

3.0 ENVIRONMENTAL SYSTEMS

3.1 INTRODUCTION

The climate of Pasadena is relatively mild and consists of mild to warm, dry days most of the year. This type of climate can offer beneficial opportunities for energy efficiency, including lower building operating costs and increased comfort levels. The design of the environmental systems in the new building should take advantage of this climate with implementation strategies that minimize consumption of our natural resources.

3.2 UTILITY INCENTIVE PROGRAMS

The City of Pasadena has developed a Green Building Program, which promotes the design and construction of environmentally responsible buildings. Under the Green Building Program, the City offers several financial incentives for commercial/ business developments that follow the City's principle of Stewardship of the Natural Environment.

- Pasadena Water and Power offers incentives for the design of buildings certified by the U.S. Green Building Council's LEED Rating System, which currently range from \$15,000 – \$30,000 based on the LEED Certification title.
- Pasadena Water and Power also offers a High-Performance Building Program which matches one month's power savings for buildings that perform better than required under California Title 24, 2005 Edition.
- Other incentive programs are offered by Pasadena Water and Power and the Metropolitan Water District of Southern California for water conservation. These incentives are offered for reduced landscape irrigation, low-water-use plumbing fixtures and recycled water reclamation.

3.3 WEATHER DATA

The purpose of the following narrative is to identify the climatic elements that affect the site. These climatic elements will be used during the Design Phase to identify opportunities to create a sustainable building and a healthy environment.

All climatic data used for analyzing temperature, wind, precipitation, solar and water resources are based on measurements taken at the Burbank/Pasadena Airport or the surrounding area as noted. The data was collected and published by the Federal Government.

Temperature

Figure 1 illustrates the average monthly temperature ranges. The average high is approximately 91°F in August and the average low is approximately 43°F in January. These temperature ranges present the potential to use natural ventilation to satisfy the building cooling loads for a large portion of the year. Figure 2 charts the average daily

temperatures recorded for each day of the year, including the extreme maximums and minimums. The averaged extreme daily maximum can seldom climb above 100°F and the average daily extreme minimum can rarely fall below 25°F. The provision for efficient heating and cooling systems for short periods during the year and at certain times of the day will need to be considered.

Wind

In addition to temperature, wind is also studied to understand its effects on the building and the potential use of the prevailing winds for natural ventilation. Figure 3 shows that the average monthly wind speeds are relatively low and constant throughout the year. The exception is when the warm, dry Santa Ana winds gust through Pasadena. This usually occurs in the late fall and winter when high pressure forms in the basin between the Sierra and Rocky Mountain ranges, accompanied by a weak low pressure system off the southern California coast. The Santa Anas are erratic; desert winds channeled by the canyons and passes near Pasadena and can reach wind speeds between 40 – 60 mph. At these times, the strong wind along with dust and other pollutants can bring difficult environment factors to the area and should be taken into consideration during design.

The wind diagram in Figure 4 demonstrates the wind direction from data collected at the Burbank airport. The strongest prevailing wind comes from the northwest and south-southwest. The building orientation and surrounding buildings will determine the applications and locations of natural ventilation systems. Special attention should be placed on the location of intake and exhaust vents with respect to surrounding buildings and elements of the site.

Solar

As illustrated in Figure 5, Pasadena is one of the best locations in the United States for solar energy applications. The City receives an average of 6000 - 6500 Wh/m²/day (557.62 - 604.09 Wh/sq.ft./day) of solar radiation and has a low frequency of cloud cover. The daily hours of solar radiation is predicted to be an average of 4.2 - 6.0 hours per day. With the average daily length of sun exposure required for a typical photovoltaic solar collector of 4.5 - 5.7 hours per day, the application of photovoltaic systems is a desirable method of utilizing the readily available solar energy at the site.

Solar radiation also emits heat, which can be either a benefit or a detriment, depending on the season and time of day. Since Pasadena is in a generally temperate climate, heat gain typically needs to be avoided throughout most of the year. Therefore, it is important to incorporate a high performance building envelope, exterior shading devices and glazing orientations that optimize natural daylighting and reduce heat gain and the need for mechanical cooling of the building. Figure 6 shows the sun paths for Pasadena for June 21st, March/September 21st and December 21st. As the sun passes over the site, it offers natural lighting and passive heating opportunities that vary with the time of day, year and function of the space.

The sun/shadow diagrams of Figure 7 show the shadow pattern created by the existing buildings at the sun's lowest, midpoint and highest angles during the year. As these diagrams portray, the sun's movement across the site and the immediate surrounding structures will influence the siting and design of the new building.

Water Resources

Pasadena has a very low average annual rainfall, but this total can vary widely when influenced by "El Nino" conditions. Any efforts to reduce the water consumption for the building systems, landscape needs, and fixture consumption will have a large impact on the overall sustainability of the building. In the effort to reduce water consumption and waste discharge into the municipal systems, rainwater and recycled water systems can be captured for use in the building and surrounding landscape. Reduction in water runoff can be achieved by the use of planted "green" roofs and the use of permeable materials for exterior landscapes, driveways and walking surfaces.

Recycled water systems are another very efficient method of conservation. These systems capture, filter and store recycled water for a variety of uses. The City of Pasadena and the Metropolitan Water Authority of Southern California offer incentives for implementing and maintaining systems and devices for reduced water consumption.

FIGURE 5 - SOLAR RADIATION OF PASADENA



FIGURE 6 - SUN PATH DIAGRAM FOR PASADENA

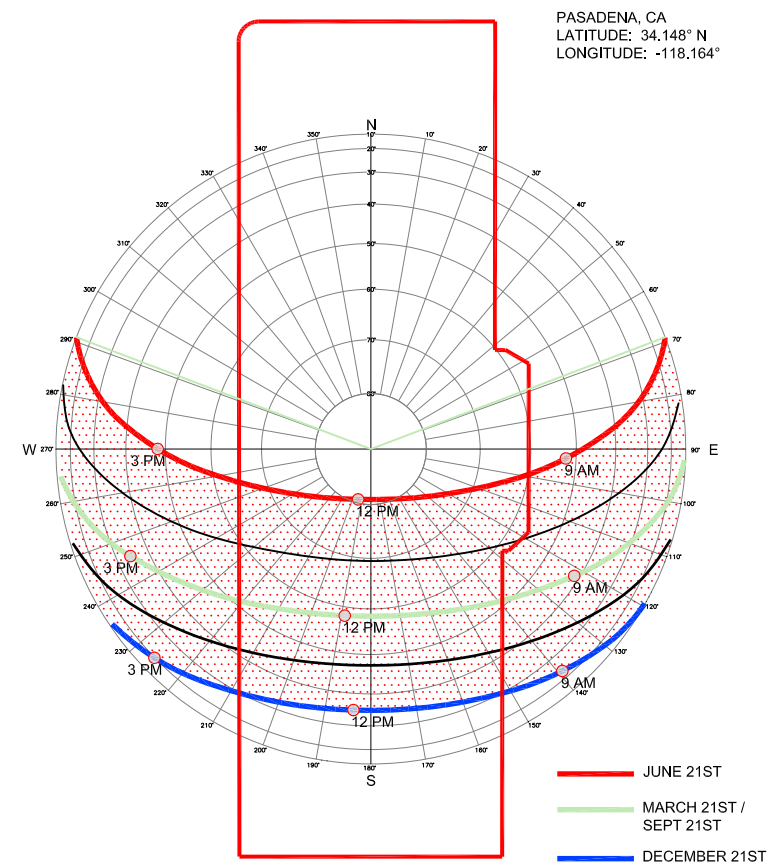


FIGURE 7 - SUN/ SHADOW DIAGRAMS OF PROJECT SITE

