Port of Seattle

P.O. Box 1209
Seattle, WA 98111-1209
Tel: 787-3000

www.portseattle.org

SUSTAINABLE DESIGN APPROACH
WORLD TRADE CENTER WEST (WTCW) ROOF REPLACEMENT

PURPOSE

This serves as a summary document for the sustainable design coordination for the World Trade Center West (WTCW) Roof Replacement project. Additional information can be found in Project Management's Notebook.

SUSTAINABLE DESIGN APPROACH

The WTCW Roof Replacement project has been identified as a Tier 2 project under the Sustainable Evaluation Framework Policy Directive (SEF Policy Directive) adopted by the Port of Seattle Commission in January 2020. Tier 2 projects are described as:

> *Tier 2: Medium-sized, or more complex, projects that have opportunities for sustainability benefit would be subject to targeted sustainability analyses and strategies. Tier 2 projects may receive a cost per ton of carbon calculation.*

The scope of the project is to replace the existing 17,000 square foot roof on top of the WTCW building.

Figure 1. WTCW Roof Replacement Project

Following the project kickoff meeting, the Project Manager and Sustainability Coordinator assembled a *Sustainable Project Assessment and Review Collaboration* (SPARC) team The SPARC team leverages port expertise and knowledge of existing and emerging sustainability practices to:

(1) Identify, review, brainstorm, and recommend sustainability concepts and ideas for project and operational teams to consider and evaluate during the development and design stage of port projects.

(2) Encourage project and operational teams to evaluate and consider innovative strategies to reduce emissions and energy use beyond traditional approaches.

(3) Select and apply the relevant Sustainable Evaluation Framework criteria to highlight tradeoffs and benefits during development of the Sustainable Design Approach (SDA).

PROJECT GOALS

The SPARC team met in August 2021 to solidify project goals which were shared with the designer to identify potential design alternatives/strategies moving into the 30% design process.

- **Energy Efficiency and Environmental Health**
  - Reduce heat island effect within the urban core
  - Explore opportunities to reduce the building's and construction project's carbon footprint (ie, buy local, material reuse, recycled content, energy efficiency)
  - Explore solar and Green Roof Technology
  - Utilize construction best management practices
- **Sustainable Asset Management**
  - Maximize total cost of ownership
  - Consider ease and frequency of maintenance
- **Materials**
  - Reuse materials if possible
  - Consider environmentally-friendly alternative materials
  - Reduce waste
- **Financial Sustainability**
  - Balance project cost and function against environmental benefits
- **Impacts to Tenant**
  - Ensure a safe project
  - Minimize tenant and visitor disruptions

SUSTAINABLE EVALUATION FRAMEWORK CRITERIA

The goals identified by the SPARC team support three of the seven criteria articulated in the SEF Policy Directive:

- **Reduce GHG Emissions/Protect Health and the Environment.** This project focuses on the replacement and upgrade of existing infrastructure while limiting environmental impacts. Goals focus on materials, reduction of carbon footprint, and construction best management practices. The project will explore that incorporation of solar.

- **Increase Resilience.** The proposed improvements will upgrade the existing roof, limiting future damage to the existing structure and upgrading the roof to meet current code requirements.
- **Advance Innovation.** This project will explore the option of installing a green roof, which has not been utilized by the Port before.

SUSTAINABLE DESIGN STRATEGY

The aforementioned goals were used to evaluate three design alternatives, two of which were analyzed as feasible alternatives. A cost-benefit analysis was assembled for each alternative and recommendations were presented to the project sponsors in October of 2021.

DESIGN STRATEGIES

- **Alternative 1: In-kind System.** This was the original design plan for the project. This entails installing new insultation where necessary, replacing the existing roof membrane, and installing a roof overlay. For sustainability measures, design is reusing as many materials as are feasible (ballast, insulation). Since this is an in-kind consideration, it was moved forward for further consideration.

- **Alternative 2: Green Roof.** This design alternative considers the installation of green roof technology. Elements include leaving the existing insulation and roof membrane in place, installing a new membrane over existing, reusing as many materials as possible (ballast), and installing approximately 11,000 square feet of green roof. This design allows for additional environmental benefits and is technically feasible (ie, weight is comparable to weight of existing ballast), so was moved forward for further consideration.

- **Alternative 3: Solar.** This design alternative considers the installation of solar technology. Elements include leaving the existing insulation and roof membrane in place, installing a new membrane over existing, reusing as many materials as possible (ballast), and installing solar panels. This alternative was not carried forward due to glare and reflection concerns on neighbors, poor positioning for solar energy, and constraints with the existing roof to hold the additional weight of the solar panels.

SUSTAINABLE DESIGN ALTERNATIVES ANALYSIS

A cost-benefit analysis was prepared for Alternatives 1 and 2. Table 1 provides the summary matrix of how each alternative meets the project goals. It was determined that Alternative 2, Green Roof, is preferred since it provides multiple environmental benefits at a moderate cost increase. This is the first green roof the Port will install and can serve as an innovative pilot project for consideration at other sites in the future. Additional details are provided below.

- **Alternative 1: In-kind System.** An in-kind replacement roof is the lowest cost alternative but does not provide any environmental benefits and continues to contribute to typical issues facing developed areas (heat island effect, high temperature runoff, carbon footprint, minimal habitat, etc).

- **Alternative 2: Green Roof.** Use of a Green Roof provides and innovation example and an opportunity for the Port to pilot a new technology and achieve significant environmental benefits in a location where none were previously. This alternative reduces heat island effect, sequesters carbon, retains stormwater, reduces runoff temperature, creates additional pollinator habitat, and provides additional rooftop insultation and interest to those tenants with a site line to the roof. The initial and 20-year life cycle cost is more expensive than in-kind replacement, but green roofs can potentially last for up to 50 years if maintained properly.

Table 1. Alternatives Analysis WTCW Roof Replacement

	Energy Efficiency and Environmental Health				Materials	Sustainable Asset Management/ Financial Sustainability			Tenant Impact	
	Heat Island Effect Reduction	**Carbon Footprint Reduction**	**Stormwater Retention/ Protection**	**Habitat Creation**	**Reuse of materials**	**ROM Cost**	**Life Cycle Cost (20 years)***	**Maintenance Requirements**	**Tenant Disruption**	**Aesthetics**
Alternative 1 *In-Kind Replacement*	Ballast creates a heat sink	No additional	No additional	None	Ballast and insulation	$48/SF ($1.34M)	$98/SF ($2.02)	Regular inspection	Construction noise	Neutral
Alternative 2 *Green Roof*	Ballast area reduced	37.5g/SF	Water retention and mitigation of high temperature runoff	Pollinator habitat	Ballast and insulation, ballast reuse offsite (habitat or stormwater)	$108/SF ($2.28M)	$163/SF ($3.36M)	Regular inspection	Construction noise, provides additional noise insulation	Visual interest for tenants with site line to roof

Coloring is to provide easy translation of pros and cons. Green is a benefit to the alternative, red is a detriment for the alternative. Orange is considered neutral.
*Green roof could have a life up to 50 years, which would bring the life cycle costs closer in line with one another.