

Green Projects Entry
Ballard Library (o)

Section 1 - Project Overview Information Part 1

Project name: Ballard Library (o)
Project owner: Seattle Public Library
Project address: 5614 22nd Avenue
Seattle, WA 98107

Section 2 - Project Overview Information Part 2

Project completion date:	5/2005	<i>(m/y) format</i>
Project Site:	Previously Developed	
Project type:	Library, Assembly, Neighborhood Service Center	
Project site context/setting:	Urban	
Other Building description:	New (100% new)	
Lot size:	28000.00 ft2	
Building gross floor area:	33200 ft2	
BOMA floor area method used?:	no	
Number of permanent occupants:	21	
Number of visitors:	1028	
Occupants (hours/week/occupant):	52	
Visitors (hours/week/visitor):	4	
Total project cost:	\$6,500,000	

Section 3 - Project Overview General Description

General description: The Seattle Public Library/Neighborhood Service Center Co-Location:

This project, the first major building designed within the new Ballard Municipal Master Plan Zone, consists of the 15,000 square-foot Ballard Library, a 3,600 square-foot neighborhood service center and 18,000 square-feet of below grade parking.

Ballard is evolving from its image as an old Scandinavian outpost to one of Seattle's most popular neighborhoods. The district is rapidly becoming the civic core of the neighborhood, easily accessible for pedestrians, by bicycles, and public transit. A pedestrian zoning overlay was recently adopted to promote development of this nature.

The public nature of this building dictated a public process along with the challenges associated with it. The effort was a collaborative one between the Architect, The Seattle Public Library, the Neighborhood Service Center, the community and various user groups. The community was represented by interested parties actively involved in the design process, continually distributing information to and from their groups to the design team. This group effort allowed the voices of thousands of potential users to be heard.

Artists were selected prior to the commencement of schematic design to allow for integration of a public art component into the overall building design.

Section 4 - Top Ten Measures

Top Ten Measure 1: Sustainable Design Intent & Innovation

Key environmental aspects: The Ballard Library and Neighborhood Service Center draw on this Seattle neighborhood's Scandinavian and maritime roots, while focusing on the community's future, composed of a young, diverse population.

The building presents a powerful civic face along a pedestrian corridor. The main entry, pulled back from the street, makes a deep front porch, joining the library and the service center under a large canopy. Grouped site furnishings encourage human interaction, reinforcing the civic nature of this sheltered space.

Libraries are traditionally stark repositories of knowledge. Our opportunity was to focus the community's interest in green design to make this facility a dynamic teaching tool for sustainable design and environmental awareness.

The gently curving roof, planted with sedums and grasses absorb water, reducing runoff. The periscope and observation deck invite visitors to engage in the green roof's ecology above the street. Day-lighting studies maximized the use of varying intensities of natural light, and metered, photovoltaic glass panels shade the Neighborhood Service Center lobby, demonstrating the effectiveness of photovoltaic technology in the Pacific Northwest.

The project illustrates green building is feasible within a modest budget, presenting the community with an ideal example of benefits realized when sustainable design combines with extraordinary architecture.

Top Ten Measure 2: Regional/Community Design & Connectivity

Regional/Community Design: The Ballard neighborhood is deeply rooted in Scandinavian tradition and culture. There is a large maritime tradition with a working waterfront close by. The design of the building is intended to reflect these cultural roots, at the same time providing a new focal point for the developing neighborhood. The building's generous, covered "front porch" serves as a Civic plaza and provides opportunities for casual gatherings, or for larger community gatherings, be it festivals, or as a starting point for parades or other means of public expression.

The site's location is ideal for its proximity to local bus routes, a new local park, the local marketing street, for its potential to reduce automobile trips, and for the neighborhood's pedestrian nature. There are ample bicycle racks located on the property, including in the covered parking garage. The building's lobby has readily accessible information outlining alternative means of transportation to and from the area. An early project goal remains in effect: to encourage and educate users as to the availability and importance of using alternative means of transportation. Additionally, the Library offers financial incentives to employees that travel using alternative modes of transport.

Use other transport options: 73% Parking spaces per person: 0.29

Use other transport options:	73%
Parking spaces per person:	0.03

Top Ten Measure 3: Land Use & Site Ecology

Site ecology:

The site, located in an urban context, was redeveloped for this project. The challenge was to develop the site in a restorative manner. Formerly home to a bank and a parking lot, hardscape comprised 100% of the lot coverage. Today, combined with the green roof and planters at the building perimeter, the hardscape has been reduced to 20% of the lot coverage. The zero lot line building has effectively incorporated over 80% vegetated surface. Urban projects often present difficulties with regard to surface runoff generated. The green roof limits and filters runoff, retaining rainfall within the roof assembly, serving a dual purpose: Runoff and irrigation needs are reduced through the retention of runoff.

The roof top planting is a mix of self sustaining, drought tolerant, indigenous grasses and sedums planted in a pattern that mimics a windborne casting of seeds. The relatively low height of the building will provide green views, in an urban setting, from neighboring properties as they develop to allowable heights. The green roof provides habitat for bird life, and in its small way diminishes the radiation of heat gain into the sky.

Top Ten Measure 4: Bioclimatic Design

Bioclimatic design: The site is located on a city block with the longest public face facing west. A public plaza, covered by a curving green roof, is located along the western, entry face of the building. The west face is located on a developing pedestrian core within the new Ballard Municipal Master Plan. The site is located one block from the main marketing street in Ballard, and diagonally across the street from a new public park.

The large west porch, covered by the green roof, affords protection from the wind and rain, and shades the entry from the glare of the low winter sun.

The building's covered porch, generous landscape, street trees and large green roof provide an oasis in all seasons, providing ample protection from the local climate in all seasons, along with generating a comfortable microclimate amidst all the impervious surfaces typical of an urban environment.

Top Ten Measure 5: Light & Air

Light & Air:

The building is designed to bring natural daylight deep into the building, minimizing the need for electric lighting during daylight hours. Photosensors monitor and augment the amount of natural light available with electric light. Electric lighting only enough power to balance natural light, raising it to the proper light levels.

Photovoltaic Panels and Glazing: The Design Team worked with the Seattle City Light Green Power Program to install rooftop solar panels, and glazing with photovoltaic film in the curtain wall. The photovoltaic glazing is one of the first such installations in the nation. The power generated by both systems is fed back into the city power grid. Seattle City Light provided the rooftop solar arrays and the curtain wall glazing, and continues to monitor their performance. An additional benefit provided by the PV glazing: Shading is provided for the lobby of the Neighborhood Service Center (other shading devices would have been necessary in this location to maintain the comfort

level for lobby occupants). Additionally, solar heat gain is minimized, lessening the call for mechanical cooling by the HVAC system.

Percent of building area that is daylit:	86%
Percent of building that can be ventilated or cooled with operable windows :	18%

Top Ten Measure 6: Water Cycle

Water Cycle: This zero lot line structure includes 80.3% vegetative site coverage site. Native vegetation covers 5,071 square feet of the site. The green roof covers an additional 18,100 square feet of contiguous roof surface. Faceted planes of the curved roof create six microclimate conditions, each a separate exposure with differing water retention properties, based on slope and orientation. The upper edges sloped more steeply, retaining less water but offering the highest opportunity for envirotranspiration. The lower slopes retain more water and are more protected from prevailing breezes. Plant species were selected based on the variety of conditions and located as though through natural propagation. Monitoring of the species will tell us which plants battle for specific conditions. Irrigation needs are minimized by the selection of drought tolerant species. Runoff is filtered through the planted roof or absorbed by the site landscape. Local interest groups are collaborating to install water monitoring devices on the green roof. Data collection will be valuable in assessing the performance of the green roof over the life of the structure.

Project water usage is conserved through devices such as a computer controlled irrigation system, low flow fixtures, sensor and timed faucets, and waterless urinals.

Precipitation managed on site:	80%
Total water used indoors:	408000 gal/yr
Total water used outdoors:	2652 gal/yr
Percent of total water from reclaimed sources:	0%
Percent wastewater reused on-site:	0%
Calculated annual potable water use:	12.4 gal/sf/yr

Top Ten Measure 7: Energy Flows & Energy Future

Energy description:

Energy efficient light fixtures were used throughout. Photocells and occupancy sensors control the call for electric lighting.

The Library and Service Center are two separate entities with different energy and conditioning needs. Mechanical units serving the two uses individually were isolated and located to simplify and reduce the length of duct runs. Simplified layouts reduce energy required to move air, and loss of energy between source and use.

Care to reduce heat sinks common with concrete construction led to innovations in the structure of the building. Pre-cast concrete plank, supported by cast-in-place concrete columns and beams, are covered with rigid insulation and a floating slab. Conditioned interior space is completely isolated from the garage below. Data and electrical runs are located in the floating slab, allowing for flexibility in the future.

Photovoltaic glazing film applied to the inner layer of glass contains a frit pattern, producing shade for the lobby of the NSC exposed to direct sun. Meters at the base of these windows allow patrons to study the path of the sun and its effects on individual panes of glass in the curved wall of photovoltaics, becoming a high tech sundial.

Performance Rating

EPA 100

HERS

Percent total energy savings 75

	Base Case	Design Case
Total energy (Btu/sf/yr)	268900	67100
Electricity (Btu/sf/yr)		313611
Natural gas (Btu/sf/yr)		1490
Other: (Btu/sf/yr)		
<hr/>		
Heating (Btu/sf/yr)		285100
Cooling (Btu/sf/yr)		24656
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Cooling capacity (sf/ton)		452
Lighting load connected (W/sf)		1.78
Lighting load after controls (W/sf)		
Plug load (W/sf)		
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Peak electricity demand (W/sf)		
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Percent on-site renewable energy (%)		3
Percent grid-supplied renewable energy (%)		0

Supplemental Narrative

Comparison of Energy Star Information and actual Utility Bill Information for first nine months of use interperlated for full year. Also interesting is the comparison to previous library facility utility information: Old building is 7,000 sf occupied with surface parking vs New building with 18,200 sf occupied with 15,000 sf of below grade parking. Old Electric 103,680 kwh per year- New 313,611 kwh per year Old gas 32,544 Therms per year- New 1,490 Therms per year Old water 3,014.9 ccf per year- New 549 ccf per year

Top Ten Measure 8: Materials & Construction

Materials description: A team commitment to utilizing recycled products ranged from recycled glass backfill, concrete forms made from milk cartons, and Architect designed jellyfish artwork in the Children’s Area, third generation recycling made from heated sheets of post-consumer plexiglass originally manufactured from recycled milk-cartons. A seventeenth solar panel will operate a motor for additional operation of the mobile.

Many components were manufactured from the source supplier, limiting field-fabrication and assembly time, simplifying the recycling of fabrication waste. Expressed simple, durable materials eliminated layers of finishes typically used in public construction allowing for future sorting and recycling of building materials. Glu-lam timbers, bolted connections, and the avoidance of adhered materials facilitates future recycling of building components.

Similar environmental goals were used for the Ballard collection of furniture. A design based on nested panels allow for maximum use of a 4 x 8 sheet of plywood. Assembly utilizes a series of slots and tabs requiring no fasteners. The furniture ships flat, maximizing the amount of

furniture shipped per load. Architect designed site furnishings use recycled content steel sheet bent to form simple, sculptural seating and waste receptacles. The design saves fabrication energy and cost.

Top Ten Measure 9: Long Life, Loose Fit

Long life, loose fit: Major building components, selected for durability, are recyclable and/or reuseable. The glu-lam roof structure – beams and purlins, are erected with bolted connections. Connectors and timbers are easily salvaged for future use. The aluminum curtain wall is stick framed, much of which can be reconfigured for reuse in smaller projects. Wood and galvanized metal siding is fastened with screws allowing for later salvage and re-use. Demolished concrete may be used as site walls or paving surfaces. The building site was a 40,000 square foot parcel. The Library and Neighborhood Service Center are located on the western portion of the property. The east parcel may be sold for future mixed-use development. Proceeds from this sale will be used to offset the cost of below grade parking. The eastern wall of the garage is structured to allow for the removal of two panels accommodating expanded, shared parking under the future development. A common driveway enables the adjacent parcel to fully develop its street frontage on both NW 56th and NW 57th Streets. The solution - wise land use - was a response to the community's desire for pedestrian friendly streets in the new civic center, allowing greater building density and fewer curb cuts.

Top Ten Measure 10: Collective Wisdom & Feedback Loops

Collective Wisdom & Feedback Loops: This project was a collaborative effort between ambitious owners, users, designers and consultants. The partnership included an informed client and an active, interested public. This combination allowed us to push the limits of green design as a fully integrated series of systems and techniques. The public, informed of the design through a series of public meetings, was able to respond with feedback during and after those sessions. As a result, the public feels greater ownership in the facility. It is truly a community's building. The facility's goals and use provides a perfect opportunity to further educate the community in the benefits and availability of green design. Green design is often seen as adding insurmountable costs to a project. Through the careful integration of building systems and components, and by creatively looking for a multiplicity of functions in all of the systems and components, the Ballard Branch Library and Neighborhood Service Center, has proven that budget need not preclude responsible and responsive design.

Section 5 - Project Economics

Finance: Early detailed cost estimating was paramount to the integration of sustainable design concepts. These ranged from the practical to spectacular. One example of the practical would be the innovative structure for the project. A comparison of the cost of cast in place concrete with spray on insulation from below and a floating slab over rigid insulation and precast planks proved to be surprisingly similar. The added benefits of eliminating heat sinks and possible air quality issues, reducing vibration and noise, and minimizing penetrations between the garage and occupied space made this a simple choice. The clean separation between structure and interior conditioned space also minimized the volume to be conditioned. While the dramatic effects of this system will not be perceived by the general public the benefit of clean exposed surfaces and comfortable interior environment will be enjoyed by all. Highly visible special opportunities such as providing a periscope and observation deck served to leverage the educational value and emotional impact of green components such as the green roof and its devices but also provided numerous naming opportunities for fundraising.

Cost and payback analysis: One of the most direct cost and payback analysis is the site strategy. A bank which was originally part of the project pulled out during the design development phase. The loss of that portion of funding seemed to lead to surface parking as a cost saving option. The design team identified an option which created a dense building on the western edge of the site allowing a 60 foot wide parcel to be sold for mixed use development. While the library was constructed a short plat was developed. The funds from the sale of this property would be earmarked to pay for below grade parking. The portion of the site was maintained as layout space during construction while being marketed for sale. The sale was delayed until construction was complete to maximize the sales price. Knockouts in the east wall of the structured parking further leveraged the neighboring property's value by allowing an option to share a common drive permitting a full 60 feet of storefront on both faces of the through lot. The eventual sale netted \$1,500,000 exceeding the structured parking cost of \$1,044,702 and provided a denser, more pedestrian friendly neighborhood.

Section 6 - Process and Results

PreDesign: During the pre-design phase the design team had inquired about free daylighting services through the Seattle Lighting Lab in Seattle. The modest public budget and state fee schedule did not allow for study models so the Better Bricks Foundation offered a grant to assist with model building. An architecture student was hired to create a model specifically for the study. Daylighting was studied and documented in a series of studies identifying the best options for obtaining even day light throughout the facility. Relites, overhangs, louvers, and placement of opening and skylights were all tuned based on this information. Early studies showed the importance of including adjacent buildings which were important factors in helping to control the harsh western sun. A potential heat buildup problem in the sw corner of the lobby was also apparent. Several louver patterns were modeled attempting to balance solar gain and the transparency desired by the tenant.

Design: In the design phase the team analyzed the problem and identified it as a potential opportunity for solar. A series of inquiries led simultaneously to a grant program through Seattle City Light's Green Power Program and to a new product manufactured by Schott Solar in Germany. Understanding that eligibility for a grant was predicated on educational opportunities we created a concept of a high tech sun dial clearly visible to the general public. The location and function of the building lent itself well to the concept. While SCL would provide traditional panels for educational opportunities it was the first time they were exposed to the new photovoltaic film. A series of brainstorming session which included all parties led to an agreement in which the library was provided with both the photovoltaic film and photovoltaic panels for the roof. As the design developed meters were added to the sills of the wall to allow patrons to understand the relationship between the panels orientation in the curved window wall to the sun and the power being produced. Further design integration led to subtle details such as separating the solar panels and providing clear glass behind the

signage band allowing it to be backlit by the interior lighting for the lobby.

Construction Process: The construction process was successful largely from the dedication of the team based on the all inclusive brainstorming sessions. The commitment to the project was embraced by the contractor and his subs as well. Scheduling an international product is always challenging and this was no exception. A great amount of coordination was required to determine how to obtain the proper size units, whether to manufacture the insulated units in Germany or the US, how to run the wires without compromising the structure of weather protection of the curtain wall, and how to wire the panels to get accurate meter readings at the sills. The shipment was delayed several times and the contractor chose to install temporary glazing to allow efficient conditioning of the space during construction. The architects diagrammed the wiring and routing through the window system after shop drawings were completed. Several team meetings refined the details for wiring and penetrations to assure a properly operating system. Calls to Germany and Schott here in the US and well as personal contacts from all sides were required to assure that the performance was optimized.

Operations/maintenance: Operation and maintenance procedures provided several solutions. A maintenance policy is in place for periodic cleaning of the glass and rooftop panels. Inverters are located in a cabinet beneath a bench in the lobby providing easy access while adjusting and monitoring panel performance. An added benefit from this location is that venting of the heat from the inverters is along the glass assisting with the prevention of condensation.

Commissioning: Commissioning of the solar installation resulted in several modifications. The inverters were oversized which interfered with some of the readings and operation. The supplier replaced these with properly sized units. Individual meters were also not registering due to compatibility with the inverter hookup and this was corrected during replacement. Individual meters in the sills were also conservatively recommended to be 10 amp although panel output was expected to be around 3 amp. While the meters work properly the minimal movement of the needles leaves the novice with an impression that the panels are not producing much power. The meters are being replaced with 3 amp meters in which the public will see a meter that is "pegged out" when in full sun. Psychologically this is a much more powerful impact on the observer and the greater variance in needle positions makes easier to record differences between panels in full and partial sun.

Measurement & verification/post-occupancy evaluation: Measurement and verification for post-occupancy evaluation are provided at several levels. Constant monitoring of window sill meters occur with class exercises tracking and studying the sun's movement, performance can be checked at the inverters, multiple residential style meters record the power production of both film and rooftop panels, and SCL is linking the meters to their website allowing real time remote monitoring of the systems performance. So far, all feedback has surpassed the team's expectations.

Rating System Name: No rating of this project was pursued
Version:
Rating Date:
Score or rating level:
Credits:

Sections 7: Visuals

Exhibit A

context plan.jpg



Image has been scaled down. Click it to view actual size...

Description:

Context Plan

Exhibit B



exploded axonometric.jpg

Image has been scaled down. Click it to view actual size...

Description:

axonometric

Exhibit C



roof axonometric.jpg

Image has been scaled down. Click it to view actual size...

Description:

Roof Axonometric

Exhibit D



plan.jpg

Image has been scaled down. Click it to view actual size...

Description:

Plan

Exhibit E



NSE_Elevations.jpg

Image has been scaled down. Click it to view actual size...

Description:

North, South and East Elevations

Exhibit F



Elevation_Section.jpg

Image has been scaled down. Click it to view actual size...

Description:

West Elevation and Section

Exhibit G

PV_axon.gif



Image has been scaled down. Click it to view actual size...

Description: Photovoltaic Glazing Axonometric

Exhibit H

furniture3.jpg



Image has been scaled down. Click it to view actual size...

Description: "Ballard Collection" furniture designed by Architect.

Exhibit I

View from 22nd Ave.jpg



Image has been scaled down. Click it to view actual size...

Description: View from 22nd Avenue Northwest.

Exhibit J

green roof.jpg



Image has been scaled down. Click it to view actual size...

Description: View of Green Roof.



Our thanks to the U.S. Department of Energy and the National Building Museum for co-sponsoring this program, and to BuildingGreen, Inc. for hosting the submission and judging forms.