Appaloosa Branch Library @ Greenbuild 2009

ENVIRONMENTAL FACTORS IN THE DESIGN OF APPALOOSA BRANCH LIBRARY

WRITTEN BY | JEREMY A. JONES, AIA, LEED AP
PHOTOGRAPHY BY | BILL TIMMERMAN

THE APPALOOSA BRANCH LIBRARY WAS DESIGNED WITH AN INITIAL AGREEMENT BETWEEN DWL ARCHITECTS + PLANNERS, DSAA ARCHITECTS AND THE SCOTTSDALE LIBRARY STAFF TO CREATE A BUILDING THAT WAS NOT ONLY FUNCTIONAL BUT WOULD BE THE MOST APPROPRIATE REGIONAL AND MICROCLIMATIC ASPECTS OF THIS NORTH SCOTTSDALE SITE.

With a renewed national interest in the environment, and Scottsdale's commitment to the LEED® program, it was assumed that an environmental statement should go beyond current design trends, must be understandable by the neighbors and, of course, had to still meet the budget. The design team took the position of first analyzing all aspects of site design to optimize orientation and access and then developed conceptual designs. The LEED program was applied later to review and then enhance initial applications. This resulted in a building that uses 31% less energy and 53% less water than a conventional library.

The original budget projected a building area of 20,000 square feet, but the architects and construction manager were able to create 21,242 square feet of building on four and a half acres of site while staying within the budget. This does not include usable outdoor spaces.

The site has a complex area with a 14-foot elevation change that is potentially subject to flooding either in the previous arroyo alignment or as sheet flow—a uniform layer of water rushing down the hillsides following the contours at a relatively even depth. The design result was location of the building on the high portion of the site with a protective berm at the west end, while the east end was raised above the arroyos to the north and south. To make that work, a bridge was created to provide a dramatic crossing over the arroyo as an entry experience. The perforated deck allows visitors to see the arroyo below and introduces sound that adds interest during the passage into the building. A screen was added to the west side of the bridge where native vines provide sun shading. Meanwhile, after a storm, water shoots from large scuppers at the west end of the building and lands on rock clusters to break the impact before flowing into an arroyo. Once the ground was sculpted, native plants from the site were relocated in natural clusters near the building. As all the environmental factors and functional components were simultaneously resolved, we developed the notion of the building as a mirage.

Arrangement of the building's functional elements included environmental considerations. Access by pedestrians from parking or drop-off areas, and the ability to drive up to a window to receive library materials, led to public functions on the south side of the building where they also serve as a buffering function from the sun. The mechanical room is placed on the west end to block the sun at the end of the afternoon. Most of the remaining exterior exposure for the large Reading Room is to the north with its steady, indirect light. The building was also rotated from true north to maximize solar gain.

Next, the Reading Room roof was elevated above adjacent portions of the building so balanced external light enters the room from all sides. South light bounces off lower white roofs to the ceiling of the Reading Room. This provides a relatively constant light level that varies with weather conditions and time of day but is directional enough to aid visibility. There is more exposure to the east, so the roof is extended far enough that shadows reach the base of the glass by 9 a.m.—the usual opening time for the library. Beyond that, a shaded patio expands the reading and meeting area.

Considerable study led to a special wall for enclosed spaces. Metal siding offered light weight and use of recycled material. A unique metal coating was found that achieves color changes, depending on view angle. The chips selected create a range of colors from dark green through silver to mauve, with an average tone of light gray/green like adjacent desert plants. Besides reflecting away a lot of heat, the siding also forms a convective layer between the siding and the sheathing. A screen detail at the base and top of the wall allows air to enter at the bottom and rise convectively as it warms. This carries away heat that would otherwise warm up the exterior of the building.

One often neglected aspect of environmental design is the ability to change uses of spaces in both short and long time periods so less building area is required. The main Reading Room floor is raised to easily accommodate electrical and data changes for future uses. Permanent dividers were minimized so shelving, display, seating and study tables can be rearranged to facilitate new work patterns that librarians may develop to meet future needs. Reversing the historic trend, a quiet room and conference rooms were developed for those who seek tranquility as they read, while more active browsing and other library uses are less restricted. Both the meeting rooms and early learning areas have folding walls, allowing for different activities of varying configurations.

CHECK OUT BACK PAGE FOR OUR ENVIRONMENTAL SUMMARY ON APPALOOSA ACCORDING TO THE LEED CHECKLIST

Environmental Summary

ON APPALOOSA BRANCH LIBRARY ACCORDING TO THE LEED CHECKLIST

SUSTAINABLE SITE

During construction, several measures were taken to insure minimal construction impact on the community. A perimeter silt fence and stabilized construction entry were installed to prevent erosion on site and sedimentation of waterways to the surrounding sites. Storm drains and drywells also have protected inlets. All construction workers were trained in dust control measures.

Community Connectivity was achieved when the City selected a site that was surrounded by a wide variety of commercial, service and residential uses including a main Post Office.

Alternative Transportation is aided by providing bicycle racks with changing areas and shower for staff, providing separate parking for low emitting and a fuel-efficient vehicles, providing carpool parking and by limiting parking to the smallest number of spaces that will keep the building available to the public. Spaces can be provided in the future for recharging electric vehicles. The surviving plants were salvaged, and new planting was selected from native and dry climate plants with form and surface texture approximating the original natural setting. Nearly 57% of the site is restored to native and adapted planting. No mowing or fertilization is required. By meeting the 20% landscaped open area requirement, as well as exceeding local open area requirements by 25%, the plan has become an oasis in the midst of less indigenous development. Much of the open area is in the storm water detention area that helps prevent flooding in the neighborhoods. A combination of allowable materials and cost did not permit obtaining the heat island credit. However, the light colored roofing did lead to that heat island credit for the structure.

Arizona set early standards for reducing light pollution with the Kitt Peak Ordinance. Further implementation by the City of Scottsdale prevents light pollution to adjacent properties, so credit in this area resulted from pre-LEED standards.

WATER EFFICIENCY

After an initial adaptation period, water to landscaping will be removed. There will be no lawn, broad leaf trees or other plants that were once imported to the area. Water from the roof is channeled into arroyos where planting is more intensive. Additional water savings were achieved within the building through fixture selection for a total 53% water consumption reduction.

ENERGY AND ATMOSPHERE

All systems in the building will undergo enhanced commissioning to assure the City that its new building works as designed. This includes testing of systems, creation of manuals and training of building system operators. The mechanical system design was compared with baseline energy consumption criteria and is vastly more efficient. Building systems were computer modeled to optimize system selections and design. The analysis is the result of an improved building envelope, more efficient equipment and better coordination of all systems, which produced a building 32% more efficient than a standard building.

Lighting and energy systems are computer controlled and occupancy sensors turn off lights when rooms are unoccupied. Dimming controls also increase room flexibility. Changes in refrigerants for air conditioning systems have made less polluting products available that have less effect on the ozone level. The air handling system uses a “fan wall” for greater efficiency and less down time if a single fan unit fails. Walls are insulated to R-19 and roofs to R-30. The windows are dual pane with low-E coating and are turquoise in color to block infrared light (heat). A 6KW photovoltaic system has been added to help reduce peak electrical loads by providing 2.5% of maximum power consumption. The system is mounted on the staff area roof but is not visible from most neighboring locations.

MATERIALS AND RESOURCES

Building design includes locations for collecting recyclable materials to minimize garbage that needs to be transported to landfills. This is a library district policy.

Additionally, an astounding 95% of all construction materials have been recycled. Construction had progressed for several months before the garbage container was dumped for the first time.

The recycled content of materials reached 26%, and regional materials account for well over 26% of all products along with the use of Certified Wood for 56% of wood usage. Products also meet low emission standards. At the close of construction, the contractor will provide the actual totals for the project.

Some examples include: 60% use of recycled steel; 60% of counter tops (Paperstone) are recycled; 90% of cabinet material in the café (Kirei Board) is recycled; 70% of restroom counter tops are recycled glass; 75% of the aluminum in the curtain wall is recycled; and 94% of the material in tire stops is recycled along with 100% of the gravel below parking surfaces.

INDOOR ENVIRONMENTAL QUALITY

Indoor air quality improvements start by meeting accepted standards, and improves from there. This is an issue in a hot climate where increased ventilation requires additional cooling. Several methods led to the clean air in Appaloosa Library.

First was to not allow smoking anywhere in the building. By monitoring both the carbon dioxide level in various rooms and the quality of outside air, additional ventilation can be provided to maintain comfort without over ventilating and losing energy. An economizer function also allows air to be passed directly into the building without heating or cooling under certain conditions. A special louver allows this to be controlled automatically.

Air quality control starts before official occupancy, when a “blow down” lasting several days uses 14,000 cubic feet of air per square foot of building to clear out all remaining exhaust vapors, fumes, off-gassing and contaminates; airflow is then controlled for the following month. This is effective because the building also contains low-emitting adhesives, particle board, plywood, sealants, paints, coatings and carpets. The carpet was even made in a certified less-polluting factory. Return air vents and door closers also keep potential fumes caused by cleaning products out of the air in occupied rooms. Air quality is then maintained by high-level filters.

A regular cleaning program contracted by the City maintains the entry mat, which stops dust at the door. Temperatures can also be adjusted in certain areas for individual comfort.

Lighting systems are automatically controlled both by program and by occupancy. This is closely linked to extensive daylighting of all regularly occupied areas and the ability to see outdoors to views from all work spaces. During the day, lights can be dimmed or turned off without decreasing lighting quality.

INNOVATION IN DESIGN

Near the entry to the meeting rooms is a computer screen that gives real-time depictions of energy consumption and solar energy generation in a graphic display. It can also provide historical trends as well as generate alarms or alerts under certain conditions. It also calculates the carbon footprint statistics.

DWL ARCHITECTS + PLANNERS, INC.

DWL Architects + Planners, Inc.
2333 North Central Avenue
Phoenix, Arizona 85004
tel 602.264.9731 fax 602.264.1928
www.dwlarchitects.com

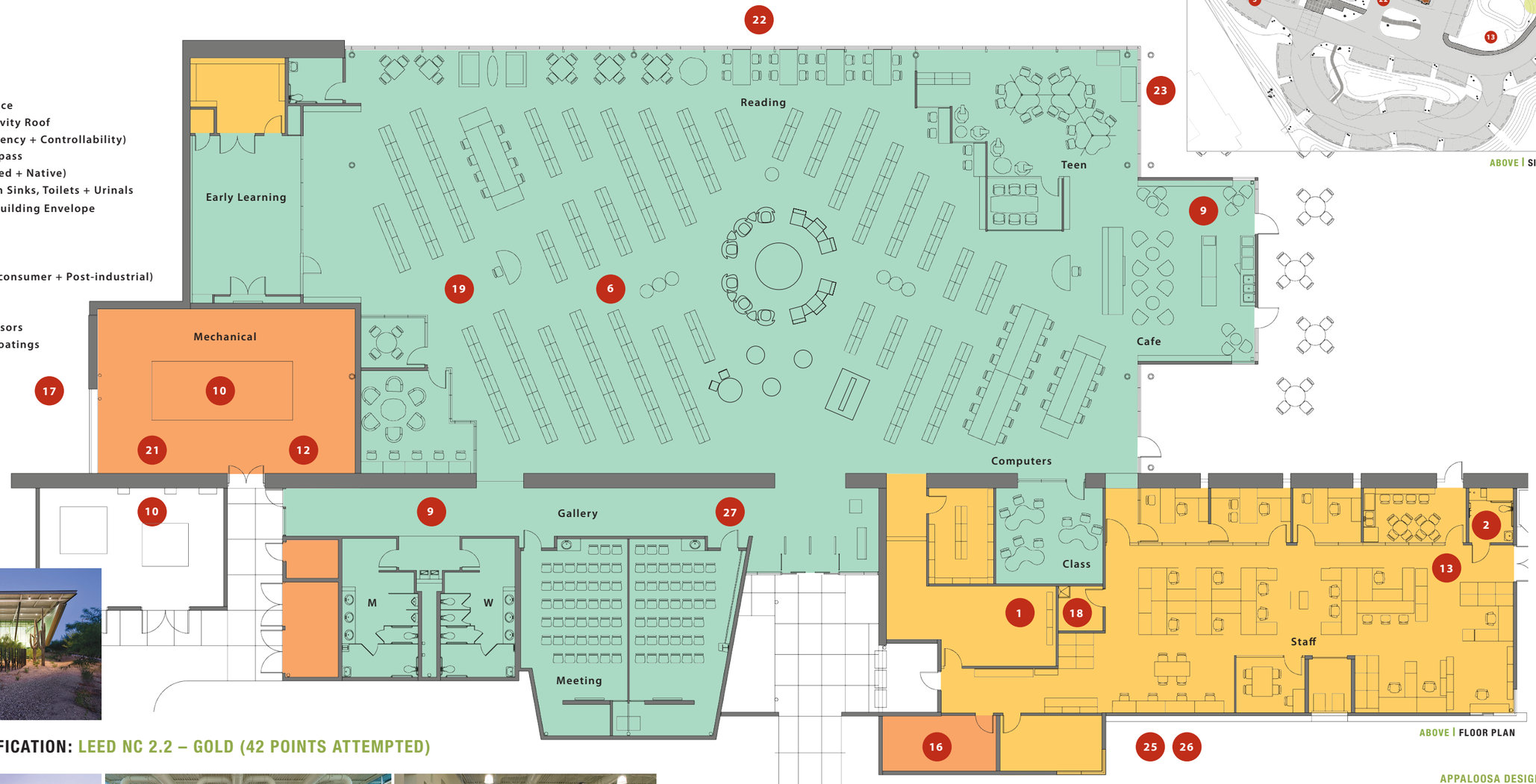
DWL & Greenbuild ‘09

WE JOINED THE GREENBUILD ‘09 CONFERENCE AS AN EXHIBITOR TO SHARE SOME OF THE LESSONS AND EXPERIENCES WE HAVE ENCOUNTERED THROUGH WORKING ON APPALOOSA BRANCH LIBRARY.

- Public
- Staff
- Utility

1) Bicycle Storage
2) Changing Rooms
3) Preferred Parking
4) Protected Habitat/Open Space
5) High-Reflective/High-Emissivity Roof
6) Interior Lighting (High Efficiency + Controllability)
7) Exterior Lighting/Light Trespass
8) Desert Landscaping (Salvaged + Native)
9) Low-flow Lavatories, Kitchen Sinks, Toilets + Urinals
10) Energy Efficient Systems + Building Envelope
11) Solar Panels
12) Low-emitting Refrigerants
13) Storage of Recyclables
14) 5% Recycled Content (Post-consumer + Post-industrial)
15) 10% Regional Materials
16) Certified Wood
17) Outdoor Air Monitoring Sensors
18) Adhesive/Sealants/Paints/Coatings
19) Carpet
20) Composite Wood
21) Thermal Comfort
22) Daylighting
23) Views
24) Flood Control
25) Convective Cooling Wall
26) Insulation
27) Real-time Video Monitoring

ABOVE | SITE PLAN



ABOVE | FLOOR PLAN

POTENTIAL LEED CERTIFICATION: LEED NC 2.2 – GOLD (42 POINTS ATTEMPTED)

APPALOOSA DESIGN TEAM

Scottsdale Public Library Staff
Scottsdale Planning Department
DWL Architects + Planners, Inc.: Architect of Record
Douglas Sydnor Architect and Associates: Team Architectural Associate
LSW Engineers Arizona, Inc.: Mechanical Electrical Plumbing Engineering
Knipp Design Associates, Inc.: Interior Design
Paragon Structural Engineering, Inc.
GBtwo Landscape Architecture, Inc.
Jacobs Engineering: Civil Engineering
Green Ideas: LEED Consultant
Anna Skibska: Public Artist
Haydon Building Corp (CM@Risk)