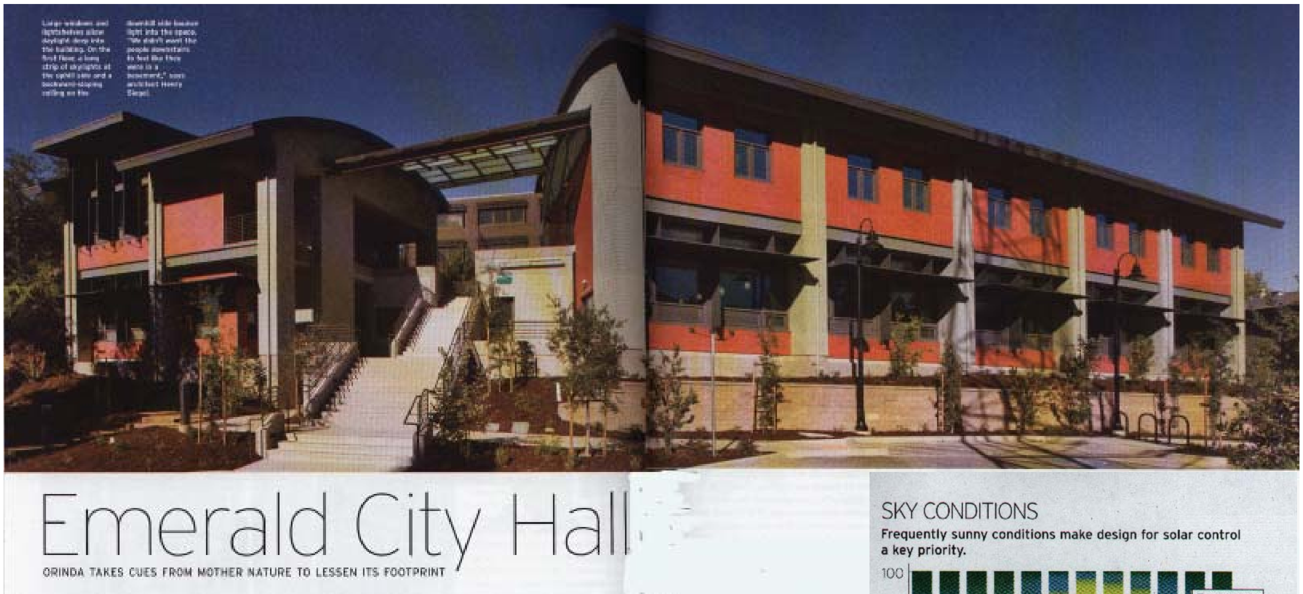
Arch 464
ECS
Spring 2009 Name_______________________________________

Quiz #3

"Is Emerald City Hall Green?"



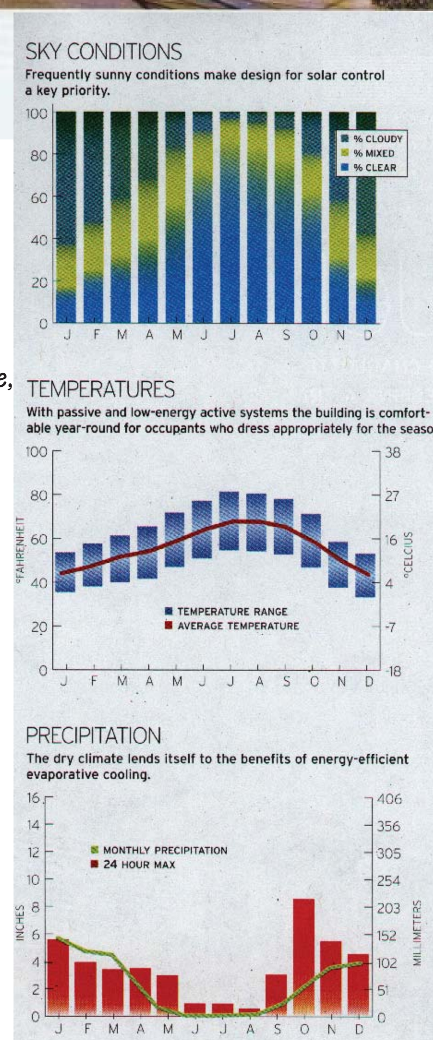
West and Southwest Elevation demonstrates the steepness of the slope.

For this problem you are a green architecture critic evaluating Orinda's new City Hall for fulfilling its intended role as an icon for regenerative design, a building that walks the talk of sustainability.

City hall is located in a mild mediterranean climate, just east of San Francisco; summers are hot and sunny and winters mild and cloudy. Rainfall is moderate, more than 40" per year, but the summer months are very dry. The two-story building is tucked into a west-facing slope, overlooking the city center. The ground floor is near grade on the east and the lower floor is near grade on the west.

Your role is to point out strengths and weakness of the building, which was written up in the November/December issue of *Green Source* magazine.

READ THE ENTIRE QUIZ BEFORE YOU BEGIN ANSWERING!

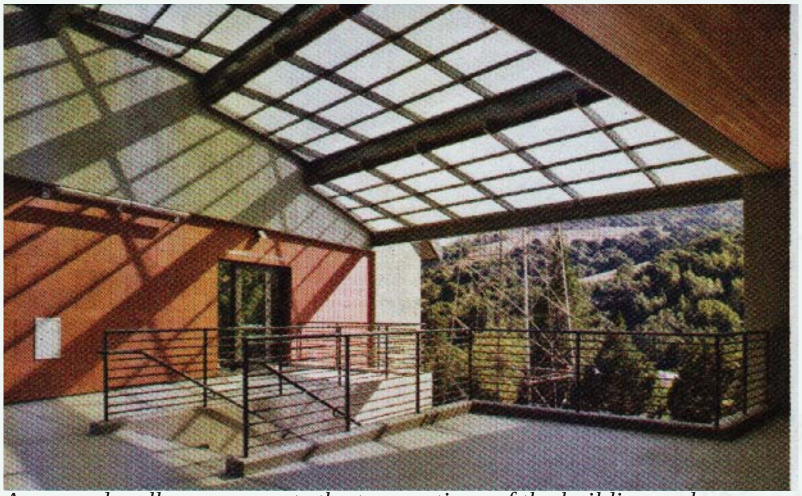


Photos, illustrations, and text: Green Source, November/December 2008.

Tucked into a steep slope in a bedroom community just east of Berkeley, California, rests Orinda City Hall. About 80 percent of the building faces southwest, while the remainder faces west, overlooking a creek and the civic buildings below. A breezeway running between these pieces allows pedestrians to walk through the building, maintaining a shortcut to downtown and "symbolizing open government," according to Henry Siegel, FAIA, principal at Siegel & Strain Architects. The two-story, 14,000-square-foot building houses a community room as well as Orinda's administrative, planning, building, and police departments.

According to Siegel, "Our approach is always to start by asking what energy demands we can get rid of and what we can do with natural flows on the site." Despite the warm climate, the project team found that cross ventilation and the stack effect—via abundant operable windows, clerestories, and skylights—could provide sufficient cooling during much of the year. Mechanical cooling would be needed during the summer, though, and the team set its sights on a compressor-free, energy-saving evaporative system.

The team determined how much cooling an evaporative system could provide and began the work of reducing cooling loads to match. This entailed considerable external shading, through horizontal and vertical elements and with a second floor that cantilevers 30 inches over the first. Inside, they trimmed the lighting power density, installed daylight and occupancy sensors, and even specified that occupants use only low-heat flat-screen computer monitors. "It took a good 30 to 40 percent reduction in loads to get to the goal of eliminating compressors," says Gwelen Paliaga, senior mechanical designer at Taylor Engineering.



A covered walkway connects the two sections of the building and maintains a pre-existing pathway from points uphill to the downtown below.

In spite of shading and load-shaving strategies, energy modeling indicated that the evaporative cooler would not be able to keep the building comfortable for about 120 hours each year. In response, the project team turned to ceiling fans, which can make temperatures feel three or four degrees cooler than they really are. This strategy cut the 120 hours of discomfort down to just 28, which was good enough for the owners. "It wasn't something we'd ever want to push on a client," says Paliaga, "but the city manager was very supportive and gave us the go-ahead."

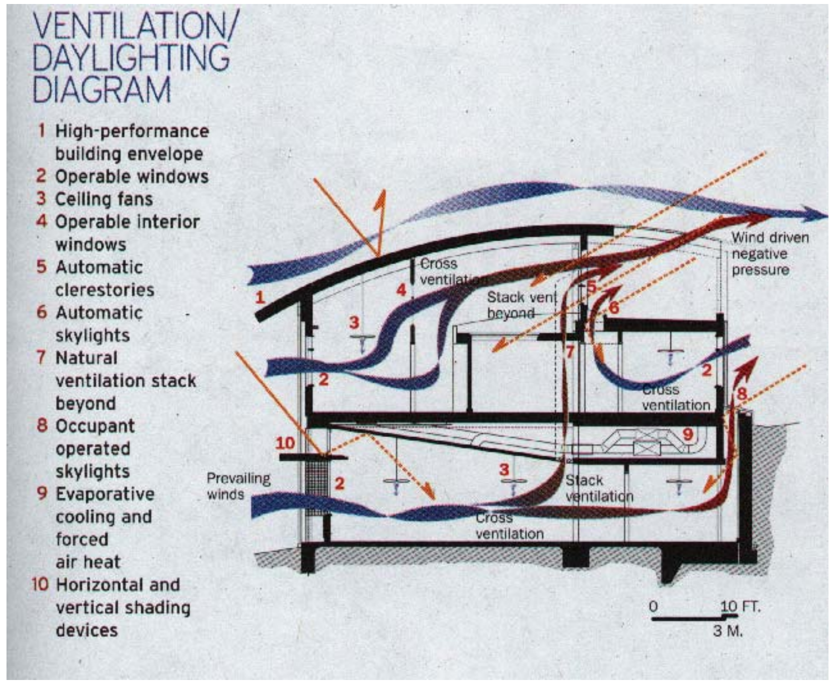
The team chose an indirect/direct evaporative cooling system. This system uses so little energy for cooling it can run on 100 percent outside air. This improves indoor-air quality and cuts down on wasted energy. Paliaga explains, "If people open their windows at the wrong time, it doesn't waste much energy. It just becomes the path for the exhaust." Thanks to the evaporative cooling system and the efficiency improvements that allowed its use, the project was anticipated to use 60 percent less energy than allowed by California's strict Title 24 standards.

The cooling system didn't perform correctly at first, creating uncomfortable conditions during the building's first summer. That has been remedied, but another problem remains; Orinda's police officers wear their bullet-proof vests throughout the day, and not even the ceiling fans can compete with that much insulation. Noting that this requirement wasn't identified during the design process, Paliaga admitted with regret "the system is not designed to create the cold temperatures that they desire. It's just not something the building can do."

Orinda is in a seismically active area, and, since the building is used for emergency response, California requires it to exceed conventional seismic standards by 50 percent. David Mar, structural engineer at Tipping Mar + associates, proposed a series of four steel braces that tilt at their bases. Cables in these braces re-center the building if it rocks. "For a medium earthquake, the frame is rigid to protect the finishes," says Mar. "But for a giant earthquake, the frame rocks. The finishes get damaged, but the structure realigns itself." The system cost about $60,000 extra, but the city saw it as a wise investment. "If you neglect durability," explains Mar, "you invalidate a lot of the life-cycle assessment. In California, seismicity is an environmental issue."

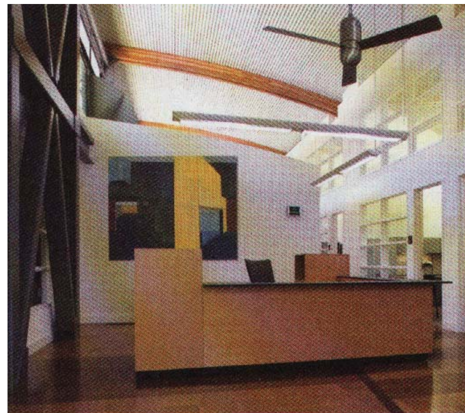
The budget became a major concern as the design progressed, and at the end of schematic design, the team was asked to shrink the building by 10 percent to cut costs. Value engineering also claimed the planned photovoltaic system as well as sustainably harvested wood, sensors to track open windows, and several other "bells and whistles," according to Paliaga. The commitment to LEED certification survived, however, and a Gold rating is anticipated. "The city council wanted that credibility," says Siegel, "and they thought it was an important statement to make for their city." «

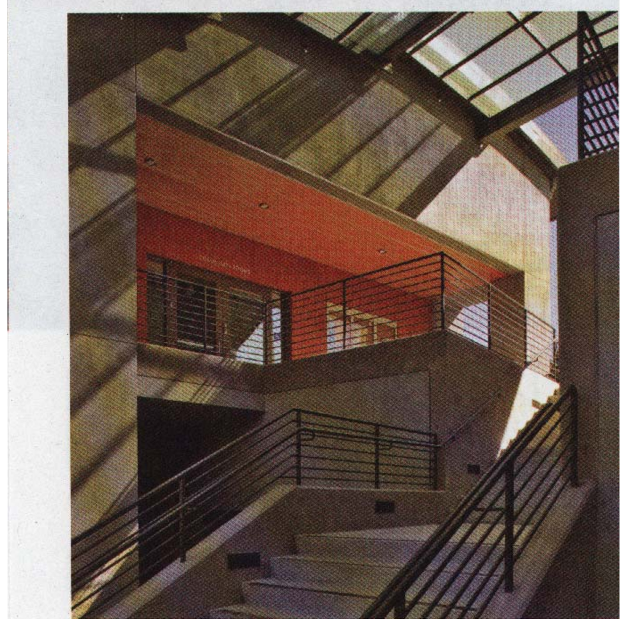
4 pts 1. **Point out and explain four sucessful features of the building and its site that work toward sustainability and reducing its carbon footprint.**



4 pts

2. Suggest four improvements that could be integrated with the building and site design that would make it more sustainable, regenerative, or reduce its carbon footprint. **Explain** each of your suggestions. Use sketches and diagrams to make your intentions clear.





[Top] Ceiling fans expand the occupants' range of comfort and signs advise occupants to open the windows when the weather is right. "I knew that we had to involve the occupants to have a successful building," says mechanical engineer Gwelen Paliaga.
[Bottom] Durability and low maintenance directed exterior material choices, including a metal roof and tile cladding. The concrete was made with slag, a byproduct of smelting ore.

2 pts **3. Propose two appropriate systems for generating site energy that would reduce the building's contribution to greenhouse gas emission and show how these can be integrated into the site and building design scheme.**