Facilities and Mission

To train, mobilize, and deploy Army ground forces in defense of the nation, Fort Carson must design, build, and maintain superior installation facilities in which to live and operate. At present, investment strategies consider only the "first cost" to build a facility, inadequately addressing the lifecycle costs associated with the operation and maintenance of inefficient facilities, which is the source of the Backlog of Maintenance and Repair (BMAR). Energy and water consumption, waste generation, and other environmental or budgetary impacts are all critical considerations for developing, constructing, maintaining, and disposing of sustainable facilities.

Sustainable development must encompass both environmental considerations and resource efficiency. Both concepts, summarized below, can facilitate the sustainable development of livable neighborhoods and greener buildings and communities at Fort Carson.

Environmental Responsiveness

"Conventional community development is often insensitive to the natural environment. Such projects may scar the landscape, take valuable agricultural—or training—land out of production, or destroy wildlife habitat. Successful, sustainable projects, on the other hand, restore and enhance natural habitats and resources while efficiently meeting the requirements of the customers, soldiers, civilians, and their families.

A responsive, sustainable approach must first respect and exploit the appropriate location. This involves the careful siting of projects and buildings to benefit from natural site features and to blend with the natural environment. Such efforts can reduce development costs, reduce heating and cooling costs, and produce a better quality of life for building occupants. Undeveloped lands must be preserved, when possible, restoring or reusing degraded land, and capitalizing on natural features for storm water management, erosion control, and roadway design. Building designs must incorporate such natural resources as the sun, wind, landforms, and natural vegetation to provide heating, cooling, lighting, ventilation, and protection from the elements."

Resource Efficiency

"Resources include the physical materials and energy flows available for man's use: land, water, soils, minerals, fossil fuels, electricity, solar energy, and so on. These resources form the capital from which a developer works in siting, constructing, and operating buildings. Resource *efficiency* is the process of doing more with less—using fewer resources (or less scarce resources) to accomplish the same goals, or maximizing the use of those resources.

Resource efficiency can apply to all aspects of sustainable development, including land use, building design, material selection, waste reduction, water conservation, and energy efficiency. Clustered neighborhood development patterns reduce infrastructure needs, simultaneously saving resources and money. Pedestrian-friendly and transit-oriented planning reduces automobile use and associated pollution. Reusing existing buildings prevents unnecessary new land development and reduces building material use. Recycling demolished buildings and construction waste saves manufacturing energy and reduces landfill loading. Specifying energy-efficient appliances reduces fossil fuel and/or electricity use."

Rocky Mountain Institute. Green Development: Integrating Ecology and Real Estate, John Wiley and Sons, Inc., 1998, New York, NY.

Key Sustainability Considerations

- **LEED System** – The U.S. Green Building Council's (USGBC) release in 2000 of the Leadership in Energy and Environmental Design (LEED) rating system provides a national standard for evaluating and comparing green building performance. The Army has developed its own version of the LEED standards, the Sustainable Project Rating Tool (SPiRiT), which incorporates military-unique aspects of building design. Projects are rated in eight categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, facility delivery process, current mission, and future missions. More information on the SPiRiT standards can be found at http://www.cecer.army.mil/sustdesign/SPiRiT.cfm.

- **Master Planning** – Just as important as "green building" is "green development," which is the process of designing areas as a cohesive whole, exploiting natural features, such as the ability to retain storm water on site, and orienting buildings to take advantage of natural lighting and cooling. Sustainable master planning must incorporate, from the beginning, site location and orientation of individual buildings, as well as the overall layout and design of the installation as a whole, to ensure livable communities.

- **Energy Conservation** – Many opportunities are available for reducing energy consumption in existing facilities and operations. Fort Carson must find the financial resources to invest in such opportunities and the time to initiate and manage much-needed retrofit projects.

- **New Construction** – Significant new construction is underway on Fort Carson. The energy consumed in new facilities will likely remain relatively constant over the 50+ years these buildings are in operation, though the costs of each unit of energy is likely to rise. New buildings can become substantially more efficient than most buildings constructed today, and much more efficient than the existing buildings on Fort Carson. Given the long lifetime of new facilities, and the difficulty of post-construction energy efficiency initiatives, energy considerations must become a top-level priority for all new Fort Carson facilities.

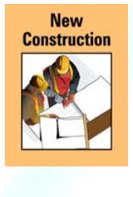
- **Water Consumption** – Water is used for many different purposes including residential use, industrial processes, and landscape irrigation. Water conservation technologies can be "built in," insuring that adequate water is available and permit limits are not exceeded.

- **Storm Water** – Rainfall at Fort Carson comes as "gully washers" or major storms. The garrison area must better retain these storm waters on site, allowing it to slowly seep into the ground. As water moves across the land, it picks up natural and manmade pollutants and deposits them in surface water bodies and underground aquifers. Erosion on active construction sites and training lands carries sediment and nutrients into streams and lakes. Runoff from industrial areas such as motor pools may contain automotive chemicals, oil, grease, and metals.

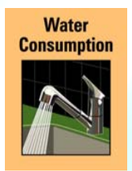
Realm of Possibilities

- **Pentagon Renovation:** The current renovation of the Pentagon is being done according to green design principles. The first project was a separate $10M central receiving facility. Given the security requirements for the building, it was designed as an earth-sheltered building with a park on top for Pentagon employees to enjoy. The $1.1B renovation of the Pentagon itself is harnessing market forces to determine how to "green" the historic structure. The contractor has been given a list of performance criteria for the building, some of which address environmental impacts. Some are mandatory and some are not; however, if the contractor can suggest a way to meet the criteria that will save money over the expected lifetime of the building, and the government accepts the suggestion, then the contractor shares in the anticipated savings by increasing the percentage of profit.

- **Continuous Commissioning:** This is a process of improving building performance through independent hourly metering, monitoring, analysis, and system fine-tuning to maximize energy conservation. This approach, which involves comparing design intent with actual building operation, has yielded an additional 15 to 45 percent savings beyond traditional conservation measures. For additional information, visit http://www-esl.tamu.edu/cc/.
- **Spectrally Selective Windows:** Spectrally selective and chromogenic windows represent the next generation of window technology. Spectrally selective windows have advanced coatings that filter certain wavelengths of radiation from incident sunlight, significantly lowering overall solar heat gain. Chromogenic windows are more advanced, with coatings that change their reflective properties based on ambient temperature or light conditions. Some estimates place the potential energy savings at 40 to 70 percent for electrically heated spaces.



- **Innovative Building Materials:** The building industry and the building products manufacturing industry have aggressive research activities that are providing a host of environmentally friendly and sustainable products. These include soy-based adhesives and foam insulators, shellfish-derived coatings, gas-filled wall panels, and ceramic insulators. For additional information, go to http://www.nahbrc.org/ and click "Green Building" on the navigation bar.
- **Intelligent Buildings**: The intelligent building is the future of architecture. It looks like any other building from the outside, but employs sophisticated control systems to make building systems (e.g., heating, cooling, ventilation, lights, windows, and appliances) more convenient and efficient. Commercial office buildings are being designed wherein lighting, temperature, and humidity in the space occupied by each worker are regulated according to his/her preferences, and windows automatically darken to provide appropriate ambient lighting for the task at hand.



- **Irrigation Meters**: Irrigation meters, in use in western Texas, save one to two-thirds of water formerly used for irrigation. A $1 block of gypsum, buried at the root zone, is connected through two wires to a clip-on meter that reads soil moisture. Drip irrigation, which delivers a small amount of water directly to the root zone of plants as needed, also drastically reduces water use.
- **Greywater Recycling:** The future of sustainable water use is *in site* water recycling and reuse. A large portion of the water we use becomes "greywater" when it is washed down our sinks and showers. This water, with minimal treatment by natural and cost-effective means, can be reused many times over for irrigation, flushing of toilets, and even dishwashing. The home or office of the future could provide up to 70 percent of its daily water needs through simple recycling of bath and laundry water. Treatment systems will be low-tech and cost effective, many times using natural bacteria and plants to clean water. For more information on greywater, visit (http://www.greenbuilder.com/sourcebook/Greywater.html) and http://www.greywater.com/).

- **Green Roofs:** All across the country, thousands of apartment buildings and offices are now growing "green roofs" in place of traditional roofing material. These roofs, made of any number of plant species, soak up water when it rains rather than letting it run off into area rivers and streams. It lowers both the overall volume and contamination levels of the runoff.

Facilities and Installation Development

Challenge: Provide great installation facilities/neighborhoods that enhance quality of life while reducing operating costs, water and energy use, and air and water pollution. How can Fort Carson…

- Site and design buildings and developed areas to reduce construction and operating/maintenance costs?
- Create an Installation that enhances quality of life for those living and working there?
- Site and design buildings and developed areas that reduce environmental impacts?

Key Facts

Energy use at Fort Carson in FY01 resulted in the emission of an estimated 27,410 tons of carbon dioxide (CO_2); 699 tons of nitrogen oxides (NO_X); 753 tons of sulfur oxides (SO_X); and 0.38 tons of mercury, cadmium, and lead from Colorado Springs Utilities.

Fort Carson includes 11M ft^2 of buildings. Over 1.2M ft^2 of building were removed from 1996-2001. This space has been and is being replaced with new construction.

Fort Carson uses 6.4M yd^2 of paved roads and parking areas and 5.4M yd^2 of gravel roads/parking areas and tank trails.

Utility costs at Fort Carson in FY01 were $14,439,889. The utility costs breakdown was 48 percent for natural gas, 40 percent for electricity, 11 percent for water, and one percent for heating fuel/propane.