3. AFFECTED ENVIRONMENT

Chapter 3 of this Site-Wide EA describes the existing environmental, social and economic conditions directly and indirectly related to the STM and DWOP sites, site circumstances, and the Proposed Action.

3.1 LAND USE, PLANNING, PUBLIC POLICY, SOCIOECONOMICS

3.1.1 Existing Land Uses

Project Site

The project site includes NREL's STM site, owned by the DOE, and interior office space within DWOP that is leased to NREL. Combined, these sites provide 516,000 sf of facilities and workspace for approximately 1,000 workers (employees, temporary personnel, and contract workers).

The STM site is located on the southeast side of South Table Mountain within unincorporated Jefferson County, near the City of Golden, Colorado, and immediately west of lands recently annexed by the City of Lakewood, Colorado. The STM site is located approximately 12 miles west of downtown Denver (see Figure 1-1). In general, land uses adjacent to the STM site include open space to the north; commercial and residential development to the east; residential development and undeveloped areas to the south; and residential development and open space and undeveloped areas to the west.

The STM site occupies 327 acres including lands located on the mesa top, slope, and toe of South Table Mountain. Of these 327 acres, 136 acres are available for development, 14 acres are restricted from development because of access and utility easements, and the remaining 177 acres are protected by a conservation easement. The conservation easement was established in exchange for 25 acres of developable land that is included in the 136 developable acres on the southernmost portion of the site. All existing facilities are within this 136 acres. Jefferson County is designated as the "beneficiary" of this conservation easement. There are approximately 104.7 acres of mesa top land within the STM site. Approximately 91.6 acres of mesa top land are within the easement area, leaving 13 acres of mesa-top land for development (see Figure 1-3).

Developed land uses at the site include research and development facilities, office space, support buildings, and testing areas. Table 3.1 presents the square footages, the zone in which they are located, and a description of the permanent buildings and facilities at the STM site. Refer to Section 2.1.1 for a detailed description of the zones at the STM site.

The DWOP site is located approximately 0.5 miles (3 kilometers) east of the STM site within an area recently annexed by the City of Lakewood and within the Denver West Metropolitan District (see Section 3.1.2 for more detailed information on the Denver West Metropolitan District).

NREL leases 191,787 sf of space within Buildings 15, 16, 17, and 27 of the DWOP (see Figure 1-2). Buildings 15, 16, 17, and 27 house DOE GO staff and over 50 percent of NREL's existing staff, and provide administration, research support activity areas and limited laboratory research. The lease for these buildings will expire as follows:

- Building 15 during March 2006;

- Buildings 16 and 17 in mid-FY 2004; and
- Building 27 in early FY 2005.

Table 3-1. Square Footage of Existing Buildings at the STM Site.

Buildings	Gross Square Feet	Zone	Description
Solar Energy Research Facility (SERF)	115,556	4	The SERF is the most prominent building at the STM site and provides-low bay laboratories and associated office space for research and development activities for fundamental science and PV.
Field Test Laboratory Building (FTLB)	118,091	4	The FTLB serves as a multi-purpose facility with low-bay laboratories, high-bay research areas, and associated office space.
Alternative Fuels User Facility (AFUF)	32,597	3	The AFUF contains a laboratory and office space as well as the PDU pilot plant.
Outdoor Test Facility (OTF)	11,247	3	The OTF provides office space and indoor laboratory facilities in support of the outdoor PV test area immediately east of the OTF.
Shipping & Receiving (S&R) Facility	14,207	3	--
Thermal Test Facility (TTF)	10,682	3	The TTF provides open bay and rooftop test areas, work space for technicians researching building thermal systems, and space for battery research for transportation systems.
Visitor's Center	6,459	5	--
Bulk Storage Building	3,792	3	--
Facility Maintenance Building	3,787	3	--
Solar Radiation Research Laboratory (SRRL)	2,688	1	The SRRL contains solar radiation measurement and metrology functions. The SRRL is the only permanent facility on the mesa top.
Waste Handling Facility	1,065	3	--
Site Entrance Building	814	5	This building provides space for security personnel and provides badges for site visitors
High Flux Solar Furnace	730	1	--
High Flux Solar Furnace	184	1	--
Solar Industrial Mesa Test Area (Building 7421)	544	1	--
Solar Industrial Mesa Test Area (Building 7521)	576	1	--
Historical Bunker	386	7	--
Camp George West Ammobunker	361	7	--
TOTAL	323,766	-	-

Denver West Realty manages Buildings 15, 16, 17, and 18. Building 27 is owned by the Jefferson County School District.

Surrounding Areas

The areas surrounding the STM and DWOP sites are within portions of unincorporated Jefferson County, as well as the Cities of Golden and Lakewood municipalities within Jefferson County. The Pleasant View Metropolitan District, within unincorporated Jefferson County, overlays portions of each of these jurisdictions (see Figure 3-1).

Specific uses adjacent to the STM site include the following:

- Camp George West;
- Colorado State Highway Patrol Driver Training Track and Jefferson County open space land to the northwest;
- Camden Denver West multi-family residential development and office buildings to the east;
- Residential development within the Pleasant View Metropolitan District and open space planned for a park to the south;
- Offices and a nursery associated with the Colorado Division of Forestry, and residential development and a neighborhood park within Pleasant View to the west; and
- A Marriott Hotel is located east of the STM site, north of Building 27 and southwest of Buildings 15, 16, and 17.

General land uses surrounding the DWOP site include commercial uses to the north and west and commercial and residential uses to the east. The recently completed Colorado Mills Mall is located on the south side of West Colfax Avenue southwest of NREL's DWOP facilities. I-70 bisects the DWOP (see Figure 3-1).

Camp George West currently comprises approximately 100 acres located south of the STM site (see to Figure 1-2). Camp George West was established in 1903 as the Colorado National Guard's (CNG's) permanent rifle and range facility. Lands associated with the Camp totaled 750 acres during the mid-1920s to late-1930s, including the acreage comprising the current STM site (DOE had been a tenant of the State of Colorado prior to acquiring the STM property in 1981). Jefferson County also acquired a significant portion of former Camp George West lands. In addition to providing storage, maintenance, and classroom space for the CNG, the remaining lands known as Camp George West currently provide land for a variety of tenants including the Colorado Office of Emergency Management, Colorado Department of Transportation, Colorado State Patrol, and the Colorado Correctional Center at Golden. However, the CNG is in the process of relocating space at Camp George West. The State of Colorado has received several requests for reuse of the site. The Camp George West Historic District, which includes portions of the present Camp George West site and the STM site, was placed on the National Register in 1993 (Colorado Department of Corrections, 2002).

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3.1.2 Applicable Local Plans, Policies, and Anticipated Future Development

Although the land use plans and policies of local governments are not applicable to federal lands, these plans and policies set forth important affected environmental context for the site and surrounding areas. The following discussions focus on zoning, land use and planning matters. Policies associated with specific technical issues, such as traffic and visual resource protection, are addressed in the corresponding sections of this EA.

Jefferson County

The Jefferson County General Land Use Plan (GLUP), adopted in 1986, provides policies and land use recommendations for the site. The GLUP does not provide a specific land use recommendation for the STM site, rather it states the area as Camp George West. The GLUP is currently being updated, and is expected to be adopted in Fall 2003.

The STM site is currently zoned A2, which permits "general farming, ranching, intensive agriculture uses, and agriculturally related uses while protecting the surrounding land from any harmful effects." The minimum lot size for the A2 zone is 10 acres.

According to the Jefferson County zoning map, designations surrounding the STM site include A-2 to the north; A-2, Planned Development Amended (P-D AMD) and Residential Two (R-2) to the east; A-2 and Residential One B to the south; and A-2 and Agriculture One (A-1) to the west. District designations surrounding the DWOP site are primarily P-D AMD. Jefferson County defines the P-D zone district as "… a versatile zoning mechanism allowing for land development of any nature (residential, commercial, conservation, mining, industrial, public or quasi-public, etc.) either as a single use or in combination, through total integrated project planning." The R-2 zone district "… is intended to provide areas for low to medium density residential development and includes both one-family and two-family dwellings." The A-1 zone district "… is intended to provide for limited farming, ranching and agriculturally related uses while protecting the surrounding land from any harmful effects." The minimum land area for this zone is five acres (Jefferson County, 2002).

Lakewood, Golden, Denver West, Pleasant View

The City of Lakewood addresses land use issues associated with the DWOP site and areas generally east of the STM site. The DWOP site is zoned Planned Development (PD) by the City of Lakewood (Siley, 2002). According to the Lakewood Zoning Ordinance (September 1, 2000), the PD zone district "… is intended to permit the planning and development of substantial parcels of land which are suitable in location and character for the uses proposed as unified and integrated developments in accordance with detailed development plans" (City of Lakewood, 2002).

The current Lakewood Comprehensive Plan, adopted in 1987, is being updated. Details of the Comprehensive Plan Update are not available at this time. Lands immediately east and southeast of the STM site, including the DWOP site, were recently annexed by the City of Lakewood and are referred to as the Denver West Center. Zoning for this area, which generally encompasses an area south of I-70, east of Indiana Street, north of 6th Avenue (U.S. Highway 6), and west of Hawthorne Road, is designated P-D. The ongoing development of this area is

within the jurisdiction of the Denver West Center Official Development Plan and includes the Mills Mall (Siley, 2002).

The City of Golden addresses land use issues to the west of the project area within its incorporated limits. The City of Golden is also in the process of updating their existing *City of Golden Comprehensive Plan Vision 2010* that was adopted in 1993. North and South Table Mountains are considered the City's future eastern boundary according to the Planned Urban Growth Map associated with the existing Comprehensive Plan. It is anticipated that lands surrounding Golden within unincorporated Jefferson County, east of South Table Mountain, will comprise transitional urban uses. An aspect of the Plan's Urban Growth Plan is the development of a park and open space system that provides links between local facilities, neighborhoods, and the Jefferson County Open Space regional system, including a link that incorporates the trail system associated with South Table Mountain (City of Golden, 2002).

The Denver West Metropolitan District was organized in 1984 and is generally located east of the STM site. In 1998, the Lena Gulch Metropolitan District was established as an associated service district to own and operate the public facilities, while the Denver West District was redesignated the financing district to generate the tax revenues to pay the costs of capital improvements (see Figure 3-2). These entities are collectively referred to as "the Districts." The general boundaries of the Districts, located almost entirely within the City of Lakewood, are Indiana Street to the west, 8th Avenue to the South, 20th Avenue to the north, and Alkire Street to the west. The total area of the Districts is 525 acres. The recently completed Colorado Mills Mall is within the Denver West Metropolitan District. In 2001, the Districts submitted the *Amended and Restated Service Plan for Denver West Metropolitan District and Service Plan for Lena Gulch Metropolitan District* in order to address the need for increased services in the Denver West Area. Major projects (those for which over $1 million is budgeted) included in this plan include Colfax Phase I ($5.2 million), Indiana/Colfax Phase II ($7.1 million), and 6th Avenue Interchange ($4.9 million) (White and Associates Professional Corporation, 2001).

The Pleasant View Metropolitan District is generally located south of the STM site (see Figure 3-2). This District is in the process of updating its 10-Year Plan to guide future development of the District. The District has also prepared a Master Plan for the Development of Camp George West Park immediately south of the STM site. The area for the proposed park currently includes open space and several historic structures (refer to Section 3.11 Cultural Resources). Construction of Camp George West Park, scheduled to begin in late 2002, will include: a lighted competition baseball/softball field; a loop trail system; a maintenance yard; two large, open multi-use field areas; a playground; restroom/concession facilities; picnic facilities; and use of the existing recreation hall and/or gun club. Construction of the park is expected to occur in multiple phases, with the first phase to include a ball field on the eastern portion of the site and gravel parking areas. Completion of Phase 1 is expected in 2003. The second phase is anticipated to involve drainage work on the western portion of the site to facilitate development of a western ball field (Wilber, 2002).

INSERT FIGURE 3-2 HERE – METROPOLITAN DISTRICT FINANCE AREA

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Overall Future Development Pattern

In addition to Pleasant View's Camp George West Park development, local governments anticipate that infill development will occur within Pleasant View to the south and on sites recently annexed or soon to be annexed by the City of Lakewood to the east over the next several years. Existing open space and undeveloped land west of the STM site and the remainder of the South Table Mountain mesa are not currently associated with any development plans at this time or in the near future. However, in the past, a privately held portion of the mesa top has been the subject of controversial development proposals. These developments have included plans for rock quarrying and a commercial office campus proposed by the Nike Corporation. Both of these proposals were denied.

3.1.3 Population Growth

The U.S. Census Bureau, state governments, and various local governments collect demographic information. The U.S. Census Bureau has released summaries of the information that was accumulated during the 2000 Census. The following sections present information relevant to population growth in the project site area.

Jefferson County, Golden, Lakewood, Pleasant View

Jefferson County is Colorado's second largest county in population. Jefferson County grew 20.2 percent from a population of 438,430 in 1990 to 527,056 in 2000. The county increased by 88,626 persons, a yearly growth rate of about 2 percent. Golden's population grew from 13,138 in 1990 to 17,159 in 2000, an increase of 30.6 percent (DRCOG, 2002). Lakewood is the largest municipality within Jefferson County. Lakewood's population grew from 126,481 in 1990 to 144,126 in 2000, an increase of 13.95 percent (DRCOG, 2002). The Pleasant View Metropolitan Area's population increased from 3,664 in 1990 to 4,037 in 2000 (U.S. Census, 2002).

Denver-Boulder Metropolitan Area

The Denver-Boulder metropolitan area grew nearly 30 percent, from 1.85 million in 1990 to 2.4 million in 2000. For comparison, the Colorado Springs metropolitan area also grew 30 percent from 397,000 to 517,000, and the Greeley and Fort Collins metropolitan areas both grew faster, at 37.3 and 35.1 percent, respectively. Based on the 2000 census, Denver was the largest county, with a population of 554,636 persons.

Colorado

Between 1990 and 2000, Colorado grew from 3.3 to 4.3 million people. The increase of slightly over 1 million persons was a 30.6 percent increase from 1990. The ten counties of the metropolitan Front Range increased from 2.7 million in 1990 to 3.5 million in 2000, or 30.0 percent, slightly less than the state average. However, the 800,000-person increase in population in these 10 counties constituted over 80 percent of the increase in the state total.

3.1.4 Ethnicity and Income

Colorado's population in 2000 was defined by the U.S. Census to be 82.8 percent white, compared to the U.S. average of 75.1 percent. Jefferson County's 2000 population was defined

by the U.S. Census as 84.9 percent white, 10.0 percent hispanic, and 0.9 percent black. Golden's 2000 population was defined by the U.S. Census as 87.0 percent white, 6.6 percent hispanic, and 1.0 percent black. Lakewood's 2000 population was defined by the U.S. Census as 78.9 percent white, 14.5 percent hispanic, and 1.5 percent black (DRCOG, 2002). Census Tract 101 in Jefferson County, Colorado encompasses the STM site and the portion of the Pleasant View Metropolitan Area closest to the STM site. Census Tract 101's 2000 population was defined by the U.S. Census as 91.3 percent white, 8.2 percent hispanic, and 1.3 percent black (U.S. Census, 2002).

Definitions for what constitutes a "low-income" household vary according to: the number of persons living in the household; federal, state and local government definitions and thresholds, and income distributions in a given area.

The median household income for Census Tract 101, encompassing the residences south of the STM site (south of Zones 3, 5 and 6), is $40,872 based on 2000 Census data. This figure is 71 percent of the median household income for Jefferson County. Households earning less than 80 percent of the County's median household income are considered "low income" households by the County and may qualify for affordable housing assistance within the County (Newman, 2003). Given this definition, Census Tract 101 should be considered a concentration of low-income persons.

The median household income for Census Tract 98.06, encompassing the residences east of the STM site (east of Zone 5), is $80,460 based on 2000 Census data, or 140 percent of the median household income for Jefferson County. Given the County's definition, this area should not be considered a concentration of low-income persons.

Based on these data and site observations, there are no concentrations of minority populations near the STM site, but Census Tract 101 could be considered a concentration of low income persons.

3.2 TRAFFIC AND CIRCULATION

The following discussion is based on consultation with local governments (Buchholz, 2002) and the information and findings presented in a Traffic Impact Study prepared by Felsburg Holt & Ullevig for the STM site in November of 2002 (NREL (FHU), 2002).

3.2.1 Traffic Network: Site Circulation and Access

The traffic network serving the STM and DWOP sites is primarily composed of Denver West Parkway, Denver West Marriott Boulevard, West Colfax Avenue (U.S. 40), I-70, Cole Boulevard, and various local streets (see Figure 3-1).

The I-70/Denver West Marriott Boulevard interchange provides regional access to the STM and DWOP sites. Denver West Marriott Boulevard is a 4-lane, divided roadway that extends between West Colfax Avenue and Denver West Parkway.

Denver West Marriott Boulevard intersects Denver West Parkway just north of the I-70/Denver West Marriott Boulevard interchange. Denver West Parkway is a four-lane, divided collector that parallels the north side of I-70 between the STM site and 20th Avenue. Denver West Marriott Boulevard is a north-south roadway connecting Denver West Parkway and West Colfax

Avenue. It features four lanes with auxiliary turn lanes and provides signalized intersections at Denver West Parkway, the I-70 ramps, Cole Boulevard, and West Colfax Avenue. These interchanges are spaced at roughly 400-foot intervals. The intersection of Denver West Marriott Boulevard and Denver West Parkway is currently controlled by a new traffic signal. Denver West Parkway provides primary access to the STM site and Building 27 within the DWOP.

The main entry to the NREL (STM) site is at the western terminus of Denver West Parkway about 2,000 feet west of the Denver West Parkway/Denver West Marriott Boulevard intersection. Gates control this entry point and a second entry point to the STM site off of Quaker Street. However, public access to parking areas near the Visitor's Center and security building is not controlled by the gate. The Quaker Street access point and security gate is located west of the main gate (see Figure 3-1). These entry points control interior access to roads within the lower portion of the STM site.

Quaker Street provides access to the STM facilities located on the mesa top. Quaker Street is paved to a point just north of the STM west gate. Beyond this point the road is unimproved. A gate is located at this location, but it is only closed and locked at night. The gate is open during the day because the road provides access to public open space. However, upon reaching the STM facilities on the mesa top, a security gate controls access to STM facilities. An access card is required to gain entry at the mesa top security gate and at the other two primary STM site gates.

Building 27 is located off of Denver West Parkway. Buildings 15, 16, and 17 of the DWOP site are located about 0.5 miles (1 kilometer) east of the STM site on Cole Boulevard, which can be accessed via West Colfax Avenue and Denver West Marriott Boulevard (see Figure 3-1).

Regional access to the STM site is provided by I-70, which is a major east-west, six-lane facility and a primary route for commuters and travelers to and from the mountains. I-70 interchanges in the vicinity of the project area include West Colfax Avenue and Denver West Marriott Boulevard. Because there is not a westbound to eastbound on-ramp from West 6th Avenue (U.S. 6) onto I-70, motorists on U.S. 6 must exit onto Indiana Street and use one of the on-ramps at either West Colfax Avenue or Denver West Marriott Boulevard to access I-70 eastbound. This limitation results in additional traffic volumes on local streets in the vicinity of the project area (Wells & Associates, LLC, 2000).

West Colfax Avenue is a major east west divided arterial roadway. Reconstruction of this road was recently completed to serve the new Colorado Mills Mall and other needs. Signalized intersections are located at the I-70 ramps, Indiana Street, the Denver West Village entrance, Denver West Marriott Boulevard, and the Cole Boulevard/Hawthorne Road intersection.

3.2.2 Traffic Volumes and Levels of Service

Existing vehicular traffic was counted along Denver West Marriott Boulevard during the morning (AM) and evening (PM) peak traffic periods of a weekday in August 2002 prior to the opening of the Colorado Mills Mall. Specifically, approach and turning traffic was counted at the following intersections:

- Denver West Marriott Boulevard and Denver West Parkway;
- Denver West Marriott Boulevard and the I-70 North Ramps;
- Denver West Marriott Boulevard and the I-70 South Ramps.

Figure 3-3 presents the existing peak hour traffic counts for these intersections. The raw traffic count data is also provided in the Appendix of the Traffic Impact Report.

Using methods documented in the *Highway Capacity Manual*, (Transportation Research Board, Third Edition, 2000), the existing peak hour traffic volumes identified on Figure 3-3 were analyzed to determine existing operational conditions (levels of service). The *Highway Capacity Manual* describes traffic operational conditions with a level of service (LOS), which is a qualitative measure based on the average delay per vehicle at a controlled intersection. An LOS is described by a letter designation of either A, B, C, D, E or F. An LOS "A" represents conditions with minimal delay, while a LOS "F" represents conditions with much longer delays. Typically, a LOS of "D" or better is considered to be acceptable operational conditions.

Figure 3-4 summarizes the existing levels of service at each of the study intersections. The results of the analyses indicate that all of the study intersections currently operate at an acceptable LOS. Specifically, the Denver West Marriott Boulevard/Denver West Parkway intersection operates at LOS "A" and LOS "B" during the AM and PM peak hours, respectively. Both of the ramp terminals along Denver West Marriott Boulevard operate at LOS "B" or better during the peak hours.

3.2.3 Future Improvements

Improvements associated with the recently opened Colorado Mills Mall development have enhanced the transportation network in the project vicinity. However, additional improvements are set forth in Jefferson County's Countywide Transportation Plan (CWTP). Preparation of the CWTP was initiated in 1995 as a cooperative effort between Jefferson County and the cities of Arvada, Broomfield, Golden, Lakewood, Westminster, and Wheat Ridge. The CWTP resulted in the adoption of six goals for the County's transportation system (Jefferson County Highways and Transportation Department, 1998):

1. Identify and address deficiencies in the County transportation system.
2. Provide a coordinated system that integrates all modes of motor vehicles, transit, bicycle, and pedestrian transportation.
3. Provide for and improve the mobility of those who have special needs or are dependant on public or specialized transportation.
4. Encourage Jefferson County and associated cities to work together to provide consistent plans and maximize influence on the regional transportation planning process.
5. Mitigate the impact of transportation on the environment and communities.
6. Encourage economic vitality.

The "Project List" in the CWTP includes the following roadway improvements in the vicinity of the project area:

- Widening South Golden Road from two lanes to four lanes between Indiana Street and Ulysses Street; and
- Widening West Colfax Avenue from four lanes to six lanes from I-70 to U.S. Highway 6.

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The following interchange/intersection improvements are included in the CWTP Project List:

- Conducting a study to determine the feasibility of eliminating the skewed, at-grade signalized intersection at U.S. Highway 6/West Colfax Avenue;
- Investigating alternatives for intersection of U.S. Highway 6/Indiana Street; and
- Adding turn lanes at major intersections along Indiana Street and West Colfax Avenue.

3.2.4 Accidents

The Colorado Department of Transportation (CDOT) was contacted to determine accident history along I-70 in the vicinity of the STM and DWOP sites. Data were obtained for the five-year period from January 1, 1996 to December 31, 2000 between mileposts 261.57 to 263.57, which include the on-ramps and off-ramps associated with West Colfax Avenue and Denver West Marriott Boulevard. In summary, there were a total of 220 reported accidents along this two-mile (3.2 kilometers) portion of I-70. Four people were killed in two separate accidents and a total of 93 people were injured in 71 injury accidents along this segment of I-70. Additionally, 147 accidents that resulted in property damage only occurred (Ellison, 2002).

Accident data for local streets is not compiled by CDOT. Local governments have not compiled accident data for local roads and intersections in the project area

3.2.5 Transit/Bicycle/Pedestrian Circulation

Bus service to the project site is provided by the Denver Regional Transportation District's (RTD's) Route 20-125 bus line, which includes a stop at the STM Visitor's Center. This bus line operates between 5:16 a.m. and 6:10 p.m. on weekdays between the STM site and downtown Denver. During the morning and evening peak commuter periods, buses stop at the Visitor's Center approximately every half hour (RTD, 2002).

Several planned bike paths are located in the vicinity of the STM site. The CWTP includes improvement of segments of South Golden Road and West Colfax Avenue as "Existing Plus Committed Projects" associated with the Bicycle/Pedestrian Plan.

Pedestrian access to the STM site is provided via Denver West Parkway. Trail easements exist on-site along the eastern boundaries of the STM site and off-site trails just west of the site's western boundary. These trails provide access to open space areas located north of the STM site. An access easement located along the eastern edge of the 25-acre Camp George West parcel provides access between the security building and the future site of Camp George West Park (see Figure 2-1). The mesa top lands within STM's conservation areas are open to the public.

3.3 AIR QUALITY

NREL implements an Air Quality Protection Program under NREL Policy 6-2, Program 6-2.5. The purpose of the program is "to prevent the degradation of local air quality while helping to preserve the quality of the local and regional air shed to the maximum extent possible." The program applies to stationary sources and mobile sources, such as vehicles. NREL project managers notify the NREL ES&H Office prior to the beginning of any project that poses the potential for air emissions. The NREL ES&H Office evaluates air emissions and permitting requirements early in a project's planning phase. The NREL ES&H office is notified of new fuel-

burning equipment and changes in the status of existing equipment. The ES&H Office contacts the Colorado Department of Public Health and Environment (CDPHE) when necessary. NREL operates all facilities at the STM and DWOP sites in compliance with all applicable regulations. DOE provides oversight to verify compliance with those regulations.

3.3.1 Climate

The STM and DWOP location is characterized by a semiarid climate that exhibits large seasonal and short-term temperature variations typically associated with movement of large continental air masses. The central Rocky Mountains are usually dominated by high pressure. The plains are usually dominated by low pressure. High pressure frequently governs the weather along the Front Range resulting in fair, dry conditions at the STM site. Although the average daily temperatures at the STM site are moderate, large diurnal temperature variations result from the site's 5,800-foot elevation and thinner atmosphere. Average daily winter temperatures range from 9° to 48° Fahrenheit (F). Average daily summer temperatures range from 59° to 90°F. Temperatures are generally above freezing from about mid-May through mid-September. The site receives on average approximately 16 inches of precipitation per year. Fifty percent of the precipitation occurs from March through June. The average seasonal snowfall is approximately 65 inches. There are occasional periods of severe drought along the Front Range. Average mid-afternoon humidity is approximately 40 percent (Department of Agriculture, 1980). Average wind speeds are approximately nine miles per hour (mph), primarily from the southwest and south-southwest (NREL, 1993).

3.3.2 Air Quality Regulatory Authorities

Ambient air quality in a given location is characterized by comparing the concentration of various pollutants in the atmosphere to the standards set by federal and state agencies. The purpose of these standards is to allow an adequate margin of safety for the protection of public health and welfare from adverse effects resulting from pollutants in the ambient air. The primary pollutants of concern for which federal and state ambient air quality standards have been established include criteria pollutants, hazardous air pollutants (HAPs), and other toxic air pollutants.

National Ambient Air Quality Standards (NAAQS) set the absolute upper limits for specific air pollutant concentrations in order to protect human health. These pollutants are called criteria pollutants and consist of carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), ozone, particulate matter less than 10 microns (PM-10), lead, and volatile organic compounds (VOCs). A geographic area that meets or exceeds the limit for a particular criteria pollutant is called a nonattainment area. Areas where pollutants are measured below the limits are called attainment areas. The Denver metropolitan area is in attainment for all criteria pollutants as of August 2002.

The EPA recently revised both the ozone and particulate matter less than 2.5 microns in effective diameter (PM-2.5) NAAQS; however, the revised limits are currently being contested in the federal judicial system. If, after approval is achieved on the federal level, it is determined that specific areas in the State of Colorado are not in attainment with the new limits, the Colorado State Implementation Plan must be revised.

The National Emission Standards for Hazardous Air Pollutants (NESHAPs) are designed to protect human health and the environment by reducing toxic air emissions. The underlying

authority for NESHAPs is Title III of the Clean Air Act Amendments of 1990 (CAAA-90), which established a listing of HAPs. Title III of the CAAA-90 specified requirements for the EPA to identify those source categories that emit, or have the potential to emit, one or more HAPs. For each source category identified, the EPA was directed to promulgate NESHAPs using standards that are modeled on the best practices and most effective emission reduction methodologies in use at the affected facilities. Threshold quantities determine application of various requirements or exemption from those requirements.

The State of Colorado has primacy to administer the Clean Air Act within the State. The Colorado Air Quality Control Commission (CAQCC) Regulation No.3, Air Contaminant Emissions Notices, provides the provisions for construction and operating permits. An Air Pollution Emission Notice (APEN) is required for each individual emission point in an attainment area with uncontrolled emissions of 2 tons per year (TPY) or more of any individual criteria pollutant or 100 pounds per year of lead.

Prevention of Significant Deterioration (PSD) regulations limit emissions of pollutants from new sources in attainment areas. To implement its policy of non-degradation, the EPA designated types of areas in which certain types of increments of additional pollution would be allowed. Class I areas include federal lands such as national parks, national wilderness areas, and national monuments. These areas are granted special air quality protections under Section 162(a) of the federal Clean Air Act. Class II areas allow additional, well-controlled growth. Under PSD regulations, a construction permit may be necessary to install a new stationary source or modification of a stationary source (any building, equipment, structure, facility, or installation or any combination, including construction activities) prior to initiation of construction activities. Construction permits are issued on the basis of production/process rates as detailed in the APEN submitted with the permit application or as requested in the application as related to emissions of criteria pollutants and HAPs. The STM site is located in a Class II PSD area for criteria pollutants for which the area is in attainment. The nearest Class I area is Rocky Mountain National Park, approximately 40 miles to the northwest of the site.

The emission of radionuclides other than radon from DOE facilities is regulated under 40 CFR 61 NESHAPS. The requirements establish a radionuclide emission standard equal to those emissions that yield an effective dose equivalent (EDE) of 10 millirems per year to any member of the public. The requirements also address measuring and monitoring fugitive emissions of airborne particles that may contain radionuclides. NREL and DOE submit an annual compliance report to EPA. Notification to the EPA is also required when emission limits are exceeded. The use of low-level radioactive materials is described in Section 3.10.1.

3.3.3 Emission Sources

Emissions sources at DWOP include those from an outdoor emergency generator located at Building 16, vehicles and limited laboratory activities. Monitoring of DWOP emissions is not required or performed. Emissions at the STM site include those generated by stationary sources during normal and emergency site operations and emissions from vehicles.

An air emissions inventory dated July 2001 indicates that the STM site lists 36 stationary sources of air emissions. The sources consist of boilers, hot water heaters, emergency generators, building heaters, and a thermochemical process development unit (TCPDU or thermal oxidizer) used for research activities. Emissions from the 2001 inventory are listed in Table 3.2. Potential emissions values reflect the operation of all sources of emissions at the site

on a continuous year-round basis at full capacity. Actual emissions of these pollutants from the site are much less than potential to emit because the sources operate intermittently and at less than full capacity.

Table 3-2. Annual Emissions at the STM Site (TPY), 2001

	Particulates	SO_2	NO_x	CO	TOC
Potential to Emit	2.86	5.18	46.41	23.21	3.63
Actuals	0.39	0.13	5.33	3.87	0.55

Source: Compiled from STM July 2001 Emissions Inventory

With respect to HAPs, the STM site emits extremely small quantities of materials from laboratory hoods. Examples of the source of these HAPs include acetone, cyclohexane, toluene, xylene, phosphoric acid, and sulfuric acid. The emission quantities are well below notification and permit thresholds.

The site also presents the potential to emit accidental releases of toxic, highly toxic and corrosive gases, such as those used in the SERF laboratory areas. The potential for accidental release of these gases exists, but NREL's existing environmental management processes, procedures, facility design specifications, and programs establish requirements for the handling, storage and use of these gases to minimize the likelihood of a release. Specific programs that address related issues such as the Risk Assessment Program and Compressed Gas Safety Program. In combination, these practices prevent adverse air quality impacts offsite and involving NREL personnel at NREL sites and facilities.

The ethanol PDU (in the AFUF) is equipped with scrubbing equipment intended to reduce or eliminate potential odor causing emissions. Other activities on the STM site have the potential to generate low levels of odors with minimal potential to migrate offsite.

Fugitive dust is also emits from the STM and DWOP sites in the form of emissions that are unplanned and escape from a process by a route other than a stack, chimney, or vent. These emissions are minor. Another source of fugitive dust is wind blown soil. Construction activities at the STM site have the potential to increase fugitive dust generation by disturbing soil.

3.3.4 STM Site Permit Status

The STM site operates under two Colorado Air Pollution Control Division (CAPCD) permits. An APEN was submitted to the CAPCD in May 1999 in association with the intent to scale up a research project that uses biomass materials to produce liquid and gaseous products. Construction Permit Number 99JE0400 associated with the TCPDU was issued in April 2002 for its installation.

A second APEN was submitted to the CAPCD in November 1999 in association with land development activities on the site. The second permit, Permit Number 00JE0009L, was issued in March 2000 and is a site-wide permit for the emission of particulates associated with land development. The STM site has developed a fugitive dust plan for land development that addresses measures to be taken during construction activities.

The emissions threshold for major source designation under Title V of the Air Quality Act is 100 TPY. No sources at the STM site approach this threshold. Operating permits may be issued for sources with threshold under 100 TPY and are called minor sources. NREL currently is not required to obtain a minor source operating permit.

3.4 NOISE

Noise is defined as unwanted or annoying sound that is typically associated with human activities and that interferes with or disrupts normal activities (Salter, 2000). Sound and noise are measured as sound pressure levels in units of decibels (dB). Response to noise varies according to its type, its perceived importance, its appropriateness in the setting and time of day, and the sensitivity of the individual receptor. Human hearing is simulated by measurements in the A-weighting (dBA) network, which de-emphasizes lower frequency sounds to simulate the response of the human ear. Some typical sound levels from common noise sources are presented in Table 3-3.

Table 3-3. Sound Levels* of Typical Noise Sources and Noise Environments (A-Weighted Sound Levels).

Noise Source (at a given distance)	Scale of A-weighted Sound Level (dBA)	Noise Environment (equivalent)	Human Judgment of Noise Loudness (relative to a reference loudness of 70 dB*)
Commercial jet take-off (200 feet/60.6 meters)	120	--	Threshold of pain *32 times as loud
Motorcycle (25 feet/7.6 meters) Diesel truck, 40 mph (50 feet/15.2 meters)	90	Boiler room; Printing press plant	*4 times as loud
Garbage disposal (3 feet/1 meter)	80	Noisy urban daytime	*2 times as loud
Bus idling (50 feet/15.2 meters)	75	--	*1.5 times as loud
Passenger car, 65 mph (25 feet/7.6 meters) Vacuum cleaner (3 feet/1 meter)	70	--	Moderately loud *70 dB (Reference loudness)
Normal conversation (5 feet/1.5 meters)	60	Data processing center; Department store	*1/2 as loud
Light traffic (100 feet/30 meters)	50	Quiet urban daytime	*1/4 as loud
Bird calls (distant)	40	Quiet urban nighttime/rural	Quiet *1/8 as loud
Library	36	Quiet suburban nighttime	Quiet *3/32 as loud

*These values are logarithmic measurements (i.e., every 10-dBA increase is perceived by the human ear as approximately twice the previous noise level; therefore, the motorcycle is twice as loud as the garbage disposal).

Source: FHWA and Salter, 2000.

3.4.1 Sensitive Receptors

Noise receptors located in the immediate vicinity of the STM site include STM personnel, inhabitants of residences to the east and south of the site boundary, and wildlife. The relationship between noise and wildlife is discussed in Section 4.8.

With respect to NREL personnel, DOE has accepted the Occupational Health and Safety Administration (OSHA) noise regulations and guidelines for worker exposure and manages compliance with them. These regulations and guidelines focus on noise from machinery, equipment and tools. NREL maintains compliance with all regulations related to worker health and safety.

Other sensitive receptors in the vicinity include multifamily residences located approximately 50 feet (15.2 meters) east of the east site boundary. Two subdivisions composed of single-family residences are located south of the STM site. The nearest residence to the site's southwestern boundary is located approximately 50 feet (15.2 meters) away. The nearest residence to the site's southeastern boundary is located approximately 100 feet (30.4 meters) away. There are no schools, hospitals, churches or daycare centers in the area. A park with ball fields is planned in the open area immediately south of the STM site.

3.4.2 Existing Noise Levels and Sources

The ambient noise level within the STM site consists of sounds generated by vehicle traffic, various activities on the site, and natural sources. Actual noise levels in and around the site are affected by specific noise events, intervening topography, vegetation, and meteorological conditions, including wind speed and direction.

Although noise measurements were not taken and noise modeling was not performed, site observations indicate the acoustic environment within the boundaries of the southeastern portion of the site can be considered similar to that of an urban location. Both sites are located near I-70, a significant noise source throughout the day and during sensitive late night and early morning periods. Noise levels on the mesa top are typical of a rural location, but can be elevated substantially when the adjacent State Highway Patrol's driver-training track is being used. It is estimated that 24-hour day-night average sound levels on the site typically range from 40 to 60 dBA. Most activity and mechanical operations at the STM site are conducted within buildings. Construction activity and routine maintenance are occasional noise sources. In the future, the new park will become another source of noise in the vicinity.

In general, roadway noise depends upon vehicle type, speed, traffic volume, surface conditions, surface gradient, and distance to receptors. On-site light vehicle traffic contributes little to overall traffic noise at off-site locations because of the limited number of vehicles that access the site, relatively low speed limits throughout the site, and relatively high ambient noise levels near most sensitive receptors (adjacent residences).

I-70 runs east-west approximately 1,400 feet (424 meters) south of the STM site's southeastern boundary. Based on site visits, I-70 is the primary ambient noise source for the southern portion of the STM site. Passenger cars moving at 65 mph can generate noise measured at 70 dBA, measured at 25 feet (15.2 meters) (see Table 3-3).

A RTD bus route serves the site, which contributes to temporary noise levels. Buses use the main access road to the site and turn around just east of the site's security building. Idling buses generate a temporary noise level of approximately 75 dB at 50 feet (15.2 meters) (see Table 3-3). The bus line serving the STM site and downtown Denver operates between 5:16 a.m. and 6:10 p.m. on weekdays. During the morning and evening peak commuter periods, buses stop at the Visitor Center approximately every half hour (RTD, 2002).

3.4.3 Regulations and Guidelines

Environmental noise regulations and guidelines for outdoor, neighborhood, and/or community noise levels have been promulgated by the EPA, the Federal Highways Administration (FHWA), the State of Colorado, and local governments such as the City of Denver. Although these standards are not directly applicable to the STM site, they provide a general context for assessing noise issues. No local regulations apply to the STM site.

The EPA provides guideline noise levels for anticipated noise/human activity disturbance impacts in relation to industrial construction and operations. The levels are set to define a point at which these levels and lower levels would protect people from activity interference and annoyance. Outdoor locations "in which quiet is a basis for use" are assigned a maximum noise level of 55 dBA. Indoor locations are assigned a maximum noise level of 45 dBA.

The DOE has accepted the OSHA noise regulations and guidelines for worker exposure and NREL operates in compliance with them. These regulations and guidelines focus on noise from machinery, equipment and tools.

The FHWA has created Noise Abatement Criteria for actions that involve federal roads. A noise level of 67 dBA is assigned to lands that include residences, schools, churches, hospitals, picnic areas, and recreation areas. A 24-hour average level, weighted to address the increased significance of nighttime noise, of 67 dBA is a typical threshold for considering mitigation for residential sensitive receptor exposure.

Although the State of Colorado Noise Statute (Code of Colorado Regulations (CCR) 25-12-101 though CCR 25-12-109) has established statewide standards for noise level limits for various time periods and areas, the standards exclude federal entities such as NREL; however, they can be used as guidelines in order to evaluate impacts. The most stringent permissible noise levels apply to residential zones, where the maximum permissible daytime (7:00 a.m. to 7:00 p.m.) noise level is 55 dBA and the noise level is measured at a distance of 25 feet (7.6 meters) from the property line. In addition, construction projects are limited to permit conditions or 80 dBA for the period within which the construction is to be completed or reasonable amount of time.

The City of Denver has promulgated a noise ordinance, Revised Municipal Code, City and County of Denver, Colorado, Ordinance No. 628-97, 22 September 1997, Supplement No. 55, (City and County of Denver, 1997) that can provide another basis for evaluating noise levels. The type of premises on which the noise is generated determines allowable noise levels. In the case of the STM site, the most conservative approach is to consider it an "industrial premises." The maximum allowable sound pressure level under the Denver ordinance is 80 dBA measured at the site property line between the hours of 7:00 a.m. and 10:00 p.m.

3.5 VISUAL QUALITY/AESTHETICS

The emphasis of the following discussion is on the STM site because NREL's operations at the DWOP are contained within leased building space and NREL's Proposed Action would not involve any substantial exterior changes to privately owned/leased DWOP buildings.

3.5.1 Visual Characteristics of the Project Site and Vicinity

Figure 3.5, photographs 1 through 11, characterize existing visual and aesthetic conditions of the STM and DWOP sites and vicinity from key vantage points. These photographs are presented at the end of Chapter 3 and are referenced throughout Chapter 3, where appropriate.

The visual characteristics of the STM site are created by permanent facilities, temporary facilities and natural conditions (see Figure 3.5, photographs 1-11). The permanent facilities are primarily composed of buildings, roads, parking areas and test sites. The temporary facilities include certain outdoor research devices and site operations and maintenance equipment. Modern office buildings and a mature and well-developed formal landscape characterize the DWOP site.

The dominant visual characteristics of the existing STM site include the prominent slope and mesa top associated with South Table Mountain, the NREL facilities located on top of South Table Mountain, the SERF, the FTLB, and the Visitor Center located at the toe of the slope. The STM site buildings are prominent against the landscape of South Table Mountain.

The STM site facilities are designed to reflect the laboratory activities related to modern energy concepts. Two of the larger buildings, the SERF and FTLB, are terraced and set against the south slope of South Table Mountain. In addition to the buildings at the STM site, NREL has constructed a variety of solar testing and measurement structures, such as the High Flux Solar Furnace, Solar Radiation Research Laboratory, and numerous PVs situated throughout the site.

The facilities located on top of South Table Mountain cover a small proportion of the overall South Table Mountain mesa top (see Figures 1.2 and 1.3). The remainder of the mesa top is almost entirely undeveloped and part of the conservation area delineated by Zone 2. NREL's solar furnace and the surrounding buildings in Zone 1 are visible from off-site locations. A Colorado State Patrol driver training track facility is also located on top of the Mesa, but it is not visible from most off-site locations. Other natural areas on the mesa top are within designated Jefferson County open space areas or NREL's on-site conservation area (Zone 2).

The visual character of the project vicinity is defined primarily by commercial and residential development (see Figure 3.5, photos 9, 10, and 11).

Night lighting and visibility from off-site locations, especially light from the mesa top (Zone 1) have been the subject of community concern about light pollution. Light pollution generally refers to the cumulative glow that urban and suburban areas typically generate at night as they increase in density. It can also refer to incidental light sources in locations where lighting is not welcome.

Exterior lighting in Zone 1 is limited and does not include area-wide lighting typical of local streets or parking areas. Recently, motion sensors have been installed to minimize the duration that these exterior lights are on and visible from off-site locations. No lighting is currently

provided in Zones 2 and 6. Exterior night lighting is provided in Zones 3, 4, and 5 to address site and worker security. Additional light from within buildings is also present at night and is visible from off-site locations.

3.5.2 Public Vantage Points and Site Visibility

There are several primary off-site public and private vantage points in the project vicinity where the site and/or site facilities are visible. The following discussions clarify the locations of these vantage points and characterize the views from these locations.

Vantage points along U.S. Highway 6 exist for east and westbound motorists west of the U.S. Highway 6/I-70 interchange (see Figure 3.5, photograph 9). Only the larger buildings at the STM site can be readily identified by a passing motorist. Occasionally, the mesa top facilities can be viewed from these vantage points.

Vantage points also exist along I-70 for motorists heading northeast toward DWOP. The STM site's larger buildings are at eye level of passing motorists. Facilities on the mesa top can be seen, although not by the casual observer. Existing development, foliage, and overhead transmission lines obscure views from vantage points to the west of the STM site looking east or northeast.

Numerous vantage points exist within the neighborhoods and commercial areas on the west, south, and east sides of the STM site (see Figure 3-5, photographs 5-11). The Pleasant View residential neighborhood is located immediately south of the NREL property line and immediately adjacent to the west and east boundaries of Zone 2. As shown in Figure 3-5 photographs 5-8, neighbors in this area have views of Zones 2, 3, 4, 5, and 6 and limited views of Zone 1.

Signs on the chain link fence (see Figure 3-5 photograph 5) indicate that some portion of the area south of Zone 6 is part of the Jefferson County Open Space program. A park with ball fields, including one lighted ball field, is planned for the southern portion of this off-site property. In the future, this lighted ball field will add new sources of light in the area.

Residents in the immediate vicinity, with homes on roads near the STM site boundary, have the most direct views of the STM site (see Figure 3-5, photographs 5 and 6). Most homes and roads within the Pleasant View neighborhood do not have views of the STM site due to topography and landscape obstructions.

Residents of the far western units in the condominiums at Camden Denver West have a view across the eastern edge of the STM site, including the mesa top facilities (see Figure 3-5 photograph 8). Views of the foothills west of Golden and Lakewood are unobstructed.

The Estates at 6th Avenue, a residential neighborhood, is located approximately one mile (1.6 kilometers) south of the STM site, south of U.S. Highway 6. This location allows for distant views of the entire NREL site (all zones) and the mesa top facilities (see Figure 3-5, photographs 9, 10, and 11).

3.5.3 Public Sensitivities Associated with Visual Quality and South Table Mountain

Although federal agencies and sites are not subject to the policies and regulations of local governments, NREL considers them during site planning and development efforts. The following discussion summarizes local policy related to visual quality and South Table Mountain.

Local policies established by Jefferson County, Golden, and Lakewood reflect community sensitivity with respect to the visual qualities provided by natural resources in the area such as South Table Mountain. Specifically, the *Jefferson County General Land Use Plan* (Land Use Plan) characterizes North and South Table Mountain as "unique landscapes," and states that "maintaining landscapes that have a unique visual quality" is a key to maintaining the quality of life in Jefferson County. According to the Land Use Plan, suitable land uses for unique landscapes such as South Table Mountain are limited to rural residential and county, regional, and conservation open space uses (Jefferson County, 1986).

Sensitivity to the development of South Table Mountain was also reflected by responses to the project's scoping letter. The responses to the scoping letter are presented in Appendix B. The key issues raised in the scoping response letters follow.

- "Current local land use plans, visions, and authorities disfavor developments on the top or upper slopes of the Table Mountains."
- "Any further developments high on the slopes and on the mesa top may set land use precedents that could lead to further developments on the higher slopes and top by other land owners."
- New development, especially on the mesa top, would increase site visibility impacts and light pollution.

The predominant view expressed by the scoping response letters that were received reflects general and specific opposition to existing and future development of the mesa tops and slopes, especially night lighting.

3.6 WATER RESOURCES

3.6.1 Surface Water

The STM site is located between Lena Gulch and Clear Creek (see Figure 1-2). Lena Gulch is approximately one-quarter mile (0.2 kilometers) to the south of the STM site, and Clear Creek is located north of South Table Mountain. Lena Gulch flows northeastward into Clear Creek. A 100-year floodplain associated with Lena Gulch has been delineated on the grounds of Camp George West south of the STM site. Future improvements associated with the Camp George West Park include measures to reduce a channel constriction associated with this floodplain.

There are no perennial creeks, streams, ponds, or floodplains on the STM site. Surface water, when present, is not used for any purpose on or off the site. There may be seasonal seeps on the STM site after small amounts of surface water percolate through the soil or the fractured basalt that caps South Table Mountain. Intermittent storms and other seasonal precipitation events may cause water to temporarily collect in topographic lows and drainages. Surface

water may briefly collect in depressions formed in the basalt on the top of the mountain (NREL (ERO), 1998). Wetlands and related issues are discussed in Sections 3.8 and 4.8 of this EA.

The general slope of the STM site is toward the south/southeast, directing stormwater toward Lena Gulch both from the top of South Table Mountain and the property below. Two primary drainages collect runoff from the top of South Table Mountain within the STM site's boundary. These drainages, as well as another drainage located just west of the site's west boundary, occasionally convey stormwater (as shown on Figure 3-9 and discussed in Section 3.8.2).

According to the 1993 Baseline Surface Water Monitoring Program, the STM site is divided into 14 hydrologic basins. The 1993 Program computed drainage basin characteristics including surface runoff rates and volumes, which were based on the drainage patterns, flow lengths, slope, precipitation amounts, soil types, and vegetative cover. The rate of water erosion and the transport of soil and rock on site and in the vicinity were determined to be generally low because most of the STM site is undeveloped.

Most of the development on the STM site is located on the southern portion of the site below the slopes of South Table Mountain. A portion of the site's stormwater is directed through engineered drainage structures designed to control runoff. The structures include earth and concrete drainage channels, which effectively direct stormwater to a detention basin near the southeastern corner of the STM site and through a 4.5-foot diameter storm sewer drain to Lena Gulch.

Background surface water quality data were gathered from five sample locations on the STM site after storms produced sufficient runoff during 1992 and 1993. An evaluation of the analytical data determined that there were no permanent, detectable impacts to surface water quality down gradient from the STM site from STM activities. Slight elevations of total suspended solids, oil and grease, and oxygen demand in the stormwater were attributed to site construction occurring during the study (NREL, 1994).

Although NREL is not required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for routine operations at the STM and DWOP sites (NREL, 1994), a stormwater permit is necessary for construction activities. The EPA administers stormwater permits for federal facilities in the State of Colorado. Based on EPA's recent site inspection and guidance to NREL, no permit is required under Phase II of the stormwater rule (MS4). NREL implements a program that identifies procedures to minimize impacts to surface waters resulting from construction activities. The procedures are detailed in NREL's "Stormwater Pollution Prevention Program for Construction Activities."

As a result of an inspection by the Colorado Department of Health, the EPA investigated two waste disposal sites on the grounds of Camp George West near the STM site during the late 1980s and early 1990s for possible contributions to the contamination of groundwater and surface water in Lena Gulch. The State of Colorado Department of Military Affairs owned the waste disposal sites. One site was located along an ephemeral tributary to Lena Gulch north of the STM site on the top of South Table Mountain. The other was located south of the STM site in the vicinity of Zone 6. This site lies in the vicinity of the current southern boundary of the STM site. Samples taken during the investigation of materials remaining at the waste sites indicated that the materials were nonhazardous. By 1993, all sources of contamination were removed; however, surface water samples indicated the presence of a small amount of pesticides in the

tributary. The pesticides were not present in the water by the time it entered Lena Gulch. There was no evidence that the pesticides were associated with the waste materials at the northern site. Soil samples taken following source removal indicated the presence of metals in the soils associated with the actual disposal areas. The study concluded that although metals were present in small amounts, there would be no impacts to local residents or users of the area. Groundwater samples were not taken because sources of local drinking water would not be affected (Morrison Knudsen, 1993).

The DWOP site is located in a fully developed area of office buildings. The office park owner has developed stormwater management structures that are approved by Jefferson County. NREL has no responsibility for the management of stormwater.

3.6.2 Groundwater

Precipitation and snowmelt are the primary sources of groundwater recharge in the uppermost geologic units that are present beneath the STM and DWOP sites. Site development is constructed on alluvial/colluvial sands and gravels. Beneath it, the Denver Formation consists of interbedded sandstone, mudstone, and claystone. Both geologic units contain groundwater. Groundwater sometimes manifests itself in perched water tables within the Denver Formation. In general, water in the Denver aquifer meets drinking water standards for public water supplies in most of the area. The STM site, however, is located near the edge of the aquifer, where water of poorer quality exists due to the proximity of pollution sources at the surface and less water available for dilution. The sources of pollution are non-specific and contribute to higher measurements of total dissolved solids. In general, the closer a formation is to the surface, the more likely that foreign materials or pollutants could infiltrate into the formation and in greater quantities, thus degrading water quality in the near-surface. Groundwater flow mimics surface water flow and trends toward the southeast. The gradient of flow is estimated at 0.06 feet per foot. The rate of flow is estimated at 0.05 feet per day, assuming that the effective porosity of the Denver Formation ranges from 12.9 to 31.1 percent (Handex, 1997).

Groundwater monitoring is not required of NREL by a regulatory agency (NREL, 1993); however, monitoring wells were installed at the STM site, and groundwater baseline data were accumulated beginning in 1990. Groundwater monitoring was performed quarterly under the direction of NREL during 1991 and annually during the years 1992 through 1994. The most recent groundwater monitoring data were obtained in 1997. In 1997, groundwater beneath the site was analyzed for VOCs, semi-volatile organic compounds (SVOCs), total metals, pesticides, and herbicides. Results of the analysis indicated that the groundwater beneath STM is uncontaminated for VOCs, SVOCs, pesticides, and herbicides. Although the samples indicated that concentrations of manganese and iron exceeded drinking water standards, the measurements fell within naturally occurring variations.

Activities at DWOP are indoors and do not have the potential to negatively impact groundwater. The owner of DWOP conducted a groundwater survey that concluded that the water beneath DWOP is not contaminated (NREL, 1993).

3.7 GEOLOGY AND SOILS

3.7.1 Geology

The STM and DWOP sites are located on the gently sloping terrain of the Foothills Province of the Rocky Mountain Front Range between the Southern Rocky Mountain Province to the west and Great Plains Province to the east. The Front Range trends north-south, with lower elevations of approximately 5,000 feet (1,515 meters) and higher elevations ranging from 9,800 feet (2,969 meters) to over 13,000 feet (3,939 meters) along the Continental Divide, approximately 16 miles (25.8 kilometers) west of the site. The sites are located on the western edge of the Denver Basin, an asymmetrical, north-south trending syncline with a steeply dipping western limb and a shallowly dipping eastern limb. The Golden Fault separates the Front Range to the west from the Denver Basin to the east. The Denver Basin proper contains more than 9,840 feet (2,982 meters) of Pennsylvanian to Cretaceous sedimentary deposits.

The sites are located in the Great Plains Tectonic Province in an area of low seismicity. The trace of the Golden Fault lies approximately 2.1 miles (12.81 kilometers) west of the STM site. It is a west dipping, reverse fault that strikes north-northwest and is apparently several hundred years old. Although the Colorado Geological Survey (CGS) considers the fault "active," the most recent movement on the fault is estimated to have occurred approximately 200,000 years ago, producing approximately 48 feet (14.5 meters) of displacement. During the period 1870 through 1979, earthquakes of magnitude up to 5.9 have been recorded in the Golden vicinity. Historically, however, the region has not been very seismically active (Bukovanshy Associates Ltd., 1996).

To the west of the Golden Fault and directly west of the STM site lay Precambrian (older than 600 million years) gneisses, schists, and quartzites of the Idaho Springs Formation and the Paleozoic (225 to 600 million years old) sandstones and mudstones of the Fountain Formation. To the east of the Golden Fault lay the Cretaceous (70 to 135 million years old) sandstones and shales of the Pierre, Fox Hills, Laramie, Arapahoe, and Denver Formations. These sediments have been upturned, and in some cases overturned, by the thrust motion of the fault (Van Horn, 1976). The STM and DWOP sites are underlain by the Denver Formation, a loosely cemented, tuffaceous sandstone, silty claystone interbedded with some conglomerate. Based on drilling done for hydrogeologic characterization, bedrock can range from zero to 35 feet (11 meters) below the surface (NREL, 1993).

Figure 3-6 illustrates the geologic cross section beneath the STM site.

The STM site area is situated on the top and south-facing slopes of South Table Mountain, a prominent local landmark consisting of flat lying, poorly cemented sedimentary rocks capped with Tertiary (two to 70 million years old) basalt lava flows. Three distinct lava flows exist. The thickness of these flows varies and is approximately 150 feet (45 meters) in some locations. The mesa top of South Table Mountain slopes gently to the south. The elevation of the site ranges from approximately 5,780 feet (1,752 meters) above sea level at the base of South Table Mountain to 6,030 feet (1828 meters) at the top of the mesa. Unconsolidated alluvial sediments associated with the Lena Creek drainage, which flows easterly approximately 1,450 feet (439 meters) south of the STM site, underlie the STM site. The DWOP buildings are located to the southeast and east of the STM site, up to one mile (1.2 kilometers) away.

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Figure 3-6. Geologic Cross Section (West-East) Beneath the STM Site.

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The sites are located in a Jefferson County "Designated Dipping Bedrock Area," where steeply dipping beds of expansive claystone bedrock are found near the ground surface. When exposed to water, layers of bedrock display different potentials for expansion, resulting in damage to roads and lightly loaded structures. Natural alluvial deposits may reduce the heaving potential of the bedrock at the site. Landslides and other mass earth movements can occur as shallow features where slopes are steep. A geologic hazards evaluation associated with construction of a natural gas pipeline in the vicinity of the STM site indicated that slopes on the south side of South Table Mountain may be unstable. There is, however, no evidence of landslides (Bukovanshy Associates Ltd., 1996).

3.7.2 Soils

Denver clay loam and the Denver cobbly clay loam dominate the soils at the DWOP and the portion of the STM site where most of the development is located (slopes of less than 9 percent). The properties of these soils differ by the greater amount of rock fragments occurring in the latter soil. Rock fragments comprise 0 to 35 percent of the total volume. The soils are deep, well-drained soils that occur on high terraces, hill slopes, and fans. They are formed in calcareous, cobbly, clayey material derived predominantly from mudstone and shale. Permeability is slow, and the available water capacity is high. Runoff rates are characterized as medium. The effective rooting depth is approximately 60 inches. Water erosion and soil blowing are moderate hazards. The shrink-swell potential is high. These soils are used mainly for grazing and recreation areas. They can also be used for crops and community development. The soil is limited for community development by the shrink-swell potential, low strength, and slow permeability, but this condition can be addressed with various construction techniques (Soil Conservation Service, 1980).

The Leyden-Standley-Primen cobbly clay loams and Leyden-Primen-Standley extremely stony clay loams dominate the soils that occur on the slopes of South Table Mountain. Immediately east of the Leyden-Standley-Primen cobbly clay loams is a smaller area of Standley-Leyden-Primen very stoney clay loams. The properties of these soils differ by the amount of rock fragments present and the relative amounts of individual components. Rock fragments comprise up to 35 percent of the total volume. The Leyden-Standley-Primen cobbly clay loams are located on the westernmost slopes within the STM site, occurring on slopes that range from 9 to 15 percent. The Leyden-Primen-Standley extremely stony clay loams are located on the easternmost slopes within the STM site, occurring on slopes that range from 30 to 70 percent. The Standley-Leyden-Primen very stoney clay loams occur on slopes that range from 15 to 30 percent. The Leyden and Standley components of these soils are deep to moderately deep and are well drained. They are formed in calcareous, cobbly, gravelly, and clayey material derived from mixed sources. Permeability is slow, and water capacity is low. The effective rooting depth is 20 to 60 inches. Runoff is rapid, and water erosion is a severe hazard. Soil blowing is a slight hazard. The shrink-swell potential is moderate to high. The Primen component is shallow and well drained. It formed in cobbly, stony, gravelly, and clayey material derived from mixed sources. Permeability is slow, and water capacity is low. The effective rooting depth is 10 to 20 inches. The soils are primarily used for grazing. The primary limitations to the use of the soil for building construction are the slope, depth to bedrock, soil slippage, the shrink-swell potential, large stones, and low strength (Soil Conservation Service, 1980).

The Lavina loam covers the top of South Table Mountain. It is a shallow, well-drained soil formed in calcareous, clayey alluvium and loess deposited over hard volcanic rock. Small areas of volcanic rock make up five to ten percent of the surface. Rock fragments comprise up to 15

percent of the volume. Permeability of this soil is low, and water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is slow, and water erosion is a slight hazard. Soil blowing is a slight hazard. The shrink-swell potential is moderate to high. This soil is used mainly for grazing and for recreation areas and areas for wildlife. The main limitations to using the Lavina loam for building construction are its shallowness to rock and the shrink-swell potential (Soil Conservation Service, 1980).

Figure 3.7 illustrates the locations of the soils found on the STM and DWOP sites.

3.8 BIOLOGICAL RESOURCES

The following section provides a description of the biological resources found at the STM project site. The DWOP site involves leased interior space; therefore no land area or biological resources would be affected by the proposed action.

The following discussion is presented in four sections: vegetation, which includes noxious weeds; wetlands; wildlife; and species of concern. This evaluation primarily relies upon previous reporting and fieldwork performed by various consultants at the STM site over the past 16 years, as well as fieldwork conducted in May 2002. Additional detail is available in the following reports:

- *South Table Mountain Vegetation Survey* (NREL (Plantae), 2002);
- *National Renewable Energy Laboratory (NREL) Site Conservation Easement Baseline Inventory* (NREL (Dames & Moore), 1999); and
- *South Table Mountain Conservation Easement Baseline Inventory* (NREL (ERO), 1998)

Located at the base of the foothills to the Rocky Mountains, the STM site occurs at elevations ranging from 5,780 (1,752 meters) to 6,030 (1827 meters) feet above mean sea level. This coincides with the interface between two ecological provinces: the Great Plains-Palouse Dry Steppe Province to the east, and the Southern Rocky Mountain Steppe – Open Woodland – Coniferous Forest – Alpine Meadow Province to the west (Bailey, 1995).

3.8.1 Vegetation

Within the STM site project area three primary plant communities occur: grasslands, shrublands, and wetlands. Table 3-4 lists the vegetation types and their areal extent. Figure 3.8 depicts the locations of these different vegetation types. Noxious weeds occur in all vegetation types and are discussed in subsection of 3.8.1. Wetlands are a special type of habitat and are discussed in the wetlands subsection. Botanical names follow Weber and Whitman (1996).

Grasslands
Grasslands make up the majority of the land area (285.61 acres) (see Table 3-6) at STM and comprise 79 percent of the total land area. These grasslands can be further divided into two subclassifications: shortgrass prairie and mixed-grass prairie (NREL (Plantae), 2002). Although each of these grassland types is composed of the same 125 species, differences in their spatial distribution and the relative dominance of the plant species is significant enough to warrant their separation (NREL (Plantae), 2002). The shortgrass community occurs on the mesa top of South Table Mountain and is dominated primarily by blue grama (*Chondrosum gracile*) and

Figure 3-7. Soils Types at the STM and DWOP Sites (Soil Conservation Service 1980)

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INSERT FIGURE 3-8 (Vegetation Map) HERE

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cheatgrass (*Anisantha tectorum*) (NREL (Plantae), 2002). The mixed-grass community occurs on the side-slopes and at the toe of South Table Mountain and is dominated by needle-and-thread grass (*Hesperostipa comata*) and western wheatgrass (P*ascopyrum smithii*). Though not dominant, other prominent species found in both types of grasslands include yucca (*Yucca glauca*), rubber rabbitbrush (*Chrysothamnus nauseosus spp. graveolens*), and prickly pear (*Optunia spp.*). Disturbed areas occur adjacent to buildings, roads, and parking lots. These areas have been revegetated and support a combination of grasses such as smooth brome (*Bromopsis inerme*) and crested wheatgrass (*Agropyron cristatum*), which are commonly found in revegetation seed mixes, as well as native grasses, and native and introduced weedy species (NREL (Plantae), 2002). Weeds are discussed in more detail in the *Noxious Weed* sub-section.

Table 3-4. Vegetation Types Occurring at the STM Site, Golden, Colorado

Vegetation Type	Area (acres)
Grassland	
Shortgrass prairie	**124**
Mixed-grass prairie	**103**
Disturbed/Reclaimed	**32**
Shrubland	
Tall shrublands	**19**
Short shrublands	**16**
Ravine shrublands	**5**
Wetlands	**<1**
Developed	**28**
Total	**327**

Shrublands

Shrublands occur at several locations within the STM site project area and comprise 13 percent (47.29 acres) of the total land area (see Table 3-6). Based on their location and dominant species composition, these shrublands have been divided into three sub-classifications: tall shrublands, short shrublands, and ravine shrublands (NREL (Plantae), 2002). Fifty-two plant species were documented as occurring within the tall and short shrubland community types. Tall shrublands occur along the rim of the mesa, usually where volcanic cap rock is exposed and are dominated primarily by mountain mahogany (*Cercocarpus montanus*) (NREL (Plantae), 2002). Short shrublands occur either on slightly elevated flat areas within grasslands and dominated by rubber rabbitbrush, or as skunkbush (*Rhus aromatica ssp. trilobata*) dominated areas along the upper slopes below the mesa rim (NREL (Plantae), 2002).

Due to their locations within swales and drainages on the upper to mid-slopes of South Table Mountain, ravine shrublands are more mesic (requiring a moderate amount of moisture) than the surrounding landscape, and contain a higher diversity of plant species than the other shrubland types. Ravine shrublands have also been called riparian (located on the bank of a natural watercourse) areas in other documents written about the STM site project. A total of 122 plant species were documented within ravine shrublands (NREL (Plantae), 2002). Shrubs that dominate these areas include chokecherry (*Padus virginiana*), wild plum (*Prunus americana*), skunkbush *(*Rhus aromatica *var.* trilobata*),* and Wood's rose *(Rosa woodsii) (*NREL (Plantae), 2002). One or two large cottonwood trees *(Populus deltoides)* and/or peach-leaved

willow trees (*Salix amygdaloides*) are commonly found in the upper portions of these drainages. Wetlands occur as small isolated pockets in the ravines and are described in Section 3.8.2 Wetlands.

Noxious Weeds

Noxious weeds occur within each of the plant communities described in Section 3.8.1. Invasive species, including noxious weeds, are regulated on federal lands by the February 3, 1999 EO 13112 "Invasive Species" and the Plant Protection Act of 2000, which mandate their control, and if possible, their eradication. Invasive species are defined as "alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." Noxious weeds are invasive species that have been designated by rule (i.e. state, county, municipality, etc.) as being noxious, and meet one or more of the following criteria: 1) aggressively invades or is detrimental to economic crops or native plant communities, 2) is poisonous to livestock, 3) is a carrier of detrimental insects, diseases, or parasites, and/or 4) the direct or indirect effect of the presence of this plant is detrimental to natural ecosystems or agricultural areas (CNAP, et al., 2000). In Colorado the Colorado Weed Management Act, Title 35, Article 5.5, enables counties and municipalities to mandate noxious weed management by public and private landowners. There are 68 noxious weed species that have been identified as being the most problematic in Colorado, 10 of which have been prioritized for immediate action due to their widespread economic impact to the State.

At the STM site, 20 plant species found on the State of Colorado Noxious Weed List were identified (NREL (Dames & Moore), 1999; NREL (Plantae), 2002). These species are listed in Table 3-5. Of these 20 species, five are found on the State's top ten-priority list, and six are found on Jefferson County's list of noxious weeds of concern.

Table 3-5. Noxious Weed Species Occurring at the National Renewable Energy Laboratory – South Table Mountain Site, Golden, Colorado

Common Name	Botanical Name
Canada thistle*[1]	*Breea arvense (Cirsium arvense)*
Chicory	*Cichorium intybus*
Common burdock	*Arctium minus*
Common mullein	*Verbascum thapsus*
Common teasel[1]	*Dipsacus fullonum*
Dalmatian toadflax[1]	*Linaria dalmatica*
Diffuse knapweed*[1]	*Acosta diffusa (Centaurea diffusa)*
Cheatgrass (Downy brome)	*Anisantha tectorum (Bromus tectorum)*
Field bindweed*	*Convolvulus arvensis*
Flixweed	*Descurainia sophia*
Houndstongue[1]	*Cynoglossum officinale*
Jointed goatgrass*	*Aegilops cylindrica*
Kochia	*Bassia sieversiana (Kochia scoparia)*
Musk thistle*[1]	*Carduus nutans*
Myrtle spurge	*Euphorbia myrsinites*
Oxeye daisy	*Chrysanthemum leucanthemum*
Poison hemlock	*Conium maculatum*
Puncturevine	*Tribulus terrestris*

Table 3-5. Noxious Weed Species Occurring at the National Renewable Energy Laboratory – South Table Mountain Site, Golden, Colorado

Common Name	Botanical Name
Redstem filaree	*Erodium cicutarium*
Russian thistle	*Salsola iberica*

*Found on the top ten priority list for noxious weed control in the State of Colorado.
[1]Found on the noxious weed list for Jefferson County.
Source: NREL (Dames & Moore), 1999, and NREL (Plantae), 2002.

The most commonly encountered noxious weeds within the NREL STM project area are cheatgrass, diffuse knapweed (*Acosta diffusa*) (19.2 acres), Canada thistle (*Breea arvense*) (15.2 acres), Dalmatian toadflax (*Linaria dalmatica*) (17.1 acres), and houndstongue (*Cynoglossum officinale*) (NREL (Plantae) 2002). Cheatgrass is a common component of grasslands and is dispersed throughout the site, especially on the mesa top. Diffuse knapweed is commonly found along roads and trails, and other areas of disturbance throughout the project area. Canada thistle is common in mesic areas such as drainages and also occurs on dry upland sites, and is especially prevalent in the drainage between the SERF and FTLB. Houndstongue is very common in almost all ravine bottoms.

3.8.2 Wetlands and Other Waters of the U.S.

Wetlands are transitional zones between terrestrial and aquatic habitats. As described in the 1987 *Corps of Engineers Wetlands Delineation Manual,* wetlands are defined to be those 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. Wetlands generally include swamps, marshes, bogs, and similar areas (Environmental Laboratory, 1987). Jurisdictional wetlands are those that fulfill the three wetland criteria stated above and that come under the jurisdiction of the USACE in accordance with their authority under Section 404 of the Clean Water Act. The USACE's authority was recently limited by the January 9, 2001 U.S. Supreme Court decision on the *Solid Waste Agency of Northern Cook County (SWANNC) vs. the U.S. Army Corps of Engineers* (531 U.S. 159 (2001)) which limited federal authority to regulate certain isolated wetlands. The SWANNC decision eliminates Section 404 jurisdiction of isolated wetlands where the sole nexus of jurisdiction is the use or potential use of such wetlands as habitat by migratory birds that cross state lines. Currently, isolated waters that do not exhibit a surface hydrologic connection to the tributary system in a watershed are not considered to be jurisdictional. In addition, small wetlands that form in ditches due to runoff (e.g., STM-6) are typically not considered jurisdictional wetlands. Wetland STM-11 is likely the only jurisdictional wetland that occurs within the project area. Official jurisdictional determinations are made by the USACE.

Through their administration of Section 404 of the Clean Water Act, the USACE have jurisdiction over all waters of the U.S., of which wetlands are one type, and rivers and streams are another. In compliance with Section 404 and EO 11900, "Protection of Wetlands," wetland surveys were performed by SAIC's wetland ecologist during the growing season of 2002. The routine wetland delineation methodology, as described in the 1987, USACE's *Wetlands Delineation Manual* (Environmental Laboratory 1987) was used. Wetlands are delineated using the simultaneous occurrence of three criteria: occurrence of at least 50 percent hydrophytic vegetation, wetland hydrology, and hydric soils.

A site is generally considered to exhibit wetland hydrology if soil saturation occurs continuously for a minimum of five percent of the growing season within the upper 12 inches of the soil profile (Environmental Laboratory, 1987). The growing season at the STM site is estimated to begin on April 30th and end on October 9th (162 days). Therefore the minimum number of consecutive days required for wetland hydrology is eight days (USDA-NRCS, 1999). Primary (e.g., drainage patterns, soil saturation in upper 12 inches of soil profile) and secondary (e.g., oxidized root channels, passage of the Fac-Neutral test) hydrologic indicators were used to determine wetland hydrology.

In the spring of 2002, soil pits were excavated on-site to a depth ranging from 12 to 16 inches, and soil horizons were described by thickness, texture, and color. Hydric soils were determined to be present where redoximorphic features were present. The Soil Conservation Service (SCS) did not identify any hydric soils at the STM site project (USDA-SCS, 1980).
A total of six wetlands, totaling 2,800 sf (0.064 ac) were identified on the STM site (see Table 3-6). They occur in Zones 2, 4 and 5. Wetlands identified within the project area are depicted in Figure 3-9. Within the STM site project area wetlands occur as small pockets within natural and man-made drainages. These wetlands are classified as palustrine emergent or palustrine forested wetland types under the Cowardin et al. (1979) wetland classification system.

Table 3-6. Wetlands Found at the National Renewable Energy Laboratory, South Table Mountain Site, Golden, Colorado

Wetland Type	Wetland Designation	Approximate Area[1] Square Feet (Acres)	
Palustrine Scrub-shrub	STM-1	1,170	(0.03)
Palustrine Emergent	STM-2	345	(0.01)
Palustrine Emergent	STM-6	150	(<0.01)
Palustrine Emergent	STM-7	760	(0.02)
Palustrine Emergent	STM-10	95	(<0.01)
Palustrine Emergent	STM-11	280	(0.01)
Total Area		**2,800**	**(<0.10)**

[1]Wetlands were not land surveyed.

Palustrine Emergent Wetlands
As indicated in Table 3-6, five (1,630 sf (0.04 acres)) of the six wetlands on the STM site are palustrine emergent wetlands. Hydrophytic vegetation dominating these areas include cattails (*Typha latifolia*), Nebraska sedge (*Carex nebrascensis*), slender sedge (*Carex praegracilis*), and Canada thistle (*Breea arvense*). Wetlands STM-6 and STM-11 occur in man-made ditches.

Palustrine Scrub-shrub Wetland
One wetland (STM-1) was identified as being the palustrine forested wetland type. This wetland was the largest wetland (1,170 sf (0.03 acres) identified on the site and is dominated by peach-leaved willow (*Salix amygdaloides*), wiregrass (*Juncus arcticus*), Kentucky bluegrass (*Poa pratensis*), and mat muhly (*Muhlenbergia richardsonis).*

INSERT FIGURE 3-9 POTENTIAL WETLANDS MAP HERE

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Waters of the U.S. Other than Wetlands

Waters of the U.S. other than wetlands are defined as perennial or intermittent streams that exhibit a defined streambed and banks, and are classified as jurisdictional waters regulated by the USACE. Seven main drainages and several swales occur on the NREL STM site (see Figure 3-9). In most cases, these areas exhibit defined beds and banks only in the areas just below the mesa top, which contain steep gradient slopes. In areas with mid and low gradients, these same drainages and swales do not possess defined beds and banks, are well vegetated, and therefore are not considered jurisdictional waters of the U.S. In 1997 the USACE determined that one of the drainages (Drainage 4) was not considered a water of the U.S. (Corps File #199780047).

3.8.3 Wildlife

Wildlife habitat at the STM site is comprised of grasslands, shrublands, and wetlands. As described in the ERO Resources report, the Colorado Division of Wildlife has estimated that these habitats may support up to 14 species of reptiles, 36 mammal species, 82 bird species, and four amphibian species. However, due to the lack of aquatic sites, the presence of amphibians is unlikely. Table 3-7 lists wildlife species commonly found at the STM site. A resident population of mule deer inhabits the STM site in the vicinity of the abandoned amphitheater. One or two mature cottonwood trees are located in the upper sections of drainages 1, 3, 4, 5, and 7 and provide perching sites for raptors such as red-tailed hawks and owls.

Table 3-7. Common Wildlife Found at the National Renewable Energy Laboratory, South Table Mountain Site, Golden, Colorado

Mammals	
Coyote	*Canis latrans*
Deer mice	*Peromyscus maniculatus*
Desert cottontail	*Sylvilagus auduboni*
Gray fox	*Urocyon cinereoargenteus*
Mexican woodrat	*Neotoma mexicana*
Mountain cottontail	*Sylvilagus nuttalli*
Mule deer	*Odocoileus hemionus*
Prairie vole	*Microtus ochrogaster*
Red fox	*Vulpes vulpes*
Birds	
American goldfinch	*Carduelis tristis*
American robin	*Turdus migratorius*
Black-billed magpie	*Pica pica*
Chipping sparrow	*Spizella passerina*
Dark-eyed junco	*Junco hyemalis*
European starling *	*Sturnus vulgaris*
Great Horned Owl	*Bubo virginianus*
Green-tailed towhee	*Pipilo chlourus*
Horned lark	*Eremophila alpestris*
MacGillivray's warbler	*Opoornis tolmiei*
Mourning dove	*Zenaida macroura*
Raven	*Corvus corax*

Red-tailed hawk	*Buteo jamaicensis*
Vesper sparrow	*Pooecetes gramineus*
Western bluebird	*Sialia mexicana*
Western meadowlark	*Sturnella neglecta*
Reptiles	
Bullsnake	*Pituophis catenifer*
Eastern fence lizard	*Sceloporous undulatus*
Plains garter snake	*Thamnophis radix*
Prairie rattlesnake	*Crotalus viridis*

Source: NREL (Dames & Moore), 1999, and NREL (ERO), 1998.
* This bird is not considered a migratory bird under the Migratory Bird Treaty Act (MBTA). The MBTA and related issues are discussed in detail in Section 3.8.5 and Table 3-9.

3.8.4 Species of Concern

The USFWS has identified eight species listed in accordance with the Endangered Species Act as threatened, endangered, or a candidate for listing, that could potentially occur within the STM site project area (Table 3-8). Of the State of Colorado's species of concern, eight species may potentially occur at the STM site (see Table 3-8). Because no open water exists within the project area, fish do not occur at the STM site.

Table 3-8. Threatened and Endangered Species, Candidates for Federal Listing, and State of Colorado Threatened, Endangered or Species of Concern Potentially Occurring at the STM Site.

Species	Status	Likely to Occur in Project Area
Birds		
American Peregrine Falcon (*Falco peregrinus*)	SSOC	Possible
Bald Eagle (*Haliaeetus leucocephalus*)	FT ST	Possible
Eskimo Curlew (*Numenius borealis*)	FE	Not likely
Ferruginous Hawk (*Buteo regalis*)	SSOC	Possible/Not likely
Mexican Spotted Owl (*Strix occidentalis lucida*)	FT ST	Not Likely
Mammals		
Black-Tailed Prairie Dog (*Cynomys ludovicianus*)	FC SSOC	Possible/Not likely
Canada Lynx (*Lynx canadensis*)	FT SE	Not Likely
Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*)	FT ST	Not likely
Amphibians		
Northern Leopard Frog (*Rana pipiens*)	SSOC	Not Likely
Insects		
Pawnee Montane Skipper (*Hesperla leonardus montana*)	FT	Not Likely
Flora		
Ute Ladies' Tresses Orchid (*Spiranthes diluvialis*)	FT	Not Likely
Colorado Butterfly Plant *(Gaura neomexicana ssp. coloradensis*)	FT	Not Likely

Abbreviations:
FT- Federal Threatened
FE – Federal Endangered
FC – Federal Candidate for Listing
ST – State Threatened
SE – State Endangered
SSOC – State Species of Concern
Source: NREL (Dames & Moore), 1999; and NREL (ERO) , 1998.

American Peregrine Falcon. Peregrine falcons nest on foothill and mountain cliffs from 4,500 feet (1,364 meters) to over 9,000 feet (2,727 meters), often above pinyon/juniper or ponderosa pine forests (Kingery, 1998). Peregrine falcons are documented in Jefferson County and may occur in the project area.

Bald Eagle. In the Denver area, bald eagle nests are located in large cottonwoods at the edge of reservoirs (Kingery, 1998). Bald eagles occur in a variety of habitats in Colorado including urban, riparian and agricultural areas. Significant numbers (472 in spring 1990) migrate annually along the edge of the Front Range foothills within two miles of the project area (Andrews and Righter, 1992). Bald eagles over-winter, migrate and summer in Colorado east of the Rocky Mountain Front Range, including eastern Jefferson County and the project area where aquatic habitats and terrestrial prey are available. Bald eagles are known to use habitat within Bear Creek Lake Park. Although no open water exists, their presence is possible within the STM site.

Eskimo Curlew. The Eskimo curlew was likely a spring migrant in Colorado, but is presumed extirpated from the State (Andrews and Righter, 1992).

Ferruginous Hawk. The ferruginous hawk nests in large expanses of lightly-grazed, shortgrass prairie, nesting in trees or on the ground (Ensign, 1983). Approximately 90 percent of their diet consists of medium-sized mammals (jackrabbits and cottontails west of the Continental Divide, and prairie dogs and ground squirrels east of the divide) (Kingery, 1998). Colorado's ferruginous hawks prey heavily on black-tailed prairie dogs, particularly in the winter (Kingery, 1998). Because of the ferruginous hawk's preference for black-tailed prairie dogs, their occurrence within the project area is possible, but unlikely, as there are no prairie dogs on the site.

Mexican Spotted Owl. Spotted owls in Colorado nest in older coniferous forests with complex vertical structure, sparsely forested canyons, and slickrock canyons in the southwest (Kingery, 1998). The Mexican spotted owl currently nests in two known locations in Colorado, Mesa Verde National Park, and the south-central mountains near the southern massif of Pikes Peak and the Wet Mountains (Kingery, 1998). Ideal breeding habitat does not exist within the project area, and no known active nest sites occur within Jefferson County.

Black-Tailed Prairie Dog. The black-tailed prairie dog exists in colonies in shortgrass or mixed prairie. They feed primarily on annual forbs, native grasses, and roots of forbs and grasses during late fall and winter. Site visits conducted by SAIC in 2002 did not observe any black-tailed prairie dogs or burrows at the STM site.

Canada Lynx. The distribution of lynx is tied to boreal forest, generally above 7,800 feet in Colorado and Utah (Koehler and Brittell, 1990). Lynx populations in the southern Rocky Mountains occur at the periphery of the species' range in North America, and lynx in Colorado

exist at low densities in fragmented distributions (Koehler and Aubry, 1994). Lynx in Colorado are rare even within suitable habitat. There is no suitable lynx habitat within the project area and therefore lynx presence is highly unlikely.

Preble's Meadow Jumping Mouse. The Preble's meadow jumping mouse (PMJM), a subspecies of the meadow jumping mouse (*Zapus hudsonius*) is known to occur only in portions of Colorado and Wyoming in moist lowlands with dense vegetation (USFWS, 1999; Fitzgerald, 1994). PMJM's habitat includes riparian corridors with diverse vegetation including shrubs such as willows (*Salix spp*.). Presence of the PMJM has not been confirmed within the STM site project area, and 1999 surveys at nearby Lena Gulch within Camp George West did not result in the successful capture of any PMJM. Lena Gulch represents the best potential habitat in the vicinity of the STM site. One factor that makes the presence of PMJM within the STM site unlikely is the absence of permanent sources of water.

Northern Leopard Frog. Water associated with ponds, streams, marshes, lakes, reservoirs, and beaver ponds and that have rooted vegetation is potential habitat for the northern leopard frog. No occurrences have been documented within the project area. Presence of the northern leopard frog is not likely due to the lack of water on the site.

Pawnee Montane Skipper Butterfly. The Pawnee montane skipper (skipper) butterfly occurs in Jefferson County, but only within the South Platte Canyon, centered on the town of Deckers, and not below 6,000 feet (1,818 meters) (USFWS, 1998). The skipper occurs in Ponderosa pine (*Pinus ponderosa*) woodlands with understories of blue grama and prairie gayfeather (*Liatris punctata*) (USFWS, 1998). The lack of suitable habitat and the limitations of its range make the occurrence of the skipper highly unlikely.

Ute Ladies' Tresses Orchid. Wetlands and areas adjacent to wetlands (within the geographic range of the project area) are potential habitat for the federally threatened Ute ladies' tresses orchid. Surveys to detect presence of the Ute ladies' tresses orchid in the STM site project area were negative, and no suitable habitat was found (NREL (Plantae), 2002).

Colorado Butterfly Plant. The Colorado butterfly plant is a species of concern within the project area (USFWS, 2002). Its known distribution is within Boulder, Douglas, Larimer, and Weld Counties (Spackman et al., 1997). This plant typically inhabits sub-irrigated alluvial soils of drainage bottoms surrounded by mixed-grass prairie between elevations of 5,800 feet (1,758 meters) and 6,200 feet (1,879 meters) (Spackman et al., 1997). Surveys for Colorado butterfly plant within the project area have not been conducted, however, the lack of suitable habitat within the project area makes their presence unlikely.

3.8.5 Migratory Birds

Jefferson County, Colorado encompasses a diverse array of habitats in which 246 bird species have been identified (NDIS, 2000). In and around Golden, Colorado, at least 235 species of birds have been identified and about 90 of those species have been observed on or near North Table Mountain (Foster, 2001). Thirty-five bird species have been identified as present or likely to occur on the STM project area (see Table 3-9). Of these 35 species, 33 are protected under the MBTA, which protects bird species native to North America (USDI, 2001). The migratory status of these birds in Colorado includes 20 residents, 5altitudinal migrants, 7 short distance migrants and 3 neotropical migrants. Additional species, especially during migration, may be present in the STM area.

Spring migration generally occurs between March and May and fall migration generally occurs between August and October. Migratory bird use on or adjacent to the STM area may include breeding, nesting, foraging, perching and roosting activities. Species most likely to nest in the grasslands include killdeer, common nighthawk, horned lark, and western meadowlark. Species that typically nest in shrubland include green-tailed towhee, Brewer's blackbird and mourning dove. Other species may nest in trees on or near the STM area including red-tailed hawk, American robin, blue jay, black-capped chickadee and black-billed magpie.

The STM area provides foraging habitat for all of these species and may be used for perching or roosting by these and other bird species during migration. Raptors may perch on trees while hunting for small mammals and birds located in the grassland and shrubland areas. Other smaller birds, such as the western meadowlark, consume insects that occur in the grassland area.

Breeding generally occurs between May and July. Courtship may begin as early as March for species such as the horned lark. Young birds generally fledge from the nest in August but some species may fledge as late as September (Kingery, 1998).

Table 3-9. Migratory Bird Species Observed and/or Likely to be Present within National Renewable Energy Laboratory South Table Mountain Site, Golden, Colorado[1]

Common Name	Scientific Name	Migratory Status in Colorado[2]	Nest Site			
			Grass/ ground	Shrub	Tree	Other[3]
American crow	*Corvus brachyrhynchos*	Resident		X	X	
American goldfinch	*Carduelis tristis*	Resident		X	X	
American kestrel	*Falco sparverius*	Resident			X	
American robin	*Turdus migratorius*	Altitudinal migrant			X	
Black-billed magpie	*Pica pica*	Resident			X	
Black-capped chickadee	*Parus atricapillus*	Resident			X	
Blue jay	*Cyanocitta cristata*	Resident			X	
Brewer's blackbird	*Euphagus cyanocephalus*	Altitudinal migrant		X		
Brown-headed cowbird	*Molothrus ater*	Short distance migrant			X	
Chipping sparrow	*Spizella passerina*	Short distance migrant		X	X	
Common nighthawk	*Chordeiles minor*	Neotropical migrant	X			
Common raven	*Corvus corax*	Resident				X
Cooper's hawk	*Accipiter cooperii*	Resident			X	
Dark-eyed junco	*Junco hyemalis*	Resident	X			
European starling[4]	*Sturnus vulgaris*	Resident			X	X
Great-horned owl	*Bubo virginianus*	Resident			X	
Green-tailed towhee	*Pipilo chlorurus*	Short distance migrant		X		
Horned lark	*Eremophila alpestris*	Resident	X			
Killdeer	*Charadruis vociferous*	Altitudinal migrant	X			

Common Name	Scientific Name	Migratory Status in Colorado[2]	Nest Site			
			Grass/ ground	Shrub	Tree	Other[3]
Lark bunting	*Calamospiza melanocorys*	Short distance migrant	X			
Lark sparrow	*Chondestes grammacus*	Short distance migrant	X	X		
MacGillivray's warbler	*Oporornis tolmiei*	Neotropical migrant	X	X		
Mountain bluebird	*Sialia currucoides*	Altitudinal migrant			X	
Mourning dove	*Zenaida macroura*	Altitudinal migrant		X		
Northern flicker	*Colaptes auratus*	Resident			X	
Northern harrier	*Circus cyaneus*	Resident	X			
Prairie falcon	*Falco mexicanus*	Resident				X
Red-tailed hawk	*Buteo jamaicensis*	Resident			X	
Red-winged blackbird	*Euphagus cyanocephalus*	Resident	X	X		
Rock dove[4]	*Columba livia*	Resident				X
Say's phoebe	*Sayornis saya*	Short distance migrant				X
Vesper sparrow	*Pooecetes gramineus*	Short distance migrant	X	X		
Western bluebird	*Sialia mexicana*	Resident foothills			X	
Western kingbird	*Tyrannus verticalis*	Neotropical migrant			X	
Western meadowlark	*Sturnella neglecta*	Resident	X			

1 Sources: DOE and NREL (Dames & Moore) 1999, NREL (ERO) 1998; NDIS, 2000; Kingery 1998; Forum, 1987
2 Sources: Andrews and Righter 1992, DeGraaf and Rappole 1995
3 Other category includes cliffs, manmade structures, etc.
4 Not protected under the Migratory Bird Treaty Act

3.9 CULTURAL RESOURCES

Cultural resources are defined as any prehistoric or historic district, site, or building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or any other reason. Cultural resources can be divided into three major categories:

1. Prehistoric and historic archaeological resources.
2. Architectural resources.
3. Traditional cultural resources.

Prehistoric and historic archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., arrowheads, bottles). Prehistoric resources that predate the advent of written records in a region range from a scatter composed of a few artifacts to village sites and rock art. Historic resources may include campsites, roads, fences, trails, dumps, battlegrounds, mines, and a variety of other features.

Architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for protection under existing cultural resource laws. However, more recent structures, such as Cold War facilities, may warrant protection if they manifest the potential to gain significance in the future.

A traditional cultural resource can be defined as a property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that are rooted in the community's history and are important in maintaining the continuing cultural identify of the community. Traditional resources can include archaeological resources, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of their traditional culture.

Cultural resources are protected under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Only significant cultural resources warrant consideration with regard to adverse impacts resulting from a proposed action. Significant cultural resources are either eligible for, or listed on, the National Register. To be eligible for the National Register, a resource must meet one or more of the criteria (as defined in 36 CFR 60.4) for inclusion on the National Register. National Register-eligible resources are those that have one or more of the following characteristics:

a) Are associated with events or have made a significant contribution to the broad patterns of our history;
b) Are associated with lives of persons significant in our past;
c) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; and/or
d) Have yielded, or may be likely to yield, information important in prehistory or history.

In accordance with federal laws and regulations, efforts to identify significant cultural resources on NREL property included a records search at the Colorado Historical Society Office of Archaeology and Historic Preservation (OAHP) in Denver and review of previous survey reports. Consultation with the State Historical Preservation Officer (SHPO) is presented in Appendix C. The records search confirmed that all NREL land, including the newly acquired 25 acres south of the Denver West Parkway, has been surveyed for Cultural Resources. DWOP Buildings 15, 16, 17, and 27, located off site, were not surveyed as they include only office space within existing office buildings.

The following four cultural resources surveys have been conducted that involve lands within the STM site.

1. Historic Resources Survey Camp George West, Golden, CO (Front Range Research Associates, Inc., 1992).
2. Archaeological Survey of Camp George West and the Works Progress Administration South Table Mountain Basalt Quarries, Jefferson County, CO (Butler, 1992).
3. Historical Review Solar Energy Research Institute Golden, CO (Forum Associates, Inc., 1988).
4. Historic and Prehistoric Resources, South Table Mountain, Golden, CO (Nelson, 1980).

These surveys resulted in the nomination and subsequent listing of one historic district in 1993 (see Figure 3-10). The Camp George West Historic District is located south of the Denver West Parkway and includes the 25-acre parcel recently transferred to NREL.

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INSERT FIGURE 3-10 HISTORIC DISTRICT BOUNDARIES MAP HERE

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3.9.1 Archaeological Resources

There are no known significant archaeological resources within or adjacent to the NREL STM property.

3.9.2 Architectural Resources

There are four significant or contributing historic structures on the STM property (Table 3.9). Two of these resources, the amphitheater and associated footbridge (5JF842) and the ammunition Igloo (5JF843), are individually listed on the National Register. The remaining resources are within the Camp George West Historic District and contribute to the District's eligibility (see Figure 3.10).

Table 3-10. Architectural Resources Identified on the NREL's STM Site

Site #	Description	NRHP Status	Historic District
5JF842	Amphitheater and Footbridge	Listed	N/A
5JF843	Ammunition Igloo (1940)	Listed	N/A
5JF145.66	Firing Range Lines (1924)	Contributing	Camp George West
5JF145.68	Low Rock Walls	Contributing	Camp George West

NRHP- National Register of Historic Places
Listed: Site is listed on the National Register of Historic Places
Contributing: Feature contributes to the overall eligibility of the historic district

The historic amphitheater is an ovate stone structure built into the natural slope of the hillside with a stone projection booth located at the base of the structure. A concrete center aisle separates the theater's concrete and stone seating areas. Some of the associated rock walls and seats have collapsed, and much of the area is overgrown with native vegetation. A small stone footbridge leads to the amphitheater. The bridge is in good condition. Outside groups have expressed an interest in restoring both of these historic structures, but no formal proposal has been submitted.

3.9.3 Traditional Cultural Resources

There are no known significant traditional cultural resources within or adjacent to the STM site.

3.10 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

Hazardous materials are substances that pose a potential hazard to human health and/or the environment if improperly managed. Hazardous wastes are hazardous materials that are no longer needed or usable and are defined as hazardous by the Resource Conservation and Recovery Act (RCRA). At the STM and DWOP sites, management programs for hazardous materials and wastes attempt to reduce impacts to human health and the environment by using the least hazardous materials and most environmentally friendly products to the greatest extent possible, thereby minimizing the use of chemicals that contain hazardous materials, and consequently minimizing the amount of hazardous waste generated.

NREL's hazardous materials management practices are based on NREL Policy 6-2 Environmental Management and 6-6 Risk Assessment, and supported by other policies and programs. Policy 6-6 requires all workers to evaluate new or substantially modified activities by identifying and mitigating/eliminating environmental hazards and their potential impacts. It does so by promoting the identification and control of environmental hazards presented by NREL activities. Policy 6-2 requires evaluations for:

- Emissions to air;
- Releases to surface water, including storm drains;
- Wastewater releases;
- Improper waste management;
- Contamination/releases to land;
- Impacts on communities;
- Use of raw materials and natural resources;
- Impacts to wildlife or vegetation;
- Erosion or contamination of stormwater;
- Contamination of groundwater; and
- Life cycle impacts.

As an example of the implementation of these policies, STM and DWOP staff members notify the NREL ES&H office prior to application of pesticides on their sites so that the pesticide can be evaluated to determine if it is the least harmful choice with respect to human health and the environment.

NREL's waste management procedures are based on NREL Policy 6-2.8 Waste Management and Minimization. It includes guidelines for solid and hazardous waste classification, waste handling, and disposal procedures. Detailed descriptions of waste minimization techniques are also included.

All chemicals and wastes at the STM site are managed through a network of integrated programs centrally managed by NREL. The programs are specifically developed to minimize or eliminate adverse effects on the environment. The programs include chemical acquisition, hazardous chemical training, use monitoring, and disposal tracking. They also address topics such as worker safety and health, chemical safety, compressed gas safety, radiation safety, and asbestos management.

The STM and DWOP sites incorporate pollution prevention practices in their research and support activities to reduce or eliminate the use of hazardous materials. All programs are managed in accordance with applicable federal, state, and local laws, regulations, and DOE/NREL requirements.

Hazardous materials, including lubricating oils, are centrally tracked through NREL's chemical inventory system. The inventory system tracks hazardous materials according to type, quantity, destination, and user. This system is supplemented by a separate waste management system that documents disposition of wastes. Hazardous waste management includes characterization, storage, transportation, and disposal of waste generated at the STM and DWOP sites. Together the two systems provide complete tracking of NREL hazardous materials and hazardous wastes. In addition, NREL actively promotes solid waste recycling.

NREL has an aggressive training program that emphasizes waste minimization and pollution prevention to ensure that chemicals are effectively selected, properly used, and disposed of in compliance with applicable laws and regulations. Chemical management training is mandatory, as are periodic refresher courses. NREL training focuses on chemical use planning, proper selection of the least hazardous materials, safe operating procedures, use of the smallest quantity possible, waste separation, waste reduction, and reuse. Spill contingency plans and reporting procedures are standardized through NREL. Reporting procedures include the preparation of occurrence reports to document incidents involving chemicals.

3.10.1 Hazardous Materials

NREL maintains a comprehensive list of chemicals present at the STM and DWOP sites. Small quantities of a wide variety of chemicals are present. These chemicals are primarily within the following groups: flammable solids and liquids, combustibles, compressed gases, acids, bases, organic materials, oxidizers, cryogenic materials, metals, and common products such as adhesives, caulks, lubricants, thinners, paints, and cleaning compounds. Compressed gas cylinders containing toxic, very toxic and corrosive gases are present in the SERF (see section 3.3.3). Both locations are free of polychlorinated biphenyl (PCB)-bearing materials, whether in transformers or light ballasts.

Asbestos is present in several buildings at the STM site. NREL tracks its asbestos-containing materials (ACM) with periodic inventories. The ACM is described, quantified, and assessed according to its condition. The condition of the ACM remaining on-site is described as "good." The most recent inventory was performed in May 2002.

Small quantities of low-level radioactive materials, including radioactive carbon, hydrogen, and phosphorus, are used as tracer materials in association with some research projects and are periodically inventoried. NREL keeps an inventory of radioactive materials. Radioactive liquids and solids are generated in association with research activities. During the period 1994 through May 2002, 1,349 pounds (gross weight including packaging) of low-level radioactive waste were generated and shipped to an approved off-site facility. No radioactive materials are known to exist in soils at the STM or DWOP sites.

Refrigerants are used and tracked at the STM and DWOP sites. They are used primarily for servicing coolers, water chillers, and building cooling, but some are used for testing purposes. Seven types of refrigerants (R-11 R-12, R-22, R-113, R-134a, R-500, R-502) have been used on-site. The site has stored R-11, R-12, and R-22 on location since early 2000 for future use in existing equipment. The total quantity of refrigerants stored on-site is approximately 320 pounds.

NREL's tank management program includes safeguards that prevent accidental releases and include use of structural controls and operational and inspection procedures. Aboveground storage tanks (ASTs) at the STM site are operated in accordance with CDPHE and the State Inspector of Oils (Colorado Department of Labor and Employment) regulations. Coordination between the State and NREL is required if a tank is installed, removed, repaired or modified, or if its use is changed. The ES&H Office evaluates changes with respect to state regulations and the NREL AST Management Plan.

Five ASTs are located at the STM site and one is located at the DWOP site. These ASTs are for emergency generator and research use. One additional tank is temporarily closed. See Table 3.10 for tank capacity details.

Table 3-11. Aboveground Storage Tanks at the STM Site.

Tank ID	Size (gallons)	Contents	Use
No. 2	800	Diesel	SERF Emergency Generator
No. 3	6,000	Ethanol 50%	PDU Ethanol Storage
No. 4	564	Diesel	PDU Emergency Generator
No. 5	560	Diesel	FTLB Emergency Generator
No. 9	500	Diesel	Building 16 Emergency Generator
No. 15 (temporarily closed)	100	Diesel	AFUF Emergency Generator

In addition to the tanks listed in Table 3.10, the STM site maintains three other tanks that store non-petroleum products. A 3,000-gallon tank and 6,000-gallon tank store liquid nitrogen for use at the SERF and the FTLB, respectively. The third tank stores hydrogen at the SERF. There is also a compressed gas storage tank at the CNG refueling station located behind the OTF. The storage capacity in 40 CNG bottles is 900 cubic feet.

Spills are tracked in a spill-tracking log. Spills exceeding a reporting threshold are reported in the Occurrence Reporting and Processing System, which is part of DOE's emergency notification system. These procedures are integrated into NREL's Emergency Management Program. There have been no spills documented at the STM site for the years 1999, 2001, and 2002, as of May 2002 (NREL, 2002). Spills in quantities greater than incidental amounts are handled according to the NREL Spill Prevention Control and Countermeasures (SPCC) Plan for the STM site.

3.10.2. Hazardous and Non-Hazardous Wastes

The STM and DWOP sites generate a variety of hazardous and non-hazardous wastes from laboratory and mission support activities. All waste handling and disposal activities at both sites comply with the requirements and regulations of OSHA, RCRA, DOE/NREL, and CDPHE. All hazardous wastes are packages and disposed of through contracted off-site commercial treatment, disposal, and recycling firms.

Many of the hazardous wastes generated on the sites are recycled in accordance with CDPHE regulations, including such items as batteries, fluorescent bulbs, and computer monitors. As a BMP in order to ensure maximal protection of the environment, many of the non-hazardous waste materials (non-regulated waste) generated at the sites are treated in the same manner as the hazardous wastes. These materials, although not classified as hazardous, are also recycled or disposed of at offsite commercial treatment, storage, disposal, and recycling facilities.

The STM site and the DWOP have distinct Colorado generator numbers and different generator classifications. The STM site is a Small Quantity Generator (SQG), which means that the facility generates more than 220.5 pounds but less than 2,205 pounds of hazardous waste per month. DWOP is a Conditionally Exempt Small Quantity Generator (CESQG), which means that the facility generates less than 220.5 pounds of hazardous waste per month. Hazardous waste tracking mechanisms and procedures are in place such that internal reviews track waste generation activities at the STM site in order to maintain SQG status. The STM site does not maintain a treatment, storage, and disposal facility.

The amount of hazardous and non-regulated waste generated by the STM site in recent years is shown in Table 3-11.

Table 3-12. Waste Generation at the STM Site

Year	1998	1999	2000	2001	2002
Amount of hazardous waste (gross weight: pounds)	11,476	34,764	7,140	24,894	2,840*
Amount of non-regulated waste (gross weight: pounds)	15,380	6,765	1,410	1,930	670*

* Quantities shown for the year 2002 reflect amounts generated as of May 2002.

The amount of hazardous and non-regulated waste generated by the DWOP in recent years is shown in Table 3-12.

Table 3-13. Waste Generation at DWOP Site

Year	1998	1999	2000	2001	2002
Amount of hazardous waste (gross weight: pounds)	394	793	370	240	65*
Amount of non-regulated waste (gross weight:pounds)	240	0	10	0	0*

* Quantities shown for the year 2002 reflect amounts generated as of May 2002.

NREL's Site Operations Office manages solid waste. NREL's activities produce about 235,910 cubic feet of solid waste annually. Solid waste is deposited in a local landfill through contracts with solid waste handling companies.

There are no known contaminated materials in STM soils or groundwater (see Sections 3.6 Water Resources and 3.7 Soils and Geology for related information).

3.10.3 Recycled Materials

NREL's formal waste minimization program includes an active recycling program. NREL collects and recycles oils (lubricants and antifreeze), fluorescent light bulbs, batteries, freon from refrigeration units, and scrap metals (iron, copper, steel, stainless steel, tin, and aluminum). Other recycled materials include wooden pallets, cardboard, newspaper, office paper, books, glass and plastic containers, packaging peanuts, tyvek, transparencies, and toner cartridges. NREL encourages employees to bring in recyclable materials from home and use the collection containers in selected NREL parking lots.

Table 3-13 lists amounts of some recycled materials at the STM site in recent years. Table 3-13 does not include quantities for all recycled materials at the STM site.

Table 3-14. Recycled Materials at the STM Site

Year	1998	1999	2000	2001	2002
Batteries (gross weight: pounds)	345	1,350	380	1,015	2,250*
Fluorescent Bulbs (gross weight: pounds)	825	1,350	675	160	385*
Used Oil (gallons)	700	400	460	450	700*

* Quantities shown for the year 2002 reflect amounts generated as of May 2002.

Table 3-14 lists amounts of some recycled materials at the DWOP in recent years. The DWOP does not generate used oil. The table does not include quantities for all recycled materials at the DWOP.

Table 3-15. Recycled Materials at DWOP Site

Year	1998	1999	2000	2001	2002
Batteries (pounds)	40	200	80	0	155*
Fluorescent Bulbs (pounds)	0	40	0	0	0*

* Quantities shown for the year 2002 reflect amounts generated as of May 2002.

3.11 PUBLIC SERVICES AND UTILITIES

The following discussions address electricity and gas, telecommunications, water, sewage service, emergency response and fire protection. Storm water drainage is addressed in Sections 3.6 and 4.6, Water Resources. Energy is discussed in Sections 3.12 and 4.12. Figure 3-11 presents the locations of existing on-site utility lines. The emphasis of this discussion is on the STM site since improvements there could result in the need for new facilities, increased capacities, and/or other impacts on service providers.

3.11.1 Electricity and Gas

Electrical power for the STM site is delivered through an Xcel Energy overhead, 13.2-kilovolt (kV) electrical distribution line that enters the site via an easement from the west end of Denver West Parkway. The STM site features a 13.2-kV high voltage distribution system that features three loops to provide electricity to the buildings on site. This distribution system and the transformers associated with each of the on-site buildings are owned, maintained, and operated by NREL. It is anticipated that this electrical system is adequate to serve the STM site for the foreseeable future. In line with its mission, NREL committed to purchase "green power," in the form of wind power, from Xcel Energy in 1999.

Xcel Energy also provides natural gas to the STM site via a main pipeline located along the main site access road (see Figure 3-11). In addition, a 20-inch regional distribution line (1,000 pounds per square inch (psi)) passes through the site. This pipeline runs north-to-south through the site between the FTLB and OTF and up to the mesa top. The gas line that serves the site is adequate to meet natural gas needs at the STM site for the foreseeable future.

3.11.2 Telecommunications

Qwest provides telephone and electronic communications services at the STM site. Although the existing telecommunications service at the site is considered adequate for current needs, NREL would increase the capacity of the system to meet increased needs in the future. The existing analog communications technology is being replaced with digital communications technology, and the Data System Infrastructure Project has installed fiber optic data and communications networks throughout the STM and DWOP sites to provide increased bandwidth. It is anticipated that in the future, the capacity of these systems will need to be increased to allow access to high-performance computing capabilities at other laboratories. Two five-inch conduits are routed through Denver West Parkway to the west of the STM site for future use.

3.11.3 Water

The Consolidated Mutual Water Company (CMWC) provides domestic water to the STM site. The CMWC serves 85,000 people in Jefferson County within a 23 square-mile service area. The existing water system is considered adequate to meet current and future needs, but drought conditions in March of 2003 have substantially limited available water supplies. The recently constructed 9,000-acre-foot Walter S. Welton Reservoir (formerly named the Fortune Reservoir) located elsewhere within the CMWC District area had not been filled due to drought conditions. As a result of the recent drought, CMWC enacted several restrictions and policies on water use. Based on information provided on the CMWC web site, these restrictions and policies include:

- All new taps, including "stub ins," are restricted to water use inside the house or building until the drought is over and water restrictions have been lifted (it is anticipated that these restriction will be in place until at least June 2003). Limited outside water use is permitted for construction purposes only;
- Tap applications that have already been received and all fees paid (stock, water development fee, tap fee, and meter materials) will be honored;

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INSERT FIGURE 3.11 INSERT UTILITIES MAP HERE

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- CMWC will honor all unexpired taps that have been "stubbed in." Stub-ins that were applied for more than 2 years ago are expired and will be subject to the same guidelines as if applying for a new tap;
- Taps will be available to developers, contractors, etc. that already have a main line extension in progress (i.e., fees paid and agreements signed);
- All other new taps will be limited and reviewed on an individual basis. A building permit and verification of a first-pour of the foundation will be required for consideration. It should not be assumed that a tap will be automatically granted if this criterion is met; and
- All outside lawn irrigation is suspended until further notice. Hand watering of trees and shrubs through a single garden hose with an attached shot-off nozzle is allowed between 4:00 p.m. and 6:00 p.m. on Wednesdays and 2:00 p.m. and 4:00 p.m. on Saturdays.

More recently, drought conditions have changed. Based on consultation with Neal Santangelo, Project Engineer with Consolidated Mutual on April 30, 2003, the water supply issue for the S&TF and other future development is as follows:

- Consolidated Mutual has a tap moratorium in place that applies to new users only.
- NREL's STM Complex is an existing user not subject to the tap moratorium.
- Water supplies, taps and service are available for the STM Complex.

In wet and normal years, the CMWC system is considered adequate to meet existing and future water demands (Queen, 2002).

3.11.4 Sewer Service

The Pleasant View Water and Sanitation District provides sewer service to the lower portions of the STM site. A septic tank and leach field system serves the one toilet, one hand sink and one janitor's sink located within the existing mesa top facilities.

Wastewater from the sewer system is discharged to Denver's Metro Wastewater Reclamation District. This system is considered adequate for existing and anticipated future sewage needs. The downstream collection system operated by the Pleasant View Water and Sanitation District is in the process of being upgraded from a 15 inch to a 24-inch pipe that should be in operation by the end of December (Isom, 2002).

3.11.5 Emergency Response and Fire Protection

In the event of a crime or other issues requiring law enforcement assistance at the STM site, on-site security personnel would respond. If off-site support were required, the Jefferson County Sheriff would be contacted. In the event of a crime or other issues requiring law enforcement assistance at the DWOP site, the City of Lakewood Police Department would be contacted.

Fire fighting equipment for buildings and facilities located below the mesa slopes includes a water supply (fire hydrant, dry hydrant, or another type of water supply) for every building except the Bulk Storage Facility and the PDU Emergency Generator buildings. Facilities on the mesa top do not have a water supply for fire protection. All facilities at the STM site have external horns and strobes that are activated when the fire alarm is triggered. Fire detection systems at the STM site are monitored by the West Metro Fire Protection District (West Metro), which

receives the signal directly from the NREL system. With the exception of the Bulk Storage and PDU Emergency Generator buildings (which do not have any form of fire protection), all buildings on the lower STM site have multiple fire protection systems. The Visitor Center, Site Entrance Building, FTLB, OTF, TTF, S&R, and Facilities Shed all feature fire detection (fire or smoke detector heads), fire alarm, and fire sprinkler systems. In addition to these systems, the SERF also features a standpipe and fire pump, while the AFUF has multiple fire sprinkler systems, a foam deluge system, and a fire pump. The SERF and AFUF have fire detection systems in the elevator lobbies and the heating, ventilation, and air conditioning systems.

To protect the site from wildfire, NREL applies its Fire Protection Program to the site, which includes wildfire protection requirements. The NREL Fire Protection Program is available on the NREL website under ES&H Programs. In 2001, Fire Mark Limited conducted an Updated Fire and Life Safety Analysis of NREL's FTLB, a Wildfire Hazard Assessment of the STM site, and an Assessment of the NREL Fire Protection Program. This assessment concluded that Fire Protection Program at the STM site is excellent. The Fire Mark Limited Wildfire Hazard Assessment concluded that the wildfire hazard potential for both the lower STM site and the mesa is low (Fire Mark Limited, 2001).

In the event of a fire on the STM or DWOP sites, West Metro is under contract to provide emergency service equipment and personnel. West Metro would also provide ambulance service. In the event of an on-site injury, illness, or other situation requiring an ambulance, West Metro personnel and equipment would be dispatched to the site. Emergency services for adjacent properties are provided by several jurisdictions including West Metro and Pleasant View. West Metro staff and equipment capabilities are being expanded to address the new demand created by the Colorado Mills Mall and other new development within their service boundaries (Abbink, 2002).

3.12 ENERGY EFFICIENCY AND RENEWABLE ENERGY

Energy is the subject of evolving national policy and longstanding debates over sources, infrastructure requirements, pricing mechanisms, environmental impacts, and related regulations and public processes. Peak period demand shortages in California in the summer of 2001 generated renewed interest in energy policy, and fueled old and new energy debates.

It is not the purpose of this EA to fully characterize energy policy or substantive points in the energy debates. This EA sets forth the idea that the mission of NREL is to lead research, development, and technology transfer in the areas of energy efficiency and renewable energy. The STM site is a nationally significant facility dedicated to this mission.

In this role, NREL takes energy conservation seriously and has implemented a comprehensive energy program as part of the "Sustainable NREL" initiative (see Section 2.7). NREL has a standing goal to reduce conventional energy use and views itself as a "model for the nation" in terms of sustainable technologies and designs. The Sustainable NREL initiative addresses the following energy-related topics.

- Energy efficient building design guidelines and operational parameters including a goal of creating "zero energy" buildings that maximize use of energy conservation technology and use solar, thermal, and PV systems to meet the remaining loads.
- Analysis of process loads to reduce consumption.

- Using renewable energy from on-site and off-site sources, where appropriate.
- Operating highly energy efficient vehicle fleets including the use of light duty alternative fuel vehicles.
- Encouraging employee ridesharing, minimizing commuting through alternative work schedule options, and reducing business travel, where possible.

Energy Standards for DOE facilities are set forth in DOE Order 430.2 (Draft). This order requires following 10 CFR 435, which sets efficiency standards for building components (insulation, windows, etc.) and EO 13123, Greening the Government Through Efficient Energy Management.

Xcel Energy provides energy in the form of electricity and gas to the project area. Related infrastructure issues are discussed in Section 3.11 and 4.11 Public Services and Utilities.

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INSERT SITE PHOTOS HERE – FIGURE 3-5.