City of Spokane
Riverfront Park Master Plan- Facility Assessment

SPOKANE, WA
09 MAY 2014

FOR THE LIFE OF YOUR BUILDING

Executive Summary

Overview

The City of Spokane Parks & Recreation Board and Department is currently undergoing the effort to develop a master plan for its Riverfront Park property. The Riverfront Park master planning project director asked McKinstry to consult on the development of a budget level life cycle costing analysis focused on incorporating energy efficiency and sustainability strategies into the ultimate master plan for the park. To this end, McKinstry completed the Life Cycle Cost Analysis and work delivered these work products:

- Conceptual energy efficiency and sustainability strategies for the Riverfront Park Master Plan.
- Developed Rough Order of Magnitude (ROM) budget level life cycle costing analysis around the developed conceptual strategies focused around the following primary areas of the Master Plan:
    - Energy efficient/sustainable HVAC design for new ice rink/gondola building.
    - Energy efficient/sustainable HVAC design for new carousel building.
    - Energy efficient/sustainable HVAC design for renovated Pavilion building.
    - Energy efficient/sustainable HVAC design for event pavilions.
    - Sidewalk snowmelt/ice rink available heat.
    - Central plant tie-in for Carousel/ice rink/snow melt.
    - LED/Solar pathway lighting.
    - Other small scale renewable, solar/wind.
- Worked with the Project Director to develop presentation materials for delivery on May 5th, 2014.

METHODOLOGY | McKinstry leveraged its deep domain knowledge of sustainability and energy efficiently planning and innovative approaches to review existing buildings, their energy use, and previous development of energy conservation and facility improvement measures, to determine potential energy efficiency and sustainability strategies that have the potential to be included in the Riverfront Park Master Plan development. We incorporated ways to analyze a "total cost of ownership" approach to these elements in order to help the Parks staff and board determine both up front and long term operational costs for various options. While this will be at the Rough Order of Magnitude (ROM) level which does NOT include actual engineering; it provides ROM level costs to base decisions on as to which elements fit on both a preferred Facilities Improvement Measure (FIM) as to energy savings and total cost of operations over time, not just first cost basis.

McKinstry completed the following analysis:

- Review of previously evaluated sustainable and energy efficiency projects and incorporate additional ideas to determine appropriate strategies for the Riverfront Park master plan.
- Developed budget level life cycle costing analysis around the recommended strategies. This analysis included costing, energy savings calculations, and operational savings analysis for each strategy as applicable.

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- Attended Park Board Riverfront Advisory Committee meeting on May 5th, 2014 and presented and discussed recommended conceptual strategies.
- Prepared post May 5th meeting materials into an Executive Summary (this report)

Findings

Efficient HVAC Design

With the level of detail the current of conceptual designs contain, we did not go deep into comparison of different HVAC systems for the new or renovated systems, as the appropriate design for each building will completely depend on the final design. Some of the more advanced types of HVAC systems on the market today include Geothermal/Ground Source Heat Pumps, Radiant slab heating and cooling, Chilled Beams, Evaporative Cooling, Variable Refrigerant Flow, and many more. All of these systems vary both with efficiency and installation cost, and the correct selection of one system is completely dependent on the application. Below we talk about one specifically that may be appropriate to the specific applications in the Riverfront Park Master Plan.

Geothermal Heat Pump

Ground-source heat pump is the name for a broad category of space conditioning systems that employ a geothermal resource – the ground, groundwater, or surface water – as both a heat source and sink. GSHPs use a reversible refrigeration cycle to provide either heating or cooling. GSHPs operate in much the same manner as air-source heat pumps. Both use a compressor to move refrigerant around a closed loop, transferring heat between an indoor coil and another coil where heat is absorbed or rejected. As the name implies, an air-source heat pump (ASHP) uses outside air, flowing over its outdoor coil, as the heat source and sink. The main drawback of ASHPs is that their performance depends on ambient air temperature, which can vary by as much as 100º over a year. Both the capacity (i.e., the ability to produce heating and cooling) and efficiency of an ASHP are significantly reduced at the extreme temperatures experienced in summer and winter. A GSHP, on the other hand, uses a geothermal resource as its heat source and sink: the earth itself, a body of surface water, or water from a subsurface aquifer. Unlike ambient air, the temperature of the earth, beginning just five to ten feet below the surface, is relatively constant, and provides a much better heat source and sink for a heat pump. The same is true of water from subsurface aquifers, as well as water from surface bodies at only slightly greater depths. The geothermal resource is generally cooler than outdoor air in the summer and warmer in the winter. For this reason, GSHPs are more efficient than air-source heat pumps.

The technical feasibility of GSHPs depends on the availability of geothermal resources and the specifics of the application. Given an ample supply of ground water (and an acceptable means of disposing of it), an open-loop system may be a viable option. Such systems usually include a plate heat exchanger to transfer heat between the ground water and a common water loop inside the building; zone heat pumps exchange heat with the common loop. Surface water from lakes and streams can also be used in an open loop system, but applications are usually limited to warmer climates, or to cooling-only applications in colder climates. In closed-loop designs, the earth itself can be used as the heat source and sink by way of vertical or horizontal ground-coupled heat exchangers. Most large systems use vertical heat exchangers, which consist of polyethylene u-tube pipes in deep (typically 150-250 feet) boreholes. Horizontal loops require more land area, but are usually less costly to install, depending on the types of soil and rock formations encountered at the site. Closed loops can also be located in lakes, ponds and other bodies of surface water.

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Snow Melt

The City has expressed a desire to incorporate surface snowmelt into the future design of the park master plan. There is a unique opportunity with the heat pumps discussed above, to utilize the waste heat produced by maintaining the ice rink ice, to provide adequate heat to a hydronic in-slab snow melt system. At a typical heat output of 100 Btus/SF and an anticipated Heat Pump Chiller size of approximately 200 Tons, this system could theoretically provide 24,000 Square feet of snow melt coverage. Many issues would need to be considered when going to full design of this system, including the snowmelts performance in relation to what material the new walking surface consists of, in relation to the water table location, and the frost line depth.

Central Plants

Incorporating the HVAC systems of multiple buildings and systems will always help to reduce overall construction cost, and increase total efficiency by maximizing load sharing and targeting proper control of less pieces of equipment. For the current Master Plan, McKinstry is proposing that the two main areas of the park, The South Channel and the North Bank, be incorporated into one central system each, each with its own set of Geothermal wells and snowmelt systems. Our preliminary analysis does not suggest one central system would be optimal for the park as there are greater distances between the different zones of the park. Therfore, we are recommending these two main areas for integrated systems.

LED, Solar Area Lighting

A worldwide push for LED outdoor lighting occurred in 2012, due in large part to various national and international political initiatives. 2 million LED luminaires were installed in tunnels and roadways during the year. Prices are forecasted to decline due to market competition. Energy consumption will continue to be a pressing issue as electricity cost and demand rise. The demand for more efficient and longer lasting LED lighting will continue to grow at an aggressive pace.

Solar/Wind

Typical Solar availability for Spokane is around 1,200 equivalent full load hours, and at a minimum of installed cost of $4/Watt, paybacks without incentives approach 50 years. Average wind speed for Spokane is 5.25 m/s Areas with annual average wind speeds around 6.5 m/s and greater at 80-m height are generally considered to have suitable wind resource for wind development. Take advantage of the wonderful made-in-Washington incentives. The State of Washington, in an effort to promote renewable electricity generation, is purchasing solar and wind generation at $.15/kWh until July 2020. If the inverter is manufactured in Washington state the $.15 is boosted to $.18/kWh. Solar modules made in WA earn $.36/kWh and if both models and inverter are made in WA you earn $.54/kWh.

Facility Summary

Below is a discussion on the columns and assumptions made in the attached Facility Summary Table.

EXISTING CONDITIONED SQUARE FOOTAGE

As provided by City of Spokane in the Riverfront Park Master Plan program listing.

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EXISTING EUI/ENERGY COST

EUI is a measurement of annual energy use, in a common energy unit and adjusted by conditioned square footage. This energy use and associated cost was determined in a variety of ways, dependent on the data available.

Fountain Café – This building does not have a full year of existing energy bills, a simple extrapolation of the provided bills to the full year was done to estimate annual energy use.

Carrousel/Skyride/CPM – These buildings have dedicated energy meters and an average of several years of use was used.

IMAX/Pavilion Admin – These buildings share energy meters, and energy cost was divided proportionally according to each space's square footage.

Pavilion – The energy meter most likely attributed to the lights, rides, and ice rink chiller was attributed 100% to the Pavilion.

EXISTING OPERATIONS AND MAINTENANCE COST

For all of the current occupied buildings, the City is under a preventative maintenance contract with DIVCO, to provide service to the HVAC systems in the conditioned buildings at both Riverfront Park and the Dwight Merkel Complex for just under $40,000. This contract was divided proportionally according to each space's square footage. Seasonal Labor and material cost was provided by the City and attributed to the existing snow removal line item.

PROPOSED EUI/ENERGY COST

Using engineering and historical knowledge, proposed energy use indexes were assigned to buildings, accounting for their specific use profile and assuming the building was built or renovated to an energy code level minimum value, as well as was operated efficiently. Costs were assigned to the buildings based on these EUI's and the new proposed square footage.

PROPOSED/ENCHANCED OPERATIONS AND MAINTENANCE COST

The same cost per square foot that was used in the baseline/existing operational and maintenance cost, was assigned to the master plan proposed square footage for the proposed cost. For the snow melt line item, the baseline cost was assumed to be completed eliminated.

ENHANCED EUI/ENERGY COST

Using engineering and historical knowledge, enchanced energy use indexes were assigned to buildings, accounting for their specific use profile and assuming HVAC systems were built as discussed earlier in the report, with two main central plants that incorporated Ground Source/Geothermal Heat Pump Chillers. Costs were assigned to the buildings based on these EUI's and the new proposed square footage.

ENHANCED BUDGET COST

Rough order of magnitude cost impacts for installing the discussed systems were calculated by building, assuming that $10/square foot was already being accounted for in the current master plan budgeting for HVAC. The costs for the two sets of central plants and 24,000 SF snow melt systems were attributed to the Pavilion admin, and Ice Rink Line items respectively.

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Conclusions

The Energy Facilities Summary matrix is presented as a tool to review different options that the Parks Board and Staff can utilize to review both the energy usage and operational impacts of current facilities compared to upgrades of existing infrastructure and building facilities, as well as what can be achieved with new energy code standards for any buildings which would be replaced. While this is a ROM level analysis it is an effective way to look at what EUI's are for various buildings, what they should be for well performing buildings and how updating its buildings can save the Parks department both energy and operational costs as the current properties are in disrepair and being used in a variety of ways that differ from their original purpose, and therefore do not operate optimally. We further analyzed what higher levels of performance beyond minimum current energy code levels, and what the benefits and cost to achieve for those increased energy efficiency changes would entail. This is provided as a backdrop to encourage a total cost of ownership approach versus a first cost only approach. Our analysis led us to recommend that updating all building stock to current code is where the Parks department and Board will gain its greatest impact. Going beyond new energy code and proper operation on existing building upgrades or new buildings within a financial only analysis is not warranted. However, if the Parks board wants to be even more inspirational and further honor the environmental stewardship of Expo 74, then the impact of attaining enhanced energy performance and LEED certification should be reconsidered as this could be viewed as a worthy accomplishment for an Expo centered around environmental stewardship.

We believe there are several other key components to be considered in how Riverfront Park positions itself which could also decrease energy use. These are elements related to the use of non-energy powered "rides" or ride replacements. This in no way is to indicate getting rid of the Carosel or the Gondola. Those are excellent attractions that help define the park. The new Carosel building can be made energy efficient even with a much larger footprint thereby saving operational costs. Rather the addition of human powered play could position the park as more natural and also be good for increasing the play factor which is also good for community wellness. Adding items like swings, slack lines, climbing toys, slides, playgrounds, etc would bring back the action into play adding to wellness while being accessible to all income levels. We also believe it would help the park create more community moments and bring people together more to utilize the park regularly vs those times when one goes to the park for a more expensive ride experience.

Overall, we recommend that this ROM level analysis be utilized to help the Park staff and Board understand the cost of various options. We realize that everything is still at conceptual level, and as such can only be estimated as to the energy usage and costs. While this provides those rough order of magnitude level costs this should not be construed to be actual costs. Detailed design engineering would need to be done to know the budget impact of final numbers. Utilizing a design build approach would be beneficial to the central systems approach and the integration of the various park components into one ecosystem. There would be additional educational value which would create increased awareness of the Park's department and board stewardship of our beautiful park on the Spokane River.

Our further recommendation would be to think holistically about the energy and water components of the park from design to build. Systems can be deployed in clusters of infrastructure where we can achieve the greatest energy efficiency in zones of the park.

Facility Summary

Project	City of Spokane Riverfront Park Master Plan
Date	5/9/2014

EXISTING BUILDINGS	Existing Conditioned SF	Existing EUI (kBtu/SF/Year)	Existing Energy Cost	Existing O+M Cost	PROPOSED BUILDINGS & EXISTING TO REMAIN	Proposed Conditioned SF	Proposed EUI (kBtu/SF/Year)	Proposed Energy Cost	Proposed O+M Cost	Enhanced EUI (kBtu/SF/Year)	Enhanced Energy Cost	Enhanced O+M Cost	Enhanced Budget Cost	Potential Avista Incentive
Fountain Cafe	1,300	60	$1,500	$878	Fountain Café	1,300	60	$1,500	$878	40	$1,000	$878	$9,750	$1,271
Carrousel	9,288	114	$17,000	$6,269	New Carrousel Building	22,685	75	$11,184	$15,312	60	$8,947	$15,312	$170,138	$5,686
Skyride Ticketing	800	363	$8,500	$540	New Ice Palace, Shared Ticketing RR with Skyride	4,485	75	$15,000	$3,027	60	$12,000	$3,027	$33,638	$7,626
	N/A	N/A	N/A	N/A	New Visitor Center/Bicycle Rental	1,300	60	$1,500	$878	40	$1,000	$878	$9,750	$1,271
Post Street Restrooms	0	0	$0	N/A	Demolished	0	0	$0	$0	0	$0	$0	$0	$0
Lower Level IMAX/Tower	14,495	209	$47,020	$9,784	Park Maintenance & Staff	13,853	60	$13,499	$9,351	40	$8,999	$9,351	$103,898	$11,438
East Pavilion	N/A	N/A	$15,000	N/A	Demolished	0	0	$0	$0	0	$0	$0	$0	$0
Pavilion	0	0	$53,000	N/A	Pavilion/Amphitheatre/Band Shell/Back of House	4,910	45	$4,000	$3,314	30	$3,500	$3,314	$36,825	$1,271
Pavilion Administration	24,039	209	$77,980	$16,226	Pavilion Administration	24,039	65	$24,252	$16,226	45	$16,790	$16,226	$1,905,293	$18,969
Forestry Shelter	0	0	$0	N/A	East Havermale Pavilion	2,860	45	$2,500	$1,931	30	$2,000	$1,931	$21,450	$1,271
Canada Island Storage	0	0	$0	N/A	Canada Island Pavilion	2,200	45	$2,000	$1,485	30	$1,500	$1,485	$16,500	$1,271
North Bank Shelter	0	0	$0	N/A	North Bank Pavilion	4,400	45	$3,500	$2,970	30	$3,000	$2,970	$33,000	$1,271
CPM Building	9,267	115	$15,000	$6,255	Demolished	0	0	$0	$0	0	$0	$0	$0	$0
Ice Rink/Snow Removal	x15,725	0	N/A	$12,141	Ice Rink/Snow Removal	x18,000		$55,000	$0	N/A	$43,000	$0	$1,725,000	$30,504
Totals	**59,189**		**$235,000**	**$52,093**		**82,032**		**$133,935**	**$55,372**		**$101,736**	**$55,372**	**$4,065,240**	**$81,849**