2.4-11 (Sheet 1 of 2)
ECOLOGICALLY ORIENTED PUBLIC RECREATION AREAS WITHIN A 50-MI RADIUS OF CPNPP

Type of Property	Name of Property	Approximate Distance and Direction from the Site
Recreation Area		
	Dinosaur Valley State Park	3.5 mi SSW
	Somervell County Park	4.4 mi S
	Big Rocks City Park	4.7 mi S
	Tres Rios Ranch River Resort	4.8 mi S
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Campground		
	Dinosaur Valley State Park	See above
	B Street RV Park	4.5 mi S
	Oakdale Park	See above
	Glen Lake Methodist Camp	4.7 mi SSE
	Leslie’s RV Park Campground	4.8 mi SSW
	Tres Rios Ranch River Resort[7]	See above
	Cleburne State Park	See above
	Meridian State Park	See above
	Lake Whitney State Park	See above
	Lake Mineral Wells State Park	See above
Fishing		
	Dinosaur Valley State Park	See above
	Big Rocks City Park	See above
	Lake Granbury	7 mi NE
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE

TABLE 2.4-11 (Sheet 2 of 2)
ECOLOGICALLY ORIENTED PUBLIC RECREATION AREAS WITHIN A 50-MI RADIUS OF CPNPP

Type of Property	Name of Property	Approximate Distance and Direction from the Site
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Heritage Preserve		
	Glen Rose Heritage Park	4.8 mi S
	Somervell County Courthouse	5.0 mi S
	Barnard’s Mill	5.0 mi S
	Acton State Historical Park	13 mi NE
Boating Areas		
	Lake Granbury	See above
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Wildlife Viewing		
	Dinosaur Valley State Park	See above
	Glen Rose Bird Sanctuary	4.8 mi S
	Fossil Rim Wildlife Center	8 mi SSW
	Quail Ridge Ranch/Chalk Mountain Conservation Area	9 mi SW
	Vivian J. Malone Preserve	25 mi E

(GRCVB 2007)
(NAPA 2007)
(NRHP 2007)
(TPWD 2007h)
(TPWD 2007i)
(TPWD 2007j)
(TPWD 2007k)
(TPWD 2007l)

TABLE 2.4-12
WATER QUALITY MEASUREMENTS FOR SQUAW CREEK RESERVOIR AND LAKE GRANBURY, 2007

	Spring		Summer		Fall		Winter	
Reservoir	SCR[a]	LG	SCR	LG	SCR	LG	SCR	LG
Temperature (°C/°F)	30/86 (1.5)[b]	27/80.6 (0.6)	36.6/97.9 (1.47)	30/86 (0.6)	29.3/84.7 (1.3)	19.1/66.4 (0.2)	21.3/70.3 (1.2)	9.9/49.8 (0.4)
Dissolved Oxygen (mg/L)	9 (0.6)	12.6 (2)	6.9 (0.76)	6.3 (0.6)	7.8 (0.6)	5.8 (0.5)	12.5 (1.6)	13.9 (1.1)
pH	8.7 (0.03)	8.6 (0.03)	8.7 (0.02)	8.3 (0.08)	9.0 (0.4)	8.0 (0.1)	8.8 (0.05)	9.4 (0.2)
Conductivity (μs/cm)	539 (2.2)	159.2 (0.5)	490.5 (1.87)	158.5 (2.5)	472.5 (3.7)	122 (0)	566.8 (2.3)	1.3 (0)
Turbidity (NTU)	2.6 (1)	3.4 (3.2)	0	0	3.3 (0.4)	8.9 (1.8)	2.9 (0.6)	9.2 (0.5)
Hardness (mg/L as ca)	792.8 (14.7)	275.7 (32.9)	699 (11)	245.8 (5.6)	677.5 (14.2)	224 (1.2)	884.4 (8.2)	200.2 (0.5)
TDS (mg/L)	3325 (24.3)	884.5 (13.7)	2763 (27)	811.5 (15.4)	2725 (22.6)	631.2 (4.3)	3326.7 (69.8)	622 (20.9)
Alkalinity (mg/L)	215 (5.5)	96 (1.6)	192 (4)	120 (8.2)	200 (0)	127.5 (5)	223.2 (5.16)	142.5 (5)

a) SCR = Squaw Creek Reservoir; LG = Lake Granbury

b) Values indicate surface sample averages across all sampling stations. Standard deviations are in parenthesis.

TABLE 2.4-13 (Sheet 1 of 2)
FISH SPECIES IDENTIFIED IN SQUAW CREEK RESERVOIR

Common Name	Scientific Name	1981	1987	2007
Channel catfish	*Ictalurus punctatus*	X	X	X
Blue catfish	*Ictalurus furcatus*	X		X
Bluegill	*Lepomis macrochirus*	X	X	X
Common carp	*Cyprinus carpio*		X	X
Flathead catfish	*Pylodictis olivaris*			X
Freshwater drum	*Aplodinotus grunniens*		X	X
Gizzard shad	*Dorosoma cependianum*	X	X	X
Green sunfish	*Lepomis cyanellus*	X	X	X
Inland silverside	*Menidia beryllina*	X	X	
Largemouth bass	*Micropterus salmoides*	X	X	X
Threadfin shad	*Dorosoma petenense*		X	X
Blacktail shiner	*Notropis venustus*	X		
River carpsucker	*Carpiodes carpio*	X	X	
Black bullhead	*Ictalurus melas*	X	X	
Yellow bullhead	*Ictalurus natalis*	X	X	
Striped bass	*Morone saxatilis*	X		
Hybrid striper	*M. saxatilis X M. chrysops*	X	X	
Warmouth	*Lepomis gulosus*	X	X	
Longear sunfish	*Lepomis megalotis*	X	X	
Redear sunfish	*Lepomis microlophus*	X	X	
White crappie	*Pomoxis annularis*	X	X	
Walleye	*Stizostedion vitreum*	X	X	
White bass	*Marone chrysops*		X	
Smallmouth bass	*Micropterus dolomieu*		X	
Redhorse sucker	*Moxostoma carinatum*		X	
Bluntnose darter	*Etheostoma chlorosoma*		X	

TABLE 2.4-13 (Sheet 2 of 2)
FISH SPECIES IDENTIFIED IN SQUAW CREEK RESERVOIR

Common Name	Scientific Name	1981	1987	2007
Log perch	*Percina caprodes*		X	
Slough darter	*Etheostoma gracile*		X	
Golden shiner	*Notemigonus crysoleucas*		X	
Redbreast sunfish	*Lepomis auritus*		X	

TABLE 2.4-14 (Sheet 1 of 2)
FISH SPECIES IDENTIFIED IN LAKE GRANBURY

Common Name	Scientific Name	1981	1992	1998	2001	2005	2007
Channel catfish	*Ictalurus punctatus*	X	X	X	X	X	X
Blue catfish	*Ictalurus furcatus*			X			
Bluegill	*Lepomis macrochirus*	X	X	X	X	X	X
Common carp	*Cyprinus carpio*	X	X				X
Flathead catfish	*Pylodictis olivaris*	X	X	X			
Freshwater drum	*Aplodinotus grunniens*	X	X				X
Gizzard shad	*Dorosoma cependianum*	X	X		X	X	X
Green sunfish	*Lepomis cyanellus*	X		X	X	X	
Inland silverside	*Menidia beryllina*	X					
Largemouth bass	*Micropterus salmoides*	X	X	X	X	X	
Threadfin shad	*Dorosoma petenense*	X	X		X	X	
Blacktail shiner	*Notropis venustus*	X					
River carpsucker	*Carpiodes carpio*	X	X				
Black bullhead	*Ictalurus melas*	X					
Yellow bullhead	*Ictalurus natalis*	X					
Striped bass	*Morone saxatilis*	X	X	X	X	X	X
Hybrid striper	*M. saxatilis X M. chrysops*			X			
Warmouth	*Lepomis gulosus*	X	X	X	X	X	
Longear sunfish	*Lepomis megalotis*	X	X	X	X	X	X
Redear sunfish	*Lepomis microlophus*	X	X	X	X	X	
White crappie	*Pomoxis annularis*	X	X	X	X	X	X
Walleye	*Stizostedion vitreum*						
White bass	*Marone chrysops*	X	X	X	X	X	X
Log perch	*Percina caprodes*	X					
Golden shiner	*Notemigonus crysoleucas*	X					

TABLE 2.4-14 (Sheet 2 of 2)
FISH SPECIES IDENTIFIED IN LAKE GRANBURY

Common Name	Scientific Name	1981	1992	1998	2001	2005	2007
Redbreast sunfish	*Lepomis auritus*	X	X				
Spotted bass	*Micropterus punctulatus*	X	X	X	X	X	
Bullhead minnow	*Pimephales vigilax*	X					
Orangespotted sunfish	*Lepomis humilis*	X					
Longnose gar	*Lepisosteus osseus*	X	X				
Suckermouth minnow	*Phenacobius mirabilis*	X					
Smallmouth buffalo	*Ictiobus bubalus*	X	X				X
Lake chubsucker	*Erimyzon sucetta*		X				

TABLE 2.4-15
INVERTEBRATES IDENTIFIED IN SQUAW CREEK RESERVOIR, 2007

		Winter		Spring		Summer		Fall	
Order	Family	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count
Ephemoroptera	Caenidae	1	2	1	7				
	Baetidae			1	7			2	2
Tricoptera	Hydroptilidae	1	1						
	Hrdropsychidae	1	1						
	Leptoceridae			1	2				
Odonata	Coenagrionidae	2	3	4	4				
	Libellulidae					1	2	2	2
	Coenagrionidae							2	80
Hemiptera	Mesoveliidae	1	2					1	5
	Belastomatidae					1	3		
	Naucoridae							1	1
Diptera	Chironimidae	4	229	8	365	8	23	12	181
	Ceratopogonidae	1	2			3	4	2	1
	Tabanidae					1	1		
	Tipulidae					1	2		
	Stratiomyidae					1	3		
Physidae	Physella	1	39						
Amphipoda	Hyalellidae	1	5	1	46				
Coleoptera	Helophoridae			1	1				
	Hydrophilidae			1	2				
Annelida						1	2		
Pulmonata	Physidae							1	2
Decapoda	Xanthidae							1	2

TABLE 2.4-16
INVERTEBRATES IDENTIFIED IN LAKE GRANBURY, 2007 – 2008

		Spring, 2007		Summer, 2007		Fall, 2007		Winter, 2008	
Order	Family	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count
Diptera	Chironimidae	7	48	6	23	8	36	10	55
	Chaoboridae			1	150	1	68	1	243
	Simuliidae					1	0	1	100
Diplostraca	Daphniidae			1	1				
Annelida				1	2				
Tricoptera	Polycentropodidae					1	3	1	1
Odonata	Coenagrionidae					1	0		
Coleoptera	Elmidae					1	0	1	3
Ephemeroptera	Ephemeridae							1	1
Pulmonata	Ancylidae							1	1

TABLE 2.4-17
INVERTEBRATES IDENTIFIED IN THE BRAZOS RIVER, 2007 – 2008

		Spring, 2007		Summer, 2007		Fall, 2007		Winter, 2008	
Order	Family	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count	Number of Genera	Count
Ephemeroptera	Baetidae	1	1	3	143	3	6	1	3
	Tricorythidae	1	1			1	13	1	2
	Caenidae			1	78	1	253		
	Leptohyphidae			1	71				
	Heptogeniidae			1	3	1	12	1	5
	Leptophlebiidae			1	31	2	37	1	40
Tricoptera	Leptoceridae	1	1	2	2	1	5	1	2
	Hydropsychidae	1	2	2	473	2	574	1	86
	Hydroptilidae			1	1				
	Philopotamidae			1	9	1	9		
Odonata	Coenagrionidae	1	1	2	4	1	1	1	4
Diptera	Chaoboridae	1	2						
	Chironimidae	7	34	6	268	8	26	10	18
	Simuliidae			1	12	1	2000	1	100
	Ceratopogonidae			1	1				
	Psychodidae			1	1				
Hemiptera	Gerridae			1	1				
Coleoptera	Gyrinidae			1	4				
	Hydrophilidae			1	3				
	Elmidae			2	17	1	6	1	3
Decapoda	Xanthidae			1	1				
Lepidoptera	Pyralidae					2	3		
Pulmonata	Physidae							1	2
	Ancylidae							1	1

Appendix A

Scientific Names of Species Mentioned in

Section 2.4 - Ecology

Vegetation

Graminoids

Bermuda grass	*Cynodon dactylon*
Big Bluestem	*Andropogon gerardii*
Broadleaf Cattail	*Typha latifolia*
Buffalograss	*Buchloe dactyloides*
Bushy Bluestem	*Andropogon glomeratus*
Fescue	*Festuca arundinacea*
Hairy Grama	*Bouteloua hirsuta*
Hairy Tridens	*Erioneuron pilosum*
Little Bluestem	*Schizachyrium scoparium*
Purple Threeawn	*Aristida purpurea*
Sedges	*Carex* spp.
Silver Bluestem	*Bothriochloa saccharoides*
Sideoats Grama	*Bouteloua curtipendula*
Southern Cattail	*Typha domingensis*
Spikerush	*Eleocharis* sp.
Tall Dropseed	*Sporobolus compositus* var. *compositus*
Texas Grama	*Bouteloua rigidiseta*
Texas Wintergrass	*Nassela* (=*Stipa*) *leucotricha*
Threeawn	*Aristida* sp.
Tumble Windmill grass	*Chloris verticillata*

Tumblegrass	*Schedonnardus paniculatus*

<u>Forbs</u>

Black-eyed Susan	*Rudbeckia hirta*
Brazilian waterweed	*Egeria densa*
Broom Snakeweed	*Gutierrezia sarothrae*
Cut-leaf Germander	*Teucrium laciniatum*
Daisy Fleabane	*Erigeron* sp.
Giant reed	*Arundo donax*
Giant salvinia	*Salvinia molesta*
Hydrilla	*Hydrilla verticillata*
Indian Paintbrush	*Castilleja indivisa*
Liatris	*Liatris* sp.
Milkweed	*Asclepias* spp.
Prickly Pear Cactus	*Opuntia macrorhiza*
Ragweed	*Ambrosia* sp.
Rose Verbena	*Glandularia canadensis*
Rooseveltweed	*Bacharris neglecta*
Skullcap	*Scuttelaria* sp.
Spiderwort	*Tradenscantia* sp.
Texas Bluebonnet	*Lupinus texensis*
Texas Pricklypear	*Opuntia engelmannii* var. *lindheimeri*
Trailing Ratany	*Krameria lanceolata*
Water hyacinth	*Eichhornia crassipes*
Western Ragweed	*Ambrosia psilostachya*

Wild Carrot (Queen Anne's lace)	*Daucus carota*
Wooly Vervain	*Verbana stricta*
Yucca	*Yucca* sp.

<u>Trees & Shrubs</u>

Agarito	*Berberis trifoliata*
Ashe Juniper	*Juniperus ashei*
Blackjack Oak	*Quercus marilandica*
Black Willow	*Salix nigra*
Buckbrush	*Ceanothus cuneatus*
Buttonbush	*Cephalanthus occidentalis*
Cedar Elm	*Ulmus crassifolia*
Chittamwood	*Sideroxlyon lanuginosa*
Cottonwood	*Populus deltoides*
Elm	*Ulmus* sp.
Hackberry	*Celtis* sp.
Lemon Sumac	*Rhus aromatica*
Live Oak	*Quercus* ssp.
Mesquite	*Prosopis* ssp.
Mexican Buckeye	*Ungnadia speciosa*
Mexican Persimmon	*Diospyros texana*
Ponderosa Pine	*Pinus ponderosa*
Post Oak	*Quercus stellata*
Salt Cedar	*Tamarix chinensis*
Shin Oak	*Quercus harvardii*

Soapberry	*Sapindus saponaria* var. *drummondii*
Sumac	*Rhus* sp
Texas Ash	*Fraxinus texensis*
Texas Oak	*Quercus buckleyi*

Mammals

American Mink	*Mustela vison*
Badger	*Taxidea taxus*
Bear	*Ursus* sp.
Beaver	*Castor canadensis*
Black-tailed Jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Cotton Rat	*Sigmodon* ssp.
Coyote	*Canis latrans*
Deer Mouse	*Peromyscus* ssp.
Domestic Cat	*Felis domesticus*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Mole	*Scalopus aquaticus*
Feral Hog	*Sus scrofa*
Fox Squirrel	*Sciurus nigra*
Gopher	*Geomys* ssp.
Gray Fox	*Urocyon cinereoargenteus*
Long-tailed Weasel	*Mustela frenata*
Mink	*Neovison vison*
Muskrat	*Ondatra zibethicus*
Nine-banded Armadillo	*Dasypus novemcinctus*

Nutria	*Myocastor coypus*
Opossum	*Didelphis virginiana*
Otter (river otter)	*Lutra canadensis*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes vulpes*
Ringtail Cat	*Bassariscus astutus*
River Otter	*Lutra canadensis*
Spotted Skunk	*Spilogale* sp.
Squirrels	*Sciurus* spp.
Striped Skunk	*Mephitis mephitis*
Vole	*Microtus* sp.
White-tailed Deer	*Odocoileus virginianus*
Wolves (Historical)	*Canis* spp.

Birds

American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Peregrine Falcon	*Falco peregrines anatum*
American Robin	*Turdus migratorius*
Arctic Peregrine Falcon	*Falco peregrines tundrius*
Bald Eagle	*Haliaeetus leucocephalus*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	Megaceryle (=*Ceryle) alcyon*
Bewick’s Wren	*Thryomanes bewickii*
Black Vulture	*Coragyps atratus*

Black-capped Vireo	*Vireo atricapilla*
Black-crowned Night Heron	*Nycticorax nycticorax*
Blue jay	*Cyanocitta cristata*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Blue-winged Teal	*Anas discors*
Brown-headed Cowbird	*Molothrus ater*
Cattle Egret	*Bubulcus ibis*
Carolina Chickadee	*Parus carolinensis*
Carolina Wren	*Thryothorus ludovicianus*
Chipping Sparrow	*Spizella passerina*
Double Crested Cormorant	*Phalacrocorax auritus*
Duck	*Anatidae* sp.
Eared Grebe	*Podiceps nigricollis*
Eastern Bluebird	*Sialia sialis*
Eastern Phoebe	*Sayornis phoebe*
Eurasian Collared Dove	*Streptopelia decaocto*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Gallinule	*Porphyrio* sp.
Goose	*Branta* spp.
Golden-cheeked Warbler	*Dendroica chrysoparia*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Green Heron	*Butorides virescens*
Great-tailed Grackle	*Quiscalus mexicanus*
Greater Roadrunner	*Geococcyx califonrianus*

House Sparrow	*Passer domesticus*
Interior Least Tern	*Sterna antillarum athalassos*
Lark Sparrow	*Chondestes grammacus*
Lincoln’s Sparrow	*Melospiza lincolnii*
Loggerhead Shrike	*Lanius ludovicianus*
Killdeer	*Charadrius vociferus*
Mourning Dove	*Zenaida macroura*
Mountain Plover	*Chadarius montanus*
Neotropic Cormorant	*Phalacrocorax brasilianus*
Northern Bobwhite Quail	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Mockingbird	*Mimus polyglottos*
Orange-crowned Warbler	*Vermivora celata*
Osprey	*Pandion haliaetus*
Painted Bunting	*Passerina ciris*
Peregrine Falcon (American)	*Falco peregrinus anatum*
Peregrine falcon (arctic)	*Falco peregrinus tundrius*
Pigeon	*Columba livia*
Purple Martin	*Progne subis*
Rails	*Rallidae* spp.
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Dove	*Columba livia*
Ruby-crowned Kinglet	*Regulus calendula*

Ruby-throated Hummingbird	*Archilochus colubris*
Rufous-crowned Sparrow	*Aimophila ruficeps*
Savannah Sparrow	*Passerculus sandwichensis*
Scissortail Flycatcher	*Tyrannus forticatus*
Snowy Egret	*Egretta thula*
Spotted Sandpiper	*Actitis macularius*
Swainson's Thrush	*Catharus ustulatus*
Tufted Titmouse	*Parus bicolor*
Turkey Vulture	*Cathartes aura*
White-winged Dove	*Zenaida asiatica*
White-crowned Sparrow	*Zonotrichia albicollis*
White-eyed Vireo	*Vireo griseus*
Whooping Crane	*Grus americana*
Wild Turkey	*Meleagris gallopavo*
Wood Duck	*Aix sponsa*
Yellow-rumped Warbler	*Dendroica coronata*

Reptiles

American Alligator	*Alligator mississippiensis*
Brazos Water Snake	*Nerodia harteri harteri*
Brown Snake	*Storeria dekayi*
Bull Snake	*Pituophis catenifer sayi*
Coachwhip	*Masticophis flagellum*
Common Snapping Turtle	*Chelydra serpentina*
Copperhead	*Agkistrodon contortix*
Corn Snake	*Elaphe guttata guttata*

Diamondback Water Snake	*Nerodia rhombifera*
Eastern Collared lizard	*Crotaphytus collaris*
Eastern coral snake	Micrurus fulvius fulvius
Eastern hognose snake	*Heterondon platirhinos*
Eastern Racer	*Coluber constrictor*
Eastern Rat Snake	*Elaphe obsoleta*
Fence Lizard	*Sceloporus undulatus*
Five-lined Skink	*Eumeces fasciatus*
Flat-headed snake	*Tantilla gracilis*
Great Plains Skink	*Eumeces obsoletus*
Greater Earless Lizard	*Cophosaurus texanus*
Ground Skink	*Scincella lateralis*
Ground snake	*Sonora semiannulata*
Harter’s Water Snake	*Nerodia harteri*
Lined snake	*Tropidoclonion lineatum*
Long-nosed snake	*Rhinocheilus lecontei*
Mountain patch-nosed snake	*Salvadora grahamiae grahamiae*
Night snake	*Hypsiglena torquata*
Northern Prairie Skink	*Eumeces septentrionalis*
Ornate Box Turtle	*Terrapene ornata*
Plain-bellied Water Snake	*Nerodia erythrogaster*
Plains black-headed snake	*Tantilla nigriceps*
Pond Slider	*Trachemys scripta*
Ring-necked snake	*Diadophis punctatus*
River Cooter	*Pseudemys concinna*
Rough earth snake	*Virginia striatula*

Rough Green Snake	*Opheodrys aestivus*
Six-Lined Racerunner	*Cnemidophorus sexlineatus*
Slender glass lizard	*Phrynosoma cornutum*
Smooth Softshell Turtle	*Apalone muticus*
Spiny Softshell Turtle	*Trionyx spiniferus*
Texas blind snake	*Leptotyphlops dulcis*
Texas Horned Lizard	*Phrynosoma cornutum*
Texas Spiny Lizard	*Sceloporus olivaceus*
Texas Spotted Whiptail	*Cnemidophorus gularis gularis*
Timber (Canebrake) Rattlesnake	*Crotalus horridus*
Western Ribbon Snake	*Thamnophis proximus*
Western Diamondback Rattlesnake	*Crotalus atrox*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Yellow Mud Turtle	*Kinosternon flavescens*

Amphibians

Bullfrog	*Rana catesbeiana*
Cricket Frog	*Acris* ssp.
Couch’s Spadefoot	*Scaphiopus couchi*
Gray Tree Frog	*Hyla versicolor*
Great Plains Narrowmouth Toad	*Gastrophryne olivacea*
Green Toad	*Bufo debilis*
Gulf Coast Toad	*Bufo valliceps*
Plains Leopard Frog	*Rana blairi*

Red-spotted Toad	*Bufo speciosus*
Rio Grande Leopard Frog	*Rana berlandieri*
Smallmouth Salamander	*Ambystoma texanum*
Southern Leopard Frog	*Rana sphenocephala (=utriculata)*
Spotted Chorus Frog	*Pseudacris clarki*
Texas Toad	*Bufo speciosus*
Woodhouse's Toad	*Bufo woodhousii*

Insects

Bee	*Aphis* sp.
Grasshopper	*Melanoplus differentialis*
Harvester Ant	*Pogonomyrmex* sp.
Red Fire Ant	*Solenopsis invicta*
Wasp	*Polistes* sp

Fish

Black Bullhead	*Ictalurus melas*
Bluegill Sunfish	*Lepomis macrochirus*
Channel Catfish	*Ictalurus punctatus*
Common Carp	*Cyprinus carpio*
Drum	*Aplodinotus grunniens*
Green Sunfish	*Lepomis cyanellus*
Hybrid Striped Bass	*Morone saxatilis x M. chrysops*
Largemouth Bass	*Micropterus salmoides*
Long-eared Sunfish	*Lepomis megalotis*
Sharpnose Shiner	*Notropis oxyrhynchus*

Smallmouth Bass	*Micropterus dolomieu*
Spotted Bass	*Lepomis micropholus*
Threadfin Shad	*Dorosoma petenense*
Walleye	*Stizostedion vitreum*
Yellow Bullhead	*Ictalurus natalis*

Mussel

Pistolgrip	*Tritogonia verrucosa*

2.5 SOCIOECONOMICS

This section presents the socioeconomic resources that have the potential to be affected by the construction, operation, and decommissioning of CPNPP Units 3 and 4. CPNPP Units 3 and 4 are built on the existing CPNPP site. The section is divided into five subsections:

- Demography
- Community characteristics
- Historic properties
- Environmental justice
- Noise

The subsection on environmental justice details racial and ethnic characteristics, and identifies low-income populations. These subsections include discussions of spatial (e.g. regional, vicinity, and site) and temporal (e.g. 10-year increments of population growth) considerations where appropriate. Figure 2.5-1 shows the relationship between the geographies used in the document.

2.5.1 DEMOGRAPHY

Demographic information is presented in three major sections: population distribution, demographic characteristics, and transient populations.

2.5.1.1 Population Distribution

The CPNPP region is defined as the area within 80 km (50 mi) of the CPNPP Units 3 and 4 center point. The center point is defined as the midpoint between CPNPP Units 3 and 4. Population distribution within the region is estimated based upon the most recent U.S. Census Bureau decennial census data (US Census 2000e). Figures 2.5-2 and 2.5-3 show the population distribution in the region estimated in nine concentric circles at 2, 4, 6, 8, 10, 16, 40, 60, and 80 km (1.24, 2.5, 3.7, 5, 6.2, 10, 25, 37, and 50 mi) from the center point between the two reactors. Population data are further divided into 16 compass directions, with each sector comprising 22.5 degrees of the circle resulting in a radial grid as defined in NUREG-1555. Population sectors from 0 – 16 km (10 mi) are shown in Figure 2.5-2 and 16 (10 mi) – 80 km (50 mi) in Figure 2.5-3. These figures display area-weighted 2007 population estimates.

2.5.1.1.1 Population Projections

Tables 2.5-1 and 2.5-2 provide population projections for 2007 followed by 10-year increments to 40 years beyond the estimated CPNPP start-up date in 2016. Projections were derived from county estimates that were based on the cohort-component method (TSDC 2006).

Population projection for the years 2007, 2016, 2026, 2036, 2046, and 2056 are estimated for each sector using the following methodology:

1. Using linear and polynomial regression, an equation is derived for each county. This equation is then used in conjunction with the 2000 county level census data to produce a county growth ratio set for each projected year.

2. Each set is then weighted by area into sectors and summed.

3. The 2000 Census block level data are then sorted into the radial grid, weighted by area, and summed.

4. The block level values for each sector are multiplied by their projection ratio, described in Step 1, to produce the final population sector tables (Tables 2.5-1 and 2.5-2) (US Census 2000e).

For transient population data that corresponds by sector, Table 2.5-3, Table 2.5-4, and Subsection 2.5.1.3.

2.5.1.1.2 Population Data by Political Jurisdiction

Figure 2.5-3 shows the CPNPP region, radial grid, and county boundaries. Table 2.5-5 identifies the counties partially or wholly contained within the CPNPP region, all of which are located in the state of Texas. The CPNPP site is located in Hood and Somervell counties. Fort Worth is the largest city within 80 km (50 mi) with a 2006 estimated population of 653,320 (US Census 2006). Smaller cities within the 80-km (50-mi) region include North Richland Hills with a 2006 estimated population of 62,306; Mansfield with a population of 41,564; Haltom City with a population of 39,987; Burleson with a population of 31,660; Cleburne with a population of 29,689; Watauga with a population of 23,685; Weatherford with a population of 24,630; and Benbrook with a population of 22,307. Several cities have 2006 estimated populations between 10,000 and 20,000. These include Azle, Forest Hill, Mineral Wells, Saginaw, Stephenville, and White Settlement. Many other small towns, cities, and urban areas with populations less than 10,000 are distributed within the 80-km (50-mi) region (US Census 2000c), (US Census 2006). Table 2.5-6 lists regional municipalities and their populations according to the 2000 Census.

2.5.1.2 Demographic Characteristics of the Region

Based on the characterization technique used in the “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” 1996 (NUREG-1437), the CPNPP site is located within a medium population area, as described below. As discussed in NUREG 1437, this categorization of the site is useful for conducting the socioeconomic analysis discussed later in this report.

According to NUREG-1437, population categories are defined by two factors: “sparseness” and “proximity.” “Sparseness” describes population density and city size within 32 km (20 mi) of a site as follows:

Demographic Categories Based on Sparseness Category:

Most sparse	1	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4	Greater than or equal to 120 persons per square mile within 20 miles

Source: NUREG-1437

“Proximity” describes population density and city size within 80 km (50 mi) as follows:

Demographic Categories Based on Proximity Category:

Not in close proximity	1	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4	Greater than or equal to 190 persons per square mile within 50 miles

Source: NUREG-1437

NUREG-1437 then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix:

		1	2	3	4
Sparseness	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area

Medium Population Area

High Population Area

Source: NUREG-1437

The 2007 projected census data and GIS software (ESRI®) were used to characterize the population within the region of CPNPP.

Based on the 2007 projected information, 63,108 people live within 20 mi of the CPNPP site resulting in a population density of 50 persons per square mile or Category 2 sparseness (40 – 60 persons per square mile and no community with 25,000 or more persons within 20 miles).

Based on the 2007 projected information, approximately 1,538,761 people live within the CPNPP region resulting in a population density of 196 persons per square mile or Category 4 proximity (greater than or equal to 190 persons per square mile within 50 mi). Therefore, with a Category 2 sparseness and Category 4 proximity, the CPNPP site is located in a medium population area.

Distributions of the population in the CPNPP vicinity and region by age and sex based on U.S. Census Bureau 2000 Summary File 1 (SF 1) block level data are compared to state numbers in Table 2.5-7. Racial, ethnic, and low-income populations are discussed in detail in Subsection 2.5.4. Transient populations are addressed in Subsection 2.5.1.3 and migrant populations are discussed in Subsection 2.5.4.5. The emergency plan addresses the population distribution in the low population zone (LPZ) and the emergency planning zone (EPZ). Subsection 2.5.4 addresses environmental justice in the 16-km (10-mi) radius, the LPZ, and the region.

2.5.1.3 Transient Populations

Transients within 0 – 80 km (50 mi) of the CPNPP center point include people attending special events, visitors to state parks, and attendees of major tourist attractions (e.g. museums, aquariums, theme parks, retail outlet centers). These populations are not typically within the census data for permanent population. Assessing or projecting the maximum capacity of outdoor recreational areas is not possible because the majority of these facilities, as outdoor spaces, do not have a maximum capacity.

Transient population data were gathered through personal communications with businesses, companies, and local chambers of commerce within the region. This method for collecting transient data provides a more accurate accounting of people visiting the area and a more precise location of transient visitors than using county estimates weighted over a sector area. Contributors to transient population are shown in Table 2.5-8. The locations of contributors listed in Table 2.5-8 are shown in Figure 2.5-4. The peak transient population is derived from summing maximum one-day transient counts (if known) with daily totals derived from the annual total to obtain the peak transient count for any given day.

Transient population data per sector were summed to develop transient population projections. The sum was multiplied by the sector growth ratio derived from the county growth ratios described above for each year. Because the method for collecting transient data provides point locations, some sectors have a zero value. This result is because there are no countable transient contributors in the zero value sectors. Table 2.5-4 illustrates the projected transient population for each sector and projections for 2007, 2016, 2026, 2036, 2046, and 2056 for the non-zero sectors. The estimated start-up date for CPNPP Unit 3 is 2016 while the estimated start-up date for CPNPP Unit 4 is 2017. The projections were carried out to 40 years past the start-up date. The sectors that have zero values are not illustrated in the table.

There are numerous facilities in the vicinity that host outdoor activities. These include the Texas Amphitheater, Oakdale Park, Tres Rios River Ranch, and Glen Lake Camp and Retreat Center. The Texas Amphitheater hosts a musical drama called “The Promise” every fall that draws over 45,000 visitors in September and October, resulting in an annual total of 60,000 visitors (Glen Rose Expo 2006), (Somervell County 2006). Oakdale Park hosts events such as the Texas State Mountain and Hammer Dulcimer Festival every May, the Fall Woodcarving Show and Sale in October, and monthly Blue Jam Sessions during the winter, resulting in nearly 200,000 visitors each year (Oakdale Park 2007), (Somervell County 2006). Tres Rios River Ranch draws 50,000 visitors a year, with the most notable event being the Tommy Alverson Family Gathering in the first week of October (Somervell County 2006), (Tres Rios River Ranch 2007). The Glen Lake Camp and Retreat Center is located to the southeast and hosts various retreats, summer camps, and events (Glen Lake 2007).

Four golf courses are located within 16 km (10 mi) of the CPNPP site: Squaw Valley Golf Course, Pecan Plantation Country Club, Nutcracker Golf Club, and Harbor Lakes Golf Course. Nutcracker Golf Club is closed to the public, so visitor numbers are not available, but approximately 103,000 rounds of golf are played at the other three courses each year.

Two lakes are located in the vicinity of the CPNPP site: SCR and Lake Granbury. SCR is owned by Luminant Generation Company LLC (Luminant) and is closed to the public. Lake Granbury has seven public use areas that provide opportunities for swimming, picnics, and camping (Brazos River Authority 2006b). Lake Granbury is also popular with boaters, with a peak season average of 290 boaters daily. Additionally, the Granbury Riverboat offers seven weekly cruises on the lake with peak attendance of up to 150 passengers per cruise (Granbury Riverboat 2007).

Excluding the Fort Worth Metropolitan area, the bulk of transient population in the region comes from parks, camping, and lodging. There are five parks run by the Texas Parks and Wildlife Department located within the 50-mi radius: Cleburne State Park, Dinosaur Valley State Park, Lake Mineral Wells State Park, Lake Whitney State Park, and Meridian State Park. These five parks account for over 643,000 visitors annually. Additionally, Acton State Historical Park is also located in the region, but no visitor numbers are kept for the site. Peak season for the parks extends from March through November. Two resorts are located in the 50-mi radius: Rough Creek Lodge and Resort and Riverbend Retreat Center. Rough Creek Lodge and Resort caters to both vacation and corporate visitors, and attracts approximately 20,000 people annually (Rough Creek Lodge and Resort 2007). Riverbend Retreat Center focuses on retreats and youth camps, drawing close to 23,000 visitors each year (Somervell County 2006) (Riverbend Retreat Center 2007).

Hunting and fishing are important recreational pastimes in the region. The number of licenses issued in the region for the 2006 license year was 33,086 for hunting; 60,657 for fishing; and 38,972 for combined hunting and fishing.

The City of Fort Worth lies on the northeast periphery of the 50-mi radius. There are several large attractions and events in the metropolitan area, which combine to host over 10 million visitors per year. The Will Rogers Memorial Center, consisting of the Will Rogers Coliseum, Auditorium, Equestrian Center, and Amon G. Carter Exhibits Building, accounts for a number of these visitors with 2.4 million visitors per year. The Fort Worth Southwest Exposition and Livestock Show attracts 960,000 of those visitors and is held each spring at the Will Rogers Memorial Center. The Fort Worth Convention Center is home to the Fort Worth Flyers Basketball team (not operating from 2007 to 2008), and numerous events and conferences every year, with a total of 1.1 million visitors per year. Two other prominent attractions are the Fort Worth Museum of Science and History and the Fort Worth Zoo, each of which draws close to one million visitors every year. Other attractions include Billy Bob’s Texas, which hosts rodeos and performances; the Amon Carter and Kimball Museums; the Fort Worth Botanic Gardens; the Bass Performance Hall, and the Bureau of Engraving and Printing’s Western Currency Facility.

Three passenger train routes pass through the region of CPNPP: Amtrak’s Texas Eagle route passes through Fort Worth and Cleburne connecting Chicago to San Antonio, while Amtrak’s Heartland Flyer travels between Fort Worth and Oklahoma City (Amtrak 2007). The Fort Worth and Cleburne stations have a combined annual usage of just under 83,600 people (Amtrak 2006). In addition, the Trinity Railway Express connects downtown Fort Worth to Dallas and served 2.16 million passengers in fiscal year 2004 (TRE 2004).

Public airports in the region include Granbury Municipal, Cleburne Municipal and Fort Worth Meacham international. No commercial service is available at these airports, so passenger counts are not available. Granbury Municipal Airport had an average of 73 operations per day for the 12-month period ending May 12, 2007, with 67 percent of these local general aviation and 33 percent transient general aviation (AirNav 2008a). Cleburne Municipal Airport had an average of 90 operations per day for the 12-month period ending May 15, 2007, with 64 percent of these local general aviation and 36 percent transient general aviation (AirNav 2008b). Fort Worth Meacham International Airport had an average of 271 operations per day for the 12-month period ending July 31, 2007, with 58 percent of these transient general aviation, 38 percent local general aviation, 4 percent air taxi, and 1 percent military (AirNav 2008c).

2.5.1.3.1 Special Transient Populations

Military, correctional, and medical facilities as well as schools and migrant workers are considered special transient populations and are not counted in the total transient population. Military and correctional facilities are discussed below. Hospitals and specialized health facilities are discussed in Subsection 2.5.2.7. Schools, including colleges and universities are discussed in Subsection 2.5.2.8 while migrant workers are discussed in Subsection 2.5.4.5.

There is one military facility located within 50 mi of the center point. The Naval Air Station (NAS) Fort Worth, Joint Reserve Base (JRB) at Carswell is located approximately 36 mi northeast of the site. The NAS employs more than 1500 people as of 2006. No other operating military facilities are within the 50-mi radius.

There are two federal correctional facilities within the 50-mi radius (BOP 2007). The Federal Correctional Institution Fort Worth and the Federal Medical Center Carswell are both located in Fort Worth. There are no state correctional facilities within the CPNPP region (TDCJ 2007) There are two privately owned prisons in the region: The Mineral Wells Pre-Parole Transfer Facility and the Estes Private Prison (TDCJ 2005a)(TDCJ 2005b). The Mineral Wells facility has 314 employees and 2106 inmates while the Estes facility has 219 employees and 998 inmates.

There are numerous hotels, motels, and bed and breakfasts within the 50-mi radius. Most are located in the populated areas such as Granbury, Burleson, Cleburne, Weatherford, and Fort Worth. Such populated areas also host numerous special events throughout the year. Table 2.5-9 shows events with an annual attendance of more than 5000 people. Recreational facilities are described in Subsection 2.5.2.

2.5.1.4 Total Permanent and Transient Populations

The annual total transient population within the CPNPP region totals approximately 10.5 million people. For an average day, the peak transient population for the CPNPP region in 2007 is projected to be approximately 352,219. Peak transient numbers were calculated by summing the highest known one-day totals for each attraction or transient location. The estimated permanent population for 2007 for the CPNPP region is 1,538,761 people (US Census 2000e). The total population within the CPNPP region is calculated to be 1,890,980.

2.5.2 COMMUNITY CHARACTERISTICS

This subsection addresses the following community characteristics for the CPNPP region where applicable: economy, transportation, taxation and political structure, land use, aesthetics and recreation, housing, community infrastructure (e.g. social services and public facilities, water and sewer facilities, public safety, and health), and education. Distinctive communities (based on state characteristics, Native American tribe, or regional characteristics) are discussed in detail in Subsections 2.5.3 and 2.5.4. Historic districts and cultural resources are presented in Subsection 2.5.3. Information about tourist attractions is discussed in Subsection 2.5.1.

2.5.2.1 Economy

The economic region includes those counties most likely to be affected by the construction and operation of CPNPP Units 3 and 4. Based on the distribution of the workforce, those counties include Bosque, Erath, Hood, Johnson, Somervell, and Tarrant (Table 5.8-2). The local economic centers near CPNPP are Glen Rose in Somervell County and Granbury in Hood County. The largest economic center within the CPNPP region is Fort Worth in Tarrant County. Table 2.5-10 details total employment and employment levels by industrial sector for the economic region.

In Bosque County in 2006, the sectors with the highest employment levels were government and government industries (15.2 percent) and retail trade (9.6 percent). The industry with the largest growth from 2001 – 2006 was real estate with an annual increase of 10.3 percent. The industry with the largest decrease was transporting and warehouse (-5.0 percent annually). Total employment in the county increased by 1.1 percent annually (BEA 2006a).

In Erath County in 2006, the government and government enterprises sector employed the largest amount of people (16.2 percent of employment) followed by the retail trade sector (10.6 percent). The industry with the largest growth from 2001 - 2006 was transporting and warehousing, with an annual increase of 18.1 percent. The industry with the largest decline was manufacturing (-4.8 percent annually). Total employment in the county increased by 1.7 percent annually (BEA 2006b).

In Hood County in 2006, the sectors with the largest employment were retail trade (15.0 percent) and government and government enterprises (12.8 percent). The industry with the largest growth was mining, with an increase of 44.8 percent annual from 2001 – 2006. A large portion of the increase in mining is due to the presence of the Barnett Shale in the county, and mining employment is expected to continue to increase until at least 2015 (Business Wire 2007). The industry with the largest decline was educational services with a decrease of 0.2 percent annually. Total employment in the county increased by 3.5 percent annually (BEA 2006c).

In Johnson County in 2006, the retail trade sector employed the largest amount of people (13.5 percent of employment) followed by the government and government enterprises sector (11.2 percent) and the construction sector (11.1 percent). The industry with the largest growth from 2001 – 2006 was transporting and warehousing, with an annual increase of 13.3 percent. The industry with the largest decline was manufacturing (-2.8 percent annually). Total employment in the county increased by 3.6 percent annually (BEA 2006d).

In Somervell County in 2006, the government and government enterprises sector employed the largest amount of people (14.2 percent of employment) followed by the retail trade sector (7.3 percent). The industry with the largest growth from 2001 – 2006 was real estate, with an annual increase of 11.7 percent. The industry with the largest decline was manufacturing (-5.2 percent). Total employment in the county decreased by 0.5 percent annually (BEA 2006e).

In Tarrant County in 2006, the sectors with the largest employment were retail trade (11.6 percent) and government and government enterprises (10.6 percent). The industry with the largest growth was real estate, with an increase of 7.0 percent annual from 2001 – 2006. The industry with the largest decline was information with a decrease of 2.2 percent annually. Total employment in the county increased by 1.8 percent annually (BEA 2006g).

The Barnett Shale is a fertile area of natural gas production located in northern Texas. In 2007, the Barnett Shale contributed $5 billion to the 14 counties atop the region, including Hood, Erath, Johnson, and Tarrant among others. An estimated 55,000 permanent jobs have been created. A study commissioned by the Fort Worth Chamber of Commerce estimates that "the Barnett Shale would be responsible for an average of 108,000 jobs and $10.4 billion in output each year through 2015." An estimated $3 billion in retail sales are generated per year due to the Barnett Shale, while in 2006 revenue to local governments including schools was approximately $227.7 million. According to the study, the economic impact of the Barnett Shale expanded by 50 percent from 2006 to 2007, with peak productivity forecast in 2014 or 2015 (Business Wire 2007).

The Barnett Shale has contributed to lower unemployment numbers in the economic region. Unemployment numbers of 4 percent or below are considered full employment by the Texas Workforce Commission. Current unemployment levels in the economic region are at 5.0 percent. Competition for workers, especially those with technical skills, has reduced the available workers for projects such as CPNPP Units 3 and 4 in the economic region.

The largest employer in Hood County is Granbury Independent School District with 1230 employees. Two retail centers are the next largest: Wal-Mart Supercenter (400 employees) and Lowe's Home Improvement (250 employees). Lake Granbury Medical Center also employs 250 people. Table 2.5-11 lists the top employers in Hood County. The largest employer in Somervell County is Luminant with 1601 – 1801 employees, followed by the Glen Rose School District with 292 employees. The next largest is The Glen Rose Medical Center with 280 employees. Table 2.5-12 shows the top employers in Somervell County.

In 2006, a total of 871,725 people were employed in the CPNPP economic region. The total labor force in the economic region is 906,123 people. From 2001 to 2006, the number of employed people in the economic region increased 1.2 percent annually. The number of people employed increased the most in Hood County (2.3 percent annually) while the number of employed people increased the least in Bosque County (0.9 percent annually). During the same period employment in Texas increased 1.5 percent annually from 9,955,982 to 10,715,616 .

In 2006, a total of 34,398 were unemployed in the economic region while 451,180 were unemployed in the state of Texas. The county with the highest unemployment rate in 2006 was Somervell County with 6.0 percent. The county with the smallest unemployment rate was Erath County with 4.0 percent. The economic region had an unemployment rate of 5.0 percent in 2006 while the state of Texas had an unemployment rate of 5.3 percent . Table 2.5-13 shows employment trends for Bosque, Erath, Hood, Johnson, Somervell, and Tarrant counties.

Table 2.5-14 shows income distribution by household for the four communities closest to CPNPP. At the county level, per capita income in the region ranges from a high of $43,520 in Dallas County to a low of $25,377 in Jack County in 2006. The Texas average per capita income in 2006 was $35,166. The state's per capita income grew at an annual rate of 5.9 percent (BEA 2006g). Table 2.5-15 shows personal income trends for Hood, Somervell, Tarrant, Bosque, Erath, and Johnson counties.

The heavy construction workforce data were analyzed by Workforce Development Area (WDA). The North Central WDA consists of Collin, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwell, Somervell, and Wise counties. Of these counties, eight are located partially or entirely within the region. The North Central WDA had 6200 employed in heavy and civil engineering construction in 2002. By 2012, this number is projected to increase 19.4 percent or 1200 people. The Tarrant WDA consists solely of Tarrant County. The Tarrant WDA had 5600 people employed in heavy and civil engineering construction in 2002. This number is projected to increase 13.4 percent or 650 people by 2012 (TWC 2002).

Table 4.4-1 shows the type of skilled craftsmen needed for the construction of CPNPP Units 3 and 4. Table 4.4-3 shows the number of craftsmen with those skills in the North Central and Tarrant WDAs. The construction labor force is discussed in Subsection 4.4.2.1.

During the peak phase of construction for CPNPP Units 3 and 4, up to 4953 workers are estimated to be required to complete the facility. In addition to the 1000 operation workers for CPNPP Units 1 and 2, an estimated 494 additional operation workers are needed for the new units. The number of operation workers is discussed more fully in Subsection 5.8.2.1.

2.5.2.2 Transportation

The CPNPP region is accessible by a transportation network of farm to market roads, federal and state highways, and railway, as well as a public airport. The Paluxy and Brazos Rivers are near the site, but there is no access to CPNPP by water-born transportation methods. Due to the predominantly rural setting and small sizes of the cities present near the site, most traffic is by either personal vehicle or over the road tractor/trailer transport. The transportation analysis focuses primarily on roads near the plant in Hood and Somervell counties. Figure 2.5-5 illustrates the road and highway system of Hood and Somervell counties, while Figure 2.5-6 charts the location of airports and rail systems in the region.

Public transit in Hood and Somervell Counties is limited to bus service, provided by The Transit System (TTS). TTS is a rural public transportation system but also provides travel to the Fort Worth area (SCDC 2007).

2.5.2.2.1 Roads

U.S. Highway 67 (US 67) is the only federal highway in Somervell County. It is located to the south of the site and runs from northeast to southwest through the City of Glen Rose. The only federal highway in Hood County is US 377, a four-lane divided highway, which also runs northeast to southwest and passes through Granbury. Texas State Highway 144 (SH144) passes to the east of the site and connects US 67 to US 377. Numerous farm-to-market (FM) roads traverse the county, providing rural access to the larger populated areas. FM 56 provides the only access to the CPNPP site. FM 56 is a two-lane highway that runs from north to south, connecting US 377 at Tolar to US 67 at Glen Rose. Plant workers are expected to commute, because there are no provisions for housing at the CPNPP site.

For the plant workers who live in Hood County, FM 56 south from Tolar or FM 51, a two-lane highway, southwest from Granbury to FM 56 provides access to CPNPP. For workers in Somervell County, FM 56 north from Glen Rose provides access to the site. For those workers and staff who live outside Hood and Somervell counties, an adequate road network is already present to allow those workers to commute to the CPNPP site. An example of this network is

US 377, which connects Fort Worth to Granbury. The impacts of construction on local roads are discussed in Subsection 4.4.1.3 while the impacts of operations on transportation are discussed in Subsection 5.8.1.3.

2.5.2.2.2 Road Conditions and Mileage

Both Hood and Somervell have hundreds of miles of public roadways. In Hood County, there is a total of 667 mi of roads while Somervell County has 257 mi of roads. Hood and Somervell counties' road systems are comprised of approximately 175 mi and 92 mi of state maintained roads, respectively. Also, in Hood County, there are 430 mi of county maintained roads; 24 mi of these roads are unpaved. In Somervell County, there are 147 mi of county maintained roads, none of which are listed as unpaved. Interstate 20 (I-20) is the closest interstate highway, is roughly 45 mi north of CPNPP, and travels west from Fort Worth through Weatherford.

According to local officials, the roads in Hood and Somervell counties are in good condition and well-maintained. In particular, US 67, FM 56, and SH 144 are in good repair, and there are no plans to make improvements on those roads in the next few years.

2.5.2.2.3 Traffic Conditions

The roadways in Hood and Somervell counties are best described as primarily rural, with some urban roadways in and near the major population centers of each county. Vehicle volume on roads is obtained from estimated Annual Average Daily Traffic (AADT) counts from the Texas Department of Transportation (TxDOT). These traffic counts were last revised in 2007. TxDOT uses AADT counts, traffic volume data, speed of traffic, time of travel, and budget restraints to determine the need for roadway expansion.

According to AADT counts in 2007, FM 56 has a daily average traffic count of 3500 just south of the plant entrance between mile markers 310 and 312. The traffic count heading south on FM 56 from FM 51 is 8500 vehicles between mile markers 304 and 306. For workers heading north from Glen Rose on FM 56, the traffic count is 5000 just north of the city between mile markers 314 and 316. Those travelling south from Granbury on FM 51 have a traffic count of 6000 just south of US 377, between mile markers 320 and 322. This decreases to 3300 just before FM 56, between mile markers 328 and 330. For workers traveling south on FM 56 from Tolar, the traffic count is 4400 between mile markers 298 and 300 increasing to 4700 just before FM 51, between mile markers 302 and 304 (TxDOT 2007).

For workers coming from Cleburne in Johnson County, the traffic count just west of the city on US 67 is 26,000 vehicles between mile markers 458 and 460. This decreases to 10,600 vehicles just east of Glen Rose between mile markers 474 and 476. The traffic counts increase through the city to 13,400 vehicles just before the turn for FM 56, between mile markers 476 and 478 (TxDOT 2007).

For workers traveling from Stephenville in Erath County, the traffic count just east of the city on US 67 is 5600 vehicles between mile markers 506 and 508, while the traffic count on FM 205 between mile markers 508 and 510 is 1750 vehicles. The traffic count on US 67 increased to 6500 just before the city of Glen Rose, between mile markers 478 and 480. The number of vehicles on FM 205 decreases to 360 before the junction with FM 51 between mile markers 526 and 528 (TxDOT 2007).

For workers traveling from Fort Worth in Tarrant County, the traffic count on US 377 just west of Fort Worth between mile markers 310 and 312 is 25,000 vehicles. This decreases to 22,000 between mile markers 328 and 330, and then increases to 34,000 vehicles before the junction with FM 51 between mile markers 334 and 336 (TxDOT 2007).

For workers traveling north from Walnut Springs in Bosque County, the traffic count on SH 144 just north of the city is 2000 vehicles between mile markers 318 and 320. The traffic count increases to 3100 vehicles just south of Glen Rose between mile markers 308 and 310 (TxDOT 2007).

No specific capacities are known for the highways in Hood and Somervell counties. FM 51 and FM 56 have a LOSA, meaning there are no traffic delays. Local officials have no concern for congestion along FM 56, and there are no current plans to improve the road. Local roads are monitored for needed maintenance and improvements, which are performed as the budget allows. Traffic due to oil and gas drilling in the area has leveled off, if not decreased, in recent years. It is estimated that by the start of construction additional vehicles due to oil and gas are not an issue.

2.5.2.2.4 Road Modifications

In Hood County, TxDOT has approved a contract for $4,568,333 to add a hot mix overlay to the road surface and shoulders of US 377. This overlay does not add any length to the road system; the only modification this produces is a new surface on the existing roads. In Somervell County, TxDOT has on record a planned bridge replacement on CR 312 at Squaw Creek. Two improvement projects are planned for US 377. However, both projects are in the planning stages and have not received funding. Typically such projects take years to be implemented. The first project affects US 377 west of Granbury through Tolar to the Erath County line. The highway is currently a two-lane highway. Plans are to make it a four-lane divided highway. The second project involves US 377 east of Granbury from SH 144 to FM 167. The highway is currently a five lane highway (four lanes with a turn lane in between). The plan is to expand it to a six-lane highway (four lanes with two designated turn lanes).

Two recently completed projects include expanding SH 144 to a four-lane divided highway and widening the bridge on US 67 that crosses the Brazos River. There are no plans for modification or expansion of FM 56.

2.5.2.2.5 Rails

Figure 2.5-6 shows railways within the CPNPP region. The Ft. Worth Western Railroad Company owns and operates a railroad line that runs through the City of Tolar approximately 9.5 mi northwest of CPNPP. This line covers the distance between Fort Worth and Brownwood. Amtrak offers no routes along this railway to the public (Amtrak 2007).

An average of two trains per day use this route traveling at speeds up to 40 mph. The railroad has a 50-ft ROW. Four to five cars of hazardous materials from various sources are transported on the main line each month.

2.5.2.2.6 Waterways

The only waterway near CPNPP is SCR, which is not accessible by the public. There is no commercial or recreational traffic on SCR.

2.5.2.2.7 Airports

The largest public airports within the region of CPNPP are shown in Figure 2.5-6. Within the region, there are 19 public airports, 102 private airstrips, 1 military airport, and 42 heliports. All of the airports are minor and do not generate significant commercial activity (AirNav 2007). The closest public airport to the site is Granbury Municipal Airport. Granbury Municipal Airport is located approximately 10 mi north of CPNPP in the City of Granbury with an asphalt runway length of 3603 ft. The airport has 82 single-engine airplanes, and 6 multi-engine airplanes, with 67 percent of the traffic classified as local general aviation and the other 33 percent classified as transient general aviation. On average, there are 73 aircraft operations per day. Besides general aviation, on occasion parachute jumping activity occurs over the field (AirNav 2008a).

2.5.2.3 Taxes and Political Structure

The following subsection discuss how state and local tax are collected and paid as well as political structures that are in place.

2.5.2.3.1 Taxes

The tax structure for Texas is found in Titles 1 through 3 of the Texas Code of Laws 1979 and its revisions: Title 1 deals with property taxes, Title 2 deals with state taxation, and Title 3 deals with local taxation. Expectations are that the cities and counties in the economic region are the tax districts most directly affected by the construction and operation of CPNPP Units 3 and 4.

The construction workers are expected to be paid wages based on their crafts. Table 4.4-1 shows the distribution of construction workers by craft. Table 2.5-28 shows the hourly wages by craft based on 2007 wages in the state of Texas. The highest paid craft was boilermakers while the lowest paid craft was construction laborers (BLS 2007). The operations workers are expected to be paid wages based on their specialties. Table 2.5-29 shows the annual salaries of operation workers based on national average wages in 2007 (CASEC 2007). While there is no state income tax, these wages contribute to spending in the economic region, which increases sales and use tax revenues.

The state of Texas has no personal or corporate income taxes. There is a corporate franchise tax that has a component based on corporate earned surplus. In 2008, however, the margin tax replaces the franchise tax. Under this tax, a company owes one percent of gross receipts less compensation or the costs of goods sold. The rate is reduced to 0.5 percent for retailers and wholesalers, while sole proprietorships, general partnerships, and businesses with total revenues of under $300,000 are exempt (The Greater Austin Chamber of Commerce 2006).

Sales and use tax is imposed on all retail sales, leases and rental of goods, and taxable services. The state tax rate is 6.25 percent. Local agencies can add an additional 0.25 – 2.0 percent, with the state tax rate plus local tax rate not to exceed 8.25 percent (Combs 2007). Groceries and both prescription and non-prescription drugs are exempt from sales tax. Bosque, Erath, and Hood counties impose a county sales and use tax of 0.5 percent. Johnson, Somervell, and Tarrant counties do not charge a sales and use tax. Cleburne, Granbury, Stephenville, and Tolar tax at a rate of 1.5 percent, while Glen Rose has a sales and use tax of 2 percent. The city of Fort Worth has a tax rate of 1 percent while the Fort Worth MTA and the Fort Worth Crime Control SPD Tax each charge 0.5 percent (Combs 2009). By combining county and city taxes, it can be seen that most populated areas have tax rates at the maximum 8.25 percent.

Texas has no state property tax. Property taxes are levied by counties, cities, school districts, and special districts (junior colleges, hospitals, road districts, and others).

In 2007, Hood County leviedalmost double the amount of 2002. Granbury Independent School District (ISD) tax revenues increased approximately $7 million since 2002, while lowering the total tax rate by $0.56. Somervell County showed a similar increase in tax revenues, with an increase of approximately $2.6 million. Glen Rose ISD levied show an increase of approximately $5 million while decreasing the tax rate by $0.20 (Combs 2007b). All counties show an increase in property tax revenues from 2006 to 2007, with only Bosque and Hood counties increasing their tax rates.

Ad valorem taxes are paid on the new CPNPP units. The ad valorem taxes are paid in two categories: (1) personal propertry and (2) real property. The two categories are assessed at the same rate. The taxed amounts are phased in through the years of construction with the total market value assessed January 1 of the year the units are operational. The taxes on CPNPP Units 3 and 4 are expected to be assessed at the same tax rates in effect on CPNPP Units 1 and 2 and to the same jurisdictions as the existing units. Currently, CPNPP Units 1 and 2 pay taxes to 6 jurisdictions in Hood County and 4 jurisdictions in Somervell County. Personal property taxes make up 99 percent of the total taxes for Somervell County but only 30 percent of the total taxes for Hood County. However, the rates for CPNPP Units 3 and 4 are not finalized. Table 2.5-17 shows the amount of ad valorem taxes paid by jurisdiction for 2006.

Based on Table 2.5-16 and 2.5-17, the ad valorem taxes from CPNPP Units 3 and 4 paid to Somervell County and Glen Rose ISD in 2006 are nearly comparable to the amount received from property taxes. In contrast, the amount of ad valorem taxes paid to Hood County and Granbury ISD are only a fraction of the amount those districts receive through property taxes. The impacts of construction of CPNPP Units 3 and 4 on taxes are discussed in Subsection 4.4.2.2.1 while the impacts of operation on taxes are discussed in Subsection 5.8.2.2.1.

2.5.2.3.2 Political Structure

The CPNPP site is situated on the border of Hood and Somervell counties. The site is also located on the border of Texas House of Representatives Districts 59 and 60, because the boundary follows the county line. The site is entirely within Texas Senate District 22 (Texas Legislative Council 2007).

There are a total of nine congressional districts within the CPNPP region: Districts 6, 11, 12, 13, 17, 19, 24, 26, and 31. The CPNPP site is located within the 17th Texas Congressional District.

Local emergency planning in Texas is the responsibility of the mayors and county judges within their jurisdictions. In Hood County, this responsibility is delegated to the Fire Marshal. Local emergency management includes threat identification and prevention, training for local officials, hazard mitigation programs, and coordinating emergency response operations. In Somervell County, the responsibility is retained by the county judge.

2.5.2.4 Land Use and Zoning

CPNPP is located at the border of Hood and Somervell counties. As the location overlaps the edges of both counties, operation and development of CPNPP has the largest socioeconomic effect on those two counties out of the nineteen counties that are completely or partially within the region of CPNPP.

The largest city that intersects the vicinity of CPNPP is Granbury. Granbury is also the county seat for Hood County. As such, Granbury has land-use zoning laws in place that mandate and regulate acceptable land-use practices. Granbury is the only city in Hood County that has defined zoning laws.

In Somervell County, Glen Rose is the only city that has zoning laws. Outside of the corporate city limits, there are no zoning laws in Somervell County. In Somervell and Hood counties, because there is little zoning or designated land use outside of the communities, code and regulation enforcement is administered through the appropriate town or city, county, state, or federal governmental agency with the appointed oversight powers.

Development in Hood and Somervell counties are joint city and county efforts. the Granbury-Hood County Economic Development Corporation works with the Lake Granbury Area Chamber of Commerce to bring new businesses into the area and to enhance the economic base of Hood County and Granbury. In Somervell County, the Glen Rose Chamber of Commerce directs businesses to the Somervell County Development Commission for information and incentives.

Based on US Geological Survey (USGS) land categories and the latest data from the National Land Cover Dataset, the land-use designations within the site are shown in Figure 2.2-1. According to the 2005 USDA soil survey data, approximately 1064 ac of prime farmland are located within the CPNPP site boundary. However, the prime farmland is not utilized (USDA 2005). The prime farmland is currently herbaceous grassland and sits adjacent to the lands previously developed for commercial purposes.

Based upon USGS land-use categories and data from the USGS website, the land use designated within the vicinity is shown in Figure 2.2-2. According to the data, the largest land use for both counties is farmland. In Somervell County, approximately 84,260 ac of farmland is further divided into 64.6 percent pasture, 25.8 percent cropland, 7.6 percent woodland, and 1.9 percent other uses. In Hood County, those same sub-classifications are applied to 202,130 ac of farmland, resulting in 55 percent pasture, 37.5 percent cropland, 5.2 percent woodland, and 2.3 percent other uses (USDA 2002c) (USDA 2002d). The impacts of construction on land use are discussed in Section 4.1. The impact of operations on land use are described in Section 5.1.

2.5.2.5 Aesthetics and Recreation

The 7950-ac site is located in rural Hood and Somervell counties in north central Texas. The two counties are drained by the Paluxy and Brazos Rivers, and contain two major water bodies: Lake Granbury and the SCR. The climate of the vicinity is subhumid subtropical characterized by dry winters and hot summers (Larkin and Bomar 1983). Hood and Somervell counties are bounded on the east by Johnson County, on the south by Bosque County, on the west by Erath County, and on the north by Parker County.

Hood and Somervell counties are in the Grand Prairie and North-Central Plains physiographic regions. The Grand Prairie region ranges in elevation from 450 ft to 1250 ft and is characterized by low hills. The western portion of the Grand Prairie region includes the Western Cross Timbers, a forested area of predominately post oaks. The North-Central Plains region ranges from 900 ft to 3000 ft in elevation and is characterized by low north-south ridges (BEG 1996).

The 50-mi region surrounding the CPNPP site is well located geographically for outdoor activities. Lake Granbury is a 7600-ac lake that hosts numerous water sports activities throughout the year including boating, swimming, and fishing. Other parks and outdoor attractions within the 50-mi radius include Cleburne State Park, Dinosaur Valley State Park, the Fort Worth Nature Reserve, Fossil Rim Wildlife Center, Lake Mineral Wells State Park, Lake Whitney State Park, and Meridian State Park. A new recreational site is planned for Wheeler Branch Reservoir, including a boat launch, fishing pier, swim area, and biking or walking trails (SCWD 2008).

Outdoor activities in the area include backpacking, climbing, camping, and hunting. Several state parks are within the region providing numerous facilities and recreational opportunities. These parks include camping facilities, beach complexes, boating access, and hiking trails.

In an effort to improve the aesthetics of the area, light pollution from CPNPP Units 1 and 2 was lessened by using low-sodium lighting after residents complained about not being able to see the stars. This practice is continued for CPNPP Units 3 and 4. Further information relating to the visual aesthetics of CPNPP, especially with regard to cooling towers, is detailed in Subsection 2.2.1.2 and Section 4.4.

2.5.2.6 Housing

Construction workers and plant staff are expected to require temporary and permanent housing with exception to those who already reside near the site. A large number of CPNPP employees are expected to live in Hood and Somervell counties. However, a few employees may opt to live in some of the surrounding counties. Table 5.8-2 shows the current pattern of residence for the CPNPP Units 1 and 2 operations workers. Most workers live in the nearby communities of Granbury (38 percent) and Glen Rose (18 percent), but many live in more distant cities and towns such as Cleburne (9.5 percent) and Fort Worth (5.7 percent). Based on this distribution of workers for CPNPP Units 1 and 2, a large number of CPNPP workers are expected to live in Hood and Somervell counties.

The gas exploration and production of the Barnett Shale has brought many workers into the region, with over 55,000 permanent jobs created. The Barnett Shale area includes many of the counties in the region, mainly to the north and east of the site. The increase in workers has increased housing demand in the area by more than 38,000 units since the inception of major drilling (Reuters 2008).

Within the 50-mi radius, residential areas are found in cities, towns, smaller rural communities, and farms. Rental property is scarce in the rural areas but is available in the communities surrounding the area such as Glen Rose, Granbury, and Cleburne. Within the vicinity of the CPNPP, the majority of the residents are clustered in residential neighborhoods within the cities of Glen Rose and Granbury. Outside of these city limits, residents generally live in scattered, single-family homes or mobile homes.

In 2007, there were a total of 20,340 housing units in Hood County of which 17,460 were occupied. Of the total housing units, 13,404 were owner occupied (65.9 percent), 4056 were renter occupied (19.9 percent), and 2880 were vacant (14.2 percent) (US Census 2007a). Detailed information concerning vacant housing was only available from the 2000 Census. In 2000, 14.7 percent of vacant housing units were for rent, 10.5 percent were for sale, and 52.6 percent for seasonal, recreational, or occasional use. According to the US Census Bureau, the remainder of the vacant housing was classified as one of three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000a).

American Community Survey data for 2007 is not available for Somervell County as the survey does not include areas with a population of less than 20,000 people. In 2000, there were a total of 2750 housing units in Somervell County of which 2438 were occupied. Of the total housing units, 1825 were owner occupied (66.4 percent), 613 were renter occupied (22.3 percent), and 312 were vacant (11.3). Of the vacant housing units, 40 were for rent, 36 were for sale, and 43 were for seasonal, recreational, or occasional use. According to the US Census Bureau, the remainder of the vacant housing was classified as one of three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000b).

American Community Survey data is not available for Bosque County. According to the 2000 Census, there were a total of 8644 housing units in Bosque County of which 6726 were occupied. Of the total housing units, 5225 were owner occupied (60.4 percent), 1501 were renter occupied (17.4 percent), and 1918 were vacant (22.2 percent). Of the vacant housing, 6.2 percent were for rent, 8.6 percent were for sale, and 51.6 percent were for seasonal, recreational, or occasional use. According to the US Census Bureau, the remainder of the vacant housing was classified as one of the three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000f).

According to the American Community Survey, in 2007 there were a total of 15,223 housing units in Erath County of which 12,750 were occupied. Of the total housing units, 7703 were owner occupied (50.6 percent), 5047 were renter occupied (33.2 percent), and 2473 were vacant (16.2 percent) (US Census 2007b). Based on 2000 Census data, 32.5 percent of the vacant housing units were for rent, 9.7 percent were for sale, and 15.9 percent were for seasonal, recreational, or occasional use. The remainder of the vacant housing was classified as one of the three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000g).

According to the American Community Survey, in 2007 there were a total of 51,628 housing units in Johnson County of which 46,920 were occupied. Of the total housing units, 36,150 were owner occupied (70 percent), 10,770 were renter occupied (20.9 percent), and 4708 were vacant (9.1 percent) (US Census 2007c). Based on 2000 Census data, 23.3 percent of the vacant housing units were for rent, 19.7 percent were for sale, and 12 percent were for seasonal, recreational, or occasional use. The remainder of the vacant housing was classified as one of the three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000h).

According to the American Community Survey, in 2007 there were a total of 657,259 housing units in Tarrant County of which 591,745 were occupied. Of the total housing units, 375,675 were owner occupied (57.1 percent), 216,070 were renter occupied (32.9 percent), and 65,514 were vacant (10 percent) (US Census 2007d). Based on 2000 Census data, 54.4 percent of the vacant housing units were for rent, 15.4 percent were for sale, and 6.0 percent were for seasonal, recreational, or occasional use. The remainder of the vacant housing was classified as one of the three other categories: rented or sold but not occupied; for migratory workers; or listed as “Other vacant” (US Census 2000i).

Table 2.5-18 presents detailed 2000 Census data on vacant housing in communities closest to CPNPP: Granbury, Glen Rose, Tolar, and Pecan Plantation CDP. Total housing units, occupation status, vacant housing units, and housing units for rent for each of these communities are included. Table 2.5-19 shows the age of housing for the same communities. Temporary housing is available at one of the many local hotels and motels in Granbury and Glen Rose areas. In 2009, Glen Rose had eight hotels with 471 hotel rooms. In 2009, Granbury had 746 hotel or motel rooms with construction of another hotel planned, creating 88 more rooms (City of Granbury 2008a)(City of Granbury 2008b). The total number of rooms and occupancy rates for each hotel are shown in Table 2.5-30. In 2007, Granbury had 74 bed and breakfast rooms (Dillard 2007). With the exception of one hotel, the hotels in the area accept long-term occupants and are frequented by the outage workers from CPNPP Units 1 and 2. Hotel rooms are awarded on a first-come first-serve basis and only two hotel reserves spaces for recreational users. Thus during outages, CPNPP outage workers and transients are competing for housing. This competition is expected to increase when the construction workers enter the area.

There are several hotels and motels in the surrounding communities. Stephenville and Cleburne are both located approximately 30 minutes away from the CPNPP site. Cleburne had 260 rooms available for rent in 2008, while Stephenville had 363 rooms for rent in 2004 (City of Cleburne 2008), (City of Stephenville 2004). The proximity of the cities to the CPNPP site makes it likely that workers seeking temporary housing would travel to those hotels for lodging.

There are also temporary housing opportunities at the local campgrounds and RV parks. There are six RV parks located in Glen Rose and Rainbow in Somervell County: B Street RV Park, Cedar Ridge Cabins and RV Park, Dinosaur Valley State Park, Jurassic RV Park, Oakdale Park, and Tres Rios River Ranch. These six RV parks have a total of 428 RV spots. Outage workers stay at the RV parks during CPNPP Units 1 and 2 outages. Of these parks, only Jurassic RV Park intends to expand if they become consistently full, with plans for 30 additional spots.

There are five RV parks located in Granbury in Hood County: 377 Market Place RV Park, Countryside RV Park, Midway Pines RV Park, The Cove Marina and RV Park (formerly Pier 144

RV Park), and Thorp Spring RV Park. Combined, these parks have a total of 191 RV spots. Outage workers stay at all of the parks with the exception of 377 Market Place RV Park. Midway Pines RV Park even takes reservations solely for outage workers. Midway Pines RV Park intends to add 24 RV spots to their facility with plans to add another 60 spots in the next 3 – 4 years. Several additional RV parks are located in the nearby communities of Stephenville, Cleburne, Joshua, and Alvarado.

The Stephenville Chamber of Commerce identifies seven RV parks located in and around Stephenville (Stephenville COC 2009). The Cleburne Tourism and Travel department lists four RV parks in Cleburne and surrounding areas. Doc's City RV Park offers 65 spots and has received outage workers in the past. The Ranch Oaks Mobile Home Park in Cleburne also has 65 spots which are solely for long-term rent. Both RV parks intend to expand if demand increases.

All of these temporary housing opportunities are also shared by visitors to the area. Subsection 4.4.2.4 discusses housing impacts due to construction while Subsection 5.8.2.3.2 discusses the impacts related to operations.

2.5.2.7 Community Infrastructure and Public Services

Public Services and community infrastructure consist of public water and wastewater treatment systems, police and fire departments, medical facilities, social services, and schools. They are typically located within municipalities or near population centers. Schools are described in Subsection 2.5.2.8. The other services are described below.

2.5.2.7.1 Public Water Supplies and Wastewater Treatment Systems

In Hood and Somervell counties, there are multiple ways residents obtain their water. Depending on geographic location, residents of these two counties are able to get water from their municipality or from private wells.

In Hood County, the Lake Granbury Surface Water and Treatment System is run by the Brazos River Authority and can supply water to the City of Granbury and the Acton Municipal Utility District (AMUD), as well as other entities in neighboring Johnson County. The SWATS facility has a water treatment capacity of 10,500,000 gpd and a current usage of 6,062,000 gpd (Brazos River Authority 2008a). The Brazos River Authority planned a complete retrofit of the facility in 2008 (Brazos River Authority 2008b). The City of Granbury obtains water from wells and also operates a drinking water treatment facility. The facility draws its water from Lake Granbury and the Trinity aquifer, and has the capacity to treat 500,000 gpd. The water distribution system currently serves approximately 43,000 connections with 700 – 800 of those connections to entities and individuals that are physically located outside of the city limits of Granbury. Plans are in place for a new 1,500,000 gpd water treatment plant north of Granbury to serve the growing population. The new plant would be capable of being expanded up to 7,500,000 gpd and would allow the city of Granbury to discontinue purchasing water from the Lake Granbury SWATS facility. Wastewater processing occurs at a facility in Granbury with a 2,000,000-gpd capacity that typically operates at 1,000,000 gpd. Portions of Hood County around Lake Granbury and the Brazos River receive water from the AMUD, including a number of subdivisions and undeveloped agricultural land. The AMUD treatment plant has a maximum capacity of 4,130,000 gpd and is currently operating at 1,900,000 gpd (TCEQ 2007b). The City of Tolar receives its water from wells and has a maximum capacity of 280,000 gpd. The city is currently utilizing 75,000 gpd. The Tolar Wastewater Treatment Plant has a capacity of 100,000 gpd and is currently operating at 70 percent capacity. Plans for expansion of the plant are expected to be made within the next few years. Residents outside of these water systems are on different systems, which are outlined in the Table 2.5-20.

In 2009, the TCEQ designated 13 counties including Hood, Johnson, and Tarrant counties as the North-Central Texas and Woodbine Aquifers Priority Groundwater Management Area (PGMA). The TCEQ further recommended that 8 of those counties including Johnson County form a Groundwater Conservation District (GCD). A PGMA is an area that is experiencing, or is expected to experience, critical groundwater problems including shortage of surface water or groundwater within 25 years (TCEQ 2009). This shortage is most likely to affect the city of Tolar, as its municipal water is drawn solely from wells.

The Somervell County Water District operates the only water treatment plant in Somervell County. The drinking water for the City of Glen Rose and other county residences comes directly from the Trinity aquifer. The system has a maximum capacity of 1.426 mgd, and the community has an average daily consumption of 0.488 mgd. The City of Glen Rose has the largest wastewater treatment plant. At maximum capacity, the plant can handle 600,000 gpd but only operates at 320,000 gpd. The rest of the county operates on septic systems, meaning wastewater is treated on-site in privately owned septic systems. The City of Glen Rose water distribution system provides service to 1294 service connections (TCEQ 2007a).

In 2008, the TCEQ designated five counties including Somervell and Bosque counties as the Central Texas Trinity Aquifer PGMA (TCEQ 2009). In an effort to decrease Somervell County's dependency on groundwater, the Somervell County Water District recently created Wheeler Branch Reservoir, located to the north of the city of Glen Rose. The reservoir was completed in 2008 and construction on the water treatment and distribution system is expected to begin in 2010. The reservoir has a capacity of 1.3 billion gal and is expected to provide access to an estimated 1,800,000 gpd of water to the city of Glen Rose and other county users (SCWD 2008).

In Bosque County, the city of Walnut Springs receives its drinking water from two wells with an average use of 6000 gpd. No capacity numbers are available for the drinking water treatment plant. However, the city currently has 315 connections and could increase to 2000 connections with the existing groundwater supply. The wastewater treatment plant has a current usage of 63,000 gpd and an approximate maximum capacity of 120,000 gpd.

In Erath County, the city of Stephenville has a water treatment plant with a maximum capacity of 5.5 million gpd. The plant provides water to 5512 connections, and the average daily consumption is 2.3 million gpd. The wastewater treatment plant has a capacity of 9 million gpd and a current utilization of 1.4 million gpd (City of Stephenville 2007).

In Johnson County, the City of Cleburne receives its drinking water from Lake Pat Cleburne, Lake Aquilla, and groundwater. However, groundwater supplies are diminishing so plans are in place to make use of unused water rights to Lake Whitney, with initial capacity of 2.1 million gpd in 2013. The water treatment plant has a capacity of 15 million gpd with plans to expand to 20 million gpd by 2011 in response to increased population and industrial demand. Average daily consumption is 7.3 million gpd with peak demand of 11.3 million gpd, usually occurring in the month of August. The city has two wastewater treatment plants with a combined total capacity of 7.5 million gpd (City of Cleburne 2008b). The average daily usage is 6.6 million gpd (City of Cleburne 2008d). There are plans to increase the plants capacity using new technology in the next few years, with a plant expansion 4-5 years after that as demand dictates.

In Tarrant County, the city of Fort Worth receives its drinking water from six sources: Benbrook Lake, Cedar Creek Lake, Lake Bridgeport, Eagle Mountain Lake, Richard-Chambers Reservoir, and Lake Worth. Lake Worth is owned by the City of Fort Worth. Benbrook Lake is owned by the Army Corps of Engineers. The other four lakes are owned by the Tarrant Regional Water District. The city has four water treatment plants. The North and South Holly Water Treatment Plant have a combined capacity of 180 million gpd, the Rolling Hills plant has a capacity of 200 million gpd, and the Eagle Mountain plant has a capacity of 105 million gpd for a total capacity of 485 million gpd. The average daily consumption is 164.8 million gpd with a peak of 335.2 million gpd. Fort Worth has one wastewater treatment plant: the Village Creek Wastewater Treatment Plant. The plant has a capacity of 166 million gpd with an average flow of 108.5 million gpd (City of Fort Worth 2009a).

There are no active landfills in Hood or Somervell counties. Solid waste from Somervell County is gathered at the IESI Somervell County Transfer Station while waste in Hood County is gathered at the IESI Granbury Transfer Station. In 2005, the IESI Somervell County Transfer Station handled 14,284 tons of waste while the IESI Granbury Transfer Station handled 16,153 tons. Waste at these stations is transported to the IEASI Weatherford Landfill in Parker County. The Weatherford Landfill is a Type 1 landfill and received 194,125 tons of waste in 2005 with an estimated 1,100,000 tons of space remaining (TCEQ 2006). The impacts of construction and operation of CPNPP Units 3 and 4 on water and wastewater are discussed in Subsections 4.4.2.3 and 5.8.2.3.1.1, respectively.

2.5.2.7.2 Police, Fire, and Medical Services

State law enforcement is conducted by the Texas Department of Public Safety (DPS). Subdivisions of the DPS included the Texas Highway Patrol, Criminal Law Enforcement, Emergency Managements, and the Texas Rangers, among others.

The Texas Rangers are a law enforcement group unique to Texas. One Ranger is typically responsible for three counties but has authority to act in any county in Texas. The Texas Rangers respond to cases of extortion and embezzlement, officer shootings, and other emergencies. Their authority supersedes that of county and municipal police organizations. Hood and Somervell counties are each under the authority of separate Rangers.

2.5.2.7.2.1 Hood County

The Hood County Sheriff's Department has jurisdiction everywhere in Hood County. In 2006, the Hood County Sheriff's Department employed 37 sworn officers and 78 civilians (TDPS 2006). Two other police departments exist in the county: Granbury Police Department and Tolar Police Department. The City of Granbury has 30 officers while Tolar employs one. The Granbury Police Department has plans in progress to augment their force with 30 – 35 citizen volunteers who are trained at the Citizens police academy in Granbury to aid the officers in disaster and emergency response, including response to situations at CPNPP.

There are a total of nine fire departments with 250 volunteers in Hood County. Each fire department is assigned one of nine response areas in the county but responds to larger emergencies anywhere in or even outside of the county. Each station has at least one 2000 gallon pumper truck. The City of Granbury is served by the Granbury Volunteer Fire Department (VFD). The department has 60 volunteers and operates out of two stations. The fire department owns four pumper trucks, one aerial ladder truck, one tanker, three brush trucks, and two rescue trucks. Granbury VFD, Tolar VFD, Indian Harbor VFD, and DeCordova/Acton VFD have a mutual aid agreement with CPNPP to respond to fires. Each department contributes one engine and a squad of approximately 10 people.

Hood County contains one hospital, Lake Granbury Medical Center. Lake Granbury Medical Center, located in Granbury has 59 beds with 36 doctors on active duty (Lake Granbury Medical Center 2007). The daily load is 16 beds and the maximum capacity is 59 beds. Four nursing homes are located in Hood County: Granbury Care Center, with 181 beds; Granbury Villa, with 90 beds; and Trinity Mission Health and Rehab, with 104 beds; and Harbor Lakes Plaza Nursing and Rehabilitation Center, with 142 beds (The Nursing Home Project 2006a).

2.5.2.7.2.2 Somervell County

Somervell County is served mainly by the Somervell County Sheriff’s Department, although the City of Glen Rose has a police chief. The Somervell Sheriff’s Department employed 19 sworn officers in 2006 (TDPS 2006).

Somervell County has a single fire department, the Somervell County Volunteer Fire, Rescue and EMS. The department is served by 40 people: 34 volunteers and 6 paid employees. The department has three engines, two tankers, one ladder truck, six brush trucks, one rescue vehicle, one command vehicle, and three ambulances. The department responds in case of an emergency at CPNPP.

Somervell County also contains a single hospital, Glen Rose Medical Center. which also has an associated nursing home. The hospital has 16 beds while the nursing home has 118 beds. Combined, both facilities employ 280 people. The daily load at the hospital is seven beds. During an emergency, the 16 beds could be augmented with 7 – 10 additional beds. One additional nursing home is located in Somervell County, Cherokee Rose Manor. Cherokee Rose Manor, located in Glen Rose, has a 102-bed capacity. The total number of nursing home beds in Hood and Somervell counties is 598.

2.5.2.7.2.3 Bosque County

Bosque County is served mainly by the Bosque County Sheriff’s Office which has 18 commissioned officers and 20 civilian workers. The cities of Clifton and Meridian have police departments (TDPS 2006). The city of Walnut Springs is serviced by the Bosque County Sheriff’s Office and has 10 volunteer firefighters.

The only hospital in Bosque County is located in Clifton, the Goodall-Witcher Hospital, with 40 beds (AHD 2009). There are four nursing homes located in Bosque County, but none in Walnut Springs. The Clifton Lutheran Sunset Home with 180 beds, the Clifton Nursing and Rehabilitation with 112 beds, and the Goodall-Witcher Nursing Facility are all located in Clifton. Meridian Manor has 91 beds and is located in Meridian (The Nursing Home Project 2006b).

2.5.2.7.2.4 Erath County

The Erath County Sheriff's Office has 23 commissioned officers and 27 civilian workers. The cities of Dublin and Stephenville have police departments as does the Tarleton State University (TDPS 2006). Stephenville has a single police station and employs 46 police officers and civilian personnel, approximately 25 percent of which are civilians (City of Stephenville 2007).

Stephenville has two fire stations with 28 paid firefighters and 16 volunteer firefighters (City of Stephenville 2007).

Stephenville is home to the county's only hospital, the Texas Health Harris Methodist Hospital Stephenville (AHD 2009) with 98 beds and more than 40 physicians (Texas Health Resources 2009a). Stephenville has four nursing homes: Canterbury Villa of Stephenville with 86 beds, Community Nursing and Rehabilitation Center with 73 beds, Mulberry Manor with 104 beds, and Stephenville Nursing home with 46 beds (The Nursing Home Project 2006c).

2.5.2.7.2.5 Johnson County

The Johnson County Sheriff's Office employs 116 commissioned officers and 135 civilian workers. There are six cities in Johnson County that have police departments, including Cleburne (TDPS 2006). The Cleburne Police Department has 55 commissioned officers and 22 civilian workers (City of Cleburne 2008c).

Cleburne has three fire stations with 49 paid firefighters and three fire chiefs.

Johnson County has two hospitals: Texas Health Harris Methodist Hospital Cleburne and Huguley Memorial Medical Center, located in Burleson (AHD 2009). The Texas Health Harris Methodist Hospital Cleburne has 137 beds and over 80 physicians, while Huguley Memorial Medical Center has 213 beds and more than 350 primary care and specialty physicians (Texas Health Resources 2009b) (Huguley Memorial Medical Center 2009). There are three nursing homes in Cleburne: Cleburne Rehabilitation and Health Center with 120 beds, Colonial Manor Nursing Home with 149, and Fireside Lodge Rehabilitation Center of Cleburne with 112 (The Nursing Home Project 2006b).

2.5.2.7.2.6 Tarrant County

The Tarrant County Sheriff's Office has 491 commissioned officers and 853 civilian workers. There are 32 cities in Tarrant County that have police departments, and three universities, one airport, and one hospital district (TDPS 2006) that have security forces. The Fort Worth Police Department has 1541 commissioned police officers and approximately 432 civilian workers. The department is divided into six bureaus: Executive Service, Administrative Service, Operational

Support, North/West Field Operations, South/East Field Operations, and Special Services (FWPD 2009).

The city of Fort Worth has 42 fire stations spread out over the city and divided into 6 battalions. There are 904 firefighters and 45 civilian workers. Department vehicles include 37 engines, 10 quintuple combination pumpers, 4 trucks, 6 aircraft rescue units, and 13 brush units (City of Fort Worth 2009b).

Tarrant County has 18 hospitals, six of which are in Fort Worth: Baylor All Saints Medical Center at Fort Worth, John Peter Smith Hospital, Medical Centre Surgical Hospital, Plaza Medical Center of Forth Worth, Texas Health Harris Methodist Hospital Fort Worth, and Texas Health Harris Methodist Hospital Southwest Fort Worth. These six hospitals have a combined total of 2055 beds (AHD 2009). There are 33 nursing homes in Fort Worth (Texas Long Term Care 2008).

2.5.2.7.3 Social Services

Social services in the state of Texas are overseen by the Texas Department of Family and Protective Services (DFPS), which has an office in Granbury. The Texas DFPS provides services such as child and adult protective services, child care licensing, and assistance to adult or elderly disabled. The agency also manages community-based programs targeting the prevention of abuse, neglect, delinquency, and exploitation of children, disabled adults, or the elderly (Texas DFPS 2007). In 2005, Texas DFPS completed 160,069 child abuse and neglect investigations through Child Protection Services; 3,173 adoptions; 45,392 investigations of in-home adult abuse or neglect through Adult Protection Services; and 8,169 facility investigations for adult abuse or neglect (Texas DFPS 2005a). The total operating expenditures on all social programs by the Texas DFPS for the 2005 fiscal year was $899,357,894 (Texas DFPS 2005b).

2.5.2.8 Education

The following subsections discuss information about the local educational system throughout the region.

2.5.2.8.1 Public Schools – Pre-Kindergarten through Grade 12

There are 102 school districts that are either wholly or partially contained within the 50-mi radius of the CPNPP center point. According to data compiled from the National Center for Education Statistics, the schools of these districts that are located within the radius had more than 287,000 enrolled students for the 2004 – 2005 school year (NCES 2005a).

2.5.2.8.2 Hood and Somervell Counties

There are three school systems contained within Hood County: Granbury ISD, Lipan ISD, and Tolar ISD, each providing PK-12 education. For the 2006 – 2007 school year, these districts had enrolled 6830, 590, and 595 students, respectively (NCES 2007a). Granbury ISD has twelve schools under its jurisdiction, Lipan ISD has one school, and Tolar ISD has two schools. According to Texas House Bill 72, elementary school classes are required to have a student-teacher ratio of 22:1 (TEA 2002). Granbury ISD has a student-teacher ratio of 14.2, Lipan ISD has a student teacher-ratio of 11.2, and Tolar ISD has a student-teacher ratio of 13.1.

There are two school districts contained within Somervell County: Brazos River Charter School and Glen Rose ISD. Brazos River Charter School provides education for grades 9 – 12, while Glen Rose ISD provides PK-12 education, For the 2006 – 2007 school year, these districts had 135 and 1684 students enrolled, respectively (NCES 2007b). Brazos River Charter School has one school under its jurisdiction while Glen Rose ISD has four schools. Brazos River Charter School has a student-teacher ratio of 15.9 while Glen Rose ISD has a student-teacher ratio of 11.6.

Glen Rose ISD has a maximum capacity of 2862 students with 1657 students enrolled for the 2007 - 2008 school year. Total capacity numbers for Granbury ISD were not available. However, local officials indicated the district was not at capacity. The maximum capacity of Granbury ISD is 8665 with enrollment of 6882 for the 2007 - 2008 school year (Granbury ISD 2007). The district has seen an enrollment growth rate of less than 2 percent over the last 4 years. Granbury ISD is developing a long range plan for the district, with a final report due in January 2008.

Both Granbury ISD and Glen Rose ISD are Chapter 41 schools, meaning they are subject to the "Robin Hood" laws. Any funds above the state-set limit per student are recaptured and distributed to poorer school districts as part of the state aid administered by the Foundation School Program. Recapture amounts are based on the wealth per weighted student in average attendance. Neither school district has a designated district partner. Preliminary estimates show that Glen Rose ISD's recapture cost for the 2007 – 2008 year was $6,976,397. Granbury ISD did not have any recapture cost for the 2007 – 2008 school year (TEA 2008).

Impacts of construction on education are discussed in Subsection 4.4.2.5 while impacts due to operations are discussed in Subsection 5.8.2.3.3.

2.5.2.8.3 Counties in the Economic Region

Bosque County contains seven Independent School Districts(ISD): Clifton, Cranfills Gap, Iredell, Kopperl, Morgan, Valley Mills, and Walnut Springs. These districts had a total of 2657 students for the 2006 – 2007 school year. The largest district is Clifton ISD with 1173 students in four schools. Based on the CPNPP Units 1 and 2 operation workers settlement patterns discussed in Subsection 5.8.2.1, the district most likely to be affected by CPNPP Units 3 and 4 construction and operations workers is Walnut Spings ISD. The district provides PK – 12 education and had an enrollment of 208 students for the 2006 – 2007 school year. The district has a student-teacher ratio of 10.7 (NCES 2007c). Walnut Springs ISD is not a Chapter 41 district.

Erath County contains nine ISD: Bluff Dale, Dublin, Erath Excels Academy, Huckabay, Lingleville, Morgan Mill, Paradigm Accelerated Charter School, Stephenville, and Three Way. Total enrollment for the 2006 – 2007 school year was 5712 students. The districts most likely to be affected are Stephenville ISD and Three Way ISD. Stephenville is the largest district in the county with 3536 students enrolled at 6 schools. The district provides PK – 12 education, and student-teacher ratio is 15.4. Three Way ISD has a single elementary school with 61 students and a student-teacher ratio of 7.3. The district provides PK – 8 education (NCES 2007d). Neither Stephenville ISD nor Three Way ISD are Chapter 41 districts.

Johnson County contains nine ISD: Alvarado, Burleson, Cleburne, Godley, Grandview, Joshua, Keene, Rio Vista, and Venus. The total enrollment of these districts for the 2006 – 2007 school year was 29,087 students. Based on the operation settlement pattern, the district most likely to be affected is Cleburne ISD. The district has 11 schools and provides PK – 12 education. In 2006 – 2007, there were 6638 students enrolled with a student-teacher ratio of 15 (NCES 2007e). Cleburne ISD is not a Chapter 41 district.

Tarrant County has 28 ISD. Excluding non-regular districts and those outside the region leaves 14 districts: Arlington, Azle, Birdville, Castleberry, Crowley, Eagle Mt-Saginaw, Everman, Fort Worth, Hurst-Euless-Bedford, Keller, Kennedale, Lake Worth, Mansfield, and White Settlement. The largest district in the county and the one most likely to be affected by CPNPP Units 3 and 4 construction and operation workers is Fort Worth ISD. The district had 79,457 students enrolled for the 2006 – 2007 school year and a student-teacher ratio of 16.4. The district provides PK – 12 education and has 147 total schools (NCES 2007f). Fort Worth ISD is not a Chapter 41 district.

Impacts of construction on education are discussed in Subsection 4.4.2.5 while impacts due to operations are discussed in Subsection 5.8.2.3.3.

2.5.2.8.4 Colleges and Universities

There are thirteen 2-year and 4-year colleges and universities within the CPNPP region. Total enrollment for these schools is more than 95,000 students (NCES 2005d). The 2-year and 4-year colleges and universities in the region are typically near peak daily capacity for the majority of the year, excluding the summer months (mid-May through mid-August).

2.5.3 HISTORIC PROPERTIES

Historic and cultural sites are identified based on several surveys conducted in the CPNPP vicinity. A description of the extent of each survey, the survey techniques, the surveyor qualifications, and the complete findings may be found in the referenced survey reports. Fifty-six properties listed or eligible for inclusion in the National Register of Historic Places (NRHP) are located within a 10-mi radius of the CPNPP site, including five properties in Somervell County (Table 2.5-21) and 51 properties in Hood County (Table 2.5-22). None are located on the CPNPP site.

Sites listed or eligible for inclusion in the NRHP in Hood County are largely consolidated within the historic downtown area of Granbury. The Hood County Courthouse and surrounding buildings in the town square comprise a National Register District. Of the 51 NRHP listed or eligible sites in Hood County within a 10-mi radius of the CPNPP, 49 sites are between 9 and 10 miles away from the on-site area of potential effect (APE) (Table 2.5-22). The remaining two NRHP eligible sites are near the town of Tolar. These 51 NRHP listed or eligible sites in Hood County are outside the CPNPP vicinity.

Two NRHP listed sites and three Recorded Texas Historic Landmarks (RTHL) in Somervell County are within the CPNPP vicinity. All are 5 mi or further from the on-site APE (Table 2.5-21).

One cemetery, SV-C004 (Hopewell Cemetery) is located on the CPNPP site, about 1 mi east of the on-site APE (Figure 2.5-7). Hopewell Cemetery is a late 19th-century cemetery in good condition (Skinner and Humphreys 1973). Hopewell Cemetery is accessible, fenced for protection, and receives periodic general upkeep.

2.5.3.1 Archaeological Sites

Twenty-eight archeological sites and four historical cemeteries on or within a 1-mi radius of CPNPP were located during the 1970s (Table 2.5-23 and Figure 2.5-8). In 1972, Southern Methodist University's (SMU) Department of Anthropology conducted a survey of the historic and prehistoric archaeological resources of the SCR under the direction of S. Alan Skinner and Gerald K. Humphreys. This survey identified 27 archeological sites within the SCR (Skinner and Humphreys 1973). Another site, 41SV55, was recorded by Gallagher of SMU during a small survey of the CPNPP transmission line and pipeline ROWs (Gallagher 1974). Of these 28 sites, 23 have either been inundated by the lake or destroyed by subsequent construction. Of the five remaining sites (41SV26, 41SV28, 41SV32, 41SV33, 41SV55), 41SV26 was revisited in 2007 as part of an archeological survey of proposed water connection lines. This lithic site was found to be highly disturbed along existing ROWs.

Site 41SV30 (Hopewell Community School Site) was recorded as a part of the original 1972 SMU survey. Skinner and SMU performed an extensive excavation of 41SV30 ahead of dam construction to mitigate impact to the site from construction on SCR. 41SV30 is no longer an intact site.

During an archaeological survey of proposed water pipelines, field crews attempted to locate 41SV53, a lime kiln recorded by SMU during the 1972 survey of SCR. Based on the information obtained from the site form and the archaeological report, the site could not be relocated during the visit. However, a probable location of the site was noted. Further attempts to locate the site were coordinated by Enercon and Luminant personnel. The site was never relocated as it appeared in the 1973 archaeological report and the site form. The area noted as the probable location of the site (based on relative site form and archaeological report data) showed no remains of the lime kiln; however, the area shows indications of past disturbance and is broadly littered with limestone cobbles at the surface. There is a broad bulldozed area along the creek. The remains of road swales were noted along the base of the creek terrace and atop the higher terrace just east of the bulldozed area resembling "loading" (the road used to put limestone rocks in the top of a kiln) and "product" (a road to the base of the kiln for removing lime from it) - access roads common to kiln features. No evidence of the kiln, however, exists along the proposed water pipeline route.

An archeological survey of proposed water pipelines was performed between August 2007 and February 2008. The survey included four alternative routes on the CPNPP site (Figure 2.5-9). Alternate Route 2 cuts across SCR and no pedestrian survey is possible. Alternate Route 3 follows an old dirt road around the north side of SCR to the CPNPP facility. Two prehistoric sites and one historic archeological site (41HD87, 41HD88, and 41HD89, respectively) were recorded along this route. However, the sites are not eligible for listing in the NRHP. Both Alternative Route 2 and Alternative Route 3 were dropped from consideration. Alternate Route 1 follows an existing road around the south side of SCR, and Alternate Route 4 is delineated within existing transmission line ROWs, also along the south side of SCR. Both routes follow previously disturbed tracts and, at points, overlap. Two prehistoric sites and one historic archeological site were recorded along [ ]. 41SV160 is a small lithic/FCR scatter near a small spring seep. The site has been extremely disturbed by transmission line, gas pipeline, and road construction. The site has little further archeological value due to the disturbances and is within the proposed water pipeline construction corridor. 41SV162 is a small lithic/FCR scatter. This site has been extremely disturbed by transmission line, existing water pipeline, and road construction. The site has little further archeological value and is located within the proposed waterline construction corridor where Alternate Routes 1 and 4 overlap. 41SV161 16 is a homestead site just outside the existing transmission line ROW along [ ]. This site was partially disturbed by previous construction activity, and much of the associated trash scatter is located in bulldozer piles adjacent to the transmission line. The earliest feature of the site, a concrete cistern, is dated 1935, insufficient age for consideration as a historic site at the time of SMU's survey of the SCR (Skinner and Humphreys 1973). Other intact features (including foundations) are located [ ] and show no evidence of occupation prior to the 1950s. Historical background research did not find references to this site.

One intact historic feature, a stone wall, is located on the CPNPP site. The feature was first recorded in 1972 by SMU. The report notes the wall "near 41SV43" though it was not recorded as a feature of 41SV43. The stone wall represents a bygone property boundary of a historic homestead which was inundated with the creation of SCR. Stone was noted to be stacked along an existing barbed wire fence. The wall is located inside of the on-site APE and is not eligible for NRHP listing.

Somervell County contains five State Archeological Landmarks (SAL) and two sites potentially eligible for SAL and NR listing. The Somervell County Courthouse is a listed SAL as well as NRHP listed (Subsection 2.5.3). The four remaining SALs are buried prehistoric archeological sites located at Dinosaur Valley State Park. 41SV56, 41SV57, 41SV58, and 41SV59 are all over 3 mi from the on-site APE. The initial recording of these four sites was performed by Gallagher and Bearden in 1974. Each of the sites was revisited by park employees to monitor their condition. 41SV130 (1996) and 41SV149 (1997) were recorded by Borderlands Archeological Research Unit. Both sites are intact hearths and are located over [ ]

2.5.3.2 Cultural Resource Surveys

The 1972 SMU survey evaluated the cultural resources relative to the proposed construction of a power plant and reservoir by Texas Utilities Services Inc. (TUSI). This investigation included an extensive review of regional archeological and historical literature, a 100-percent surface reconnaissance of the CPNPP property, and reporting of survey results (Skinner and Humphreys 1973). Skinner's reference to sites 41HD55, 41HD56, and 41HD57 have been assigned new site numbers by the Texas Historical Commission (THC), and these numbers were reassigned to sites in other areas. Skinner's sites 41HD55, 41HD56 and 41HD57 have been redesignated as 41HD64, 41HD65, and 41HD66, respectively.

Twenty-eight archeological sites were located on or within a 1-mi radius of the CPNPP site in Hood and Somervell counties. Archeological sites recorded by the SCR survey, but outside the reservoir limits, are further detailed in the report as well. These sites are: 41SV6 - 41SV25, 41SV27, 41SV49 - 41SV51.

Between August 8 and 24, 1974, the Archaeology Research Program at SMU conducted a survey of the proposed CPNPP transmission line, intake, and return pipeline ROW (Gallagher

1974). The inspection included a pre-survey of the corridor, a ground survey of ROWs, and documentation of survey results through site forms and maps. Site materials were observed and documented but not collected in order to maintain the integrity of the sites (Gallagher 1974). Four archaeological sites were located, including three prehistoric sites and one historic dwelling. These sites are 41SV55 and 41SV58 - 41SV60 (Gallagher 1974). Site 41SV60 is located outside a 10-mi radius of the CPNPP site. Of these, site 41SV55 is within a 1-mi radius of the CPNPP site.

Site 41SV55 is a prehistoric base camp. The site was located within the original water pipeline route before being recorded by SMU (Gallagher 1974). The initial water pipeline route was moved prior to construction, and site 41SV55 was entirely avoided by the creation of the existing water pipeline. The site is located adjacent to the CPNPP site and is [ ] of the on-site APE. The existing water pipeline is just inside the CPNPP property fence which is over [ ] from the nearest boundary of 41SV55. During a recent Phase 1A-1B Archaeological Survey of CPNPP Proposed Water Connection Lines, extensive shovel testing and surface inspections were performed just inside the CPNPP property fence at its closest distance to 41SV55. These investigations were performed to determine whether development impacts or erosion at the site had scattered artifacts more extensively. No evidence of 41SV55 was observed in the survey area or on the CPNPP site.

Sites 41SV154 and 41SV155 were recorded during the Wheeler Branch Reservoir survey and are located about [ ] of the CPNPP site (Moore 2005).

Site 41SV154 includes a well/cistern and storm cellar associated with house remains. The features were constructed using local rock and are dated early to middle 20th century. The site is at least 50 percent destroyed. Comments on the site form state that the site appears too destroyed to be significant while the survey report characterizes it as potentially eligible for nomination to the NRHP. 41SV154 may be demolished for construction of a park by the Somervell County Water District (Moore 2005).

Site 41SV155 represents a 100-percent intact barn. The barn is associated with a house outside the Wheeler Branch Reservoir project area, which was not evaluated. The barn was constructed by stacking local rock vertically. It was recommended that this site be evaluated by an architectural historian for NRHP eligibility prior to being demolished (Moore 2005). The barn may be demolished by Somervell Water District during construction of a park (Moore 2005). This site is located [ ] of the on-site APE.

Site descriptions were obtained through restricted access to the THC Archaeological Site Atlas.

2.5.3.3 Consultations With State and Federal Agencies

On January 24, 2007, a consultation letter was sent to the THC with details and a map of the proposed plant expansion. On February 21, 2007, the State Historic Preservation Office (SHPO) for the THC responded with a stamped copy of the letter, noting that no historic properties would be affected and the project may proceed.

Consultation letters were also sent on January 24, 2007, to thirteen Native American tribes, all of which have historical concerns in the region around Comanche Peak (Appendix A). On

February 12, 2007, a response was received from the Comanche Tribe stating they had no immediate concerns for the project. As of March 31, 2008, no other responses were received from the tribes.

2.5.3.4 Traditional Cultural Properties

Traditional cultural properties include localities, specific places, and natural objects of special concern to a particular group or ethnic association. Areas that may have some concern or importance to these groups include earlier historic and prehistoric villages, graves and sacred areas in the region. Comanche Peak, a geological feature north of the property, may have some significance to the Comanche Tribe. Squaw Creek, given the name from a group of Indian women killed in the area, and the Battle of Squaw Creek, may also have special significance to the Comanche Tribe. No specific localities, sites or features on the CPNPP site, however, have been identified.

Letters were sent to the thirteen Native American tribes that have special or traditional attachments to the area, including the Comanche Tribe. On February 12, 2007, a response letter from the Comanche Tribe was received. The Tribe did not have specific concerns or issues with the property in general but did request copies of project reports as they are generated. Completed archaeological survey reports are sent to appropriate tribal groups upon report submittal to the THC.

2.5.3.5 Historic Properties in Transmission Corridors and Off-Site Areas

In January 1981, a survey of the Hood County 138-kV transmission line was completed covering 2.3 mi and 27.4 ac by Espey, Huston and Associates Inc. The principal investigator for the survey was Vance Langley. The report discusses two sites in Hood County: 41HD14 and 41HD15 (Wooldridge 1981).

Site 41HD14 is a lithic scatter of unknown prehistoric age. The extent of subsurface artifacts could not be determined from surface evidence, though it was noted that subsurface deposits may extend north and south from the existing transmission line. The site was not recommended for further testing. The site is located within the off-site APE near the water pipeline's terminus into Lake Granbury (Figure 2.5-9).

Site 41HD15 is also a lithic scatter of unknown prehistoric age. The site was not recommended for further testing. It is located within the off-site APE near the water pipeline's terminus into Lake Granbury (Figure 2.5-9).

Both of these sites were re-visited in 2007 as part of an archeological survey of proposed water connection lines. 41HD14 received additional shovel testing to determine the presence and extent of remaining buried deposits. Both of these sites have been heavily impacted since their original recording by bulldozing and clearing in ROWs and soil erosion.

Two additional sites were recording during the 2008 survey. 41HD90 and 41HD91 are prehistoric archeological sites located between 41HD14 and 41HD15. 41HD90 is a small and extremely disturbed FCR scatter. 41HD91 is a small and heavily disturbed lithic scatter. Both sites have been heavily disturbed by land clearing activity for transmission line and water pipeline construction and maintenance. These sites are not eligible for listing in the NRHP.

Nubbin Ridge Cemetery is a Historic Texas Cemetery (HTC) located [ ] of the on-site APE and within [ ] of the proposed off-site water pipeline route. The cemetery is fenced, in good condition, and well maintained.

2.5.3.6 Cultural and Historical Background Summary

Hood and Somervell Counties are located in North Central Texas. One of the major problems with associating the cultures of the study area with those of the greater region is in defining the region in general. Various researchers have called the area a part of West Texas, Northwest Texas, West Central Texas, North Central Texas, Lower Plains, etc. Locally, most people call the area "The Brazos Country." The original Southern Methodist University (SMU) archeological research (Skinner and Humphreys 1973) conducted on the Comanche Peak Steam Electric Station property identified a number of prehistoric and historic sites. See also Blaine et al. (1968) and Gallagher and Bearden (1976) for more examples of prehistoric sites in the area.

Detailed summaries of the prehistoric cultural background of the general area, including Collins (1998), Crook and Harris (1952), (Long 1963), Prewitt (1981), and (Prikryl 1990), provide broader generalized syntheses for the area. For in-depth regional definitions, "A Review of Central Texas Archeology," (Suhm 1960) provides a worthy summation. However, Michael B. Collins details various research issues that have contributed to Central Texas being ambiguously placed in other geographic designations (Collins 1998). Moreover, Collins (1995) addresses long-term research issues in Central Texas, as well as the difficulty of defining a Central Texas culture area, in “Forty Years of Archeology in Central Texas,” found in the 1995 Bulletin of the Texas Archeological Society. This article gives a more up-to-date synthesis of the area’s prehistory while considering both past research and the integrity of the archeological record.

The following is a brief summary of the prehistory and history of the region surrounding the Comanche Peak Nuclear Power Plant.

There are currently four major archeological periods recognized for Central Texas and the study area: the Paleo-Indian, Archaic, Late Prehistoric, and Historic periods.

Paleo-Indian Period

The Paleo-Indian period has been the focus of a great deal of research in Texas and throughout America. The Paleo-Indian period is recognized as the temporal span from 11,500 to 8,800 B.P (Collins 1995). Traditionally, Paleoindian culture has been narrowly defined as, simply, nomadic big-game hunters. However, the “...simple cultural sequence of big-game hunting ‘cultures’ . . . is no longer adequate to accommodate the diverse material culture assemblages, projectile point styles, and indicated subsistence behaviors now documented” (Collins 1995).

Clovis (approximately 11,200-10,900 B.P.) represents the earliest cultural horizon documented in Central Texas and throughout the contiguous United States, and it generally has the most diverse site types of the Paleo-Indian period (Collins 1995). Continued research and improved faunal data increasingly indicate a less nomadic lifeway for Clovis culture. “Overall, the Clovis lifeway seems to have been that of well-adapted, generalized hunter-gatherers with the technology to hunt big game but not the need to rely exclusively on it. Clovis material is widely distributed in Texas in a number of different environmental zones" (Collins 1998).

In Folsom times, subsistence patterns appear more specialized toward bison hunting. This is reflected not only in documented bison kill sites but also in tools such as Folsom points, end scrapers, and large ultra-thin bifaces (Collins 1995).

Dalton and San Patrice projectile point types occur near the end of the Early Paleoindian subperiod and continue to the late subperiod. The occurrence of San Patrice points is much more frequent than that for Dalton points, and neither are very common; thus, questions remain about the temporal placement and cultural significance of these point types. The Horn Shelter 2 site (containing both point types) indicates an Archaic-like, hunter-gatherer lifeway; it is posited that Dalton and San Patrice point types are transitional artifacts between the early and late Paleoindian subperiods (Collins 1998).

Wilson, Golondrina-Barber, and St. Mary's Hall projectile point style intervals are placed in the Late Paleoindian subperiod. The Wilson-Leonard site contains all these point styles, though the Wilson type is better represented. Dates for the Wilson component at the Wilson-Leonard site are ca. 10,000 to 9650 B.P. The point types and associated features, artifacts, a human burial, and faunal remains resemble Archaic characteristics more so than those of the Paleoindian period (Collins 1998). "The Archaic like character continues for the Golondrina-Barber and St. Mary's Hall components date between 9500 and 8000 B.P." (Collins 1998). For these point types, features continue to exhibit Archaic-like characteristics, though the sizes of associated burned rock features are smaller than those typical of their Archaic period counterparts. Thus, this Late Paleoindian subperiod appears to be transitional between the Early Paleoindian subperiod and the Archaic (Collins 1995).

Archaic Period

The Archaic period spans the time from ca. 8800 to 1200 or 1300 B.P. and includes three subperiods – early, middle, and late. The length of this period is indicative of the success of basic adaptation. Characteristic of Archaic period archeology is the abundant utilization of heated rock manifested in hearths, middens, ovens, scatters, and other features (Collins 1995).

In the early Archaic ca. 8800 to 6000 B.P., archeological evidence in Central Texas suggests a period when settlement patterns favored exploitation of live-oak savanna resources (Edwards Plateau) in which various nuts, berries, fruits, and geophytes, as well as smaller animals, comprise a reliable subsistence. The period's associated point style intervals include Angostura, Early Split Stem, and Martindale-Uvalde (Collins 1995).

Middle Archaic (6000 to 4000 B.P.) is marked by three style intervals: Bell-Andice-Calf Creek Taylor, and Nolan-Travis (Collins 1995). The earliest interval of the Middle Archaic period has a more mesic climate, and the tool kit reflects bison hunting weaponry. The later Middle Archaic period sees the arrival of more xeric climates and the appearance of burned rock middens (Collins 1995).

The Late Archaic period (4000 to 1200 B.P.) continues with subsistence technology seen in the Middle Archaic, including the manifestation of burned rock middens. The point styles during the Late Archaic are among the most widely distributed dart points, and bison becomes a viable hunting prey again (Collins 1998). The period exhibits a wider range of point types and six point style intervals are postulated for the Late Archaic (Collins 1995).

Late Prehistoric

The Late Prehistoric period (often labeled as Neo-Indian, Neo-American, Post-Archaic, or Neo-Archaic) represents material culture changes at ca. 1200 B.P. This period contains both an early and late subperiod corresponding to the Austin and Toyah intervals (Collins 1995). The early subperiod of Late Prehistoric sees the continuation of basic hunting and gathering subsistence, including the presence of burned rock middens. The change most noted in transition from Late Archaic to early Late Prehistoric (Austin interval) is the prevalence of arrowpoints indicating a shift from atlatl/dartpoint technology to bow and arrow usage.

The late subperiod of the Late Prehistoric is associated with the Perdiz arrow point, though other distinictive archeological traits span the same time period across much of the state. The Toyah manifestation includes pottery, large thin bifaces, end scrapers, and prismatic blades, as well as Perdiz points. The question remains as to whether the Toyah manifestation reflects the expansion of a particular people across the state, or a distribution of ideas and technologies between peoples (Collins 1995).

Historic

The Historic Period begins with the arrival of European culture in America. The subperiod, early Historic in Central Texas, starts in the late 1600s. Indigenous populations and lifeways are confronted with the multiple consequences of European contact. European-introduced disease, the Spanish and French presence, the acquisition of horses by native peoples, and mounted Apache incursions southward surely mark drastic cultural changes and conflict.

The middle Historic period spans the time from 1730 to 1800 A. D. It sees the expansion and subsequent failure of Spanish Missions systems (Collins 1995). The Wichita and Comanche were at that time new residents of the northwest Texas/southwest Oklahoma region where they had established fortified villages along the Red River. Apaches had once raided Spanish settlements near San Antonio, but in light of increasing war with the Wichita and Comanches, they lobbied for Spanish protection along the San Saba River. Two missions were formed near Menard, Texas. In 1758, allied Wichita, Comanche, and Tawakonis attacked the Spanish mission, targeting Apaches and leading to subsequent retaliation by the Spanish (Smith 2000).

The Kiowa entered the Southern Plains around 1800, and were followed by the Cheyenne and Arapaho about 1840. The West Texas region was held primarily as a common hunting area by all of the Southern Plains tribes. The Comanche, in particular, considered the Brazos environs to be part of their homeland.

The first permanent Early Anglo settlements enter the Paluxy River and Squaw Creek valleys around 1853-1854, a period when the Brazos was referred to as the ‘deadline’ by settlers fearing

Comanche and other native groups west of the river (Skinner and Humphreys 1973) and (Ewell 1895).

Hood County

Hood County embraces 425 square miles of the north central plains of Texas. Granbury, the county seat, is 41 miles southwest of Fort Worth. Before settlers from the East ventured onto the plains, the area was the home of the Comanche and, to a lesser extent, the Lipan Apaches and Kiowas. In the 19th century, a band of Comanches known as the Penatekas or Honey-Eaters roamed the area west of the Cross Timbers, generally between the headwaters of the Colorado and Brazos rivers. Comanche Peak, the highest point in Hood County, was a Comanche meeting place. The Lipan Apaches also roamed the area, and the town of Lipan in extreme northwestern Hood County was named after a group that once lived in the Kickapoo Valley (Callaway 2006).

Settlers from the East began to arrive in the area 10 or 15 years before the Civil War. One of the first, Charles E. Barnard, set up a trading post and Barnard's Mill at a site now in Somervell County. George B. Erath, for whom an adjacent county is named, was one of the first to survey on the Brazos River (1846-50). Other settlers, mostly stock raisers and farmers, began to settle in the Brazos and Paluxy river valleys in 1854. The main concern facing these early settlers was the frequent raids by the Comanches. Native American horse-stealing raids into the Paluxy and Squaw Creek country occurred all during the Civil War and until 1872, when a party of Native Americans stole horses from a section of land close to Cresson in northeast Hood County (Callaway 2006).

Hood County was formed in November 1866 by an act of the Eleventh Texas Legislature. The area had been within the Municipality of San Felipe de Austin as early as 1823 and the Municipality of Viesca in 1834. After Texas became a republic, the area now known as Hood County had, at one time or another, been part of Robertson, Navarro, McLennan, Johnson, and Erath counties. The county was named after Lt. Gen. John Bell Hood of the Confederate Army. The county seat was to be named in honor of Confederate general Hiram Bronson Granbury. Location of the new county seat was a controversial issue. Residents in the southern section of the county favored the center of the county, as stated in the law. The other choice was a parcel of land donated by influential county leaders Thomas Lambert and J. F. and J. Nutt. The commission established to designate the county seat, citing a poor water supply at the center of the county, voted in favor of the donated land. The controversy surrounding the site of Granbury eventually caused the residents of the southern section of the county to petition for a new county. As a result, in 1875, Somervell County was established by an act of the Texas legislature. In that same year, a fire destroyed the courthouse in Granbury (Callaway 2006).

In 1870 whites made up 96 percent of the population. The highest total of blacks in Hood County was 241 in 1900, or only 3 percent of the population. The last three decades of the 19th century saw a steady increase in the population, and in 1910 the total was just over 10,000. Residents were able to send their produce and livestock to market on the Fort Worth and Rio Grande Railway, which had been completed in 1887 (Callaway 2006).

By the turn of the century, Hood County had several towns: Granbury, Acton, Tolar, Lipan, and Cresson. After 1910 Hood County's population fell to 8,759 in 1920, to 6,779 in 1930, and to its

20thcentury low of 5,287 in 1950. The number of farms fell by almost a third between 1910 and 1920 to 1,234, then dropped more gradually to 830 in 1950 (Callaway 2006).

From 1960 to 1980, the population increased from 5,443 to 17,714. Between 1970 and 1980, Hood County ranked sixth among all United States counties in the category of highest growth rate. One of the main reasons for the sudden increase was the completion in 1969 of Lake Granbury, which turned the county into a popular recreation and resort center, as well as a retirement community. The influx of people into Hood County between 1970 and 1980 had a tremendous impact on the area, and by 1990 the county's population had grown to 28,981. The census counted 41,100 people living in Hood County in 2000 (Callaway 2006).

Somervell County

Somervell County is in north central Texas and comprises 188 square miles, the second-smallest area among Texas counties. Glen Rose, the principal town and county seat, is 55 miles southwest of Fort Worth. Prior to European settlement of North America, the area was inhabited by Native Americans, particularly members of the Caddo groups and Tonkawas. The southern edge of the Wichita Confederacy of Caddos extended into this area, although the Tonkawas were the major tribal group. Apaches and Comanches came into the area periodically (Elam 2006).

Most of the early history of Somervell County was as part of either Johnson or Hood Counties. Somervell County was established in 1875, when residents in southern Hood and northern Bosque counties petitioned for a new county because of their separation from markets and seats of government. The county, taken completely from Hood County, was named for Alexander Somervell, who led an expedition to Mexico under the Republic of Texas. The first and only county seat is Glen Rose, named in 1872. Other early communities included Wilcox, Rainbow, Nemo, and Glass. The census of 1880 indicated a population of 2,649, with only 132 in Glen Rose (Elam 2006).

Glen Rose was the center of activity for the county during the last two decades of the 19th century. Four periodicals were published in Glen Rose during these decades; the Glen Rose Citizen, the Glen Rose Falcon, and the Glen Rose Herald were local newspapers, while the Monthly Baptist Standard had a wider circulation. The county entered the 20th century with a population of 3,498. The population peaked at 3,931 in 1910 and then declined to a low of 2,542 by 1950 (Elam 2006).

Although agricultural production during the Great Depression remained fairly constant, unemployment increased dramatically. New Deal programs provided some assistance. Glen Rose borrowed $80,000 under the Public Works Administration to construct a new water and sewage system. Three low-water dams on the Paluxy River, several local school buildings, and a canning plant were built with Work Projects Administration money (Elam 2006).

In the years after World War II, county proximity to the Dallas-Fort Worth area led to a rapid increase in industry that transformed it. Dramatic changes came with the construction of a nuclear power plant by the Texas Utilities Electric Company along Squaw Creek north of Glen Rose. The construction of this plant, begun in the mid-1970s, resulted in some important financial advantages for the county. Between 1960 and 1970, the county grew by 8 percent, but the next census reflected a 49 percent growth rate; half the population of 4,154 lived in Glen

Rose. In 1990 the population of the county was 5,360, with Glen Rose (1,949) the most populous community (Elam 2006).

2.5.3.6.1 Historic Land Use Summary

Early land use on the CPNPP property consisted of farming and raising livestock. As early as 1853, some families began to settle the valleys of Squaw Creek and the Paluxy River within present day Somervell County. The earliest known settlement at the site is that of John Monroe Williams who settled in 1859, farming and raising livestock. Several of these earliest settlements were affected by a large flood of the Paluxy River and Squaw Creek in August of 1859 (Skinner and Humphreys 1973). The Location of the Williams Cabin is shown in Skinner and Humphreys (1973).

Farming and ranching continued to be the primary land uses, but the presence of trees and abundant limestone led to timber harvesting and small-scale quarrying. T. B. Chalmers attempted to establish a town along Squaw Creek, convincing a sawmill firm to locate at the new community, "...and they proceeded to saw up all the heavy timber that was available in the vicinity... Lots did not sell well and once the timber was logged out, the portable sawmill was moved elsewhere, thus snuffing out the life of Chalmers' planned Squaw Creek community" (Skinner and Humphreys 1973). Benjamin F. May settled on the property in 1877, and by 1882 began building a rock house. "The entire May family helped to quarry the limestone on the nearby hill" (Skinner and Humphreys 1973). Additional houses were constructed on May's property as his children became adults. These home sites include 41SV42, 41SV43, 41SV29, and a destroyed log structure.

Along with the homes of the May family, several other historic sites date from the late 1800s to early 1900s. Site 41HD65 (originally 41HD56) represents a turn of the century farmstead. The associated features included a house, windmill, stone-lined cellar, and stone-lined well. Site 41SV35 was a ranch complex dated from the late 1800s to the early 1900s. Site 41SV46 was a house site with a limestone block chimney, also from this period. Site 41SV53 represents a lime kiln from this period (Skinner and Humphreys 1973).

The Hopewell School Site (41SV30) "served . . . as an elementary school and sometime church from 1888 until 1942 when the school was incorporated into the Glen Rose Public Schools" (Skinner and Humphreys 1973). Also, Hopewell Cemetery, which includes the graves of people associated with the Hopewell Community, remains within the property to this day. A small, log-cabin-style post office was established at the Hopewell Community on May 24, 1901, but was discontinued just three years later. This structure is presently in the downtown square in Glen Rose.

County-wide data published through The Handbook of Texas Online gives broader data on land use for the county at large. The article notes that "...the county was still primarily agricultural and rural . . . Between 1940 and 1960 the number of farms was reduced by more than half, and agricultural production dropped" (Elam 2006). Also, "By the 1970s the chief agricultural products were cattle and hogs" (Elam 2006).

Agriculture and rural residency continued to be primary activities until 1973, when the property was acquired for the construction of Units 1 and 2. A portion of CPNPP property east of the

Squaw Creek Dam spillway is presently used as cattle pasture. Subsequent to the creation of Squaw Creek Reservoir, Texas Utilities (now Luminant) has maintained a 475-acre park across from the plant. For additional information on current land use related to mineral rights and energy production, see ER Section 2.2.

2.5.4 ENVIRONMENTAL JUSTICE

This section identifies, describes, and locates low-income and minority populations.

2.5.4.1 Methodology

In RG 4.7, the NRC defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental effects led President Clinton to issue an Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” in 1994 to address these issues. The order directs federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. The Council on Environmental Quality has provided guidance for addressing environmental justice. Guidance from the NRC Office of Nuclear Reactor Regulation regarding “Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues” (LIC-203, Revision 1) was used in this analysis.

The NRC guidance concluded that an 80-km (50-mi) radius, the CPNPP region, could reasonably be expected to contain potentially affected areas and that the state was an appropriate geographic area for comparative analysis. The methodology, contained in the guidance, was followed to identify the locations of minority and low-income populations within the region. Potential adverse effects are identified and discussed in Sections 4.4 and 5.8.

2.5.4.2 Minority Populations

The NRC Guidance and the U.S. Census Bureau defines a “minority” population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; Multiracial; and Hispanic ethnicity. Additionally, the NRC guidance requires that all other single minorities are to be treated as one population and analyzed (Other), and that the aggregate of all minority populations (Aggregate) is to be treated as one population and analyzed. The guidance indicates that a minority population exists if either of the following two conditions exist:

1. The minority population of the census block or environmental impact site exceeds 50 percent, or

2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority

population percentage in the geographic area chosen for the comparative analysis.

The area within the CPNPP region is used in this analysis to define the potential environmental impact area. Census blocks that are located within or are intersected by the boundary of the region are included in this area.

The geographic area used to define the criteria is the state of Texas. The census data are averaged for the state of Texas in each minority category to derive a criteria set. The calculated percentages derived from census block data within the region are compared to both criteria sets to locate census blocks that contain a minority population.

In addition to the minority definitions stated above, Hispanic ethnicity was also considered. According to the U.S. Census Bureau, Hispanic ethnicity is not a race. Therefore, a Hispanic individual can be counted in any of the race categories as well as the Hispanic ethnicity category. Because both Hispanic ethnicity and minority races are included in the Aggregate Minority plus Hispanic category, individuals who reported both a Hispanic ethnicity and a minority race, are counted twice.

Using the NRC minority guidance conditions and the U.S. Census data for Texas, the 37,212 census blocks in the CPNPP region were analyzed for minority populations. The results of the analysis are listed in Table 2.5-24 and shown in Figures 2.5-10, 2.5-11, 2.5-12, 2.5-13, 2.5-14, 2.5-15, 2.5-16, 2.5-17, and 2.5-18. The minority population percentage based on individuals throughout the region was also calculated for the CPNPP region and is presented in Table 2.5-25.

There are a total of 1295 blocks that are completely or partially contained in the 16-km (10-mi) radius of CPNPP. The number of census blocks containing minority populations within the 16-km (10-mi) radius of the CPNPP center point is tabulated in Table 2.5-26.

There are a total of 39 blocks that are completely or partially contained in the LPZ, defined as a 3.2-km (2-mi) radius from the CPNPP center point. Of these 39 blocks, two contain minority populations (Figure 2.5-18). One of the blocks represents the Persons Reporting Some Other Race category as well as the Hispanic category. Both blocks represent the Aggregate Minority plus Hispanic category.

According to the 2000 census data, there are a total of 65 Hispanic individuals and 35 individuals of some other race out of 96 total individuals living in the first block. The second block contains 77 individuals of some other race plus 139 Hispanic individuals out of a total of 362. The sum of the minority individuals is greater than the total because of the duplication that occurs when Hispanic individuals identify themselves as both Hispanic and some other race, as described above.

The two minority blocks near the site consist of small homes and trailers. Agriculture is limited to the keeping of goats, chickens, or gardens for personal use. The nearest residence is 0.9 mi from the CPNPP Units 3 and 4 center point. According to Table 5.3-6, the amount of salt deposition from the cooling towers at that distance and direction is 0.01 kg/km^2/month. Further information about salt deposition is found in Subsection 5.3.3.1.3. The residences closest to the site are located approximately 0.5 mi from FM 56.

2.5.4.3 Low-Income Populations

NRC guidance defines low-income households based upon statistical poverty thresholds. A block group is considered low-income if either of the following two conditions are met:

1. The low-income population in the census block groups or the environmental impact site exceeds 50 percent, or

2. The percentage of households below the poverty level in an environmental impact site is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

The same geographic area used in Subsection 2.5.4.2 is used for this analysis. The census data for poverty status are used for this analysis. The US Census Bureau determines poverty status by comparing a person's total family income, family size, and composition to a poverty threshold matrix. The poverty matrix contains 48 thresholds arranged by family size and number of children. Anyone meeting the matrix criteria for poverty is counted as an individual in poverty. To calculate household poverty data, only the householder and related individuals are considered. Anyone who is not related by marriage or birth to the householder is not included. To achieve a more conservative estimate, the census-defined "individuals below poverty level" data were used rather than the "households below poverty level" data.

Using the state geographic area criteria, 41 census block groups (3.7 percent) of the 1119 census block groups within the region have low-income populations that meet the conditions described above (Figure 2.5-19). Table 2.5-25 shows the percentage census block groups in the region that have low-income populations that meet the criteria. Within the vicinity there are no block groups that meet the conditions as shown in Table 2.5-26.

2.5.4.4 Subsistence Populations

Based upon the demographic (local and regional) and environmental justice analyses set forth in NUREG-1555, Luminant is not aware of any unusual resource dependencies or practices, or other circumstances, that could result in disproportionate impacts to minority or low-income populations. Indeed, the foregoing analysis suggests that such disproportionate impacts are unlikely given the observed distribution of low-income and minority populations within the site, vicinity and region.

Specifically, based on the U.S. Census data, Luminant identified no low-income populations within the site vicinity (Figure 2.5-19), where potential plant-related impacts (which have been found to be generally SMALL) would be expected to be most significant. Moreover, as reflected in Figures 2.5-18 and 2.5-19, minority and low-income populations were identified within the region and located principally within urban areas, where subsistence type dependence on natural resources (e.g., fish, game, agricultural products, and natural water sources) is less likely. To the extent that fishing, hunting, and agriculture occur in the vicinity of the CPNPP site, they appear to be recreational in nature.

2.5.4.5 Migrant Populations

Information on migrants is difficult to collect and evaluate. The most recent data source for this information is the 2002 Census of Agriculture. Farm operators were asked whether any hired or contract workers were migrant workers. A migrant worker is defined as a farm worker whose employment required travel that prevented the worker from returning to his permanent place of residence the same day. Migrants tend to work short-duration, labor-intensive jobs such as harvesting fruits and vegetables. Table 2.5-27 provides information on farms in the region that employ migrant labor (USDA 2002a), (USDA 2002b). Based on Table 2.5-27 migrant labor is not a significant part of agriculture in the CPNPP region with workers numbering less than one percent of the total permanent population in the same area. Thus, the presence of migrant workers is negligible.

2.5.5 NOISE

An ambient noise survey was conducted at the CPNPP site in February of 2007. CPNPP is currently an operational nuclear power facility. Noise sources during operation include heating, ventilation and air-conditioning systems, vents, transformers and electrical equipment, transmission lines and switch yards, water pumps, material-handling equipment, motors, public address systems, maintenance vehicles (fork lifts, tractors, trucks, etc.), warning sirens, trucks and vehicular traffic. Many of the noise sources are confined indoors, underground, or are used infrequently. A firearms shooting range is also located on-site, away from the main portion of the facility, but can create sporadic noise during times weapons are fired.

Other noise generated on-site is from natural sources such as wind through foliage, wildlife, and insects. Noise generated outside of the fence line from nearby off-site sources includes, residential activities (near locations 1 and 2), traffic along the western fence line (plant entrance), and boats near the swim beach at the northern fence line (location 15) (Figure 2.5-20).

Nearby locations with potential sensitivity to noise were identified from the ambient noise survey as well as site reconnaissance conducted in 2007. Receptors were reviewed within a 10-mi radius of the site and include the nearest residences and meeting places: location 23 (south fence line), location 1 and location 17 (near the east fence line), Post Oak Memorial Chapel and cemetery (location 25), Freedom Church (location 40), and Happy Hill Children's Home (location 30). The nearest residence (location 1) is approximately 0.8 mi southwest of the center point. Recreation locations were also selected such as the swim beach on the north side of SCR, now closed to the public (location 2). No sensitive receptors, except for wildlife and migratory birds, were located within the fence line of the facility. The nearby residences are located across SCR and to the south-southwest of the fence line. Noise is attenuated with distance for the residences to the south-southwest because trees with foliage, ground cover, earthen berms, and other natural features act to dampen the noise. However, because water is between the eastern fence line and the residences across SCR, potential noise from the site would not be attenuated with distance past the fence line (location 2) as it would be by natural methods. All these residences are located at a substantial distance that is unaffected by proposed additional CPNPP noise.

The ambient noise survey was conducted within an 5-mi radius of the site and along extant transmission lines. The report concluded that the fence line (locations 1, 2, 3, and 15) and off-site noise levels measured were in the range of values expected for ambient noise for a low density residential and rural location. Area noise levels ranged between 35 and 70 (traffic) dBA (daytime) and between 36 and 60 dBA (nighttime). Average equivalent sound levels (Leq) measured between 36 and 55 dBA (daytime) and from 37 to 55 (nighttime). These measurements for the day-night average (Ldn) are similar to expected levels for the day-night time average in a rural area ranging from 50 to 55 Ldn.

Subsection 2.5.3 references historic properties within a 10-mi radius of the site boundaries. Historic properties are located within 1.2 mi of an extant transmission line. Historic properties should not be impacted by operational noise from the site or extant transmission line noise. Historic properties are located at a sufficient distance from noise sources that noise levels would attenuate to below background levels or ambient noise levels at the historic sites.

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TABLE 2.5-1 (Sheet 1 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
North							
2007	0	16	51	154	337	9395	9953
2016	0	18	59	179	390	10,884	11,530
2026	0	21	67	206	450	12,540	13,284
2036	0	24	76	233	509	14,195	15,037
2046	0	27	85	260	568	15,850	16,790
2056	0	29	94	287	628	17,506	18,544
NNE							
2007	1	18	39	113	220	6379	6770
2016	1	21	45	131	255	7391	7844
2026	1	24	52	151	293	8515	9036
2036	1	26	59	171	332	9639	10,228
2046	1	29	66	191	371	10,763	11,421
2056	1	32	73	210	409	11,887	12,612
NE							
2007	0	15	112	161	359	2296	2943
2016	0	17	130	186	416	2660	3409
2026	0	19	150	214	479	3065	3927
2036	0	21	170	243	542	3469	4445
2046	0	23	190	271	605	3874	4963
2056	0	25	209	299	668	4279	5480
ENE							
2007	0	2	36	84	271	2566	2959
2016	0	2	40	95	311	2970	3418
2026	0	3	45	108	355	3867	3929
2036	0	3	49	121	399	4315	4439
2046	0	3	54	133	443	4315	4948
2056	0	3	58	146	488	4763	5458

TABLE 2.5-1 (Sheet 2 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
EAST							
2007	0	5	131	29	54	161	380
2016	0	6	145	32	60	177	420
2026	0	6	159	35	66	195	461
2036	0	7	174	39	72	213	505
2046	0	8	188	42	78	232	548
2056	0	8	203	45	84	250	590
ESE							
2007	0	23	57	111	247	495	933
2016	0	25	62	123	272	544	1026
2026	0	27	69	135	299	600	1131
2036	0	30	75	147	327	655	1234
2046	0	33	81	160	355	710	1339
2056	0	35	87	172	382	765	1442
SE							
2007	0	71	89	135	316	304	915
2016	0	79	98	148	348	335	1008
2026	0	87	108	163	383	369	1110
2036	0	95	117	178	419	403	1212
2046	0	102	127	193	454	437	1313
2056	0	110	137	208	489	471	1415
SSE							
2007	0	140	109	799	1516	598	3162
2016	0	154	120	879	1668	658	3479
2026	0	169	132	968	1837	725	3831
2036	0	185	144	1057	2006	791	4183
2046	0	200	156	1146	2175	858	4535
2056	0	216	168	1235	2344	925	4888

TABLE 2.5-1 (Sheet 3 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
SOUTH							
2007	8	80	24	124	68	365	669
2016	8	88	26	136	75	401	734
2026	9	97	29	150	83	442	810
2036	10	106	32	163	91	483	885
2046	11	115	35	177	98	523	959
2056	12	124	37	191	106	564	1034
SSW							
2007	29	67	20	25	40	193	374
2016	32	74	22	27	44	213	412
2026	35	81	25	30	48	234	453
2036	38	89	27	33	52	256	495
2046	41	96	29	36	57	277	536
2056	44	104	32	38	61	299	578
SW							
2007	28	51	31	44	42	92	288
2016	31	56	35	48	46	101	317
2026	34	62	38	53	51	112	350
2036	37	68	42	58	55	122	382
2046	40	73	45	63	60	132	413
2056	43	79	49	67	65	143	446
WSW							
2007	39	31	40	23	44	73	250
2016	43	34	45	26	50	83	281
2026	47	37	50	29	56	94	313
2036	52	41	54	32	62	105	346
2046	56	44	59	36	69	115	379
2056	61	48	64	39	75	126	413

TABLE 2.5-1 (Sheet 4 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
WEST							
2007	12	12	49	101	45	119	338
2016	14	14	57	117	52	138	392
2026	15	16	65	135	60	159	450
2036	16	17	74	153	68	180	508
2046	18	19	83	170	76	201	567
2056	19	21	91	188	83	222	624
WNW							
2007	1	5	22	68	77	216	389
2016	1	6	26	79	89	250	451
2026	1	7	29	91	102	288	518
2036	1	8	33	103	116	326	587
2046	1	9	37	115	130	364	656
2056	1	10	41	127	143	402	724
NW							
2007	1	2	6	4	27	985	1025
2016	1	3	7	4	32	1141	1188
2026	1	3	8	5	37	1315	1369
2036	1	4	9	5	41	1488	1548
2046	1	4	10	6	46	1662	1729
2056	1	4	11	7	51	1835	1909
NNW							
2007	1	4	16	63	169	851	1103
2016	1	4	18	73	196	986	1277
2026	1	5	21	85	226	1136	1473
2036	1	6	24	96	256	1286	1668
2046	1	6	26	107	285	1436	1860
2056	1	7	29	118	315	1585	2054

TABLE 2.5-1 (Sheet 5 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
Totals							
2007	119	542	832	2038	3832	25,088	32,451
2016	131	601	935	2283	4304	28,932	37,186
2026	143	665	1047	2558	4825	33,207	42,445
2036	156	730	1159	2832	5347	37,478	47,702
2046	169	791	1271	3106	5870	41,749	52,956
2056	182	855	1384	3377	6391	46,022	58,211

Cumulative Totals	0-2 (km)	0-4 (km)	0-6 (km)	0-8 (km)	0-10 (km)	0-16 (km)
2007	119	661	1493	3531	7363	32,451
2016	131	732	1667	3950	8254	37,186
2026	143	808	1855	4413	9238	42,445
2036	156	886	2045	4877	10,224	47,702
2046	169	960	2231	5337	11,207	52,956
2056	182	1037	2421	5798	12,189	58,211

a) Based on 2000 Census data

TABLE 2.5-2 (Sheet 1 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 16 KM (10 MI) – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year		Sector 16-40 (km)	40-60 (km)	60-80 (km)	16-80 (km)
North					
	2007	11,320	37,256	17,904	66,480
	2016	13,082	42,981	20,702	76,765
	2026	15,040	49,342	23,811	88,193
	2036	16,997	55,702	26,920	99,619
	2046	18,955	62,063	30,028	111,046
	2056	20,913	68,424	33,137	122,474
NNE					
	2007	7586	61,636	91,401	160,623
	2016	8777	70,856	104,610	184,243
	2026	10,099	81,100	119,287	210,486
	2036	11,422	91,345	133,964	236,731
	2046	12,745	101,589	148,641	262,975
	2056	14,067	111,834	163,318	289,219
NE					
	2007	5896	207,161	646,328	859,385
	2016	6963	237,503	736,399	980,865
	2026	8149	271,217	836,478	1,115,844
	2036	9335	304,930	936,557	1,250,822
	2046	10,521	338,644	1,036,636	1,385,801
	2056	11,707	372,358	1,136,715	1,520,780
ENE					
	2007	11,865	69,338	142,365	223,568
	2016	14,123	82,491	167,494	264,108
	2026	16,632	97,106	195,416	309,154
	2036	19,141	111,721	223,337	354,199
	2046	21,650	126,336	251,259	399,245
	2056	24,160	140,950	279,180	444,290

TABLE 2.5-2 (Sheet 2 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 16 KM (10 MI) – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year		Sector 16-40 (km)	40-60 (km)	60-80 (km)	16-80 (km)
EAST					
	2007	27,428	15,290	9326	52,044
	2016	32,648	18,041	11,060	61,749
	2026	38,447	21,097	12,987	72,531
	2036	44,246	24,154	14,914	83,314
	2046	50,045	27,211	16,840	94,096
	2056	55,845	30,267	18,767	104,879
ESE					
	2007	975	3951	13,732	18,658
	2016	1129	4398	15,293	20,820
	2026	1301	4894	17,026	23,221
	2036	1472	5391	18,760	25,623
	2046	1644	5888	20,493	28,025
	2056	1815	6384	22,227	30,426
SE					
	2007	1154	8043	6691	15,788
	2016	1249	8816	7258	17,323
	2026	1355	9676	7999	19,030
	2036	1461	10,535	8740	20,736
	2046	1566	11,394	9481	22,441
	2056	1672	12,254	10,222	24,148
SSE					
	2007	1061	2866	7218	11,145
	2016	1145	3092	7792	12,029
	2026	1238	3342	8430	13,010
	2036	1331	3593	9069	13,993
	2046	1424	3844	9707	14,975
	2056	1517	4094	10,345	15,956

TABLE 2.5-2 (Sheet 3 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 16 KM (10 MI) – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year		Sector 16-40 (km)	40-60 (km)	60-80 (km)	16-80 (km)
SOUTH					
	2007	1673	933	2547	5153
	2016	1808	1000	2776	5584
	2026	1958	1074	3022	6054
	2036	2108	1147	3262	6517
	2046	2258	1220	3493	6971
	2056	2408	1291	3718	7417
SSW					
	2007	688	2050	4478	7216
	2016	748	2132	4639	7519
	2026	814	2211	4788	7813
	2036	880	2276	4906	8062
	2046	946	2329	4991	8266
	2056	1012	2368	5045	8425
SW					
	2007	1172	1360	1492	4024
	2016	1291	1471	1541	4303
	2026	1424	1590	1580	4594
	2036	1557	1706	1601	4864
	2046	1689	1819	1605	5113
	2056	1822	1927	1592	5341
WSW					
	2007	5206	21,732	5543	32,481
	2016	5738	23,951	5796	35,485
	2026	6329	26,417	6024	38,770
	2036	6919	28,883	6196	41,998
	2046	7510	31,348	6313	45,171
	2056	8101	33,814	6374	48,289

TABLE 2.5-2 (Sheet 4 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 16 KM (10 MI) – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year		Sector 16-40 (km)	40-60 (km)	60-80 (km)	16-80 (km)
WEST					
	2007	1566	3388	996	5950
	2016	1728	3734	1035	6497
	2026	1908	4118	1068	7094
	2036	2087	4503	1090	7680
	2046	2267	4887	1100	8245
	2056	2447	5271	1100	8818
WNW					
	2007	1236	853	1777	3866
	2016	1374	936	1890	4200
	2026	1527	1027	2009	4563
	2036	1680	1118	2120	4918
	2046	1833	1210	2224	5267
	2056	1986	1301	2320	5607
NW					
	2007	1805	1949	1703	5457
	2016	2061	2104	1834	5999
	2026	2345	2277	1980	6602
	2036	2629	2449	2126	7204
	2046	2914	2622	2272	7808
	2056	3198	2794	2418	8410
NNW					
	2007	4307	7022	23,143	34,472
	2016	4979	8013	25,718	38,710
	2026	5726	9115	28,580	43,421
	2036	6474	10,216	31,441	48,131
	2046	7221	11,317	34,303	52,841
	2056	7969	12,419	37,165	57,553

TABLE 2.5-2 (Sheet 5 of 5)
THE PROJECTED PERMANENT POPULATION FOR EACH SECTOR 16 KM (10 MI) – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Direction / Year	Sector 16-40 (km)	40-60 (km)	60-80 (km)	16-80 (km)
Totals				
2007	84,938	444,828	976,544	1,506,310
2016	98,843	511,519	1,115,837	1,726,199
2026	114,292	585,603	1,270,485	1,970,380
2036	129,739	659,669	1,425,003	2,214,411
2046	145,188	733,721	1,579,386	2,458,295
2056	160,639	807,750	1,733,643	2,702,032

Cumulative Totals	16-40 (km)	16-60 (km)	16-80 (km)
2007	84,938	529,766	1,506,310
2016	98,843	610,362	1,726,199
2026	114,292	699,895	1,970,380
2036	129,739	789,408	2,214,411
2046	145,188	878,909	2,458,295
2056	160,639	968,389	2,702,032

a) Based on 2000 Census data

TABLE 2.5-3
THE CURRENT RESIDENTIAL AND TRANSIENT POPULATION FOR EACH SECTOR 0 – 16 KM (10 MI)

Direction (2007)	Sector 0-2 (km)	2-4 (km)	4-6 (km)	6-8 (km)	8-10 (km)	10-16 (km)	0-16 (km)
NORTH	0	16	51	154	337	39,034	39,592
NNE	1	18	39	113	220	6439	6830
NE	0	15	112	161	359	2504	3151
ENE	0	2	36	84	271	2566	2959
EAST	0	5	131	29	54	161	380
ESE	0	23	57	111	247	495	933
SE	0	71	2989	2326	879	373	6638
SSE	0	140	109	799	3238	598	4884
SOUTH	8	80	24	377	68	665	1222
SSW	29	67	726	25	40	193	1080
SW	28	51	31	44	42	92	288
WSW	69	31	40	23	44	73	280
WEST	12	12	49	101	45	119	338
WNW	1	5	22	68	77	216	389
NW	1	2	6	4	27	1154	1194
NNW	0	4	16	63	169	851	1103
Totals	149	542	4438	4482	6117	55,533	71,261

Cumulative Totals	0-2 (km)	0-4 (km)	0-6 (km)	0-8 (km)	0-10 (km)	0-16 (km)
2007	149	691	5129	9611	15,728	71,261

a) Based on 2000 Census data

TABLE 2.5-4
THE PROJECTED TRANSIENT POPULATION FOR EACH SECTOR 0 – 80 KM (50 MI) FOR YEARS 2007, 2016, 2026, 2036, 2046, AND 2056

Distance (km)	Direction	2007	2016	2026	2036	2046	2056
2	WSW	30	33	36	39	42	46
6	SE	2900	3191	3514	3837	4160	4483
6	SSW	706	776	855	934	1012	1091
8	SE	2191	2411	2655	2899	3143	3387
8	S	253	278	307	335	363	391
10	SE	563	620	682	745	808	871
10	SSE	1722	1895	2087	2279	2471	2663
16	N	29,639	34,339	39,561	44,784	50,006	55,228
16	NNE	60	69	80	90	101	111
16	NE	208	242	278	315	352	388
16	SE	69	76	84	91	99	107
16	S	300	330	364	397	431	464
16	NW	169	196	226	255	285	315
40	N	136	157	180	204	227	251
40	NNE	107	124	143	162	181	199
40	NE	80	95	111	127	144	160
40	E	11,634	13,848	16,308	18,768	21,228	23,687
40	SSW	270	294	320	346	372	398
40	SW	1	1	1	1	2	2
40	WSW	5580	6150	6783	7416	8050	8683
40	NW	22	26	29	33	36	40
40	NNW	6	7	8	9	9	10
60	N	45,423	52,403	60,158	67,913	75,668	83,423
60	NNE	92	106	122	137	152	168
60	NE	2215	2539	2899	3260	3620	3981
60	ENE	5680	6757	7955	9152	10,349	11,546
60	SE	11,135	12,205	13,395	14,585	15,775	16,964
60	SSE	715	771	834	896	959	1022
80	N	114	131	151	171	191	210
80	NNE	898	1028	1172	1316	1460	1604
80	NE	210,974	240,374	273,042	305,710	338,377	371,045
80	SSE	5321	5744	6215	6685	7155	7626
80	SSW	1750	1813	1871	1917	1950	1971
80	NNW	11,256	12,508	13,900	15,292	16,684	18,075

TABLE 2.5-5
COUNTIES ENTIRELY OR PARTIALLY LOCATED WITHIN THE CPNPP REGION

Texas Counties

Bosque	Ellis	Jack	Somervell
Comanche	Erath	Johnson	Stephens
Coryell	Hamilton	McLennan	Tarrant
Dallas	Hill	Palo Pinto	Wise
Eastland	Hood	Parker	

TABLE 2.5-6 (Sheet 1 of 3)
MUNICIPALITIES IN THE CPNPP REGION

Populated Places	2000 Population
Fort Worth	534,694
North Richland Hills	55,635
Haltom City	39,018
Mansfield	28,031
Cleburne	26,005
Watauga	21,908
Burleson	20,976
Benbrook	20,208
Weatherford	19,000
Mineral Wells	16,946
Stephenville	14,921
White Settlement	14,831
Forest Hill	12,949
Saginaw	12,374
Azle	9600
Rendon CDP	9022
Hillsboro	8232
Richland Hills	8132
Midlothian	7480
Crowley	7467
River Oaks	6985
Eagle Mountain CDP	6599
Kennedale	5850
Everman	5836
Granbury	5718
Keene	5003
Lake Worth	4618
Joshua	4528
Sansom Park	4181
Dublin	3754
Pecan Plantation CDP	3544
Clifton	3542
Alvarado	3288

TABLE 2.5-6 (Sheet 2 of 3)
MUNICIPALITIES IN THE CPNPP REGION

Populated Places	2000 Population
Hamilton	2977
Willow Park	2849
Edgecliff Village	2550
Oak Trail Shores CDP	2475
Reno	2441
De Leon	2433
Blue Mound	2388
Pantego	2318
Pecan Acres CDP	2289
Dalworthington Gardens	2186
Glen Rose	2122
Springtown	2062
Whitney	1833
Aledo	1726
Hudson Oaks	1637
Pelican Bay	1505
Itasca	1503
Meridian	1491
Grandview	1358
Hico	1341
Valley Mills	1123
Annetta	1108
Lakeside	1040
Venus	910
Godley	879
Walnut Springs	755
Maypearl	746
Strawn	739
Oak Grove	710
Westover Hills	658
Rio Vista	656
Annetta South	555
Tolar	504

TABLE 2.5-6 (Sheet 3 of 3)
MUNICIPALITIES IN THE CPNPP REGION

Populated Places	2000 Population
Briaroaks	493
Morgan	485
Annetta North	467
Gustine	457
Gordon	451
Lipan	425

(US Census 2000c)

TABLE 2.5-7
DISTRIBUTION OF POPULATION IN THE CPNPP REGION BY AGE AND SEX

	Vicinity		Region		State	
Age	Males (%)	Females (%)	Males (%)	Females (%)	Males (%)	Females (%)
Under 5 Yr	2.9	2.8	3.9	3.7	4.0	3.8
5 to 9 Yr	3.4	3.3	4.0	3.8	4.1	3.9
10 to 14 Yr	4.0	3.7	4.0	3.8	4.0	3.8
15 to 17 Yr	2.5	2.4	2.4	2.2	2.4	2.3
18 and 19 Yr	1.3	1.0	1.5	1.5	1.6	1.5
20 Yr	0.5	0.4	0.7	0.7	0.8	0.8
21 Yr	0.4	0.4	0.7	0.7	0.8	0.7
22 to 24 Yr	1.3	1.3	2.1	2.0	2.3	2.1
25 to 29 Yr	2.2	2.1	3.7	3.6	3.9	3.7
30 to 34 Yr	2.5	2.8	3.8	3.7	3.8	3.7
35 to 39 Yr	3.6	3.7	4.2	4.1	4.1	4.0
40 to 44 Yr	3.7	3.9	4.0	4.0	3.9	3.9
45 to 49 Yr	3.6	3.7	3.4	3.4	3.4	3.4
50 to 54 Yr	3.4	3.8	2.9	3.0	2.8	2.9
55 to 59 Yr	3.1	3.5	2.2	2.3	2.1	2.2
60 and 61 Yr	1.3	1.3	0.7	0.8	0.7	0.7
62 to 64 Yr	2.0	1.9	1.0	1.1	0.9	1.0
65 and 66 Yr	1.1	1.1	0.6	0.7	0.6	0.7
67 to 69 Yr	1.6	1.5	0.8	1.0	0.8	0.9
70 to 74 Yr	2.4	2.2	1.2	1.5	1.1	1.4
75 to 79 Yr	1.4	1.7	0.9	1.3	0.8	1.2
80 to 84 Yr	0.6	1.0	0.5	0.9	0.5	0.8
85 Yr and Over	0.5	1.2	0.3	0.9	0.3	0.8
Total	49.3	50.7	49.5	50.5	49.7	50.2

(US Census 2000e)

TABLE 2.5-8 (Sheet 1 of 2)
CONTRIBUTORS TO TRANSIENT POPULATION WITHIN THE CPNPP REGION

Facility Name	Average Daily Transients	Peak Daily Transients
Will Rogers Memorial Center	12,458	41,667
Billy Bob’s Texas	5918	---
Fort Worth Cats Baseball	4167	---
Casa Manana Dinner Theater	---	3718
Fort Worth Convention Center	3014	3801
Fort Worth Museum of Science and History	2901	---
Fort Worth Botanical Gardens	2740	---
Fort Worth Zoo	2714	---
Bass Performance Hall	2135	---
Kimball Art Museum	971	---
Brazos Drive-In Theater	962	---
Fort Worth Herd	767	---
Hamilton Roping Arena	750	---
Modern Art Museum	649	---
Dinosaur Valley State Park	644	---
Fort Worth Nature Center and Refuge	551	---
Oakdale Park	548	---
Glen Rose Expo Center	545	2000
Lake Whitney State Park	332	---
Amon Carter Museum	325	---
Lake Granbury Boating	207	290
Lake Mineral Wells State Park	284	---
National Cowgirl Museum and Hall of Fame	276	---
Meridian State Park	274	---
Fossil Rim Wildlife Center	274	---
Stockyards Museum	272	---
Bureau of Engraving and Printing Visitors Center	255	---
Texas Cowboy Hall of Fame	247	---
Creation Evidence Museum	231	---
Cleburne State Park	229	---

TABLE 2.5-8 (Sheet 2 of 2)
CONTRIBUTORS TO TRANSIENT POPULATION WITHIN THE CPNPP REGION

Facility Name	Average Daily Transients	Peak Daily Transients
Fort Worth Amtrak Texas Eagle	224	---
Texas Amphitheatre	164	---
Tres Rios River Ranch	137	---
Granbury Riverboat	136	---
Pecan Plantation County Club	123	---
Squaw Valley Golf Course	99	300
Weatherford Rodeo Arena	96	5000
Hidden Oaks Golf Course	93	---
Texas Civil War Museum	82	---
Glen Lake Methodist Camp and Retreat Center	77	---
Riverbend Retreat Center	63	---
Harbor Lakes Golf Course	60	---
Rough Creek Lodge and Resort	55	---
DeCordova Bend Golf Course	51	---
Shooting Gallery Gun Range	50	---
Granbury Country Club	35	---
Hood County Jail and Historical Museum	34	---
CPNPP Visitor Center	27	---
Somervell County Historical Museum	24	---
Pier 144 Marina and RV Park	21	---
Chandler’s Gun Shop and Shooting Range	8	---
Cleburne Amtrak Texas Eagle	5	---
Starr Hollow Golf Course	3	20
The Windmill Farm and Bed and Breakfast	3	150
Trickle Creek Cabins	2	---
Hideaway Ranch and Retreat	1	---

(Amtrak 2006), (Brazos River Authority 2006a), (CHL 2006), (Glen Rose Expo 2006), and (Somervell County 2006)

TABLE 2.5-9
TOP EVENTS IN THE CPNPP REGION

Event	Location	Dates for 2007	Total Visitors
Honeyfest 2007	Burleson	May 12	10,000
Antique Alley and Yard Sale Spring	Cleburne	April 15-17	30,000
Antique Alley and Yard Sale Fall	Cleburne	September 16-18	25,000
Octoberfest and Kaleidoscope Festival	Clifton	October 20	5000
Cowtown Marathon	Fort Worth	February 24	12,620
Jazz by the Boulevard Music and Arts Festival	Fort Worth	September 16-17	50,000
Main Street Arts Festival	Fort Worth	April 19-22	450,000
Mayfest	Fort Worth	May 4-7	300,000
Crown Plaza Invitational Golf Tournament	Fort Worth	May 24-27	175,000
Fort Worth Southwestern Exposition Livestock Show and Rodeo	Fort Worth	Jan. 12 – Feb. 4	1,000,000
Red Steagall Cowboy Gathering	Fort Worth	October 27-29	45,000
Texas Forts Muster	Fort Worth	April 28-29	30,000
Willie Nelson & Friends 4th of July	Fort Worth	July 4	50,000
PRCA Rodeo	Glen Rose	March	6000
Tommy Alverson Family Gathering	Glen Rose	October 5	7500
Annual 4th of July Celebration	Granbury	July 3-4	50,000
Brazos River Musicfest	Granbury	March 24	5000
Country Christmas Celebration	Granbury	November 23	7000
General Granbury's Birthday	Granbury	March 24	7000
Harvest Moon Festival	Granbury	October 20-21	5000
Thunder over Texas Christian Bike Rally and Car Show	Granbury	August 31	7000
Dove Festival	Hamilton	Labor Day Weekend	5000
Crazy Water Festival	Mineral Wells	October 8	10,000
Texas Music Festival	Stephenville	April 17-21	20,000
Christmas on the Square	Weatherford	December	5000
First Monday Weekends	Weatherford	Monthly	8000
Parker County Peach Festival	Weatherford	July 9	40,000
PRCA Rodeo	Weatherford	June 14	20,000
AMA Pro/Am National Motocross	Whitney	March 6-11	10,000
Pioneer Days	Whitney	October	10,000
West Shores Fire Dept. Fish Fry	Whitney	Labor Day Weekend	5000

(The Cowtown 2007), (Craftlister 2005a), (Craftlister 2005b), and (Guide to Texas Outside 2007)

TABLE 2.5-10 (Sheet 1 of 2)
EMPLOYMENT BY INDUSTRY (2001 – 2006)

County	Bosque			Erath			Hood			Johnson			Somervell			Tarrant		
Industry	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change
Total employment	7781	8213	1.1	20,587	22,341	1.7	14,070	16,524	3.5	52,826	62,212	3.6	5076	4947	-0.5	897,896	979,676	1.8
Wage and salary employment	4362	4314	-0.2	14,954	15,885	1.2	10,399	12,113	3.3	35,699	40,923	2.9	3856	3583	-1.4	754,043	790,657	1.0
Proprietors employment	3419	3899	2.8	5633	6456	2.9	3671	4411	4.0	17,127	21,289	4.9	1220	1364	2.4	143,853	189,019	6.3
Forestry, fishing, related activities	(D)	97	(D)	(D)	648	(D)	70	73	0.9	(D)	(D)	(D)	(D)	(D)	(D)	569	553	-0.6
Mining	(D)	73	(D)	103	98	-1.0	113	366	44.8	(D)	891	(D)	(D)	(D)	(D)	8823	10,538	3.9
Utilities	65	60	-1.5	(D)	81	(D)	119	130	1.8	185	179	-0.6	(D)	(D)	(D)	1589	1549	-0.5
Construction	607	702	3.1	1068	1424	6.7	1306	1568	4.0	5403	6897	5.5	(D)	345	(D)	56,783	62,519	2.0
Manufacturing	627	642	0.5	2043	1548	-4.8	446	552	4.8	7654	6568	-2.8	299	222	-5.2	98,797	92,085	-1.4
Wholesale trade	284	241	-3.0	621	620	0.0	170	302	15.5	1436	1994	7.8	(D)	(D)	(D)	40,820	42,962	1.0
Retail trade	719	784	1.8	2142	2368	2.1	2103	2482	3.6	7221	8370	3.2	310	363	3.4	107,792	113,655	1.1
Transportation and warehousing	188	141	-5.0	313	596	18.1	202	272	6.9	1921	3199	13.3	(D)	170	(D)	66,328	64,906	-0.4
Information	58	58	0.0	161	198	4.6	176	254	8.9	490	710	9.0	(D)	(D)	(D)	21,819	19,451	-2.2
Finance and insurance	261	285	1.8	598	617	0.6	592	696	3.5	1903	1912	0.1	96	115	4.0	45,839	52,138	2.7
Real estate and rental and leasing	220	333	10.3	409	586	8.7	586	731	4.9	1717	2527	9.4	149	236	11.7	27,835	37,605	7.0
Professional and technical services	(D)	247	(D)	631	(D)	(D)	672	697	0.7	(D)	2262	(D)	(D)	145	(D)	47,573	54,813	3.0
Management of companies and enterprises	0	(D)	(D)	0	(D)	(D)	(D)	(D)	(D)	(D)	307	(D)	0	0	0	3793	4857	5.6
Administrative and waste services	(D)	(D)	(D)	481	(D)	(D)	(D)	(D)	(D)	2161	2949	7.3	(D)	272	(D)	61,035	73,484	4.1
Educational services	(D)	126	(D)	98	93	-1.0	128	127	-0.2	616	749	4.3	(L)	15	(D)	11,944	15,920	6.7
Health care and social assistance	(D)	491	(D)	1814	1763	-0.6	1262	1321	0.9	4151	4374	1.1	(D)	(D)	(D)	71,633	81,463	2.7
Arts, entertainment, and recreation	59	84	8.5	235	319	7.1	485	485	0.0	688	(D)	(D)	(D)	77	(D)	16,389	18,754	2.9
Accommodation and food services	209	276	6.4	1391	1806	6.0	1036	1417	7.4	2522	3339	6.5	(D)	339	(D)	64,153	70,352	1.9
Other services, except public administration	504	612	4.3	1392	1619	3.3	1001	1304	6.1	3552	4385	4.7	167	269	12.2	48,576	57,060	3.5

TABLE 2.5-10 (Sheet 2 of 2)
EMPLOYMENT BY INDUSTRY (2001 – 2006)

County	Bosque			Erath			Hood			Johnson			Somervell			Tarrant		
Industry	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change	2001	2006	Annual Percent Change
Government and government enterprises	1025	1252	4.4	3249	3613	2.2	1870	2116	2.6	6104	6947	2.8	599	704	3.5	94,317	103,611	2.0

(D) Not shown to avoid disclosure of confidential information

(L) Less than 10 jobs

Source: Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce

References: (BEA 2006a), (BEA 2006b), (BEA 2006c), (BEA 2006d), (BEA 2006e), (BEA 2006f)

TABLE 2.5-11
TOP EMPLOYERS LOCATED IN HOOD COUNTY

Company	City	Product	Employees
Granbury ISD	Granbury	School district	1230
Wal-Mart Supercenter	Granbury	Retail	400
Lake Granbury Medical Center	Granbury	Medical	250
Lowe’s Home Improvement	Granbury	Retail	250
Gay & Sons Masonry	Granbury	Construction	200
Hood County	Granbury	County government	200
Granbury Care Center	Granbury	Medical	170
City of Granbury	Granbury	Government	151
Home Depot	Granbury	Retail	150
First National Bank	Granbury	Financial services	140

(Granbury EDC 2006)

TABLE 2.5-12
TOP EMPLOYERS LOCATED IN SOMERVELL COUNTY

Company	City	Product	Employees
Luminant - CPNPP Units 1 and 2	Glen Rose	Electric generation	1000 Operations 800 – 1200 Outage
Glen Rose ISD	Glen Rose	School district	292
Glen Rose Medical Center	Glen Rose	Medical	280
Somervell County	Glen Rose	County government	145
Fossil Rim Wildlife Center	Glen Rose	Recreation	69
Unimin Corporation	Glen Rose	Industrial mineral producer	45
Squaw Valley Golf Course	Glen Rose	Recreation	40

TABLE 2.5-13
EMPLOYMENT TRENDS IN THE ECONOMIC REGION 2001 – 2006

	2001				2006				Percent Changes		
County	Labor Force	Employed	Unemployed	Unemployment Rate	Labor Force	Employed	Unemployed	Unemployment Rate	Labor Force	Employed	Unemployed
Bosque	7,896	7,537	359	4.5%	8,301	7,876	425	5.1%	1.0%	0.9%	3.7%
Erath	16,098	15,488	610	3.8%	17,368	16,667	701	4.0%	1.6%	1.5%	3.0%
Hood	20,016	19,154	862	4.3%	22,487	21,314	1,173	5.2%	2.5%	2.3%	7.2%
Johnson	66,742	64,128	2,614	3.9%	71,760	68,312	3,448	4.8%	1.5%	1.3%	6.4%
Somervell	3,365	3,217	148	4.4%	3,699	3,476	223	6.0%	2.0%	1.6%	10.1%
Tarrant	792,006	762,201	29,805	3.8%	851,209	808,214	42,995	5.1%	1.5%	1.2%	8.9%
Economic Region	906,123	871,725	34,398	4.1%	974,824	925,859	48,965	5.0%	1.5%	1.2%	8.5%
Texas	10,407,162	9,955,982	451,180	4.5%	11,309,982	10,715,616	594,366	5.3%	1.7%	1.5%	6.3%

TABLE 2.5-14
INCOME DISTRIBUTION BY HOUSEHOLD FOR COMMUNITIES NEAR CPNPP

	Glen Rose		Granbury		Pecan Plantation CDP		Tolar	
Income by Household	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
Less than $10,000	121	14.8	289	11.8	15	1.0	14	8.0
$10,000 to $14,999	79	9.6	155	6.3	0	0.0	10	5.7
$15,000 to $19,999	74	9.0	130	5.3	37	2.5	19	10.8
$20,000 to $24,999	66	8.1	177	7.2	28	1.9	4	2.3
$25,000 to $29,999	71	8.7	239	9.8	39	2.6	5	2.8
$30,000 to $34,999	63	7.7	196	8.0	39	2.6	19	10.8
$35,000 to $39,999	54	6.6	179	7.3	76	5.1	19	10.8
$40,000 to $44,999	42	5.1	160	6.5	54	3.6	11	6.3
$45,000 to $49,999	24	2.9	100	4.1	69	4.6	17	9.7
$50,000 to $59,999	79	9.6	230	9.4	174	11.7	11	6.3
$60,000 to $74,999	55	6.7	172	7.0	211	14.2	13	7.4
$75,000 to $99,999	49	6.0	281	11.5	244	16.4	19	10.8
$100,000 to $124,999	26	3.2	71	2.9	223	15.0	5	2.8
$125,000 to $149,999	10	1.2	13	0.5	80	5.4	7	4.0
$150,000 to $199,999	2	0.2	24	1.0	127	8.5	3	1.7
$200,000 or more	4	0.5	33	1.3	72	4.8	0	0.0

(US Census 2000e)

TABLE 2.5-15
PER CAPITA PERSONAL INCOME – 1996, 2001, AND 2006

	1996	2001	2006	Average Annual Growth 1996 - 2006 (%)
Hood County, TX	20,326	28,206	33,923	6.7
Somervell County, TX	19,798	25,998	29,356	4.8
Tarrant County, TX	23,866	31,560	36,642	5.4
Bosque County, TX	17,154	22,390	26,619	5.5
Erath County, TX	18,803	23,494	25,945	3.8
Johnson County, TX	18,925	24,609	27,973	4.8

(BEA 2006g)

TABLE 2.5-16
ECONOMIC REGION 2002 AND 2007 PROPERTY TAXES

	2002		2007	
	Total Tax Rate ($)	Total Levy ($)	Total Tax Rate	Total Levy
Bosque County				
Bosque County	0.3395	2,881,379	0.365	3,879,978
Clifton	0.43	420,987	0.3377	432,008
Meridian	0.4228	139,265	0.4274	209,897
Morgan	0.2155	12,027	0.2254	18,338
Valley Mills	0.379	97,906	0.439	165,830
Walnut Springs	0.3146	31,577	0.3043	45,178
Iredell	0.1793	10,946	0.1848	16,576
Cranfills Gap	0.2236	14,488	0.2254	19,793
Clifton ISD	1.5662	5,814,762	1.1675	4,825,159
Meridian ISD	1.3369	1,150,880	1.3342	1,717,902
Morgan ISD	1.43	548,701	1.04	538,682
Valley Mills ISD	1.695	1,816,906	1.314	2,219,619
Walnut Springs ISD	1.1	383,419	0.8999	562,229
Iredell ISD	1.473	587,081	1.1467	742,298
Kopperl ISD	1.5	943,039	1.0393	995,645
Cranfills Gap ISD	1.46	560,793	1.04	473,996
Erath County				
Erath County	0.47	5,842,771	0.4187	8,564,924
Erath County				
Dublin	0.6405	450,400	0.699	633,232
Stephenville	0.485	2,514,278	0.445	3,642,297
Middle Trinity Water Dist.	0.015	194,271	0.015	316,787
Three-Way ISD	1.18	283,904	1.04	348,861
Dublin ISD	1.4359	2,352,883	1.2369	3,134,719
Stephenville ISD	1.69	11,364,633	1.192	13,568,803
Bluff Dale ISD	1.3243	562,661	1.0962	1,224,852
Huckabay ISD	1.3999	755,172	1.04	1,006,166
Lingleville ISD	1.3912	550,664	1.1062	702,745
Morgan Mill ISD	1.2457	438,463	1.04	580,316
Hood County				

TABLE 2.5-16
ECONOMIC REGION 2002 AND 2007 PROPERTY TAXES

	2002		2007	
	Total Tax Rate ($)	Total Levy ($)	Total Tax Rate	Total Levy
Hood County	0.3325	7,455,898	0.367	14,412,633
Granbury	0.44	1,860,460	0.415	3,621,038
Lipan	0.33	32,399	0.4	51,267
Tolar	0.46	55,915	0.46	82,081
Acton MUD	0.1322	924,416	0.1025	27,866
Granbury ISD	1.73	33,209,441	1.1712	40,667,901
Lipan ISD	1.75	913,191	1.2343	1,146,053
Tolar ISD	1.67	1,089,765	1.2493	1,764,950
Johnson County				
Johnson County	0.4251	19,480,589	0.4098	34,274,715
Alvarado	0.7787	669,209	0.6973	1,133,006
Burleson	0.6043	5,981,933	0.6618	11,896,094
Godley	0.6195	114,132	0.5	258,884
Grandview	0.7107	281,142	0.7428	450,356
Keene	0.7296	693,358	0.8217	1,312,842
Venus	0.7317	354,933	0.7949	708,260
Cleburne	0.73	7,832,487	0.65	11,351,274
Joshua	0.5247	892,280	0.6562	1,636,730
Rio Vista	0.4989	90,206	0.528	161,290
Johnson County				
Hill College - Alvarado	0.0455	231,024	0.0394	369,634
Johnson Co. Fire District	0.03	1,376,876	0.03	1,450,678
Hill College - Cleburne	0.0498	746,511	0.0399	1,006,758
Hill College - Godley	0.0381	59,722	0.0158	109,898
Hill College - Grandview	0.0425	62,375	0.036	101,903
Hill College - Joshua	0.0423	289,665	0.034	369,731
Hill College - Keene	0.045	46,652	0.0414	62,358
Hill College - Rio Vista	0.041	40,219	0.0268	54,438
Hill College - Venus	0.0408	66,538	0.0314	84,748
Alvarado ISD	1.71	7,516,409	1.41	12,100,968
Burleson ISD	1.7799	24,726,713	1.4051	34,005,557
Cleburne ISD	1.6937	22,274,081	1.2368	29,036,641
Grandview ISD	1.585	1,979,580	1.115	2,918,867

TABLE 2.5-16
ECONOMIC REGION 2002 AND 2007 PROPERTY TAXES

	2002		2007	
	Total Tax Rate ($)	Total Levy ($)	Total Tax Rate	Total Levy
Joshua ISD	1.7381	10,237,791	1.46	14,522,508
Keene ISD	1.74	1,504,981	1.04	1,399,137
Rio Vista ISD	1.65	1,362,291	1.18	2,226,707
Venus ISD	1.5	2,131,198	1.18	2,993,159
Godley ISD	1.6133	2,283,340	1.0318	7,533,136
Somervell County				
Somervell County	0.33	5,850,365	0.313	8,483,358
Glen Rose	0.4857	438,959	0.4669	606,625
Somervell Co. Water Dist.	0.0044	79,567	0.1266	3,431,275
Glen Rose ISD	1.0753	18,833,355	0.8784	24,839,584
Tarrant County				
Tarrant County	0.2725	217,224,792	0.2665	306,591,822
Azle	0.691	2,934,628	0.582	3,630,092
Bedford	0.3841	10,220,325	0.4469	13,302,843
Benbrook	0.7725	6,761,596	0.6975	8,946,590
Blue Mound	0.53	326,150	0.5925	442,668
Colleyville	0.3474	8,330,428	0.3559	12,076,730
Tarrant County				
Crowley	0.6574	1,971,333	0.5755	3,604,812
Dalworthington Gardens	0.172	373,443	0.2627	760,070
Edgecliff	0.36	505,757	0.3041	525,082
Everman	0.9091	1,019,739	0.8541	1,271,832
Forest Hill	0.925	2,722,690	0.95	3,748,093
Grapevine	0.366	17,921,003	0.3625	21,472,412
Haslet	0.35	928,461	0.2903	1,377,977
Keller	0.438	10,058,869	0.4322	15,343,607
Kennedale	0.7125	2,121,429	0.7225	3,174,458
Lakeside	0.298	173,803	0.298	272,596
Lake Worth	0.312	761,304	0.314	1,284,594
Mansfield	0.71	14,481,193	0.69	26,424,886
N. Richland Hills	0.57	16,161,306	0.57	20,365,275
Pantego	0.4502	883,642	0.3733	912,564

TABLE 2.5-16
ECONOMIC REGION 2002 AND 2007 PROPERTY TAXES

	2002		2007	
	Total Tax Rate ($)	Total Levy ($)	Total Tax Rate	Total Levy
Richland Hills	0.4173	1,567,530	0.4507	1,937,954
Saginaw	0.54	3,700,524	0.456	5,155,069
Southlake	0.462	15,562,936	0.462	22,703,031
Westover Hills	0.5111	1,149,973	0.4156	1,450,037
Arlington	0.634	91,506,473	0.648	113,746,900
Euless	0.4973	9,956,304	0.47	12,242,964
Fort Worth	0.865	207,977,767	0.855	323,701,020
Haltom City	0.4558	5,920,234	0.5983	9,530,295
Hurst	0.499	9,139,758	0.535	12,318,629
River Oaks	0.798	1,283,393	0.7827	1,776,547
White Settlement	0.615	2,395,931	0.613	3,535,980
Watauga	0.5989	5,088,593	0.5808	5,933,251
Sansom Park	0.54	372,687	0.5	521,184
Pelican Bay	0.8751	129,487	0.8985	224,471
Westworth Village	0.5	150,482	0.5	721,455
Tarrant Co. FWSD #1	0.218	163,207	N/A	N/A
Tarrant Co. Jt. College Dist.	0.1394	112,400,154	0.1394	160,880,850
Tarrant Co. WCID #1	0.02	5,295,960	0.02	8,057,666
Tarrant Co.EMSD	0.1	1,895,830	0.064	2,901,891
Tarrant County				
Tarrant Co. Hospital Dist.	0.2324	185,258,869	0.2304	264,308,157
Arlington ISD	1.7405	297,046,110	1.278	252,450,796
Birdville ISD	1.617	89,389,755	1.405	96,346,771
Everman ISD	1.607	9,161,423	1.25	12,004,412
Fort Worth ISD	1.6858	274,494,781	1.19	276,273,396
Grapevine-Colleyville ISD	1.6598	128,258,956	1.29	129,786,041
Keller ISD	1.6519	86,604,276	1.3574	127,651,920
Mansfield ISD	1.682	71,402,963	1.45	112,433,679
Lake Worth ISD	1.68	6,509,973	1.535	11,297,182
Crowley ISD	1.723	44,672,352	1.409	60,264,479
Kennedale ISD	1.6231	10,408,820	1.35861	12,197,068
Azle ISD	1.65	17,102,630	1.19	22,312,399
Hurst-Euless-Bedford ISD	1.7119	118,547,437	1.3037	105,529,787
Castleberry ISD	1.619	5,040,593	1.2033	5,463,733

TABLE 2.5-16
ECONOMIC REGION 2002 AND 2007 PROPERTY TAXES

	2002		2007	
	Total Tax Rate ($)	Total Levy ($)	Total Tax Rate	Total Levy
Eagle Mt-Saginaw ISD	1.55	42,520,233	1.3301	73,571,146
Carroll ISD	1.935	66,600,484	1.465	71,264,907
White Settlement ISD	1.58	11,183,992	1.466	18,952,537

Note: Economic Region is defined as Bosque, Erath, Hood, Johnson, Somervell and Tarrant counties.

(Combs 2002), (Combs 2007b)

TABLE 2.5-17
CPNPP AD VALOREM NET TAXES 2006

Jurisdiction	Net Taxes
Hood County	8,594.75
Granbury ISD	18,734.26
Tolar ISD	15,073.04
Tolar	37.54
Hood Co. Library Dist.	255.29
Somervell County	5,124,603.75
Glen Rose ISD	17,355,170.82
Glen Rose	35.33
Somervell Co. Water Dist.	1,882,099.22

(TXU 2006a) and (TXU 2006b)

TABLE 2.5-18
HOUSING IN COMMUNITIES CLOSEST TO CPNPP

	Glen Rose	Granbury	Tolar	Pecan Plantation CDP
Year			2000	
Total Housing Units	903	2727	217	1568
Total Occupied	801	2391	186	1475
Owner-Occupied	474	1321	140	1410
Renter-Occupied	327	1070	46	65
Vacant Units	102	336	31	93
For Rent	20	160	5	11

(US Census 2000d)

TABLE 2.5-19
PERCENT OF HOUSES BUILT BY DECADE

	Date of Construction						
	Before1940	1940 – 1949	1950 – 1959	1960 – 1969	1970 – 1979	1980 – 1989	1990 – 2000
Glen Rose							
Owner-Occupied	15.7	8.2	10.7	13.8	19.2	17.2	15.3
Renter-Occupied	11.8	6.0	4.2	13.3	25.4	20.8	18.6
Granbury							
Owner-Occupied	8.6	4.4	11.1	9.0	10.9	26.1	29.9
Renter-Occupied	2.1	2.5	10.0	13.1	27.1	20.2	24.9
Pecan Plantation CDP							
Owner-Occupied	0	0.0	0.7	0.0	10.2	20.6	67.5
Renter-Occupied	0	0.0	0.0	0.0	69.0	31.0	0.0
Tolar							
Owner-Occupied	12.4	14.0	8.5	7.0	20.2	23.3	14.8
Renter-Occupied	5.7	17.1	20.0	21.4	22.9	4.3	8.6

(US Census 2000e)

TABLE 2.5-20 (Sheet 1 of 3)
PUBLIC WATER SYSTEMS WITHIN HOOD AND SOMERVELL COUNTIES

Name	Number of Connections	Max Capacity (MGD)	Average Daily Consumption (MGD)
Hood County			
Acton MUD	5483	4.13	1.9
Acton Water Co. Royal Oaks	68	0.053	0.017
Arrowhead Shores	392	0.072	0.112
Bentwater on Lake Granbury	145	0.504	0.09
Blue Water Shores	297	0.268	0.049
Boynton Water Co	65	0.061	0.141
Brazos River Acres	139	0.208	0.54
Canyon Creek Addition	373	0.175	0.106
City of Granbury	4329	2.146	1.605
City of Lipan	286	0.319	0.087
City of Tolar[a]	305	0.32	0.067
Comanche Cove & Heritage Heights	353	0.133	0.093
Comanche Harbor & Port Ocall	449	0.194	0.116
Comanche Peak North	101	0.105	0.051
Country Meadows Subdivision	105	0.171	0.021
Eastwood Village	153	0.083	0.028
Fall Creek Utility Company	65	0.101	0.02
Granbury Acres Water System	88	0.018	0.004
Hideaway Bay Estates	53	0.043	0.009
Hunterwoods Subdivision Water System	93	0	0.016
Laguna Tres Subdivision	191	0.15	0.045
Laguna Vista Subdivision	170	0.187	0.047

TABLE 2.5-20 (Sheet 2 of 3)
PUBLIC WATER SYSTEMS WITHIN HOOD AND SOMERVELL COUNTIES

Name	Number of Connections	Max Capacity (MGD)	Average Daily Consumption (MGD)
Lake County Acres	196	0.07	0.054
Lake Granbury Surface Water and Treatment System[(b)]	23,187	14.2	5.36
Lakeside Hills	62	0.026	0.015
Long Creek Water Co.	102	0.121	0.039
Mallard Pointe Subdivision	99	0.215	0.035
Messa Grande WSC	117	0.108	0.028
Midhaven Estates	51	0.065	0.019
Montego Bay Estates	118	0.072	0.064
Mooreland Water Co	117	0.131	0
Mountain View Subdivision	274	0.209	0.074
Nolan Creek Estates	52	0.044	0.014
North Fork Creek	49	0.039	0.01
North Fork Creek II	115	0.046	0.034
Oak Trail Shores	1413	1.262	0.383
Peninsula Addition	55	0.21	0.023
Rain WSC	44	0.059	0
Rancho Brazos Subdivision	99	0.075	0.017
Ridge Utilities Inc	105	0.108	0.029
River Country Acres	74	0.105	0.017
River Run Subdivision	83	0.132	0.162
Rock Harbor Estates	143	0.164	0.026
Rolling Hills Water Service Inc	111	0.145	0
Scenic Ridge Addition	32	0.05	0.009

TABLE 2.5-20 (Sheet 3 of 3)
PUBLIC WATER SYSTEMS WITHIN HOOD AND SOMERVELL COUNTIES

Name	Number of Connections	Max Capacity (MGD)	Average Daily Consumption (MGD)
Shady Grove Subdivision	93	0.072	0.031
Sky Harbour WSC	346	0.429	0.059
South Harbor Subdivision	76	0.102	0.04
Summerlin Addition	27	0.053	0
Sunchase Meadows	98	0.034	0.014
Sunset Acres Mobile Home Park	27	0.029	0.011
Sunset Canyon Water Moore Estates	32	0.019	0.053
Western Hills Harbor	391	0.112	0.076
Whipporwill Bay Subdivision	247	0.216	0.079
Somervell County			
Cheyenne Hills Water Supply	16	0.073	0
City of Glen Rose	1294	1.426	0.488
Country Meadows	27	0.025	0.004
Greenfields on Squaw Creek	13	0.091	0.004
Happy Hill Farm	42	0.388	0.17
Oak River Ranch	28	0.04	0.007
Squaw Creek Subdivision Water System	74	0.135	0.02
Sunset Park Subdivision	27	0.078	0.012

(a) Amounts presented differ from those provided by local officials.

(b) Amounts in the text are from 2009.

(TCEQ 2007b) and (TCEQ 2007c)

TABLE 2.5-21 (Sheet 1 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 2 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 3 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 4 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 5 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 6 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-21 (Sheet 7 of 7)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN SOMERVELL COUNTY

TABLE 2.5-22 (Sheet 1 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-22 (Sheet 2 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-22 (Sheet 3 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-22 (Sheet 4 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-22 (Sheet 5 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-22 (Sheet 6 of 6)
HISTORICAL SITES WITHIN A 10-MI RADIUS OF THE CPNPP SITE IN HOOD COUNTY

TABLE 2.5-23
HISTORICAL SITES WITHIN A 1-MI RADIUS OF THE CPNPP SITE

TABLE 2.5-24
REGIONAL MINORITY AND LOW-INCOME POPULATIONS ANALYSIS RESULTS

Race Category	Blocks	Percent	Figure
Black or African American	2498	6.71	2.5-10
Aggregate Minority	3917	10.5	2.5-11
Hispanic	2902	7.80	2.5-12
American Indian or Alaskan Native	102	0.27	2.5-13
Asian	369	0.99	2.5-14
Native Hawaiian or Other Pacific Islander	11	0.03	2.5-15
Persons Reporting Two or More Races	406	1.09	2.5-16
Persons Reporting Some Other Race	2078	5.58	2.5-17
Aggregate Minority plus Hispanic	7641	20.5	2.5-18
Low-Income Population[a]	41	3.7	2.5-19

a) US Census 2000 SF3 Block Group Data was used for the Low-Income population analysis.

TABLE 2.5-25
MINORITY AND LOW-INCOME PERCENTAGES FOR THE CPNPP REGION

Description	Percent in the CPNPP Region
Black or African American Persons	11.40
American Indian and Alaska Native Persons	0.60
Asian Persons	2.62
Persons Reporting Some Other Race	8.49
Persons Reporting Two or More Races	2.27
Native Hawaiian and Other Pacific Islander	0.08
Aggregate Minority Percentage	25.46
Hispanic Persons	18.80
Aggregate Minority plus Hispanic Percentage	44.26
Low-Income Percentage	11.41

(US Census 2000e)

TABLE 2.5-26
MINORITY AND LOW-INCOME POPULATIONS ANALYSIS RESULTS FOR THE 16-KM (10-MI) RADIUS

Race Category	Blocks in the 16-km (10-mi) Radius	Percentage
Aggregate Minority plus Hispanic	66	5.10
Aggregate Minority	17	1.31
Black or African American	2	0.15
Persons Reporting Two or More Races	18	1.39
Hispanic	31	2.39
Asian	3	0.23
Persons Reporting Some Other Race	26	2.01
American Indian or Alaskan Native	10	0.77
Native Hawaiian or Other Pacific Islander	0	0
Low-Income	0	0

(US Census 2000e)

TABLE 2.5-27
FARMS THAT EMPLOY MIGRANT LABOR IN THE CPNPP REGION 2002

County	Total Farms	Farms with Migrant Workers	Percent of Total Farms	Workers working less than 150 days
Bosque	1285	8	0.6	408
Comanche	1352	8	0.6	631
Coryell	1221	1	0.1	342
Dallas	730	13	1.8	95
Eastland	1166	1	0.1	391
Ellis	2089	36	1.7	1065
Erath	1977	9	0.5	955
Hamilton	996	11	1.1	417
Hill	2014	1	0.0	489
Hood	935	3	0.3	204
Jack	884	0	0.0	127
Johnson	2579	1	0.0	498
McLennan	2571	14	0.5	1449
Palo Pinto	965	2	0.2	783
Parker	3215	38	1.2	1742
Somervell	339	0	0.0	22
Stephens	435	0	0.0	62
Tarrant	1227	17	1.4	545
Wise	2696	10	0.4	581

(USDA 2002a) and (USDA 2002b)

TABLE 2.5-28
CONSTRUCTION WORKER WAGES BY CRAFT

Craft	Hourly Wage
Asbestos Workers	$16.46
Boilermakers	$23.45
Carpenters	$14.35
Cement Masons	$12.97
Electricians	$18.36
Ironworker	$14.28
Laborers	$10.00
Millwrights	$20.67
Operating Engineers	$14.06
Painters	$13.30
Pipefitters	$19.08
Roofers	$11.99
Sheet Metal Workers	$14.99
Steamfitters	$19.08

(BLS 2007)

TABLE 2.5-29
OPERATION WORKER WAGES BY SPECIALTY

Specialty	Annual Wages
Mechanical Technician	$66,581
Electrical Technician	$67,517
Instrumentation & Control Technician	$72,238
Chemistry Technician	$70,990
Radiation protection Technician	$69,056
Non-licensed Operator	$70,793
Reactor Operator	$77,782
Senior Reactor Operator	$85,426

(CASEC 2007)

TABLE 2.5-30 (Sheet 1 of 2)
TEMPORARY AVAILABLE HOUSING IN HOOD AND SOMERVELL COUNTIES

Hotel	Rooms	Average Occupancy Rate
Glen Rose		
Americas Best Value Inn and Suites	46	30%
Best Western Dinosaur Valley Inn and Suites	53	Weekends 100% Weekdays 50%
Comfort Inn and Suites	70	Winter 70-80% Summer 80-90%
Glen Rose Inn and Suites	94	70%
Glen Hotel	37	Upper floor rooms always available
Holiday Inn Express Hotel & Suites	71	(a)
Inn on the River	22	63%
La Quinta Inn and Suites	78	(b)
Granbury		
Americas Best Value Inn and Suites	53	85%
Best Western Granbury Inn and Suites	57	80%
Classic Inn	41	50%
Comfort Inn Granbury	48	90.50%
Comfort Suites	70	50%
Economy Inn and Suites	15	60%
Granbury Inn and Suites (Formerly Days Inn)	67	70%
Hilton Garden Inn (Convention Center)	106	(b)
La Quinta Inn and Suites	74	94%
The Lodge of Granbury	41	Summer 60-70% Winter 50-60%

TABLE 2.5-30 (Sheet 2 of 2)
TEMPORARY AVAILABLE HOUSING IN HOOD AND SOMERVELL COUNTIES

Hotel	Rooms	Average Occupancy Rate
The Pendleton Hotel & Boutique	57	(b)
Plantation Inn on Lake Granbury	53	(a)
Sleep Inn and Suites	64	45-50%
Studio 6 (Planned for 2009 with 88 rooms)		(b)

(a)Hotel declined to provide information.

(b)Hotel is not yet open or has recently opened and annual occupancy is not available.

2.6 GEOLOGY

In accordance with NUREG-1555, *Standard Review Plans for Environmental Reviews of Nuclear Power Plants*, an environmental review of the site geology is not required in the Environmental Report (ER). However, in order to assess the suitability of the site for Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4, a summary of the structural geology and geologic features for the CPNPP site region (200 mi radius), vicinity (25 mi radius), site area (5 mi radius), and the site location (0.6 mi radius) is provided in Section 2.5.1 of the Final Safety Analysis Report (FSAR), Part 2 of the Application. In addition, Section 2.5 of the FSAR presents detailed analyses and evaluation of geological, seismological, and geotechnical data. The FSAR information includes estimates of peak horizontal and vertical ground accelerations and response spectra associated with the safe shutdown earthquake.

2.7 METEOROLOGY AND AIR QUALITY

2.7.1 REGIONAL CLIMATOLOGY

This section describes the general climate of the region with respect to types of air masses, synoptic features (high- and low-pressure systems, and frontal systems), general airflow patterns (wind direction and speed), temperature, humidity, precipitation (rain, snow, sleet, and freezing rain), potential influences from regional topography, and relationships between synoptic-scale atmospheric processes and local (site) meteorological conditions.

2.7.1.1 General Climate

From the hot, dry desert of far West Texas and the blue northers that blast the Llano Estacado to the humid, rainy pine forests of East Texas and the hurricanes that sweep across the Gulf Coast, Texas' climate is as varied as its landscape. That variability is a result of the interactions between Texas' unique geographic location and the movements of seasonal air masses, such as arctic fronts, the jet stream, subtropical west winds, tropical storms, and a subtropical high pressure system known as the Bermuda high (Figure 2.7-1) (TWDB 2007). The location of Texas with relation to the North American continent, the warm Gulf of Mexico, and the not-far-distant Pacific Ocean guarantees a constant exchange of settled and unstable weather. The state's varied physiography, from the forests of the east and the Coastal Plain in the south to the elevated plateaus and basins in the north and west, also brings a wide variety of weather on almost any day of the year. Because of its expansive and topographically diverse nature, Texas offers continental, marine, and mountain-type climates. West of the Caprock on the High Plains, a continental climate, marked by cold winters and low humidity, predominates. In the Trans-Pecos, a form of mountain climate is found. The eastern two-thirds of Texas, on the other hand, have a humid, subtropical climate that is occasionally interrupted by intrusions of cold air from the north. Though variations in climate across Texas are considerable, they are nonetheless gradual (TSHA 2006).

The state of Texas lies within both "cool" and "warm" parts of the temperate zone of the northern hemisphere. Texas has three major climatic types which are classified as continental, mountain, and modified marine. There are no distinct boundaries that divide these climate types, but the approximate area of Texas that each encompasses is indicated on Figure 2.7-2 by the broad stippled lines (TDWR 1983).

A continental steppe climate is prevalent in the Texas High Plains. This climate type is typical of interiors of continents and is characterized by large variations in the magnitude of ranges in daily temperature extremes, low relative humidity, and irregularly-spaced rainfall of moderate amounts. The main feature of this climate in Texas is semi-arid with mild winters (TDWR 1983).

The mountain climate is dominant in the Guadalupe, Davis, and Chisos Mountains of the Trans-Pecos region of Texas. The characteristics of this climate are cooler temperatures, lower relative humidity, orographic precipitation anomalies, and less dense air. The mountain climate is contrasted by the subtropical arid climate of the surrounding lowlands (TDWR 1983).

Most of the state, climatologically, has a modified marine climate that is classified and named "subtropical," with four subheadings. A marine climate is caused by the predominant onshore flow of tropical maritime air from the Gulf of Mexico. The onshore flow is modified by a decrease in moisture content from east to west and by intermittent seasonal intrusions of continental air. The four subheadings of subtropical-humid, subhumid, semi-arid, and arid account for the changes in moisture content of the northward flow of Gulf air across the state (TDWR 1983).

The climatic descriptions of the regions delineated on Figure 2.7-2 are given below:

- The eastern third of Texas has a subtropical humid climate that is most noted for warm summers.
- The central third of Texas has a subtropical subhumid climate characterized by hot summers and dry winters.
- The broad swath of Texas from the mid-Rio Grande Valley to the Pecos Valley has a subtropical steppe climate and is typified by semi-arid to arid conditions.
- The High Plains region of West Texas features a continental steppe climate with large variations in daily temperature extremes, low relative humidity, and irregularly-spaced rainfall of moderate amounts.
- The basin and plateau region of the Trans-Pecos features a subtropical arid climate that is marked by summertime precipitation anomalies of the mountain relief.
- A mountain type climate is common in the higher elevations of the Guadalupe, Davis, and Chisos mountains.

The variation of climate types in Texas is caused by the physical influences of the state being located (1) downwind from mountain ranges to the west, (2) proximate to the Gulf of Mexico and the southern Great Plains, (3) west of the center of the Bermuda high pressure cell, (4) at a relatively low latitude, and by (5) the changes in land elevation from the High Plains and mountains to the Coastal Plains. These influences on the weather, particularly on the moisture content of the air, define climate and are evident by comparing the changes of contour patterns that are illustrated on the monthly series of maps in the following paragraphs (TDWR 1983).

Far West Texas has a climate more similar to New Mexico than to the rest of Texas. This region of Far West Texas is also referred to as the Trans-Pecos region and is represented by division 5 on Figure 2.7-3. Winters are cold and generally dry, except for rain and snow that fall mostly in the higher elevations. Summer is the rainy season, and moisture from both the Gulf of Mexico and the Gulf of California contribute to afternoon thunderstorms. Annual precipitation depends on elevation more than location; the dry grasslands near Marfa that form the backdrop of the movie Giant do not resemble the rest of the state but have become part of the public consciousness of the Texas natural environment (NCDC 2008).

Other parts of Texas have neither the topographic relief nor the wide variations of climate of Far West Texas. The terrain changes steadily and continuously from one end of the state to the other; the terrain is interrupted only by such features as the Caprock Escarpment, in the Panhandle, and the Balcones Escarpment, along the southern and eastern margin of the hill country. The terrain descends from northwest to southeast, drained into the Gulf of Mexico by a series of parallel rivers (NCDC 2008).

The climate changes are even more gradual than the terrain. Annual mean temperatures are coolest to the north and warmest to the south (temperature and precipitation graphs on Figure 2.7-3). Annual mean precipitation is heaviest in the east and lightest in the west. Precipitation changes are more substantial than the temperature changes, as the near-desert in the west gradually gives way to annual accumulations close to 60 in along the Louisiana border (NCDC 2008).

With subtle variations in climate and terrain, sub-regions of the state of Texas are often more clearly delimited by changes in vegetation or terrain character. Because many transitions are gradual, categorizations are somewhat arbitrary (NCDC 2008). The 10 climate divisions identified by the National Climatic Data Center (NCDC) group the regions according to similarity of overall climatic characteristics. The Trans-Pecos region was discussed above. The other nine divisions are described below.

The NCDC divides Texas into 10 climate divisions (Figure 2.7-3). Climate divisions represent regions with similar climatic characteristics, such as vegetation, temperature, humidity, rainfall, and seasonal weather changes. Data collected at locations throughout the state are averaged within the divisions in order to make maps such as the one in Figure 2.7-3. These divisions are commonly used to report climatic information, such as precipitation, temperature, and drought indices (TWDB 2007). The Texas High Plains (climatic division 1 on Figure 2.7-3) occupies most of the Texas Panhandle and is defined on the north and west by the state boundaries and on the east by the Caprock Escarpment. The High Plains are about as flat as the coastal plains of Texas. The major cities of the High Plains are Amarillo, Lubbock, and on the margin of the Trans-Pecos, the neighboring cities of Midland and Odessa. Much of the High Plains is underlain by the Ogalalla Aquifer, which supplies a large but dwindling water supply to the area’s irrigated agriculture. The High Plains are divided in two by a valley carved by the Canadian River, and a branch of the Red River has created the dramatic Palo Duro Canyon. Elsewhere, the High Plains are pockmarked with shallow, intermittent lakes and an occasional district where sand dunes have been set in motion by the wind (NCDC 2008).

The Low Rolling Plains (climatic division 2 on Figure 2.7-3) are largely rangeland, consisting of grasslands interspersed with forests of mesquite, a short, invasive tree with sweet-smelling wood but sparse shade. They lie east of the High Plains and include the cities of Abilene and Wichita Falls. While surface waterways are much more numerous than in the High Plains, lakes are much less frequent, as the land drops steadily toward the east. Many soils are quite red, and the runoff from this area helps give the Red River its name. This area has the greatest frequency of tornadoes in Texas (NCDC 2008).

The Cross Timbers (climatic division 3 on Figure 2.7-3) are also a mixture of grasslands and forest, although the forest includes oak and other species besides mesquite. The greater biological diversity among trees is attributable to higher precipitation totals and slightly warmer temperatures, along with soil variations. Like the Low Rolling Plains, the Cross Timbers slope mainly from west to east. Most lakes are man-made. Fort Worth and Temple are prominent cities on its eastern edge, while Austin, the state capital, sits at the intersection of the Cross Timbers, the Blackland Prairies, and the Edwards Plateau (NCDC 2008).

The Edwards Plateau (climatic division 6 on Figure 2.7-3) lies south of the High Plains, Low Rolling Plains, and Cross Timbers, and east of the Trans-Pecos. Its southern margin is the Balcones Escarpment, and the region includes both the relatively flat plateau area as well as the high-relief plateau margin where some of the most rugged terrain in Texas, known as the Hill Country, is located. The area is underlain by limestone formations, and many dramatic caves are located here. The vegetation varies from grasslands in the west to forests in the east, with pockets of maple and cypress hundreds of miles from their normal ecosystems. The most prominent city is San Angelo, but its eastern margin abuts Austin and San Antonio, and various bedroom communities have developed, attracting people from the cities with its scenic ruggedness and slightly cooler summertime temperatures. Various spring-fed rivers and streams originate along the Balcones Escarpment (NCDC 2008).

The Blackland Prairies (climatic division 7 on Figure 2.7-3) are defined by several strips of rich, black soil that extend from San Antonio to Dallas and beyond and eastward to the Piney Woods. Most of the Blackland Prairies are occupied by farming operations, but in the 18th and 19th centuries, the prairies formed easy corridors for long-distance travel from west to east. Now, the primary transportation corridor is along the western edge of the Blackland Prairies, along Interstate 35 (IH-35) and a string of major cities from San Antonio to Austin, Temple, Waco, Dallas, and Sherman. The prairies are generally flat or rolling, and are devoted primarily to non-irrigated agriculture (NCDC 2008). The Post Oak Savannah region lies mainly east of the Blackland Prairies, but is interlaced with the Blackland Prairies in a few areas. The Post Oak Savannah was a fire-driven ecosystem, with oak trees underlain by grasslands. The territory consists of a mosaic of oak woods, tree-studded fields, and open grazing areas, with farming confined mainly to sediment-filled river valleys. The Post Oak Savannah includes Bryan/College Station, home of Texas A&M University (NCDC 2008).

The Piney Woods (climatic division 4 on Figure 2.7-3) are the westernmost portion of the mixed evergreen-deciduous forest belt that stretches westward across the Deep South from the Carolinas. The wide variety of trees is dominated by pine and oak, resting on fast-draining, sandy soils. Occasionally cleared grasslands are outnumbered by productive forests, both public and private. In the interior of this region is the Big Thicket, a combination of uplands and lowlands with a rich diversity of plant species. In the Piney Woods, tall pines, prickly pear cactus, and palmetto exist side by side. Population centers include Longview, Tyler, and Texarkana (NCDC 2008).

The Gulf Coastal Plain (climatic division 8 on Figure 2.7-3) is primarily a combination of prairies and marshes. Behind the barrier beach is a set of lagoons and estuaries that form a rich habitat for migratory and resident birds, including a major wintering area for the endangered whooping crane. While tornadoes and floods are the primary weather hazards in the rest of the state, the Gulf Coastal Plain is most vulnerable to hurricanes. Major cities along the coastal plain include Houston, Beaumont, Victoria, Corpus Christi, and on a barrier island, Galveston (NCDC 2008).

The South Texas Plains (climatic division 9 on Figure 2.7-3) are largely arid and treeless. The largest ranch in Texas, the King Ranch, is here. Widespread areas are covered with dense thickets of subtropical brush. San Antonio is along the northern margin of this region, while Laredo is in its southwestern corner (NCDC 2008).

The Lower Rio Grande Valley (climatic division 10 on Figure 2.7-3) is the smallest geographical area described. It consists of alluvial plains that are under widespread irrigated agriculture. The salt and freshwater marshes and other plant communities host a wide variety of tropical and temperate species of birds, many of which pass through the area en route between North and Central America. The area, often known simply as “the Valley,” is a popular wintering area for residents of the central United States. Primary cities include Brownsville and McAllen (NCDC 2008).

The climate of Texas is determined by geographical features external to the state. To the southeast, the Gulf of Mexico provides a source of warm, moist air throughout the year. During the summer, the entire state comes under the influence of the Gulf of Mexico, as southeasterly and southerly winds settle into place. Air approaching Texas from the Gulf of Mexico may have a long history of being over the tropical waters of the Caribbean and the Atlantic, or it may recently have moved offshore from the southeast United States. The latter circumstance leads to air that is more polluted and in summertime is hazier. Tropical Atlantic air is relatively clean and visibility tends to be excellent despite the high humidity. Except for the Trans-Pecos, most of the water that falls as precipitation in Texas has entered the state from the Gulf coast (NCDC 2008).

The second climate maker is the Mexican High Plain, or Altiplanicie Mexicana. This arid, high-altitude plateau region extends northward from Mexico City nearly to the U.S. border. Rarely does this air reach ground level in Texas except in the Trans-Pecos region, but it influences the weather throughout the state. When surface winds in Texas are from the south or southeast, winds 10,000 ft aboveground are normally from the southwest. Low-level air from the Gulf of Mexico is overlaid with warmer, drier air from the Mexican High Plain. Close to the Mexican border, this warm air ”caps” the humid Gulf air, preventing thunderstorm activity and trapping the humid air close to the ground. As the air masses precede north, particularly during the spring and fall, they progressively move beneath cooler air aloft. While the humid low-level air becomes more unstable, it still cannot convect because of the capping inversion. Eventually, if a frontal system or other disturbance causes larger-scale ascent, the Mexican High Plain air can cool enough to eliminate the cap, suddenly allowing vigorous thunderstorm activity to take place. The combination of the Gulf of Mexico and the Altiplanicie Mexicana makes Texas and the southern Great Plains the worldwide hot spot for severe convection and tornadoes (NCDC 2008).

The third climate maker is the Rocky Mountains. Arizona, New Mexico, and West Texas form one of two relative gaps in the Rocky Mountain Cordillera; the other is along the U.S. - Canadian border. Westerly winds often blow through this gap, but the Rockies form a broad barrier to westerlies for the rest of the state. In the eastern half of Texas, the least likely wind direction is from the west. The Rockies also block air from moving across them from the east. In particular, cold air masses that reach the United States from the north cannot easily spread westward and are funneled southward parallel to the mountains. Such cold air reaches farther south into Texas than anywhere else on the continent. Nevertheless, it is rare for bitterly cold air to reach the Lower Rio Grande Valley, allowing grapefruit to be one of the area’s largest cash crops (NCDC 2008).

Precipitation is not evenly distributed over the state, and variations in precipitation at any one locale from year to year are apt to be pronounced. The mean annual precipitation varies from a statewide maximum of 59.20 in at Orange, in the lower Sabine River valley of East Texas, to a minimum of 7.82 in at El Paso, at the western tip of the state (TSHA 2006). The annual average precipitation map for Texas is shown on Figure 2.7-4. This figure shows the decrease in precipitation going from east to west. The mean annual rainfall distribution correlates roughly with longitude and varies little from north to south across Texas. Generally, annual precipitation decreases about an inch for each 15-mi displacement from east to west. West Texas is the driest region in the state, with an average annual region-wide precipitation of 11.65 in, while the Upper Coast (45.93 in) and East Texas (44.02 in) are the wettest. At most locations, rainfall for any single month varies appreciably from the norm. Likewise, the number of days with precipitation usually is significantly abnormal. The number of "rain days" follows the general trend of rainfall totals in that seasonal frequencies of rain days are lowest when rainfall totals are lowest. The mean number of days in January with at least 0.1 in of precipitation varies from 7 days in East Texas to 1 day or fewer in the Trans-Pecos; in July, rain days normally are as numerous in the mountainous Trans-Pecos as in East Texas and along the upper coast. Particularly in the western half of Texas, one or two rainstorms often account for nearly all of a month's rainfall. The wet season does not occur at the same time of year in all parts of Texas. Intense and prolific thunderstorms, often moving in "squall lines," roam much of Texas in the late spring; Central, North, and East Texas receive their maximum rainfall in May. The warmest time of year is also the wettest for the High Plains and Trans-Pecos; nearly three-fourths of the total annual precipitation in these regions occurs from May to October. Tropical weather disturbances ensure that the late summer and early autumn are the two wettest periods for the part of Texas within 100 mi of the Gulf of Mexico (TSHA 2006). The annual average precipitation for each of the 10 Texas climate divisions for the period 1895 – 2005 is shown in Figure 2.7-5. This figure also shows the percent deviation from the annual average for each of the 10 divisions. The annual average for climate division 3, which includes the CPNPP site, is 34.3 in.

Winter is the driest time of the year in nearly all of Texas. The exception is East Texas, where rainfall typically is the least substantial in July and August. December or January is normally the driest month on the High and Low Rolling Plains, as well as on the Edwards Plateau. The dry season peaks somewhat later farther east in north central and south central Texas, while on the coastal plains, February is the driest month. Early spring (March – April) is normally very dry in the Trans-Pecos region; In this semiarid region, rainless spells often last several weeks at a time, and two or even three months can elapse without significant rain. Because much of the annual rainfall occurs quickly, excessive runoff often leads to flooding. The broad, flat valleys in the eastern half of Texas sustain comparatively slow runoff, and mean annual rainfall exceeds 25 – 30 in. When rain is heavy, these valleys store vast amounts of water before slowly releasing it into the streams. The resulting flat-crested, slow-moving flood in the lower basins causes protracted periods of inundation. By contrast, in the western half of Texas, where ground and tree cover is sparse and stream slopes are typically quite steep, high-intensity rains produce rapid runoff that frequently leads to flash flooding. The area along the Balcones Escarpment (from Austin south to San Antonio, then west to Del Rio) is one of the nation's three most flash-flood-prone regions (TSHA 2006).

Snowfall occurs at least once every winter in the northern half of Texas, although accumulations rarely are substantial except in the High Plains. Snow is not uncommon in the mountainous areas of the Trans-Pecos, though heavy snows (5 in or more) come only once every two or three winters. More often than not, snow falling in the southern half of the state melts and does not stick to the surface; snow stays on the ground only once or twice in every decade. Snowfall rarely is observed before early November and hardly ever occurs after mid-April. Where it is not uncommon, snow is almost always heaviest in either January or February. Mean seasonal snowfall is 15 – 18 in, in the Texas Panhandle, and 4 – 8 in elsewhere in the High and Low Rolling Plains (TSHA 2006).

Temperatures vary considerably among the 10 climatic regions of Texas. Few or no areas of Texas escape freezing weather in any winter. Conversely, the heat of summer is intense everywhere. Whereas precipitation varies longitudinally across Texas, mean annual temperature varies latitudinally. On a year-around basis, readings are the coolest in the extreme north and warmest in the far south. In mid-winter, the mean daily minimum temperature varies between the upper teens in the northern periphery of the Panhandle and the low fifties in the lower Rio Grande valley; afternoon highs range from the upper forties in the extreme north to near seventy in the far south. Conversely, summer lows in the Panhandle average in the low sixties, and in the lower Valley, in the middle to upper seventies; daytime highs reach into the low nineties in both regions. All-time temperature extremes in Texas include: -23°F at Tulia (1899) and Seminole (1933), and 120°F at Seymour (1936) and Monahans (1994) (TSHA 2006). Other Texas weather records are given in Table 2.7-1. The annual average maximum daily temperature map for Texas is shown on Figure 2.7-6 based on data from 1971 to 2000. This figure shows an annual average maximum of 76°F near the CPNPP site. Extended periods, more than 1 or 2 days, of subfreezing highs are rare even in the far north. Parts of the Panhandle generally have subfreezing temperatures for many successive winter nights. The mean number of days with freezing temperatures in the northern High Plains is 120 days. In this region, the first autumn freeze ordinarily occurs at the end of October, and the last freeze in spring takes place in mid-April. The "freeze-free" season lengthens with distance north-to-south down the state. The mean number of days with freezes is 40 – 45 days in north central Texas and 20 – 25 days in south central Texas. In some years, the temperature never reaches the freeze level in the Valley. Even when it does, it almost always remains below 32°F for only 4 – 6 hours (hr) or less, usually around sunrise (TSHA 2006).

The entire Texas coastline is subject to the threat of hurricanes and lesser tropical storms during the summer and autumn. Vulnerability reaches a maximum during August and September, the height of the hurricane season in the Gulf of Mexico and Caribbean Sea. Hurricanes strike the Texas coast an average of one every 3 years. Inland, hurricanes cause damage due to high winds, including tornadoes, and flooding from excessive rainfall. Persons along the coast must also contend with storm tides (TSHA 2006).

Although tornadoes can occur anytime, most of them materialize during April, May, and June. In a normal year, about 130 tornadoes are sighted in Texas, 30 percent of which occur in May. On average, about 200 people are hurt, and a dozen are killed annually by the twisters. Tornadoes are most likely to occur along and south of the Red River between Lubbock and Dallas; they are least likely in the Trans-Pecos. Thunderstorms occur in every month of the year, though least in winter. With an average of 60 thunderstorm days a year, East Texas is most susceptible to the severe localized phenomena fostered by the storm (hail, high winds, flash flooding). The mean annual number of thunderstorm days diminishes from east to west across Texas; the Trans-Pecos has only about 40 such days each year. The lower Valley has fewer still, 30 days. The peak hail frequency statewide is in May. Most hailstorms are short-lived, because the macroscale weather systems, such as squall lines, that generate hail move rapidly. Hailstones are usually largest in the High Plains, where hail the size of tennis balls, even baseballs, is not uncommon in the summer. Sunshine is most abundant in the extreme west, where El Paso receives an average of 80 percent of the total possible sunshine annually. Cloud cover is most prevalent along the coast, especially in the Upper Coast, where the mean annual sunshine amounts to only about 60 percent of possible sunshine days (TSHA 2006).

Weather stations in the region surrounding the CPNPP site are shown on Figure 2.7-7. The closest weather stations to the CPNPP site are: Dublin, Glen Rose, Cleburne, Benbrook, Dallas Fort Worth Airport, Dallas Love Field Airport, Mineral Wells Airport, Weatherford, and Stephenville. Based on data for the period 1971 – 2000 for Dallas Fort Worth Airport, Dallas Love Field Airport, Mineral Wells Airport, and Glen Rose, the mean daily maximum temperature is 77.6°F, and the mean daily minimum temperature is 54°F. The lowest daily minimum is -15°F and the highest daily maximum temperature is 115°F. The annual average precipitation is 34.6 in. Monthly data from these stations are given in Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5. From data collected at the Dallas Fort Worth Airport, Mineral Wells Airport, and CPNPP site, the typical wind direction for the region is 147 degrees (Figures 2.7-8, 2.7-9, and 2.7-10), the average wind speed is 10.5 miles per hour (mph). The frequency of snowfall in this region is so low that the average annual snowfall is near zero. The frequency of sleet and freezing rain is discussed in the following sections along with the regional dew point/relative humidity.

2.7.1.2 Regional Meteorological Conditions

2.7.1.2.1 General

Meteorological data are presented in this section for severe weather phenomena such as hurricanes, tornadoes, thunderstorms, lightning, hail, high air pollution, and ice storms.

The interplay between synoptic scale phenomena and topography is small in the region surrounding the site. The effect of terrain features on synoptic scale flow can readily be ascertained when a larger area, which takes in the high country of West Texas and Eastern New Mexico, is included; i.e., the principal effect is that the high country forms a natural barrier to the flow of air. Consequently, moist tropical air from the Gulf of Mexico and air from the arctic or polar sources, which flows uninhibited through the site region, is effectively blocked from the areas to the west of the mountains. The net result is wide fluctuations in rainfall, humidity, and annual sunshine over the larger area. Severe weather in the region is usually associated with heavy thunderstorms (including tornadoes) and tropical cyclones. Property damage occurs from flooding and high winds. Damaging hail also occasionally occurs in the site region (CPSES 2007).

2.7.1.2.2 Hurricanes

Hurricanes and tropical storms are among the most devastating naturally occurring hazards in the United States. A tropical cyclone is defined as a low-pressure area of closed circulation winds that originates over tropical waters. A tropical cyclone begins as a tropical depression with wind speeds below 39 mph. As it intensifies, a tropical cyclone may develop into a tropical storm with wind speeds between 39 mph and 74 mph. When wind speeds go beyond 74 mph, the tropical storm is known as a hurricane. The Gulf of Mexico and the Atlantic Coast areas are the most susceptible to tropical cyclones (NCTCOG 2004).

Based on data from the National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum National Weather Service (NWS) SR-206 (NOAA 1999) and data for 2004 – 2006 from the National Hurricane Center, the number of tropical storms and hurricanes affecting Texas from the period of 1899 – 2006 was 39. The storms that have affected Texas are listed in Table 2.7-6 along with the date and storm category. Based on these data, the storm return period is 2.8 years as shown in Table 2.7-7. This table also provides the Saffir/Simpson storm category definitions and gives a breakdown of storms by month and storm category. There have been no category-5 storms and only six category-4 storms affecting Texas. August and September have the most storms with approximately 60 percent of the storms occurring in these months. Figure 2.7-11 gives the tropical cyclone frequency and intensity along the U.S. coastline, from Texas to Maine, based on data from 1871 to 1998. This figure shows a relative Texas peak in frequency at Galveston. Using this peak, the frequency of tropical storms and hurricanes at Galveston is approximately 43 per 100 years, or a return period of 2.3 years. Considering the hurricanes, only the return period increases to 4 years. For major hurricanes, the return period is 12.5 years. These results are in good general agreement with the data from SR-206 given in Table 2.7-7. Figure 2.7-12 gives the number of hurricanes as a function of wind speed. As expected, the hurricane frequency decreases with wind speed. For a wind speed of 125 knots (144 mph), the return period is given as 10 years.

The number of tropical storms passing within 50 statute miles of the CPNPP site are listed on Table 2.7-8 and shown on Figure 2.7-13. These data, obtained from the NOAA Coastal Services Center, show that only one hurricane, in 1900, passed within 50 mi of the site during the period 1851 – 2006. There appears to be a connection between hurricane frequency and El Nino and La Nina events. El Nino events tend to suppress the formation of hurricanes by steering the subtropical jet stream into the hurricane's path and shearing off the tops of the storms before they develop into full intensity. During La Nina episodes, the jet stream moves north, and hurricanes tend to more easily evolve without interference. The tropical cyclone season for Texas extends from June to October; storms are more frequent in August and September, and rarely occur after the first of October. The average frequency of tropical cyclones with hurricane force winds, i.e., winds greater than 74 mph that affected Texas during the period 1899 – 2002 is approximately one cyclone every 3 years (NOAA 2002).

After a hurricane or tropical storm makes landfall, it begins to break apart, and remnants of the storm can continue moving inland. These remnants have been known to bring heavy precipitation, high winds, and tornadoes to locations near the CPNPP site. For instance, a remnant of the September 1900 hurricane that devastated Galveston made its way into north central Texas, where it produced heavy rains. In 1934, a tropical disturbance moved inland along the middle Texas coast and eventually found its way to Kaufman County, where it caused damage from straight-line winds. In 1981, the remnants of Pacific Hurricane Norma came across north central Texas, bringing torrential rain (10 – 13 in between Denton and Bridgeport) and a few weak tornadoes (NCTCOG 2004). In 1995, the remnants of Tropical Storm Dean brought heavy rain to Hood and Somervell counties and 6 – 10 in of rain fell near Glen Rose (Table 2.7-5).

Tropical cyclones including hurricanes lose strength rapidly as they move inland, and the greatest concern is potential damage from winds or flooding due to excessive rainfall. Figure 2.7-14 shows the decay of tropical cyclone winds after landfall. As seen, only the fastest moving storms would maintain any significant wind speed by the time they reach the CPNPP site. From this figure, a tropical cyclone with 86 mph winds traveling at 18 mph would have dissipated to less than 40 mph at the CPNPP site.

The Probable Maximum Hurricane (PMH) is discussed in CPNPP Units 1 and 2 UFSAR Section 2.3.1.2.2. For the CPNPP site, the PMH sustained (10-minute average) wind speed at 30 ft aboveground is 81 mph (CPSES 2007).

2.7.1.2.3 Tornadoes

During the period January 1, 1950 - July 31, 2006, 158 tornadoes (mean annual frequency of 2.8/year) occurred within Somervell County and the surrounding counties (Bosque, Erath, Hood, and Johnson) (NOAA 2008). It should be noted that statistical data on severe local storms, tornadoes particularly, are highly dependent on human observation. For example, as population density increases, the number of tornado occurrences observed and accurately reported generally increases. Tornadoes that cross county lines may be counted twice due to this increase in reporting.

The probability that a tornado would occur at the CPNPP site is low. Records show that in a 56-year period (1950 – 2006) there were three tornadoes reported in Somervell County, the location of the site (NOAA 2008). The data reported by the NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) (NOAA 2008) are given in Tables 2.7-9 and 2.7-10. From these data, the average tornado area in Somervell and the surrounding counties, ignoring events with a zero path length, is approximately 0.21 sq mi. Using the principle of geometric probability described by H. C. S. Thom (Thom 1963), a mean tornado path area of 0.21 sq mi, and an average tornado frequency of 2.79/year for this area (3414 mi^2), the point probability of a tornado striking the plant is 1.7×10^{-4}/year. This corresponds to an estimated recurrence interval of 5881 years.

The tornadoes reported during the years 1950 – 2006 in the vicinity of the site (Bosque, Erath, Hood, and Johnson counties) are shown in Tables 2.7-9 and 2.7-10. During this period, a total of 158 tornadoes touched down in these counties that have a combined area of 3414 sq mi (USC 2008). These local tornadoes have a mean path area of 0.21 sq mi excluding tornadoes with a zero length or without a length specified. The site recurrence frequency of tornadoes can be calculated using the point probability method as follows:

Total area of tornado sightings = 3414 sq mi

Average annual frequency = 158 tornadoes/56.58 year = 2.79 tornadoes/year

Annual frequency of a tornado striking a particular point P = [(0.21 mi^2/tornado)(2.79 tornadoes/year)] / 3414 sq mi = 0.00017 year-1

Mean recurrence interval = 1/P = 5883 years

This result shows that the frequency of a tornado in the immediate vicinity of the site is low. The frequency increases northward until tornado alley is entered north of Dallas. Another methodology for determining the tornado wind speed and associated strike probability at the CPNPP site is given in NUREG/CR-4461. Based on a 1-degree longitude and latitude box centered on the CPNPP site, the number of tornadoes is 216 between 1950 and August 2003. The corresponding expected maximum tornado wind speed and upper limit (95 percentile) of the expected wind speed based on a 2-degree longitude and latitude box centered on the CPNPP site is given below with the associated probabilities.

Probability	Expected maximum tornado wind speed (mph)	Upper limit (95 percent) of the expected tornado wind speed (mph)
10^{-5}	168	176
10^{-6}	225	233
10^{-7}	275	283

In the area north of about the 34-degrees north latitude, there is a greater frequency of large tornadoes with wide paths and long trajectories.

Based on the approximately 56-year period of record from 1950 to 2006, the mean seasonal and annual number of tornado occurrences for the area around the site is (NOAA 2008):

Winter	0.14	Summer	0.37
Spring	1.73	Autumn	0.57
Annual	2.81		

Waterspouts are common along the southeast U.S. coast, especially off southern Florida and the Keys and can happen over seas, bays, and lakes worldwide. Water spouts are not expected to occur at the CPNPP site because the only nearby bodies of water are Squaw Creek Reservoir (SCR) and Lake Granbury. The small size of these lakes does not produce the conditions conducive to waterspouts.

2.7.1.2.4 Thunderstorms

Thunderstorms, from which damaging local weather can develop (tornadoes, hail, high winds, and flooding), occur about 16 days each year based on data from the counties surrounding the site (NOAA 2008). The maximum frequency of thunderstorms and high wind events occurs from April to June, while the months November through February have few thunderstorms. The distribution of thunderstorms and high wind events are displayed by county in Table 2.7-11.

2.7.1.2.5 Lightning

Data on lightning strike density are becoming more readily available due to the National Lightning Detection Network (NLDN), which has measured cloud-to-ground (CG) lightning for the contiguous United States since 1989. Prior to the availability of these data, isokeraunic maps of thunderstorm days were used to predict the relative incidence of lightning in a particular region. A general rule, based on a large amount of data from around the world, estimates the earth flash mean density to be from 1 to 2 cloud-to-ground flashes per 10 thunderstorm days/km^{2}r (IAEA 2003). The annual mean number of thunderstorm days in the site area is conservatively estimated to be 48 based on interpolation from the isokeraunic map (Hubbell 2001); therefore, it is estimated that the annual lightning strike density in the CPNPP site area is 25 strikes/sq mi/year. Other studies gave a ground flash density (GFD) (strikes/km^2/year), based on thunderstorm days per year (TSD) as GFD = 0.04 (TSD)$^{1.25}$ = 0.04 (48)$^{1.25}$ = 5 strikes/km^2/year or 13 strikes/mi^2-year (Alessandro 1998).

Recent studies based on data from the National Lightning Detection Network (NLDN) (Huffines 1999) indicate that the above strike densities are upper bounds for the CPNPP site. Mean annual flash density given in Huffines and Orville (Huffines 1999) for 1989 – 96 is from 3 to 5 strikes/km^2/year or 13 strikes/mi^2-year in North Central Texas.

2.7.1.2.6 Hail

Almost all localities in Texas occasionally experience damage from hail. While the most commonly reported hailstones are 1/2 to 3/4 in diameter, hailstones 3 to 3-1/2 in diameter are reported in Texas several times a year (CPSES 2007).

During the period January 1, 1950 – March 31, 2007 there were 707 reports of large hail (0.75 in diameter or larger) occurrences within the five county area (Somervell, Bosque, Erath, Hood, and Johnson) around the CPNPP site (NOAA 2008). This result gives a mean annual frequency of 12.3 hailstorms/year for this area. Fortunately, recurrence of damaging hail at a specific location is very infrequent.

The monthly and seasonal breakdown of large-hail occurrences (0.75 in diameter or larger) for the area around the CPNPP site is given in Table 2.7-12. Damaging hailstorms are most frequent during April, May, and June, the period of severe-thunderstorm activity.

2.7.1.2.7 Air Pollution Potential

The Clean Air Act, which was last amended in 1990, requires the U.S. Environmental Protection Agency (EPA) to set National Air Quality Standards for pollutants considered harmful to the public health and the environment. The EPA Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards for six principle pollutants, which are called “criteria” pollutants. Units of measure for the standards are parts per million (ppm), milligrams per cubic meter (mg/m^3), and micrograms per cubic meter of air (μgm/m^3). Areas are either in attainment of the air quality standards or in non-attainment. Attainment means that the air quality is better than the standard.

The promulgated EPA 8-hr ozone standard (62 FR 36, July 18, 1997) is 0.08 ppm in accordance with 40 CFR 50.10 (FR 1997). Somervell County is in attainment for all criteria pollutants: carbon monoxide, lead, nitrogen dioxide, particulate matter (PM_{10}, particulate matter less than 10 micron), particulate matter ($PM_{2.5}$, particulate matter less than 2.5 micron), ozone, and sulfur oxides. There are nine counties, or parts of counties, north and northeast of Somervell County that are in non-attainment with the 8-hr ozone standard (EPA 2006). As of March 2, 2008, designated non-attainment areas in this region of Texas for the criteria pollutants are as follows:

TEXAS (Region VI)
Dallas - Fort Worth, TX (Moderate)
Collin Co [(a)] [(b)]
Dallas Co [(a)] [(b)]
Denton Co [(a)] [(b)]
Ellis Co
Johnson Co
Kaufman Co
Parker Co
Rockwall Co
Tarrant Co [(a)] [(b)]

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a) area has whole or part county or counties in a previous 1-hr ozone nonattainment area (as of June 15, 2005) no longer subject to the 1-hr standard.

b) area has whole or part county or counties in a CO, PM-10, or PM-2.5 nonattainment or maintenance area or previous 1-hr ozone nonattainment or maintenance area (as of June 15, 2005).

Texas non-attainment areas are shown on Figure 2.7-172.

The ventilation rate is a significant consideration in the dispersion of pollutants. Higher ventilation rates are better for dispersing pollution than lower ventilation rates. The atmospheric ventilation rate is numerically equal to the product of the mixing height and the wind speed within the mixing layer (NCDENR 2006).

Conditions in the region generally favor turbulent mixing. Two conditions that reduce mixing, increasing the air pollution potential, are surface inversions and stable air layers aloft. The surface inversion is generally a short-term effect, and surface heating on most days creates a uniform mixing layer by mid-afternoon. Conversely, if warming caused by subsiding air occurs, the second condition, namely a subsidence inversion, may result. Because both conditions usually occur in conjunction with light winds, the air pollution potential is amplified (CPSES 2007).

Holzworth (Holzworth 1972) has computed mean morning and afternoon mixing heights and corresponding wind speeds for several stations in Texas, and plots of morning and afternoon mixing heights and wind speeds. The data from these plots are given in Table 2.7-13 for the CPNPP vicinity. There is considerable variation in mixing heights among Texas stations; but the mixing heights all display similar seasonal variation, the heights being greatest during the warm months and shallowest during the cold months. Holzworth also provides isopleths of the total number of forecast-days of high air pollution potential in 5 years. Figure 2.7-15 shows that the number of high air pollution days in 5 years for the CPNPP region is zero.

Mixing height data for Stephenville are given in Table 2.7-14. Table 2.7-14 gives the seasonal morning and afternoon mixing heights. This table shows that there is reasonable agreement with the earlier data provided by Holzworth. A comparison with the Holzworth data indicates that the morning mixing heights at Stephenville are higher in winter and lower in summer. The Stephenville afternoon mixing heights are highest in the spring and summer, which generally agree with the Holzworth data. The mean morning and afternoon ventilation rate for Stephenville is given in Table 2.7-15. Mixing height data were also obtained from the Ventilation Climate Information System (VCIS) (VCIS 2007) and are presented in Table 2.7-16 on a monthly basis along with the wind speed, ventilation index, and wind direction. The data indicate that stable periods with light wind conditions are generally of short duration in the region. Based on data from 1981 to 1989, the VCIS provides the daily and annual variability of the mixing height on a monthly basis. These data are provided in Figures 2.7-16, 2.7-17, 2.7-18, 2.7-19, 2.7-20, 2.7-21, 2.7-22, 2.7-23, 2.7-24, 2.7-25, 2.7-26, 2.7-27, 2.7-28, 2.7-29, 2.7-30, 2.7-31, 2.7-32, 2.7-33, 2.7-34, 2.7-35, 2.7-36, 2.7-37, 2.7-38, and 2.7-39. The monthly morning mixing height variability is given on Figure 2.7-40 and the afternoon on Figure 2.7-41. The average monthly morning and afternoon mixing heights are shown on Figure 2.7-42.

Based on a 50-year period of record (1948 – 1998), Wang and Angell (Wang 1999) tabulated the number of times stagnating anticyclones persisted for four or more days. Occurrences of stagnation were determined primarily on the basis of a surface pressure-gradient analysis. In the general area of the site, the mean duration was 5 days, and the mean annual frequency was 5 percent of the days annually (Figure 2.7-43). The mean annual days of stagnation were 20, and four cases per year exceeded 4 days duration (Figure 2.7-44). The number of air stagnation days was highest in July and August with 6 days each (Figure 2.7-45). The other months subject to air stagnation (June, September, and October) had 2, 4, and 3 stagnation days, respectively (Figure 2.7-45). The air stagnation trend for this general area is negative (Figure 2.7-46) over the 50-year period of record.

2.7.1.2.8 Precipitation

Historic precipitation data covering the period of 1971 – 2000 for the Dallas Fort Worth Airport, Dallas Love Field, Mineral Wells Airport, and the Glen Rose weather station are given in Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5. The annual average and maximum 24-hr rainfalls for these stations are given below:

	Annual Average Rainfall (in)	Maximum 24-hr Rainfall (in) and date
Dallas Fort Worth	34.73	5.91 (1959)
Dallas Love Field	37.05	6.02 (1977)
Mineral Wells	31.79	6.65 (1981)
Glen Rose	34.82	8.48 (1995)

The maximum 24-hr rainfall for Glen Rose was associated with Tropical Storm Dean.

Maximum rainfall, estimated by statistical analysis of regional precipitation data, is given in Table 2.7-17 for return periods of 1 – 100 years, and for rainfall durations of from 5 minutes to 10 days. These data were taken from NOAA Technical Memorandum NWS Hydro-35 (NOAA 1977), National Weather Service Technical Paper No. 40 (WB 1961), and National Weather Service Technical Paper No. 49 (WB 1964). Figure 2.7-47 gives a comparison of the monthly rainfall for representative regional weather stations covering the period of 1971 – 2000. This figure shows that the peak rainfall (~ 5 in) is in May for all referenced weather stations. A secondary peak (~4 in) occurs in October for these weather stations.

Probable maximum precipitation (PMP), sometimes called maximum possible precipitation, for a given area and duration is the depth that can be reached but not exceeded under known meteorological conditions. For the site area, using a 100-y return period, the PMP for 6, 12, 24, and 48 hr is 6.9, 8.3, 9.5, and 11.0 in, respectively (Table 2.7-17).

Drought is considered by many to be a normal condition in Texas. In every decade of the last century, Texas was a victim of one or more serious droughts. The drought of the 1930s caused significant declines in rangeland production, which was thought to have never fully recovered to pre-drought conditions. The severe to extreme drought that affected every region of Texas in the early to mid-1950s was the most serious drought to strike Texas in recorded weather history. In fact, the drought reached its worst in the late summer of 1956 in North Central Texas (NCTCOG 2004).

Texas experiences so many droughts in part because of its location along 30 degrees north latitude, a climate transition zone called the Great American Desert, the same latitude where many of the earth's deserts are found. A drought with duration of 3 months is likely to occur in some part of the state every 9 months. A drought with duration of 6 months or longer is likely to occur once every 16 months, and a drought with a duration of 12 months is likely somewhere in the state once every 3 years. Over the past decade, in addition to the droughts in 1996 and 1998, Texas also suffered droughts in 2000 and 2002. The duration of droughts in the North Central Texas Climatic Division between 1892 and 1971 is given below. For this purpose, droughts have been arbitrarily defined as when the area has less than 75 percent of the 1931 – 1960 average precipitation (NCTCOG 2004).

Droughts in North Central Texas: 1892 - 1971

Year	Drought Duration (in days)
1893	67
1901	70
1909	72
1910	64
1917	63
1924	73
1925	72
1943	72
1948	73
1954	68
1956	61
1963	63
1970	63

The most severe drought of this century in Texas occurred during 1954 – 1956. Fort Worth precipitation records, which illustrate the regional conditions, indicate that the average annual precipitation for this 3-year period was 21.1 in, with only 18.55 in occurring in 1956. Although this period represents the worst drought in Texas, there have been three occurrences of annual precipitation less than 18.55 in during the 81-year period from 1895 to 1975 at Fort Worth. The extreme minimum annual precipitation recorded, 17.91 in, occurred in 1921 (CPSES 2007).

Historic snowfall data covering the period of 1971 – 2000 for the Dallas Fort Worth Airport, Dallas Love Field, Mineral Wells Airport, and the Glen Rose weather station are given in Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5. The annual average and maximum 24-hr snowfall for these stations is given below:

	Annual Average Snowfall (in)	Maximum 24-hr Snowfall (in) and date
Dallas Fort Worth	2.5	12.1 (Jan 1964)
Dallas Love Field	1.7	6.0 (Feb 1978)
Mineral Wells	1.8	4.0 (Feb 1978)
Glen Rose	1.8	4.5 (Jan 1973)

Snowfall records for Dublin for the period 1897 – 2005 are illustrated in Figure 2.7-48. Snowfall records for Weatherford for the period 1896 – 2005 are illustrated in Figure 2.7-49.

Ice storms, precipitation in the form of freezing rain or sleet, occur occasionally in the region during the period December – March. Ice storms recorded for the adjoining counties of Bosque, Erath, Hood, Somervell, and Johnson for the period 1950 – 2007 are listed in Table 2.7-18. This data shows that the number of ice storms is slightly more than 1/year for these counties.

The evaluations of ice thickness from freezing rain performed by American Lifelines Alliance (ALA), “Extreme Ice Thicknesses from Freezing Rain,” September 2004, (ALA 2004) indicated that for the site area, the ice thickness is 1 in with a 100-year return period (Figure 2.7-50). Another study performed by the North Central Texas Council of Governments (NCTCOG) provided estimates of ice thickness with various return periods. Their results, based on a Weibull distribution, are given below (NCTCOG 2004):

Location (years of data)	2-year estimate (in)	10-year estimate (in)	50-year estimate (in)	100-year estimate (in)
Dallas Love Field (52)	0.35	1.04	3.05	4.86
Dallas Hensley Field (52)	0.38	1.01	2.67	4.07
Grapevine Dam (49)	0.48	1.07	1.67	1.93
Dallas-Fort Worth Int'l AP (28)	0.31	0.76	1.89	2.80
Eagle Mountain Lake (24)	0.33	1.01	3.12	5.06
Benbrook Dam (49)	0.45	0.85	1.24	1.42

The results from this analysis are considerably higher than those reported by the ALA. These results are attributed to the methodology employed by NCTCOG that used a combination of precipitation and minimum temperatures as a surrogate for winter ice storms or as a measure of potential winter ice storms. Daily precipitation data were used in the analysis if the precipitation equaled or exceeded 0.25 in and the minimum temperature for that day and the previous day were below 33°F. The assumption was that if the minimum temperature were below 33°F for the previous and current day, then precipitation would likely occur as ice or freezing rain resulting in a winter ice storm (NCTCOG 2004). These results may have resulted in an over estimate of ice thickness when compared to actual observations. These results should provide an upper bound to the actual ice thickness.

The density of the snowpack varies with age and the conditions to which it has been subjected. Thus, the depth of the snowpack is not a true indication of the pressure the snowpack exerts on the surface it covers. Due to the variable density in snowpack, a more useful statistic for estimating the snowpack pressure is the water equivalent (in inches) of the snowpack.

Texas is not a heavy snow load region. ANSI/ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," (ASCE 2005) identifies that the ground snowload for the CPNPP area is 4 lbf/ft^2 based on a 50-year recurrence. This amount is converted to a 100-year recurrence weight of 4.9 lbf/ft^2 (psf) using a factor of 1.22 (1/0.82) taken from ANSI/ASCE 7-05 Table C7-3. Local snow measurements support this ANSI/ASCE 7-05 value.

To estimate the weight of the 100-year snowpack at the CPNPP site, the maximum reported snow depths at the Dallas Fort Worth Airport was determined. Table 2.7-2 shows that the greatest snow depth over the 30-year record is 8 in. The 100-year recurrence snow depth is 11.2 in using a factor of 1.4 to convert from a 30-year recurrence interval to 100-year interval (ASCE 2005).

Freshly fallen snow has a snow density (the ratio of the volume of melted water to the original volume of snow) of 0.07 to 0.15, and glacial ice formed from compacted snow has a maximum density of 0.91 (Huschke 1959). In the CPNPP site area, snow melts and evaporates quickly, usually within 48 hr, and before additional snow is added. The water equivalent of the snowpack can be considered equal to the water equivalent of the falling snow as reported hourly during the snowfall. A conservative estimate of the water equivalent of snowpack in the CPNPP site area would be 0.20 in of water per inch of snowpack. Then, the water equivalent of the 100-year return snowpack would be 11.2 in of snowpack x 0.2 in of water equivalent/inch of snowpack = 2.24 in of water.

Because 1 cubic inch of water is approximately 0.0361 pounds in weight, a 1-in water equivalent snowpack would exert a pressure of 5.20 pounds per square foot (0.0361 lb/cu in x 144 sq in). For the 100-year return snowpack, the water equivalent would exert a pressure of 11.7 pounds per square foot (5.20 lbm/sq ft/in x 2.24 in). This very conservative estimate is approximately twice the value provided in ANSI-ANS 7-05.

The 100-year return period snow and ice pack for the area in which the plant is located, in terms of snow load on the ground and water equivalent, is listed below:

- Snow Load = 11.7 lb/ft^2

- Ice Load = 5.06 in * 5.20 lb/ft^2/in = 26.1 lb/ft^2

From Hydrometeorological Report No. 53, NUREG/CD-1486 the 24-hr probable maximum winter precipitation (PMWP) for a 10 sq-mi area is estimated to be 43 in. The 72-hr PMWP for a 10 sq-mi area is estimated to be 53 in. Assuming a linear relationship between these values gives a 48-hr PMWP of 48 in. Because of the southern location of the site, almost all of this PMWP occurs as liquid. As stated in the US-APWR Design Control Document (DCD) Section 3.4.1.2, “If PMP were to occur, US-APWR safety-related SSCs would not be jeopardized.” US-APWR “seismic category I building roofs are designed as a drainage system capable of handling the PMP.” The US-APWR DCD also states that “seismic category I structures have sloped roofs designed to preclude roof ponding. This is accomplished by channeling rainfall expeditiously off the roof.”

2.7.1.2.9 Dust Storms

Blowing dust or sand may occur occasionally in West Texas where strong winds are more frequent and vegetation is sparse. While blowing dust or sand may reduce visibility to less than 5 mi over an area of thousands of square miles, dust storms that reduce visibility to 1 mi or less are quite localized and depend on soil type, soil condition, and vegetation in the immediate area. The NCDC Storm Event database did not report any dust storms in Somervell County between January 1, 1950 and August 31, 2007.

2.7.1.2.10 Extreme Winds

Estimated extreme winds (fastest mile) for the general area based on the Frechet distribution are:

Return Period (Year)	Wind Speed (mph)
2	51
10	61
50	71
100	76

Fastest mile winds are sustained winds, normalized to 30 ft msl and include all meteorological phenomena except tornadoes (CPSES 2007).

2.7.2 LOCAL METEOROLOGY

2.7.2.1 Normal and Extreme Values of Meteorological Parameters

The CPNPP site is located approximately equidistant between Cleburne and Stephenville, west of the Brazos River. The site elevation is approximately 810 ft msl. The terrain slopes gradually from 300 to 700 ft msl southeast of the site to 1200 to 1800 ft msl northwest of the site (CPSES 2007).

2.7.2.1.1 General

In this section, the normal and extreme statistics of wind, temperature, water vapor, precipitation, fog, and atmospheric stability are described. Long-term data from proximal weather stations (Figure 2.7-7) have been used to supplement the shorter-term on-site data.

2.7.2.1.2 Surface Winds

Annually, the prevailing surface winds in the region are from the south to southeast while the average wind speed is about 10 mph based on site data from 2001-2004 and 2006. As shown on Figures 2.7-8, 2.7-9, and 2.7-10, the annual resultant wind vectors for Dallas Fort Worth, Mineral Wells, and CPNPP are 149 degrees, 138 degrees, and 153 degrees, respectively. The annual average wind speeds for Dallas Fort Worth, Mineral Wells, and CPNPP are 10.3, 9.0, and 9.8 mph, respectively. In winter, there is a secondary wind direction maximum from the north to northwest due to frequent outbreaks of polar air masses (Mineral Wells and CPNPP wind rose Figures 2.7-62, 2.7-63, 2.7-64, 2.7-65, 2.7-66, 2.7-67, 2.7-68, 2.7-69, 2.7-70, 2.7-71, 2.7-72, 2.7-73, 2.7-74, 2.7-75, 2.7-76, 2.7-77, 2.7-78, 2.7-79, 2.7-80, 2.7-81, 2.7-82, 2.7-83, 2.7-84, 2.7-85, 2.7-86, 2.7-87, 2.7-88, 2.7-89, 2.7-90, 2.7-91, 2.7-92, 2.7-93, 2.7-94, 2.7-95, 2.7-96, 2.7-97, 2.7-98, 2.7-99, 2.7-100, 2.7-101, 2.7-102, 2.7-103, 2.7-104, 2.7-105, and 2.7-106).

Percentage frequencies of surface wind direction, by wind speed, at the Dallas Fort Worth airport for the years 1997 – 2006 are shown on a monthly and annual basis in Tables 2.7-20, 2.7-21, 2.7-22, 2.7-23, 2.7-24, 2.7-25, 2.7-26, 2.7-27, 2.7-28, 2.7-29, 2.7-30, 2.7-31 and 2.7-32. According to the annual table, surface wind directions at the Dallas Fort Worth airport are from the southeast, south-southeast, and south 43 percent of the time. These directions predominate during the individual months also, but to a lesser extent during November – March. The annual average wind speed (shown in Table 2.7-32) is 10.3 mph. The maximum average wind speed (12.7 mph) occurs in the spring, while the minimum (8.2 mph) occurs in the fall.

Percentage frequencies of surface wind direction, by wind speed, at the Mineral Wells Airport for the years 2001 – 2006 are shown on a monthly and annual basis in Tables 2.7-33, 2.7-34, 2.7-35, 2.7-36, 2.7-37, 2.7-38, 2.7-39, 2.7-40, 2.7-41, 2.7-42, 2.7-43, 2.7-44 and 2.7-45. According to the annual table, Table 2.7-45, surface wind directions at the Mineral Wells Airport are from the southeast, south-southeast, south, and south-southwest 41 percent of the time. These directions predominate during the individual months also, but to a lesser extent during November – March. The annual average wind speed (shown in Table 2.7-45) is 8.81 mph. The maximum average monthly wind speed (10.73 mph) occurs in the spring, while the minimum (7.32 mph) occurs in the late summer.

Monthly and annual on-site wind frequency distributions for CPNPP using data measured at the 10-m level (lower level) for the years 2001 – 2004 and 2006 are included in Tables 2.7-46, 2.7-47, 2.7-48, 2.7-49, 2.7-50, 2.7-51, 2.7-52, 2.7-53, 2.7-54, 2.7-55, 2.7-56, 2.7-57, and 2.7-58. Similar to the off-site distribution, the surface wind is from the southeast, south-southeast, south, and south-southwest 51 percent of the time. The annual average wind speed is also similar on-site, averaging 9.8 mph. The maximum average wind speed (11.3 mph) occurs in the spring, while the minimum (8.0 mph) occurs in the late summer.

Monthly and annual on-site wind frequency distributions for the CPNPP site using data measured at the 60-m level (upper level) for the years 2001 – 2004 and 2006 are included in Tables 2.7-59, 2.7-60, 2.7-61, 2.7-62, 2.7-63, 2.7-64, 2.7-65, 2.7-66, 2.7-67, 2.7-68, 2.7-69, 2.7-70, and 2.7-71. Similar to the off-site distribution, the surface wind is from the southeast, south-southeast, south, and south-southwest 52 percent of the time. The annual average wind speed averages 12.6 mph. The maximum average wind speed (14.8 mph) occurs in the spring, while the minimum (10.3 mph) occurs in the summer. As expected, the average wind speeds at the upper elevation are greater than the lower level wind speeds where surface effects reduce the wind speed.

The maximum 2-minute and 5-second wind speeds at Dallas Fort Worth (1971 – 2000) for each month is presented in Table 2.7-2. As shown, the maximum 5-second wind speed of 78 mph occurred in February 2000.

Wind direction persistence, determined for a 10-year period (1997 – 2006) at the Dallas Fort Worth airport, is presented in Tables 2.7-72, 2.7-73, and 2.7-74. Table 2.7-72 gives the persistence for a single sector (22.5 degrees). As expected, the direction with the maximum average number of hours with wind from a single sector was south (37 hr). Table 2.7-73 provides similar data for persistence from three adjacent sectors. For this case, the south-southeast direction had the maximum average number of hours (106 hr) with wind from three adjacent sectors. Table 2.7-74 gives the persistence for five adjacent sectors. For this case, the south-southeast direction had the maximum average number of hours (167 hr) with wind from five adjacent sectors. Persistence was assumed to be broken by calm or missing observations. Because of these criteria, persistence as given by the number of consecutive 3-hr observations tends to have a bias towards shorter durations.

Wind direction persistence, determined to be a 6-year period (2001 – 2006) at the Mineral Wells Airport, is presented in Tables 2.7-75, 2.7-76, and 2.7-77. Table 2.7-75 gives the persistence for a single sector (22.5 degrees). The direction with the maximum average number of hours (17 hr) with wind from a single sector was south. Table 2.7-76 provides similar data for persistence from three adjacent sectors. For this case, the south-southeast direction had the maximum average number of hours (103 hr) with wind from three adjacent sectors. Table 2.7-77 gives the persistence for five adjacent sectors. For this case, the south direction had the maximum average number of hours (157 hr) with wind from five adjacent sectors. As before, persistence was assumed to be broken by calm or missing observations. Because of these criteria, persistence as given by the number of consecutive 3-hr observations tends to have a bias towards shorter durations.

Annual wind direction persistence from a single sector, determined from hourly on-site observations at the 10-m level (lower level) are presented in Table 2.7-78. These data, which are independent of atmospheric stability, indicate that one-third of the monthly maximum number of consecutive hours of persistence at the CPNPP site are less than 12 hr in duration. During the 5-year period of record, there were only five cases of persistence greater than 24 hr, two cases occurred in the north sector, two cases in the south sector, and one case in the north-northwest sector. The direction with the maximum average number of hours with wind from a single sector was north (25 hr). Table 2.7-79 provides similar data for persistence from three adjacent sectors. For this case, the south direction had the maximum average number of hours (120 hr) with wind from three adjacent sectors. Table 2.7-80 gives the persistence for five adjacent sectors. For this case, the south-southeast direction had the maximum average number of hours (200 hr) with wind from five adjacent sectors.

Annual wind direction persistence from a single sector, determined from hourly on-site observations at the 60-m level are presented in Table 2.7-81. These data, which are independent of atmospheric stability, indicate that one-third of the monthly maximum number of consecutive hours of persistence at the CPNPP site are less than 12 hr in duration. During the 5-year period of record, there were only four cases of persistence greater than 24 hr, two of which occurred in the south-southeast sector. The directions with the maximum average number of hours with wind from a single sector were south-southeast (23 hr) and north-northwest (24 hr). Table 2.7-82 provides similar data for persistence from three adjacent sectors. For this case, the south direction had the maximum average number of hours (147 hr) with wind from three adjacent sectors. Table 2.7-83 gives the persistence for five adjacent sectors. For this case, the south direction had the maximum average number of hours (222 hr) with wind from five adjacent sectors.

A comparison of the average wind persistence for Dallas Fort Worth, Mineral Wells, and CPNPP is provided in Table 2.7-84. These data show that the wind persistence is generally higher at both CPNPP measurement levels than the persistence at Dallas Fort Worth or Mineral Wells for single or multiple sectors. This comparison is illustrated in Figures 2.7-59, 2.7-60, and 2.7-61 for a single sector, three adjacent sectors, and five adjacent sectors, respectively. These figures show good general agreement between the three locations with the exception of the single sector persistence for Dallas Fort Worth, which has a higher persistence in the southern direction.

The monthly and seasonal wind rose for Mineral Wells Airport is provided on Figures 2.7-62, 2.7-63, 2.7-64, 2.7-65, 2.7-66, 2.7-67, 2.7-68, 2.7-69, 2.7-70, 2.7-71, 2.7-72, 2.7-73, 2.7-74, 2.7-75, 2.7-76, and 2.7-77. On a monthly basis, these figures show the dominant south-southeast wind direction. The seasonal wind rose plots show an additional north-northwest component in the winter and fall. The annual wind rose plot for Mineral Wells is provided on Figure 2.7-9.

Similar monthly and seasonal wind rose for the lower level (10-m) CPNPP data are provided on Figures 2.7-78, 2.7-79, 2.7-80, 2.7-81, 2.7-82, 2.7-83, 2.7-84, 2.7-85, 2.7-86, 2.7-87, 2.7-88, 2.7-89, 2.7-90, 2.7-91, 2.7-92, and 2.7-93. On a monthly basis, these figures show the dominant south and south-southeast wind direction. The seasonal wind rose plots show a significant additional north and north-northwest component in the winter and fall. The annual wind rose plot for CPNPP is provided on Figure 2.7-10. Monthly and seasonal wind roses for the upper level (60-m) CPNPP data are provided on Figures 2.7-94, 2.7-95, 2.7-96, 2.7-97, 2.7-98, 2.7-99, 2.7-100, 2.7-101, 2.7-102, 2.7-103, 2.7-104, 2.7-105, 2.7-106, 2.7-107, 2.7-108, and 2.7-109. On a monthly basis, these figures show the dominant south-southeast wind direction. The seasonal wind rose plots show the only significant north and north-northwest component is in the winter. The annual wind rose plot for the CPNPP site is provided on Figure 2.7-110.

2.7.2.1.3 Temperatures

During the winter and early spring, outbreaks of polar continental air are the most common frontal activity. Although these fronts frequently have little weather associated with them, they often stall in Central and South Texas. Low stratus clouds often linger for a day or two before skies become clear (NCDC 2008). On occasion, arctic air masses push through the region and cause some of the coldest temperatures. Cold spells, however, rarely last more than a few days. Normally, temperatures drop to 32°F or below about 30 days each year (CPSES 2007). Winter is the driest season, but one or two occurrences of snow and one or two occurrences of sleet or freezing rain may be expected in both January and February, the coldest months (CPSES 2007).

Pacific maritime cold fronts are more frequent in spring and fall than in winter or summer. These air masses usually bring clear skies to the region, although the weather along the leading edge of the front may be quite violent. Most of the dust storms of early spring and the violent thunderstorms during April, May, and June are associated with these frontal systems. Warm fronts are generally confined to the late fall and early spring months in this region. They are usually confined to the southern half of the region and move northward very slowly (CPSES 2007).

Spring is characterized by rapid changes of temperature; i.e., alternating periods of warm and cold conditions. On the average, thunderstorms are more frequent and more violent in the spring than any other season. Spring is normally the wettest season of the year. The fall is characterized by fair weather, low wind speeds, and moderate temperatures. It is the most pleasant season of the year (CPSES 2007).

Typically, summer has over 90 days with temperatures of 90°F or above, and temperatures often exceed 100°F (USHCN 2007). Table 2.7-19 provides the number of days with temperatures above 90°F, above 100°F, and below 32°F in addition to the number of days with precipitation or snow for Dublin and Weatherford based on data from 1902 through 2004. Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5 provide similar data for Dallas Fort Worth, Dallas Love Field, Mineral Wells, and Glen Rose, respectively over the period of 1971 – 2000. These data show that there are approximately 100 days with maximum daily temperatures above 90°F and approximately 3 days/year with maximum daily temperatures below 32°F for these stations. The normal mean temperature for these stations is 64°F – 66°F.

Normal monthly average temperatures for Benbrook Dam, Cleburne, Dallas Fort Worth Airport, Dallas Love Field, Dublin, Glen Rose, Mineral Wells, Stephenville, and Weatherford are shown on Figure 2.7-51 for the period 1971 – 2000. The monthly average temperature for these stations ranges from 45°F in winter to almost 85°F in summer. The normal monthly minimum temperature for the same stations is shown on Figure 2.7-52. The normal monthly minimum average temperature ranges from 30°F in winter to 75°F in summer. The normal monthly normal maximum temperature for these stations is shown on Figure 2.7-53. The normal monthly average maximum temperature ranges from 55°F in winter to 95°F in summer. The monthly averages indicate that July and August are the hottest months and January the coldest month. A longer term temperature record is provided by the U. S. Historical Climatology Network for Dublin and Weatherford. This database covers the years 1896 – 2005. The monthly minimum, mean, and maximum temperatures for Dublin for the 1897 – 2005 time period are shown on Figure 2.7-54. The annual average minimum, mean, and maximum temperatures for Dublin over the period

1902 – 2005 are shown on Figure 2.7-55. The range of the monthly mean maximum temperature over the period of record (1897 – 2005) for Dublin is shown on Figure 2.7-56, and the monthly mean and monthly mean minimum temperatures for Dublin are shown on Figures 2.7-57 and 2.7-58, respectively. The annual mean of the monthly mean maximum temperature for Dublin over the period of record (1897 – 2005) is shown on Figure 2.7-111. This figure shows that the annual mean of the monthly mean maximum temperature varied from approximately 73°F to 78°F over the last 111 years. The annual mean of the monthly mean for Dublin shown on Figure 2.7-112 shows that the annual mean has varied from about 62°F to 66°F over the last 45 years. The annual mean before 1960 was slightly higher. The variation of the annual mean of the monthly mean minimum temperature at Dublin (Figure 2.7-113) over the same time period (1897 – 2005) is less consistent showing a downward trend in temperature to a range of 51°F – 54°F in the last 45 years.

The monthly minimum, mean, and maximum temperatures for Weatherford for the 1896 – 2005 time period are shown on Figure 2.7-114. The annual average minimum, mean, and maximum temperatures for Weatherford over the period 1897 – 2005 are shown on Figure 2.7-115. The range of the monthly mean maximum temperature over the period of record (1897 – 2005) for Weatherford is shown on Figure 2.7-116, and the monthly mean and monthly mean minimum temperatures for Weatherford are shown on Figures 2.7-117 and 2.7-118, respectively. The annual mean of the monthly mean maximum temperature for Weatherford over the period of record (1897 – 2005) is shown on Figure 2.7-119. This figure shows that the annual mean of the monthly mean maximum temperature varied from approximately 74°F to 78°F over the last 70 years. The annual mean of the monthly mean for Weatherford, Figure 2.7-120, shows that the annual mean has varied from about 62°F to 66°F over the last 45 years. The annual mean before 1960 was slightly higher. The variation of the annual mean of the monthly minimum temperature at Weatherford (Figure 2.7-121) over the same time period (1897 – 2005) is less consistent showing a downward trend in temperature to a range of 49°F – 54°F in the last 45 years.

The monthly minimum, mean, and maximum temperatures at the site are shown in Table 2.7-85. The annual daily mean at the CPNPP site is 67°F, which is only slightly higher than the regional data. The monthly mean, minimum, and maximum temperatures at the CPNPP site over the time period of 2001-2004 and 2006 are shown on Figure 2.7-122. The monthly mean, minimum, and maximum temperatures at Mineral Wells over the time period of 1971 – 2000 are shown on Figure 2.7-123. Comparison of the site data from Figure 2.7-122 with the Mineral Wells data in Figure 2.7-123 shows good general agreement but with relatively higher winter temperatures reported at the CPNPP site. These data are due to the shorter period of record at the CPNPP site. The daily mean, minimum, and maximum temperatures at Mineral Wells over the time period of 1971 – 2000 are shown on Figure 2.7-124.

2.7.2.1.4 Water Vapor

Monthly and annual average relative humidity for four different times of day is given in Table 2.7-86 from 10 years of record at the Dallas Fort Worth Airport weather station. Based on these data, the annual average relative humidity is estimated to be about 65 percent. Monthly and annual average relative humidity for four different times of day is given in Table 2.7-87 from 5 years of record at the Mineral Wells Airport. Based on these data, the annual average relative humidity at Mineral Wells is estimated to be about 69 percent. The monthly and annual mean dew point temperatures and extreme maximum and minimum dew point temperatures are shown in Table

2.7-88, based on 1949 – 2006 data from the Mineral Wells Airport. The average daily dew point temperature from Mineral Wells Airport for the same time period is shown on Figure 1.2-125.

Based on 10 years of data (1997 – 2006) from the Dallas Fort Worth Airport (Table 2.7-89), the worst one-day (May 26, 1997) average wet bulb temperature was 78.6°F, and the corresponding average dry bulb temperature was 83.6°F. The worst consecutive 5-day period (June 6, 1997 – July 3, 1997) is given in Table 2.7-90. The average wet bulb temperature for these five days was 77.4°F, and the corresponding dry bulb temperature was 84.6°F. The worst 30 consecutive day period for Forth Worth is given in Table 2.7-91. The average wet bulb temperature for this period (July 4, 2001 through August 2, 2001) was 76.1°F, and the dry bulb temperature was 87.4°F. Based on 6 years of data (2001 – 2006) from the Mineral Wells Airport (Table 2.7-92), the worst one-day (June 24, 2003) average wet bulb temperature was 77.0°F, and the corresponding average dry bulb temperature was 84.4°F. The worst consecutive 5-day period (June 21, 2003 – June 25, 2003) is given in Table 2.7-93. The average wet bulb temperature for these five days was 75.8°F with a dry bulb temperature of 83.3°F. The worst consecutive 30-day period for Mineral Wells is given in Table 2.7-94. The average wet bulb temperature for this period (July 14, 2001 through August 12, 2001) was 73.8°F with a dry bulb temperature of 88.3°F.

2.7.2.1.5 Precipitation

The monthly and annual precipitation normals, and the mean number of days with precipitation greater than 0.01 in for the CPNPP site are presented in Table 2.7-95. These data indicate that the highest monthly average rainfall occurs in March with an annual average total rainfall of 30.3 in. The number of days with measurable precipitation (74 days) is also presented in Table 2.7-95 based on site data from 2001, 2003, and 2006. The maximum 24-hr rainfall and 48-hr rainfall totals are also given in this table as 3.8 in and 4.5 in, respectively. The annual rainfall frequency distribution as a function of rainfall intensity is given in Tables 2.7-96, 2.7-97, and 2.7-98 for Fort Worth, Mineral Wells, and CPNPP, respectively. These figures show that the winter months have the highest total hours of rainfall; however, most of this rainfall is light. The monthly and annual distribution of rainfall by direction for a 10-year period of record at the Dallas Fort Worth Airport, a 6-year period at the Mineral Wells Airport, and a 3-year period at the CPNPP site are given in Tables 2.7-99, 2.7-100, and 2.7-101, respectively. These tables show that rainfall with wind from the north is the most common due to arctic air intrusions followed by rainfall with winds from the most common southerly direction. The long term (1987 – 2006) average annual rainfall at Mineral Wells is given in Figure 2.7-126. This figure shows an increasing trend in rainfall which is biased by the drought in 1993 – 1995. The average annual rainfall for this station over the longer period of 1949 – 2006 for which there is data is 34.1 in. Figures 2.7-127, 2.7-128, 2.7-129, and 2.7-130 give the average monthly precipitation for Mineral Wells, Weatherford, Dublin, and CPNPP, respectively. The Mineral Wells data (1971 – 2000) show a peak in the spring with a secondary, smaller peak in the fall, and a minimum in January. These data agree with the data from the longer term records for Weatherford (1896 – 2005) and Dublin (1896 – 2005) shown in Figures 2.7-128 and 2.7-129. The data from the CPNPP site also show a spring peak and a smaller fall peak, but the other details of the precipitation curve do not match the longer term records from other weather stations. This result is due to the very short data record (3 years) used for the CPNPP site. The long term annual precipitation data for Dublin (1896 – 2005) and Weatherford (1889 – 2005) are given in Figures 2.7-131 and 2.7-132. The data for Dublin show a gradually increasing trend that may be due to localized relative drought conditions in the early 1900s. The data for Weatherford in Figure 2.7-128 are considered to be more representative of the general regional conditions with an annual average of about 30 in.

Monthly, seasonal, and annual precipitation wind roses for Mineral Wells are presented in Figures 2.7-133, 2.7-134, 2.7-135, 2.7-136, 2.7-137, 2.7-138, 2.7-139, 2.7-140, 2.7-141, 2.7-142, 2.7-143, 2.7-144, 2.7-145, 2.7-146, 2.7-147, 2.7-148, and 2.7-149. These data are based on 6 years of data at Mineral Wells Airport. These data show that the highest incidence of precipitation occurred with winds from the north. The monthly, seasonal, and annual precipitation wind roses for CPNPP for the years 2001, 2003, and 2006 presented in Figures 2.7-150, 2.7-151, 2.7-152, 2.7-153, 2.7-154, 2.7-155, 2.7-156, 2.7-157, 2.7-158, 2.7-159, 2.7-160, 2.7-161, 2.7-162, 2.7-163, 2.7-164, 2.7-165, and 2.7-166 show the same pattern as the Mineral Wells data. The annual precipitation wind rose for Dallas Fort Worth Airport presented on Figure 2.7-167 also shows the maximum frequency of precipitation occurred with north winds.

Snow and sleet occur from December through March with an occasional snow flurry in late November or early April. Monthly and annual average totals of snow from 30 years of record at the Dallas Fort Worth Airport, Dallas Love Field, Mineral Wells, and Glen Rose are provided in Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5, respectively. These data give an annual expectancy of 2.5 in of snow. Extremes of snowfall at these selected stations were also previously presented in Tables 2.7-2, 2.7-3, 2.7-4, and 2.7-5.

2.7.2.1.6 Fog

Heavy fog reduces visibility to 0.25 mi or less. Average monthly and annual number of heavy fog days based on 10 years of data at the Dallas Fort Worth Airport is presented in Table 2.7-102. These data indicate that most (63 percent) of the heavy fog days occur in winter with a few occurrences during the remainder of the year. The annual average hours of fog were 16.2 hr. Average monthly and annual number of heavy fog days based on 6 years of data at the Mineral Wells Airport presented in Table 2.7-103 also show that winter produces the highest hours of fog, although the annual hours of fog at Mineral Wells is higher (46.7 hr).

2.7.2.1.7 Atmospheric Stability

Based on data for the period 2001 – 2004, and 2006 at the CPNPP site, the monthly and annual frequency distributions of stability classes are shown in Table 2.7-104. The stability classes are based on the standard Pasquill classification using the 10 – 60 m temperature differential. These data indicate that the frequency of stable classes reaches a peak during the fall and winter. The stable classes (F and G) only account for less than 10 percent of the total hours. The neutral (class D) and slightly stable (class E) account for almost 70 percent of the annual hours.

The CPNPP joint frequency distribution for each stability category is provided in Table 2.7-105. The upper bounds for each wind speed category are ≤0.5 m/s, ≤0.75 m/s, ≤1.0 m/s, ≤1.25 m/s, ≤1.5 m/s, ≤2.0 m/s, ≤3.0 m/s, ≤4.0 m/s, ≤5.0 m/s, ≤6.0 m/s, ≤8.0 m/s, and ≤16.0 m/s. For the years of data under consideration, there were no hourly recordings of wind speeds greater than 16.0 m/s. In this table, calms were classified as hourly average wind speeds below the vane or anemometer starting speed, whichever is higher. According to the meteorological tower instrumentation data given in Table 2.3-34 of the CPNPP Units 1 and 2 FSAR (CPSES 2007), the starting wind speeds for the anemometer and vane are 0.45 m/s. Therefore, a starting wind speed of 0.45 m/s (1.0 mph) is used.

The CPNPP joint frequency distributions were not compared to the long-term joint frequency distributions from the National Weather Service stations, because the joint frequency distributions using the National Weather Service data would be based on different criteria for determining Pasquill stability classes.

2.7.2.1.8 Mixing Heights

The frequencies of seasonal and annual mixing heights are included and discussed in Subsection 2.7.1.2.7. Because on-site measurements of mixing depth are neither required nor made, monthly mixing depths from upper air data at Stephenville and data from the VCIS are used.

Temperature inversions are also important in evaluating the potential for dispersion of pollutants. A temperature inversion generally refers to an increase in temperature with height or to the layer within which such an increase occurs. An inversion can lead to pollution such as smog being trapped close to the ground, with possible adverse effects on health. An inversion can also suppress convection by acting as a "cap." An inversion is defined as any three readings on a sounding that show temperatures increasing with elevation (below 3000 m). The inversion layer height is the point, found by interpolation between readings, at which temperature again starts to decrease with elevation. The maximum inversion strength is the maximum temperature rise divided by elevation difference within the inversion layer. The frequency and strength of inversion layers are evaluated using 6 years of weather balloon data collected at the Fort Worth radiosonde station (EPA 2006a). Weather balloons are released twice daily at 0:00 Greenwich Mean Time (GMT) (6:00 am CST) and 12:00 GMT (6:00 pm CST) to obtain vertical profiles of temperature, wind, and dew point temperature. The monthly data are provided in Tables 2.7-106, 2.7-107, 2.7-108, 2.7-109, 2.7-110, 2.7-111, 2.7-112, 2.7-113, 2.7-114, 2.7-115, 2.7-116, and 2.7-117 in terms of number of mornings and afternoons containing inversions, average inversion layer elevation, and the average strength of the inversions. Table 2.7-118 provides annual average data for the period.

2.7.2.1.9 Representativeness of the On-site Data

The comparison of the temperature, precipitation, wind speed, and wind direction provided in the previous sections demonstrates that the CPNPP on-site data are representative of longer-term climatological conditions. The differences that do occur indicate, conservatively, that diffusion estimates would probably be higher than normal.

2.7.2.2 Potential Influence of the Plant and Its Facilities on Local Meteorology

2.7.2.2.1 General

Potential modifications of the local meteorology at the site resulting from the construction and operation of CPNPP Units 3 and 4 are believed to be small. The CPNPP Units 1 and 2 containment buildings and associated facilities in addition to the CPNPP Units 3 and 4 reactor complex are expected to have some small influence on the local air flow; specifically, mechanical turbulence is expected downwind of the plant due to building wake effects.

2.7.2.2.2 Impact of SCR

The impact of filling SCR on the local meteorology has already taken place, and no changes are anticipated during the CPNPP Unit 3 and 4 construction or operations. The impact of filling SCR was addressed in the CPNPP Units 1 and 2 FSAR, Section 2.3, and is not discussed further.

2.7.2.2.3 Topographical Description

A map of the CPNPP area for a distance of 5 mi from the site is shown in Figure 2.7-168. The topographic cross-sections for each compass direction out to 5 mi from the site are given in Figure 2.7-169. These figures indicate the maximum elevation versus distance from the plant in each sector. The site elevation is approximately 810 ft msl. The terrain varies from 600 to 1000 ft msl within 5 mi of the site, and is generally in this range out to 50 mi. General topographic features for a radius of 50 mi are shown in Figure 2.7-170. The topographic cross-sections out to 50 mi in each compass direction are given in Figure 2.7-171. As seen from these figures, the elevation increases to about 600 – 700 ft above the plant elevation in the west, northwest, and west-southwest directions.

Variable terrain has a potential to influence local diffusion characteristics. Terrain variations on the order of plus or minus 200 ft are not pronounced enough to cause any significant flow blocking. Two possible influences, cold air drainage and channeling, have been investigated. The occurrences of cold, more dense, air drainage down Squaw Creek was assessed in the CPNPP Units 1 and 2 FSAR by a comparison of wind direction frequencies between the 10-m (850-ft msl) and 60-m (1000-ft msl) levels for a 131-day period. If drainage were to occur, then marked increases of down-valley wind frequencies, east- southeast and southeast, from the upper to the lower level would be expected. Marked changes in frequency did not appear in the data; therefore, it was concluded that cold air drainage along Squaw Creek is not significant. Because Squaw Creek is completed, this effectively modifies the topography over a large area surrounding the CPNPP site to a minimum elevation of 770 ft msl, or only about 40 ft less than site elevation. Thus, cold air drainage is unlikely.

Channeling of air flow, the other potential topographical effect, was evaluated in the CPNPP Units 1 and 2 FSAR by comparing the 10-m wind directions with wind direction data from Dallas Love Field, where surroundings are relatively flat. A significant increase in wind direction frequencies for both up and down valley sectors, west-northwest, northwest, north-northwest, east-southeast, and southeast, would occur if channeling is an important influence. Approximately 8 months of concurrent wind direction data were evaluated indicating that channeling of the air along Squaw Creek is not a prominent effect.

The channeling and air-drainage study results presented in the CPNPP Units 1 and 2 FSAR are indicative of a relatively flat terrain with little, if any, topographic effect on the local airflow.

2.7.3 SHORT-TERM ATMOSPHERIC DISPERSION ESTIMATES FOR ACCIDENT RELEASES

2.7.3.1 Objective

The on-site meteorological data record at CPNPP site for the period 2001-2004 and 2006, has been used to calculate dilution factors that can be anticipated in the event of an accidental release of radionuclides into the atmosphere. The 2-hr dilution factors are calculated at the exclusion area boundary (EAB); for longer time periods the factors are calculated at the outer boundary of the low population zone (LPZ).

The consequence of a design basis accident in terms of personnel exposure is a function of the atmospheric dispersion conditions at the site of the potential release. Atmospheric dispersion consists of two components: 1) atmospheric transport due to organized or mean airflow within the atmosphere and 2) atmospheric diffusion due to disorganized or random air motions. Atmospheric diffusion conditions are represented by relative air concentration (χ/Q) values. This section describes the development of the short-term diffusion estimates for the site boundary and the low population zone.

2.7.3.2 Calculations

The efficiency of diffusion is primarily dependent on winds (speed and direction) and atmospheric stability characteristics. As stated in Regulatory Guide 1.145 and NUREG/CR-2858, dispersion is rapid within stability classes A – D and much slower for classes E – G. That is, atmospheric dispersion capabilities decrease with progression from class A to class G, with an abrupt reduction from class D to class E.

As indicated in NUREG/CR 2858, relative concentrations of released gases, χ/Q values, as a function of direction for various time periods at the exclusion area boundary (EAB) and the outer boundary of the low population (LPZ), were determined by the use of the computer code PAVAN. This code implements the guidance provided in Regulatory Guide 1.145. The χ/Q calculations are based on the theory that material released to the atmosphere would be normally distributed (Gaussian) about the plume centerline. As stated in NUREG/CR 2858 and Regulatory Guide 1.145, a straight-line trajectory is assumed between the point of release and all distances for which χ/Q values are calculated.

Using joint frequency distributions of wind direction and wind speed by atmospheric stability, PAVAN provides the χ/Q values as functions of direction for various time periods at the exclusion area boundary (EAB) and the low population zone (LPZ). The meteorological data needed for this calculation included wind speed, wind direction, and atmospheric stability. The meteorological data used for this analysis was collected from the on-site monitoring equipment from 2001 to 2006. Data recovery for 2005 was below 90 percent. Consequently this year of data was not used. The five years of data (2001 - 2004 and 2006) were averaged and the joint frequency distributions are reported in Table 2.7-105. Other plant specific data included tower height at which wind speed was measured (10.0 m) and distances to the EAB (0.5 mi) and LPZ (2 mi). The distances to the EAB, LPZ, and from the release boundary to the EAB are given in Table 2.7-119.

Within the ground release category, two sets of meteorological conditions are treated differently. During neutral (D) or stable (E, F, or G) atmospheric stability conditions when the wind speed at the 10-m level is less than 6 meters per second (m/s), horizontal plume meander is considered. The χ/Q values are determined through the selective use of the following set of equations for ground-level relative concentrations at the plume centerline:

$$\chi/Q = \frac{1}{\bar{U}_{10}(\Pi\sigma_y\sigma_z + A/2)} \qquad \text{Equation 1}$$

$$\chi/Q = \frac{1}{\bar{U}_{10}(3\Pi\sigma_y\sigma_z)} \qquad \text{Equation 2}$$

$$\chi/Q = \frac{1}{\bar{U}_{10}\Pi\Sigma_y\sigma_z} \qquad \text{Equation 3}$$

where:

χ/Q is relative concentration, in s/m^3,

U_{10} is wind speed at 10 m above plant grade, in m/s

σ_y is lateral plume spread, in meters, a function of atmospheric stability and distance

σ_z is vertical plume spread, in meters, a function of atmospheric stability and distance

Σ_y is lateral plume spread with meander and building wake effects, in meters, a function of atmospheric stability, wind speed, and distance

A is the smallest vertical-plane cross-sectional area of the reactor building, in meters^2

PAVAN calculates χ/Q values using equations (1), (2), and (3). The values from equations (1) and (2) are compared, and the higher value is selected. This value is then compared with the value from equation (3), and the lower value of these two is selected as the appropriate χ/Q value.

During all other meteorological conditions, unstable (A, B, or C) atmospheric stability and 10-m level wind speeds of 6 m/s or more, plume meander is not considered. The higher value calculated from equation (1) or (2) is used as the appropriate χ/Q value.

From here, PAVAN constructs a cumulative probability distribution of χ/Q values for each of the 16 directional sectors. This distribution is the probability of the given χ/Q values being exceeded in that sector during the total time. The sector χ/Q values and the maximum sector χ/Q value are determined by effectively "plotting" the χ/Q versus probability of being exceeded and selecting the χ/Q value that is exceeded 0.5 percent of the total time. This same method is used to determine the five percent overall site χ/Q value.

As stated in Regulatory Guide 1.145, the χ/Q value for the EAB or LPZ boundary evaluations would be the maximum sector χ/Q or the 5 percent overall site χ/Q, whichever is greater.

Regulatory Guide 1.145 divides release configurations into two modes, ground release and stack release. A ground release includes all release points that are effectively lower than two and one-half times the height of the adjacent solid structures. This is conservative because the building wake effect would tend to reduce the calculated χ/Q. All release point would be considered as ground releases.

PAVAN requires the meteorological data in the form of joint frequency distributions of wind direction and wind speed by atmospheric stability class. The meteorological data used were obtained from the CPNPP site meteorological data collected from 2001-2004 and 2006.

The stability classes were based on the classification system given in U.S. Nuclear Regulatory Commission Regulatory Guide 1.23, Table 1 as follows:

Classification of Atmospheric Stability

Stability Classification	Pasquill Stability Category	Ambient Temperature change with height (°C/100m)
Extremely unstable	A	ΔT<-1.9
Moderately unstable	B	-1.9 < ΔT ≤ -1.7
Slightly unstable	C	-1.7 < ΔT ≤ -1.5
Neutral	D	-1.5 < ΔT ≤ -0.5
Slightly stable	E	-0.5 < ΔT ≤ 1.5
Moderately stable	F	1.5 < ΔT ≤ 4.0
Extremely stable	G	ΔT > 4.0

Joint frequency distribution tables were developed from the meteorological data with the assumption that if data required as input to the PAVAN program (i.e., lower level wind direction, lower level wind speed, and temperature differential) were missing from the hourly data record, all data for that hour were discarded. Also, the data in the joint frequency distribution tables were rounded for input into the PAVAN code.

Building area is defined as the smallest vertical-plane cross-sectional area of the reactor building, in square meters. Building height is the height above plant grade of the containment structure used in the building-wake term for the annual-average calculations. For conservatism, the containment area is used in the determination of building-wake effects. A conservative building cross-sectional area of 2500 m^2 and a building height of 69.9 m were used for building wake calculations.

The tower height is the height at which the wind speed was measured. Based on the lower measurement location, the tower height used was 10 m.

As stated in Regulatory Guide 1.145, a ground release includes all release points that are effectively lower than two and one-half times the height of adjacent solid structures. Therefore, as stated above, a ground-release was assumed.

The median (50 percent) frequency of χ/Q at the EAB and LPZ can be found in Table 2.7-121. Median atmospheric dispersion estimates are used in making realistic estimates of the environmental effects of potential radiological accidents.

2.7.3.3 Representativeness and Topographic Effects

The on-site data are considered to be conservatively representative of meteorological conditions at the site. Topographic effects at the site were discussed in Subsection 2.7.2.2.3. The results were indicative of a flat terrain with no appreciable effects on short-term diffusion estimates.

2.7.4 LONG-TERM ATMOSPHERIC DISPERSION ESTIMATES FOR ROUTINE RELEASES

2.7.4.1 Objective

The on-site meteorological record is used to provide realistic estimates of annual average atmospheric dilution factors to a distance of 50 mi from the plant for use in calculating the dispersion through air pathways of radionuclides released in routine plant operations.

For a routine release, the concentration of radioactive material in the surrounding region depends on the amount of effluent released, the height of the release, the momentum and buoyancy of the emitted plume, the wind speed, atmospheric stability, airflow patterns of the site, and various effluent removal mechanisms. Annual average relative concentration, χ/Q, and annual average relative deposition, D/Q, for gaseous effluent routine releases were calculated.

2.7.4.2 Calculations

The average annual dilution factors that are applicable to routine venting or other routine gaseous-effluent releases have been evaluated from the data record using the technique presented in Regulatory Guide 1.111.

As stated in NUREG/CR-2919, the XOQDOQ Computer Program that implements the assumptions outlined in Regulatory Guide 1.111 developed by the U.S. Regulatory Commission (NRC), was used to generate the annual average relative concentration, χ/Q, and annual average relative deposition, D/Q. Values of χ/Q and D/Q were determined at points of maximum potential concentration outside the site boundary, at points of maximum individual exposure, and at points within a radial grid of sixteen 22.5-degree sectors and extending to a distance of 50 mi. Radioactive decay and dry deposition were considered.

Meteorological data for the period from 2001-2004 and 2006 were used, and receptor locations were determined from the locations given in the current land-use census. An assumed release point located at the center of the containment was used to calculate χ/Q and D/Q values beyond the EAB. For χ/Q and D/Q values calculated at the EAB, the distance is measured from an assumed release boundary, with a 670-ft radius from the containment centerline, to the EAB. Hourly meteorological data were used in the development of joint frequency distributions, in hours, of wind direction and wind speed by atmospheric stability class. The wind speed categories used were consistent with the CPNPP short-term (accident) diffusion χ/Q calculation discussed above. Calms were distributed as the first wind-speed class.

Joint frequency distribution tables were developed from the hourly meteorological data with the assumption that if data required as input to the XOQDOQ program (i.e., lower level wind direction and wind speed, and temperature differential as opposed to upper level wind direction and wind speed) were missing from the hourly data record, all data for that hour would be discarded. This assumption maximizes the data being included in the calculation of the χ/Q and D/Q values because hourly data are not discarded if only upper data are missing.

The analysis assumed a combined vent located at the center of the proposed facility location. At ground level locations beyond several miles from the plant, the annual average concentration of effluents are essentially independent of release mode; however, for ground level concentrations within a few miles, the release mode is very important. Gaseous effluents released from tall stacks generally produce peak ground-level air concentrations near or beyond the site boundary. Near ground level releases usually produce concentrations that decrease from the release point to all locations downwind. Guidance for selection of the release mode is provided in Regulatory Guide 1.111. In general, in order for an elevated release to be assumed, either the release height must be at least twice the height of adjacent buildings, or detailed information must be known about the wind speed at the height of the release. For this analysis, the proposed CPNPP Units 3 and 4 facility's routine releases were conservatively modeled as ground level releases.

Building cross-sectional area and building height are used in calculation of building wake effects. Regulatory Guide 1.111 identifies the tallest adjacent building, in many cases the reactor building, as appropriate for use. A conservative building area of 2500 m^2 and a building height of 69.9 m were used in the calculation of building wake effects.

Consistent with Regulatory Guide 1.111 guidance regarding radiological impact evaluations, radioactive decay and deposition were considered. For conservative estimates of radioactive decay, an overall half-life of 2.26 days is acceptable for short-lived noble gases and a half-life of 8 days for all iodines released to the atmosphere. At sites where there is not a well-defined rainy season associated with a local grazing season, wet deposition does not have a significant impact. The dry deposition rate of noble gases is so slow that the depletion is negligible within 50 mi. In this analysis, only the effects of dry deposition of iodines were considered. The calculation results, with and without the consideration of dry deposition, are identified in the output as "depleted" and "undepleted," respectively.

Terrain recirculation factor was not considered, because the meteorological data do not show any conclusive or systematic up and down or cross valley flow.

Off-site receptor locations for the CPNPP site were also evaluated (Table 2.7-120). The χ/Q and D/Q at points of potential maximum concentration outside the site boundary, at points of maximum individual exposure, and at points within a radial grid of 16, 22.5-degree sectors (centered on true north, north-northeast, northeast, etc.) and extending to a distance of 80 km (50 mi) from the station were determined. A set of data points were located within each sector at increments of 0.4 km (0.25 mi) to a distance of 1.6 km (1 mi) from the plant, at increments of 0.8 km (0.5 mi) from a distance of 1.6 km (1 mi) to 8 km (5 mi), at increments of 4 km (2.5 mi) from a distance of 8 km (5 mi) to 16 km (10 mi), and at increments of 8 km (5 mi) thereafter to a distance of 80 km (50 mi). Estimates of χ/Q (undecayed and undepleted; depleted for radioiodines) and D/Q radioiodines and particulates is provided at each of these grid points.

The results of the analysis, based on five years of on-site data, are presented in Table 2.7-122, Table 2.7-123, Table 2.7-124, Table 2.7-125, Table 2.7-126, Table 2.7-127, and Table 2.7-128.

Annual average undecayed and undepleted dilution factors to a distance of 50 mi from the plant are shown in Table 2.7-122. The maximum value at the actual EAB is 5.5 x 10^{-6} s/m^3 and occurs north-northwest of the plant at a distance of 0.37 mi. There are no higher values beyond the site boundary because for ground level releases, concentrations monontonically decrease from the release point to all locations downwind. Annual average undecayed and undepleted dilution and deposition factors for special off-site receptor locations are given in Table 2.7-124.

2.7.4.3 Evaporation Pond

An additional CPNPP Units 3 and 4 gaseous release source is the evaporation pond (EP). The purpose of the EP is to prevent tritium concentration in the Squaw Creek Reservoir (SCR) from exceeding the limit described in the existing CPNPP Offsite Dose Calculation Manual (ODCM), Revision 26, due to tritium discharge from Units 3 & 4. The EP decrease the level of tritium discharge into the SCR by accepting liquid wastes, including tritium, from the liquid waste management system (LWMS) and evaporating the liquid wastes by natural processes. The atmospheric transport and dispersion of radioactive materials, in the form of aerosols, vapors, or gases, released from the EP are discussed below.

The χ/Q and D/Q values for the evaporation pond are determined at points of potential maximum concentration, outside the site boundary, at points of maximum individual exposure and at points within a radial grid of sixteen 22.5° sectors extending to a distance of 50 miles. Radioactive decay and dry deposition are considered. The atmospheric dispersion calculation uses meteorological data collected at CPNPP for the five-year period beginning January 1, 2001 and ending December 31, 2006, excluding January 1 through December 31 of 2005.

The evaporation pond is located approximately 0.4 mi southwest of CPNPP Units 3 and 4 power blocks. Given the distance from the power block, the effects of building wake are conservatively neglected in the atmospheric dispersion analysis. Consistent with the guidance of Regulatory Guide 1.111, a ground level release mode is used. The release elevation of the EP is 0.0 m relative to the plant grade. The evaporation pond has a surface area of approximately one acre. Although the evaporation pond is a diffuse area source, in the atmospheric dispersion evaluation, it is assumed to be a point source. This assumption is conservative since for a given release rate, a ground level point source has a higher concentration than a ground level diffuse area source at the release location and locations downwind. Near ground level releases usually produce concentrations that decrease from the release point to all locations downwind. Therefore, for distant receptors, the assumption of a point source results in conservatively high relative concentrations.

Distances from the center of the evaporation pond to the closest point on the EAB in each of the 16 compass directions are given in Table 2.7-129. The nearest receptor locations include residences or locations at which plants or animals that become food for the public may be exposed to either direct radiation or contamination. No milk or meat animals (cows or goats) were identified near the CPNPP based on the land use census presented in the CPNPP Annual Radiological Environmental Operating Report for 2006 (AREOR). For each of the 16 compass directions, the shortest distance from the center point of the evaporation pond to a receptor within a 45° angle centered on the compass direction was used. Because of this conservative methodology, the nearest garden is captured in both the ENE and E sectors instead of just the ENE sector (the direction relative to Units 1 & 2 given in the ODCM). The distances from the center point of the evaporation pond to the nearest receptor in each sector are given in Table 2.7-130. The XOQDOQ software (NUREG/CR-2919) was used to determine the EP atmospheric dispersion values.

From Table 2.7-248, the highest χ/Q and D/Q values for the EAB occur in the south sector and are 5.2x10^{-5} s/m3 and 2.7x10^{-7} m^{-2}, respectively. The maximum χ/Q value is not bounded by the EAB (annual average) value of 1.6x10^{-5} s/m3 given in Table 2.0-1 of the US-APWR Design Control Document (DCD). Table 2.0-1 also gives an EAB (annual average) D/Q value of 4.0x10^{-8} m^{-2}. The maximum site D/Q value is also not bounded by the DCD value. Table 2.7-131 gives the annual average χ/Q and D/Q values for no decay, undepleted, as well as 2.26 day decay, undepleted and 8.00 day decay, depleted.

There are no meat animals identified in the area surrounding the CPNPP site. Therefore, it is assumed that the χ/Q and D/Q values at any location of meat animals within five miles of the plant would be bounded by values determined at other receptors, and no specific χ/Q or D/Q values are provided.

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TABLE 2.7-1 (Sheet 1 of 2)
TEXAS WEATHER RECORDS

Temperature (F)			
Coldest	-23	Tulia (40 mi S of Amarillo)	Feb. 12, 1899
		Seminole (65 mi SW of Lubbock)	Feb. 8, 1933
Hottest	120	Seymour (180 mi NW of Dallas)	Aug. 12, 1936
		Monahans (45 mi SW of Midland)	June 28, 1994
Warmest year statewide	68.6		1921
Coldest year statewide	63.2		1976
Highest monthly average	102.4	Presidio (210 mi SE of El Paso)	June 1962
Lowest monthly average	19.4	Dalhart (60 mi NW of Amarillo)	January 1959
Highest annual average	74.1	McAllen (60 mi NW of Brownsville)	1988
Lowest annual average	56.1	Dalhart (60 mi NW of Amarillo)	1959
Rainfall (in)			
Greatest in a 24-hr period	29.05	Albany (105 mi W of Ft. Worth)	Aug. 4, 1978
Greatest in 1 month	35.70	Alvin (20 mi SE of Houston)	July 1979
Greatest in 1 year	109.38	Clarksville (105 mi NE of Dallas)	1873
Least in 1 year	1.64	Presidio (210 SE of El Paso)	1956
Snowfall (in)			
Greatest in a 24-hour period	24.0	Plainview (45 mi N of Lubbock)	Feb.3-5, 1956
Greatest maximum depth	33.0	Hale Center (35 mi N of Lubbock)	Feb. 4, 1956
		Vega (25 mi w of Amarillo)	Feb. 4, 1956

TABLE 2.7-1 (Sheet 2 of 2)
TEXAS WEATHER RECORDS

Greatest in a single storm	61.0	Vega	Feb. 1-8, 1956
Greatest in 1 month	61.0	Vega	Feb. 1956
Greatest in 1 season	65.0	Romero	1923-24
Wind (mph)			
Highest sustained speed	SE 145	Matagorda (70 mi SW of Houston) Hurricane Carla	Sept. 11, 1961
	NE 145	Port Lavaca (70 mi NE of Corpus Christi) Hurricane Carla	Sept. 11, 1961
Highest peak gust	SW 180	Aransas Pass (20 m E of Corpus Christi) Hurricane Celia	Aug. 3, 1970
Hazardous Weather			
Longest and worst drought			1950 - 1956
Worst heat wave			1980
Most damage from 1 tornado	442M	Wichita Falls (120 mi NW of Dallas)	April 10, 1979
Most tornadoes in 1 year	232		1967
Most tornadoes in 1 month	124		Sept. 1967
Most damage from 1 hailstorm	1.2B **U.S. record	Parker, Tarrant counties	May 5, 1995
Deadliest hurricane	6,000 - 8,000	Galveston	Sept. 8, 1900
Most damaging hurricane	3.0 Billion	Hurricane Alicia	Aug. 18, 1983

(TWR 2008)

TABLE 2.7-2 (Sheet 1 of 4)
DALLAS-FORT WORTH, TX (DFW) NORMALS, MEANS, AND EXTREMES

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
Temperature °F	NORMAL DAILY MAXIMUM	54.1	60.1	68.3	75.9	83.2	91.1	95.4	94.8	87.7	77.9	65.1	56.5	75.8
	MEAN DAILY MAXIMUM	54.9	59.9	67.5	76.2	83.3	91.5	95.9	95.8	88.4	78.6	66.3	57.9	76.3
	HIGHEST DAILY MAXIMUM	88	95	96	95	103	113	110	109	111	102	89	88	113
	YR OF OCCURRENCE	1969	1996	1991	1990	1985	1980	1998	2003	2000	1979	1989	1955	Jun-80
	MEAN OF EXTREME MAXS.	76.1	79.8	85	89.1	94.2	98.6	102.7	103.3	98.6	92.4	83	77.1	90
	NORMAL DAILY MINIMUM	34	38.7	46.4	54	63	70.7	74.6	74	67.2	56.4	45.1	36.8	55.1
	MEAN DAILY MINIMUM	33.9	38.3	45.3	54.6	63.1	70.9	74.7	74.2	67	56.2	44.9	37	55
	LOWEST DAILY MINIMUM	4	7	15	29	41	51	59	56	43	29	20	-1	-1
	YR OF OCCURRENCE	1964	1985	2002	1989	1978	1964	1972	1967	1984	1993	1959	1989	Dec-89
	MEAN OF EXTREME MINS.	16.2	21.6	27.6	37.7	49.8	60.5	67.8	66	52.6	40.5	28.7	20.7	40.8
	NORMAL DRY BULB	44.1	49.4	57.4	65	73.1	80.9	85	84.4	77.5	67.2	55.1	46.7	65.5
	MEAN DRY BULB	44.5	49.1	56.3	65.4	73.1	81.2	85.3	85.1	77.6	67.3	55.5	47.3	65.6
	MEAN WET BULB	40.5	44.7	50.4	58	66.7	72.3	73.9	73.2	68	59.7	50.2	42.5	58.3
	MEAN DEW POINT	34.3	37.9	43.9	51.9	62.4	68.2	68.7	67.5	62.5	54.1	44.5	36.5	52.7
	NORMAL NUMBER OF DAYS WITH:													
	MAXIMUM ≥ 90°	0	0.1	0.2	0.8	5.6	20.2	28.2	27.1	15.7	3	0	0	100.9
	MAXIMUM ≤ 32°	1.5	0.9	0.1	0	0	0	0	0	0	0	0	1.1	3.6
	MINIMUM ≤ 32°	13.5	6.9	2	0.2	0	0	0	0	0	0.1	2.9	10	35.6
	MINIMUM ≤ 0°	0	0	0	0	0	0	0	0	0	0	0	*	0
H/C	NORMAL HEATING DEG. DAYS	650	448	248	74	13	0	0	0	2	52	312	571	2370
	NORMAL COOLING DEG. DAYS	3	7	10	72	265	478	621	601	376	118	15	2	2568

TABLE 2.7-2 (Sheet 2 of 4)
DALLAS-FORT WORTH, TX (DFW) NORMALS, MEANS, AND EXTREMES

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
RH	NORMAL (PERCENT)	68	66	64	64	70	67	60	59	64	66	69	70	66
	HOUR 00 LST	74	71	69	71	78	74	67	66	71	73	74	73	72
	HOUR 06 LST	80	80	79	81	87	86	81	80	83	83	82	80	82
	HOUR 12 LST	61	58	56	55	59	55	49	49	54	55	58	60	56
	HOUR 18 LST	59	55	51	51	57	52	45	45	51	54	60	60	53
S	PERCENT POSSIBLE SUNSHINE	52	54	58	61	57	67	75	73	67	63	57	52	61
W/0	MEAN NO. DAYS WITH:													
	HEAVY FOG(VISBY ≤ 1/4 MI)	2.4	1.5	1.0	0.6	0.3	0.1	0.0	0.0	0.1	0.8	1.5	2.4	10.7
	THUNDERSTORMS	1.5	1.9	4.4	6.0	7.7	6.2	4.6	4.5	3.4	3.0	2.1	1.3	46.6
CLOUDINESS	MEAN:													
	SUNRISE-SUNSET (OKTAS)			4.0		4.0	3.2						4.8	
	MIDNIGHT-MIDNIGHT (OKTAS)			4.0										
	MEAN NUMBER OF DAYS WITH:													
	CLEAR	2.0	6.0	15.0		10.0	11.0							
	PARTLY CLOUDY		2.0			4.0	8.0							
	CLOUDY	2.0		7.0		6.0	2.0							
PR	MEAN STATION PRESSURE(IN)	29.49	29.49	29.40	29.30	29.30	29.30	29.40	29.40	29.39	29.40	29.40	29.50	29.40
	MEAN SEA-LEVEL PRES. (IN)	30.14	30.09	30.01	29.93	29.90	29.91	29.96	29.96	29.98	30.04	30.08	30.13	30.01

TABLE 2.7-2 (Sheet 3 of 4)
DALLAS-FORT WORTH, TX (DFW) NORMALS, MEANS, AND EXTREMES

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
WINDS	MEAN SPEED (MPH)	11.0	11.7	12.6	12.4	11.1	10.6	10.0	9.1	9.4	9.9	11.0	11.1	10.8
	PREVAIL.DIR (TENS OF DEGS)	18	18	18	18	18	18	18	18	16	16	18	18	18
	MAXIMUM 2-MINUTE:													
	SPEED (MPH)	41	51	48	47	43	51	41	47	33	46	40	39	51
	DIR. (TENS OF DEGS)	29	23	30	30	34	32	06	33	24	23	28	31	32
	YR OF OCCURRENCE	1996	2000	2000	2000	1998	2002	2002	1996	1996	2001	2001	2003	JUN 2002
	MAXIMUM 5-SECOND:													
	SPEED (MPH)	51	78	74	64	55	57	53	47	39	54	47	47	78
	DIR. (TENS OF DEGS)	19	23	27	26	28	34	06	34	19	23	30	28	23
	YR OF OCCURRENCE	1996	2000	2000	2000	2000	1996	2002	2002	2001	2001	1998	2003	FEB 2000
PRECIPITATION	NORMAL (IN)	1.90	2.37	3.06	3.20	5.15	3.23	2.12	2.03	2.42	4.11	2.57	2.57	34.73
	MAXIMUM MONTHLY (IN)	5.07	7.40	7.39	12.19	13.66	8.75	11.13	6.85	9.52	14.18	6.95	8.75	14.18
	YR OF OCCURRENCE	1998	1997	2002	1957	1982	1989	1973	1970	1964	1981	2000	1991	OCT 1981
	MINIMUM MONTHLY (IN)	T	0.15	0.10	0.11	0.95	0.40	0.00	0.00	0.09	T	0.20	0.17	0.00
	YR OF OCCURRENCE	1986	1963	1972	1987	1996	1964	1993	2000	1984	1975	1970	1981	AUG 2000
	MAXIMUM IN 24 HR (IN)	3.46	4.06	4.39	4.55	5.34	3.15	3.83	4.05	4.76	5.91	2.83	4.22	5.91
	YR OF OCCURRENCE	2002	1965	1977	1957	1989	1989	2001	1976	1965	1959	1964	1991	OCT 1959
	NORMAL NUMBER OF DAYS WITH:													
	PRECIPITATION $\geq$ 0.01	7.2	6.3	7.8	7.1	9.3	7.2	4.3	4.5	5.9	6.7	6.4	6.5	79.2
	PRECIPITATION $\geq$ 1.00	0.3	0.7	0.8	1.1	1.8	0.8	0.6	0.6	0.8	1.4	0.7	0.6	10.2

TABLE 2.7-2 (Sheet 4 of 4)
DALLAS-FORT WORTH, TX (DFW) NORMALS, MEANS, AND EXTREMES

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
SNOWFALL	NORMAL (IN)	0.8	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.2	0.2	2.5
	MAXIMUM MONTHLY (IN)	12.1	13.5	2.5	T	T	0.0	0.0	0.0	0.0	T	5.0	2.6	13.5
	YR OF OCCURRENCE	1964	1978	1962	1995	1995					1993	1976	1963	FEB 1978
	MAXIMUM IN 24 HR (IN)	12.1	7.5	2.5	T	T	0.0	0.0	0.0	0.0	T	4.8	2.5	12.1
	YR OF OCCURRENCE	1964	1978	1962	1995	1995					1993	1976	1963	JAN 1964
	MAXIMUM SNOW DEPTH (IN)	6	8	2	0	0	0	0	0	0	0	3	2	8
	YR OF OCCURRENCE	1964	1978	1971								1976	1983	FEB 1978
	NORMAL NO. DAYS WITH:													
	SNOWFALL $\geq$ 1.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.0

(SRCC 2008)

NOTE:

1. Dallas-Fort Worth, Texas (WBAN Station No. 3927), Monthly Climate Summary, Period of record: 1971 to 2000.

TABLE 2.7-3 (Sheet 1 of 4)
DALLAS LOVE FIELD, TX
NORMALS, MEANS, AND EXTREMES

	Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (°F)	Mean Daily Max[(a)]	55.4	61	69.1	76.5	83.8	91.6	96.1	95.8	88.5	78.6	66	57.4	76.7
	Mean Daily Min[(a)]	36.4	41	48.5	56.1	64.9	72.7	76.8	76.4	69.2	58.2	46.8	38.6	57.1
	Daily Mean	45.9	51	58.8	66.3	74.4	82.2	86.5	86.1	78.9	68.4	56.4	48	66.9
	Highest Daily Extreme[(b)]	95	95+	98	99	103+	112+	111	115	110	100+	92	89	115
	Year	1911	1996	1911	1963	1985	1980	1954	1909	2000	1979	1910	1955	9-Aug
	Day	31	22	10	10	31	27	25	18	4	1	24	24	18
	Highest Monthly Mean[(a)]	53.6	59.7	64.5	71.1	80.8	87.2	92.1	90.5	84.8	71.9	62.6	54.7	92.1
	Year	1990	1976	1974	1981	1996	1998	1998	2000	1998	1998	1999	1984	Jul-98
	Lowest Daily Extreme[(b)]	2	2+	12	29+	36+	48	57	55+	40+	26	15+	1	1
	Year	1949	1910	1948	1914	1908	1903	1905	1906	1908	1910	1911	1989	Dec-89
	Day	31	19	11	10	1	1	10	29	29	30	30	23	23
	Lowest Monthly Mean[(a)]	35.1	38.3	54.9	60.9	69.1	78.8	82.4	81	69.1	61.2	50	35.8	35.1
	Year	1978	1978	1996	1983	1976	1989	1976	1992	1974	1976	1976	1983	Jan-78
	Mean Number of Days with[(c)]													
	Max > = 100	0	0	0	0	0.1	1.6	8.3	8.6	1.7	@	0	0	20.3
	Max > = 90	0	0.1	0.3	1.1	6.9	20.5	27.8	26.9	15.9	3.3	0	0	102.8
	Max > = 50	20.5	22.1	29.4	30	31	30	31	31	30	30.9	27.7	23.4	337
	Max < = 32	1.4	0.8	0.1	0	0	0	0	0	0	0	0	0.9	3.2
	Min < = 32	11.6	6.3	1.8	@	0	0	0	0	0	0.1	2.2	8.2	30.2
	Min <= 0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2.7-3 (Sheet 2 of 4)
DALLAS LOVE FIELD, TX
NORMALS, MEANS, AND EXTREMES

		Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Precipitation (in)	Precipitation Totals	Mean[a]	1.89	2.31	3.13	3.46	5.30	3.92	2.43	2.17	2.65	4.65	2.61	2.53	37.05
		Median[a]	1.93	2.09	2.65	3.40	5.91	2.97	2.06	1.79	2.30	3.43	2.14	2.02	36.98
		Highest Daily Extreme[b]	5.14	3.35	6.02	5.10	5.14	3.64	4.62	4.42	4.32	6.01	3.40	3.98	6.02
		Year	1949	1997	1977	1957	1949	1989	1962	1915	1965	1959	1902	1991	Mar-77
		Day	24	12	27	26	17	13	27	18	21	1	4	20	27
		Highest Monthly[a]	5.49	7.91	9.09	8.05	10.56	10.87	6.14	5.98	7.16	16.05	7.01	9.25	16.05
		Year	1998	1997	1977	1997	1989	1989	1988	1974	1974	1981	2000	1991	Oct-81
		Lowest Monthly Extreme[a]	.00+	0.17	0.26	0.04	0.54	1.26	.00+	.00+	0.03	.00	0.17	0.05	.00+
		Year	1988	1996	1972	1983	1977	1983	2000	2000	2000	1975	1979	1981	Aug-00
	Mean Number of Days with Daily Precipitation[c]														
		>= 0.01	7.2	6.1	7.4	7.2	9.3	7.2	4.7	4.6	5.8	7.1	6.6	6.4	79.6
		>= 0.10	3.7	3.8	4.7	4.7	6.3	4.8	3.4	3.1	3.9	5.0	4.2	3.9	51.5
		>= 0.50	1.1	1.5	2.2	2.5	3.6	2.8	1.5	1.6	1.8	2.8	2.0	1.9	25.3
		>= 1.00	0.3	0.8	0.9	1.1	2.0	1.5	0.7	0.6	0.8	1.6	0.7	0.8	11.8

TABLE 2.7-3 (Sheet 3 of 4)
DALLAS LOVE FIELD, TX
NORMALS, MEANS, AND EXTREMES

		Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Snow Totals (inches)	Means/Medians(d)	Snow Fall Mean	0.7	0.6	.0	.0	.0	.0	.0	.0	.0	.0	0.2	0.2	1.7
		Snow Fall Median	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	#	#
		Snow Depth Mean	#	#	#	0	#	0	0	0	0	0	#	#	N/A
		Snow Dept Median	0	0	0	0	0	0	0	0	0	0	0	0	N/A
	Extremes(b)	Highest Daily Snow Fall	4.5	6.0	0.8	.0	.0	.0	.0	.0	.0	.0	3.1	4.0	6.0
		Year	1977	1978	1971	0	0	0	0	0	0	0	1976	1983	Feb-78
		Day	30	17	2	0	0	0	0	0	0	0	13	16	17
		Highest Monthly Snow Fall	5.5	10.1	0.8	.0	.0	.0	.0	.0	.0	.0	3.1	4.0	10.1
		Year	1977	1978	1971	0	0	0	0	0	0	0	1976	1983	Feb-78
		Highest Daily Snow Depth	4	4	1+	0	0	0	0	0	0	0	3	2	4+
		Year	1977	1978	1989	0	0	0	0	0	0	0	1976	1983	Feb-78
		Day	31	18	6	0	0	0	0	0	0	0	14	16	18
		Highest Monthly Mean Snow Depth	#	1	#	0	#	0	0	0	0	0	#	#	1
		Year	1988	1978	1989	0	1997	0	0	0	0	0	1993	1983	Feb-78

TABLE 2.7-3 (Sheet 4 of 4)
DALLAS LOVE FIELD, TX
NORMALS, MEANS, AND EXTREMES

		Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Number of Days(d)	Snow Fall >= Thresholds	0.1	0.6	0.5	0.1	.0	.0	.0	.0	.0	.0	.0	0.1	0.1	1.4
		1.0	0.4	0.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.7
		3.0	0.1	@	.0	.0	.0	.0	.0	.0	.0	.0	@	@	0.1
		5.0	.0	@	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	@
		10.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	Snow Depth >= Thresholds	1	0.5	0.5	0.1	.0	.0	.0	.0	.0	.0	.0	0.2	@	1.3
		3	0.2	0.2	.0	.0	.0	.0	.0	.0	.0	.0	@	.0	0.4
		5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

a) From the 1971 – 2000 Monthly Normals

b) Derived from station's available digital record: 1897 – 2001

c) Derived from 1971 – 2000 serially complete daily data

d) Derived from Snow Climatology and 1971 – 2000 daily data

+ Also occurred on an earlier date(s)
@ Denotes mean number of days greater than 0 but less than .05
#Denotes trace amounts
** Statistics not computed because less than six years out of thirty had measurable precipitation

Notes:

1. (NCDC 2008) Station: DALLAS LOVE AP, TX, COOP ID: 412244

TABLE 2.7-4 (Sheet 1 of 4)
MINERAL WELLS, TX
NORMALS, MEANS, AND EXTREMES

	Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (°F)	Mean Daily Max[a]	58.2	63.7	72.5	79.6	86.1	92.8	97.3	96.6	89.7	80.5	67.8	59.6	78.7
	Mean Daily Min[a]	33.4	38.0	46.1	53.1	62.0	68.7	72.2	71.7	65.3	55.3	44.3	35.6	53.8
	Daily Mean	45.8	50.9	59.3	66.4	74.1	80.8	84.8	84.2	77.5	67.9	56.1	47.6	66.3
	Highest Daily Extreme[b]	91	97	96+	100+	106+	114+	112	110	111	104	93	90	114+
	Year	1969	1996	1995	1972	2000	1980	1954	1964	2000	1951	1980	1955	Jun-80
	Day	8	21	22	12	24	28	25	6	4	3	9	24	28
	Highest Monthly Mean[a]	53.2	60.1	64.7	71.5	80.7	85.7	89.7	89.8	84.1	71.1	63.6	53.0	89.8
	Year	1990	2000	2000	1981	1996	1980	1998	1999	1998	1979	1999	1984	Aug-99
	Lowest Daily Extreme[b]	4+	3	12	28	39	51	58	47	40+	23	12	-8	-8
	Year	1966	1951	1980	2000	1954	1983	1971	1967	1989	1993	1950	1989	Dec-89
	Day	23	2	2	4	3	1	31	12	25	31	11	23	23
	Lowest Monthly Mean[a]	35.7	38.4	54.4	59.3	68.4	75.1	80.0	80.0	69.1	59.3	48.5	35.9	35.7
	Year	1978	1978	1983	1983	1983	1983	1976	1971	1974	1976	1976	1983	Jan-78
	Mean Number of Days with[c]													
	Max > = 100	.0	.0	.0	@	0.3	2.4	9.0	9.9	2.0	0.1	.0	.0	23.7
	Max > = 90	.0	0.2	0.6	2.3	8.4	20.9	28.3	27.4	17.7	3.7	0.1	.0	109.6
	Max > = 50	22.0	23.0	29.7	30.0	31.0	30.0	31.0	31.0	30.0	30.8	28.0	24.4	340.9
	Max < = 32	1.2	0.6	@	.0	.0	.0	.0	.0	.0	.0	.0	0.9	2.7
	Min < = 32	15.6	9.0	3.5	0.5	.0	.0	.0	.0	.0	0.2	4.6	13.1	46.5
	Min <= 0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.1	0.1

TABLE 2.7-4 (Sheet 2 of 4)
MINERAL WELLS, TX
NORMALS, MEANS, AND EXTREMES

		Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Precipitation (in)	Precipitation Totals	Mean[a]	1.42	1.99	2.69	2.75	4.59	3.25	2.25	2.34	2.80	3.81	2.16	1.74	31.79
		Median[a]	1.29	1.53	2.35	2.51	3.97	2.08	1.95	2.33	2.49	3.04	1.60	1.47	30.72
		Highest Daily Extreme[b]	2.46	2.48	4.18	5.15	4.09+	5.23	6.24	3.42	3.48	6.65	2.84+	3.25	6.65
		Year	1968	1997	1977	1978	1983	2000	1962	1991	1993	1981	1996	1991	Oct-81
		Day	18	20	27	10	23	4	27	12	14	12	24	20	12
		Highest Monthly[a]	3.88	8.53	7.87	12.30	12.68	10.30	8.07	6.95	8.57	20.00	5.92	8.50	20.00
		Year	1973	1997	1977	1990	1982	2000	1973	1996	1980	1981	1994	1991	Oct-81
		Lowest Monthly Extreme[a]	.03	0.25	0.43	0.23	1.03	0.10	.01	0.00	0.03	0.16	.00	0.04	.00+
		Year	1976	1996	1971	1983	1988	1980	1993	2000	1983	1975	1999	1973	Aug-00
	Mean Number of Days with Daily Precipitation[c]														
		>= 0.01	6.8	6.4	7.5	7.0	8.7	6.9	5.3	5.7	5.1	7.3	6.4	7.2	80.3
		>= 0.10	3.2	3.7	4.4	4.1	6.2	4.6	2.9	3.5	3.2	4.5	3.7	3.6	47.6
		>= 0.50	0.8	1.3	1.6	1.4	3.3	2.2	1.3	1.3	1.4	2.4	1.4	1.2	19.6
		>= 1.00	0.2	0.3	0.6	0.8	1.4	1.1	0.7	0.5	0.8	1.1	0.5	0.4	8.4

TABLE 2.7-4 (Sheet 3 of 4)
MINERAL WELLS, TX
NORMALS, MEANS, AND EXTREMES

		Element		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Snow Totals (inches)	Means/Medians(d)	Snow Fall Mean		0.6	0.8	.1	#	.0	.0	.0	.0	.0	#	0.1	0.2	1.8
		Snow Fall Median		.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	#	#
		Snow Depth Mean		#	#	#	0	#	0	0	0	0	0	#	#	N/A
		Snow Dept Median		0	0	0	0	0	0	0	0	0	0	0	0	N/A
	Extremes(b)	Highest Daily Snow Fall		4.0	4.0	2.0	#	.0	.0	.0	.0	.0	#	1.6	4.0	4.0+
			Year	1977	1978	1971	1996	0	0	0	0	0	1993	1995	1975	Feb-78
			Day	30	15	2	12	0	0	0	0	0	30	28	25	15
		Highest Monthly Snow Fall		5.0	8.5	2.0	#+	.0	.0	.0	.0	.0	#	1.6	4.0	8.5
			Year	1977	1978	1971	1996	0	0	0	0	0	1993	1995	1975	Feb-78
		Highest Daily Snow Depth		2+	3+	2	0	0	0	0	0	0	#	1+	1+	3+
			Year	1997	1980	1971	0	0	0	0	0	0	1991	1996	1982	Feb-80
			Day	8	10	3	0	0	0	0	0	0	26	25	31	10
		Highest Monthly Mean Snow Depth		#	#	#	0	#	0	0	0	0	0	#	#	#+
			Year	1997	1996	1971	0	2000	0	0	0	0	0	1996	1982	May-00

TABLE 2.7-4 (Sheet 4 of 4)
MINERAL WELLS, TX
NORMALS, MEANS, AND EXTREMES

Element			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Number of Days(d)	Snow Fall >= Thresholds	0.1	0.5	0.5	0.0	.0	.0	.0	.0	.0	.0	.0	0.2	0.1	1.3
		1.0	0.4	0.3	0.0	.0	.0	.0	.0	.0	.0	.0	0.0	0.1	0.8
		3.0	@	0.1	0	.0	.0	.0	.0	.0	.0	.0	0	0.1	0.2
		5.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		10.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	Snow Depth >= Thresholds	1	0.3	0.4	@	.0	.0	.0	.0	.0	.0	.0	0.1	0.1	0.9
		3	.0	0.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.1
		5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

a) From the 1971 – 2000 Monthly Normals

b) Derived from station's available digital record: 1897 - 2001

c) Derived from 1971 – 2000 serially complete daily data

d) Derived from Snow Climatology and 1971 – 2000 daily data

+ Also occurred on an earlier date(s)
@ Denotes mean number of days greater than 0 but less than .05
#Denotes trace amounts
** Statistics not computed because less than six years out of thirty had measurable precipitation

Notes:

1. (NCDC 2008) Station: MINERAL WELLS AP, TX, COOP ID: 415958

TABLE 2.7-5 (Sheet 1 of 4)
GLEN ROSE, TX
NORMALS, MEANS, AND EXTREMES

	Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (°F)	Mean Daily Max[a]	58.2	64.0	72.3	79.6	86.0	92.5	97.3	97.0	89.5	80.5	68.5	59.9	78.8
	Mean Daily Min[a]	28.9	33.7	41.9	49.7	58.7	66.6	69.5	67.7	61.7	50.9	39.9	31.1	50.0
	Daily Mean	43.6	48.9	57.1	64.7	72.4	79.6	83.4	82.4	75.6	65.7	54.2	45.5	64.4
	Highest Daily Extreme[b]	89	96+	101	100	105	110+	110+	115	110	99+	95	86	115
	Year	1969	1996	1974	1990	1967	1994	1978	1984	1985	1983	1980	1973	Aug-84
	Day	8	22	31	29	11	26	15	19	1	4	8	12	19
	Highest Monthly Mean[a]	48.5	57.8	64.2	70.5	78.1	84.6	89.6	88.0	83.2	69.2	61.5	53.1	89.6
	Year	1990	1976	1974	1972	1996	1980	1978	1999	1977	1979	1973	1984	Jul-78
	Lowest Daily Extreme[b]	-1+	-8	7	16	29	47	45	41	30	9	5	-15	-15
	Year	1982	1996	1996	1994	1999	1993	1994	1992	1989	1993	1993	1989	Dec-89
	Day	14	4	9	7	7	1	28	28	25	31	27	23	23
	Lowest Monthly Mean[a]	35.6	39.0	51.3	59.2	66.5	76.2	79.4	75.6	70.0	59.0	46.1	35.2	35.2
	Year	1978	1978	1996	1993	1999	1983	1976	1992	1989	1993	1993	1983	Dec-83
	Mean Number of Days with[c]													
	Max > = 100	.0	.0	@	@	0.4	2.5	10.9	12.6	2.4	.0	.0	.0	28.8
	Max > = 90	.0	0.2	0.6	2.7	10.1	22.3	29.1	28.1	18.7	5.3	0.2	.0	117.3
	Max > = 50	23.2	23.7	30.1	30.0	31.0	30.0	31.0	31.0	30.0	30.9	28.0	25.1	344.0
	Max < = 32	0.7	0.6	@	.0	.0	.0	.0	.0	.0	.0	.0	0.6	1.9
	Min < = 32	21.1	13.3	6.9	2.2	0.2	.0	.0	.0	0.2	1.6	9.2	17.7	72.4
	Min <= 0	0.1	0.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.1	0.3

TABLE 2.7-5 (Sheet 2 of 4)
GLEN ROSE, TX
NORMALS, MEANS, AND EXTREMES

		Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Precipitation (in)	Precipitation Totals	Mean[a]	1.64	2.28	2.80	2.91	5.20	4.02	2.19	2.18	3.15	3.83	2.24	2.38	34.82
		Median[a]	1.51	1.70	2.28	2.80	4.95	3.68	1.52	1.51	2.54	3.35	1.88	1.99	33.45
		Highest Daily Extreme[b]	1.91	2.56	6.25	3.83	5.92	4.27	8.48	3.29	6.90	4.84	2.87	7.14	8.48
		Year	1979	1998	1989	1964	1989	1988	1995	1990	1986	1991	1998	1991	Jul-95
		Day	19	26	28	21	17	1	31	4	2	27	13	20	31
		Highest Monthly[a]	3.82	9.13	7.48	8.07	11.40	10.24	9.73	9.55	12.04	10.60	5.74	11.41	12.04
		Year	1973	1997	1989	1973	1989	1989	1995	1996	1986	1991	1998	1991	Sep-86
		Lowest Monthly Extreme[a]	.00	0.03	0.03	0.33	0.97	0.42	.00	0.12	0.05	0.28	.40	0.25	.00+
		Year	1986	1999	1971	1987	1996	1978	1993	1973	1982	1992	1979	1973	Jul-93
	Mean Number of Days with Daily Precipitation[c]														
		>= 0.01	7.4	7.1	7.5	7.0	9.2	7.4	4.8	5.8	6.5	7.6	7.0	7.5	84.8
		>= 0.10	3.8	3.9	4.4	4.4	6.3	5.2	3.1	3.4	4.3	5.2	3.9	3.8	51.7
		>= 0.50	0.9	1.6	1.7	2.0	3.0	2.5	1.3	1.4	1.8	2.2	1.7	1.7	21.8
		>= 1.00	0.3	0.6	0.6	0.8	1.7	1.4	0.6	0.6	0.9	1.3	0.7	0.6	10.1

TABLE 2.7-5 (Sheet 3 of 4)
GLEN ROSE, TX
NORMALS, MEANS, AND EXTREMES

		Element		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Snow Totals (inches)	Means/Medians(d)	Snow Fall Mean		0.7	0.5	.2	.0	.0	.0	.0	.0	.0	.0	0.2	0.2	1.8
		Snow Fall Median		.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0	0
		Snow Depth Mean		#	#	#	0	0	0	0	0	0	#	#	#	N/A
		Snow Depth Median		0	0	0	0	0	0	0	0	0	0	0	0	N/A
	Extremes(b)	Highest Daily Snow Fall		4.5	3.5	3.0	.0	.0	.0	.0	.0	.0	.0	3.5	3.5	4.5
			Year	1973	1975	1978	0	0	0	0	0	0	0	1976	1983	Jan-73
			Day	11	23	3	0	0	0	0	0	0	0	13	16	11
		Highest Monthly Snow Fall		6.3	5.0	3.0	.0	.0	.0	.0	.0	.0	.0	4.0	3.5	6.3
			Year	1978	1978	1978	0	0	0	0	0	0	0	1976	1986	Jan-78
		Highest Daily Snow Depth		5	2	1+	0	0	0	0	0	0	#	3	2	5
			Year	1973	1979	1989	0	0	0	0	0	0	1988	1976	1978	Jan-73
			Day	11	17	6	0	0	0	0	0	0	1	13	31	11
		Highest Monthly Mean Snow Depth		#+	#+	#+	0	0	0	0	0	0	#	#+	#+	#+
			Year	1988	1996	1989	0	0	0	0	0	0	1988	1997	1997	Dec-97

TABLE 2.7-5 (Sheet 4 of 4)
GLEN ROSE, TX
NORMALS, MEANS, AND EXTREMES

Element			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Number of Days(d)	Snow Fall >= Thresholds	0.1	0.5	0.4	0.1	.0	.0	.0	.0	.0	.0	.0	0.2	0.2	1.4
		1.0	0.2	0.2	0.1	.0	.0	.0	.0	.0	.0	.0	0.1	0.2	0.8
		3.0	0.2	0.1	@	.0	.0	.0	.0	.0	.0	.0	@	0.1	0.4
		5.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		10.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	Snow Depth >= Thresholds	1	0.4	0.2	0.1	.0	.0	.0	.0	.0	.0	.0	0.1	0.1	0.9
		3	0.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	@	.0	0.1
		5	@	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	@
		10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

a) From the 1971 – 2000 Monthly Normals

b) Derived from station's available digital record: 1897 – 2001

c) Derived from 1971 – 2000 serially complete daily data

d) Derived from Snow Climatology and 1971 – 2000 daily data

+ Also occurred on an earlier date(s)
@ Denotes mean number of days greater than 0 but less than .05
#Denotes trace amounts
** Statistics not computed because less than six years out of thirty had measurable precipitation

Notes:

1. (NCDC 2008) Station: GLEN ROSE 2 W, TX, COOP ID: 413591.

TABLE 2.7-6 (Sheet 1 of 2)
HURRICANE LANDFALLS IN TEXAS

1899 – 2006

Year	Month	Name	Category	State and Category
1900	SEP	-	4	TX 4
1909	JUL	-	3	TX 3
1909	AUG	-	2	TX 2
1910	SEP	-	2	TX 2
1912	OCT	-	1	TX 1
1913	JUN	-	1	TX 1
1915	AUG	-	4	TX 4
1916	AUG	-	3	TX 3
1919	SEP	-	4	FL 4, TX 4
1921	JUN	-	2	TX 2
1929	JUN	-	1	TX 1
1932	AUG	-	4	TX 4
1933	JUL/AUG	-	2	FL 1, TX 2
1933	SEP	-	3	TX 3
1934	JUL	-	2	TX 2
1936	JUN	-	1	TX 1
1940	AUG	-	2	TX 2, LA 2
1941	SEP	-	3	TX 3
1942	AUG	-	1	TX 1
1942	AUG	-	3	TX 3
1943	JUL	-	2	TX 2
1945	AUG	-	2	TX 2
1947	AUG	-	1	TX 1
1949	OCT	-	2	TX 2
1957	JUN	Audrey	4	TX 4, LA 4
1959	JUL	Debra	1	TX 1
1961	SEP	Carla	4	TX 4
1963	SEP	Cindy	1	TX 1
1967	SEP	Beulah	3	TX 3
1970	AUG	Celia	3	TX 3
1971	SEP	Fern	1	TX 1
1980	AUG	Allen	3	TX 3

TABLE 2.7-6 (Sheet 2 of 2)
HURRICANE LANDFALLS IN TEXAS

1899 – 2006

Year	Month	Name	Category	State and Category
1983	AUG	Alicia	3	TX 3
1986	JUN	Bonnie	1	TX 1
1989	AUG	Chantal	1	TX 1
1989	OCT	Jerry	1	TX 1
1999	AUG	Bret	3	TX 3
2003	AUG	Claudette	1	TX 1
2005	SEP	Rita	3	TX 5

(NWS 2008)
(NHC 2006)
(NHC 2004 - 2005)

TABLE 2.7-7
FREQUENCY OF TROPICAL CYCLONES (BY MONTH)

	Category of Storm							
	1 (No.)	2 (No.)	3 (No.)	4 (No.)	5 (No.)	Monthly Total (No.)	Annual Frequency (yr^{-1})	% of Total
Jun	4	1	0	1	0	6	0.06	15%
Jul	1	3	1	0	0	5	0.05	13%
Aug	4	3	6	2	0	15	0.14	38%
Sep	2	1	4	3	0	10	0.09	26%
Oct	2	1	0	0	0	3	0.03	8%
Total	13	9	11	6	0	39	0.36	100%

	Number of Hurricanes: Saffir/Simpson Category Number						Landfall Frequency (storms per year)	Return Period (years)
Area	1	2	3	4	5	Total		
Texas	13	9	11	6	0	39	0.38	2.8

Where the definition of Storm Category is as follows:

Storm Category	Wind Speed (mph)	Storm Surge (ft. above normal)
1	74 to 95	4 to 5
2	96 to 110	6 to 8
3	111 to 130	9 to 12
4	131 to 155	13 to 18
5	Greater than 155	Greater than 18

(NWS 2008)
(NHC 2006)
(NHC 2004 - 2005)

TABLE 2.7-8 (Sheet 1 of 2)
TROPICAL STORMS WITHIN 50 MILES OF CPNPP

Number	Year	Month	Day	Storm Name	Wind Speed (KTS)	Wind Speed (mph)	Pressure(MB)	Category
1	1874	9	7	NOT NAMED	30	34.5	0	TD
2	1900	9	9	NOT NAMED	65	74.8	0	H1
3	1900	9	9	NOT NAMED	50	57.5	0	TS
4	1932	8	14	NOT NAMED	35	40.3	0	TS
5	1932	8	15	NOT NAMED	25	28.8	1002	TD
6	1943	7	29	NOT NAMED	25	28.8	0	TD
7	1943	7	29	NOT NAMED	25	28.8	0	TD
8	1945	8	29	NOT NAMED	30	34.5	1002	TD
9	1945	8	29	NOT NAMED	25	28.8	1006	TD
10	1947	8	26	NOT NAMED	20	23.0	0	TD
11	1947	8	26	NOT NAMED	20	23.0	0	TD
12	1947	8	27	NOT NAMED	15	17.3	0	TD
13	1954	7	30	BARBARA	25	28.8	0	TD
14	1961	9	12	CARLA	60	69.0	975	TS
15	1961	9	12	CARLA	45	51.8	979	TS
16	1968	6	24	CANDY	30	34.5	0	TD
17	1968	6	24	CANDY	25	28.8	0	TD
18	1970	9	16	FELICE	30	34.5	1006	TD
19	1970	9	17	FELICE	25	28.8	0	TD
20	1970	9	17	FELICE	25	28.8	0	TD
21	1983	8	19	ALICIA	35	40.3	998	TS

TABLE 2.7-8 (Sheet 2 of 2)
TROPICAL STORMS WITHIN 50 MILES OF CPNPP

Number	Year	Month	Day	Storm Name	Wind Speed (KTS)	Wind Speed (mph)	Pressure(MB)	Category
22	1983	8	19	ALICIA	30	34.5	1003	TD
23	1989	8	2	CHANTAL	25	28.8	1004	TD
24	1989	8	2	CHANTAL	20	23.0	1007	TD
25	1995	8	1	DEAN	20	23.0	1004	TD
26	1995	8	1	DEAN	20	23.0	1004	TD

(NOAA 1851 - 2006)
Hurricane tracks wn 50 statue miles of site.pdf

TABLE 2.7-9 (Sheet 1 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
Bosque County, TX						
1 BOSQUE	4/28/1954	1700	F1	100	2	0.114
2 BOSQUE	5/18/1954	1500	F1	0	0	
3 BOSQUE	8/15/1958	1650	F1	50	1	0.028
4 BOSQUE	4/11/1961	1700	F1	100	14	0.795
5 BOSQUE	4/19/1966	1600	F2	880	2	1.000
6 BOSQUE	4/19/1966	1630	F1	0	0	
7 BOSQUE	10/26/1970	1730	F0	33	1	0.019
8 BOSQUE	10/26/1970	1730	F0	50	0	
9 BOSQUE	5/9/1971	1755	F2	67	0	
10 BOSQUE	5/25/1976	1315	F2	33	4	0.075
11 BOSQUE	6/18/1976	2034	F1	0	0	
12 BOSQUE	9/13/1977	1410	F1	0	0	
13 BOSQUE	4/30/1978	1920	F2	0	0	
14 BOSQUE	6/20/1980	2010	F2	100	4	0.227
15 BOSQUE	6/2/1987	1320	F0	10	0	
16 BOSQUE	9/17/1988	1415	F0	10	0	
17 BOSQUE	4/14/1990	350	F1	440	1	0.250
18 BOSQUE	4/27/1990	1527	F2	10	0	
19 BOSQUE	5/2/1990	2230	F2	10	0	
20 Iredell	4/26/1994	1720	F2	100	1	0.057
21 Meridian	4/26/1994	1806	F0	10	0	
22 Meridian	4/26/1994	1930	F0	10	0	
23 Morgan	4/26/1994	2043	F1	10	0	
24 Kopperl	10/21/1996	2:30 PM	F0	30	0	
25 Valley Mills	3/16/1998	4:53 PM	F0	0	0	

TABLE 2.7-9 (Sheet 2 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
26 Meridian	3/8/1999	9:37 AM	F0	0	0	
27 Laguna Park	5/12/2000	4:10 PM	F3	400	7	1.591
28 Kopperl	5/5/2001	3:05 PM	F0	75	2	0.085
29 Valley Mills	10/12/2001	7:54 PM	F1	75	2	0.085
30 Valley Mills	10/12/2001	8:00 PM	F0	50	2	0.057
Erath County, TX						
1 ERATH	2/12/1950	115	F1	233	2	0.265
2 ERATH	5/4/1960	1810	F2	33	0	
3 ERATH	5/4/1960	1820	F1	33	0	
4 ERATH	3/20/1962	930	F1	67	1	0.038
5 ERATH	5/30/1967	2020	F0	17	1	0.010
6 ERATH	4/28/1971	1650	F2	0	0	
7 ERATH	4/19/1976	1930	F2	300	11	1.875
8 ERATH	5/31/1976	1555	F2	33	4	0.075
9 ERATH	5/31/1976	1655	F1	33	0	
10 ERATH	4/24/1980	1730	F1	0	0	
11 ERATH	4/24/1980	1745	F0	0	0	
12 ERATH	6/20/1980	1920	F1	0	0	
13 ERATH	5/12/1982	1224	F0	7	0	
14 ERATH	5/12/1982	1410	F3	100	5	0.284
15 ERATH	5/12/1982	2007	F1	50	6	0.170
16 ERATH	6/15/1982	2030	F1	50	3	0.085
17 ERATH	6/20/1982	1525	F1	50	2	0.057
18 ERATH	2/26/1984	400	F1	30	0	
19 ERATH	4/18/1986	1900	F0	10	0	
20 ERATH	9/29/1988	50	F1	50	1	0.028

TABLE 2.7-9 (Sheet 3 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
21 ERATH	5/2/1989	1915	F1	10	0	
22 ERATH	4/25/1990	1727	F2	50	3	0.085
23 ERATH	4/25/1990	1857	F1	50	1	0.028
24 ERATH	4/25/1990	2114	F1	50	3	0.085
25 Hico	4/26/1994	1705	F0	10	0	
26 Alexander	4/26/1994	1950	F0	10	0	
27 Stephenville	5/7/1995	2020	F0	10	0	
28 Thurber	10/21/1996	10:10 AM	F0	30	0	
29 Morgan Mill	6/1/1999	6:00 PM	F0	20	0	
30 Dublin	6/1/1999	8:22 PM	F0	10	0	
31 Chalk Mtn	3/30/2002	4:20 PM	F0	30	0	
Hood County, TX						
1 HOOD	5/25/1957	1400	F0	33	1	0.019
2 HOOD	11/15/1960	1610	F0	167	0	
3 HOOD	9/14/1966	1800	F1	33	2	0.038
4 HOOD	4/28/1971	1730	F2	33	12	0.225
5 HOOD	8/8/1972	1750	F1	10	1	0.006
6 HOOD	4/19/1976	2028	F2	33	0	
7 HOOD	4/19/1976	2055	F2	33	0	
8 HOOD	5/9/1977	1400	F1	0	0	
9 HOOD	7/27/1977	1930	F2	250	1	0.142
10 HOOD	10/30/1979	835	F0	0	0	
11 HOOD	5/12/1982	1740	F1	73	7	0.290
12 HOOD	4/29/1985	1533	F0	10	0	
13 HOOD	5/4/1989	2110	F1	10	0	
14 HOOD	5/4/1989	2120	F2	500	4	1.136

TABLE 2.7-9 (Sheet 4 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
15 HOOD	5/16/1989	1800	F1	73	1	0.041
16 HOOD	5/16/1989	1815	F1	73	1	0.041
17 HOOD	6/7/1989	614	F1	10	0	
18 HOOD	6/2/1991	928	F1	10	0	
19 Granbury	10/21/1996	7:00 AM	F1	10	0	
Johnson County, TX						
1 JOHNSON	6/16/1951	30	F2	20	15	0.170
2 JOHNSON	8/31/1956	1400	F1	100	1	0.057
3 JOHNSON	4/19/1957	400	F0	17	0	
4 JOHNSON	8/3/1958	425	F0	100	6	0.341
5 JOHNSON	10/3/1959	230	F1	100	1	0.057
6 JOHNSON	10/4/1959	230	F1	50	13	0.369
7 JOHNSON	5/20/1960	345	F1	300	1	0.170
8 JOHNSON	3/16/1961	1700	F1	200	3	0.341
9 JOHNSON	3/16/1961	1755	F2	33	1	0.019
10 JOHNSON	3/26/1961	1600	F3	50	1	0.028
11 JOHNSON	3/26/1961	1600	F2	17	0	
12 JOHNSON	6/8/1962	1500	F2	133	2	0.151
13 JOHNSON	6/28/1962	1800	F2	27	1	0.015
14 JOHNSON	9/7/1962	2040	F2	167	2	0.190
15 JOHNSON	8/8/1963	1500	F1	67	2	0.076
16 JOHNSON	9/6/1963	1430	F2	50	2	0.057
17 JOHNSON	11/19/1964	1	F0	50	1	0.028
18 JOHNSON	6/23/1965	2015	F2	17	0	
19 JOHNSON	5/13/1968	1217	F2	33	0	
20 JOHNSON	12/18/1968	1115	F1	13	0	

TABLE 2.7-9 (Sheet 5 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
21 JOHNSON	12/18/1968	1137	F0	100	0	
22 JOHNSON	10/26/1970	2100	F1	23	1	0.013
23 JOHNSON	2/18/1971	1645	F1	50	0	
24 JOHNSON	4/28/1971	1830	F1	20	1	0.011
25 JOHNSON	4/28/1971	1830	F2	20	1	0.011
26 JOHNSON	4/28/1971	1830	F1	20	1	0.011
27 JOHNSON	10/19/1971	1800	F2	50	8	0.227
28 JOHNSON	12/14/1971	1710	F2	17	0	
29 JOHNSON	12/14/1971	1715	F1	17	0	
30 JOHNSON	12/14/1971	1720	F1	17	0	
31 JOHNSON	4/23/1973	1700	F3	333	3	0.568
32 JOHNSON	5/6/1973	1915	F2	100	12	0.682
33 JOHNSON	11/24/1973	1315	F3	33	0	
34 JOHNSON	4/11/1974	415	F1	100	3	0.170
35 JOHNSON	4/7/1975	2230	F2	27	0	
36 JOHNSON	4/20/1976	20	F1	33	0	
37 JOHNSON	5/26/1976	1430	F1	50	0	
38 JOHNSON	5/26/1976	1445	F1	50	1	0.028
39 JOHNSON	5/26/1976	1512	F3	100	4	0.227
40 JOHNSON	5/26/1976	1525	F1	50	0	
41 JOHNSON	5/26/1976	1540	F2	100	0	
42 JOHNSON	5/26/1976	1617	F4	300	2	0.341
43 JOHNSON	9/2/1976	1735	F0	0	0	
44 JOHNSON	6/12/1977	1645	F0	0	0	
45 JOHNSON	9/13/1977	1200	F1	0	0	
46 JOHNSON	4/30/1978	1820	F2	33	2	0.038

TABLE 2.7-9 (Sheet 6 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
47 JOHNSON	4/30/1978	1850	F1	33	1	0.019
48 JOHNSON	5/3/1979	1000	F1	33	0	
49 JOHNSON	10/30/1979	915	F1	50	1	0.028
50 JOHNSON	10/13/1981	1145	F2	50	3	0.085
51 JOHNSON	10/13/1981	1150	F1	0	0	
52 JOHNSON	10/13/1981	1200	F1	50	6	0.170
53 JOHNSON	11/8/1981	1722	F1	73	2	0.083
54 JOHNSON	11/8/1981	1730	F0	0	0	
55 JOHNSON	4/27/1985	1712	F0	30	1	0.017
56 JOHNSON	4/27/1985	1814	F0	30	1	0.017
57 JOHNSON	5/16/1989	1838	F1	73	3	0.124
58 JOHNSON	4/12/1991	1745	F2	200	2	0.227
59 JOHNSON	4/12/1991	1805	F2	300	2	0.341
60 JOHNSON	4/12/1991	1851	F2	10	0	
61 JOHNSON	4/12/1991	1940	F0	10	0	
62 JOHNSON	4/12/1991	1955	F1	10	0	
63 Grandview	5/9/1993	1408	F0	10	0	
64 Lake Pat Cleburne	9/13/1993	610	F1	150	13	1.108
65 Keene	10/17/1993	2300	F0	10	0	
66 Godley	4/28/1994	2357	F0	10	0	
67 Alvarado	4/29/1994	23	F0	10	0	
68 Mansfield	4/29/1994	40	F0	10	0	
69 Cleburne	5/4/2001	7:42 PM	F1	50	0	
70 Alvarado	5/4/2001	8:45 PM	F1	50	3	0.085
71 Grandview	4/16/2002	5:56 PM	F0	70	1	0.040
72 Grandview	4/16/2002	6:07 PM	F0	40	1	0.023

TABLE 2.7-9 (Sheet 7 of 7)
TORNADOES IN SURROUNDING AREA

Location or County	Date	Time	Magnitude	Width (yards)	Length (mi)	Area (mi^2)
73 Grandview	4/16/2002	6:11 PM	F0	100	1	0.057
74 Grandview	4/16/2002	6:14 PM	F0	40	1	0.023
75 Alvarado	4/25/2005	3:25 PM	F0	15	0	
Somervell County, TX						
1 SOMERVELL	10/1/1988	1617	F0	10	0	
2 SOMERVELL	4/12/1991	1640	F2	100	2	0.114
3 SOMERVELL	4/12/1991	1655	F2	150	3	0.256

TORNADO MAGNITUDE
Bosque, Erath, Somervell, Hood, and Johnson Counties

Month	F0	F1	F2	F3	F4	Grand Total	%
Feb		3				3	1.9%
Mar	3	2	2	1		8	5.1%
Apr	19	14	18	1		52	32.9%
May	6	18	9	3	1	37	23.4%
Jun	4	6	5			15	9.5%
Jul			1			1	0.6%
Aug	1	4				5	3.2%
Sep	2	5	2			9	5.7%
Oct	8	8	2			18	11.4%
Nov	3	1		1		5	3.2%
Dec	1	3	1			5	3.2%
Total	47	64	40	6	1	158	100.0%
Percent	29.7%	40.5%	25.3%	3.8%	0.6%	100.0%	

NOTES:

1. Tornado data from all years were used to calculate the annual frequencies.
2. (NCDC 2008a) Data recorded in the NCDC Storm Event database, January 1, 1950 through July 31, 2006.

TABLE 2.7-10
TORNADOES IN SURROUNDING COUNTIES BY MONTH

Month	Bosque (#)	Erath (#)	Hood (#)	Johnson (#)	Somervell (#)	All Five Areas (#)	Average per Year (#/yr)
Jan			1			1	0.02
Feb		2		1		3	0.05
Mar	2	2		4		8	0.14
Apr	11	10	4	25	2	52	0.92
May	6	10	7	14		37	0.65
Jun	3	5	2	5		15	0.27
Jul			1			1	0.02
Aug	1		1	3		5	0.09
Sep	2	1	1	5		9	0.16
Oct	5	1	2	9	1	18	0.32
Nov			1	4		5	0.09
Dec				5		5	0.09
Total	30	31	20	75	3	159	2.81
Percent	18.9%	19.5%	12.6%	47.2%	1.9%	100.0%	

NOTES:

1. Tornado data from all years were used to calculate the annual frequencies.
2. (NCDC 2008a) Data recorded in the NCDC Storm Event database, January 1, 1950 through July 31, 2006.

TABLE 2.7-11
THUNDERSTORMS AND HIGH WIND EVENTS

Month	Bosque (#)	Erath (#)	Hood (#)	Johnson (#)	Somervell (#)	All Five Areas (#)	Average per Year (#/yr)
Jan	1	2	1	1		5	0.19
Feb		2	2	6		10	0.39
Mar	7	6	5	2	2	22	0.86
Apr	10	15	6	19	7	57	2.22
May	15	24	19	26	11	95	3.70
Jun	14	22	21	23	13	93	3.62
Jul	4	2	2	8	1	17	0.66
Aug	3	2	8	15	5	33	1.29
Sep	3	5	8	5	3	24	0.94
Oct	6	5	6	13	2	32	1.25
Nov	3		1	4	1	9	0.35
Dec	1	2	2	6	1	12	0.47
Total	67	87	81	128	46	409	15.73
Percent	16.4%	21.3%	19.8%	31.3%	11.2%	100%	

NOTES:

1. Storms listed at different sites in the same county on the same day were counted as separate events.
2. Data obtained for the period January 1, 1950 – July 31, 2006. Prior to 1981, the yearly storm averages were markedly less frequent, suggesting less thorough storm data collection. Consequently, the average/year was based on 1981 through 7/31/2006 data.
3. CPNPP site is in Somervell County. The other counties listed surround Somervell County.
4. (NCDC 2008a) Data recorded in the NCDC Storm Event database. 1950 – 2005.

TABLE 2.7-12
HAIL STORM EVENTS

COUNTIES SURROUNDING SITE

County	Number of Events	Percentage
Bosque	159	22.5%
Erath	198	28.0%
Somervell	54	7.6%
Hood	107	15.1%
Johnson	189	26.7%
Total	707	100%

Average number per year = 12.3

NOTES:

1. (NCDC 2008a) Data recorded in the NCDC Storm Event database. January 1, 1950 – March 31, 2007
2. For this table, each occurrence of hail was counted as an individual event, even if two counties recorded hail simultaneously.
3. Hail storm events defined as storms producing hail 3/4 in. diameter or greater.

TABLE 2.7-13
MIXING HEIGHT CPNPP VICINITY

	Morning		Afternoon	
	Mixing Height (m)	Wind Speed Averaged Through the Mixing Layer (m/sec)	Mixing Height (m)	Wind Speed Averaged Through the Mixing Layer (m/sec)
Winter	400	7	1050	7.8
Spring	500	8	1600	9
Summer	550	7	2000	6.8
Fall	450	6.5	1600	7
Annual	480	7	1600	7.5

(Holzworth 1972)

TABLE 2.7-14
MIXING HEIGHTS AT STEPHENVILLE TEXAS

Season	Morning (m)	Afternoon (m)
Winter	509	1187
Spring	616	2076
Summer	366	1778
Fall	445	1383
Annual	484	1612

	Mixing Height Data	
Month	Avg. Morning (m)	Avg. Afternoon (m)
Jan	576	1195
Feb	491	1207
Mar	709	2154
Apr	422	2158
May	694	1830
Jun	425	1454
July	365	1825
Aug	306	2046
Sep	463	1583
Oct	367	1249
Nov	482	1191
Dec	437	1030

NOTES:

1. Season is selected per designated 3 month period, and as such seasons are not necessarily the same number of days. Furthermore, minor discrepancies between the annual value and the average per season may be present, due to the inconsistent length of period used.

2. (EPA 2006a) Data is from the NCDC SCRAM Mixing Height Data collection for the period of 1984 – 1985 and 1987 – 1990.

TABLE 2.7-15
MEAN VENTILATION RATE BY MONTH
STEPHENVILLE TEXAS

	Morning Ventilation Rate (m^2/s)	Afternoon Ventilation Rate (m^2/s)	Mean Ventilation Rate (m^2/s)
Jan	3364	6565	4965
Feb	3377	7219	5298
Mar	4332	10940	7636
Apr	2994	12391	7692
May	4771	9343	7057
Jun	2992	8611	5801
July	2210	9307	5759
Aug	1643	9496	5569
Sep	2775	8933	5854
Oct	2713	6856	4784
Nov	3475	6553	5014
Dec	2422	5794	4108

NOTES:

1. Atmospheric ventilation rate is numerically equal to the product of the mixing height and the wind speed within the mixing layer.

2. (EPA 2006a) Data is from the NCDC SCRAM Mixing Height Data collection for the period of 1984 – 1985 and 1987 – 1990.

TABLE 2.7-16 (Sheet 1 of 5)
MIXING HEIGHT
CPNPP AREA

	Wind Speed 1959 – 1998 (m/s)	Mixing Height 1961 – 1990 (meters agl)	Ventilation Index 1961 – 1990 (m^2/s)
January AM			
Min	3.2	340	1402 (Marginal)
Max	4.4	615	2374 (Fair)
Mean	3.9	485	1920 (Marginal)
January PM			
Min	3.1	680	2455 (Fair)
Max	4.1	1148	4330 (Good)
Mean	3.5	926	3307 (Fair)
February AM			
Min	2.9	416	1595 (Marginal)
Max	4.5	662	2832 (Fair)
Mean	3.8	530	2105 (Marginal)
February PM			
Min	2.6	828	2279 (Marginal)
Max	4.0	1552	6075 (Good)
Mean	3.4	1131	3943 (Good)
March AM			
Min	3.4	423	1710 (Marginal)
Max	4.5	719	2903 (Fair)
Mean	4.0	589	2475 (Fair)

TABLE 2.7-16 (Sheet 2 of 5)
MIXING HEIGHT
CPNPP AREA

	Wind Speed 1959 – 1998 (m/s)	Mixing Height 1961 – 1990 (meters agl)	Ventilation Index 1961 – 1990 (m^2/s)
March PM			
Min	3.1	1168	4244 (Good)
Max	4.0	1774	6276 (Good)
Mean	3.6	1399	5158 (Good)
April AM			
Min	3.6	425	1717 (Marginal)
Max	4.5	818	3640 (Good)
Mean	4.0	612	2544 (Fair)
April PM			
Min	3.1	1107	3708 (Good)
Max	4.1	2011	7721 (Good)
Mean	3.6	1527	5702 (Good)
May AM			
Min	3.2	440	1406 (Marginal)
Max	4.7	856	3478 (Fair)
Mean	3.9	647	2592 (Fair)
May PM			
Min	2.7	1193	4265 (Good)
Max	4.5	1936	7718 (Good)
Mean	3.5	1579	5646 (Good)

TABLE 2.7-16 (Sheet 3 of 5)
MIXING HEIGHT
CPNPP AREA

	Wind Speed 1959 – 1998 (m/s)	Mixing Height 1961 – 1990 (meters agl)	Ventilation Index 1961 – 1990 (m^2/s)
June AM			
Min	3.1	558	1704 (Marginal)
Max	4.7	828	3243 (Fair)
Mean	3.7	688	2604 (Fair)
June PM			
Min	2.7	1373	4721 (Good)
Max	4.1	2199	8678 (Good)
Mean	3.4	1746	6084 (Good)
July AM			
Min	3.0	496	1756 (Marginal)
Max	4.6	751	2717 (Fair)
Mean	3.5	658	2292 (Marginal)
July PM			
Min	2.9	1621	5126 (Good)
Max	4.3	2605	9684 (Good)
Mean	3.6	2009	7230 (Good)
August AM			
Min	2.6	438	1318 (Marginal)
Max	3.9	788	2956 (Fair)
Mean	3.3	619	2085 (Marginal)

TABLE 2.7-16 (Sheet 4 of 5)
MIXING HEIGHT
CPNPP AREA

	Wind Speed 1959 – 1998 (m/s)	Mixing Height 1961 – 1990 (meters agl)	Ventilation Index 1961 – 1990 (m^2/s)
August PM			
Min	2.6	1636	4677 (Good)
Max	3.9	2486	9009 (Good)
Mean	3.4	2030	7086 (Good)
September AM			
Min	2.7	446	1485 (Marginal)
Max	4.2	788	3241 (Fair)
Mean	3.3	611	2090 (Marginal)
September PM			
Min	2.6	1189	3318 (Fair)
Max	4.1	2006	6778 (Good)
Mean	3.2	1644	5278 (Good)
October AM			
Min	3.2	373	1346 (Marginal)
Max	4.0	620	2557 (Fair)
Mean	3.6	493	1867 (Marginal)
October PM			
Min	2.9	1118	3528 (Good)
Max	3.7	2182	7091 (Good)
Mean	3.3	1414	4665 (Good)

TABLE 2.7-16 (Sheet 5 of 5)
MIXING HEIGHT
CPNPP AREA

	Wind Speed 1959 – 1998 (m/s)	Mixing Height 1961 – 1990 (meters agl)	Ventilation Index 1961 – 1990 (m^2/s)
November AM			
Min	3.2	426	1515 (Marginal)
Max	4.4	648	2666 (Fair)
Mean	3.9	519	2086 (Marginal)
November PM			
Min	2.9	830	2621 (Fair)
Max	4.2	1435	5883 (Good)
Mean	3.5	1111	3934 (Good)
December AM			
Min	3.2	390	1548 (Marginal)
Max	4.5	600	2555 (Fair)
Mean	3.9	483	1941 (Marginal)
December PM			
Min	2.9	795	2463 (Marginal)
Max	4.0	1134	4277 (Good)
Mean	3.5	929	3314 (Fair)

(VCIS 2007)

Notes:

1. agl is aboveground level.
2. Ventilation Index is the product of the mixing height and the wind speed averaged through the mixing depth.

TABLE 2.7-17
POINT PRECIPITATION RECURRENCE INTERVALS FOR REGION

	Recurrence Intervals (Years)						
Duration	1	2	5	10	25	50	100
5 minutes	-	0.5	0.6	0.6	0.7	0.9	0.9
10 minutes	-	0.8	1.0	1.1	1.2	1.5	1.5
15 minutes	-	1.1	1.3	1.4	1.6	1.9	1.9
30 minutes	1.2	1.5	1.8	2.0	2.4	2.9	2.9
1 hour	1.5	1.9	2.4	2.7	3.2	4.0	4.0
2 hours	1.8	2.2	3.0	3.5	4.3	4.6	5.1
3 hours	2.0	2.5	3.3	3.9	4.5	5.2	5.7
6 hours	2.4	2.9	3.9	4.7	5.3	6.2	6.9
12 hours	2.8	3.4	4.7	5.5	6.4	7.4	8.3
24 hours	3.2	3.9	5.4	6.2	7.5	8.5	9.5
2 days	-	4.5	6.0	7.2	8.5	9.6	11.0
4 days	-	5.3	7.0	8.0	9.8	11.0	12.5
7 days	-	6.0	8.0	9.5	11.2	12.8	14.0
10 days	-	6.7	8.9	10.3	12.3	14.0	15.8

Notes:

1. (NOAA 1977) 5 - 60 min data based on spatial interpolation of isopluvials.
2. (WB 1961) hr through 24-hr data based on spatial interpolation of isopluvials.
3. (WB 1964) day through 10-day data based on interpolation of isopluvials.
4. Point precipitation values reported above are measured in inches.

TABLE 2.7-18 (Sheet 1 of 3)
ICE STORMS

Bosque, Erath, Somervell, Hood, and Johnson Counties

Date	Time	Type	Deaths	Injuries	Property Damage	Crop Damage
Bosque County, Texas						
2/9/1994	0	Ice Storm	0	0	50.0M	0
11/24/1996	2:00 PM	Winter Storm	0	0	0	0
1/6/1997	12:00 PM	Heavy Snow	0	0	0	0
12/22/1998	12:00 AM	Ice Storm	6	0	0	0
1/25/2000	12:00 AM	Winter Storm	4	0	0	0
12/12/2000	6:00 PM	Winter Storm	0	0	0	0
12/25/2000	12:00 AM	Winter Storm	0	0	0	0
12/31/2000	12:00 AM	Winter Storm	0	0	0	0
1/1/2001	12:00 AM	Heavy Snow	0	0	0	0
11/27/2001	12:30 PM	Ice Storm	0	0	0	0
2/24/2003	11:20 AM	Winter Storm	0	0	15.0M	0
12/22/2004	12:01 AM	Winter Weather/mix	0	0	0	0
2/18/2006	3:30 AM	Winter Weather/mix	0	0	0	0
1/17/2007	3:00 AM	Winter Weather	0	0	105K	0
Erath County, Texas						
2/9/1994	0	Ice Storm	0	0	50.0M	0
11/24/1996	2:00 PM	Winter Storm	0	0	0	0
1/6/1997	12:00 PM	Heavy Snow	0	0	0	0
12/22/1998	12:00 AM	Ice Storm	6	0	0	0
1/25/2000	12:00 AM	Winter Storm	4	0	0	0
12/12/2000	6:00 PM	Winter Storm	0	0	0	0
12/25/2000	12:00 AM	Winter Storm	0	0	0	0
12/31/2000	12:00 AM	Winter Storm	0	0	0	0
1/1/2001	12:00 AM	Heavy Snow	0	0	0	0
1/18/2001	12:00 AM	Winter Storm	0	0	0	0
11/27/2001	12:30 PM	Ice Storm	0	0	0	0
2/5/2002	5:00 AM	Winter Storm	0	0	0	0
3/2/2002	2:15 AM	Winter Storm	0	0	0	0
2/24/2003	11:20 AM	Winter Storm	0	0	15.0M	0
12/22/2004	12:01 AM	Winter Weather/mix	0	0	0	0
12/7/2005	7:00 AM	Winter Storm	0	0	0	0
1/13/2007	5:00 AM	Ice Storm	0	5	715K	0
1/17/2007	3:00 AM	Winter Weather	0	0	105K	0

TABLE 2.7-18 (Sheet 2 of 3)
ICE STORMS

Bosque, Erath, Somervell, Hood, and Johnson Counties

Date	Time	Type	Deaths	Injuries	Property Damage	Crop Damage
Hood County, Texas						
2/9/1994	0	Ice Storm	0	0	50.0M	0
11/24/1996	2:00 PM	Winter Storm	0	0	0	0
1/6/1997	9:50 AM	Winter Storm	0	0	0	0
12/22/1998	12:00 AM	Ice Storm	6	0	0	0
1/25/2000	12:00 AM	Winter Storm	4	0	0	0
12/12/2000	6:00 PM	Winter Storm	0	0	0	0
12/25/2000	12:00 AM	Winter Storm	0	0	0	0
12/31/2000	12:00 AM	Winter Storm	0	0	0	0
1/1/2001	12:00 AM	Heavy Snow	0	0	0	0
1/18/2001	12:00 AM	Winter Storm	0	0	0	0
11/27/2001	12:30 PM	Ice Storm	0	0	0	0
3/2/2002	2:15 AM	Winter Storm	0	0	0	0
2/24/2003	11:20 AM	Winter Storm	0	0	15.0M	0
12/22/2004	12:01 AM	Winter Weather/mix	0	0	0	0
12/7/2005	7:00 AM	Winter Storm	0	0	0	0
2/18/2006	3:30 AM	Winter Weather/mix	0	0	0	0
1/13/2007	5:00 AM	Ice Storm	0	5	715K	0
1/17/2007	3:00 AM	Winter Weather	0	0	105K	0
Johnson County, Texas						
2/9/1994	0	Ice Storm	0	0	50.0M	0
11/24/1996	2:00 PM	Winter Storm	0	0	0	0
1/6/1997	12:00 PM	Heavy Snow	0	0	0	0
12/22/1998	12:00 AM	Ice Storm	6	0	0	0
1/25/2000	12:00 AM	Winter Storm	4	0	0	0
12/12/2000	6:00 PM	Winter Storm	0	0	0	0
12/25/2000	12:00 AM	Winter Storm	0	0	0	0
12/31/2000	12:00 AM	Winter Storm	0	0	0	0
1/1/2001	12:00 AM	Heavy Snow	0	0	0	0
11/27/2001	12:30 PM	Ice Storm	0	0	0	0
2/5/2002	5:00 AM	Winter Storm	0	0	0	0
2/24/2003	11:20 AM	Winter Storm	0	0	15.0M	0
12/22/2004	12:01 AM	Winter Weather/mix	0	0	0	0
12/7/2005	7:00 AM	Winter Storm	0	0	0	0
1/13/2007	5:00 AM	Ice Storm	0	5	715K	0

TABLE 2.7-18 (Sheet 3 of 3)
ICE STORMS

Bosque, Erath, Somervell, Hood, and Johnson Counties

Date	Time	Type	Deaths	Injuries	Property Damage	Crop Damage
Somervell County, Texas						
2/9/1994	0	Ice Storm	0	0	50.0M	0
11/24/1996	2:00 PM	Winter Storm	0	0	0	0
1/6/1997	9:50 AM	Winter Storm	0	0	0	0
12/22/1998	12:00 AM	Ice Storm	6	0	0	0
1/25/2000	12:00 AM	Winter Storm	4	0	0	0
12/12/2000	6:00 PM	Winter Storm	0	0	0	0
12/25/2000	12:00 AM	Winter Storm	0	0	0	0
12/31/2000	12:00 AM	Winter Storm	0	0	0	0
1/1/2001	12:00 AM	Heavy Snow	0	0	0	0
11/27/2001	12:30 PM	Ice Storm	0	0	0	0
3/2/2002	2:15 AM	Winter Storm	0	0	0	0
2/24/2003	11:20 AM	Winter Storm	0	0	15.0M	0
12/22/2004	12:01 AM	Winter Weather/mix	0	0	0	0
12/7/2005	7:00 AM	Winter Storm	0	0	0	0
2/18/2006	3:30 AM	Winter Weather/mix	0	0	0	0
1/13/2007	5:00 AM	Ice Storm	0	5	715K	0

County Affected	Number of Ice Storms 01/01/1994 to 03/31/2007	#/yr	Return Period (years)
Bosque	14	1.06	0.9
Erath	18	1.36	0.7
Hood	18	1.36	0.7
Johnson	15	1.13	0.9
Somervell	16	1.21	0.8

NOTES:

1. CPNPP site is in Somervell County. The other counties surround Somervell County.
2. A single storm that affects more than one county is counted as an individual storm for each county.
3. Number of Ice storms, #/yr and Return Period evaluated for the period of January 1, 1994 – March 31, 2007 due to the lack of data before 1994.
4. (NCDC 2008a) Data recorded in the NCDC Storm Events Database, January 1, 1950 – March 31, 2007.

TABLE 2.7-19
LOCAL CLIMATE AVERAGES

Average number of days with	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Dublin, Texas													
Temperature >= 90	0	0	0	2	5	17	24	24	14	3	0	0	89
Temperature >= 100	0	0	0	0	0	1	4	6	1	0	0	0	13
Temperature <= 32	14	9	5	0	0	0	0	0	0	0	4	12	45
Precipitation	5	6	6	7	8	5	4	4	5	6	5	5	66
Snow	1	0	0	0	0	0	0	0	0	0	0	0	2
Weatherford, Texas													
Temperature >= 90	0	0	0	1	5	19	27	26	15	3	0	0	97
Temperature >= 100	0	0	0	0	0	1	6	7	1	0	0	0	15
Temperature <= 32	18	12	6	1	0	0	0	0	0	0	6	14	57
Precipitation	6	6	6	7	8	6	5	5	6	6	6	6	72
Snow	0	0	0	0	0	0	0	0	0	0	0	0	1

Notes:

1. (USHCN 2007) Data 1902 through 2004.

TABLE 2.7-20
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
JANUARY

1997 – 2006

January	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.62%	3.44%	5.32%	2.91%	0.95%	0.27%	0.01%	13.51%	10.97
N-NE	0.31%	1.45%	2.46%	1.34%	0.39%	0.01%	0.00%	5.97%	10.35
NE	0.35%	0.77%	0.72%	0.16%	0.05%	0.00%	0.00%	2.06%	7.69
E-NE	0.34%	0.61%	0.69%	0.15%	0.01%	0.00%	0.00%	1.80%	7.85
E	0.58%	1.35%	0.77%	0.20%	0.00%	0.00%	0.00%	2.91%	7.27
E-SE	0.35%	1.26%	1.20%	0.09%	0.00%	0.00%	0.00%	2.91%	7.46
SE	0.37%	1.79%	1.91%	0.42%	0.04%	0.00%	0.00%	4.52%	8.33
S-SE	0.39%	1.83%	3.34%	1.45%	0.22%	0.01%	0.00%	7.24%	10.22
S	0.50%	2.64%	7.79%	6.71%	2.96%	0.88%	0.16%	21.64%	13.26
S-SW	0.18%	1.23%	2.42%	1.42%	0.70%	0.18%	0.03%	6.15%	11.87
SW	0.14%	0.69%	1.16%	0.39%	0.19%	0.01%	0.00%	2.58%	10.29
W-SW	0.11%	0.57%	0.68%	0.43%	0.15%	0.09%	0.00%	2.03%	11.06
W	0.09%	0.30%	0.87%	0.61%	0.19%	0.05%	0.00%	2.11%	11.76
W-NW	0.14%	0.50%	1.27%	0.87%	0.31%	0.23%	0.04%	3.35%	12.92
NW	0.16%	0.89%	2.11%	1.57%	0.87%	0.37%	0.07%	6.03%	13.07
N-NW	0.15%	1.57%	3.60%	2.14%	1.28%	0.54%	0.19%	9.47%	13.18
CALM	5.06%	0.66%	0.00%	0.00%	0.00%	0.00%	0.00%	5.72%	1.00
Total	9.83%	21.53%	36.30%	20.86%	8.32%	2.65%	0.50%	100.00%	10.74

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-21
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
FEBRUARY

1997 – 2006

February	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.79%	2.99%	5.69%	3.05%	0.95%	0.12%	0.06%	13.65%	10.76
N-NE	0.30%	1.11%	2.62%	0.96%	0.12%	0.04%	0.01%	5.17%	9.96
NE	0.31%	1.21%	1.01%	0.09%	0.01%	0.00%	0.00%	2.64%	7.68
E-NE	0.37%	0.99%	0.77%	0.10%	0.00%	0.00%	0.00%	2.24%	7.57
E	0.70%	1.94%	1.60%	0.04%	0.03%	0.00%	0.00%	4.31%	7.08
E-SE	0.58%	1.53%	1.59%	0.36%	0.04%	0.00%	0.00%	4.09%	8.37
SE	0.37%	1.99%	2.44%	0.71%	0.19%	0.10%	0.00%	5.81%	9.55
S-SE	0.36%	1.59%	3.41%	1.70%	0.58%	0.09%	0.01%	7.73%	11.07
S	0.47%	1.99%	6.05%	5.54%	3.05%	1.47%	0.31%	18.88%	14.07
S-SW	0.18%	0.90%	1.38%	0.77%	0.41%	0.10%	0.00%	3.75%	11.27
SW	0.12%	0.73%	0.89%	0.31%	0.10%	0.03%	0.00%	2.18%	9.72
W-SW	0.15%	0.40%	0.46%	0.19%	0.09%	0.10%	0.00%	1.39%	10.57
W	0.16%	0.50%	0.95%	0.43%	0.22%	0.13%	0.04%	2.44%	12.12
W-NW	0.16%	0.53%	1.01%	0.71%	0.34%	0.22%	0.04%	3.02%	13.18
NW	0.12%	0.79%	2.64%	1.59%	0.96%	0.46%	0.07%	6.62%	13.60
N-NW	0.37%	1.82%	3.69%	1.88%	1.14%	0.50%	0.10%	9.51%	12.28
CALM	5.66%	0.90%	0.00%	0.00%	0.00%	0.00%	0.00%	6.56%	1.16
Total	11.16%	21.91%	36.18%	18.45%	8.25%	3.38%	0.67%	100.00%	10.72

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-22
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
MARCH

1997 – 2006

March	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.30%	2.65%	4.59%	2.49%	1.07%	0.36%	0.04%	11.50%	11.62
N-NE	0.26%	1.42%	3.04%	1.38%	0.39%	0.11%	0.01%	6.61%	11.00
NE	0.20%	1.03%	1.36%	0.24%	0.09%	0.00%	0.00%	2.93%	8.97
E-NE	0.34%	0.99%	1.20%	0.32%	0.04%	0.00%	0.00%	2.89%	8.71
E	0.45%	1.55%	2.39%	0.50%	0.04%	0.00%	0.00%	4.93%	8.40
E-SE	0.39%	1.49%	1.84%	0.53%	0.04%	0.01%	0.00%	4.30%	8.53
SE	0.39%	1.70%	2.22%	1.09%	0.23%	0.01%	0.01%	5.66%	9.73
S-SE	0.30%	1.78%	3.97%	2.30%	0.96%	0.27%	0.04%	9.62%	11.69
S	0.42%	1.74%	6.01%	6.00%	4.11%	2.28%	0.43%	21.00%	15.18
S-SW	0.15%	0.93%	1.53%	0.72%	0.45%	0.20%	0.01%	3.99%	11.88
SW	0.03%	0.46%	0.74%	0.16%	0.20%	0.04%	0.00%	1.63%	11.18
W-SW	0.07%	0.34%	0.65%	0.27%	0.04%	0.05%	0.00%	1.42%	10.46
W	0.12%	0.26%	0.74%	0.41%	0.26%	0.11%	0.03%	1.92%	12.56
W-NW	0.04%	0.31%	0.78%	0.68%	0.42%	0.24%	0.07%	2.54%	14.12
NW	0.09%	0.78%	1.66%	1.00%	1.08%	0.49%	0.19%	5.30%	14.38
N-NW	0.14%	1.15%	3.08%	1.65%	1.46%	0.57%	0.03%	8.07%	13.58
CALM	4.59%	1.11%	0.00%	0.00%	0.00%	0.00%	0.00%	5.70%	1.43
Total	8.27%	19.69%	35.82%	19.73%	10.88%	4.76%	0.86%	100.00%	11.60

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-23
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
APRIL

1997 – 2006

April	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.29%	1.96%	3.44%	1.91%	0.81%	0.21%	0.01%	8.63%	17.82
N-NE	0.19%	0.79%	1.57%	0.70%	0.31%	0.11%	0.03%	3.70%	11.33
NE	0.25%	1.04%	0.67%	0.24%	0.06%	0.00%	0.00%	2.25%	8.19
E-NE	0.11%	0.78%	0.81%	0.36%	0.11%	0.01%	0.00%	2.18%	9.87
E	0.45%	1.24%	1.53%	0.38%	0.04%	0.01%	0.00%	3.65%	8.58
E-SE	0.32%	1.14%	1.98%	0.50%	0.04%	0.00%	0.00%	3.98%	9.13
SE	0.42%	1.73%	3.49%	1.10%	0.36%	0.00%	0.00%	7.10%	10.18
S-SE	0.18%	1.41%	4.97%	3.83%	1.29%	0.29%	0.03%	12.00%	12.98
S	0.29%	1.64%	7.36%	9.17%	6.47%	2.84%	0.42%	28.19%	16.00
S-SW	0.13%	0.90%	1.73%	0.74%	0.47%	0.15%	0.00%	4.12%	11.95
SW	0.06%	0.67%	0.90%	0.33%	0.18%	0.06%	0.00%	2.20%	10.72
W-SW	0.03%	0.26%	0.64%	0.28%	0.11%	0.07%	0.00%	1.39%	11.67
W	0.10%	0.42%	0.75%	0.38%	0.25%	0.15%	0.01%	2.06%	12.28
W-NW	0.04%	0.31%	0.99%	0.43%	0.36%	0.19%	0.03%	2.35%	13.92
NW	0.13%	0.50%	2.10%	1.28%	0.64%	0.29%	0.07%	5.01%	13.35
N-NW	0.25%	1.21%	2.17%	1.35%	0.71%	0.53%	0.06%	6.28%	12.67
CALM	4.19%	0.72%	0.00%	0.00%	0.00%	0.00%	0.00%	4.91%	1.13
Total	7.42%	16.73%	35.10%	22.96%	12.22%	4.93%	0.65%	100.00%	12.74

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-24
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
MAY

1997 – 2006

May	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.46%	1.95%	3.33%	1.26%	0.34%	0.05%	0.00%	7.39%	9.95
N-NE	0.17%	1.59%	1.81%	0.91%	0.13%	0.04%	0.00%	4.66%	10.07
NE	0.35%	1.53%	1.14%	0.15%	0.03%	0.00%	0.00%	3.20%	7.69
E-NE	0.43%	1.13%	0.93%	0.13%	0.01%	0.01%	0.00%	2.65%	7.40
E	0.59%	1.92%	1.69%	0.35%	0.01%	0.00%	0.00%	4.57%	7.64
E-SE	0.27%	1.51%	1.86%	0.35%	0.05%	0.01%	0.00%	4.05%	8.68
SE	0.36%	1.69%	3.68%	1.47%	0.17%	0.04%	0.00%	7.42%	10.25
S-SE	0.24%	1.71%	6.34%	5.07%	1.73%	0.17%	0.01%	15.28%	12.81
S	0.35%	2.30%	9.52%	11.29%	5.82%	1.37%	0.16%	30.81%	14.59
S-SW	0.01%	0.70%	1.87%	1.55%	0.39%	0.12%	0.01%	4.65%	12.68
SW	0.04%	0.51%	0.74%	0.20%	0.15%	0.00%	0.00%	1.64%	10.43
W-SW	0.05%	0.31%	0.54%	0.16%	0.07%	0.01%	0.00%	1.14%	9.78
W	0.07%	0.30%	0.44%	0.19%	0.09%	0.00%	0.01%	1.10%	10.50
W-NW	0.00%	0.12%	0.35%	0.15%	0.03%	0.03%	0.01%	0.69%	12.40
NW	0.05%	0.47%	0.78%	0.52%	0.16%	0.07%	0.00%	2.06%	11.77
N-NW	0.17%	0.85%	1.26%	0.67%	0.31%	0.11%	0.03%	3.40%	10.93
CALM	4.15%	1.13%	0.00%	0.00%	0.00%	0.00%	0.00%	5.28%	1.64
Total	7.78%	19.71%	36.30%	24.43%	9.50%	2.04%	0.24%	100.00%	11.24

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-25
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
JUNE

1997 – 2006

June	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.38%	1.95%	2.33%	0.91%	0.10%	0.04%	0.01%	5.71%	9.35
N-NE	0.24%	1.30%	1.99%	0.64%	0.18%	0.01%	0.00%	4.36%	9.31
NE	0.46%	0.92%	0.92%	0.22%	0.06%	0.00%	0.00%	2.58%	7.81
E-NE	0.38%	0.99%	1.03%	0.20%	0.01%	0.00%	0.00%	2.61%	7.80
E	0.50%	2.58%	1.48%	0.22%	0.03%	0.00%	0.00%	4.81%	7.23
E-SE	0.60%	2.91%	2.38%	0.61%	0.01%	0.01%	0.00%	6.54%	8.06
SE	0.78%	3.15%	5.56%	1.73%	0.21%	0.04%	0.01%	11.48%	9.50
S-SE	0.47%	2.91%	7.26%	4.15%	0.91%	0.04%	0.01%	15.76%	11.21
S	0.40%	2.63%	10.10%	9.41%	3.64%	1.02%	0.06%	27.26%	13.49
S-SW	0.18%	0.78%	1.92%	1.74%	0.67%	0.11%	0.00%	5.41%	12.24
SW	0.07%	0.45%	0.43%	0.22%	0.08%	0.01%	0.00%	1.27%	9.80
W-SW	0.04%	0.20%	0.17%	0.06%	0.01%	0.00%	0.00%	0.47%	8.71
W	0.04%	0.24%	0.26%	0.08%	0.01%	0.01%	0.01%	0.67%	10.31
W-NW	0.03%	0.10%	0.17%	0.04%	0.01%	0.01%	0.03%	0.39%	11.61
NW	0.07%	0.26%	0.47%	0.15%	0.03%	0.03%	0.00%	1.02%	10.34
N-NW	0.14%	0.96%	0.74%	0.15%	0.07%	0.03%	0.01%	2.10%	9.03
CALM	5.62%	1.94%	0.00%	0.00%	0.00%	0.00%	0.00%	7.55%	2.03
Total	10.40%	24.26%	37.23%	20.54%	6.03%	1.38%	0.15%	100.00%	10.23

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-26
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
JULY

1997 – 2006

July	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.27%	1.05%	1.41%	0.36%	0.05%	0.03%	0.00%	3.17%	8.96
N-NE	0.20%	0.62%	1.08%	0.27%	0.05%	0.01%	0.00%	2.23%	9.35
NE	0.22%	0.60%	0.59%	0.13%	0.01%	0.00%	0.01%	1.57%	8.56
E-NE	0.23%	0.69%	0.67%	0.17%	0.01%	0.00%	0.00%	1.77%	8.06
E	0.51%	1.65%	1.38%	0.13%	0.01%	0.00%	0.00%	3.70%	7.35
E-SE	0.47%	1.67%	2.47%	0.30%	0.05%	0.00%	0.01%	4.97%	8.54
SE	0.63%	2.10%	4.85%	0.95%	0.03%	0.00%	0.01%	8.58%	9.14
S-SE	0.43%	2.92%	8.44%	2.86%	0.36%	0.05%	0.01%	15.08%	10.31
S	0.46%	4.78%	19.18%	7.06%	1.32%	0.16%	0.00%	32.96%	10.98
S-SW	0.19%	1.87%	6.57%	2.50%	0.27%	0.03%	0.00%	11.42%	10.85
SW	0.05%	0.59%	1.73%	0.40%	0.01%	0.00%	0.00%	2.80%	10.09
W-SW	0.09%	0.40%	0.67%	0.09%	0.00%	0.01%	0.00%	1.28%	8.87
W	0.08%	0.31%	0.35%	0.05%	0.01%	0.00%	0.00%	0.81%	8.21
W-NW	0.05%	0.05%	0.07%	0.03%	0.00%	0.03%	0.00%	0.23%	9.95
NW	0.01%	0.19%	0.16%	0.05%	0.00%	0.00%	0.00%	0.42%	8.66
N-NW	0.11%	0.48%	0.70%	0.13%	0.04%	0.00%	0.00%	1.47%	8.55
CALM	5.04%	2.51%	0.00%	0.00%	0.00%	0.00%	0.00%	7.55%	2.52
Total	9.05%	22.49%	50.34%	15.51%	2.24%	0.32%	0.05%	100.00%	9.45

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-27
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
AUGUST

1997 – 2006

August	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.51%	1.73%	1.41%	0.27%	0.07%	0.00%	0.00%	3.99%	7.69
N-NE	0.30%	0.95%	1.16%	0.16%	0.03%	0.01%	0.00%	2.61%	8.08
NE	0.35%	0.77%	0.69%	0.13%	0.03%	0.00%	0.00%	1.96%	7.64
E-NE	0.35%	1.02%	1.24%	0.24%	0.01%	0.00%	0.00%	2.86%	8.28
E	0.63%	2.82%	2.58%	0.16%	0.03%	0.00%	0.00%	6.22%	7.40
E-SE	0.75%	3.14%	3.33%	0.15%	0.04%	0.00%	0.01%	7.43%	7.53
SE	0.69%	3.66%	4.07%	0.60%	0.01%	0.01%	0.00%	9.04%	8.05
S-SE	0.55%	3.31%	6.69%	1.40%	0.13%	0.00%	0.00%	12.08%	9.36
S	0.71%	4.89%	13.34%	5.83%	1.25%	0.09%	0.01%	26.14%	10.87
S-SW	0.16%	1.88%	4.73%	1.32%	0.30%	0.00%	0.00%	8.39%	10.40
SW	0.15%	0.91%	1.55%	0.17%	0.04%	0.00%	0.00%	2.82%	8.93
W-SW	0.12%	0.50%	0.50%	0.05%	0.01%	0.01%	0.00%	1.20%	8.04
W	0.13%	0.43%	0.54%	0.07%	0.03%	0.01%	0.00%	1.21%	8.56
W-NW	0.08%	0.20%	0.24%	0.01%	0.00%	0.00%	0.00%	0.54%	7.73
NW	0.12%	0.38%	0.27%	0.03%	0.03%	0.01%	0.00%	0.83%	8.33
N-NW	0.30%	0.97%	0.58%	0.05%	0.08%	0.03%	0.01%	2.02%	8.24
CALM	7.39%	3.27%	0.00%	0.00%	0.00%	0.00%	0.00%	10.66%	2.17
Total	13.29%	30.83%	42.91%	10.66%	2.08%	0.19%	0.04%	100.00%	8.39

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-28
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
SEPTEMBER

1997 – 2006

September	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.61%	3.19%	3.52%	1.76%	0.53%	0.07%	0.00%	9.68%	10.02
N-NE	0.27%	1.63%	2.25%	0.92%	0.38%	0.04%	0.01%	5.50%	10.27
NE	0.43%	1.48%	1.51%	0.17%	0.08%	0.03%	0.00%	3.70%	8.03
E-NE	0.52%	1.40%	1.46%	0.31%	0.10%	0.06%	0.00%	3.84%	8.44
E	0.93%	3.56%	2.96%	0.40%	0.07%	0.00%	0.00%	7.92%	7.70
E-SE	0.86%	3.25%	2.99%	0.33%	0.03%	0.00%	0.00%	7.46%	7.71
SE	1.07%	3.98%	3.24%	0.74%	0.06%	0.01%	0.00%	9.10%	7.88
S-SE	0.60%	2.39%	5.04%	2.08%	0.29%	0.00%	0.00%	10.39%	9.89
S	0.71%	3.32%	6.92%	3.26%	0.98%	0.33%	0.03%	15.56%	10.65
S-SW	0.25%	1.41%	1.70%	0.56%	0.11%	0.01%	0.00%	4.05%	8.79
SW	0.08%	0.53%	0.39%	0.10%	0.00%	0.00%	0.00%	1.10%	7.56
W-SW	0.06%	0.40%	0.29%	0.01%	0.00%	0.00%	0.00%	0.77%	7.23
W	0.04%	0.32%	0.28%	0.10%	0.00%	0.01%	0.00%	0.75%	9.11
W-NW	0.07%	0.36%	0.38%	0.10%	0.07%	0.00%	0.00%	0.98%	9.39
NW	0.18%	0.75%	0.54%	0.28%	0.07%	0.00%	0.00%	1.83%	9.06
N-NW	0.18%	1.84%	1.37%	0.80%	0.32%	0.10%	0.03%	4.63%	10.57
CALM	9.46%	3.29%	0.00%	0.00%	0.00%	0.00%	0.00%	12.75%	1.89
Total	16.34%	33.11%	34.82%	11.91%	3.08%	0.67%	0.07%	100.00%	8.24

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-29
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
OCTOBER

1997 – 2006

October	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.46%	2.85%	4.22%	2.14%	0.67%	0.17%	0.00%	10.51%	10.67
N-NE	0.34%	1.48%	2.04%	0.91%	0.20%	0.01%	0.00%	4.99%	9.87
NE	0.27%	1.21%	0.85%	0.15%	0.00%	0.00%	0.00%	2.47%	7.18
E-NE	0.35%	1.16%	0.71%	0.01%	0.00%	0.00%	0.00%	2.23%	6.74
E	0.62%	2.37%	1.02%	0.08%	0.00%	0.00%	0.00%	4.09%	6.52
E-SE	0.73%	2.59%	2.11%	0.31%	0.00%	0.00%	0.00%	5.74%	7.65
SE	0.75%	3.23%	4.66%	0.91%	0.12%	0.01%	0.00%	9.69%	8.62
S-SE	0.40%	3.06%	7.08%	2.43%	0.56%	0.07%	0.00%	13.62%	10.11
S	0.54%	3.45%	8.80%	5.50%	2.03%	0.46%	0.01%	20.80%	12.02
S-SW	0.20%	0.95%	1.72%	0.79%	0.31%	0.11%	0.00%	4.09%	11.05
SW	0.12%	0.48%	0.78%	0.22%	0.03%	0.03%	0.00%	1.65%	9.88
W-SW	0.12%	0.38%	0.42%	0.07%	0.01%	0.00%	0.00%	0.99%	8.07
W	0.09%	0.30%	0.55%	0.28%	0.11%	0.04%	0.01%	1.38%	10.92
W-NW	0.07%	0.30%	0.81%	0.23%	0.08%	0.05%	0.00%	1.53%	11.31
NW	0.12%	0.67%	1.09%	0.54%	0.27%	0.09%	0.05%	2.84%	11.13
N-NW	0.27%	1.64%	1.64%	0.83%	0.47%	0.07%	0.01%	4.93%	9.98
CALM	6.84%	1.60%	0.00%	0.00%	0.00%	0.00%	0.00%	8.44%	1.27
Total	12.29%	27.72%	38.51%	15.41%	4.87%	1.12%	0.09%	100.00%	9.31

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-30
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
NOVEMBER

1997 – 2006

November	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.54%	3.00%	4.62%	2.17%	0.78%	0.01%	0.00%	11.12%	10.48
N-NE	0.24%	1.07%	1.67%	0.57%	0.12%	0.03%	0.00%	3.69%	9.46
NE	0.40%	1.10%	0.83%	0.18%	0.00%	0.00%	0.00%	2.51%	7.47
E-NE	0.32%	1.04%	0.51%	0.01%	0.00%	0.00%	0.00%	1.89%	6.49
E	0.53%	1.47%	1.26%	0.03%	0.00%	0.00%	0.00%	3.29%	6.96
E-SE	0.62%	1.54%	1.42%	0.14%	0.00%	0.00%	0.00%	3.72%	7.47
SE	0.54%	2.12%	2.83%	0.44%	0.01%	0.00%	0.00%	5.96%	8.63
S-SE	0.32%	1.97%	5.41%	1.43%	0.21%	0.01%	0.00%	9.36%	10.14
S	0.53%	2.83%	8.23%	6.26%	2.57%	0.92%	0.10%	21.43%	13.14
S-SW	0.35%	1.33%	2.14%	0.75%	0.37%	0.18%	0.00%	5.12%	10.37
SW	0.18%	0.78%	0.76%	0.15%	0.12%	0.00%	0.00%	2.00%	8.67
W-SW	0.08%	0.58%	0.33%	0.14%	0.07%	0.03%	0.00%	1.24%	9.21
W	0.10%	0.54%	0.97%	0.65%	0.24%	0.12%	0.06%	2.68%	12.65
W-NW	0.06%	0.44%	1.75%	0.79%	0.39%	0.15%	0.08%	3.66%	12.43
NW	0.10%	1.01%	2.54%	1.19%	0.81%	0.35%	0.15%	6.15%	12.53
N-NW	0.25%	1.57%	3.80%	2.03%	0.87%	0.31%	0.08%	8.91%	11.97
CALM	6.66%	0.61%	0.00%	0.00%	0.00%	0.00%	0.00%	7.27%	0.76
Total	11.81%	23.01%	39.09%	16.94%	6.57%	2.11%	0.47%	100.00%	10.10

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-31
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
DECEMBER

1997 – 2006

December	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.51%	1.96%	4.91%	2.29%	0.80%	0.14%	0.00%	10.61%	13.68
N-NE	0.16%	1.14%	2.12%	0.97%	0.20%	0.01%	0.00%	4.61%	9.60
NE	0.28%	0.80%	0.87%	0.07%	0.00%	0.01%	0.00%	2.03%	7.55
E-NE	0.31%	0.55%	0.64%	0.19%	0.00%	0.01%	0.00%	1.70%	8.10
E	0.37%	1.10%	0.73%	0.14%	0.01%	0.00%	0.00%	2.34%	6.76
E-SE	0.46%	1.23%	0.95%	0.35%	0.08%	0.00%	0.00%	3.07%	7.35
SE	0.41%	1.68%	1.53%	0.31%	0.16%	0.04%	0.00%	4.13%	8.21
S-SE	0.39%	2.26%	4.64%	1.75%	0.37%	0.00%	0.00%	9.40%	10.32
S	0.43%	3.02%	7.77%	5.03%	2.48%	0.83%	0.07%	19.62%	12.87
S-SW	0.34%	1.53%	2.00%	0.65%	0.28%	0.15%	0.05%	5.01%	10.29
SW	0.07%	0.88%	1.07%	0.20%	0.08%	0.04%	0.00%	2.34%	9.58
W-SW	0.09%	0.62%	0.85%	0.28%	0.15%	0.08%	0.04%	2.12%	10.80
W	0.14%	0.89%	1.58%	0.78%	0.24%	0.14%	0.08%	3.86%	11.70
W-NW	0.09%	0.87%	2.00%	1.15%	0.46%	0.26%	0.09%	4.92%	12.97
NW	0.16%	1.53%	3.79%	1.53%	1.08%	0.35%	0.14%	8.58%	12.57
N-NW	0.15%	1.57%	3.80%	2.58%	1.19%	0.46%	0.09%	9.85%	13.13
CALM	5.34%	0.47%	0.00%	0.00%	0.00%	0.00%	0.00%	5.82%	0.67
Total	9.71%	22.09%	39.25%	18.28%	7.59%	2.52%	0.57%	100.00%	10.89

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-32
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
DALLAS-FORT WORTH AIRPORT
ANNUAL

1997 – 2006

All Months	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.48%	2.39%	3.72%	1.78%	0.59%	0.12%	0.01%	9.09%	11.17
N-NE	0.25%	1.21%	1.98%	0.81%	0.21%	0.04%	0.01%	4.50%	10.06
NE	0.32%	1.04%	0.93%	0.16%	0.04%	0.00%	0.00%	2.49%	7.86
E-NE	0.34%	0.94%	0.89%	0.18%	0.03%	0.01%	0.00%	2.39%	8.00
E	0.57%	1.96%	1.62%	0.22%	0.02%	0.00%	0.00%	4.39%	7.49
E-SE	0.53%	1.94%	2.01%	0.33%	0.03%	0.00%	0.00%	4.86%	8.01
SE	0.57%	2.40%	3.38%	0.87%	0.13%	0.02%	0.00%	7.38%	9.02
S-SE	0.39%	2.27%	5.57%	2.54%	0.63%	0.08%	0.01%	11.49%	10.94
S	0.48%	2.95%	9.30%	6.76%	3.05%	1.05%	0.15%	23.74%	13.17
S-SW	0.19%	1.21%	2.49%	1.13%	0.39%	0.11%	0.01%	5.54%	11.14
SW	0.09%	0.64%	0.93%	0.24%	0.10%	0.02%	0.00%	2.02%	9.83
W-SW	0.08%	0.41%	0.52%	0.17%	0.06%	0.04%	0.00%	1.29%	9.86
W	0.10%	0.40%	0.69%	0.34%	0.14%	0.07%	0.02%	1.75%	11.45
W-NW	0.07%	0.34%	0.82%	0.43%	0.20%	0.12%	0.03%	2.01%	12.74
NW	0.11%	0.69%	1.50%	0.81%	0.50%	0.21%	0.06%	3.87%	12.67
N-NW	0.20%	1.30%	2.19%	1.18%	0.66%	0.27%	0.05%	5.86%	12.04
CALM	5.83%	1.52%	0.00%	0.00%	0.00%	0.00%	0.00%	7.35%	1.55
Total	10.60%	23.60%	38.53%	17.96%	6.79%	2.16%	0.36%	100.00%	10.30

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-33
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
JANUARY

2001 – 2006

January	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.61%	2.17%	5.84%	2.22%	0.70%	0.29%	0.02%	11.86%	11.19
N-NE	0.27%	0.93%	1.18%	0.20%	0.02%	0.00%	0.00%	2.60%	8.18
NE	0.34%	0.93%	0.84%	0.00%	0.00%	0.00%	0.00%	2.11%	7.23
E-NE	0.36%	0.95%	0.63%	0.11%	0.00%	0.00%	0.00%	2.06%	7.07
E	0.23%	1.13%	1.04%	0.11%	0.00%	0.00%	0.00%	2.51%	7.72
E-SE	0.18%	0.91%	0.88%	0.07%	0.00%	0.00%	0.00%	2.04%	7.42
SE	0.41%	3.08%	5.50%	0.91%	0.11%	0.00%	0.00%	10.01%	8.68
S-SE	0.45%	3.26%	10.37%	1.83%	0.41%	0.07%	0.00%	16.39%	9.80
S	0.34%	1.68%	4.84%	1.97%	0.75%	0.07%	0.00%	9.64%	10.77
S-SW	0.09%	0.59%	1.09%	0.75%	0.43%	0.02%	0.00%	2.97%	11.03
SW	0.14%	0.36%	1.18%	0.38%	0.20%	0.05%	0.00%	2.31%	10.33
W-SW	0.34%	0.45%	1.04%	0.36%	0.20%	0.07%	0.02%	2.49%	9.42
W	0.68%	2.33%	1.79%	0.25%	0.38%	0.25%	0.02%	5.71%	8.60
W-NW	0.45%	1.20%	1.18%	0.34%	0.25%	0.07%	0.00%	3.49%	8.72
NW	0.27%	0.95%	1.63%	1.02%	0.57%	0.16%	0.07%	4.66%	11.63
N-NW	0.52%	1.40%	2.74%	2.17%	1.02%	0.27%	0.05%	8.17%	11.93
CALM	10.73%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	10.98%	0.00
Total	16.41%	22.32%	41.77%	12.70%	5.05%	1.31%	0.43%	100.00%	8.75

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-34
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
FEBRUARY

2001 – 2006

February	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.78%	2.64%	5.38%	3.57%	1.83%	0.35%	0.00%	14.55%	11.56
N-NE	0.38%	1.26%	1.63%	0.75%	0.20%	0.03%	0.00%	4.25%	9.31
NE	0.38%	1.31%	1.38%	0.25%	0.03%	0.00%	0.00%	3.34%	8.00
E-NE	0.48%	1.16%	0.63%	0.05%	0.00%	0.00%	0.00%	2.31%	6.26
E	0.33%	1.13%	0.90%	0.03%	0.00%	0.00%	0.00%	2.39%	7.25
E-SE	0.35%	1.03%	1.28%	0.15%	0.00%	0.00%	0.00%	2.81%	7.85
SE	0.53%	2.19%	6.08%	1.23%	0.28%	0.00%	0.03%	10.33%	9.61
S-SE	0.35%	2.36%	9.22%	2.61%	0.53%	0.03%	0.00%	15.10%	10.58
S	0.45%	1.46%	4.02%	3.12%	0.95%	0.15%	0.00%	10.15%	11.80
S-SW	0.08%	0.25%	0.93%	0.50%	0.28%	0.08%	0.00%	2.11%	11.47
SW	0.15%	0.43%	0.63%	0.38%	0.18%	0.00%	0.03%	1.78%	11.41
W-SW	0.23%	0.40%	0.40%	0.30%	0.10%	0.03%	0.03%	1.48%	11.11
W	0.75%	1.63%	1.33%	0.33%	0.30%	0.00%	0.03%	4.37%	8.88
W-NW	0.55%	1.13%	1.06%	0.23%	0.13%	0.03%	0.05%	3.17%	9.14
NW	0.28%	0.95%	1.71%	0.83%	0.48%	0.15%	0.05%	4.45%	11.88
N-NW	0.38%	1.28%	2.66%	1.81%	1.21%	0.50%	0.13%	7.96%	12.63
CALM	9.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.45%	0.00
Total	15.88%	20.60%	39.25%	16.13%	6.48%	1.33%	0.33%	100.00%	9.45

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-35
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
MARCH

2001 – 2006

March	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.64%	2.70%	4.07%	2.08%	1.08%	0.30%	0.00%	10.87%	11.17
N-NE	0.41%	1.33%	1.53%	0.50%	0.14%	0.00%	0.00%	3.91%	8.73
NE	0.30%	1.46%	1.92%	0.62%	0.09%	0.02%	0.00%	4.42%	8.61
E-NE	0.41%	1.14%	1.49%	0.30%	0.11%	0.07%	0.00%	3.52%	8.16
E	0.46%	1.26%	2.04%	0.43%	0.07%	0.00%	0.00%	4.26%	8.34
E-SE	0.25%	1.33%	1.99%	0.27%	0.21%	0.00%	0.00%	4.05%	8.16
SE	0.37%	2.61%	5.61%	1.10%	0.27%	0.05%	0.00%	10.00%	9.18
S-SE	0.30%	2.65%	9.06%	2.93%	0.69%	0.18%	0.00%	15.81%	10.49
S	0.18%	1.10%	5.49%	4.32%	2.31%	0.37%	0.02%	13.80%	12.89
S-SW	0.09%	0.39%	1.05%	0.87%	0.41%	0.07%	0.02%	2.91%	12.91
SW	0.23%	0.41%	0.78%	0.23%	0.18%	0.09%	0.02%	1.94%	10.72
W-SW	0.05%	0.55%	0.64%	0.34%	0.25%	0.07%	0.02%	1.92%	11.35
W	0.66%	1.37%	0.98%	0.53%	0.14%	0.21%	0.09%	3.98%	8.67
W-NW	0.32%	0.80%	0.53%	0.34%	0.34%	0.11%	0.07%	2.52%	10.55
NW	0.23%	0.78%	0.80%	0.73%	0.64%	0.21%	0.05%	3.43%	12.50
N-NW	0.18%	1.19%	2.10%	0.87%	1.08%	0.43%	0.09%	5.95%	12.83
CALM	6.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	6.73%	0.00
Total	11.78%	21.07%	40.08%	16.47%	8.01%	2.17%	0.41%	100.00%	9.84

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-36
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
APRIL

2001 – 2006

April	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.61%	1.60%	2.89%	1.85%	0.89%	0.19%	0.02%	8.05%	11.80
N-NE	0.16%	0.82%	1.31%	0.49%	0.07%	0.00%	0.00%	2.86%	9.37
NE	0.16%	0.63%	1.10%	0.31%	0.09%	0.00%	0.00%	2.30%	9.34
E-NE	0.16%	0.63%	0.96%	0.12%	0.05%	0.00%	0.00%	1.93%	8.64
E	0.31%	0.68%	1.34%	0.00%	0.05%	0.00%	0.00%	2.37%	8.09
E-SE	0.28%	1.06%	1.74%	0.31%	0.02%	0.00%	0.02%	3.43%	9.11
SE	0.40%	2.84%	7.04%	1.41%	0.12%	0.00%	0.00%	11.81%	9.42
S-SE	0.19%	3.24%	13.90%	4.30%	1.20%	0.26%	0.02%	23.10%	11.04
S	0.14%	1.13%	8.03%	7.49%	3.38%	0.31%	0.09%	20.57%	13.78
S-SW	0.00%	0.28%	0.73%	0.94%	0.40%	0.02%	0.00%	2.37%	13.28
SW	0.14%	0.28%	0.59%	0.31%	0.19%	0.00%	0.00%	1.50%	11.77
W-SW	0.12%	0.42%	0.47%	0.28%	0.07%	0.09%	0.02%	1.48%	11.98
W	0.38%	0.75%	0.82%	0.35%	0.38%	0.14%	0.05%	2.86%	10.54
W-NW	0.45%	0.40%	0.42%	0.42%	0.40%	0.09%	0.02%	2.21%	11.32
NW	0.26%	0.33%	1.01%	0.52%	0.33%	0.07%	0.12%	2.63%	12.63
N-NW	0.19%	0.42%	1.60%	0.92%	0.73%	0.19%	0.07%	4.11%	12.53
CALM	5.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.61%	6.41%	0.00
Total	9.74%	15.52%	43.95%	20.00%	8.36%	1.36%	1.06%	100.00%	10.73

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-37
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
MAY

2001 – 2006

May	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.60%	1.03%	1.88%	1.03%	0.64%	0.02%	0.00%	5.20%	10.60
N-NE	0.39%	0.96%	2.01%	0.57%	0.07%	0.00%	0.00%	4.01%	8.94
NE	0.32%	1.21%	1.85%	0.30%	0.16%	0.00%	0.00%	3.85%	9.04
E-NE	0.18%	1.24%	1.95%	0.27%	0.07%	0.02%	0.02%	3.75%	8.67
E	0.43%	1.51%	1.42%	0.18%	0.05%	0.00%	0.00%	3.59%	7.37
E-SE	0.32%	1.46%	1.85%	0.30%	0.07%	0.02%	0.00%	4.03%	8.23
SE	0.34%	2.95%	6.78%	1.65%	0.14%	0.02%	0.00%	11.88%	9.39
S-SE	0.41%	2.91%	15.86%	5.10%	1.37%	0.23%	0.05%	25.93%	11.13
S	0.27%	1.92%	9.00%	6.45%	1.92%	0.21%	0.05%	19.82%	12.44
S-SW	0.05%	0.57%	1.44%	1.28%	0.16%	0.00%	0.00%	3.50%	11.63
SW	0.14%	0.23%	0.73%	0.34%	0.02%	0.02%	0.00%	1.49%	9.99
W-SW	0.09%	0.25%	0.57%	0.16%	0.00%	0.00%	0.02%	1.10%	9.26
W	0.18%	0.41%	0.39%	0.16%	0.05%	0.00%	0.00%	1.19%	8.95
W-NW	0.16%	0.37%	0.32%	0.07%	0.02%	0.00%	0.02%	0.96%	8.38
NW	0.14%	0.34%	0.48%	0.14%	0.11%	0.00%	0.00%	1.21%	8.31
N-NW	0.05%	0.34%	0.69%	0.62%	0.23%	0.05%	0.00%	1.97%	12.17
CALM	6.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	6.52%	0.00
Total	10.57%	17.72%	47.22%	18.63%	5.08%	0.60%	0.18%	100.00%	9.83

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-38
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
JUNE

2001 – 2006

June	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.76%	2.19%	1.76%	0.43%	0.10%	0.00%	0.02%	5.26%	8.16
N-NE	0.36%	1.00%	1.81%	0.29%	0.12%	0.00%	0.00%	3.57%	8.62
NE	0.48%	1.62%	1.31%	0.36%	0.05%	0.02%	0.00%	3.83%	8.32
E-NE	0.36%	1.52%	1.19%	0.33%	0.02%	0.02%	0.00%	3.45%	7.56
E	0.43%	1.26%	1.93%	0.43%	0.05%	0.00%	0.00%	4.09%	8.32
E-SE	0.40%	2.19%	2.88%	0.43%	0.07%	0.00%	0.00%	5.97%	8.50
SE	0.69%	6.18%	8.59%	2.07%	0.33%	0.02%	0.02%	17.91%	8.81
S-SE	0.43%	5.92%	14.41%	3.57%	1.05%	0.10%	0.00%	25.48%	10.04
S	0.19%	1.81%	7.59%	4.59%	0.98%	0.14%	0.00%	15.29%	12.17
S-SW	0.07%	0.33%	1.36%	0.71%	0.05%	0.02%	0.00%	2.55%	11.74
SW	0.05%	0.29%	0.38%	0.12%	0.00%	0.00%	0.02%	0.86%	9.21
W-SW	0.02%	0.10%	0.21%	0.02%	0.00%	0.00%	0.00%	0.36%	8.16
W	0.12%	0.29%	0.26%	0.07%	0.02%	0.00%	0.00%	0.76%	7.04
W-NW	0.21%	0.21%	0.24%	0.05%	0.00%	0.00%	0.00%	0.71%	7.44
NW	0.21%	0.19%	0.24%	0.02%	0.00%	0.00%	0.00%	0.67%	6.73
N-NW	0.12%	0.43%	0.38%	0.17%	0.02%	0.00%	0.02%	1.14%	9.07
CALM	8.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8.11%	0.00
Total	13.01%	25.52%	44.53%	13.65%	2.85%	0.33%	0.10%	100.00%	8.88

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-39
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
JULY

2001 – 2006

July	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.79%	1.59%	0.99%	0.25%	0.05%	0.00%	0.00%	3.67%	7.10
N-NE	0.09%	0.58%	0.69%	0.21%	0.07%	0.00%	0.00%	1.64%	8.97
NE	0.30%	0.69%	0.49%	0.14%	0.05%	0.02%	0.00%	1.69%	7.83
E-NE	0.16%	0.74%	0.97%	0.21%	0.05%	0.02%	0.00%	2.15%	8.82
E	0.37%	1.16%	1.59%	0.16%	0.07%	0.02%	0.00%	3.37%	7.85
E-SE	0.44%	1.71%	2.10%	0.25%	0.12%	0.02%	0.00%	4.65%	8.31
SE	0.76%	6.17%	7.65%	1.02%	0.14%	0.00%	0.00%	15.74%	8.27
S-SE	1.18%	8.99%	16.04%	2.70%	0.46%	0.00%	0.00%	29.37%	8.62
S	0.30%	4.16%	10.75%	3.30%	0.76%	0.02%	0.00%	19.30%	9.92
S-SW	0.16%	0.67%	2.54%	0.60%	0.07%	0.00%	0.00%	4.04%	9.73
SW	0.09%	0.65%	1.41%	0.12%	0.00%	0.00%	0.00%	2.26%	8.46
W-SW	0.09%	0.55%	0.83%	0.12%	0.00%	0.00%	0.00%	1.59%	8.41
W	0.14%	0.55%	0.44%	0.07%	0.02%	0.00%	0.00%	1.22%	7.82
W-NW	0.09%	0.18%	0.23%	0.00%	0.00%	0.00%	0.00%	0.51%	6.64
NW	0.05%	0.21%	0.23%	0.02%	0.02%	0.00%	0.02%	0.55%	9.51
N-NW	0.16%	0.23%	0.32%	0.05%	0.00%	0.00%	0.00%	0.76%	7.01
CALM	7.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.46%	0.00
Total	12.64%	28.84%	47.28%	9.22%	1.87%	0.12%	0.02%	100.00%	8.02

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-40
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
AUGUST

2001 – 2006

August	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	1.24%	1.93%	0.83%	0.17%	0.02%	0.00%	0.00%	4.19%	6.08
N-NE	0.21%	0.59%	0.74%	0.14%	0.02%	0.00%	0.00%	1.71%	8.45
NE	0.24%	0.83%	0.88%	0.14%	0.02%	0.02%	0.00%	2.14%	8.28
E-NE	0.29%	1.05%	1.31%	0.14%	0.02%	0.00%	0.00%	2.81%	8.01
E	0.45%	2.02%	2.74%	0.36%	0.02%	0.02%	0.00%	5.62%	8.24
E-SE	0.71%	2.78%	2.76%	0.52%	0.02%	0.02%	0.00%	6.83%	7.77
SE	1.05%	6.97%	6.42%	1.07%	0.17%	0.00%	0.00%	15.68%	7.82
S-SE	1.12%	8.07%	12.54%	1.40%	0.21%	0.00%	0.00%	23.34%	8.28
S	0.50%	3.09%	8.61%	2.62%	0.21%	0.02%	0.00%	15.06%	9.89
S-SW	0.05%	0.74%	2.17%	0.76%	0.07%	0.00%	0.00%	3.78%	10.46
SW	0.05%	0.36%	0.86%	0.21%	0.00%	0.00%	0.00%	1.48%	9.45
W-SW	0.21%	0.26%	0.74%	0.10%	0.02%	0.02%	0.02%	1.38%	8.75
W	0.31%	0.64%	0.62%	0.00%	0.00%	0.00%	0.00%	1.57%	6.26
W-NW	0.10%	0.29%	0.36%	0.05%	0.02%	0.00%	0.00%	0.81%	7.57
NW	0.26%	0.17%	0.21%	0.07%	0.00%	0.00%	0.00%	0.71%	7.04
N-NW	0.24%	0.45%	0.40%	0.07%	0.00%	0.00%	0.00%	1.17%	7.12
CALM	11.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	11.73%	0.00
Total	18.70%	30.24%	42.18%	7.83%	0.86%	0.12%	0.07%	100.00%	7.32

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-41
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
SEPTEMBER

2001 – 2006

September	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	1.03%	2.27%	3.00%	1.00%	0.24%	0.02%	0.00%	7.56%	8.52
N-NE	0.74%	1.79%	2.12%	0.76%	0.14%	0.00%	0.02%	5.58%	8.68
NE	0.50%	1.45%	2.05%	0.45%	0.07%	0.02%	0.00%	4.55%	8.21
E-NE	0.57%	1.65%	1.31%	0.21%	0.05%	0.00%	0.00%	3.79%	7.64
E	0.41%	2.36%	2.58%	0.43%	0.02%	0.02%	0.00%	5.82%	8.29
E-SE	0.55%	2.46%	2.31%	0.21%	0.07%	0.00%	0.00%	5.60%	7.72
SE	0.57%	6.37%	6.65%	0.91%	0.07%	0.00%	0.00%	14.57%	8.01
S-SE	0.60%	6.70%	8.56%	1.10%	0.14%	0.00%	0.00%	17.10%	8.36
S	0.17%	1.72%	6.08%	2.12%	0.64%	0.02%	0.00%	10.75%	10.84
S-SW	0.05%	0.62%	1.31%	0.55%	0.26%	0.00%	0.00%	2.79%	10.65
SW	0.26%	0.24%	0.45%	0.14%	0.05%	0.02%	0.00%	1.17%	7.50
W-SW	0.07%	0.17%	0.21%	0.02%	0.02%	0.00%	0.00%	0.50%	7.21
W	0.48%	0.83%	0.43%	0.07%	0.02%	0.00%	0.00%	1.84%	6.73
W-NW	0.52%	0.36%	0.14%	0.02%	0.00%	0.00%	0.00%	1.05%	5.44
NW	0.21%	0.38%	0.50%	0.10%	0.12%	0.00%	0.00%	1.31%	8.70
N-NW	0.21%	0.64%	0.88%	0.41%	0.05%	0.00%	0.00%	2.19%	8.76
CALM	13.78%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	13.83%	0.00
Total	20.72%	30.00%	38.60%	8.51%	1.98%	0.12%	0.07%	100.00%	7.32

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-42
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
OCTOBER

2001 – 2006

October	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.48%	2.03%	3.67%	1.48%	0.75%	0.18%	0.00%	8.60%	10.71
N-NE	0.21%	1.14%	1.55%	0.23%	0.05%	0.00%	0.00%	3.17%	8.65
NE	0.30%	1.03%	0.71%	0.21%	0.05%	0.00%	0.00%	2.28%	7.30
E-NE	0.14%	1.32%	0.57%	0.05%	0.05%	0.02%	0.00%	2.14%	6.54
E	0.25%	1.25%	1.07%	0.00%	0.00%	0.00%	0.00%	2.58%	6.64
E-SE	0.21%	1.30%	1.57%	0.02%	0.00%	0.00%	0.00%	3.10%	7.29
SE	0.66%	3.97%	6.57%	0.39%	0.07%	0.00%	0.00%	11.66%	8.15
S-SE	0.59%	4.81%	11.13%	1.41%	0.11%	0.00%	0.00%	18.07%	9.14
S	0.30%	1.76%	6.09%	2.26%	0.66%	0.00%	0.00%	11.06%	11.15
S-SW	0.11%	0.34%	0.98%	0.78%	0.11%	0.00%	0.00%	2.33%	11.02
SW	0.14%	0.50%	0.64%	0.23%	0.02%	0.00%	0.00%	1.53%	8.63
W-SW	0.18%	0.23%	0.46%	0.18%	0.02%	0.00%	0.00%	1.07%	8.90
W	0.43%	0.78%	0.68%	0.23%	0.00%	0.00%	0.00%	2.12%	7.33
W-NW	0.23%	0.43%	0.66%	0.18%	0.07%	0.07%	0.00%	1.64%	8.10
NW	0.32%	0.62%	1.16%	0.32%	0.14%	0.07%	0.02%	2.65%	9.80
N-NW	0.36%	0.55%	1.69%	0.84%	0.41%	0.16%	0.05%	4.06%	10.61
CALM	11.43%	0.00%	0.00%	0.00%	0.00%	0.00%	10.52%	21.94%	0.00
Total	16.33%	22.06%	39.21%	8.80%	2.51%	0.50%	10.58%	100.00%	8.01

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-43
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
NOVEMBER

2001 – 2006

November	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.70%	2.90%	4.07%	1.40%	0.61%	0.19%	0.02%	9.89%	10.07
N-NE	0.33%	0.73%	1.29%	0.37%	0.00%	0.00%	0.00%	2.71%	8.89
NE	0.23%	0.94%	0.75%	0.00%	0.00%	0.00%	0.00%	1.92%	6.80
E-NE	0.30%	0.63%	0.65%	0.02%	0.00%	0.00%	0.00%	1.61%	6.61
E	0.40%	1.03%	1.10%	0.02%	0.00%	0.00%	0.00%	2.55%	7.06
E-SE	0.30%	1.10%	1.15%	0.14%	0.00%	0.00%	0.00%	2.69%	7.80
SE	0.54%	3.27%	5.85%	0.65%	0.05%	0.00%	0.00%	10.36%	8.31
S-SE	0.73%	4.07%	13.54%	1.85%	0.37%	0.00%	0.00%	20.56%	9.35
S	0.40%	1.50%	5.87%	2.27%	0.56%	0.05%	0.00%	10.64%	10.79
S-SW	0.07%	0.54%	0.91%	0.91%	0.42%	0.00%	0.00%	2.85%	12.28
SW	0.05%	0.35%	0.65%	0.63%	0.14%	0.02%	0.00%	1.85%	11.69
W-SW	0.12%	0.42%	0.54%	0.16%	0.14%	0.02%	0.02%	1.43%	11.08
W	0.75%	1.78%	1.29%	0.33%	0.12%	0.05%	0.09%	4.40%	8.58
W-NW	0.42%	1.19%	1.05%	0.49%	0.21%	0.12%	0.09%	3.58%	10.17
NW	0.28%	1.03%	1.73%	1.15%	0.61%	0.19%	0.28%	5.26%	11.93
N-NW	0.30%	1.47%	2.60%	1.31%	0.63%	0.37%	0.26%	6.95%	11.74
CALM	10.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.40%	10.74%	0.00
Total	16.26%	22.95%	43.04%	11.72%	3.86%	1.01%	1.17%	100.00%	8.68

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-44
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
DECEMBER

2001 – 2006

December	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.63%	2.22%	3.67%	1.99%	0.70%	0.05%	0.02%	9.29%	10.77
N-NE	0.23%	0.86%	1.11%	0.23%	0.07%	0.00%	0.00%	2.49%	8.69
NE	0.27%	0.52%	0.70%	0.02%	0.05%	0.02%	0.00%	1.59%	7.05
E-NE	0.34%	0.23%	0.34%	0.00%	0.02%	0.00%	0.00%	0.93%	6.33
E	0.14%	0.50%	0.54%	0.02%	0.00%	0.00%	0.00%	1.20%	7.19
E-SE	0.29%	0.72%	0.77%	0.05%	0.05%	0.00%	0.00%	1.88%	6.62
SE	0.48%	1.90%	6.25%	0.63%	0.20%	0.07%	0.00%	9.54%	8.91
S-SE	0.45%	3.35%	11.46%	2.06%	0.29%	0.02%	0.00%	17.65%	9.70
S	0.27%	1.88%	5.14%	2.70%	1.09%	0.11%	0.00%	11.19%	11.44
S-SW	0.16%	0.54%	1.22%	0.88%	0.25%	0.05%	0.00%	3.10%	11.78
SW	0.23%	0.45%	0.68%	0.20%	0.20%	0.02%	0.00%	1.79%	10.32
W-SW	0.18%	0.82%	0.68%	0.20%	0.07%	0.02%	0.00%	1.97%	8.17
W	1.00%	2.83%	1.95%	0.45%	0.16%	0.14%	0.05%	6.57%	8.12
W-NW	0.54%	1.31%	1.56%	0.48%	0.34%	0.11%	0.00%	4.35%	9.25
NW	0.59%	0.91%	2.67%	1.40%	0.72%	0.27%	0.18%	6.75%	12.58
N-NW	0.20%	1.25%	2.72%	1.74%	0.86%	0.18%	0.07%	7.02%	12.21
CALM	12.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.69%	0.00
Total	18.69%	20.30%	41.48%	13.07%	5.07%	1.06%	0.32%	100.00%	8.76

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-45
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
MINERAL WELLS AIRPORT
ANNUAL

2001 – 2006

All Months	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.74%	2.10%	3.17%	1.45%	0.63%	0.13%	0.01%	8.23%	10.45
N-NE	0.31%	1.00%	1.41%	0.39%	0.08%	0.00%	0.00%	3.20%	8.80
NE	0.32%	1.05%	1.16%	0.23%	0.05%	0.01%	0.00%	2.83%	8.14
E-NE	0.31%	1.02%	1.00%	0.15%	0.04%	0.01%	0.00%	2.53%	7.70
E	0.35%	1.27%	1.52%	0.18%	0.03%	0.01%	0.00%	3.35%	7.86
E-SE	0.36%	1.50%	1.77%	0.23%	0.05%	0.01%	0.00%	3.91%	8.00
SE	0.56%	4.03%	6.58%	1.08%	0.16%	0.01%	0.00%	12.43%	8.66
S-SE	0.57%	4.69%	12.19%	2.57%	0.57%	0.07%	0.01%	20.67%	9.70
S	0.29%	1.93%	6.80%	3.60%	1.19%	0.12%	0.01%	13.95%	11.62
S-SW	0.08%	0.49%	1.31%	0.80%	0.24%	0.02%	0.00%	2.95%	11.42
SW	0.14%	0.38%	0.75%	0.27%	0.10%	0.02%	0.01%	1.67%	10.07
W-SW	0.14%	0.39%	0.57%	0.19%	0.08%	0.03%	0.01%	1.40%	9.70
W	0.49%	1.19%	0.92%	0.24%	0.13%	0.07%	0.03%	3.06%	8.36
W-NW	0.34%	0.66%	0.65%	0.22%	0.15%	0.05%	0.02%	2.09%	9.22
NW	0.26%	0.57%	1.04%	0.53%	0.31%	0.09%	0.07%	2.87%	11.47
N-NW	0.24%	0.81%	1.57%	0.92%	0.52%	0.18%	0.06%	4.29%	11.75
CALM	9.55%	0.00%	0.00%	0.00%	0.00%	0.00%	1.01%	10.57%	0.00
Total	15.05%	23.07%	42.40%	13.06%	4.33%	0.84%	1.25%	100.00%	8.81

(USHCN 2007)

NOTES:

1. Calm is classified as a wind speed less than 2.3 mph or a variable wind direction.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-46
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
JANUARY

2001 – 2006

January	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.24%	0.89%	3.20%	3.63%	1.32%	0.16%	0.00%	9.44%	12.48
N-NE	0.22%	0.91%	1.75%	1.18%	0.05%	0.00%	0.00%	4.12%	9.71
NE	0.16%	0.46%	0.70%	0.51%	0.03%	0.00%	0.00%	1.86%	9.03
E-NE	0.30%	0.30%	0.86%	0.19%	0.00%	0.00%	0.00%	1.64%	7.78
E	0.27%	1.43%	0.70%	0.16%	0.00%	0.00%	0.00%	2.56%	6.47
E-SE	0.46%	1.91%	1.45%	0.08%	0.00%	0.00%	0.00%	3.90%	6.34
SE	0.43%	2.07%	4.98%	0.70%	0.03%	0.00%	0.00%	8.20%	8.27
S-SE	0.24%	2.31%	5.46%	2.61%	0.43%	0.00%	0.00%	11.05%	9.96
S	0.43%	1.69%	3.85%	3.85%	1.29%	0.05%	0.00%	11.16%	11.47
S-SW	0.51%	1.88%	2.26%	2.18%	0.91%	0.03%	0.00%	7.77%	10.45
SW	0.67%	1.94%	1.34%	1.86%	0.51%	0.00%	0.00%	6.32%	9.60
W-SW	0.54%	1.88%	1.59%	1.21%	0.27%	0.00%	0.00%	5.49%	8.92
W	0.48%	0.62%	0.46%	0.32%	0.11%	0.00%	0.00%	1.99%	7.67
W-NW	0.51%	1.21%	1.37%	0.59%	0.16%	0.08%	0.00%	3.93%	8.32
NW	0.35%	2.18%	2.82%	1.56%	1.00%	0.24%	0.11%	8.26%	10.77
N-NW	0.30%	1.32%	2.85%	3.42%	2.80%	0.78%	0.11%	11.57%	13.99
CALM	0.75%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.75%	0.00
Total	6.11%	23.00%	35.64%	24.05%	8.90%	1.34%	0.22%	100.00%	10.25

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-47
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
FEBRUARY

2001 – 2006

February	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.27%	1.45%	5.44%	3.96%	2.54%	0.80%	0.03%	14.48%	12.88
N-NE	0.12%	0.95%	1.60%	1.71%	0.35%	0.09%	0.03%	4.85%	11.30
NE	0.27%	0.86%	1.48%	0.35%	0.03%	0.00%	0.00%	2.98%	8.14
E-NE	0.21%	0.83%	1.12%	0.15%	0.00%	0.00%	0.00%	2.30%	7.39
E	0.50%	1.74%	0.59%	0.00%	0.00%	0.00%	0.00%	2.84%	5.46
E-SE	0.33%	3.34%	1.39%	0.24%	0.09%	0.00%	0.00%	5.38%	6.49
SE	0.33%	2.98%	5.17%	1.45%	0.30%	0.00%	0.00%	10.22%	8.88
S-SE	0.47%	1.60%	5.02%	3.25%	1.21%	0.12%	0.00%	11.67%	11.18
S	0.30%	1.39%	3.63%	3.90%	1.95%	0.41%	0.24%	11.82%	13.08
S-SW	0.38%	0.80%	1.33%	1.27%	0.41%	0.03%	0.00%	4.23%	10.53
SW	0.30%	0.68%	1.03%	0.38%	0.12%	0.00%	0.00%	2.51%	8.45
W-SW	0.44%	1.12%	0.56%	0.27%	0.12%	0.09%	0.00%	2.60%	7.65
W	0.47%	0.50%	0.15%	0.09%	0.09%	0.00%	0.00%	1.30%	6.09
W-NW	0.59%	1.06%	1.09%	0.71%	0.12%	0.03%	0.00%	3.61%	8.27
NW	0.33%	1.95%	1.98%	1.24%	1.03%	0.27%	0.00%	6.80%	11.05
N-NW	0.15%	0.98%	2.54%	3.52%	2.51%	1.95%	0.24%	11.88%	15.53
CALM	0.53%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.53%	0.00
Total	5.44%	22.22%	34.13%	22.49%	10.87%	3.78%	0.53%	100.00%	10.92

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-48
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
MARCH

2001 – 2006

March	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.19%	1.48%	3.69%	1.96%	1.40%	0.32%	0.05%	9.10%	11.87
N-NE	0.27%	1.40%	3.77%	1.80%	0.62%	0.16%	0.03%	8.05%	10.74
NE	0.22%	0.86%	2.56%	1.05%	0.24%	0.00%	0.00%	4.92%	9.97
E-NE	0.19%	1.48%	1.70%	0.27%	0.00%	0.00%	0.00%	3.63%	7.76
E	0.22%	1.32%	1.21%	0.16%	0.03%	0.00%	0.00%	2.93%	7.28
E-SE	0.24%	2.61%	1.43%	0.19%	0.00%	0.00%	0.00%	4.47%	6.57
SE	0.27%	2.99%	5.71%	1.13%	0.03%	0.05%	0.00%	10.17%	8.64
S-SE	0.32%	1.99%	5.73%	4.74%	2.18%	0.48%	0.00%	15.45%	12.18
S	0.38%	1.56%	3.61%	4.71%	4.17%	0.65%	0.03%	15.10%	13.93
S-SW	0.40%	0.89%	1.61%	0.91%	0.35%	0.00%	0.00%	4.17%	9.80
SW	0.32%	0.73%	1.40%	0.54%	0.16%	0.03%	0.00%	3.18%	9.21
W-SW	0.16%	0.97%	0.81%	0.35%	0.22%	0.11%	0.00%	2.61%	9.32
W	0.13%	0.32%	0.48%	0.16%	0.03%	0.05%	0.00%	1.18%	8.91
W-NW	0.11%	0.54%	0.73%	0.38%	0.13%	0.11%	0.00%	1.99%	10.29
NW	0.19%	1.56%	1.29%	0.97%	0.70%	0.08%	0.08%	4.87%	10.79
N-NW	0.16%	1.10%	1.67%	2.42%	1.72%	0.59%	0.27%	7.94%	14.26
CALM	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.24%	0.00
Total	3.77%	21.80%	37.38%	21.74%	11.98%	2.64%	0.46%	100.00%	11.00

NOTES:

1. Calm is classified as a wind speed less than 1 mph.

2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-49
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
APRIL

2001 – 2006

April	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.00%	0.75%	2.04%	1.95%	0.75%	0.34%	0.00%	5.82%	12.73
N-NE	0.14%	0.89%	1.83%	1.12%	0.40%	0.09%	0.03%	4.50%	10.77
NE	0.20%	0.77%	1.46%	0.37%	0.14%	0.00%	0.00%	2.95%	8.65
E-NE	0.14%	0.89%	1.00%	0.17%	0.00%	0.00%	0.00%	2.21%	7.28
E	0.14%	1.63%	0.80%	0.06%	0.00%	0.00%	0.00%	2.64%	6.25
E-SE	0.40%	2.38%	2.18%	0.17%	0.00%	0.00%	0.00%	5.13%	6.89
SE	0.11%	2.38%	6.08%	1.55%	0.03%	0.00%	0.00%	10.15%	9.08
S-SE	0.40%	2.29%	9.12%	7.08%	3.47%	0.37%	0.06%	22.79%	12.29
S	0.34%	1.75%	4.87%	9.26%	5.22%	1.12%	0.32%	22.88%	14.37
S-SW	0.32%	0.97%	1.69%	1.38%	0.72%	0.03%	0.00%	5.10%	10.91
SW	0.52%	0.72%	0.97%	0.29%	0.00%	0.00%	0.00%	2.49%	7.12
W-SW	0.23%	0.52%	0.77%	0.49%	0.17%	0.00%	0.00%	2.18%	9.43
W	0.23%	0.69%	0.37%	0.09%	0.09%	0.00%	0.00%	1.46%	6.99
W-NW	0.23%	0.52%	0.26%	0.60%	0.06%	0.03%	0.00%	1.69%	9.43
NW	0.29%	0.80%	0.83%	0.54%	0.23%	0.00%	0.00%	2.69%	9.21
N-NW	0.06%	0.75%	1.58%	1.03%	1.12%	0.49%	0.09%	5.10%	13.70
CALM	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.20%	0.00
Total	3.76%	18.69%	35.87%	26.15%	12.39%	2.47%	0.49%	100.00%	11.32

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-50
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
MAY

2001 – 2006

May	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.27%	1.08%	1.80%	1.10%	0.83%	0.19%	0.03%	5.30%	11.40
N-NE	0.22%	0.75%	2.29%	0.91%	0.16%	0.03%	0.00%	4.36%	9.69
NE	0.27%	1.08%	2.42%	0.59%	0.13%	0.03%	0.00%	4.52%	8.83
E-NE	0.11%	1.29%	1.10%	0.46%	0.05%	0.00%	0.00%	3.01%	8.09
E	0.11%	1.61%	1.43%	0.05%	0.00%	0.00%	0.00%	3.20%	6.93
E-SE	0.32%	2.37%	1.83%	0.35%	0.00%	0.00%	0.00%	4.87%	7.15
SE	0.32%	2.23%	6.27%	2.04%	0.11%	0.00%	0.00%	10.97%	9.35
S-SE	0.16%	2.10%	8.85%	10.16%	4.19%	0.19%	0.00%	25.65%	12.85
S	0.27%	1.40%	5.38%	8.85%	3.85%	0.27%	0.00%	20.01%	13.45
S-SW	0.19%	0.97%	1.83%	1.59%	0.46%	0.00%	0.00%	5.03%	10.81
SW	0.46%	0.81%	0.91%	0.67%	0.05%	0.03%	0.00%	2.93%	8.55
W-SW	0.19%	0.97%	0.13%	0.30%	0.05%	0.00%	0.00%	1.64%	7.35
W	0.24%	0.27%	0.08%	0.05%	0.00%	0.00%	0.00%	0.65%	5.02
W-NW	0.30%	0.67%	0.22%	0.03%	0.00%	0.00%	0.00%	1.21%	5.20
NW	0.16%	0.81%	0.56%	0.24%	0.05%	0.00%	0.00%	1.83%	7.88
N-NW	0.13%	0.81%	1.21%	1.21%	0.86%	0.22%	0.05%	4.49%	12.73
CALM	0.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.35%	0.00
Total	3.71%	19.20%	36.30%	28.61%	10.81%	0.94%	0.08%	100.00%	10.98

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-51
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
JUNE

2001 – 2006

June	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.31%	1.37%	2.26%	0.92%	0.11%	0.03%	0.00%	5.00%	8.89
N-NE	0.14%	1.84%	2.74%	1.09%	0.28%	0.03%	0.03%	6.14%	9.21
NE	0.31%	1.70%	1.87%	0.53%	0.34%	0.00%	0.03%	4.78%	8.72
E-NE	0.45%	1.51%	1.56%	0.34%	0.00%	0.00%	0.00%	3.85%	7.06
E	0.25%	2.93%	1.12%	0.11%	0.00%	0.00%	0.00%	4.41%	6.22
E-SE	0.25%	4.38%	3.13%	0.45%	0.00%	0.00%	0.00%	8.21%	6.95
SE	0.59%	6.09%	10.67%	2.96%	0.22%	0.00%	0.00%	20.52%	8.73
S-SE	0.36%	3.32%	10.16%	5.78%	1.34%	0.11%	0.00%	21.08%	10.62
S	0.28%	1.79%	4.30%	4.36%	2.15%	0.34%	0.00%	13.21%	12.44
S-SW	0.47%	1.12%	1.59%	0.53%	0.20%	0.00%	0.00%	3.91%	8.38
SW	0.47%	0.47%	0.45%	0.08%	0.06%	0.00%	0.00%	1.54%	6.35
W-SW	0.34%	0.81%	0.25%	0.06%	0.00%	0.00%	0.00%	1.45%	5.29
W	0.20%	0.39%	0.20%	0.00%	0.00%	0.00%	0.00%	0.78%	5.70
W-NW	0.31%	0.47%	0.34%	0.06%	0.00%	0.00%	0.00%	1.17%	5.66
NW	0.31%	0.64%	0.17%	0.03%	0.03%	0.00%	0.00%	1.17%	5.57
N-NW	0.31%	0.67%	0.73%	0.50%	0.11%	0.00%	0.00%	2.32%	8.55
CALM	0.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.45%	0.00
Total	5.33%	29.52%	41.52%	17.79%	4.83%	0.50%	0.06%	100.00%	9.10

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-52
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
JULY

2001 – 2006

July	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.16%	0.38%	0.97%	0.40%	0.05%	0.00%	0.00%	1.97%	9.39
N-NE	0.11%	0.54%	0.97%	0.40%	0.00%	0.00%	0.00%	2.02%	8.75
NE	0.13%	1.10%	0.62%	0.27%	0.00%	0.00%	0.00%	2.13%	7.21
E-NE	0.24%	0.81%	0.54%	0.22%	0.00%	0.00%	0.00%	1.80%	7.01
E	0.38%	1.56%	0.54%	0.05%	0.00%	0.00%	0.00%	2.53%	5.72
E-SE	0.19%	2.96%	1.75%	0.05%	0.00%	0.00%	0.00%	4.96%	6.57
SE	0.22%	4.44%	8.62%	1.78%	0.05%	0.03%	0.00%	15.14%	8.68
S-SE	0.43%	4.66%	13.74%	5.20%	0.32%	0.00%	0.00%	24.35%	9.73
S	0.35%	3.72%	13.06%	5.44%	0.57%	0.00%	0.00%	23.13%	10.18
S-SW	0.43%	2.94%	6.06%	1.32%	0.03%	0.00%	0.00%	10.77%	8.60
SW	0.54%	2.10%	2.80%	0.13%	0.00%	0.00%	0.00%	5.58%	7.09
W-SW	0.40%	0.86%	1.05%	0.05%	0.00%	0.00%	0.00%	2.37%	6.33
W	0.16%	0.40%	0.22%	0.00%	0.00%	0.00%	0.00%	0.78%	5.40
W-NW	0.16%	0.22%	0.11%	0.03%	0.00%	0.00%	0.00%	0.51%	5.33
NW	0.08%	0.22%	0.22%	0.03%	0.00%	0.00%	0.00%	0.54%	6.54
N-NW	0.11%	0.40%	0.46%	0.13%	0.00%	0.00%	0.00%	1.10%	7.71
CALM	0.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.00
Total	4.09%	27.31%	51.71%	15.51%	1.02%	0.03%	0.00%	100.00%	8.82

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-53
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
AUGUST

2001 – 2006

August	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.16%	0.97%	0.97%	0.03%	0.05%	0.03%	0.00%	2.20%	7.49
N-NE	0.22%	1.67%	1.21%	0.27%	0.16%	0.03%	0.00%	3.55%	7.77
NE	0.38%	2.12%	1.32%	0.27%	0.13%	0.00%	0.00%	4.22%	7.10
E-NE	0.24%	2.26%	2.39%	0.40%	0.00%	0.00%	0.00%	5.30%	7.46
E	0.35%	3.12%	1.42%	0.16%	0.00%	0.00%	0.00%	5.05%	6.22
E-SE	0.51%	4.70%	2.55%	0.22%	0.03%	0.00%	0.00%	8.01%	6.55
SE	0.46%	5.27%	7.39%	1.34%	0.19%	0.00%	0.00%	14.65%	8.12
S-SE	0.38%	4.06%	10.46%	3.49%	0.16%	0.00%	0.00%	18.55%	9.24
S	0.38%	2.53%	9.62%	5.62%	0.30%	0.00%	0.00%	18.44%	10.49
S-SW	0.65%	2.31%	3.33%	0.86%	0.00%	0.00%	0.00%	7.15%	7.76
SW	0.75%	1.83%	1.45%	0.22%	0.00%	0.00%	0.00%	4.25%	6.21
W-SW	0.59%	1.26%	0.32%	0.00%	0.00%	0.00%	0.00%	2.18%	4.58
W	0.70%	0.56%	0.08%	0.03%	0.00%	0.00%	0.00%	1.37%	3.81
W-NW	0.30%	0.75%	0.27%	0.00%	0.00%	0.00%	0.00%	1.32%	4.99
NW	0.30%	0.94%	0.32%	0.05%	0.00%	0.00%	0.00%	1.61%	5.43
N-NW	0.13%	0.89%	0.46%	0.05%	0.03%	0.00%	0.00%	1.56%	6.39
CALM	0.59%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.59%	0.00
Total	6.48%	35.24%	43.58%	13.01%	1.05%	0.05%	0.00%	100.00%	8.04

NOTES:

1. Calm is classified as a wind speed less than 1 mph.

2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-54
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
SEPTEMBER

2001 – 2006

September	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.14%	2.00%	3.64%	2.17%	0.47%	0.00%	0.00%	8.43%	10.05
N-NE	0.64%	1.86%	3.95%	1.67%	0.61%	0.00%	0.00%	8.74%	9.55
NE	0.53%	1.73%	2.73%	0.86%	0.03%	0.00%	0.00%	5.87%	8.04
E-NE	0.83%	2.17%	2.17%	0.50%	0.11%	0.00%	0.00%	5.79%	7.22
E	0.31%	2.92%	2.06%	0.11%	0.00%	0.00%	0.00%	5.40%	6.60
E-SE	0.47%	5.65%	1.78%	0.17%	0.00%	0.00%	0.00%	8.07%	5.88
SE	0.45%	6.46%	7.85%	1.00%	0.06%	0.00%	0.00%	15.80%	7.61
S-SE	0.86%	3.76%	6.76%	2.17%	0.17%	0.06%	0.00%	13.77%	8.65
S	0.78%	1.25%	3.26%	2.62%	1.00%	0.06%	0.00%	8.96%	10.88
S-SW	0.89%	1.84%	1.14%	0.61%	0.17%	0.00%	0.00%	4.65%	7.33
SW	1.11%	0.89%	0.36%	0.22%	0.00%	0.00%	0.00%	2.59%	5.05
W-SW	0.58%	0.78%	0.33%	0.00%	0.00%	0.00%	0.00%	1.70%	4.82
W	0.33%	0.42%	0.08%	0.00%	0.00%	0.00%	0.00%	0.83%	3.89
W-NW	0.42%	0.70%	0.56%	0.08%	0.08%	0.00%	0.00%	1.84%	6.46
NW	0.47%	1.81%	0.42%	0.78%	0.03%	0.00%	0.00%	3.51%	7.31
N-NW	0.19%	1.14%	0.89%	0.86%	0.06%	0.00%	0.00%	3.14%	8.81
CALM	0.92%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.92%	0.00
Total	9.02%	35.36%	37.98%	13.83%	2.78%	0.11%	0.00%	100.00%	8.02

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-55
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
OCTOBER

2001 – 2006

October	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.27%	1.02%	3.44%	2.66%	1.29%	0.40%	0.03%	9.12%	12.43
N-NE	0.11%	1.43%	2.72%	1.02%	0.08%	0.05%	0.00%	5.40%	9.32
NE	0.22%	1.32%	1.13%	0.35%	0.03%	0.00%	0.00%	3.04%	7.83
E-NE	0.27%	1.21%	1.16%	0.08%	0.00%	0.00%	0.00%	2.72%	6.77
E	0.30%	2.23%	1.34%	0.00%	0.00%	0.00%	0.00%	3.87%	6.08
E-SE	0.48%	3.76%	0.99%	0.00%	0.00%	0.00%	0.00%	5.24%	5.47
SE	0.38%	5.03%	6.10%	0.62%	0.00%	0.00%	0.00%	12.13%	7.49
S-SE	0.59%	2.93%	8.39%	3.47%	0.16%	0.00%	0.00%	15.54%	9.47
S	0.70%	1.94%	4.84%	4.38%	1.29%	0.00%	0.00%	13.15%	11.01
S-SW	0.83%	2.02%	2.02%	1.21%	0.22%	0.00%	0.00%	6.29%	8.30
SW	0.91%	1.99%	1.05%	0.59%	0.13%	0.00%	0.00%	4.68%	6.98
W-SW	0.40%	1.64%	1.05%	0.24%	0.00%	0.00%	0.00%	3.33%	6.44
W	0.35%	0.73%	0.54%	0.00%	0.00%	0.00%	0.00%	1.61%	5.55
W-NW	0.56%	0.91%	0.83%	0.27%	0.08%	0.03%	0.00%	2.69%	7.16
NW	0.56%	1.59%	1.48%	1.18%	0.24%	0.05%	0.00%	5.11%	8.82
N-NW	0.24%	0.99%	1.69%	1.32%	0.89%	0.30%	0.08%	5.51%	12.43
CALM	0.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.56%	0.00
Total	7.18%	30.73%	38.77%	17.40%	4.41%	0.83%	0.11%	100.00%	8.89

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-56
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
NOVEMBER

2001 – 2006

November	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.14%	1.12%	4.61%	2.46%	1.15%	0.09%	0.00%	9.57%	11.48
N-NE	0.26%	0.80%	1.69%	0.80%	0.43%	0.03%	0.00%	4.01%	10.20
NE	0.32%	0.74%	1.00%	0.14%	0.00%	0.00%	0.00%	2.21%	7.17
E-NE	0.11%	0.72%	1.17%	0.17%	0.03%	0.00%	0.00%	2.21%	7.72
E	0.29%	1.75%	1.58%	0.06%	0.00%	0.00%	0.00%	3.67%	6.47
E-SE	0.26%	2.23%	0.86%	0.06%	0.00%	0.00%	0.00%	3.41%	6.21
SE	0.20%	2.66%	5.76%	0.60%	0.00%	0.00%	0.00%	9.23%	8.20
S-SE	0.34%	2.23%	8.08%	3.44%	0.29%	0.00%	0.00%	14.38%	9.89
S	0.34%	1.40%	4.61%	5.16%	1.09%	0.11%	0.00%	12.72%	11.60
S-SW	0.54%	2.23%	1.83%	1.66%	0.26%	0.09%	0.00%	6.62%	9.05
SW	0.66%	1.26%	1.43%	0.69%	0.23%	0.03%	0.00%	4.30%	8.36
W-SW	0.52%	1.92%	1.00%	0.40%	0.09%	0.03%	0.00%	3.95%	7.04
W	0.34%	0.66%	0.34%	0.17%	0.11%	0.00%	0.00%	1.63%	6.98
W-NW	0.34%	0.97%	1.20%	0.92%	0.32%	0.06%	0.09%	3.90%	10.30
NW	0.34%	2.09%	2.12%	1.29%	1.17%	0.49%	0.26%	7.77%	11.85
N-NW	0.11%	1.29%	2.12%	3.64%	1.95%	0.72%	0.26%	10.09%	14.21
CALM	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.34%	0.00
Total	5.13%	24.10%	39.43%	21.66%	7.11%	1.63%	0.60%	100.00%	10.05

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-57
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
DECEMBER

2001 – 2006

December	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.16%	1.05%	3.23%	2.53%	1.24%	0.19%	0.00%	8.40%	12.24
N-NE	0.08%	0.54%	2.13%	0.75%	0.16%	0.05%	0.00%	3.72%	10.61
NE	0.05%	0.40%	0.65%	0.08%	0.03%	0.00%	0.00%	1.21%	7.99
E-NE	0.27%	0.19%	0.43%	0.03%	0.00%	0.00%	0.00%	0.92%	6.64
E	0.13%	0.65%	0.40%	0.00%	0.00%	0.00%	0.00%	1.19%	5.83
E-SE	0.16%	1.72%	0.62%	0.08%	0.00%	0.00%	0.00%	2.59%	6.17
SE	0.40%	3.34%	4.17%	0.59%	0.11%	0.00%	0.00%	8.62%	7.79
S-SE	0.38%	2.80%	7.41%	3.56%	0.67%	0.03%	0.00%	14.84%	10.19
S	0.35%	2.59%	5.55%	3.82%	2.21%	0.08%	0.00%	14.60%	11.38
S-SW	0.73%	2.40%	2.18%	1.40%	0.57%	0.27%	0.00%	7.54%	9.37
SW	0.67%	1.89%	1.08%	0.51%	0.08%	0.11%	0.05%	4.39%	7.46
W-SW	0.78%	2.29%	2.18%	0.38%	0.08%	0.00%	0.00%	5.71%	6.97
W	0.51%	1.16%	0.75%	0.05%	0.03%	0.00%	0.00%	2.50%	6.14
W-NW	0.38%	1.75%	1.99%	0.94%	0.30%	0.11%	0.08%	5.55%	9.46
NW	0.19%	2.56%	3.42%	1.91%	1.62%	0.35%	0.03%	10.07%	11.34
N-NW	0.27%	0.73%	2.13%	1.99%	1.97%	0.62%	0.05%	7.76%	13.93
CALM	0.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.40%	0.00
Total	5.52%	26.04%	38.32%	18.64%	9.05%	1.80%	0.22%	100.00%	9.99

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-58
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, LOWER LEVEL
ANNUAL

2001 – 2006

All Months	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.19%	1.13%	2.92%	1.97%	0.93%	0.21%	0.01%	7.35%	11.66
N-NE	0.21%	1.13%	2.22%	1.06%	0.27%	0.05%	0.01%	4.95%	9.88
NE	0.25%	1.10%	1.49%	0.45%	0.09%	0.00%	0.00%	3.39%	8.34
E-NE	0.28%	1.14%	1.27%	0.25%	0.02%	0.00%	0.00%	2.95%	7.38
E	0.27%	1.91%	1.10%	0.08%	0.00%	0.00%	0.00%	3.35%	6.34
E-SE	0.34%	3.17%	1.66%	0.17%	0.01%	0.00%	0.00%	5.35%	6.45
SE	0.35%	3.83%	6.56%	1.31%	0.09%	0.01%	0.00%	12.15%	8.40
S-SE	0.41%	2.85%	8.28%	4.59%	1.21%	0.11%	0.00%	17.46%	10.66
S	0.41%	1.93%	5.58%	5.16%	2.08%	0.25%	0.05%	15.46%	12.08
S-SW	0.53%	1.71%	2.26%	1.24%	0.36%	0.04%	0.00%	6.13%	9.20
SW	0.62%	1.29%	1.20%	0.52%	0.11%	0.02%	0.00%	3.75%	7.69
W-SW	0.43%	1.26%	0.84%	0.31%	0.08%	0.02%	0.00%	2.94%	7.26
W	0.35%	0.56%	0.31%	0.08%	0.04%	0.00%	0.00%	1.34%	6.21
W-NW	0.35%	0.82%	0.75%	0.38%	0.10%	0.04%	0.01%	2.44%	8.32
NW	0.30%	1.43%	1.30%	0.82%	0.51%	0.12%	0.04%	4.51%	10.16
N-NW	0.18%	0.92%	1.52%	1.66%	1.16%	0.46%	0.09%	6.00%	13.39
CALM	0.47%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.47%	0.00
Total	5.46%	26.14%	39.27%	20.04%	7.06%	1.32%	0.23%	100.00%	9.77

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-59
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
JANUARY

2001 – 2006

January	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.18%	0.89%	2.86%	3.35%	1.75%	0.46%	0.12%	9.63%	13.50
N-NE	0.31%	0.89%	1.69%	1.82%	0.22%	0.00%	0.00%	4.92%	10.64
NE	0.28%	0.40%	0.71%	0.80%	0.15%	0.00%	0.00%	2.34%	10.13
E-NE	0.25%	0.58%	0.92%	0.49%	0.09%	0.00%	0.00%	2.34%	9.11
E	0.34%	0.86%	1.02%	0.25%	0.00%	0.00%	0.00%	2.46%	7.08
E-SE	0.22%	1.14%	1.17%	0.31%	0.00%	0.00%	0.00%	2.83%	7.64
SE	0.25%	1.29%	2.98%	2.58%	0.52%	0.00%	0.00%	7.63%	10.80
S-SE	0.12%	1.23%	2.71%	3.88%	2.22%	0.28%	0.00%	10.43%	13.28
S	0.12%	1.14%	2.31%	3.91%	2.03%	0.92%	0.00%	10.43%	14.02
S-SW	0.18%	0.52%	1.60%	2.68%	2.00%	1.17%	0.12%	8.28%	15.65
SW	0.22%	0.86%	1.20%	1.42%	1.57%	0.58%	0.09%	5.94%	14.22
W-SW	0.18%	0.68%	0.92%	1.02%	1.63%	1.32%	0.09%	5.85%	16.04
W	0.25%	0.52%	0.34%	0.43%	1.17%	0.28%	0.00%	2.98%	14.01
W-NW	0.03%	0.55%	0.65%	0.74%	0.43%	0.12%	0.00%	2.52%	12.38
NW	0.34%	0.77%	1.05%	3.11%	1.51%	0.86%	0.31%	7.94%	15.03
N-NW	0.09%	1.08%	2.92%	3.60%	2.92%	1.63%	0.95%	13.20%	16.05
CALM	0.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.28%	0.00
Total	3.35%	13.42%	25.05%	30.37%	18.22%	7.63%	1.69%	100.00%	13.46

NOTES:

1. Calm is classified as a wind speed less than 1 mph.

2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-60
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
FEBRUARY

2001 – 2006

February	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.24%	1.04%	3.42%	4.14%	2.05%	1.55%	0.36%	12.80%	14.54
N-NE	0.33%	1.16%	2.44%	2.05%	1.01%	0.30%	0.03%	7.32%	11.90
NE	0.24%	1.04%	1.43%	0.74%	0.12%	0.00%	0.00%	3.57%	8.91
E-NE	0.33%	0.83%	1.58%	0.45%	0.00%	0.00%	0.00%	3.18%	8.35
E	0.21%	1.31%	1.07%	0.03%	0.00%	0.00%	0.00%	2.62%	6.54
E-SE	0.12%	2.83%	1.46%	0.30%	0.06%	0.00%	0.00%	4.76%	7.05
SE	0.15%	1.34%	3.69%	2.92%	1.07%	0.15%	0.06%	9.38%	11.84
S-SE	0.21%	0.77%	2.56%	4.11%	2.50%	1.31%	0.27%	11.73%	15.25
S	0.00%	0.51%	2.26%	3.66%	3.36%	1.10%	0.45%	11.34%	16.32
S-SW	0.12%	0.54%	0.77%	1.61%	1.79%	0.54%	0.06%	5.42%	15.34
SW	0.12%	0.33%	0.68%	0.65%	0.51%	0.09%	0.03%	2.41%	12.95
W-SW	0.12%	0.39%	0.48%	0.36%	0.36%	0.15%	0.09%	1.93%	13.01
W	0.09%	0.51%	0.27%	0.21%	0.12%	0.12%	0.00%	1.31%	10.72
W-NW	0.06%	0.48%	0.48%	0.68%	0.39%	0.09%	0.00%	2.17%	12.29
NW	0.12%	0.51%	1.22%	1.67%	1.10%	0.48%	0.27%	5.36%	14.85
N-NW	0.15%	0.89%	2.11%	4.17%	2.77%	2.20%	1.79%	14.08%	17.49
CALM	0.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.63%	0.00
Total	2.59%	14.46%	25.92%	27.74%	17.20%	8.07%	3.39%	100.00%	13.63

NOTES:

1. Calm is classified as a wind speed less than 1 mph.

2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-61
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
MARCH

2001 – 2006

March	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.14%	1.08%	2.82%	2.44%	1.33%	0.41%	0.27%	8.48%	13.25
N-NE	0.30%	1.00%	2.95%	2.82%	0.84%	0.46%	0.03%	8.40%	12.34
NE	0.14%	0.68%	2.30%	2.19%	0.38%	0.16%	0.00%	5.85%	11.52
E-NE	0.19%	0.95%	1.79%	1.00%	0.24%	0.00%	0.03%	4.20%	9.85
E	0.08%	1.06%	1.60%	0.41%	0.03%	0.00%	0.00%	3.17%	8.47
E-SE	0.14%	1.60%	1.92%	0.30%	0.03%	0.00%	0.00%	3.98%	7.90
SE	0.11%	1.16%	2.68%	3.47%	0.70%	0.05%	0.05%	8.24%	11.94
S-SE	0.08%	1.11%	3.58%	4.85%	4.15%	1.46%	0.35%	15.58%	15.22
S	0.08%	1.06%	2.52%	3.68%	5.15%	2.52%	0.76%	15.77%	17.06
S-SW	0.03%	0.51%	0.68%	1.52%	1.27%	0.60%	0.08%	4.69%	15.52
SW	0.14%	0.19%	0.84%	0.87%	0.30%	0.08%	0.03%	2.44%	12.43
W-SW	0.11%	0.22%	0.60%	0.84%	0.76%	0.38%	0.16%	3.06%	15.92
W	0.08%	0.19%	0.33%	0.41%	0.27%	0.00%	0.03%	1.30%	12.45
W-NW	0.05%	0.27%	0.33%	0.51%	0.14%	0.05%	0.08%	1.44%	13.23
NW	0.05%	0.33%	0.81%	1.11%	0.62%	0.49%	0.22%	3.63%	15.56
N-NW	0.08%	0.81%	1.84%	2.66%	1.92%	1.84%	0.33%	9.48%	16.22
CALM	0.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%	0.00
Total	1.79%	12.22%	27.58%	29.07%	18.13%	8.51%	2.41%	100.00%	13.85

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-62
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
APRIL

2001 – 2006

April	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.11%	0.55%	1.24%	2.04%	1.41%	0.40%	0.14%	5.89%	14.48
N-NE	0.09%	0.55%	1.52%	1.64%	0.52%	0.32%	0.11%	4.74%	13.39
NE	0.20%	0.57%	1.21%	0.78%	0.34%	0.00%	0.00%	3.10%	10.37
E-NE	0.11%	0.60%	1.24%	0.46%	0.06%	0.00%	0.00%	2.47%	9.03
E	0.17%	0.98%	1.21%	0.29%	0.00%	0.00%	0.00%	2.64%	7.82
E-SE	0.17%	2.01%	2.01%	0.26%	0.06%	0.00%	0.00%	4.51%	7.70
SE	0.06%	0.98%	2.56%	4.37%	1.21%	0.06%	0.03%	9.25%	12.89
S-SE	0.06%	1.18%	3.19%	8.47%	6.55%	2.30%	1.06%	22.81%	16.54
S	0.11%	0.75%	2.87%	6.29%	7.87%	5.11%	0.80%	23.81%	17.86
S-SW	0.20%	0.23%	1.38%	1.81%	1.58%	0.83%	0.03%	6.06%	15.45
SW	0.09%	0.26%	0.89%	0.57%	0.32%	0.03%	0.00%	2.15%	11.79
W-SW	0.03%	0.23%	0.55%	0.57%	0.52%	0.20%	0.03%	2.13%	14.65
W	0.06%	0.29%	0.49%	0.34%	0.17%	0.11%	0.00%	1.47%	12.17
W-NW	0.14%	0.29%	0.09%	0.34%	0.32%	0.09%	0.03%	1.29%	13.06
NW	0.00%	0.11%	0.78%	0.55%	0.55%	0.14%	0.00%	2.13%	14.07
N-NW	0.03%	0.46%	1.29%	1.58%	0.63%	0.78%	0.46%	5.23%	15.99
CALM	0.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.00
Total	1.64%	10.03%	22.49%	30.36%	22.09%	10.37%	2.70%	100.00%	14.79

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-63
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
MAY

2001 – 2006

May	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.19%	0.65%	1.67%	0.94%	0.75%	0.35%	0.16%	4.71%	13.37
N-NE	0.11%	1.02%	1.59%	1.37%	0.48%	0.16%	0.11%	4.84%	12.14
NE	0.22%	0.94%	1.99%	1.29%	0.30%	0.03%	0.03%	4.79%	10.70
E-NE	0.16%	1.10%	1.53%	0.78%	0.13%	0.11%	0.00%	3.82%	9.77
E	0.11%	0.89%	1.53%	0.38%	0.11%	0.00%	0.00%	3.01%	8.69
E-SE	0.22%	1.29%	2.34%	0.43%	0.00%	0.00%	0.05%	4.33%	8.42
SE	0.27%	1.05%	2.74%	4.09%	1.56%	0.11%	0.03%	9.84%	12.76
S-SE	0.30%	1.02%	2.72%	8.69%	7.48%	2.53%	0.13%	22.86%	16.07
S	0.11%	0.59%	2.58%	7.56%	7.80%	3.66%	0.35%	22.64%	17.30
S-SW	0.03%	0.30%	1.10%	2.34%	1.67%	0.73%	0.00%	6.16%	15.59
SW	0.13%	0.40%	0.67%	0.81%	0.56%	0.19%	0.03%	2.80%	13.33
W-SW	0.00%	0.27%	0.43%	0.30%	0.30%	0.03%	0.00%	1.32%	11.99
W	0.08%	0.22%	0.27%	0.16%	0.05%	0.00%	0.00%	0.78%	8.86
W-NW	0.00%	0.22%	0.16%	0.03%	0.05%	0.00%	0.24%	0.70%	30.90
NW	0.05%	0.48%	0.43%	0.32%	0.22%	0.00%	0.00%	1.51%	10.37
N-NW	0.03%	0.48%	0.99%	0.70%	0.99%	0.62%	0.32%	4.14%	15.87
CALM	1.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.77%	0.00
Total	1.99%	10.92%	22.75%	30.17%	22.45%	8.50%	1.45%	100.00%	14.17

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-64
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
JUNE

2001 – 2006

June	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.17%	0.78%	1.54%	1.40%	0.25%	0.08%	0.00%	4.23%	10.73
N-NE	0.14%	1.48%	2.44%	1.68%	0.50%	0.22%	0.06%	6.52%	10.74
NE	0.34%	1.76%	1.96%	1.23%	0.25%	0.08%	0.03%	5.66%	9.45
E-NE	0.25%	1.37%	1.85%	0.70%	0.08%	0.00%	0.00%	4.26%	8.63
E	0.25%	1.71%	1.62%	0.31%	0.03%	0.00%	0.00%	3.92%	7.48
E-SE	0.22%	2.88%	3.22%	0.64%	0.03%	0.03%	0.00%	7.03%	7.74
SE	0.28%	2.63%	6.33%	7.06%	1.85%	0.14%	0.00%	18.29%	11.84
S-SE	0.11%	2.55%	6.64%	8.49%	4.20%	1.43%	0.36%	23.77%	13.79
S	0.22%	1.34%	3.50%	4.76%	3.50%	1.60%	0.17%	15.09%	14.57
S-SW	0.08%	0.78%	1.51%	1.09%	0.59%	0.11%	0.00%	4.17%	11.78
SW	0.17%	0.36%	0.36%	0.17%	0.06%	0.03%	0.03%	1.18%	9.05
W-SW	0.11%	0.34%	0.50%	0.17%	0.06%	0.06%	0.00%	1.23%	9.10
W	0.11%	0.25%	0.25%	0.08%	0.00%	0.00%	0.00%	0.70%	7.30
W-NW	0.08%	0.28%	0.28%	0.11%	0.00%	0.00%	0.00%	0.76%	7.55
NW	0.20%	0.14%	0.39%	0.06%	0.03%	0.06%	0.00%	0.87%	8.26
N-NW	0.25%	0.67%	0.56%	0.31%	0.22%	0.06%	0.00%	2.07%	9.36
CALM	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.00
Total	3.00%	19.35%	32.96%	28.26%	11.65%	3.89%	0.64%	100.00%	11.62

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-65
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
JULY

2001 – 2006

July	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.05%	0.40%	0.81%	0.57%	0.13%	0.00%	0.00%	1.97%	10.41
N-NE	0.19%	0.35%	0.57%	0.70%	0.11%	0.00%	0.00%	1.91%	10.27
NE	0.05%	0.75%	0.73%	0.70%	0.00%	0.00%	0.00%	2.24%	9.17
E-NE	0.22%	0.92%	0.27%	0.43%	0.05%	0.00%	0.00%	1.89%	7.73
E	0.30%	0.73%	1.08%	0.13%	0.03%	0.00%	0.00%	2.26%	7.35
E-SE	0.13%	1.83%	2.32%	0.38%	0.03%	0.00%	0.00%	4.69%	7.84
SE	0.16%	1.70%	5.20%	5.47%	0.92%	0.00%	0.00%	13.44%	11.53
S-SE	0.30%	2.18%	7.84%	9.61%	2.99%	0.24%	0.03%	23.19%	12.58
S	0.22%	1.70%	7.68%	9.94%	3.12%	0.30%	0.00%	22.95%	12.76
S-SW	0.30%	1.48%	3.69%	5.84%	1.70%	0.08%	0.00%	13.09%	12.45
SW	0.19%	1.29%	2.07%	2.18%	0.65%	0.00%	0.00%	6.38%	11.05
W-SW	0.16%	0.48%	1.40%	0.67%	0.11%	0.00%	0.00%	2.83%	9.85
W	0.11%	0.40%	0.51%	0.11%	0.00%	0.00%	0.00%	1.13%	7.53
W-NW	0.03%	0.16%	0.19%	0.00%	0.03%	0.00%	0.00%	0.40%	8.07
NW	0.05%	0.13%	0.24%	0.00%	0.03%	0.00%	0.00%	0.46%	7.54
N-NW	0.11%	0.19%	0.43%	0.19%	0.03%	0.00%	0.00%	0.94%	8.57
CALM	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.24%	0.00
Total	2.56%	14.71%	35.01%	36.92%	9.91%	0.62%	0.03%	100.00%	11.53

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-66
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
AUGUST

2001 – 2006

August	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.27%	0.99%	0.59%	0.27%	0.00%	0.05%	0.00%	2.18%	7.44
N-NE	0.24%	1.24%	0.99%	0.62%	0.13%	0.08%	0.03%	3.33%	8.97
NE	0.40%	1.75%	1.26%	0.75%	0.03%	0.08%	0.00%	4.27%	8.08
E-NE	0.43%	2.12%	1.91%	0.97%	0.13%	0.05%	0.00%	5.62%	8.30
E	0.32%	2.12%	1.96%	0.48%	0.05%	0.00%	0.00%	4.95%	7.63
E-SE	0.22%	3.68%	3.82%	0.38%	0.03%	0.00%	0.00%	8.12%	7.38
SE	0.24%	2.23%	4.70%	3.76%	0.97%	0.08%	0.00%	11.99%	10.96
S-SE	0.27%	2.58%	6.05%	7.53%	2.15%	0.13%	0.00%	18.71%	12.10
S	0.30%	1.77%	5.67%	9.09%	3.31%	0.08%	0.03%	20.24%	12.95
S-SW	0.24%	1.42%	3.15%	3.92%	0.81%	0.00%	0.00%	9.54%	11.49
SW	0.19%	0.94%	1.51%	0.86%	0.16%	0.00%	0.00%	3.66%	9.60
W-SW	0.19%	0.86%	0.59%	0.16%	0.05%	0.00%	0.00%	1.85%	7.38
W	0.16%	0.65%	0.32%	0.00%	0.00%	0.00%	0.00%	1.13%	5.60
W-NW	0.08%	0.59%	0.40%	0.03%	0.00%	0.00%	0.00%	1.10%	6.48
NW	0.19%	0.48%	0.32%	0.05%	0.05%	0.00%	0.00%	1.10%	6.67
N-NW	0.16%	0.81%	0.54%	0.19%	0.05%	0.00%	0.00%	1.75%	7.44
CALM	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%	0.00
Total	3.90%	24.25%	33.79%	29.06%	7.93%	0.56%	0.05%	100.00%	10.37

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-67
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
SEPTEMBER

2001 – 2006

September	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.25%	1.62%	2.70%	2.17%	1.17%	0.03%	0.00%	7.94%	11.21
N-NE	0.42%	2.03%	3.51%	1.73%	1.25%	0.08%	0.00%	9.02%	10.64
NE	0.64%	1.67%	2.37%	2.01%	0.14%	0.03%	0.00%	6.85%	9.36
E-NE	0.53%	2.53%	2.53%	1.20%	0.22%	0.00%	0.00%	7.02%	8.36
E	0.53%	1.78%	2.53%	0.78%	0.11%	0.03%	0.00%	5.76%	8.20
E-SE	0.31%	3.48%	3.73%	0.14%	0.00%	0.00%	0.00%	7.66%	7.11
SE	0.36%	2.92%	5.76%	4.68%	0.67%	0.06%	0.00%	14.45%	10.54
S-SE	0.33%	2.26%	5.76%	5.04%	1.45%	0.25%	0.03%	15.12%	11.52
S	0.36%	1.75%	2.98%	2.98%	2.01%	0.72%	0.03%	10.83%	12.76
S-SW	0.22%	0.72%	1.45%	1.06%	0.67%	0.19%	0.00%	4.32%	11.76
SW	0.31%	0.61%	0.75%	0.31%	0.17%	0.00%	0.00%	2.14%	8.58
W-SW	0.14%	0.19%	0.33%	0.25%	0.00%	0.00%	0.00%	0.92%	8.72
W	0.08%	0.22%	0.08%	0.03%	0.00%	0.00%	0.00%	0.42%	5.79
W-NW	0.08%	0.39%	0.25%	0.11%	0.00%	0.00%	0.00%	0.84%	7.29
NW	0.19%	0.28%	0.50%	0.72%	0.36%	0.06%	0.06%	2.17%	12.37
N-NW	0.17%	0.84%	1.11%	1.00%	0.58%	0.03%	0.00%	3.73%	11.22
CALM	0.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.81%	0.00
Total	4.93%	23.31%	36.37%	24.20%	8.80%	1.48%	0.11%	100.00%	10.29

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-68
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
OCTOBER

2001 – 2006

October	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.32%	1.18%	1.80%	2.02%	1.45%	0.46%	0.13%	7.37%	12.99
N-NE	0.35%	0.99%	2.45%	1.99%	0.48%	0.13%	0.11%	6.51%	11.08
NE	0.43%	1.26%	1.86%	0.62%	0.19%	0.00%	0.00%	4.36%	8.73
E-NE	0.24%	1.16%	1.37%	0.46%	0.08%	0.00%	0.00%	3.31%	8.09
E	0.40%	1.37%	1.96%	0.13%	0.00%	0.00%	0.00%	3.87%	7.19
E-SE	0.40%	2.53%	1.91%	0.05%	0.00%	0.00%	0.00%	4.89%	6.36
SE	0.13%	2.26%	4.33%	3.15%	0.38%	0.03%	0.00%	10.27%	10.31
S-SE	0.16%	1.91%	4.84%	7.37%	2.55%	0.19%	0.00%	17.02%	12.76
S	0.24%	0.94%	3.31%	5.22%	3.85%	0.78%	0.00%	14.33%	14.39
S-SW	0.13%	1.18%	1.51%	2.37%	1.29%	0.32%	0.00%	6.80%	12.68
SW	0.13%	0.59%	1.26%	1.75%	0.56%	0.05%	0.00%	4.36%	12.11
W-SW	0.16%	0.35%	0.91%	0.56%	0.46%	0.05%	0.00%	2.50%	11.70
W	0.13%	0.38%	0.83%	0.46%	0.08%	0.11%	0.00%	1.99%	10.41
W-NW	0.05%	0.32%	0.54%	0.19%	0.13%	0.03%	0.11%	1.37%	11.76
NW	0.13%	0.56%	0.89%	1.56%	0.81%	0.13%	0.13%	4.22%	13.64
N-NW	0.51%	0.73%	1.64%	1.48%	1.13%	0.56%	0.32%	6.37%	13.56
CALM	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%	0.00
Total	3.95%	17.72%	31.41%	29.36%	13.44%	2.85%	0.81%	100.00%	11.70

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-69
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
NOVEMBER

2001 – 2006

November	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.17%	0.81%	3.29%	3.36%	1.29%	0.17%	0.00%	9.08%	12.58
N-NE	0.17%	1.29%	2.00%	1.22%	0.44%	0.07%	0.00%	5.19%	10.26
NE	0.37%	0.61%	1.15%	0.61%	0.20%	0.07%	0.00%	3.02%	9.73
E-NE	0.27%	0.68%	1.29%	0.71%	0.07%	0.03%	0.00%	3.05%	9.60
E	0.20%	1.56%	2.44%	0.20%	0.00%	0.00%	0.00%	4.41%	7.73
E-SE	0.14%	1.49%	1.53%	0.51%	0.00%	0.00%	0.00%	3.66%	7.83
SE	0.07%	1.25%	3.15%	2.95%	0.68%	0.00%	0.00%	8.10%	11.44
S-SE	0.20%	1.22%	3.53%	6.44%	3.19%	0.24%	0.07%	14.88%	13.67
S	0.10%	0.71%	2.71%	4.85%	3.02%	0.47%	0.03%	11.90%	14.48
S-SW	0.14%	0.75%	1.76%	1.59%	1.63%	0.41%	0.14%	6.41%	13.81
SW	0.24%	0.95%	0.68%	1.12%	1.02%	0.17%	0.00%	4.17%	12.53
W-SW	0.14%	0.47%	1.29%	0.71%	0.64%	0.44%	0.07%	3.76%	13.21
W	0.14%	0.31%	0.68%	0.34%	0.20%	0.14%	0.03%	1.83%	11.73
W-NW	0.07%	0.37%	0.34%	0.75%	0.58%	0.03%	0.03%	2.17%	13.34
NW	0.07%	0.47%	0.98%	1.66%	0.95%	0.92%	0.71%	5.76%	17.30
N-NW	0.17%	1.08%	2.54%	4.34%	2.61%	1.32%	0.44%	12.51%	15.22
CALM	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00
Total	2.64%	14.03%	29.36%	31.36%	16.51%	4.47%	1.53%	100.00%	12.88

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-70
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
DECEMBER

2001 – 2006

December	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.34%	0.88%	2.67%	3.04%	2.06%	0.61%	0.00%	9.58%	13.43
N-NE	0.13%	0.47%	1.89%	1.75%	0.61%	0.17%	0.07%	5.10%	12.56
NE	0.07%	0.17%	0.81%	0.13%	0.00%	0.03%	0.00%	1.21%	9.16
E-NE	0.13%	0.34%	0.37%	0.24%	0.00%	0.00%	0.00%	1.08%	8.11
E	0.10%	0.24%	0.71%	0.07%	0.00%	0.00%	0.00%	1.11%	8.20
E-SE	0.13%	0.81%	0.57%	0.17%	0.07%	0.00%	0.00%	1.75%	7.32
SE	0.10%	1.01%	1.55%	1.52%	0.44%	0.17%	0.00%	4.79%	11.62
S-SE	0.20%	1.01%	3.44%	5.20%	2.26%	0.78%	0.00%	12.89%	13.84
S	0.17%	1.65%	4.72%	5.50%	2.46%	0.78%	0.03%	15.32%	13.12
S-SW	0.17%	1.42%	2.97%	3.14%	1.45%	0.78%	0.24%	10.16%	13.43
SW	0.24%	1.11%	1.75%	1.65%	0.51%	0.17%	0.20%	5.64%	11.99
W-SW	0.07%	1.01%	1.05%	0.91%	0.71%	0.10%	0.03%	3.88%	11.65
W	0.07%	0.37%	0.54%	0.61%	0.88%	0.20%	0.00%	2.67%	14.32
W-NW	0.03%	0.40%	0.84%	1.28%	0.57%	0.03%	0.00%	3.17%	12.78
NW	0.13%	0.84%	2.13%	1.65%	0.94%	0.71%	0.20%	6.61%	13.78
N-NW	0.24%	1.32%	1.65%	3.21%	2.13%	2.36%	0.47%	11.37%	15.91
CALM	3.64%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.64%	0.00
Total	2.33%	13.06%	27.67%	30.07%	15.09%	6.88%	1.25%	100.00%	12.72

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-71
PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (MPH)
CPNPP, UPPER LEVEL
ANNUAL

2001 – 2006

All Months	Wind Speed (mph)								
	0-3	4-7	8-12	13-17	18-22	23-27	≥28		
Direction From	Frequency of Occurrence (%)							Total (%)	Avg. Speed
N	0.20%	0.91%	2.07%	2.08%	1.10%	0.37%	0.10%	6.83%	12.92
N-NE	0.23%	1.04%	2.00%	1.61%	0.55%	0.17%	0.05%	5.65%	11.36
NE	0.28%	0.99%	1.50%	1.01%	0.18%	0.04%	0.00%	4.01%	9.68
E-NE	0.26%	1.13%	1.41%	0.67%	0.10%	0.02%	0.00%	3.58%	8.76
E	0.25%	1.23%	1.57%	0.29%	0.03%	0.00%	0.00%	3.38%	7.73
E-SE	0.20%	2.17%	2.22%	0.32%	0.02%	0.00%	0.00%	4.94%	7.49
SE	0.18%	1.68%	3.86%	3.90%	0.93%	0.07%	0.01%	10.63%	11.51
S-SE	0.20%	1.61%	4.47%	6.71%	3.51%	0.94%	0.19%	17.63%	13.95
S	0.17%	1.16%	3.62%	5.68%	4.01%	1.53%	0.23%	16.40%	14.97
S-SW	0.15%	0.82%	1.79%	2.43%	1.36%	0.47%	0.05%	7.07%	13.58
SW	0.18%	0.65%	1.06%	1.02%	0.52%	0.11%	0.03%	3.56%	11.87
W-SW	0.12%	0.45%	0.74%	0.53%	0.45%	0.22%	0.04%	2.54%	12.71
W	0.11%	0.36%	0.41%	0.26%	0.23%	0.07%	0.00%	1.44%	11.10
W-NW	0.06%	0.36%	0.37%	0.37%	0.20%	0.04%	0.04%	1.44%	12.43
NW	0.13%	0.42%	0.78%	0.99%	0.57%	0.30%	0.15%	3.34%	14.13
N-NW	0.17%	0.76%	1.43%	1.86%	1.27%	0.91%	0.41%	6.80%	15.27
CALM	0.74%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.74%	0.00
Total	2.90%	15.73%	29.30%	29.74%	15.03%	5.24%	1.31%	100.00%	12.56

NOTES:

1. Calm is classified as a wind speed less than 1 mph.
2. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-72
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM A SINGLE SECTOR
DALLAS FORT WORTH AIRPORT

Sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	21	11	13	13	17	21	26	21	14	23	26	18.0
NNE	11	14	10	15	12	10	5	9	9	10	15	10.5
NE	7	8	5	7	4	5	4	5	9	7	9	6.1
ENE	7	6	4	10	7	8	5	4	11	5	11	6.7
E	6	8	11	13	10	11	9	9	10	10	13	9.7
ESE	6	7	6	7	8	7	8	11	6	11	11	7.7
SE	13	12	10	8	8	13	9	9	7	10	13	9.9
SSE	11	14	10	20	11	10	17	19	11	13	20	13.6
S	31	24	39	36	52	40	48	28	31	43	52	37.2
SSW	9	8	9	9	6	10	13	5	10	7	13	8.6
SW	4	6	5	5	4	3	7	5	3	6	7	4.8
WSW	5	6	8	6	7	4	4	5	4	9	9	5.8
W	8	8	8	7	6	6	8	12	12	10	12	8.5
WNW	5	8	8	7	6	7	9	6	10	8	10	7.4
NW	15	12	9	10	8	10	12	9	9	10	15	10.4
NNW	21	12	9	15	9	20	22	15	20	10	22	15.3

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a variable (VRB) wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-73
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM THREE ADJACENT SECTORS
DALLAS FORT WORTH AIRPORT

Sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	34	56	44	42	49	56	75	54	41	66	75	51.7
NNE	40	35	43	48	71	44	29	38	51	66	71	46.5
NE	21	41	18	18	25	26	21	13	26	16	41	22.5
ENE	28	28	24	28	24	40	15	28	35	29	40	27.9
E	29	27	32	31	27	41	16	23	28	26	41	28.0
ESE	25	27	39	23	27	44	33	33	36	39	44	32.6
SE	44	32	23	38	31	27	29	40	39	45	45	34.8
SSE	80	110	110	86	106	89	73	152	96	158	158	106.0
S	80	114	99	95	93	105	92	131	84	96	131	98.9
SSW	59	79	52	55	57	57	48	44	64	69	79	58.4
SW	16	15	23	12	16	16	29	27	19	15	29	18.8
WSW	17	21	18	15	28	16	12	21	20	12	28	18.0
W	23	30	21	13	22	17	17	27	23	21	30	21.4
WNW	47	28	36	24	17	37	34	37	38	22	47	32.0
NW	35	49	41	24	31	38	34	35	38	30	49	35.5
NNW	67	47	51	41	62	53	50	49	46	39	67	50.5

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-74
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM FIVE ADJACENT SECTORS
DALLAS FORT WORTH AIRPORT

Sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	67	64	51	83	74	69	88	72	87	66	88	72.1
NNE	50	72	48	84	71	67	80	58	63	66	84	65.9
NE	59	73	55	74	72	74	39	47	70	66	74	62.9
ENE	51	86	49	45	46	71	27	34	36	36	86	48.1
E	38	39	39	44	41	62	34	33	41	39	62	41.0
ESE	58	50	72	38	60	68	38	43	42	45	72	51.4
SE	91	110	110	131	132	125	110	152	96	170	170	122.7
SSE	96	140	140	156	156	185	123	232	136	304	304	166.8
S	105	210	145	138	168	152	92	233	124	274	274	164.1
SSW	81	236	181	136	119	128	107	131	89	96	236	130.4
SW	67	81	54	55	57	59	48	44	72	69	81	60.6
WSW	28	30	31	21	41	22	29	27	27	30	41	28.6
W	49	31	50	29	28	37	35	37	47	27	50	37.0
WNW	57	72	51	51	40	44	39	50	54	34	72	49.2
NW	85	62	56	57	65	53	55	61	49	58	85	60.1
NNW	74	75	56	49	76	57	82	73	57	66	82	66.5

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-75
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM A SINGLE SECTOR
MINERAL WELLS AIRPORT

Sector	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	18	22	25	16	17	14	25	18.7
NNE	8	8	9	6	5	5	9	6.8
NE	7	6	3	8	4	6	8	5.7
ENE	7	4	8	9	8	5	9	6.8
E	8	12	5	7	9	8	12	8.2
ESE	8	9	7	5	4	8	9	6.8
SE	18	8	15	13	8	10	18	12.0
SSE	18	17	15	15	13	16	18	15.7
S	14	17	17	24	15	17	24	17.3
SSW	5	7	6	7	5	7	7	6.2
SW	5	3	5	7	6	4	7	5.0
WSW	3	3	5	4	5	3	5	3.8
W	10	11	7	8	8	10	11	9.0
WNW	5	4	4	10	8	5	10	6.0
NW	5	7	10	10	9	9	10	8.3
NNW	10	10	10	9	15	13	15	11.2

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 93985.
3. Period of record is 6 years (2001 – 2006).

TABLE 2.7-76
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM THREE ADJACENT SECTORS
MINERAL WELLS AIRPORT

Sector	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	54	35	50	47	48	37	54	45.2
NNE	29	28	26	31	24	30	31	28.0
NE	17	23	18	20	28	21	28	21.2
ENE	20	23	13	24	24	22	24	21.0
E	30	52	13	16	21	14	52	24.3
ESE	34	37	21	27	17	30	37	27.7
SE	48	39	39	45	49	58	58	46.3
SSE	83	118	95	124	90	107	124	102.8
S	104	84	89	100	71	107	107	92.5
SSW	28	22	28	24	24	26	28	25.3
SW	8	11	12	17	11	10	17	11.5
WSW	24	12	17	16	12	24	24	17.5
W	16	14	19	16	21	24	24	18.3
WNW	20	27	18	19	26	20	27	21.7
NW	27	23	37	34	29	28	37	29.7
NNW	38	55	41	37	40	29	55	40.0

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 93985.
3. Period of record is 6 years (2001 – 2006).

TABLE 2.7-77
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM FIVE ADJACENT SECTORS
MINERAL WELLS AIRPORT

Sector	2001	2002	2003	2004	2005	2006	Maximum	Avg.
N	65	55	70	72	51	39	72	58.7
NNE	54	42	52	55	64	66	66	55.5
NE	43	35	29	40	37	56	56	40.0
ENE	34	56	27	26	29	30	56	33.7
E	46	52	23	29	35	36	52	36.8
ESE	49	52	48	49	54	63	63	52.5
SE	90	137	95	138	100	129	138	114.8
SSE	140	184	98	169	175	216	216	114.8
S	142	179	109	211	109	194	211	157.3
SSW	104	84	91	110	71	134	134	99.0
SW	31	31	31	31	24	46	46	32.3
WSW	29	23	23	28	24	26	29	25.5
W	37	29	31	20	35	40	40	32.0
WNW	32	31	37	53	45	49	53	41.2
NW	46	57	41	63	56	48	63	51.8
NNW	66	56	70	48	51	38	70	54.8

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. (USHCN 2007) Station No. 93985.
3. Period of record is 6 years (2001 – 2006).

TABLE 2.7-78
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM A SINGLE SECTOR
CPNPP, LOWER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	18	19	21	27	41	41	25.2
NNE	15	13	12	12	11	15	12.6
NE	14	6	7	6	10	14	8.6
ENE	8	10	8	9	12	10	9.4
E	9	8	9	8	11	9	9.0
ESE	8	8	10	12	11	12	9.8
SE	11	19	20	19	14	20	16.6
SSE	21	24	18	15	17	24	19.0
S	23	31	26	19	13	31	22.4
SSW	9	11	11	12	13	12	11.2
SW	10	13	10	10	9	13	10.4
WSW	10	6	10	9	11	10	9.2
W	4	4	5	5	5	5	4.6
WNW	8	10	8	8	8	10	8.4
NW	13	20	16	15	12	20	15.2
NNW	21	17	32	18	14	32	20.4

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.
2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-79
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM THREE ADJACENT SECTORS
CPNPP, LOWER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	56	68	70	53	65	70	62.4
NNE	69	49	32	43	46	69	47.8
NE	38	25	21	21	28	38	26.6
ENE	26	25	18	21	28	26	23.6
E	38	26	15	25	29	38	26.6
ESE	35	55	43	48	37	55	43.6
SE	60	114	49	104	70	114	79.4
SSE	83	127	106	146	120	146	116.4
S	116	124	90	92	176	124	119.6
SSW	48	39	34	28	39	48	37.6
SW	29	25	26	37	33	37	30.0
WSW	29	18	19	18	29	29	22.6
W	32	26	13	31	16	32	23.6
WNW	19	26	25	23	21	26	22.8
NW	34	39	36	43	51	43	40.6
NNW	60	61	79	44	48	79	58.4

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.
2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-80
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM FIVE ADJACENT SECTORS
CPNPP, LOWER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	79	69	81	71	68	81	73.6
NNE	69	69	70	75	68	75	70.2
NE	90	57	41	73	55	90	63.2
ENE	72	45	35	45	53	72	50.0
E	49	65	55	69	44	69	56.4
ESE	72	114	61	117	74	117	87.6
SE	134	143	157	148	120	157	140.4
SSE	169	203	162	146	321	203	200.2
S	155	253	106	146	279	253	187.8
SSW	116	127	104	92	176	127	123.0
SW	49	59	49	54	48	59	51.8
WSW	42	29	36	48	38	48	38.6
W	47	37	35	35	40	47	38.8
WNW	34	48	43	61	53	61	47.8
NW	60	61	79	45	61	79	61.2
NNW	75	69	79	70	65	79	71.6

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.

2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-81
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM A SINGLE SECTOR
CPNPP, UPPER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	16	23	31	16	23	31	21.8
NNE	15	17	11	14	15	17	14.4
NE	10	9	9	9	8	10	9.0
ENE	9	9	9	6	12	9	9.0
E	7	11	7	9	11	11	9.0
ESE	11	11	9	15	9	15	11.0
SE	17	15	20	18	16	20	17.2
SSE	31	18	19	16	30	31	22.8
S	21	20	18	22	19	22	20.0
SSW	17	12	10	12	14	17	13.0
SW	10	9	13	12	11	13	11.0
WSW	11	9	13	14	9	14	11.2
W	5	6	12	6	5	12	6.8
WNW	6	7	6	6	6	7	6.2
NW	15	18	12	16	17	18	15.6
NNW	24	40	16	19	22	40	24.2

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.

2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-82
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM THREE ADJACENT SECTORS
CPNPP, UPPER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	56	68	63	70	65	70	64.4
NNE	52	60	50	45	44	60	50.2
NE	42	58	34	30	28	58	38.4
ENE	26	25	20	25	22	26	23.6
E	41	34	17	32	29	41	30.6
ESE	35	56	21	48	37	56	39.4
SE	71	40	57	103	68	103	67.8
SSE	122	121	136	122	118	136	123.8
S	99	162	88	204	184	204	147.4
SSW	30	105	52	40	73	105	60.0
SW	28	34	35	36	38	36	34.2
WSW	32	25	26	37	29	37	29.8
W	20	19	17	26	17	26	19.8
WNW	18	18	14	26	27	26	20.6
NW	37	47	31	55	35	55	41.0
NNW	61	58	44	43	58	61	52.8

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.

2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-83
MAXIMUM NUMBER OF CONSECUTIVE HOURS WITH WIND FROM FIVE ADJACENT SECTORS
CPNPP, UPPER LEVEL

Sector	2001	2002	2003	2004	2006	Maximum	Avg.
N	81	75	65	88	68	88	75.4
NNE	72	102	66	84	68	102	78.4
NE	69	98	61	73	47	98	69.6
ENE	67	58	41	76	53	76	59.0
E	49	65	31	69	67	69	56.2
ESE	89	68	60	114	69	114	80.0
SE	153	146	136	123	118	153	135.2
SSE	169	204	161	240	321	240	219.0
S	163	256	167	243	283	256	222.4
SSW	123	162	104	204	184	204	155.4
SW	49	106	63	62	76	106	71.2
WSW	37	38	42	57	42	57	43.2
W	46	32	43	47	36	47	40.8
WNW	37	58	36	61	51	61	48.6
NW	61	63	44	67	64	67	59.8
NNW	77	69	65	88	67	88	73.2

NOTES:

1. Wind values which were either not provided or had a zero speed value were not included, and assumed to break any consecutive wind direction count.

2. CPNPP site data. Period of record is 5 years (2001 – 2004, 2006).

TABLE 2.7-84 (Sheet 1 of 2)
COMPARISON OF AVERAGE WIND PERSISTENCE

Wind Persistence (hrs)

	Single Sector				Three Adjacent Sectors				Five Adjacent Sectors			
Sector	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth
N	25.2	21.8	18.7	18.0	62.4	64.4	45.2	51.7	73.6	75.4	58.7	72.1
NNE	12.6	14.4	6.8	10.5	47.8	50.2	28.0	46.5	70.2	78.4	55.5	65.9
NE	8.6	9.0	5.7	6.1	26.6	38.4	21.2	22.5	63.2	69.6	40.0	62.9
ENE	9.4	9.0	6.8	6.7	23.6	23.6	21.0	27.9	50.0	59.0	33.7	48.1
E	9.0	9.0	8.2	9.7	26.6	30.6	24.3	28.0	56.4	56.2	36.8	41.0
ESE	9.8	11.0	6.8	7.7	43.6	39.4	27.7	32.6	87.6	80.0	52.5	51.4
SE	16.6	17.2	12.0	9.9	79.4	67.8	46.3	34.8	140.4	135.2	114.8	122.7
SSE	19.0	22.8	15.7	13.6	116.4	123.8	102.8	106.0	200.2	219.0	163.7	166.8
S	22.4	20.0	17.3	37.2	119.6	147.4	92.5	98.9	187.8	222.4	157.3	164.1
SSW	11.2	13.0	6.2	8.6	37.6	60.0	25.3	58.4	123.0	155.4	99.0	130.4
SW	10.4	11.0	5.0	4.8	30.0	34.2	11.5	18.8	51.8	71.2	32.3	60.6
WSW	9.2	11.2	3.8	5.8	22.6	29.8	17.5	18.0	38.6	43.2	25.5	28.6
W	4.6	6.8	9.0	8.5	23.6	19.8	18.3	21.4	38.8	40.8	32.0	37.0
WNW	8.4	6.2	6.0	7.4	22.8	20.6	21.7	32.0	47.8	48.6	41.2	49.2

TABLE 2.7-84 (Sheet 2 of 2)
COMPARISON OF AVERAGE WIND PERSISTENCE

Wind Persistence (hrs)

	Single Sector				Three Adjacent Sectors				Five Adjacent Sectors			
Sector	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth	CPNPP Upper Level	CPNPP Lower Level	Mineral Wells	Dallas Ft. Worth
NW	15.2	15.6	8.3	10.4	40.6	41.0	29.7	35.5	61.2	59.8	51.8	60.1
NNW	20.4	24.2	11.2	15.3	58.4	52.8	40.0	50.5	71.6	73.2	54.8	66.5

NOTES:

1. Wind values which were either not provided, had a zero speed value, or a VRB wind direction were not included, and assumed to break any consecutive wind direction count.
2. Wind persistence values above are the average persistence durations for the period of record.
3. Period of record at CPNPP site and Mineral Wells Airport, 2001 – 2004, 2006.
4. Period of record at Dallas Fort Worth Airport, 1997 – 2006.
5. Period of record at Mineral Wells Airport, 2001 – 2006.

TABLE 2.7-85
CPNPP NORMAL TEMPERATURES

	Daily Minimum	Daily Mean	Daily Maximum
JAN	22.3	49.6	89.0
FEB	19.2	48.9	84.6
MAR	32.9	58.3	93.0
APR	49.4	69.2	100.2
MAY	47.5	75.2	98.9
JUN	65.0	80.3	100.2
JUL	72.7	84.9	103.1
AUG	66.6	85.1	105.0
SEP	56.8	77.4	97.8
OCT	42.3	68.4	93.2
NOV	28.0	58.0	88.0
DEC	18.6	50.8	78.5
Annual	43.4	67.2	94.3

NOTE:

1. CPNPP site data 2001-2004 and 2006.

TABLE 2.7-86
RELATIVE HUMIDITY DALLAS FORT WORTH AIRPORT
FOR 4 TIME PERIODS PER DAY

1997 – 2006

Time	00:00 - 06:00	06:00 - 12:00	12:00 - 18:00	18:00 - 24:00
Jan	76%	72%	56%	66%
Feb	78%	74%	58%	67%
Mar	76%	69%	54%	65%
Apr	76%	67%	52%	63%
May	80%	70%	55%	66%
Jun	80%	70%	54%	65%
Jul	72%	62%	44%	55%
Aug	69%	60%	43%	54%
Sep	72%	63%	45%	58%
Oct	77%	69%	52%	65%
Nov	78%	71%	54%	67%
Dec	75%	69%	53%	65%
Annual	76%	68%	52%	63%

NOTES:

1. (USHCN 2007) Station No. 03927.

TABLE 2.7-87
RELATIVE HUMIDITY MINERAL WELLS AIRPORT FOR 4 TIME PERIODS PER DAY

2001 – 2005

Time	00:00 - 06:00	06:00 - 12:00	12:00 - 18:00	18:00 - 24:00
Jan	81%	75%	53%	70%
Feb	83%	76%	55%	72%
Mar	81%	72%	53%	67%
Apr	91%	68%	54%	75%
May	88%	73%	56%	74%
Jun	88%	72%	53%	72%
Jul	83%	64%	44%	64%
Aug	82%	65%	45%	65%
Sep	82%	66%	44%	66%
Oct	86%	73%	53%	75%
Nov	81%	70%	49%	69%
Dec	77%	67%	43%	64%
Annual	84%	70%	50%	69%

NOTES:

1. (USHCN 2007) Station No. 93985.

TABLE 2.7-88
MONTHLY MEAN AND EXTREME MAXIMUM AND MINIMUM DEW POINT TEMPERATURES
MINERAL WELLS

Month	Dew Point (°F)		
	Mean	Maximum	Minimum
Jan	32	36.3	24.9
Feb	35	39.2	29.7
Mar	39	48.5	33.6
Apr	50	58.2	41.3
May	60	65.6	52.1
Jun	66	68.9	62.2
Jul	67	69.7	62.9
Aug	66	69.0	62.3
Sep	61	67.3	53.3
Oct	52	59.2	45.2
Nov	41	50.2	29.6
Dec	33	41.1	27.0
Annual	50	69.7	24.9

Notes:

1. (USHCN 2007) NCDC Data Mineral Wells AP, WBAN Station ID 93985, Mineral Wells data 1949 – 2006.

TABLE 2.7-89
HOURLY METEOROLOGICAL DATA DALLAS FORT WORTH AIRPORT
WORST 1-DAY PERIOD

MAY 26, 1997

Hour	Dry Bulb Temperature (F)	Wet Bulb Temperature (F)
1	78	76
2	78	76
3	78	76
4	77	75
5	77	75
6	76	75
7	78	75
8	80	76
9	83	78
10	86	79
11	88	81
12	89	81
13	90	82
14	92	82
15	92	82
16	91	83
17	89	82
18	88	81
19	86	80
20	84	79
21	83	79
22	83	79
23	81	78
24	80	77
AVERAGE	83.6	78.6

NOTES:

1. The average wet bulb temperature above (78.6°F) is calculated from 24 hourly observations for this date.
2. Period of record is 10 years (1997 – 2006).
3. (USHCN 2007) Station No. 03927.

TABLE 2.7-90
DAILY AVERAGE METEOROLOGICAL DATA
DALLAS FORT WORTH AIRPORT
WORST 5-CONSECUTIVE-DAY PERIOD

Date	Dry Bulb Temperature (F)	Wet Bulb Temperature (F)
6/29/1997	83	77
6/30/1997	84	77
7/1/1997	85	77
7/2/1997	85	77
7/3/1997	86	78
AVERAGE	84.6	77.4

NOTES:

1. Period of record is 10 years (1997 – 2006).

2. (USHCN 2007) Station No. 03927.

TABLE 2.7-91 (Sheet 1 of 2)
DAILY AVERAGE METEOROLOGICAL DATA
DALLAS FORT WORTH AIRPORT
WORST 30-CONSECUTIVE-DAY PERIOD

			Daily Average	
Year	Month	Day	Dry Bulb (°F)	Wet Bulb (°F)
2001	7	4	85	75
2001	7	5	86	76
2001	7	6	87	77
2001	7	7	86	76
2001	7	8	85	76
2001	7	9	87	76
2001	7	10	87	76
2001	7	11	88	76
2001	7	12	88	75
2001	7	13	89	76
2001	7	14	85	78
2001	7	15	86	78
2001	7	16	88	77
2001	7	17	88	77
2001	7	18	88	76
2001	7	19	87	76
2001	7	20	88	76
2001	7	21	89	76
2001	7	22	89	74
2001	7	23	89	75
2001	7	24	89	77
2001	7	25	88	76
2001	7	26	87	76
2001	7	27	86	76
2001	7	28	87	78
2001	7	29	87	77
2001	7	30	89	76
2001	7	31	88	76
2001	8	1	89	75
2001	8	2	87	76

TABLE 2.7-91 (Sheet 2 of 2)
DAILY AVERAGE METEOROLOGICAL DATA
DALLAS FORT WORTH AIRPORT
WORST 30-CONSECUTIVE-DAY PERIOD

			Daily Average	
Year	Month	Day	Dry Bulb (°F)	Wet Bulb (°F)
Average	-	-	87.4	76.1

NOTES:

1. (USHCN 2007) Station No. 03927.

2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-92
HOURLY METEOROLOGICAL DATA MINERAL WELLS AIRPORT
WORST 1-DAY PERIOD

June 24, 2003

Hour	Dry Bulb Temperature (F)	Wet Bulb Temperature (F)
1	80	75
2	80	76
3	79	76
4	77	76
5	76	75
6	76	75
7	78	75
8	79	75
9	83	77
10	86	77
11	86	77
12	88	77
13	90	78
14	91	79
15	93	79
16	93	79
17	92	78
18	91	78
19	89	78
20	86	77
21	85	78
22	84	78
23	83	78
24	81	77
AVERAGE	84.4	77.0

(USHCN 2007)

NOTES:

1. The average wet bulb temperature above (77.0°F) is calculated from 24 hourly observations for this date.
2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-93
DAILY AVERAGE METEOROLOGICAL DATA
MINERAL WELLS AIRPORT
WORST 5-CONSECUTIVE-DAY PERIOD

Date	Dry Bulb Temperature (F)	Wet Bulb Temperature (F)
6/21/2003	80.6	74.3
6/22/2003	83.2	75.5
6/23/2003	83.8	76.3
6/24/2003	84.4	77.0
6/25/2003	84.5	76.1
AVERAGE	83.3	75.8

(USHCN 2007)

NOTE:

1. Period of record is 6 years (2001 – 2006).

TABLE 2.7-94 (Sheet 1 of 2)
DAILY AVERAGE METEOROLOGICAL DATA
MINERAL WELLS AIRPORT
WORST 30-CONSECUTIVE-DAY PERIOD

			Daily Average	
Year	Month	Day	Dry Bulb (°F)	Wet Bulb (°F)
2001	7	14	87.2	75.8
2001	7	15	89.5	75.4
2001	7	16	90.8	74.5
2001	7	17	89.2	74.7
2001	7	18	89.8	74.6
2001	7	19	88.3	75.1
2001	7	20	89.2	74.7
2001	7	21	90.9	73.3
2001	7	22	90.1	71.6
2001	7	23	89.9	72.1
2001	7	24	89.3	74.6
2001	7	25	88.4	73.8
2001	7	26	88.4	74.1
2001	7	27	87.7	75.4
2001	7	28	86.7	75.3
2001	7	29	88.0	76.0
2001	7	30	90.0	74.7
2001	7	31	89.8	73.6
2001	8	1	89.0	73.1
2001	8	2	87.5	72.8
2001	8	3	84.9	71.0
2001	8	4	86.6	70.0
2001	8	5	89.5	70.8
2001	8	6	88.1	71.3
2001	8	7	83.8	73.1
2001	8	8	87.7	74.3
2001	8	9	90.0	73.6
2001	8	10	84.5	75.5
2001	8	11	84.7	75.0
2001	8	12	88.8	74.5

TABLE 2.7-94 (Sheet 2 of 2)
DAILY AVERAGE METEOROLOGICAL DATA
MINERAL WELLS AIRPORT
WORST 30-CONSECUTIVE-DAY PERIOD

			Daily Average	
Year	Month	Day	Dry Bulb (°F)	Wet Bulb (°F)
Average	-	-	88.3	73.8

(USHCN 2007)

NOTES:

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-95
PRECIPITATION DATA CPNPP

	Precipitation Measurements				
Month	Monthly Mean	Max 48-hr Precipitation	Monthly (hrs)	Max 24 hour rain (in)	Number of Days >0.01 in
Jan	2.2	2.5	32	2.5	5
Feb	3.6	3.0	37	2.8	8
Mar	3.7	4.5	31	3.8	7
Apr	2.5	2.8	19	1.8	7
May	2.6	2.0	23	1.7	8
Jun	3.3	2.6	22	1.8	6
Jul	0.7	1.2	8	1.2	4
Aug	3.4	2.7	29	2.5	7
Sep	3.1	2.5	28	2.5	7
Oct	2.7	1.9	28	1.9	6
Nov	1.2	0.8	19	0.7	6
Dec	1.4	1.7	30	1.5	5
Annual	30.3	4.5	307	3.8	74

NOTES:

1. CPNPP site data 2001, 2003, 2006.

TABLE 2.7-96
RAINFALL FREQUENCY DISTRIBUTION
DALLAS FORT WORTH AIRPORT

NUMBER OF HR PER MONTH, AVERAGE YR

Rainfall (inch/hr)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.01-0.019	9	12	12	6	5	7	2	4	4	10	11	10
0.02-.099	16	25	15	10	11	15	4	7	8	14	16	18
0.10-0.249	5	6	6	5	6	4	2	3	3	6	4	6
0.25-0.499	1	2	2	2	2	2	1	1	1	2	2	2
0.50-0.99	0	1	1	1	2	1	1	1	0	1	0	0
1.00-1.99	0	0	1	0	1	0	0	0	0	0	0	0
2.0 & over	0	0	0	0	0	0	0	0	0	0	0	0
Total	32	45	35	24	26	29	10	15	16	34	33	37

NOTES:

1. Instances of "trace" precipitation were not counted in determining hours of precipitation.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-97
RAINFALL FREQUENCY DISTRIBUTION
MINERAL WELLS

NUMBER OF HR PER MONTH, AVERAGE YR

Rainfall (in/hr)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.01-0.019	10	10	16	9	14	5	5	10	10	14	15	10
0.02-.099	17	23	15	8	11	13	7	11	8	15	16	10
0.10-0.249	3	6	6	4	4	7	2	3	2	4	5	3
0.25-0.499	0	1	2	1	2	2	1	1	0	1	2	1
0.50-0.99	0	0	1	1	1	2	1	0	1	1	0	0
1.00-1.99	0	0	0	0	0	0	0	0	0	0	0	0
2.0 & over	0	0	0	0	0	0	0	0	0	0	0	0
Total	31	41	39	22	31	29	16	25	20	35	38	24

NOTES:

1. Instances of "trace" precipitation were not counted in determining hours of precipitation.
2. (USHCN 2007) Station No. 93985.
3. Period of record is 6 years (2001 – 2006).

TABLE 2.7-98
RAINFALL FREQUENCY DISTRIBUTION
CPNPP

NUMBER OF HR PER MONTH, AVERAGE YR

Rainfall (in/hr)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.01-0.019	9	11	8	7	6	6	4	7	8	7	6	11
0.02-.099	17	16	13	7	10	8	3	12	15	15	9	15
0.10-0.249	4	7	5	2	4	5	0	6	3	2	3	3
0.25-0.499	1	2	2	1	3	2	0	3	0	3	1	1
0.50-0.99	1	1	1	1	1	1	0	1	1	1	0	0
1.00-1.99	0	0	1	0	0	1	0	0	1	0	0	0
2.0 & over	0	0	0	0	0	0	0	0	0	0	0	0
Total	32	37	31	19	23	22	8	29	28	28	19	30

NOTES:

1. CPNPP site data 2001, 2003, 2006

TABLE 2.7-99
PERCENT OF TOTAL OBSERVATIONS (BY MONTH) OF INDICATED WIND DIRECTIONS AND PRECIPITATION
DALLAS FORT WORTH AIRPORT

Sector	January	February	March	April	May	June	July	August	September	October	November	December	Total
N	2.06	2.59	1.56	0.75	1.23	0.98	0.65	0.50	0.75	1.57	2.06	1.90	16.60
N-NE	0.76	1.12	0.80	0.56	0.53	0.45	0.20	0.37	0.56	0.61	0.81	1.09	7.87
NE	0.28	0.78	0.59	0.20	0.34	0.25	0.03	0.16	0.31	0.55	0.72	0.65	4.86
E-NE	0.67	0.81	0.78	0.39	0.30	0.41	0.05	0.28	0.25	0.45	0.64	0.78	5.80
E	1.06	1.18	1.42	0.59	0.67	0.59	0.27	0.36	0.64	0.62	0.51	0.64	8.56
E-SE	0.87	0.95	0.90	0.55	0.47	0.89	0.36	0.33	0.42	0.64	0.51	0.73	7.62
SE	0.64	1.11	0.95	0.84	0.65	1.00	0.41	0.31	0.23	0.90	0.69	0.55	8.28
S-SE	0.53	0.70	0.86	0.98	0.75	1.08	0.31	0.31	0.27	1.39	0.62	0.47	8.26
S	0.94	1.20	0.61	1.04	1.06	1.15	0.42	0.47	0.30	1.18	0.59	0.61	9.57
S-SW	0.27	0.19	0.31	0.30	0.28	0.34	0.19	0.25	0.12	0.22	0.20	0.22	2.88
SW	0.08	0.16	0.22	0.20	0.09	0.16	0.12	0.19	0.08	0.11	0.09	0.12	1.62
W-SW	0.08	0.14	0.14	0.16	0.09	0.11	0.08	0.11	0.08	0.16	0.11	0.17	1.42
W	0.09	0.14	0.25	0.30	0.16	0.19	0.05	0.23	0.22	0.22	0.19	0.30	2.32
W-NW	0.41	0.20	0.30	0.17	0.09	0.08	0.02	0.03	0.14	0.25	0.30	0.19	2.17
NW	0.42	0.41	0.64	0.37	0.27	0.19	0.09	0.08	0.20	0.55	0.67	0.53	4.41
N-NW	0.97	0.97	0.69	0.31	0.51	0.20	0.28	0.16	0.48	0.76	1.23	1.17	7.73
Total	10.12	12.64	11.01	7.72	7.50	8.06	3.54	4.13	5.05	10.18	9.95	10.12	100

NOTES:

1. Instances of "trace" precipitation were counted as precipitation.
2. (USHCN 2007) Station No. 03927.
3. Period of record is 10 years (1997 – 2006).

TABLE 2.7-100
PERCENT OF TOTAL OBSERVATIONS (BY MONTH) OF INDICATED WIND DIRECTIONS AND PRECIPITATION
MINERAL WELLS AIRPORT

Sector	January	February	March	April	May	June	July	August	September	October	November	December	Total
N	0.99	2.59	1.30	1.44	1.16	0.76	0.56	0.96	0.73	2.54	2.62	1.75	17.39
N-NE	0.34	0.51	0.51	0.23	0.51	0.34	0.23	0.14	0.37	0.51	0.56	0.65	4.88
NE	0.25	0.73	0.85	0.14	0.28	0.54	0.08	0.31	0.42	0.42	0.42	0.28	4.74
E-NE	0.37	0.54	0.68	0.25	0.48	0.31	0.23	0.34	0.25	0.31	0.45	0.28	4.48
E	1.04	0.65	1.10	0.28	0.39	0.45	0.25	0.51	0.51	0.70	0.99	0.45	7.33
E-SE	0.65	0.68	1.16	0.39	0.70	0.56	0.25	0.68	0.37	0.62	0.76	0.76	7.58
SE	1.24	1.47	1.44	1.27	1.41	1.55	0.85	0.59	0.37	1.04	1.21	1.16	13.59
S-SE	1.07	1.49	0.99	1.35	1.10	1.27	0.70	0.73	0.45	1.35	1.04	0.48	12.04
S	0.54	0.70	0.39	0.68	1.04	0.54	0.65	0.70	0.51	0.37	0.23	0.25	6.60
S-SW	0.08	0.06	0.28	0.17	0.23	0.20	0.23	0.20	0.17	0.17	0.06	0.08	1.92
SW	0.08	0.08	0.11	0.14	0.14	0.14	0.08	0.20	0.11	0.14	0.11	0.08	1.44
W-SW	0.03	0.06	0.14	0.06	0.23	0.06	0.11	0.17	0.17	0.11	0.14	0.03	1.30
W	0.23	0.23	0.20	0.23	0.34	0.06	0.08	0.31	0.20	0.11	0.20	0.25	2.42
W-NW	0.23	0.14	0.11	0.31	0.17	0.08	0.00	0.31	0.17	0.20	0.48	0.45	2.65
NW	0.28	0.25	0.39	0.34	0.20	0.08	0.17	0.23	0.34	0.34	1.04	0.42	4.09
N-NW	0.87	0.96	0.85	0.45	0.45	0.25	0.23	0.28	0.34	0.73	1.44	0.70	7.56
Total	8.29	11.14	10.49	7.72	8.82	7.19	4.71	6.65	5.47	9.67	11.76	8.09	100.00

NOTES:

1. Instances of "trace" precipitation were counted as precipitation.
2. (USHCN 2007) Station No. 93985.
3. Period of record is 6 years (2001 – 2006).

TABLE 2.7-101
PERCENT OF TOTAL OBSERVATIONS (BY MONTH) OF INDICATED WIND DIRECTIONS AND PRECIPITATION CPNPP

Sector	January	February	March	April	May	June	July	August	September	October	November	December	Total
N	0.33	2.51	1.42	0.65	0.87	0.98	0.00	0.33	0.76	1.09	1.42	1.09	11.44
N-NE	0.98	0.98	0.44	0.22	0.33	0.22	0.22	0.76	1.09	0.65	0.33	0.44	6.64
NE	0.54	0.76	0.44	0.11	0.54	0.76	0.11	0.65	0.54	0.33	0.22	0.22	5.23
E-NE	0.65	0.22	0.76	0.11	0.54	0.33	0.00	0.65	0.00	0.22	0.00	0.22	3.70
E	1.42	0.00	0.76	0.00	0.54	0.11	0.54	0.98	0.98	0.54	0.33	0.54	6.75
E-SE	1.85	1.20	1.09	0.54	0.33	0.33	0.22	0.44	1.09	0.44	0.33	1.42	9.26
SE	1.09	1.53	0.65	0.76	0.87	0.44	0.44	1.31	0.98	1.63	0.33	0.98	11.00
S-SE	0.76	1.09	0.87	0.76	0.87	0.76	0.22	0.33	0.87	1.09	0.76	0.54	8.93
S	0.54	0.65	0.11	0.76	0.54	0.33	0.33	0.54	0.44	0.54	0.00	0.11	4.90
S-SW	0.33	0.00	0.33	0.33	0.00	0.54	0.22	0.33	0.22	0.33	0.00	0.00	2.61
SW	0.11	0.11	0.54	0.22	0.44	0.54	0.33	0.76	0.11	0.22	0.22	0.44	4.03
W-SW	0.22	0.11	0.54	0.11	0.00	0.33	0.00	0.33	0.44	0.11	0.22	0.44	2.83
W	0.00	0.11	0.22	0.54	0.22	0.22	0.00	0.87	0.00	0.00	0.00	0.33	2.51
W-NW	0.22	0.22	0.54	0.22	0.22	0.22	0.11	0.22	0.54	0.76	0.00	0.65	3.92
NW	0.98	0.65	0.76	0.11	0.54	0.33	0.00	0.76	0.22	0.33	0.00	0.87	5.56
N-NW	0.44	2.07	0.54	0.76	0.65	0.65	0.00	0.33	0.87	0.87	2.07	1.42	10.68
Total	10.46	12.20	10.02	6.21	7.52	7.08	2.72	9.59	9.15	9.15	6.21	9.69	100.00

NOTES:

1. Instances of "trace" precipitation were counted as precipitation.
2. Period of record is 3 years (2001, 2003, 2006).

TABLE 2.7-102
AVERAGE HOURS OF FOG AND HAZE
DALLAS FORT WORTH AIRPORT

Month	Fog (Average hours/month)	Haze (Average hours/month)
Jan	6.3	5.3
Feb	1.8	5.4
Mar	1.7	4.7
Apr	0.8	4.9
May	0.0	13.8
Jun	0.1	4.2
Jul	0.2	4.2
Aug	0.0	4.7
Sep	0.0	9.2
Oct	1.3	2.4
Nov	1.9	1.8
Dec	2.1	1.2
Annual (hours/year)	16.2	61.8

NOTES:

1. (USHCN 2007) Station No. 03927.

2. Period of record is 10 years (1997 – 2006).

TABLE 2.7-103
AVERAGE HOURS OF FOG AND HAZE
MINERAL WELLS AIRPORT

Month	Fog (Average hours/month)	Haze (Average hours/month)
Jan	12.5	9.0
Feb	8.2	2.2
Mar	5.8	4.7
Apr	3.8	5.8
May	1.7	11.8
Jun	0.3	6.7
Jul	0.3	7.5
Aug	0.7	5.5
Sep	0.3	13.0
Oct	5.5	3.8
Nov	4.3	5.5
Dec	3.2	5.5
Annual (hours/year)	46.7	81.0

NOTES:

1. (USHCN 2007) Station No. 93985.

2. Period of record is 6 years (2001 – 2006).

TABLE 2.7-104
CPNPP MONTHLY AND ANNUAL STABILITY CLASS PERCENT FREQUENCY DISTRIBUTIONS

	Stability Class						
Month	A	B	C	D	E	F	G
JAN	0.3%	0.5%	0.5%	4.1%	1.8%	0.7%	0.6%
FEB	0.4%	0.4%	0.5%	4.2%	1.4%	0.5%	0.3%
MAR	0.7%	0.5%	0.6%	4.2%	1.7%	0.5%	0.3%
APR	0.6%	0.6%	0.6%	4.1%	1.9%	0.3%	0.2%
MAY	1.0%	0.7%	0.7%	3.9%	1.7%	0.3%	0.1%
JUN	0.8%	0.7%	0.8%	3.7%	2.0%	0.2%	0.0%
JUL	1.1%	0.9%	0.7%	3.6%	2.0%	0.2%	0.0%
AUG	1.2%	0.8%	0.6%	3.6%	2.1%	0.2%	0.0%
SEP	0.7%	0.5%	0.7%	3.4%	2.5%	0.4%	0.1%
OCT	0.5%	0.5%	0.6%	4.0%	2.0%	0.6%	0.3%
NOV	0.3%	0.4%	0.5%	4.1%	1.9%	0.6%	0.4%
DEC	0.2%	0.4%	0.5%	3.9%	2.2%	0.8%	0.5%
Annual	7.8%	6.8%	7.3%	46.7%	23.2%	5.3%	2.9%

NOTE:

1. CPNPP site data 2001 – 2004, 2006.

TABLE 2.7-105 (Sheet 1 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS A HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.175	.000	.175	.175	.175	.524	1.398	4.892	5.940	5.066	11.355	3.843	33.716	5.741
NNE	.000	.349	.175	.349	.524	.699	2.271	3.494	5.066	5.940	3.843	.699	23.409	4.626
NE	.000	.175	.524	.000	1.398	1.223	7.512	7.512	6.638	2.795	1.572	.349	29.698	3.679
ENE	.000	.000	.000	.349	1.223	1.572	5.940	8.211	2.970	1.747	1.048	.000	23.060	3.415
E	.000	.000	.000	.175	.699	2.795	6.988	6.464	2.620	.175	.349	.000	20.265	3.023
ESE	.000	.000	.524	.524	.873	1.048	14.150	20.090	8.910	4.018	1.572	.000	51.710	3.519
SE	.000	.175	.175	.000	.349	1.048	7.337	16.422	22.885	15.199	6.988	1.398	71.975	4.496
SSE	.000	.000	.349	.175	.699	1.398	8.385	15.897	25.855	26.379	26.205	8.036	113.378	5.227
S	.000	.175	.000	.175	.175	1.048	5.590	15.199	20.440	28.126	38.608	18.867	128.402	5.840
SSW	.000	.000	.349	.000	.349	.175	4.717	7.163	10.831	11.355	18.518	5.416	58.873	5.512
SW	.000	.000	.000	.000	.000	.524	3.319	6.638	4.717	1.922	2.620	1.048	20.789	4.398
WSW	.000	.000	.175	.000	.175	.349	.873	1.398	1.747	1.398	1.048	1.572	8.735	5.249
W	.000	.000	.175	.000	.000	.175	.349	.524	.349	.175	.349	.524	2.620	4.861
WNW	.000	.000	.175	.000	.000	.524	.175	.175	.524	.175	1.572	.699	4.018	5.823
NW	.000	.000	.175	.000	.000	.000	.524	1.398	.873	1.922	3.843	6.813	15.548	7.443
NNW	.000	.000	.000	.000	.175	.000	2.795	3.494	5.940	6.289	13.626	18.168	50.487	7.155
CALM	.87												.87	.38

TABLE 2.7-105 (Sheet 2 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS A HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
TOTAL	1.05	.87	2.97	1.92	6.81	13.10	72.32	118.97	126.31	112.68	133.12	67.43	657.56	
HOURS OF CALM			.87											

STABILITY CLASS B HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.000	.175	.524	.000	.349	.699	3.145	4.367	5.241	4.892	10.307	5.765	35.463	5.741
NNE	.000	.175	.000	.349	.524	2.620	5.241	5.416	4.018	4.892	4.717	3.843	31.795	4.799
NE	.000	.000	.349	.699	.1.398	4.717	8.735	6.114	3.145	2.271	1.747	1.572	30.747	3.458
ENE	.000	.175	.000	.873	1.223	4.193	9.434	4.193	1.922	1.572	1.048	.000	24.632	2.952
E	.000	.000	.349	.699	1.048	1.048	6.114	3.843	1.747	.524	.000	.000	15.373	2.823
ESE	.000	.175	.175	.524	.000	2.271	10.482	8.036	2.970	1.048	.349	.000	26.030	3.110
SE	.000	.000	.000	.000	.524	1.398	11.006	7.861	10.132	6.114	3.145	.699	40.879	4.018
SSE	.000	.000	.349	.349	.699	1.572	8.385	10.831	10.132	13.976	20.265	7.687	74.246	5.303
S	.000	.175	.349	.349	.524	1.048	6.988	9.608	17.120	22.187	41.578	21.837	121.764	6.125
SSW	.000	.000	.000	.175	.175	1.398	3.843	7.512	7.337	7.337	9.259	4.717	41.753	5.246
SW	.000	.000	.175	.699	.524	1.048	6.464	9.259	6.638	6.988	4.018	.873	36.686	4.259

TABLE 2.7-105 (Sheet 3 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS B			HRS			wind speed in m/sec								
DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
WSW	.000	.000	.000	.000	.000	.873	2.271	4.717	2.446	1.223	2.970	1.572	16.072	4.742
W	.000	.000	.175	.000	.175	.349	.873	.000	1.223	.000	.349	.000	3.145	3.522
WNW	.000	.000	.000	.000	.000	.349	.000	.524	.699	.699	1.223	.699	4.193	5.925
NW	.000	.349	.000	.000	.175	.000	.524	1.747	2.620	3.145	6.114	4.892	19.566	6.401
NNW	.000	.000	.000	.175	.175	1.223	5.416	6.114	6.813	6.988	10.132	16.596	53.632	6.405
CALM	.70												.70	.35
TOTAL	.70	1.22	2.45	4.89	7.51	24.81	88.92	90.14	84.20	83.85	117.22	70.75	576.67	
HOURS OF CALM			.70											

STABILITY CLASS C			HRS			wind speed in m/sec								
DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.000	.175	.699	.873	1.048	1.572	5.416	6.289	7.163	7.687	12.403	10.132	53.457	5.531
NNE	.000	.175	.524	1.223	1.223	4.018	3.843	5.066	4.542	4.717	4.892	4.367	34.590	4.575
NE	.000	.175	.699	1.747	3.494	4.717	9.608	3.843	1.922	2.970	2.970	.349	32.494	3.128
ENE	.175	.175	1.223	1.223	3.319	6.289	8.036	4.018	4.367	1.747	.873	.175	31.620	2.806
E	.000	.524	.699	1.223	1.048	4.367	6.638	3.494	1.223	.349	.349	.000	19.915	2.480

TABLE 2.7-105 (Sheet 4 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS C HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
ESE	.175	.349	.349	.175	.524	4.367	14.500	6.464	2.271	1.398	.524	.000	31.096	2.875
SE	.000	.524	.000	.175	.873	1.398	8.910	8.211	9.608	8.385	4.018	.349	42.451	4.114
SSE	.000	.175	.524	.349	.349	4.367	7.687	12.054	9.783	16.946	20.964	8.385	81.583	5.250
S	.000	.175	.000	.873	.873	1.048	6.114	8.910	15.548	24.283	43.849	25.506	127.179	6.226
SSW	.000	.349	.524	.524	.873	2.271	5.416	2.795	7.163	7.687	12.403	4.717	44.722	5.233
SW	.000	.000	.349	.349	.175	1.398	5.940	5.416	4.542	4.717	5.241	1.747	29.873	4.597
WSW	.000	.000	.349	.349	.175	2.096	2.970	4.542	4.542	3.145	4.367	1.922	24.458	4.647
W	.000	.349	.349	.000	.699	.524	1.398	1.223	2.446	1.747	1.048	.699	10.482	4.272
WNW	.175	.349	.000	.000	.000	.524	1.398	1.048	1.223	1.048	1.398	2.271	9.434	5.422
NW	.000	.000	.349	.524	.175	.524	1.572	3.145	3.843	3.494	6.114	9.608	29.349	6.397
NNW	.000	.175	1.048	.175	.699	2.446	8.211	6.289	4.367	5.241	11.006	16.771	56.427	6.016
CALM	1.57												1.57	.36
TOTAL	2.10	3.67	7.69	9.78	15.55	41.93	97.66	82.81	84.55	95.56	132.42	87.00	660.70	

HOURS OF CALM 1.57

TABLE 2.7-105 (Sheet 5 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS D HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.000	.873	1.223	1.223	3.494	9.783	42.626	73.897	86.126	83.854	103.071	51.885	458.055	5.293
NNE	.000	1.223	2.620	2.620	2.620	10.482	35.463	50.837	57.301	45.596	42.626	13.277	264.666	4.584
NE	.349	1.048	2.620	4.193	5.416	9.434	26.379	36.337	42.102	29.873	16.247	2.271	176.269	3.998
ENE	.175	1.398	3.319	5.066	5.241	11.181	28.301	38.608	35.289	20.090	7.337	.349	156.354	3.605
E	.000	1.572	2.446	3.669	6.988	15.373	58.873	53.807	18.693	6.464	1.922	.000	169.805	2.990
ESE	.175	1.223	3.669	2.795	9.434	24.108	78.439	53.632	23.759	10.657	2.795	.349	211.034	2.986
SE	.000	.873	2.620	2.620	5.416	14.849	73.547	110.408	103.246	76.168	35.289	3.145	428.182	4.104
SSE	.000	.699	2.620	2.446	3.145	11.879	41.753	88.397	149.715	161.944	197.757	55.728	716.083	5.394
S	.175	1.048	1.572	2.096	2.795	8.560	30.397	64.813	114.601	143.601	195.835	76.867	642.360	5.745
SSW	.000	.524	2.096	2.271	1.398	7.512	25.331	27.427	27.427	23.759	23.409	6.988	148.143	4.421
SW	.175	.873	2.096	1.572	2.620	6.988	14.325	11.879	9.783	7.861	8.910	4.717	71.800	4.004
WSW	.175	1.048	1.922	1.572	2.271	6.813	13.801	7.337	4.367	3.843	7.163	1.572	51.885	3.540
W	.000	.699	2.096	.175	1.398	1.398	7.512	4.717	4.367	2.795	3.319	1.922	30.397	3.827
WNW	.000	.524	.873	1.048	1.922	2.446	11.355	14.150	12.753	12.054	17.120	8.385	82.632	4.940
NW	.175	1.048	1.223	.524	1.223	4.193	15.548	16.771	19.391	24.458	41.753	27.078	153.384	5.711
NNW	.175	.873	1.747	1.223	2.446	7.512	19.741	26.554	37.036	50.662	93.812	76.168	317.948	6.192

TABLE 2.7-105 (Sheet 6 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS D HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
CALM	9.96												9.96	.33
TOTAL	11.53	15.55	34.76	35.11	57.82	152.51	523.39	679.57	745.96	703.68	798.36	330.70	4088.95	

HOURS OF CALM 9.96

STABILITY CLASS E HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.349	1.398	1.398	2.096	1.922	5.590	12.403	15.373	13.102	7.861	2.271	.175	63.939	3.423
NNE	.000	.873	.699	1.223	1.922	5.416	12.928	20.440	13.452	4.717	.524	.175	62.367	3.359
NE	.000	.524	.524	1.398	1.398	3.494	6.813	4.367	3.319	.524	.349	.000	22.711	2.755
ENE	.175	1.048	1.048	.873	1.048	3.494	5.241	2.620	1.747	.349	.000	.000	17.644	2.361
E	.000	1.398	2.446	1.747	3.145	10.657	25.506	11.530	1.747	.349	.000	.000	58.523	2.385
ESE	.349	.699	2.795	3.494	8.735	22.361	64.987	26.554	3.843	.175	.175	.000	134.167	2.454
SE	.175	3.145	2.271	4.193	8.910	23.584	113.902	163.516	80.535	14.675	1.572	.000	416.477	3.290
SSE	.699	2.271	3.494	3.669	5.416	17.994	84.204	149.715	144.125	54.505	17.295	2.795	486.181	3.845
S	.349	2.970	4.018	3.669	5.416	9.084	34.066	57.825	55.379	32.144	15.548	2.271	222.739	3.901
SSW	.524	2.795	4.542	3.843	6.114	8.560	26.030	28.476	26.030	16.946	10.482	1.398	135.739	3.627

TABLE 2.7-105 (Sheet 7 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS E HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
SW	.524	2.620	6.988	4.542	5.066	8.910	11.705	12.403	8.735	7.861	8.560	1.398	79.312	3.272
WSW	.175	1.747	2.970	2.446	4.193	6.464	9.783	5.940	5.765	4.717	3.843	.175	48.216	3.071
W	.175	1.223	1.747	2.096	3.319	4.367	7.337	3.843	3.319	1.572	.349	.000	29.349	2.519
WNW	.000	.873	3.669	3.319	2.446	4.892	13.976	13.452	11.181	4.193	2.620	.524	61.144	3.189
NW	.175	1.223	1.747	2.970	5.241	9.958	26.903	26.554	19.391	5.590	1.922	.524	102.198	3.173
NNW	.349	.349	1.572	1.747	3.494	5.241	12.229	13.277	9.434	5.940	3.145	2.271	59.048	3.561
CALM	23.76												23.76	.35
TOTAL	27.78	25.16	41.93	43.32	67.78	150.06	468.01	555.89	401.10	162.12	68.66	11.70	2023.51	

HOURS OF CALM 23.76

STABILITY CLASS F HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.000	.349	.000	.524	.349	.524	.175	.873	.699	.175	.000	.000	3.669	2.686
NNE	.000	.000	.175	.175	.000	.000	.349	1.747	.699	.349	.000	.000	3.494	3.668
NE	.000	.349	.175	.349	.000	.000	.000	.175	.000	.000	.000	.000	1.048	1.296
ENE	.000	.349	.000	.000	.000	.000	.000	.175	.000	.000	.000	.000	.524	1.565

TABLE 2.7-105 (Sheet 8 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS F			HRS			wind speed in m/sec								
DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
E	.000	.000	.000	.175	.175	.524	.699	.000	.000	.000	.000	.000	1.572	1.912
ESE	.000	.699	.699	.699	.524	1.398	1.572	1.572	.175	.000	.175	.000	7.512	2.091
SE	.175	.699	2.271	1.398	2.446	4.018	22.361	20.265	4.193	.175	.175	.000	58.174	2.776
SSE	.000	.873	3.319	2.620	2.620	5.940	16.422	17.295	5.590	.349	.000	.000	55.030	2.684
S	.349	1.223	3.669	1.572	6.464	9.608	15.548	13.102	5.765	1.223	.175	.175	58.873	2.545
SSW	.175	1.922	5.066	5.590	6.638	8.211	13.801	9.958	6.114	1.922	.349	.000	59.746	2.418
SW	.000	1.747	3.843	8.385	5.940	8.036	9.608	6.464	6.638	1.572	.349	.000	52.584	2.335
WSW	.175	2.096	4.018	5.241	5.416	5.590	14.150	6.813	4.193	1.922	.349	.000	49.963	2.345
W	.175	1.747	3.494	3.843	2.446	5.241	4.018	3.145	1.223	.699	.175	.000	26.205	2.000
WNW	.175	1.572	2.970	3.319	4.367	5.066	7.687	5.765	2.795	.524	.349	.000	34.590	2.262
NW	.000	1.223	1.922	2.096	4.193	6.638	24.807	15.199	2.096	.175	.000	.000	58.349	2.552
NNW	.000	.524	1.223	.699	.349	1.922	2.620	1.747	.175	.175	.000	.000	9.434	2.090
CALM	9.96												9.96	.36
TOTAL	11.18	15.37	32.84	36.69	41.93	62.72	133.82	104.29	40.35	9.26	2.10	.17	490.72	
HOURS OF CALM			9.96											

TABLE 2.7-105 (Sheet 9 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS G HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
N	.000	.175	.000	.175	.175	.000	.000	.000	.000	.000	.000	.000	.524	1.013
NNE	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
NE	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
ENE	.175	.000	.000	.000	.000	.000	.175	.000	.000	.000	.000	.000	.349	1.699
E	.000	.175	.000	.000	.000	.000	.175	.000	.000	.000	.000	.000	.349	1.654
ESE	.000	.175	.175	.000	.699	.175	.175	.000	.175	.000	.000	.000	1.572	1.704
SE	.000	.000	.873	.524	.349	1.747	2.271	1.398	.000	.000	.175	.000	7.337	2.235
SSE	.000	.873	1.048	1.223	1.922	.699	.699	.524	.000	.000	.000	.524	7.512	2.137
S	.000	.349	1.223	1.223	2.446	5.066	4.717	1.922	.699	.000	.524	.524	18.693	2.440
SSW	.000	.873	.524	3.319	6.464	11.006	8.735	5.416	2.096	.524	.349	.000	39.307	2.231
SW	.175	.524	2.271	3.494	4.542	8.560	12.229	5.590	2.271	.175	.175	.000	40.006	2.212
WSW	.000	1.048	2.271	3.145	4.542	11.355	18.168	11.530	5.241	1.048	.175	.000	58.523	2.537
W	.000	1.048	2.096	4.018	3.669	4.892	3.843	1.398	.175	.175	.000	.524	21.837	1.903
WNW	.175	1.048	4.018	3.319	3.494	5.940	4.717	.699	.175	.349	.000	.000	23.933	1.651
NW	.000	1.048	1.223	1.572	4.018	5.765	15.897	3.843	.349	.000	.000	.000	33.716	2.175
NNW	.000	.000	.175	.873	.175	1.398	1.572	.349	.000	.000	.000	.000	4.542	1.950

TABLE 2.7-105 (Sheet 10 of 10)
ANNUAL STABILITY CLASS FREQUENCY DISTRIBUTION FOR CPNPP
(UPPER BOUND OF WIND SPEED CATEGORY LISTED)

STABILITY CLASS G HRS wind speed in m/sec

DIR	0.5	0.75	1	1.25	1.5	2.00	3	4.0	5.0	6	8	16	TOTAL	AVE SPEED
CALM	3.67												3.67	.34
TOTAL	4.19	7.34	15.90	22.89	32.49	56.60	73.37	32.67	11.18	2.27	1.40	1.57	261.87	

HOURS OF CALM 3.67

TABLE 2.7-106
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
JANUARY

2000 – 2005

January	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	10	1323	0.401	19	577	0.444
2001	21	1327	0.336	33	932	0.355
2002	4	1634	0.184	13	761	0.456
2003	9	1254	0.406	18	600	0.487
2004	6	1270	0.393	16	736	0.357
2005	6	912	0.384	17	703	0.462
Total	56	1286	0.359	116	743	0.417

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-107
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
FEBRUARY

2000 – 2005

February	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	4	1509	0.260	16	705	0.729
2001	17	1234	0.294	29	776	0.543
2002	2	1876	0.392	12	360	0.531
2003	8	874	0.417	14	729	0.375
2004	6	1463	0.173	11	746	0.645
2005	4	1005	0.238	12	655	0.353
Total	41	1233	0.296	94	685	0.535

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-108
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
MARCH

2000 – 2005

March	Mornings with Inversions[(a)]	Average Height[(b)] (m)	Average Strength[(c)] (0.1ºC/m)	Afternoons with Inversions[(a)]	Average Height[(b)] (m)	Average Strength[(c)] (0.1ºC/m)
2000	4	1326	0.511	10	664	0.300
2001	13	1434	0.307	20	808	0.472
2002	7	1183	0.297	13	852	0.397
2003	7	1507	0.335	10	754	0.384
2004	2	1537	0.524	8	535	0.666
2005				9	1010	0.207
Total	33	1390	0.349	70	783	0.409

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-109
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
APRIL

2000 – 2005

April	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	7	1249	0.324	14	602	0.448
2001	16	1853	0.370	26	1184	0.375
2002	3	1850	0.387	10	1294	0.379
2003	2	1235	0.438	15	793	0.464
2004	5	1616	0.468	8	1273	0.328
2005	2	1677	0.443	4	814	0.362
Total	35	1652	0.385	77	1006	0.401

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-110
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
MAY

2000 – 2005

May	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	5	1250	0.343	8	989	0.383
2001	3	1898	0.301	13	1147	0.415
2002	4	1636	0.181	2	1317	0.361
2003	6	1750	0.361	7	1150	0.275
2004	4	1372	0.552	7	1013	0.188
2005				2	1278	0.262
Total	22	1567	0.351	39	1107	0.332

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-111
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
JUNE

2000 – 2005

June	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	1	1454	0.357	2	908	0.315
2001	2	1949	0.175	15	822	0.319
2002	1	1996	0.381	1	196	0.532
2003	2	945	0.222	2	655	0.308
2004	1	2285	0.545	1	1496	0.200
2005	1	2097	0.375	2	1398	0.284
Total	8	1703	0.307	23	867	0.319

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-112
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
JULY

2000 – 2005

July	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000				2	402	0.352
2001	1	2602	0.250	2	603	0.345
2002				1	196	1.333
2003	1	1753	0.200	2	844	0.304
2004	2	1464	0.318	1	2110	0.125
2005				1	1932	0.055
Total	4	1821	0.271	9	882	0.391

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-113
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
AUGUST

2000 – 2005

August	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000				1	196	0.364
2001	3	1085	0.301	3	325	0.254
2002				2	1075	0.145
2003						
2004				1	662	0.486
2005						
Total	3	1085	0.301	7	569	0.254

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-114
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
SEPTEMBER

2000 – 2005

September	Mornings with Inversions(a)	Average Height(b) (m)	Average Strength(c) (0.1ºC/m)	Afternoons with Inversions(a)	Average Height(b) (m)	Average Strength(c) (0.1ºC/m)
2000				7	585	0.609
2001	7	1560	0.370	19	857	0.296
2002						
2003				4	1665	0.318
2004	1	2761	0.435	1	1533	0.273
2005	3	2451	0.275	1	2382	0.364
Total	11	1912	0.350	32	967	0.312

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-115
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
OCTOBER

2000 – 2005

October	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	2	1293	0.189	6	1009	0.286
2001	18	1530	0.257	28	715	0.418
2002	3	790	0.338	5	1133	0.228
2003	4	1759	0.169	7	556	0.406
2004	2	1278	0.381	3	468	0.514
2005	3	1919	0.236	8	1106	0.426
Total	32	1495	0.255	57	805	0.392

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-116
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
NOVEMBER

2000 – 2005

November	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	6	1342	0.151	5	798	0.404
2001	9	1403	0.313	19	727	0.371
2002	6	1124	0.468	14	530	0.328
2003	7	1021	0.363	14	658	0.391
2004	3	1132	0.157	6	906	0.301
2005	2	1295	0.103	7	605	0.332
Total	33	1229	0.295	65	678	0.358

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-117
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
DECEMBER

2000 – 2005

December	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	8	1124	0.486	15	804	0.321
2001	12	1330	0.317	26	672	0.410
2002	3	725	0.233	15	560	0.292
2003	4	1465	0.246	17	625	0.315
2004	4	1360	0.223	13	636	0.212
2005	5	1045	0.240	13	645	0.323
Total	36	1213	0.319	99	659	0.325

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-118
INVERSION HEIGHTS AND STRENGTHS, FORT WORTH
ANNUAL

2000 – 2005

Annual	Mornings with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)	Afternoons with Inversions[a]	Average Height[b] (m)	Average Strength[c] (0.1ºC/m)
2000	47	1290	0.353	105	707	0.447
2001	122	1472	0.313	233	847	0.400
2002	33	1332	0.315	88	737	0.389
2003	50	1309	0.344	110	744	0.390
2004	36	1456	0.354	76	822	0.385
2005	26	1379	0.287	76	833	0.353
Total	314	1395	0.327	688	791	0.397

a) Inversion is defined as three or more NOAA weather balloon elevation readings showing consecutive increases in temperature with height below 3000 m.

b) Balloons were released each day at 0000 Universal Time Coordinated (UTC) and 1200 UTC. Height is defined as elevation in meters where temperature first increases and is averaged only over those days with inversions.

c) Strength is the maximum temperature gradient in tenths of a degree centigrade per meter within the inversion layer.

(RDA 2008)

TABLE 2.7-119
MINIMUM EXCLUSION AREA BOUNDARY (EAB) AND LPZ DISTANCES

Boundary	Distance
EAB distance (from containment centerline)	0.5 mile
Release boundary (from containment centerline)	670 ft
Distance from release boundary to EAB	1970 ft (600 m)
LPZ distance (from center point between Units 3 and 4)	2 miles (10560 ft, 3219 m)

TABLE 2.7-120
OFF-SITE RECEPTOR LOCATIONS

Sector	Residence	Garden
S	5751	
SSW	4185	
SW	4185	
WSW	6132	
W	6132	
WNW	11959	
NW	11532	
NNW	11532	
N	10504	
NNE	10504	
NE	12640	
ENE	12675	15120
E	14598	15120
ESE	12804	
SE	10320	
SSE	9653	

NOTE:

1. Distances, in feet, from the center point between Units 3 & 4 to the nearest receptor (residence or garden) in each sector.

TABLE 2.7-121
ACCIDENT ATMOSPHERIC DISPERSION VALUES FOR
CPNPP UNITS 3 AND 4

Comanche Peak Maximum 50% Probability-Level χ/Q Values (s/m^3)

	0 – 2 Hrs	0 – 8 Hrs	8 – 24 Hrs	24 – 96 Hrs	96 – 720 Hrs
EAB	5.75E-05				
LPZ		3.32E-06	2.75E-06	1.83E-06	1.01E-06

TABLE 2.7-122 (Sheet 1 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, UNDEPLETED

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	3.31E-06	1.10E-06	6.09E-07	4.00E-07	2.19E-07	1.42E-07	1.02E-07	7.70E-08	6.10E-08	4.99E-08	4.17E-08
SSW	2.66E-06	8.71E-07	4.82E-07	3.16E-07	1.73E-07	1.12E-07	8.02E-08	6.09E-08	4.83E-08	3.95E-08	3.31E-08
SW	2.03E-06	6.61E-07	3.61E-07	2.35E-07	1.27E-07	8.16E-08	5.79E-08	4.38E-08	3.46E-08	2.82E-08	2.35E-08
WSW	1.93E-06	6.36E-07	3.49E-07	2.27E-07	1.23E-07	7.89E-08	5.60E-08	4.23E-08	3.34E-08	2.72E-08	2.27E-08
W	2.71E-06	8.79E-07	4.88E-07	3.22E-07	1.77E-07	1.16E-07	8.28E-08	6.30E-08	5.01E-08	4.10E-08	3.44E-08
WNW	4.41E-06	1.39E-06	7.70E-07	5.08E-07	2.83E-07	1.86E-07	1.35E-07	1.03E-07	8.24E-08	6.78E-08	5.72E-08
NW	8.85E-06	2.75E-06	1.51E-06	1.00E-06	5.65E-07	3.75E-07	2.73E-07	2.11E-07	1.69E-07	1.40E-07	1.18E-07
NNW	1.11E-05	3.44E-06	1.89E-06	1.25E-06	7.05E-07	4.67E-07	3.39E-07	2.62E-07	2.10E-07	1.74E-07	1.47E-07
N	7.85E-06	2.45E-06	1.32E-06	8.55E-07	4.76E-07	3.14E-07	2.28E-07	1.75E-07	1.41E-07	1.16E-07	9.85E-08
NNE	7.05E-06	2.12E-06	1.12E-06	7.24E-07	4.09E-07	2.73E-07	2.00E-07	1.57E-07	1.27E-07	1.06E-07	9.07E-08
NE	6.25E-06	1.86E-06	9.67E-07	6.25E-07	3.53E-07	2.36E-07	1.74E-07	1.36E-07	1.11E-07	9.32E-08	7.98E-08
ENE	4.86E-06	1.44E-06	7.25E-07	4.59E-07	2.57E-07	1.72E-07	1.27E-07	1.00E-07	8.24E-08	6.96E-08	5.99E-08
E	2.57E-06	7.66E-07	3.89E-07	2.48E-07	1.40E-07	9.40E-08	6.93E-08	5.48E-08	4.49E-08	3.78E-08	3.25E-08
ESE	3.44E-06	1.03E-06	5.31E-07	3.41E-07	1.92E-07	1.29E-07	9.45E-08	7.45E-08	6.09E-08	5.11E-08	4.39E-08
SE	4.47E-06	1.35E-06	7.04E-07	4.53E-07	2.56E-07	1.71E-07	1.25E-07	9.83E-08	8.01E-08	6.70E-08	5.73E-08
SSE	2.61E-06	8.39E-07	4.58E-07	2.98E-07	1.64E-07	1.07E-07	7.67E-08	5.85E-08	4.66E-08	3.82E-08	3.21E-08

TABLE 2.7-122 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, UNDEPLETED

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	3.56E-08	1.94E-08	1.26E-08	6.93E-09	4.56E-09	3.29E-09	2.53E-09	2.02E-09	1.67E-09	1.41E-09	1.21E-09
SSW	2.82E-08	1.54E-08	1.01E-08	5.55E-09	3.66E-09	2.66E-09	2.05E-09	1.64E-09	1.36E-09	1.15E-09	9.90E-10
SW	2.01E-08	1.09E-08	7.08E-09	3.89E-09	2.57E-09	1.87E-09	1.44E-09	1.16E-09	9.59E-10	8.13E-10	7.01E-10
WSW	1.93E-08	1.05E-08	6.79E-09	3.72E-09	2.45E-09	1.77E-09	1.36E-09	1.09E-09	9.02E-10	7.63E-10	6.57E-10
W	2.95E-08	1.62E-08	1.06E-08	5.87E-09	3.88E-09	2.82E-09	2.18E-09	1.75E-09	1.45E-09	1.23E-09	1.06E-09
WNW	4.91E-08	2.74E-08	1.81E-08	1.02E-08	6.80E-09	4.98E-09	3.86E-09	3.12E-09	2.59E-09	2.20E-09	1.91E-09
NW	1.02E-07	5.77E-08	3.85E-08	2.19E-08	1.48E-08	1.09E-08	8.46E-09	6.86E-09	5.72E-09	4.88E-09	4.23E-09
NNW	1.27E-07	7.14E-08	4.77E-08	2.71E-08	1.82E-08	1.34E-08	1.05E-08	8.48E-09	7.08E-09	6.03E-09	5.23E-09
N	8.48E-08	4.80E-08	3.22E-08	1.84E-08	1.24E-08	9.19E-09	7.19E-09	5.85E-09	4.89E-09	4.18E-09	3.64E-09
NNE	7.88E-08	4.59E-08	3.14E-08	1.84E-08	1.27E-08	9.50E-09	7.51E-09	6.17E-09	5.20E-09	4.47E-09	3.91E-09
NE	6.95E-08	4.09E-08	2.81E-08	1.67E-08	1.15E-08	8.69E-09	6.89E-09	5.67E-09	4.80E-09	4.14E-09	3.62E-09
ENE	5.24E-08	3.14E-08	2.19E-08	1.32E-08	9.23E-09	7.01E-09	5.61E-09	4.64E-09	3.94E-09	3.42E-09	3.01E-09
E	2.84E-08	1.69E-08	1.17E-08	7.01E-09	4.89E-09	3.70E-09	2.95E-09	2.43E-09	2.06E-09	1.78E-09	1.57E-09
ESE	3.82E-08	2.26E-08	1.56E-08	9.27E-09	6.43E-09	4.85E-09	3.86E-09	3.18E-09	2.69E-09	2.32E-09	2.04E-09
SE	4.98E-08	2.92E-08	2.00E-08	1.18E-08	8.13E-09	6.11E-09	4.84E-09	3.97E-09	3.35E-09	2.89E-09	2.53E-09
SSE	2.75E-08	1.52E-08	1.00E-08	5.61E-09	3.74E-09	2.73E-09	2.12E-09	1.71E-09	1.42E-09	1.21E-09	1.05E-09

TABLE 2.7-122 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, UNDEPLETED

SECTOR	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	6.24E-07	2.25E-07	1.03E-07	6.13E-08	4.19E-08	2.00E-08	7.14E-09	3.32E-09	2.03E-09	1.41E-09
SSW	4.95E-07	1.78E-07	8.10E-08	4.85E-08	3.32E-08	1.59E-08	5.72E-09	2.68E-09	1.65E-09	1.15E-09
SW	3.72E-07	1.31E-07	5.86E-08	3.48E-08	2.36E-08	1.12E-08	4.02E-09	1.89E-09	1.16E-09	8.15E-10
WSW	3.58E-07	1.26E-07	5.67E-08	3.36E-08	2.28E-08	1.08E-08	3.84E-09	1.79E-09	1.10E-09	7.65E-10
W	5.01E-07	1.82E-07	8.36E-08	5.03E-08	3.45E-08	1.66E-08	6.04E-09	2.85E-09	1.76E-09	1.23E-09
WNW	7.92E-07	2.90E-07	1.36E-07	8.28E-08	5.73E-08	2.81E-08	1.04E-08	5.02E-09	3.13E-09	2.21E-09
NW	1.56E-06	5.77E-07	2.75E-07	1.70E-07	1.19E-07	5.90E-08	2.24E-08	1.09E-08	6.88E-09	4.89E-09
NNW	1.95E-06	7.21E-07	3.42E-07	2.11E-07	1.47E-07	7.31E-08	2.77E-08	1.35E-08	8.51E-09	6.04E-09
N	1.36E-06	4.88E-07	2.30E-07	1.41E-07	9.87E-08	4.91E-08	1.88E-08	9.25E-09	5.87E-09	4.19E-09
NNE	1.16E-06	4.18E-07	2.02E-07	1.28E-07	9.09E-08	4.68E-08	1.88E-08	9.55E-09	6.18E-09	4.48E-09
NE	1.01E-06	3.61E-07	1.75E-07	1.12E-07	7.99E-08	4.16E-08	1.69E-08	8.73E-09	5.69E-09	4.14E-09
ENE	7.66E-07	2.64E-07	1.28E-07	8.26E-08	6.00E-08	3.18E-08	1.34E-08	7.04E-09	4.65E-09	3.42E-09
E	4.10E-07	1.43E-07	7.01E-08	4.51E-08	3.26E-08	1.72E-08	7.11E-09	3.71E-09	2.44E-09	1.79E-09
ESE	5.58E-07	1.97E-07	9.56E-08	6.10E-08	4.39E-08	2.30E-08	9.42E-09	4.87E-09	3.18E-09	2.32E-09
SE	7.37E-07	2.62E-07	1.27E-07	8.03E-08	5.74E-08	2.97E-08	1.20E-08	6.14E-09	3.98E-09	2.89E-09
SSE	4.72E-07	1.69E-07	7.75E-08	4.68E-08	3.22E-08	1.56E-08	5.76E-09	2.76E-09	1.72E-09	1.21E-09

TABLE 2.7-123 (Sheet 1 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, DEPLETED

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	3.08E-06	9.96E-07	5.43E-07	3.50E-07	1.86E-07	1.18E-07	8.22E-08	6.12E-08	4.76E-08	3.83E-08	3.16E-08
SSW	2.48E-06	7.92E-07	4.30E-07	2.77E-07	1.47E-07	9.30E-08	6.50E-08	4.84E-08	3.77E-08	3.03E-08	2.50E-08
SW	1.89E-06	6.01E-07	3.22E-07	2.05E-07	1.08E-07	6.76E-08	4.69E-08	3.48E-08	2.70E-08	2.16E-08	1.78E-08
WSW	1.80E-06	5.78E-07	3.11E-07	1.99E-07	1.04E-07	6.54E-08	4.54E-08	3.36E-08	2.61E-08	2.09E-08	1.72E-08
W	2.52E-06	7.99E-07	4.35E-07	2.81E-07	1.50E-07	9.56E-08	6.71E-08	5.01E-08	3.91E-08	3.15E-08	2.60E-08
WNW	4.11E-06	1.27E-06	6.86E-07	4.45E-07	2.41E-07	1.54E-07	1.09E-07	8.19E-08	6.43E-08	5.21E-08	4.32E-08
NW	8.23E-06	2.50E-06	1.35E-06	8.76E-07	4.80E-07	3.11E-07	2.21E-07	1.67E-07	1.32E-07	1.07E-07	8.96E-08
NNW	1.03E-05	3.13E-06	1.69E-06	1.10E-06	5.98E-07	3.87E-07	2.75E-07	2.08E-07	1.64E-07	1.33E-07	1.11E-07
N	7.31E-06	2.23E-06	1.17E-06	7.48E-07	4.05E-07	2.60E-07	1.84E-07	1.39E-07	1.10E-07	8.94E-08	7.44E-08
NNE	6.56E-06	1.92E-06	9.93E-07	6.33E-07	3.47E-07	2.26E-07	1.62E-07	1.24E-07	9.92E-08	8.15E-08	6.86E-08
NE	5.82E-06	1.69E-06	8.62E-07	5.47E-07	3.00E-07	1.95E-07	1.41E-07	1.08E-07	8.67E-08	7.15E-08	6.03E-08
ENE	4.53E-06	1.31E-06	6.46E-07	4.02E-07	2.18E-07	1.42E-07	1.03E-07	7.97E-08	6.43E-08	5.34E-08	4.53E-08
E	2.39E-06	6.97E-07	3.47E-07	2.17E-07	1.19E-07	7.78E-08	5.62E-08	4.35E-08	3.51E-08	2.90E-08	2.46E-08
ESE	3.20E-06	9.39E-07	4.74E-07	2.98E-07	1.63E-07	1.06E-07	7.66E-08	5.91E-08	4.75E-08	3.93E-08	3.32E-08
SE	4.16E-06	1.23E-06	6.27E-07	3.97E-07	2.17E-07	1.42E-07	1.02E-07	7.81E-08	6.25E-08	5.14E-08	4.33E-08
SSE	2.43E-06	7.63E-07	4.08E-07	2.61E-07	1.39E-07	8.86E-08	6.21E-08	4.65E-08	3.63E-08	2.93E-08	2.43E-08

TABLE 2.7-123 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, DEPLETED

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	2.66E-08	1.37E-08	8.49E-09	4.31E-09	2.66E-09	1.82E-09	1.33E-09	1.02E-09	8.10E-10	6.58E-10	5.46E-10
SSW	2.10E-08	1.09E-08	6.77E-09	3.45E-09	2.14E-09	1.47E-09	1.08E-09	8.30E-10	6.59E-10	5.37E-10	4.46E-10
SW	1.50E-08	7.68E-09	4.76E-09	2.42E-09	1.50E-09	1.03E-09	7.60E-10	5.85E-10	4.65E-10	3.80E-10	3.16E-10
WSW	1.44E-08	7.38E-09	4.56E-09	2.31E-09	1.43E-09	9.80E-10	7.18E-10	5.51E-10	4.38E-10	3.56E-10	2.96E-10
W	2.20E-08	1.14E-08	7.12E-09	3.65E-09	2.27E-09	1.56E-09	1.15E-09	8.83E-10	7.02E-10	5.73E-10	4.76E-10
WNW	3.66E-08	1.93E-08	1.22E-08	6.33E-09	3.97E-09	2.75E-09	2.04E-09	1.58E-09	1.26E-09	1.03E-09	8.59E-10
NW	7.61E-08	4.07E-08	2.59E-08	1.36E-08	8.61E-09	6.01E-09	4.46E-09	3.46E-09	2.77E-09	2.28E-09	1.91E-09
NNW	9.43E-08	5.03E-08	3.20E-08	1.69E-08	1.07E-08	7.43E-09	5.52E-09	4.28E-09	3.43E-09	2.82E-09	2.36E-09
N	6.32E-08	3.38E-08	2.16E-08	1.14E-08	7.25E-09	5.08E-09	3.79E-09	2.95E-09	2.37E-09	1.95E-09	1.64E-09
NNE	5.87E-08	3.24E-08	2.11E-08	1.15E-08	7.40E-09	5.26E-09	3.96E-09	3.11E-09	2.52E-09	2.09E-09	1.76E-09
NE	5.18E-08	2.88E-08	1.89E-08	1.04E-08	6.74E-09	4.81E-09	3.64E-09	2.87E-09	2.33E-09	1.93E-09	1.63E-09
ENE	3.91E-08	2.21E-08	1.47E-08	8.20E-09	5.39E-09	3.88E-09	2.96E-09	2.34E-09	1.91E-09	1.60E-09	1.35E-09
E	2.12E-08	1.19E-08	7.87E-09	4.36E-09	2.85E-09	2.05E-09	1.55E-09	1.23E-09	1.00E-09	8.32E-10	7.05E-10
ESE	2.85E-08	1.59E-08	1.05E-08	5.77E-09	3.76E-09	2.68E-09	2.03E-09	1.60E-09	1.30E-09	1.08E-09	9.17E-10
SE	3.71E-08	2.06E-08	1.34E-08	7.33E-09	4.75E-09	3.38E-09	2.55E-09	2.01E-09	1.63E-09	1.35E-09	1.14E-09
SSE	2.05E-08	1.07E-08	6.74E-09	3.49E-09	2.18E-09	1.51E-09	1.12E-09	8.64E-10	6.90E-10	5.65E-10	4.72E-10

TABLE 2.7-123 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR NO DECAY, DEPLETED

SECTOR	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	5.58E-07	1.92E-07	8.32E-08	4.79E-08	3.17E-08	1.42E-08	4.51E-09	1.85E-09	1.03E-09	6.62E-10
SSW	4.42E-07	1.52E-07	6.58E-08	3.79E-08	2.51E-08	1.13E-08	3.61E-09	1.49E-09	8.36E-10	5.39E-10
SW	3.32E-07	1.12E-07	4.76E-08	2.72E-08	1.79E-08	8.00E-09	2.53E-09	1.05E-09	5.89E-10	3.81E-10
WSW	3.20E-07	1.08E-07	4.60E-08	2.62E-08	1.73E-08	7.69E-09	2.42E-09	9.95E-10	5.56E-10	3.58E-10
W	4.48E-07	1.55E-07	6.79E-08	3.93E-08	2.61E-08	1.18E-08	3.81E-09	1.58E-09	8.90E-10	5.75E-10
WNW	7.08E-07	2.48E-07	1.10E-07	6.47E-08	4.34E-08	2.00E-08	6.58E-09	2.79E-09	1.59E-09	1.03E-09
NW	1.39E-06	4.93E-07	2.23E-07	1.33E-07	8.99E-08	4.20E-08	1.41E-08	6.08E-09	3.49E-09	2.29E-09
NNW	1.74E-06	6.15E-07	2.78E-07	1.65E-07	1.12E-07	5.20E-08	1.75E-08	7.52E-09	4.31E-09	2.83E-09
N	1.22E-06	4.17E-07	1.87E-07	1.11E-07	7.47E-08	3.49E-08	1.18E-08	5.15E-09	2.97E-09	1.96E-09
NNE	1.04E-06	3.57E-07	1.64E-07	9.96E-08	6.88E-08	3.32E-08	1.18E-08	5.31E-09	3.13E-09	2.10E-09
NE	9.06E-07	3.08E-07	1.42E-07	8.71E-08	6.05E-08	2.95E-08	1.07E-08	4.85E-09	2.88E-09	1.94E-09
ENE	6.85E-07	2.25E-07	1.04E-07	6.46E-08	4.54E-08	2.26E-08	8.40E-09	3.91E-09	2.35E-09	1.60E-09
E	3.67E-07	1.22E-07	5.69E-08	3.52E-08	2.46E-08	1.22E-08	4.47E-09	2.06E-09	1.23E-09	8.35E-10
ESE	4.99E-07	1.68E-07	7.76E-08	4.77E-08	3.32E-08	1.63E-08	5.92E-09	2.71E-09	1.61E-09	1.09E-09
SE	6.59E-07	2.23E-07	1.03E-07	6.27E-08	4.34E-08	2.11E-08	7.54E-09	3.41E-09	2.02E-09	1.35E-09
SSE	4.22E-07	1.44E-07	6.29E-08	3.66E-08	2.44E-08	1.11E-08	3.63E-09	1.53E-09	8.71E-10	5.68E-10

TABLE 2.7-124 (Sheet 1 of 2)
χ/Q AND D/Q VALUES FOR NORMAL RELEASES

No Decay, Undepleted and Depleted, at Each Receptor Location

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (s/m^3) No Decay Undepleted	χ/Q (s/m^3) No Decay Depleted	D/Q (m^{-2})
EAB	S	0.37	600	1.70E-06	1.50E-06	2.30E-08
EAB	SSW	0.37	600	1.30E-06	1.20E-06	1.50E-08
EAB	SW	0.37	600	1.00E-06	9.40E-07	1.10E-08
EAB	WSW	0.37	600	9.80E-07	9.00E-07	9.10E-09
EAB	W	0.37	600	1.40E-06	1.30E-06	1.10E-08
EAB	WNW	0.37	600	2.20E-06	2.00E-06	1.70E-08
EAB	NW	0.37	600	4.40E-06	4.10E-06	3.80E-08
EAB	NNW	0.37	600	5.50E-06	5.10E-06	5.50E-08
EAB	N	0.37	600	3.90E-06	3.60E-06	4.90E-08
EAB	NNE	0.37	600	3.50E-06	3.20E-06	1.90E-08
EAB	NE	0.37	600	3.10E-06	2.80E-06	1.20E-08
EAB	ENE	0.37	600	2.40E-06	2.20E-06	9.00E-09
EAB	E	0.37	600	1.30E-06	1.20E-06	4.00E-09
EAB	ESE	0.37	600	1.70E-06	1.60E-06	7.50E-09
EAB	SE	0.37	600	2.20E-06	2.00E-06	1.40E-08
EAB	SSE	0.37	600	1.30E-06	1.20E-06	1.90E-08
Residence	S	1.09	1753	3.50E-07	3.10E-07	3.90E-09
Residence	SSW	0.79	1276	4.40E-07	3.90E-07	4.50E-09

TABLE 2.7-124 (Sheet 2 of 2)
χ/Q AND D/Q VALUES FOR NORMAL RELEASES

No Decay, Undepleted and Depleted, at Each Receptor Location

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (s/m^3) No Decay Undepleted	χ/Q (s/m^3) No Decay Depleted	D/Q (m^{-2})
Residence	SW	0.79	1276	3.30E-07	3.00E-07	3.10E-09
Residence	WSW	1.16	1869	1.80E-07	1.60E-07	1.40E-09
Residence	W	1.16	1869	2.60E-07	2.20E-07	1.60E-09
Residence	WNW	2.26	3645	1.60E-07	1.30E-07	8.00E-10
Residence	NW	2.18	3515	3.30E-07	2.70E-07	1.90E-09
Residence	NNW	2.18	3515	4.10E-07	3.40E-07	2.80E-09
Residence	N	1.99	3202	3.20E-07	2.60E-07	2.90E-09
Residence	NNE	1.99	3202	2.70E-07	2.30E-07	1.20E-09
Residence	NE	2.39	3853	1.80E-07	1.50E-07	5.20E-10
Residence	ENE	2.4	3863	1.30E-07	1.10E-07	3.90E-10
Residence	E	2.76	4449	6.10E-08	4.90E-08	1.40E-10
Residence	ESE	2.43	3903	9.80E-08	8.00E-08	3.20E-10
Residence	SE	1.95	3146	1.80E-07	1.50E-07	8.70E-10
Residence	SSE	1.83	2942	1.20E-07	1.00E-07	1.30E-09
GARDEN	ENE	2.86	4609	1.10E-07	8.50E-08	2.90E-10
GARDEN	E	2.86	4609	5.80E-08	4.60E-08	1.30E-10

TABLE 2.7-125 (Sheet 1 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	3.31E-06	1.09E-06	6.08E-07	3.99E-07	2.18E-07	1.42E-07	1.01E-07	7.65E-08	6.06E-08	4.94E-08	4.13E-08
SSW	2.66E-06	8.69E-07	4.81E-07	3.15E-07	1.72E-07	1.12E-07	7.97E-08	6.05E-08	4.79E-08	3.91E-08	3.27E-08
SW	2.03E-06	6.60E-07	3.61E-07	2.34E-07	1.26E-07	8.11E-08	5.75E-08	4.34E-08	3.42E-08	2.78E-08	2.32E-08
WSW	1.93E-06	6.35E-07	3.48E-07	2.26E-07	1.22E-07	7.84E-08	5.56E-08	4.19E-08	3.30E-08	2.68E-08	2.24E-08
W	2.71E-06	8.77E-07	4.87E-07	3.21E-07	1.76E-07	1.15E-07	8.21E-08	6.25E-08	4.95E-08	4.05E-08	3.40E-08
WNW	4.41E-06	1.39E-06	7.68E-07	5.07E-07	2.82E-07	1.85E-07	1.34E-07	1.02E-07	8.15E-08	6.70E-08	5.64E-08
NW	8.84E-06	2.74E-06	1.51E-06	9.98E-07	5.63E-07	3.73E-07	2.71E-07	2.09E-07	1.68E-07	1.39E-07	1.17E-07
NNW	1.11E-05	3.43E-06	1.89E-06	1.25E-06	7.00E-07	4.63E-07	3.36E-07	2.58E-07	2.07E-07	1.71E-07	1.44E-07
N	7.85E-06	2.45E-06	1.31E-06	8.53E-07	4.75E-07	3.13E-07	2.26E-07	1.74E-07	1.40E-07	1.15E-07	9.73E-08
NNE	7.04E-06	2.11E-06	1.11E-06	7.18E-07	4.04E-07	2.69E-07	1.97E-07	1.53E-07	1.24E-07	1.03E-07	8.78E-08
NE	6.24E-06	1.85E-06	9.62E-07	6.20E-07	3.48E-07	2.32E-07	1.70E-07	1.33E-07	1.08E-07	9.02E-08	7.69E-08
ENE	4.86E-06	1.44E-06	7.22E-07	4.57E-07	2.56E-07	1.70E-07	1.25E-07	9.91E-08	8.13E-08	6.85E-08	5.88E-08
E	2.57E-06	7.64E-07	3.88E-07	2.46E-07	1.39E-07	9.31E-08	6.85E-08	5.41E-08	4.42E-08	3.71E-08	3.18E-08
ESE	3.43E-06	1.03E-06	5.30E-07	3.39E-07	1.91E-07	1.27E-07	9.36E-08	7.36E-08	6.00E-08	5.03E-08	4.30E-08
SE	4.47E-06	1.35E-06	7.02E-07	4.52E-07	2.55E-07	1.70E-07	1.25E-07	9.74E-08	7.92E-08	6.62E-08	5.65E-08
SSE	2.61E-06	8.38E-07	4.57E-07	2.98E-07	1.63E-07	1.06E-07	7.62E-08	5.81E-08	4.62E-08	3.79E-08	3.18E-08

TABLE 2.7-125 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	3.52E-08	1.91E-08	1.24E-08	6.71E-09	4.36E-09	3.12E-09	2.37E-09	1.87E-09	1.53E-09	1.28E-09	1.09E-09
SSW	2.79E-08	1.51E-08	9.82E-09	5.35E-09	3.49E-09	2.50E-09	1.90E-09	1.51E-09	1.23E-09	1.03E-09	8.76E-10
SW	1.98E-08	1.07E-08	6.88E-09	3.72E-09	2.42E-09	1.74E-09	1.32E-09	1.04E-09	8.52E-10	7.12E-10	6.05E-10
WSW	1.90E-08	1.02E-08	6.57E-09	3.54E-09	2.29E-09	1.63E-09	1.23E-09	9.74E-10	7.92E-10	6.59E-10	5.59E-10
W	2.90E-08	1.58E-08	1.03E-08	5.60E-09	3.65E-09	2.61E-09	1.98E-09	1.57E-09	1.28E-09	1.07E-09	9.05E-10
WNW	4.83E-08	2.67E-08	1.76E-08	9.71E-09	6.38E-09	4.60E-09	3.51E-09	2.79E-09	2.29E-09	1.91E-09	1.63E-09
NW	1.01E-07	5.66E-08	3.76E-08	2.11E-08	1.40E-08	1.02E-08	7.84E-09	6.28E-09	5.17E-09	4.35E-09	3.73E-09
NNW	1.24E-07	6.90E-08	4.55E-08	2.53E-08	1.67E-08	1.20E-08	9.20E-09	7.32E-09	6.00E-09	5.03E-09	4.29E-09
N	8.38E-08	4.71E-08	3.13E-08	1.77E-08	1.18E-08	8.60E-09	6.64E-09	5.33E-09	4.40E-09	3.71E-09	3.18E-09
NNE	7.60E-08	4.36E-08	2.93E-08	1.67E-08	1.12E-08	8.13E-09	6.26E-09	5.01E-09	4.12E-09	3.46E-09	2.96E-09
NE	6.67E-08	3.86E-08	2.61E-08	1.49E-08	1.00E-08	7.30E-09	5.62E-09	4.50E-09	3.70E-09	3.11E-09	2.66E-09
ENE	5.14E-08	3.05E-08	2.10E-08	1.24E-08	8.54E-09	6.36E-09	4.99E-09	4.05E-09	3.38E-09	2.87E-09	2.48E-09
E	2.77E-08	1.63E-08	1.12E-08	6.54E-09	4.45E-09	3.29E-09	2.56E-09	2.07E-09	1.71E-09	1.45E-09	1.24E-09
ESE	3.74E-08	2.19E-08	1.50E-08	8.70E-09	5.91E-09	4.36E-09	3.39E-09	2.74E-09	2.27E-09	1.92E-09	1.64E-09
SE	4.90E-08	2.85E-08	1.93E-08	1.12E-08	7.61E-09	5.62E-09	4.38E-09	3.54E-09	2.94E-09	2.49E-09	2.15E-09
SSE	2.72E-08	1.49E-08	9.78E-09	5.40E-09	3.56E-09	2.57E-09	1.97E-09	1.57E-09	1.29E-09	1.08E-09	9.24E-10

TABLE 2.7-125 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED

SECTOR	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	6.23E-07	2.24E-07	1.02E-07	6.09E-08	4.15E-08	1.97E-08	6.92E-09	3.15E-09	1.88E-09	1.28E-09
SSW	4.94E-07	1.77E-07	8.05E-08	4.81E-08	3.28E-08	1.56E-08	5.52E-09	2.52E-09	1.51E-09	1.03E-09
SW	3.71E-07	1.30E-07	5.82E-08	3.44E-08	2.33E-08	1.10E-08	3.85E-09	1.75E-09	1.05E-09	7.14E-10
WSW	3.58E-07	1.26E-07	5.62E-08	3.32E-08	2.25E-08	1.06E-08	3.66E-09	1.65E-09	9.79E-10	6.61E-10
W	5.00E-07	1.81E-07	8.30E-08	4.98E-08	3.41E-08	1.63E-08	5.77E-09	2.64E-09	1.58E-09	1.07E-09
WNW	7.90E-07	2.89E-07	1.35E-07	8.19E-08	5.65E-08	2.74E-08	9.97E-09	4.64E-09	2.80E-09	1.92E-09
NW	1.56E-06	5.75E-07	2.74E-07	1.68E-07	1.17E-07	5.80E-08	2.16E-08	1.03E-08	6.30E-09	4.36E-09
NNW	1.95E-06	7.16E-07	3.39E-07	2.08E-07	1.44E-07	7.07E-08	2.60E-08	1.21E-08	7.36E-09	5.04E-09
N	1.36E-06	4.87E-07	2.28E-07	1.40E-07	9.76E-08	4.82E-08	1.81E-08	8.66E-09	5.35E-09	3.72E-09
NNE	1.16E-06	4.14E-07	1.99E-07	1.24E-07	8.80E-08	4.44E-08	1.70E-08	8.19E-09	5.03E-09	3.47E-09
NE	1.01E-06	3.57E-07	1.72E-07	1.08E-07	7.71E-08	3.93E-08	1.52E-08	7.35E-09	4.52E-09	3.12E-09
ENE	7.64E-07	2.63E-07	1.27E-07	8.15E-08	5.89E-08	3.09E-08	1.26E-08	6.39E-09	4.07E-09	2.88E-09
E	4.09E-07	1.43E-07	6.93E-08	4.43E-08	3.19E-08	1.66E-08	6.64E-09	3.31E-09	2.07E-09	1.45E-09
ESE	5.56E-07	1.96E-07	9.46E-08	6.02E-08	4.31E-08	2.23E-08	8.85E-09	4.39E-09	2.74E-09	1.92E-09
SE	7.35E-07	2.61E-07	1.26E-07	7.94E-08	5.66E-08	2.90E-08	1.14E-08	5.66E-09	3.55E-09	2.50E-09
SSE	4.71E-07	1.68E-07	7.70E-08	4.64E-08	3.19E-08	1.54E-08	5.55E-09	2.59E-09	1.58E-09	1.08E-09

TABLE 2.7-126 (Sheet 1 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR AN 8.00 DAY DECAY, DEPLETED

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	3.08E-06	9.96E-07	5.43E-07	3.50E-07	1.86E-07	1.18E-07	8.21E-08	6.11E-08	4.75E-08	3.82E-08	3.15E-08
SSW	2.48E-06	7.92E-07	4.30E-07	2.77E-07	1.47E-07	9.28E-08	6.48E-08	4.83E-08	3.76E-08	3.02E-08	2.49E-08
SW	1.89E-06	6.01E-07	3.22E-07	2.05E-07	1.08E-07	6.74E-08	4.68E-08	3.47E-08	2.69E-08	2.16E-08	1.77E-08
WSW	1.80E-06	5.78E-07	3.11E-07	1.98E-07	1.04E-07	6.52E-08	4.53E-08	3.35E-08	2.60E-08	2.08E-08	1.71E-08
W	2.52E-06	7.99E-07	4.35E-07	2.81E-07	1.50E-07	9.54E-08	6.69E-08	4.99E-08	3.90E-08	3.14E-08	2.59E-08
WNW	4.11E-06	1.27E-06	6.86E-07	4.44E-07	2.40E-07	1.54E-07	1.09E-07	8.17E-08	6.41E-08	5.19E-08	4.30E-08
NW	8.23E-06	2.50E-06	1.35E-06	8.75E-07	4.79E-07	3.10E-07	2.21E-07	1.67E-07	1.32E-07	1.07E-07	8.93E-08
NNW	1.03E-05	3.13E-06	1.69E-06	1.09E-06	5.97E-07	3.86E-07	2.74E-07	2.07E-07	1.63E-07	1.33E-07	1.10E-07
N	7.31E-06	2.23E-06	1.17E-06	7.48E-07	4.04E-07	2.60E-07	1.84E-07	1.39E-07	1.10E-07	8.91E-08	7.42E-08
NNE	6.56E-06	1.92E-06	9.92E-07	6.32E-07	3.46E-07	2.25E-07	1.61E-07	1.24E-07	9.85E-08	8.09E-08	6.79E-08
NE	5.81E-06	1.69E-06	8.61E-07	5.46E-07	2.99E-07	1.95E-07	1.40E-07	1.08E-07	8.60E-08	7.09E-08	5.97E-08
ENE	4.52E-06	1.31E-06	6.45E-07	4.01E-07	2.18E-07	1.42E-07	1.02E-07	7.94E-08	6.41E-08	5.32E-08	4.51E-08
E	2.39E-06	6.96E-07	3.46E-07	2.16E-07	1.19E-07	7.76E-08	5.60E-08	4.34E-08	3.49E-08	2.89E-08	2.44E-08
ESE	3.20E-06	9.39E-07	4.73E-07	2.98E-07	1.63E-07	1.06E-07	7.63E-08	5.89E-08	4.73E-08	3.91E-08	3.30E-08
SE	4.16E-06	1.23E-06	6.27E-07	3.96E-07	2.17E-07	1.41E-07	1.01E-07	7.79E-08	6.23E-08	5.13E-08	4.31E-08
SSE	2.43E-06	7.63E-07	4.08E-07	2.61E-07	1.39E-07	8.84E-08	6.20E-08	4.64E-08	3.63E-08	2.93E-08	2.42E-08

TABLE 2.7-126 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR AN 8.00 DAY DECAY, DEPLETED

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	2.65E-08	1.36E-08	8.44E-09	4.27E-09	2.63E-09	1.79E-09	1.31E-09	9.99E-10	7.89E-10	6.40E-10	5.29E-10
SSW	2.10E-08	1.08E-08	6.72E-09	3.42E-09	2.11E-09	1.45E-09	1.06E-09	8.09E-10	6.40E-10	5.20E-10	4.31E-10
SW	1.49E-08	7.63E-09	4.72E-09	2.39E-09	1.48E-09	1.01E-09	7.41E-10	5.68E-10	4.50E-10	3.65E-10	3.03E-10
WSW	1.44E-08	7.33E-09	4.52E-09	2.28E-09	1.40E-09	9.57E-10	6.98E-10	5.34E-10	4.22E-10	3.42E-10	2.83E-10
W	2.19E-08	1.13E-08	7.05E-09	3.60E-09	2.23E-09	1.53E-09	1.12E-09	8.56E-10	6.78E-10	5.50E-10	4.56E-10
WNW	3.64E-08	1.92E-08	1.21E-08	6.25E-09	3.90E-09	2.69E-09	1.98E-09	1.53E-09	1.21E-09	9.88E-10	8.21E-10
NW	7.58E-08	4.04E-08	2.57E-08	1.35E-08	8.49E-09	5.90E-09	4.37E-09	3.38E-09	2.69E-09	2.20E-09	1.84E-09
NNW	9.37E-08	4.98E-08	3.16E-08	1.65E-08	1.04E-08	7.18E-09	5.30E-09	4.09E-09	3.25E-09	2.65E-09	2.21E-09
N	6.30E-08	3.37E-08	2.14E-08	1.13E-08	7.15E-09	4.99E-09	3.70E-09	2.87E-09	2.30E-09	1.89E-09	1.58E-09
NNE	5.81E-08	3.19E-08	2.07E-08	1.11E-08	7.12E-09	5.01E-09	3.75E-09	2.92E-09	2.34E-09	1.92E-09	1.61E-09
NE	5.12E-08	2.83E-08	1.85E-08	1.00E-08	6.46E-09	4.56E-09	3.42E-09	2.67E-09	2.14E-09	1.76E-09	1.48E-09
ENE	3.88E-08	2.20E-08	1.45E-08	8.06E-09	5.27E-09	3.77E-09	2.86E-09	2.25E-09	1.83E-09	1.52E-09	1.28E-09
E	2.10E-08	1.18E-08	7.77E-09	4.27E-09	2.78E-09	1.98E-09	1.49E-09	1.17E-09	9.48E-09	7.84E-10	6.60E-10
ESE	2.83E-08	1.58E-08	1.04E-08	5.66E-09	3.67E-09	2.60E-09	1.96E-09	1.54E-09	1.24E-09	1.03E-09	8.62E-10
SE	3.70E-08	2.04E-08	1.33E-08	7.23E-09	4.66E-09	3.30E-09	2.48E-09	1.94E-09	1.57E-09	1.29E-09	1.09E-09
SSE	2.04E-08	1.07E-08	6.69E-09	3.45E-09	2.15E-09	1.49E-09	1.10E-09	8.43E-10	6.71E-10	5.47E-10	4.55E-10

TABLE 2.7-126 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (SEC/M^3) FOR AN 8.00 DAY DECAY, DEPLETED

SECTOR	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	5.58E-07	1.92E-07	8.31E-08	4.78E-08	3.16E-08	1.42E-08	4.47E-09	1.82E-09	1.01E-09	6.43E-10
SSW	4.42E-07	1.52E-07	6.57E-08	3.78E-08	2.50E-08	1.13E-08	3.57E-09	1.47E-09	8.16E-10	5.23E-10
SW	3.32E-07	1.11E-07	4.75E-08	2.71E-08	1.78E-08	7.95E-09	2.50E-09	1.03E-09	5.72E-10	3.67E-10
WSW	3.20E-07	1.08E-07	4.59E-08	2.62E-08	1.72E-08	7.64E-09	2.39E-09	9.72E-10	5.38E-10	3.43E-10
W	4.48E-07	1.55E-07	6.77E-08	3.92E-08	2.60E-08	1.18E-08	3.76E-09	1.55E-09	8.63E-10	5.53E-10
WNW	7.07E-07	2.47E-07	1.10E-07	6.45E-08	4.32E-08	1.98E-08	6.50E-09	2.73E-09	1.54E-09	9.93E-10
NW	1.39E-06	4.92E-07	2.23E-07	1.32E-07	8.96E-08	4.18E-08	1.40E-08	5.98E-09	3.40E-09	2.21E-09
NNW	1.74E-06	6.14E-07	2.77E-07	1.64E-07	1.11E-07	5.15E-08	1.71E-08	7.28E-09	4.12E-09	2.67E-09
N	1.22E-06	4.16E-07	1.86E-07	1.10E-07	7.45E-08	3.48E-08	1.17E-08	5.05E-09	2.89E-09	1.89E-09
NNE	1.04E-06	3.56E-07	1.63E-07	9.89E-08	6.81E-08	3.27E-08	1.15E-08	5.07E-09	2.93E-09	1.93E-09
NE	9.05E-07	3.07E-07	1.41E-07	8.64E-08	5.99E-08	2.90E-08	1.03E-08	4.61E-09	2.68E-09	1.77E-09
ENE	6.85E-07	2.25E-07	1.04E-07	6.43E-08	4.52E-08	2.24E-08	8.26E-09	3.81E-09	2.27E-09	1.52E-09
E	3.66E-07	1.22E-07	5.67E-08	3.50E-08	2.45E-08	1.21E-08	4.39E-09	2.00E-09	1.18E-09	7.87E-10
ESE	4.99E-07	1.68E-07	7.73E-08	4.75E-08	3.31E-08	1.62E-08	5.82E-09	2.63E-09	1.55E-09	1.03E-09
SE	6.58E-07	2.23E-07	1.03E-07	6.25E-08	4.33E-08	2.09E-08	7.44E-09	3.34E-09	1.95E-09	1.30E-09
SSE	4.22E-07	1.44E-07	6.28E-08	3.65E-08	2.43E-08	1.11E-08	3.59E-09	1.51E-09	8.49E-10	5.50E-10

TABLE 2.7-127 (Sheet 1 of 3)
D/Q (M-2) AT EACH 22.5-DEGREE SECTOR FOR EACH DISTANCE (MILES) SHOWN AT THE TOP

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	4.25E-08	1.44E-08	7.38E-09	4.53E-09	2.26E-09	1.37E-09	9.27E-10	6.71E-10	5.11E-10	4.02E-10	3.26E-10
SSW	2.85E-08	9.65E-09	4.96E-09	3.04E-09	1.52E-09	9.20E-10	6.22E-10	4.51E-10	3.43E-10	2.70E-10	2.19E-10
SW	1.99E-08	6.73E-09	3.45E-09	2.12E-09	1.06E-09	6.41E-10	4.34E-10	3.14E-10	2.39E-10	1.88E-10	1.52E-10
WSW	1.68E-08	5.69E-09	2.92E-09	1.80E-09	8.95E-10	5.43E-10	3.67E-10	2.66E-10	2.02E-10	1.59E-10	1.29E-10
W	1.95E-08	6.59E-09	3.39E-09	2.08E-09	1.04E-09	6.28E-10	4.25E-10	3.08E-10	2.34E-10	1.84E-10	1.49E-10
WNW	3.09E-08	1.04E-08	5.36E-09	3.29E-09	1.64E-09	9.95E-10	6.73E-10	4.88E-10	3.71E-10	2.92E-10	2.36E-10
NW	7.04E-08	2.38E-08	1.22E-08	7.50E-09	3.74E-09	2.27E-09	1.53E-09	1.11E-09	8.45E-10	6.66E-10	5.39E-10
NNW	1.02E-07	3.45E-08	1.77E-08	1.09E-08	5.43E-09	3.29E-09	2.23E-09	1.61E-09	1.23E-09	9.66E-10	7.82E-10
N	8.99E-08	3.04E-08	1.56E-08	9.58E-09	4.78E-09	2.90E-09	1.96E-09	1.42E-09	1.08E-09	8.50E-10	6.88E-10
NNE	3.60E-08	1.22E-08	6.26E-09	3.84E-09	1.92E-09	1.16E-09	7.85E-10	5.69E-10	4.33E-10	3.41E-10	2.76E-10
NE	2.20E-08	7.44E-09	3.82E-09	2.35E-09	1.17E-09	7.09E-10	4.80E-10	3.47E-10	2.64E-10	2.08E-10	1.69E-10
ENE	1.66E-08	5.62E-09	2.89E-09	1.77E-09	8.84E-10	5.36E-10	3.63E-10	2.63E-10	2.00E-10	1.57E-10	1.27E-10
E	7.45E-09	2.52E-09	1.29E-09	7.94E-10	3.96E-10	2.40E-10	1.62E-10	1.18E-10	8.95E-11	7.05E-11	5.71E-11
ESE	1.39E-08	4.70E-09	2.41E-09	1.48E-09	7.39E-10	4.48E-10	3.03E-10	2.20E-10	1.67E-10	1.32E-10	1.07E-10
SE	2.60E-08	8.80E-09	4.52E-09	2.77E-09	1.38E-09	8.39E-10	5.67E-10	4.11E-10	3.12E-10	2.46E-10	1.99E-10
SSE	3.47E-08	1.17E-08	6.02E-09	3.70E-09	1.84E-09	1.12E-09	7.56E-10	5.47E-10	4.16E-10	3.28E-10	2.66E-10

TABLE 2.7-127 (Sheet 2 of 3)
D/Q (M-2) AT EACH 22.5-DEGREE SECTOR FOR EACH DISTANCE (MILES) SHOWN AT THE TOP

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	2.69E-10	1.32E-10	8.28E-11	4.19E-11	2.53E-11	1.70E-11	1.22E-11	9.14E-12	7.11E-12	5.68E-12	4.63E-12
SSW	1.81E-10	8.86E-11	5.56E-11	2.81E-11	1.70E-11	1.14E-11	8.17E-12	6.14E-12	4.77E-12	3.81E-12	3.11E-12
SW	1.26E-10	6.18E-11	3.88E-11	1.96E-11	1.19E-11	7.95E-12	5.70E-12	4.28E-12	3.33E-12	2.66E-12	2.17E-12
WSW	1.07E-10	5.23E-11	3.28E-11	1.66E-11	1.00E-11	6.73E-12	4.82E-12	3.62E-12	2.81E-12	2.25E-12	1.84E-12
W	1.24E-10	6.05E-11	3.80E-11	1.92E-11	1.16E-11	7.79E-12	5.58E-12	4.19E-12	3.26E-12	2.60E-12	2.13E-12
WNW	1.96E-10	9.59E-11	6.01E-11	3.04E-11	1.84E-11	1.23E-11	8.84E-12	6.64E-12	5.16E-12	4.12E-12	3.37E-12
NW	4.46E-10	2.19E-10	1.37E-10	6.93E-11	4.20E-11	2.81E-11	2.02E-11	1.51E-11	1.18E-11	9.40E-12	7.67E-12
NNW	6.47E-10	3.17E-10	1.99E-10	1.01E-10	6.09E-11	4.08E-11	2.92E-11	2.20E-11	1.71E-11	1.36E-11	1.11E-11
N	5.70E-10	2.79E-10	1.75E-10	8.85E-11	5.36E-11	3.59E-11	2.57E-11	1.93E-11	1.50E-11	1.20E-11	9.80E-12
NNE	2.28E-10	1.12E-10	7.02E-11	3.55E-11	2.15E-11	1.44E-11	1.03E-11	7.75E-12	6.02E-12	4.81E-12	3.93E-12
NE	1.39E-10	6.83E-11	4.29E-11	2.17E-11	1.31E-11	8.79E-12	6.30E-12	4.73E-12	3.68E-12	2.94E-12	2.40E-12
ENE	1.05E-10	5.16E-11	3.24E-11	1.64E-11	9.91E-12	6.65E-12	4.76E-12	3.58E-12	2.78E-12	2.22E-12	1.81E-12
E	4.72E-11	2.31E-11	1.45E-11	7.34E-12	4.44E-12	2.98E-12	2.13E-12	1.60E-12	1.25E-12	9.95E-13	8.12E-13
ESE	8.81E-11	4.32E-11	2.71E-11	1.37E-11	8.29E-12	5.56E-12	3.98E-12	2.99E-12	2.32E-12	1.86E-12	1.52E-12
SE	1.65E-10	8.08E-11	5.07E-11	2.56E-11	1.55E-11	1.04E-11	7.45E-12	5.59E-12	4.35E-12	3.47E-12	2.84E-12
SSE	2.20E-10	1.08E-10	6.75E-11	3.41E-11	2.07E-11	1.39E-11	9.93E-12	7.45E-12	5.79E-12	4.63E-12	3.78E-12

TABLE 2.7-127 (Sheet 3 of 3)
D/Q (M-2) AT EACH 22.5-DEGREE SECTOR FOR EACH DISTANCE (MILES) SHOWN AT THE TOP

SECTOR	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.67E-09	2.37E-09	9.43E-10	5.15E-10	3.28E-10	1.41E-10	4.36E-11	1.73E-11	9.23E-12	5.71E-12
SSW	5.15E-09	1.59E-09	6.33E-10	3.46E-10	2.20E-10	9.44E-11	2.93E-11	1.16E-11	6.20E-12	3.84E-12
SW	3.59E-09	1.11E-09	4.41E-10	2.41E-10	1.53E-10	6.58E-11	2.04E-11	8.09E-12	4.32E-12	2.67E-12
WSW	3.04E-09	9.38E-10	3.73E-10	2.04E-10	1.30E-10	5.57E-11	1.73E-11	6.85E-12	3.66E-12	2.26E-12
W	3.52E-09	1.09E-09	4.32E-10	2.36E-10	1.50E-10	6.45E-11	2.00E-11	7.93E-12	4.23E-12	2.62E-12
WNW	5.57E-09	1.72E-09	6.85E-10	3.74E-10	2.38E-10	1.02E-10	3.17E-11	1.26E-11	6.70E-12	4.15E-12
NW	1.27E-08	3.92E-09	1.56E-09	8.53E-10	5.42E-10	2.33E-10	7.22E-11	2.86E-11	1.53E-11	9.46E-12
NNW	1.84E-08	5.69E-09	2.26E-09	1.24E-09	7.87E-10	3.38E-10	1.05E-10	4.15E-11	2.22E-11	1.37E-11
N	1.62E-08	5.01E-09	1.99E-09	1.09E-09	6.92E-10	2.97E-10	9.22E-11	3.66E-11	1.95E-11	1.21E-11
NNE	6.50E-09	2.01E-09	7.99E-10	4.37E-10	2.78E-10	1.19E-10	3.70E-11	1.47E-11	7.83E-12	4.84E-12
NE	3.97E-09	1.23E-09	4.88E-10	2.67E-10	1.70E-10	7.28E-11	2.26E-11	8.95E-12	4.78E-12	2.96E-12
ENE	3.00E-09	9.27E-10	3.69E-10	2.02E-10	1.28E-10	5.50E-11	1.71E-11	6.76E-12	3.61E-12	2.24E-12
E	1.34E-09	4.15E-10	1.65E-10	9.03E-11	5.74E-11	2.47E-11	7.65E-12	3.03E-12	1.62E-12	1.00E-12
ESE	2.51E-09	7.75E-10	3.08E-10	1.69E-10	1.07E-10	4.60E-11	1.43E-11	5.65E-12	3.02E-12	1.87E-12
SE	4.69E-09	1.45E-09	5.77E-10	3.15E-10	2.00E-10	8.61E-11	2.67E-11	1.06E-11	5.65E-12	3.50E-12
SSE	6.25E-09	1.93E-09	7.69E-10	4.20E-10	2.67E-10	1.15E-10	3.56E-11	1.41E-11	7.53E-12	4.66E-12

TABLE 2.7-128 (Sheet 1 of 2)
χ/Q AND D/Q VALUES FOR 2.26 AND 8 DAY DECAY HALF-LIVES

Type of Location	Sector	Distance (miles)	Distance (meters)	X/Q (s/m^3) 2.26 Day Decay Undepleted	X/Q (s/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
EAB	S	0.37	600	1.70E-06	1.50E-06	2.30E-08
EAB	SSW	0.37	600	1.30E-06	1.20E-06	1.50E-08
EAB	SW	0.37	600	1.00E-06	9.40E-07	1.10E-08
EAB	WSW	0.37	600	9.80E-07	9.00E-07	9.10E-09
EAB	W	0.37	600	1.40E-06	1.30E-06	1.10E-08
EAB	WNW	0.37	600	2.20E-06	2.00E-06	1.70E-08
EAB	NW	0.37	600	4.40E-06	4.10E-06	3.80E-08
EAB	NNW	0.37	600	5.50E-06	5.10E-06	5.50E-08
EAB	N	0.37	600	3.90E-06	3.60E-06	4.90E-08
EAB	NNE	0.37	600	3.50E-06	3.20E-06	1.90E-08
EAB	NE	0.37	600	3.10E-06	2.80E-06	1.20E-08
EAB	ENE	0.37	600	2.40E-06	2.20E-06	9.00E-09
EAB	E	0.37	600	1.30E-06	1.20E-06	4.00E-09
EAB	ESE	0.37	600	1.70E-06	1.60E-06	7.50E-09
EAB	SE	0.37	600	2.20E-06	2.00E-06	1.40E-08
EAB	SSE	0.37	600	1.30E-06	1.20E-06	1.90E-08
Residence	S	1.09	1753	3.50E-07	3.10E-07	3.90E-09

TABLE 2.7-128 (Sheet 2 of 2)
χ/Q AND D/Q VALUES FOR 2.26 AND 8 DAY DECAY HALF-LIVES

Type of Location	Sector	Distance (miles)	Distance (meters)	X/Q (s/m^3) 2.26 Day Decay Undepleted	X/Q (s/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
Residence	SSW	0.79	1276	4.40E-07	3.90E-07	4.50E-09
Residence	SW	0.79	1276	3.30E-07	3.00E-07	3.10E-09
Residence	WSW	1.16	1869	1.80E-07	1.60E-07	1.40E-09
Residence	W	1.16	1869	2.60E-07	2.20E-07	1.60E-09
Residence	WNW	2.26	3645	1.50E-07	1.30E-07	8.00E-10
Residence	NW	2.18	3515	3.30E-07	2.70E-07	1.90E-09
Residence	NNW	2.18	3515	4.10E-07	3.40E-07	2.80E-09
Residence	N	1.99	3202	3.20E-07	2.60E-07	2.90E-09
Residence	NNE	1.99	3202	2.70E-07	2.30E-07	1.20E-09
Residence	NE	2.39	3853	1.80E-07	1.50E-07	5.20E-10
Residence	ENE	2.4	3863	1.30E-07	1.10E-07	3.90E-10
Residence	E	2.76	4449	6.00E-08	4.90E-08	1.40E-10
Residence	ESE	2.43	3903	9.70E-08	8.00E-08	3.20E-10
Residence	SE	1.95	3146	1.80E-07	1.50E-07	8.70E-10
Residence	SSE	1.83	2942	1.20E-07	1.00E-07	1.30E-09
Garden	ENE	2.86	4609	1.10E-07	8.50E-08	2.90E-10
Garden	E	2.86	4609	5.70E-08	4.60E-08	1.30E-10

TABLE 2.7-129 DISTANCES, IN METERS, FROM THE CENTER POINT OF THE EVAPORATION POND TO THE NEAREST BOUNDARY OF THE EAB IN EACH SECTOR

Sector	EAB Distance
S	122
SSW	122
SW	145
WSW	156
W	203
WNW	295
NW	486
NNW	822
N	1205
NNE	1436
NE	1697
ENE	1413
E	874
ESE	434
SE	255
SSE	185

TABLE 2.7-130 DISTANCES, IN METERS, FROM THE CENTER POINT OF THE EVAPORATION POND TO THE NEAREST RECEPTOR (RESIDENCE OR GARDEN) IN EACH SECTOR

Sector	Nearest Residence	Nearest Garden
S	1073	
SSW	493	
SW	493	
WSW	493	
W	1328	
WNW	1328	
NW	3472	
NNW	3723	
N	3927	
NNE	3927	
NE	4621	
ENE	4621	5265
E	4680	5265
ESE	2995	
SE	2565	
SSE	1073	

TABLE 2.7-131 (Sheet 1 of 3)

ANNUAL AVERAGE χ/Q (S/M^3) FOR NO DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	5.60E-06	1.62E-06	7.94E-07	4.87E-07	2.49E-07	1.56E-07	1.10E-07	8.20E-08	6.44E-08	5.23E-08	4.35E-08
SSW	4.50E-06	1.30E-06	6.36E-07	3.89E-07	1.99E-07	1.25E-07	8.75E-08	6.56E-08	5.15E-08	4.18E-08	3.48E-08
SW	3.31E-06	9.40E-07	4.57E-07	2.79E-07	1.42E-07	8.84E-08	6.16E-08	4.61E-08	3.61E-08	2.92E-08	2.43E-08
WSW	3.20E-06	9.11E-07	4.44E-07	2.71E-07	1.38E-07	8.61E-08	6.00E-08	4.48E-08	3.51E-08	2.84E-08	2.36E-08
W	4.60E-06	1.33E-06	6.53E-07	4.00E-07	2.05E-07	1.29E-07	9.07E-08	6.82E-08	5.36E-08	4.36E-08	3.64E-08
WNW	7.44E-06	2.16E-06	1.06E-06	6.50E-07	3.35E-07	2.12E-07	1.50E-07	1.13E-07	8.92E-08	7.28E-08	6.10E-08
NW	1.52E-05	4.44E-06	2.19E-06	1.34E-06	6.97E-07	4.43E-07	3.14E-07	2.38E-07	1.89E-07	1.55E-07	1.30E-07
NNW	1.89E-05	5.52E-06	2.72E-06	1.67E-06	8.65E-07	5.50E-07	3.90E-07	2.95E-07	2.34E-07	1.92E-07	1.61E-07
N	1.32E-05	3.81E-06	1.86E-06	1.14E-06	5.91E-07	3.75E-07	2.66E-07	2.01E-07	1.59E-07	1.30E-07	1.09E-07
NNE	1.21E-05	3.51E-06	1.72E-06	1.06E-06	5.53E-07	3.55E-07	2.54E-07	1.94E-07	1.55E-07	1.28E-07	1.08E-07
NE	1.07E-05	3.13E-06	1.52E-06	9.39E-07	4.92E-07	3.17E-07	2.27E-07	1.74E-07	1.39E-07	1.15E-07	9.73E-08
ENE	8.34E-06	2.42E-06	1.17E-06	7.24E-07	3.82E-07	2.47E-07	1.78E-07	1.37E-07	1.10E-07	9.10E-08	7.72E-08
E	4.43E-06	1.29E-06	6.27E-07	3.87E-07	2.04E-07	1.32E-07	9.49E-08	7.28E-08	5.84E-08	4.83E-08	4.10E-08
ESE	5.92E-06	1.73E-06	8.41E-07	5.20E-07	2.73E-07	1.76E-07	1.27E-07	9.71E-08	7.78E-08	6.43E-08	5.45E-08
SE	7.68E-06	2.24E-06	1.09E-06	6.74E-07	3.53E-07	2.27E-07	1.63E-07	1.24E-07	9.94E-08	8.20E-08	6.93E-08
SSE	4.38E-06	1.26E-06	6.16E-07	3.77E-07	1.93E-07	1.22E-07	8.56E-08	6.44E-08	5.07E-08	4.13E-08	3.45E-08

TABLE 2.7-131 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR NO DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	3.70E-08	1.99E-08	1.29E-08	7.01E-09	4.59E-09	3.31E-09	2.54E-09	2.03E-09	1.67E-09	1.41E-09	1.21E-09
SSW	2.96E-08	1.60E-08	1.04E-08	5.68E-09	3.73E-09	2.70E-09	2.08E-09	1.67E-09	1.38E-09	1.17E-09	1.00E-09
SW	2.06E-08	1.11E-08	7.15E-09	3.91E-09	2.57E-09	1.86E-09	1.44E-09	1.15E-09	9.54E-10	8.08E-10	6.97E-10
WSW	2.00E-08	1.07E-08	6.92E-09	3.77E-09	2.47E-09	1.79E-09	1.37E-09	1.10E-09	9.08E-10	7.67E-10	6.60E-10
W	3.10E-08	1.68E-08	1.09E-08	6.00E-09	3.95E-09	2.87E-09	2.21E-09	1.77E-09	1.47E-09	1.24E-09	1.07E-09
WNW	5.20E-08	2.85E-08	1.87E-08	1.04E-08	6.93E-09	5.06E-09	3.92E-09	3.16E-09	2.62E-09	2.23E-09	1.93E-09
NW	1.11E-07	6.16E-08	4.07E-08	2.29E-08	1.53E-08	1.12E-08	8.73E-09	7.06E-09	5.88E-09	5.01E-09	4.34E-09
NNW	1.38E-07	7.62E-08	5.04E-08	2.83E-08	1.89E-08	1.39E-08	1.08E-08	8.73E-09	7.27E-09	6.19E-09	5.36E-09
N	9.37E-08	5.19E-08	3.44E-08	1.94E-08	1.30E-08	9.59E-09	7.48E-09	6.07E-09	5.07E-09	4.32E-09	3.76E-09
NNE	9.28E-08	5.25E-08	3.53E-08	2.04E-08	1.39E-08	1.03E-08	8.12E-09	6.64E-09	5.58E-09	4.79E-09	4.18E-09
NE	8.39E-08	4.78E-08	3.23E-08	1.88E-08	1.28E-08	9.58E-09	7.56E-09	6.19E-09	5.21E-09	4.48E-09	3.92E-09
ENE	6.68E-08	3.84E-08	2.62E-08	1.54E-08	1.06E-08	7.95E-09	6.31E-09	5.19E-09	4.39E-09	3.79E-09	3.32E-09
E	3.54E-08	2.03E-08	1.38E-08	8.04E-09	5.52E-09	4.14E-09	3.27E-09	2.69E-09	2.27E-09	1.95E-09	1.71E-09
ESE	4.70E-08	2.68E-08	1.82E-08	1.06E-08	7.23E-09	5.40E-09	4.27E-09	3.50E-09	2.95E-09	2.54E-09	2.22E-09
SE	5.97E-08	3.39E-08	2.28E-08	1.32E-08	8.99E-09	6.70E-09	5.28E-09	4.32E-09	3.63E-09	3.12E-09	2.72E-09
SSE	2.94E-08	1.60E-08	1.05E-08	5.81E-09	3.85E-09	2.81E-09	2.17E-09	1.75E-09	1.46E-09	1.24E-09	1.07E-09

TABLE 2.7-131 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR NO DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	8.40E-07	2.61E-07	1.11E-07	6.48E-08	4.37E-08	2.06E-08	7.24E-09	3.34E-09	2.04E-09	1.42E-09
SSW	6.73E-07	2.08E-07	8.87E-08	5.18E-08	3.50E-08	1.65E-08	5.86E-09	2.73E-09	1.67E-09	1.17E-09
SW	4.85E-07	1.48E-07	6.25E-08	3.63E-08	2.44E-08	1.14E-08	4.03E-09	1.88E-09	1.16E-09	8.10E-10
WSW	4.71E-07	1.44E-07	6.09E-08	3.53E-08	2.37E-08	1.11E-08	3.89E-09	1.80E-09	1.10E-09	7.69E-10
W	6.91E-07	2.15E-07	9.20E-08	5.40E-08	3.65E-08	1.73E-08	6.18E-09	2.89E-09	1.78E-09	1.24E-09
WNW	1.12E-06	3.51E-07	1.52E-07	8.97E-08	6.12E-08	2.94E-08	1.07E-08	5.10E-09	3.17E-09	2.23E-09
NW	2.31E-06	7.28E-07	3.18E-07	1.90E-07	1.30E-07	6.34E-08	2.35E-08	1.13E-08	7.09E-09	5.02E-09
NNW	2.88E-06	9.05E-07	3.95E-07	2.35E-07	1.61E-07	7.84E-08	2.90E-08	1.40E-08	8.76E-09	6.20E-09
N	1.98E-06	6.18E-07	2.69E-07	1.60E-07	1.10E-07	5.34E-08	1.99E-08	9.67E-09	6.09E-09	4.33E-09
NNE	1.82E-06	5.77E-07	2.57E-07	1.56E-07	1.08E-07	5.38E-08	2.08E-08	1.04E-08	6.66E-09	4.80E-09
NE	1.62E-06	5.14E-07	2.30E-07	1.40E-07	9.76E-08	4.89E-08	1.91E-08	9.63E-09	6.21E-09	4.49E-09
ENE	1.25E-06	3.98E-07	1.80E-07	1.10E-07	7.74E-08	3.93E-08	1.56E-08	8.00E-09	5.20E-09	3.79E-09
E	6.68E-07	2.13E-07	9.59E-08	5.87E-08	4.11E-08	2.07E-08	8.19E-09	4.16E-09	2.70E-09	1.96E-09
ESE	8.95E-07	2.85E-07	1.28E-07	7.82E-08	5.46E-08	2.74E-08	1.08E-08	5.43E-09	3.51E-09	2.54E-09
SE	1.16E-06	3.68E-07	1.65E-07	9.99E-08	6.95E-08	3.47E-08	1.35E-08	6.74E-09	4.33E-09	3.13E-09
SSE	6.53E-07	2.02E-07	8.68E-08	5.10E-08	3.46E-08	1.65E-08	5.97E-09	2.83E-09	1.76E-09	1.24E-09

TABLE 2.7-132 (SHEET 1 OF 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	5.59E-06	1.61E-06	7.93E-07	4.86E-07	2.48E-07	1.56E-07	1.09E-07	8.15E-08	6.39E-08	5.18E-08	4.31E-08
SSW	4.50E-06	1.29E-06	6.34E-07	3.88E-07	1.98E-07	1.24E-07	8.69E-08	6.51E-08	5.11E-08	4.14E-08	3.45E-08
SW	3.31E-06	9.38E-07	4.56E-07	2.78E-07	1.41E-07	8.79E-08	6.12E-08	4.56E-08	3.57E-08	2.89E-08	2.39E-08
WSW	3.20E-06	9.09E-07	4.43E-07	2.70E-07	1.37E-07	8.55E-08	5.95E-08	4.44E-08	3.47E-08	2.80E-08	2.33E-08
W	4.59E-06	1.33E-06	6.52E-07	3.99E-07	2.04E-07	1.28E-07	9.00E-08	6.75E-08	5.30E-08	4.31E-08	3.59E-08
WNW	7.43E-06	2.15E-06	1.06E-06	6.48E-07	3.34E-07	2.11E-07	1.49E-07	1.12E-07	8.82E-08	7.19E-08	6.01E-08
NW	1.51E-05	4.43E-06	2.18E-06	1.34E-06	6.94E-07	4.41E-07	3.12E-07	2.36E-07	1.87E-07	1.53E-07	1.28E-07
NNW	1.89E-05	5.51E-06	2.71E-06	1.66E-06	8.59E-07	5.45E-07	3.85E-07	2.91E-07	2.30E-07	1.88E-07	1.58E-07
N	1.32E-05	3.81E-06	1.86E-06	1.14E-06	5.89E-07	3.73E-07	2.64E-07	2.00E-07	1.58E-07	1.29E-07	1.08E-07
NNE	1.20E-05	3.50E-06	1.71E-06	1.05E-06	5.47E-07	3.50E-07	2.50E-07	1.90E-07	1.51E-07	1.24E-07	1.05E-07
NE	1.07E-05	3.11E-06	1.51E-06	9.32E-07	4.87E-07	3.12E-07	2.23E-07	1.70E-07	1.36E-07	1.12E-07	9.40E-08
ENE	8.33E-06	2.42E-06	1.17E-06	7.21E-07	3.79E-07	2.45E-07	1.76E-07	1.35E-07	1.08E-07	8.96E-08	7.59E-08
E	4.42E-06	1.29E-06	6.24E-07	3.85E-07	2.02E-07	1.31E-07	9.37E-08	7.18E-08	5.75E-08	4.74E-08	4.01E-08
ESE	5.92E-06	1.72E-06	8.38E-07	5.17E-07	2.72E-07	1.75E-07	1.25E-07	9.59E-08	7.67E-08	6.32E-08	5.34E-08
SE	7.67E-06	2.24E-06	1.09E-06	6.72E-07	3.51E-07	2.26E-07	1.61E-07	1.23E-07	9.82E-08	8.09E-08	6.83E-08
SSE	4.38E-06	1.26E-06	6.15E-07	3.76E-07	1.93E-07	1.21E-07	8.51E-08	6.39E-08	5.03E-08	4.09E-08	3.41E-08

TABLE 2.7-132 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	3.66E-08	1.96E-08	1.26E-08	6.79E-09	4.39E-09	3.13E-09	2.38E-09	1.88E-09	1.53E-09	1.28E-09	1.09E-09
SSW	2.93E-08	1.57E-08	1.01E-08	5.47E-09	3.55E-09	2.54E-09	1.93E-09	1.53E-09	1.25E-09	1.04E-09	8.87E-10
SW	2.03E-08	1.08E-08	6.94E-09	3.73E-09	2.42E-09	1.73E-09	1.31E-09	1.04E-09	8.47E-10	7.07E-10	6.01E-10
WSW	1.97E-08	1.05E-08	6.69E-09	3.58E-09	2.31E-09	1.64E-09	1.24E-09	9.80E-10	7.96E-10	6.63E-10	5.61E-10
W	3.05E-08	1.64E-08	1.06E-08	5.73E-09	3.71E-09	2.65E-09	2.01E-09	1.59E-09	1.29E-09	1.08E-09	9.15E-10
WNW	5.12E-08	2.79E-08	1.82E-08	9.95E-09	6.51E-09	4.67E-09	3.56E-09	2.83E-09	2.31E-09	1.93E-09	1.64E-09
NW	1.10E-07	6.04E-08	3.97E-08	2.21E-08	1.46E-08	1.05E-08	8.09E-09	6.46E-09	5.31E-09	4.46E-09	3.82E-09
NNW	1.35E-07	7.36E-08	4.81E-08	2.65E-08	1.73E-08	1.24E-08	9.48E-09	7.53E-09	6.16E-09	5.15E-09	4.39E-09
N	9.25E-08	5.09E-08	3.35E-08	1.86E-08	1.24E-08	8.97E-09	6.90E-09	5.52E-09	4.55E-09	3.83E-09	3.28E-09
NNE	8.97E-08	5.00E-08	3.31E-08	1.85E-08	1.23E-08	8.87E-09	6.80E-09	5.42E-09	4.44E-09	3.72E-09	3.18E-09
NE	8.07E-08	4.52E-08	3.00E-08	1.69E-08	1.12E-08	8.09E-09	6.20E-09	4.94E-09	4.05E-09	3.39E-09	2.89E-09
ENE	6.55E-08	3.73E-08	2.52E-08	1.45E-08	9.79E-09	7.22E-09	5.62E-09	4.54E-09	3.76E-09	3.19E-09	2.74E-09
E	3.46E-08	1.96E-08	1.31E-08	7.49E-09	5.03E-09	3.68E-09	2.84E-09	2.28E-09	1.88E-09	1.59E-09	1.36E-09
ESE	4.60E-08	2.60E-08	1.74E-08	9.89E-09	6.63E-09	4.85E-09	3.75E-09	3.01E-09	2.48E-09	2.09E-09	1.79E-09
SE	5.87E-08	3.30E-08	2.21E-08	1.25E-08	8.41E-09	6.17E-09	4.78E-09	3.85E-09	3.18E-09	2.69E-09	2.31E-09
SSE	2.90E-08	1.57E-08	1.02E-08	5.59E-09	3.66E-09	2.64E-09	2.02E-09	1.60E-09	1.32E-09	1.10E-09	9.42E-10

TABLE 2.7-132 (Sheet 3 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR A 2.26 DAY DECAY, UNDEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	8.39E-07	2.60E-07	1.10E-07	6.43E-08	4.33E-08	2.03E-08	7.01E-09	3.17E-09	1.89E-09	1.28E-09
SSW	6.72E-07	2.08E-07	8.81E-08	5.14E-08	3.46E-08	1.62E-08	5.65E-09	2.57E-09	1.54E-09	1.05E-09
SW	4.84E-07	1.48E-07	6.21E-08	3.59E-08	2.40E-08	1.12E-08	3.86E-09	1.75E-09	1.04E-09	7.09E-10
WSW	4.70E-07	1.44E-07	6.04E-08	3.49E-08	2.34E-08	1.08E-08	3.71E-09	1.66E-09	9.85E-10	6.65E-10
W	6.90E-07	2.14E-07	9.12E-08	5.34E-08	3.60E-08	1.69E-08	5.91E-09	2.68E-09	1.60E-09	1.08E-09
WNW	1.12E-06	3.49E-07	1.51E-07	8.88E-08	6.03E-08	2.87E-08	1.02E-08	4.72E-09	2.84E-09	1.94E-09
NW	2.31E-06	7.26E-07	3.16E-07	1.88E-07	1.29E-07	6.22E-08	2.27E-08	1.06E-08	6.49E-09	4.48E-09
NNW	2.87E-06	8.99E-07	3.90E-07	2.32E-07	1.58E-07	7.58E-08	2.72E-08	1.26E-08	7.56E-09	5.17E-09
N	1.97E-06	6.15E-07	2.67E-07	1.59E-07	1.09E-07	5.24E-08	1.91E-08	9.04E-09	5.54E-09	3.84E-09
NNE	1.81E-06	5.71E-07	2.53E-07	1.52E-07	1.05E-07	5.13E-08	1.90E-08	8.94E-09	5.44E-09	3.73E-09
NE	1.61E-06	5.08E-07	2.26E-07	1.36E-07	9.43E-08	4.64E-08	1.73E-08	8.16E-09	4.96E-09	3.40E-09
ENE	1.25E-06	3.96E-07	1.78E-07	1.09E-07	7.61E-08	3.82E-08	1.48E-08	7.26E-09	4.55E-09	3.19E-09
E	6.65E-07	2.11E-07	9.48E-08	5.77E-08	4.02E-08	2.00E-08	7.65E-09	3.70E-09	2.29E-09	1.59E-09
ESE	8.93E-07	2.83E-07	1.27E-07	7.70E-08	5.36E-08	2.66E-08	1.01E-08	4.88E-09	3.02E-09	2.09E-09
SE	1.16E-06	3.67E-07	1.63E-07	9.87E-08	6.85E-08	3.39E-08	1.28E-08	6.21E-09	3.86E-09	2.69E-09
SSE	6.52E-07	2.02E-07	8.63E-08	5.06E-08	3.42E-08	1.62E-08	5.76E-09	2.66E-09	1.61E-09	1.11E-09

TABLE 2.7-133 (Sheet 1 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR AN 8.00 DAY DECAY, DEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	5.30E-06	1.48E-06	7.07E-07	4.26E-07	2.11E-07	1.29E-07	8.85E-08	6.51E-08	5.01E-08	4.00E-08	3.28E-08
SSW	4.26E-06	1.18E-06	5.66E-07	3.40E-07	1.69E-07	1.03E-07	7.07E-08	5.20E-08	4.01E-08	3.20E-08	2.63E-08
SW	3.14E-06	8.58E-07	4.07E-07	2.44E-07	1.20E-07	7.31E-08	4.98E-08	3.65E-08	2.81E-08	2.23E-08	1.83E-08
WSW	3.03E-06	8.31E-07	3.96E-07	2.37E-07	1.17E-07	7.11E-08	4.85E-08	3.55E-08	2.73E-08	2.17E-08	1.78E-08
W	4.35E-06	1.21E-06	5.82E-07	3.50E-07	1.74E-07	1.07E-07	7.33E-08	5.40E-08	4.17E-08	3.34E-08	2.74E-08
WNW	7.04E-06	1.97E-06	9.44E-07	5.69E-07	2.84E-07	1.75E-07	1.21E-07	8.95E-08	6.94E-08	5.57E-08	4.59E-08
NW	1.43E-05	4.05E-06	1.95E-06	1.18E-06	5.91E-07	3.67E-07	2.54E-07	1.89E-07	1.47E-07	1.18E-07	9.79E-08
NNW	1.79E-05	5.04E-06	2.42E-06	1.46E-06	7.34E-07	4.55E-07	3.15E-07	2.34E-07	1.82E-07	1.46E-07	1.21E-07
N	1.25E-05	3.48E-06	1.66E-06	1.00E-06	5.01E-07	3.10E-07	2.15E-07	1.59E-07	1.24E-07	9.98E-08	8.25E-08
NNE	1.14E-05	3.21E-06	1.53E-06	9.23E-07	4.68E-07	2.93E-07	2.05E-07	1.53E-07	1.20E-07	9.72E-08	8.08E-08
NE	1.01E-05	2.85E-06	1.36E-06	8.20E-07	4.17E-07	2.61E-07	1.83E-07	1.37E-07	1.08E-07	8.75E-08	7.28E-08
ENE	7.89E-06	2.21E-06	1.04E-06	6.33E-07	3.24E-07	2.04E-07	1.44E-07	1.08E-07	8.54E-08	6.96E-08	5.81E-08
E	4.19E-06	1.18E-06	5.58E-07	3.38E-07	1.73E-07	1.09E-07	7.66E-08	5.76E-08	4.54E-08	3.69E-08	3.08E-08
ESE	5.60E-06	1.58E-06	7.49E-07	4.54E-07	2.32E-07	1.46E-07	1.02E-07	7.69E-08	6.05E-08	4.91E-08	4.10E-08
SE	7.27E-06	2.05E-06	9.73E-07	5.90E-07	2.99E-07	1.88E-07	1.31E-07	9.85E-08	7.73E-08	6.27E-08	5.22E-08
SSE	4.14E-06	1.15E-06	5.49E-07	3.30E-07	1.64E-07	1.01E-07	6.92E-08	5.10E-08	3.95E-08	3.16E-08	2.60E-08

TABLE 2.7-133 (Sheet 2 of 3)
ANNUAL AVERAGE χ/Q (S/M^3) FOR AN 8.00 DAY DECAY, DEPLETED FOR EACH 22.5° SECTOR AT THE DISTANCES (MILES) SHOWN AT THE TOP

SECTOR	5	7.5	10	15	20	25	30	35	40	45	50
S	2.75E-08	1.40E-08	8.59E-09	4.32E-09	2.65E-09	1.80E-09	1.31E-09	1.00E-09	7.91E-10	6.41E-10	5.30E-10
SSW	2.20E-08	1.12E-08	6.92E-09	3.49E-09	2.15E-09	1.47E-09	1.07E-09	8.21E-10	6.49E-10	5.27E-10	4.36E-10
SW	1.53E-08	7.75E-09	4.76E-09	2.40E-09	1.48E-09	1.01E-09	7.38E-10	5.65E-10	4.47E-10	3.63E-10	3.01E-10
WSW	1.49E-08	7.51E-09	4.60E-09	2.31E-09	1.42E-09	9.65E-10	7.03E-10	5.37E-10	4.24E-10	3.43E-10	2.84E-10
W	2.30E-08	1.18E-08	7.27E-09	3.68E-09	2.27E-09	1.55E-09	1.13E-09	8.67E-10	6.86E-10	5.56E-10	4.61E-10
WNW	3.86E-08	2.00E-08	1.25E-08	6.40E-09	3.98E-09	2.74E-09	2.01E-09	1.55E-09	1.23E-09	9.99E-10	8.29E-10
NW	8.26E-08	4.32E-08	2.72E-08	1.41E-08	8.82E-09	6.11E-09	4.51E-09	3.48E-09	2.77E-09	2.26E-09	1.88E-09
NNW	1.02E-07	5.32E-08	3.34E-08	1.73E-08	1.08E-08	7.43E-09	5.47E-09	4.21E-09	3.34E-09	2.72E-09	2.26E-09
N	6.96E-08	3.64E-08	2.29E-08	1.19E-08	7.50E-09	5.21E-09	3.86E-09	2.98E-09	2.38E-09	1.95E-09	1.63E-09
NNE	6.85E-08	3.65E-08	2.33E-08	1.23E-08	7.81E-09	5.46E-09	4.06E-09	3.15E-09	2.52E-09	2.06E-09	1.72E-09
NE	6.18E-08	3.32E-08	2.12E-08	1.13E-08	7.19E-09	5.04E-09	3.75E-09	2.92E-09	2.34E-09	1.92E-09	1.60E-09
ENE	4.95E-08	2.69E-08	1.74E-08	9.39E-09	6.05E-09	4.28E-09	3.22E-09	2.52E-09	2.04E-09	1.68E-09	1.42E-09
E	2.62E-08	1.42E-08	9.12E-09	4.90E-09	3.14E-09	2.21E-09	1.66E-09	1.30E-09	1.04E-09	8.59E-10	7.21E-10
ESE	3.48E-08	1.87E-08	1.20E-08	6.44E-09	4.12E-09	2.90E-09	2.17E-09	1.69E-09	1.36E-09	1.12E-09	9.39E-10
SE	4.43E-08	2.37E-08	1.52E-08	8.08E-09	5.15E-09	3.62E-09	2.71E-09	2.11E-09	1.70E-09	1.40E-09	1.17E-09
SSE	2.18E-08	1.12E-08	6.99E-09	3.57E-09	2.22E-09	1.53E-09	1.12E-09	8.63E-10	6.86E-10	5.59E-10	4.64E-10

TABLE 2.7-133 (Sheet 3 of 3)

ANNUAL AVERAGE χ/Q (S/M^3) FOR AN 8.00 DAY DECAY, DEPLETED AT EACH 22.5° SECTOR FOR EACH SEGMENT (MILES) SHOWN AT THE TOP

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.53E-07	2.23E-07	9.00E-08	5.06E-08	3.30E-08	1.46E-08	4.53E-09	1.83E-09	1.01E-09	6.44E-10
SSW	6.03E-07	1.78E-07	7.19E-08	4.04E-08	2.64E-08	1.17E-08	3.66E-09	1.49E-09	8.28E-10	5.30E-10
SW	4.35E-07	1.27E-07	5.07E-08	2.83E-08	1.84E-08	8.10E-09	2.51E-09	1.03E-09	5.70E-10	3.65E-10
WSW	4.22E-07	1.23E-07	4.93E-08	2.75E-08	1.79E-08	7.85E-09	2.42E-09	9.81E-10	5.41E-10	3.45E-10
W	6.19E-07	1.83E-07	7.45E-08	4.20E-08	2.75E-08	1.23E-08	3.85E-09	1.58E-09	8.74E-10	5.59E-10
WNW	1.01E-06	2.99E-07	1.23E-07	6.99E-08	4.61E-08	2.08E-08	6.67E-09	2.78E-09	1.56E-09	1.00E-09
NW	2.07E-06	6.21E-07	2.58E-07	1.48E-07	9.83E-08	4.48E-08	1.47E-08	6.19E-09	3.50E-09	2.27E-09
NNW	2.58E-06	7.71E-07	3.20E-07	1.83E-07	1.21E-07	5.52E-08	1.80E-08	7.53E-09	4.24E-09	2.74E-09
N	1.77E-06	5.27E-07	2.18E-07	1.25E-07	8.28E-08	3.78E-08	1.24E-08	5.28E-09	3.00E-09	1.96E-09
NNE	1.63E-06	4.91E-07	2.08E-07	1.21E-07	8.11E-08	3.77E-08	1.28E-08	5.52E-09	3.17E-09	2.07E-09
NE	1.45E-06	4.37E-07	1.86E-07	1.09E-07	7.31E-08	3.42E-08	1.17E-08	5.10E-09	2.93E-09	1.92E-09
ENE	1.12E-06	3.39E-07	1.46E-07	8.59E-08	5.83E-08	2.77E-08	9.68E-09	4.33E-09	2.54E-09	1.69E-09
E	5.98E-07	1.81E-07	7.76E-08	4.56E-08	3.09E-08	1.46E-08	5.06E-09	2.24E-09	1.30E-09	8.62E-10
ESE	8.02E-07	2.43E-07	1.04E-07	6.08E-08	4.11E-08	1.93E-08	6.65E-09	2.93E-09	1.70E-09	1.12E-09
SE	1.04E-06	3.14E-07	1.33E-07	7.78E-08	5.24E-08	2.45E-08	8.36E-09	3.66E-09	2.12E-09	1.40E-09
SSE	5.85E-07	1.73E-07	7.04E-08	3.98E-08	2.61E-08	1.17E-08	3.73E-09	1.55E-09	8.69E-10	5.61E-10

TABLE 2.7-134 (Sheet 1 of 3)
ANNUAL AVERAGE D/Q (M^{-2}) AT EACH 22.5° SECTOR
FOR EACH DISTANCE (MILES) SHOWN AT THE TOP

DIRECTION	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
S	4.26E-08	1.44E-08	7.40E-09	4.54E-09	2.26E-09	1.37E-09	9.28E-10	6.73E-10	5.12E-10	4.03E-10	3.26E-10
SSW	2.87E-08	9.70E-09	4.98E-09	3.06E-09	1.52E-09	9.25E-10	6.25E-10	4.53E-10	3.44E-10	2.71E-10	2.20E-10
SW	1.98E-08	6.71E-09	3.44E-09	2.11E-09	1.05E-09	6.39E-10	4.32E-10	3.13E-10	2.38E-10	1.88E-10	1.52E-10
WSW	1.68E-08	5.69E-09	2.92E-09	1.80E-09	8.95E-10	5.43E-10	3.67E-10	2.66E-10	2.02E-10	1.59E-10	1.29E-10
W	1.96E-08	6.62E-09	3.40E-09	2.09E-09	1.04E-09	6.31E-10	4.26E-10	3.09E-10	2.35E-10	1.85E-10	1.50E-10
WNW	3.08E-08	1.04E-08	5.35E-09	3.29E-09	1.64E-09	9.93E-10	6.72E-10	4.87E-10	3.70E-10	2.92E-10	2.36E-10
NW	7.05E-08	2.39E-08	1.23E-08	7.52E-09	3.75E-09	2.27E-09	1.54E-09	1.11E-09	8.47E-10	6.67E-10	5.40E-10
NNW	1.02E-07	3.46E-08	1.77E-08	1.09E-08	5.43E-09	3.29E-09	2.23E-09	1.61E-09	1.23E-09	9.67E-10	7.83E-10
N	8.95E-08	3.03E-08	1.55E-08	9.54E-09	4.76E-09	2.89E-09	1.95E-09	1.41E-09	1.08E-09	8.47E-10	6.86E-10
NNE	3.61E-08	1.22E-08	6.27E-09	3.85E-09	1.92E-09	1.16E-09	7.87E-10	5.70E-10	4.34E-10	3.42E-10	2.77E-10
NE	2.21E-08	7.46E-09	3.83E-09	2.35E-09	1.17E-09	7.12E-10	4.81E-10	3.49E-10	2.65E-10	2.09E-10	1.69E-10
ENE	1.66E-08	5.60E-09	2.88E-09	1.77E-09	8.81E-10	5.34E-10	3.61E-10	2.62E-10	1.99E-10	1.57E-10	1.27E-10
E	7.39E-09	2.50E-09	1.28E-09	7.88E-10	3.93E-10	2.38E-10	1.61E-10	1.17E-10	8.87E-11	6.99E-11	5.66E-11
ESE	1.39E-08	4.70E-09	2.42E-09	1.48E-09	7.39E-10	4.48E-10	3.03E-10	2.20E-10	1.67E-10	1.32E-10	1.07E-10
SE	2.60E-08	8.78E-09	4.51E-09	2.77E-09	1.38E-09	8.37E-10	5.66E-10	4.10E-10	3.12E-10	2.46E-10	1.99E-10
SSE	3.47E-08	1.17E-08	6.02E-09	3.70E-09	1.84E-09	1.12E-09	7.56E-10	5.48E-10	4.16E-10	3.28E-10	2.66E-10

TABLE 2.7-134 (Sheet 2 of 3)
ANNUAL AVERAGE D/Q (M^{-2}) AT EACH 22.5° SECTOR FOR EACH DISTANCE (MILES) SHOWN AT THE TOP

DIRECTION	5	7.5	10	15	20	25	30	35	40	45	50
S	2.70E-10	1.32E-10	8.30E-11	4.19E-11	2.54E-11	1.70E-11	1.22E-11	9.16E-12	7.12E-12	5.69E-12	4.64E-12
SSW	1.82E-10	8.91E-11	5.59E-11	2.82E-11	1.71E-11	1.15E-11	8.21E-12	6.17E-12	4.80E-12	3.83E-12	3.13E-12
SW	1.26E-10	6.16E-11	3.86E-11	1.95E-11	1.18E-11	7.92E-12	5.68E-12	4.26E-12	3.32E-12	2.65E-12	2.16E-12
WSW	1.07E-10	5.23E-11	3.28E-11	1.66E-11	1.00E-11	6.73E-12	4.82E-12	3.62E-12	2.81E-12	2.25E-12	1.84E-12
W	1.24E-10	6.07E-11	3.81E-11	1.93E-11	1.17E-11	7.82E-12	5.60E-12	4.21E-12	3.27E-12	2.61E-12	2.13E-12
WNW	1.95E-10	9.57E-11	6.00E-11	3.03E-11	1.84E-11	1.23E-11	8.82E-12	6.62E-12	5.15E-12	4.11E-12	3.36E-12
NW	4.47E-10	2.19E-10	1.37E-10	6.95E-11	4.20E-11	2.82E-11	2.02E-11	1.52E-11	1.18E-11	9.42E-12	7.69E-12
NNW	6.48E-10	3.17E-10	1.99E-10	1.01E-10	6.09E-11	4.08E-11	2.93E-11	2.20E-11	1.71E-11	1.37E-11	1.11E-11
N	5.67E-10	2.78E-10	1.74E-10	8.81E-11	5.33E-11	3.58E-11	2.56E-11	1.92E-11	1.50E-11	1.20E-11	9.76E-12
NNE	2.29E-10	1.12E-10	7.04E-11	3.56E-11	2.15E-11	1.44E-11	1.03E-11	7.76E-12	6.04E-12	4.82E-12	3.94E-12
NE	1.40E-10	6.85E-11	4.30E-11	2.17E-11	1.32E-11	8.82E-12	6.32E-12	4.75E-12	3.69E-12	2.95E-12	2.41E-12
ENE	1.05E-10	5.15E-11	3.23E-11	1.63E-11	9.88E-12	6.62E-12	4.74E-12	3.56E-12	2.77E-12	2.21E-12	1.81E-12
E	4.68E-11	2.29E-11	1.44E-11	7.27E-12	4.40E-12	2.95E-12	2.12E-12	1.59E-12	1.24E-12	9.86E-13	8.05E-13
ESE	8.81E-11	4.32E-11	2.71E-11	1.37E-11	8.29E-12	5.56E-12	3.98E-12	2.99E-12	2.33E-12	1.86E-12	1.52E-12
SE	1.64E-10	8.06E-11	5.06E-11	2.56E-11	1.55E-11	1.04E-11	7.43E-12	5.58E-12	4.34E-12	3.47E-12	2.83E-12
SSE	2.20E-10	1.08E-10	6.75E-11	3.41E-11	2.07E-11	1.39E-11	9.93E-12	7.45E-12	5.80E-12	4.63E-12	3.78E-12

TABLE 2.7-134 (SHEET 3 OF 3)
ANNUAL AVERAGE D/Q (M^{-2}) AT EACH 22.5° SECTOR
|FOR EACH SEGMENT (MILES) SHOWN AT THE TOP

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.68E-09	2.37E-09	9.45E-10	5.16E-10	3.28E-10	1.41E-10	4.37E-11	1.73E-11	9.25E-12	5.72E-12
SSW	5.17E-09	1.60E-09	6.36E-10	3.48E-10	2.21E-10	9.49E-11	2.94E-11	1.17E-11	6.23E-12	3.86E-12
SW	3.58E-09	1.11E-09	4.40E-10	2.40E-10	1.53E-10	6.56E-11	2.04E-11	8.06E-12	4.31E-12	2.67E-12
WSW	3.04E-09	9.38E-10	3.73E-10	2.04E-10	1.30E-10	5.57E-11	1.73E-11	6.85E-12	3.66E-12	2.26E-12
W	3.53E-09	1.09E-09	4.34E-10	2.37E-10	1.51E-10	6.47E-11	2.01E-11	7.96E-12	4.25E-12	2.63E-12
WNW	5.56E-09	1.72E-09	6.83E-10	3.73E-10	2.37E-10	1.02E-10	3.16E-11	1.25E-11	6.69E-12	4.14E-12
NW	1.27E-08	3.93E-09	1.56E-09	8.55E-10	5.43E-10	2.33E-10	7.24E-11	2.87E-11	1.53E-11	9.48E-12
NNW	1.84E-08	5.70E-09	2.27E-09	1.24E-09	7.87E-10	3.38E-10	1.05E-10	4.16E-11	2.22E-11	1.37E-11
N	1.62E-08	4.99E-09	1.99E-09	1.09E-09	6.89E-10	2.96E-10	9.18E-11	3.64E-11	1.94E-11	1.20E-11
NNE	6.52E-09	2.01E-09	8.01E-10	4.38E-10	2.78E-10	1.20E-10	3.71E-11	1.47E-11	7.84E-12	4.85E-12
NE	3.98E-09	1.23E-09	4.90E-10	2.68E-10	1.70E-10	7.30E-11	2.27E-11	8.98E-12	4.79E-12	2.97E-12
ENE	2.99E-09	9.24E-10	3.68E-10	2.01E-10	1.28E-10	5.48E-11	1.70E-11	6.74E-12	3.60E-12	2.23E-12
E	1.33E-09	4.12E-10	1.64E-10	8.95E-11	5.69E-11	2.44E-11	7.58E-12	3.00E-12	1.60E-12	9.93E-13
ESE	2.51E-09	7.75E-10	3.09E-10	1.69E-10	1.07E-10	4.60E-11	1.43E-11	5.66E-12	3.02E-12	1.87E-12
SE	4.68E-09	1.45E-09	5.76E-10	3.15E-10	2.00E-10	8.59E-11	2.66E-11	1.06E-11	5.64E-12	3.49E-12
SSE	6.26E-09	1.93E-09	7.69E-10	4.20E-10	2.67E-10	1.15E-10	3.56E-11	1.41E-11	7.53E-12	4.66E-12

TABLE 2.7-135 (Sheet 1 of 2)
X/Q AND D/Q VALUES AT EACH RECEPTOR LOCATION

RELEASE	DIRECTION	DIST. (MI)	X/Q (SEC/M^3) NO DECAY, UNDEPLETED	X/Q (SEC/M^3) 2.26 DAY DECAY, UNDEPLETED	X/Q (SEC/M^3) 8 DAY DECAY, DEPLETED	D/Q (M^{-2})
EAB	S	0.08	5.20E-05	5.10E-05	5.00E-05	2.30E-07
EAB	SSW	0.08	4.10E-05	4.10E-05	4.10E-05	1.60E-07
EAB	SW	0.09	2.20E-05	2.20E-05	2.20E-05	8.50E-08
EAB	WSW	0.1	1.90E-05	1.90E-05	1.80E-05	6.60E-08
EAB	W	0.13	1.60E-05	1.60E-05	1.60E-05	5.30E-08
EAB	WNW	0.18	1.30E-05	1.30E-05	1.30E-05	4.90E-08
EAB	NW	0.3	1.10E-05	1.10E-05	1.00E-05	5.30E-08
EAB	NNW	0.51	5.30E-06	5.30E-06	4.80E-06	3.30E-08
EAB	N	0.75	1.90E-06	1.90E-06	1.70E-06	1.60E-08
EAB	NNE	0.89	1.30E-06	1.30E-06	1.10E-06	4.70E-09
EAB	NE	1.05	8.60E-07	8.50E-07	7.50E-07	2.10E-09
EAB	ENE	0.88	9.00E-07	8.90E-07	7.90E-07	2.20E-09
EAB	E	0.54	1.10E-06	1.10E-06	1.00E-06	2.20E-09
EAB	ESE	0.27	5.20E-06	5.20E-06	4.90E-06	1.20E-08
EAB	SE	0.16	1.70E-05	1.70E-05	1.70E-05	5.10E-08
EAB	SSE	0.11	1.80E-05	1.80E-05	1.80E-05	1.10E-07
Residence	S	0.67	9.70E-07	9.70E-07	8.70E-07	9.00E-09
Residence	SSW	0.31	3.10E-06	3.10E-06	2.90E-06	2.10E-08

TABLE 2.7-135 (Sheet 2 of 2)
X/Q AND D/Q VALUES AT EACH RECEPTOR LOCATION

RELEASE	DIRECTION	DIST. (MI)	X/Q (SEC/M^3) NO DECAY, UNDEPLETED	X/Q (SEC/M^3) 2.26 DAY DECAY, UNDEPLETED	X/Q (SEC/M^3) 8 DAY DECAY, DEPLETED	D/Q (M^{-2})
Residence	SW	0.31	2.30E-06	2.30E-06	2.10E-06	1.50E-08
Residence	WSW	0.31	2.20E-06	2.20E-06	2.10E-06	1.20E-08
Residence	W	0.83	5.50E-07	5.50E-07	4.90E-07	2.90E-09
Residence	WNW	0.83	9.00E-07	9.00E-07	8.00E-07	4.60E-09
Residence	NW	2.16	3.90E-07	3.90E-07	3.20E-07	2.00E-09
Residence	NNW	2.31	4.40E-07	4.30E-07	3.60E-07	2.60E-09
Residence	N	2.44	2.80E-07	2.70E-07	2.20E-07	2.00E-09
Residence	NNE	2.44	2.60E-07	2.60E-07	2.10E-07	8.20E-10
Residence	NE	2.87	1.90E-07	1.80E-07	1.50E-07	3.80E-10
Residence	ENE	2.87	1.50E-07	1.40E-07	1.20E-07	2.80E-10
Residence	E	2.91	7.60E-08	7.50E-08	6.00E-08	1.20E-10
Residence	ESE	1.86	2.00E-07	2.00E-07	1.60E-07	5.10E-10
Residence	SE	1.59	3.20E-07	3.20E-07	2.70E-07	1.20E-09
Residence	SSE	0.67	7.60E-07	7.60E-07	6.80E-07	7.30E-09
Garden	ENE	3.27	1.20E-07	1.20E-07	9.50E-08	2.20E-10
Garden	E	3.27	6.40E-08	6.30E-08	5.00E-08	1.00E-10

2.8 RELATED FEDERAL PROJECT ACTIVITIES

The purpose of this section is to identify any federal activities related to the proposed project. This review provides data that supports a summary of the project's cumulative impacts and also supports an assessment of whether any other federal agency needs to participate in the preparation of the environmental impact statement (EIS) as a cooperating agency. Actions related only to the granting of licenses, permits, or approvals by other federal agencies are not considered in this review in accordance with NUREG-1555.

Future federal actions related to this project include permits and licenses that may be required at the time of the proposed construction/operations phase. Other federal projects, not as yet identified, may be required at the Combined Operating License (COL) stage. Such activities are unrelated to the current proposal and have not been started; the cumulative impacts from any of these unidentified future activities cannot be reasonably postulated.

A review has been performed for possible federal agency actions in the vicinity of this project site. Two federal projects were identified pursuant to the National Environmental Policy Act (NEPA); an Environmental Assessment was prepared in 2006 to develop Ham Creek Park into a Class A campground at Whitney Lake, Johnson County, Texas (USACE 2006). The second project is the Wheeler Branch Reservoir being built by the Somervell County Water District. Figure 4.7-1 shows the location of these projects. A US Army Corps of Engineers (USACE) 404 permit has been issued for this project. Operationally, this reservoir is not expected to have impact on Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4. Section 4.7 contains additional information regarding cumulative impacts from past, present, and future projects related to construction activities at the CPNPP site.

As listed below, no other federal projects have been identified that are or may be related to this COL application:

- No planned federal actions are associated with the acquisition and/or use of sites for CPNPP Units 3 and 4.
- No federal projects are planned to provide facility cooling water, as cooling water will be coming from Lake Granbury which is not owned by Luminant and is regulated by Brazos River Authority.
- No federal projects must be completed as a condition of facility construction or operation. However, it is possible that the USACE might require the project sponsor to perform 404 wetlands mitigation.
- No planned federal actions are related to the utility corridor.
- No federal projects are contingent on facility construction and operation.

2.8.1 REFERENCES

(USACE 2006) US Army Corps of Engineers, Ft. Worth District. *Environmental Assessment, Ham Creek Park Development Whitney Lake, Johnson County, Texas*,http://www.swf.usace.army.mil/pubdata/notices/HamCreek/Ham_Creek_Final_EA_March_2006_reduced.pdf. (Accessed February 2006)

2.9 EXISTING PLANT PARAMETERS AND SITE CHARACTERISTICS

This is a supplemental Environmental Report (ER) section and, therefore, is not covered by a NUREG-1555, Environmental Standard Review Plan (ESRP). This section is provided to guide the reviewer to other ER sections that address various aspects of plant parameters and site characteristics of CPNPP Units 1 and 2.

The current reactor units at the CPNPP site are part of the existing environment that would be affected by construction and operation of CPNPP Units 3 and 4. Therefore, the parameters and characteristics describing CPNPP Units 1 and 2 constitute a baseline against which the parameters and characteristics for CPNPP Units 3 and 4 can be compared to assess cumulative impacts. The environmental impacts from the proposed reactor units are expected to be cumulative with any impacts documented from the operation of CPNPP Units 1 and 2.

Table 2.9-1 presents the CPNPP Units 1 and 2 parameters and site characteristics that are important for assessing the cumulative environmental impacts from construction and operation of the two proposed units. This table summarizes these parameters and site characteristics under the environmental resource, impact, and monitoring topics in Chapters 2, 3, 4, 5, and 6: land use, water, ecology, socioeconomics, radiological impacts, nonradiological impacts, and meteorological measurements program. The data presented under these topics are drawn from other ER sections, annual radioactive effluent release reports detailing the licensed operations at CPNPP Units 1 and 2, and other appropriate reference sources.

2.9.1 LAND USE

A detailed description of current land use within the boundary of the CPNPP site is provided in Subsection 2.2.1.1, and it is broken down by land-use category in Table 2.2.1. The existing land-use parameters and characteristics for CPNPP Units 1 and 2 are the same as those for CPNPP Units 3 and 4. They are briefly summarized in Table 2.9-1. In this table, the developed land consists of developed open space and areas of land with low intensity, medium intensity, and high intensity development. Open water is primarily Squaw Creek Reservoir (SCR), but it also includes several much smaller bodies of on-site surface water. The on-site agricultural land is classified by the U.S. Geological Survey (USGS) as pasture/hay and cultivated crops. Undeveloped natural land includes deciduous forest, evergreen forest, shrub/scrub land, grassland/herbaceous areas, and woody wetlands (USGS 2001).

The exclusion area boundary and low population zone boundary for CPNPP Units 1 and 2 are listed in Table 2.9-1.

2.9.2 WATER

CPNPP Units 1 and 2 obtain their cooling water directly from Squaw Creek Reservoir (SCR) using a once-through pass. Thermal effects and evaporation at the intake on SCR were recently studied for both existing baseline operations (~3458 MWt/1198 MWe per unit) and a potential thermal uprating to as high as ~3650 MWt (1265 MWe) per unit in Fall 2008 and 2009. All relevant water data from 1999 to 2005 were used in the study. The modeling results describe the statistical boundaries that would result in exceeding regulatory thermal criteria and the need to "power down" to meet those criteria. Additional cooling water is supplied via makeup pipeline from Lake Granbury.

CPNPP Units 3 and 4 are projected to produce ~ 4451 MWt (1625 MWe) each. Cooling water would be drawn from Lake Granbury via pipeline and would be discharged back to Lake Granbury. A closed-cycle cooling design is proposed, and the thermal effects on the reservoir are discussed in Chapter 5.

Water use parameters and characteristics for CPNPP Units 1 and 2 are presented in Table 2.9-1. The listed values are 5-year averages (2002 - 2006) for consumptive use of surface water and for groundwater withdrawal. The most recent available data are for 2006 and do not include the proposed thermal uprating.

2.9.3 ECOLOGY

CPNPP Units 1 and 2 draw their cooling water from the SCR and return it to this body of surface water, which is located within the site boundary. However, CPNPP Units 3 and 4 would draw their cooling water from, and return it to, Lake Granbury. This lake is located approximately 7 mi northeast of the site. Therefore, with regard to aquatic ecology, impacts from the operation of CPNPP Units 3 and 4 would not be cumulative with those from the operation of Units 1 and 2. Table 2.9-1 presents the three key parameters and characteristics of SCR water that are relevant to its aquatic ecology. They were measured across all four seasons in 2007. On the table, these values are expressed as ranges, and the numbers in parentheses after them are their associated standard deviations. The complete set of water quality measurements for the SCR is in Table 2.4-12.

2.9.4 SOCIOECONOMICS

The total human populations within 10 mi and 50 mi of CPNPP Units 1 and 2 and the total number of workers at these two units are presented in Table 2.9-1. The population numbers are estimates for 2008, and they were derived from the most recent population projections in the FSAR, which was updated in February 2007. Totals for the workforce are based on data available from TXU in June 2007. The permanent workforce includes TXU employees, security personnel, staff augmentation workers, and contractor services workers. The number of outage employees ranged from 600 to 800, but the high end of this range is entered on Table 2.9-1 in the interest of using the most conservative numbers for cumulative impact assessments.

2.9.5 RADIOLOGICAL IMPACTS

Parameters and characteristics relevant to the radiological impacts topic are airborne emissions, liquid discharges, liquid pathway collective whole body dose, solid radiological waste volume shipped, solid radiological waste radioactivity shipped, and worker collective dose. Pertinent data are presented in Table 2.9-1.

2.9.6 NONRADIOLOGICAL IMPACTS

CPNPP Units 1 and 2 parameters and characteristics relevant to the nonradiological impacts topic are air emissions, noise, and heights of the tallest man-made structures on the CPNPP site.

Pertinent data are presented in Table 2.9-1. The air emissions data are based on Texas Commission on Environmental Quality (TCEQ) Air Permit No. 19225 - Permit Renewal Application for Comanche Peak Steam Electric Station, February 19, 2004. The data are also based on TCEQ, formerly TNRCC, Form PI-8 - Special Certification Form for Exemptions, 30 TAC Chapter 106; and Standard Permits, 30 TAC Chapter 116 for EDG7, September 6, 2001. Noise data for current operations at CPNPP Units 1 and 2 were collected in the spring of 2008 at the CPNPP site. The tallest man-made structures on the site are the two containment buildings for the operating reactors and the primary meteorological tower.

2.9.7 OTHER

The baseline thermal and electrical generation outputs for CPNPP Units 1 and 2 are in Table 2.9-1. Each of these units has a waste heat load of 2260 MWt. Under the potential uprating in Fall 2008 and 2009, the thermal and electrical generation outputs for each unit are 3650 MWt and 1265 MWe, with a waste heat load of 2400 MWt per unit.

2.9.8 REFERENCES

(TCEQ 2006) Annual Water Use Report for Comanche Peak Steam Electric Station, Texas Commission on Environmental Quality, December 2006.

(TXU 2002) Comanche Peak Steam Electric Station (CPSES) Radioactive Effluent Release Report. Units 1 and 2, TXU Energy. January 1, 2002 - December 31, 2002.

(TXU 2003) Comanche Peak Steam Electric Station (CPSES) Radioactive Effluent Release Report. Units 1 and 2. TXU Energy. January 1, 2003 - December 31, 2003.

(TXU 2004) Comanche Peak Steam Electric Station (CPSES) Annual Radiological Environmental Operating Report for 2004. TXU Energy. January 1, 2004 - December 31, 2004.

(TXU 2005) Comanche Peak Steam Electric Station (CPSES) Radioactive Effluent Release Report. Units 1 and 2. TXU Energy. January 1, 2005 - December 31, 2005.

(TXU 2006) Comanche Peak Steam Electric Station (CPSES) Radioactive Effluent Release Report 2006. Units 1 and 2. TXU Energy. January 1, 2006 - December 31, 2006.

(USGS 2001) Seamless Data Distribution - National Land Cover Database. U.S. Geological Survey. http://seamless.usgs.gov/website/seamless/Mapframe.html Accessed January 30, 2007.

TABLE 2.9-1 (Sheet 1 of 3)
PLANT PARAMETERS AND SITE CHARACTERISTICS FOR CPNPP UNITS 1 AND 2

Parameter	Quantity and Units
Land Use	
Developed acreage	Developed land, 845.6 ac (342.2 ha); open water, 3327.5 ac (1346.6 ha); cultivated crops, 35 ac (14.2 ha); undeveloped natural land, 3802.7 ac (1538.9 ha); total site, 8010.9 ac (3241.9 ha) (USGS 2001)
Exclusion area boundary	5067 ft from midpoint of the centerline between the two containment buildings.
Low population zone boundary	4-mi radius from the center point of the CPNPP site.
Water	
SCR water consumptive use	18,344.6 ac-ft (5-year average) (TCEQ 2006)
Groundwater use	29.0 ac-ft (5-year average) (TCEQ 2006)
Ecology	
Key water quality parameters (SCR)	Water temperature range: 21.3 (±1.2) - 36.6 (±1.47) °C Dissolved oxygen range: 6.9 (±0.76) - 12.5 (±1.6) mg/L Total dissolved solids range: 2725 (±22.6) - 33.26.7(±69.8) mg/L
Socioeconomics	
Permanent plant workforce (2007)	1001
Outage workforce (2007)	800
Population within 10 mi	25,452
Population within 50 mi	1,686,076
Radiological Impacts	
Airborne emissions (curies/yr)	Fission/Activation Products - 214.1 (5-year average) Radioiodines - 1.15E-4 (5-year average) Particulates - 2.28E-6 (5-year average) Tritium - 46.44 (5-year average) (TXU 2002), (TXU 2003), (TXU 2004), (TXU 2005), and (TXU 2006)

TABLE 2.9-1 (Sheet 2 of 3)
PLANT PARAMETERS AND SITE CHARACTERISTICS FOR CPNPP UNITS 1 AND 2

Parameter	Quantity and Units
Liquid discharges (curies/yr)	Fission/Activation Products - 1.29E-1 (5-year average) Tritium - 1118.0 (5-year average) Dissolved/Entrained Gases - 7.80E-1 (5-year average) Gross Alpha - 0.00 (5-year average) (TXU 2002), (TXU 2003), (TXU 2004), (TXU 2005), and (TXU 2006)
Liquid pathway collective whole body dose (mrem)	1.02E-1 (5-year average) (TXU 2002), (TXU 2003), (TXU 2004), (TXU 2005), and (TXU 2006)
Solid radiological waste volume shipped	401.0 m^3/year (5-year average) (TXU 2002), (TXU 2003), (TXU 2004), (TXU 2005), and (TXU 2006)
Solid radiological waste radioactivity shipped (curies/yr)	300.6 (5-year average) (TXU 2002), (TXU 2003), (TXU 2004), (TXU 2005), and (TXU 2006)
Worker collective dose (rem)	Year Dose 2002 - 225 2003 - 66 2004 - 135 2005 - 242 2006 - 60 Average 145.6 rem/yr
Nonradiological Impacts	
Air emissions	Tons per year (tons/yr) of criteria pollutants (Not to Exceed): NO_x - 92.232 tons/yr SO_2 - 24.34 tons/yr PM/PM10 - 2.172 tons/yr CO - 12.085 tons/yr
Min-Max Range Noise [dB9A)]	Southwest fence line 38 – 87 dB(A) Eastern fence line across SCR 35 – 85 dB(A) Western fence line 37 – 82 dB(A) Squaw Creek Park near shoreline 42 – 65 dB(A)
Building height	Containment domes: 260.5 ft above grade Primary MET Tower: 196.9 ft above grade (Subsection 6.4.1)

TABLE 2.9-1 (Sheet 3 of 3)
PLANT PARAMETERS AND SITE CHARACTERISTICS FOR CPNPP UNITS 1 AND 2

Parameter	**Quantity and Units**
Other	
Megawatts thermal	3458 MWt per unit
Gross megawatts electrical	1198 MWe per unit

ºC Degrees Celsius.

CO Carbon monoxide.

ha Hectares.

mg/L Milligrams per liter.

mrem Millirem (1/1000 rem).

MWe Megawatts electric.

MWt Megawatts thermal.

NO_x Oxides of nitrogen.

PM/PM10 Combined PM2.5 particulate matter (< 2.5 microns in diameter) and PM10 particulate matter (< 10 microns in diameter).

SO_2 Sulfur dioxide.