Volunteer Park Amphitheater Project
Schematic Design: Phase I
Volunteer Park Trust
ORA + Walker Macy
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EXECUTIVE SUMMARY

In May 2016, Volunteer Park Trust moved forward with ORA and Walker Macy to develop the concept design for a replacement outdoor Amphitheater in Volunteer Park. This first phase of Schematic Design was funded by a grant from the Seattle Department of Neighborhoods “Small and Simple Projects Fund” and Volunteer Park Trust. In this phase the consultant team completed concept design for Volunteer Park Amphitheater, building upon findings from the feasibility study conducted by the team that concluded in March 2016. Through this Schematic Design phase the consultant team established design intent for future architectural and landscape improvements to the amphitheater, including new stage, backstage support, public restrooms, access and conceptual intent for related park improvements, including grading and circulation enhancements. An acoustic study and additional public outreach were also conducted as part of the concept development.

COMMUNITY OUTREACH AND ENGAGEMENT

This phase of the project built upon the extensive outreach, interviews and meetings conducted during the feasibility study with additional outreach to user groups, neighbors, and daily park users. On August 31st, the project team presented the design studies in a major Public Meeting, gaining valuable insights from community members.

LANDMARKS BOARD REVIEW

On September 2nd, the project team presented several concept studies to the Architectural Review Committee of the Seattle Landmarks Preservation Board to continue their engagement with the project. A presentation to the entire Landmarks Preservation Board was done at the end of the feasibility study, so this presentation was intended as an update on the progress of the project. The Board was receptive to the preliminary studies presented, particularly where there was opportunity to restore original elements of the Olmsted design intent and reference the other architectural pieces of the park.

CORE PRINCIPLES

The following core set of principles that emerged as fundamental during the feasibility study continued to guide the process through the first phase of Schematic Design:

- **Enhance Olmsted Landscape** (distinctive character that respects original Olmsted vision)
- **Improve Quality of Space for Daily Park Users** (design for non-event / informal use and views)
- **Broaden Performance Diversity - Not Size** (existing 500-600 primary audience capacity is optimal)
- **Provide Accessibility for All** (full ADA compliance – pathways, audience, and backstage)
- **Improve Acoustics and Noise Control** (physical acoustic improvements + tighter event management)
- **Improve Safety and Access** (parking and traffic; lighting; improved visibility and safety)
EXECUTIVE SUMMARY - CONTINUED

SITING & ACCESS

The site analysis and alternative studies resulted in the following key recommendations:

**Accessibility:** recommend upgrades to existing pathways along south and west edges of the great lawn area to create an accessible route from Volunteer Park’s primary Boulevard to the stage area. Provide ADA compliant grades and surfaces with added handrails at limited areas where required, integrated carefully to minimize modifications to the existing landscape.

**Orientation and Landscape Enhancements:** recommend moving stage north of existing location as explored in preliminary concept studies. Advantages include a) intimate “outdoor room” created by the trees and grading of the new site; b) reintroduction of a key Olmsted pathway; and c) more idyllic view from the great lawn; d) improved surveillability of public restrooms.

MANAGEMENT OF THE AMPHITHEATER SPACE

A key issue identified in reviews with neighbors and in the Public Meetings was the strong desire to establish more active management and more stringent noise limitations by the Department of Parks and Recreation. There was also strong interest in developing a method of assuring that the range of performance uses are both diverse and compatible with other park uses. To assure project success and broad community support, it will be important to develop this management plan with clear criteria in parallel with developing the project design.

DESIGN PROGRAM

The design program includes comprehensive recommendations for the entire amphitheater space. The stage, backstage, open lawn area, pathways, and related site work should integrate seamlessly with the surrounding park to create a unified space which respects and enhances the historic Olmsted landscape. The design should be optimized for everyday non-event uses and diverse performances. The key design program elements are as follows:

**Stage:** provide a 1200 sf stage floor surface, nominally 30’ deep by 40’ wide; provide a resilient floor surface (concrete is problematic for actors and precludes dance performances). Provide backstage entry positions for improved performer access.

**Backstage:** provide a flexible space that can be used as a changing/staging space (+500 sf), 2 single restrooms, and a storage area (100 sf). Spaces should be flexible to accommodate summer youth programs and daily use of the pavilion. Provide an outdoor space behind the backstage area for loading.

**Acoustics and Weather Protection:** recommend integration of a translucent roof over the stage for improved acoustics and weather protection when the stage is in use. In-depth exploration and review of on site acoustics done during this phase is described more completely in the acoustics section of the report.

**Lawn & Amphitheater Seating:** maintain continuous lawn area for optimal flexibility. Limited integral bench seating at front edges of space was considered but is not desired due to the desire for flexibility for other uses. Provide continuous ADA compliance accessible pathways from ADA parking spaces to ADA compliant seating areas within the lawn area.

**Public Restrooms:** the current outdated and normally closed public restrooms are proposed to be replaced with new public restrooms with fixture counts and access as described in the detailed program. The new public restrooms, to be integrated within the design of the new amphitheater, will include fully accessible men’s, women’s, and universal / all-gender facilities consistent with City of Seattle requirements for new facilities.
OVERVIEW OF PROCESS

The basis for the beginning of Schematic Design was the Volunteer Park Amphitheater Project: Feasibility Study and Design Program, a report developed by the design team completed in March 2016. The report analyzed the existing building, site conditions, and the needs of performing groups and daily park users. This report informed the design process relative to site improvements and program of the project. The first step during concept development was to test the site for the full range of potential uses with the least impact on the restorative experience of the park. Options were developed using physical and digital models as well as plan and section studies. One of the options developed during this exercise re-envisioned the backstage space as more open, allowing the amphitheater to function as an open pavilion when not in use for a performance. The test fit options were then vetted through meetings with user groups, the parks department, neighbors, and others to better understand the needs and desires of each group within the context of the studies. From these conversations came the development of a Preferred Concept Design option. This option was presented at the public meeting in at the end of August with discussion and comments welcomed after the presentation to aid in moving the design forward to Schematic Design: Phase II, the completion of Schematic Design.

This Schematic Design: Phase I report, including public comments, provides the basis for evaluating next steps, laying the groundwork to proceed with design. It is important to note that this early project phase focused on a design concept for Amphitheater form and plan, and does not include complete schematic design. While conceptual studies have been developed to facilitate dialogue and discovery, this concept phase does not represent final design decisions for materials and systems.

Schedule Outline

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SITE INVENTORY AND ANALYSIS

The site inventory and analysis identified the following key considerations as described in the site plan below and the enlarged plan on the following page.

**Sun Orientation:** the yellow arc represents the sun path at summer solstice. The current stage location and orientation creates significant glare and visibility issues, since the audience faces southwest, looking directly toward the sun in late afternoon and early evening. In summer, the new site eliminates afternoon glare, but the sun is still an issue around sunset. See diagrams on the following page.

**Accessible Route:** there is currently no ADA compliant accessible route to the stage or the lawn seating area in front of the stage. The existing pathway from the main Concourse to the stage area and front of the lawn exceed in some areas the 5% maximum slope allowed without handrails. The pathways should be upgraded to meet accessibility requirements with relatively minor regrading, improvements to walkway surfaces, and with added handrails at limited areas, integrated carefully to minimize modifications to the existing landscape.

**Lawn Slopes and Grading:** the dotted lines show two foot contour lines, demonstrating the steeper grades and flat area in front of the current stage integrated in the 1971 amphitheater construction. (The original Olmsted grading maintained a gradual grade to the edge of the forested area.) For this phase, Walker Macy took a more detailed look at grading of the park to determine what was possible. Those findings are on the following page.
ACCESS AND GRADING

A closer look at the grading of the lawn and paths done by Walker Macy, landscape architects, gave the project a clear scope of area needed to create an ADA path to the stage seating area, create a new bowl for the amphitheater, and return the primary slope of the lawn to the original Olmsted contours. That limit of work is shown below.
SITING

The topography poses a challenge for rotating the amphitheater as far north as shown in the feasibility study. The updated siting study and comparison to the original park planting plan is shown below.

PROPOSED STAGE RELOCATION

OLMSTED PLAN WITH ORIGINAL PATHWAY
COMMUNITY AND USER ENGAGEMENT

ORA and the consultant team worked closely with Volunteer Park Trust and Seattle Parks and Recreation to develop an extensive outreach process and attempt to identify and explore as many different perspectives as possible, through an inclusive, transparent community consultation process. The goal of conducting outreach was to capture the dreams and concerns of the community, park neighbors, everyday park visitors, performance groups and performance attendees.

GOALS OF THE COMMUNITY AND USER ENGAGEMENT PROCESS

The aims of the community and user consultation process were to:

• Understand and address the dreams and concerns of the community, neighbors and everyday park visitors
• Explore the full range of desired functionality and appearance of the amphitheater
• Develop a facility that meets the needs for new and existing users
• Coordinate with the Volunteer Park Trust and Seattle Parks staff to identify and address operational issues
• Develop proposals which respect and enhance the historic Olmsted vision for Volunteer Park
• Encourage active dialogue and understanding of all community needs and goals
• Develop a shared vision with strong community support

The team gathered information on spatial needs by interviewing focus groups of performance and community organizations that currently use the performance space, as well as other parties interested in using an improved facility. The preliminary results were shared at a public meeting in August where local community members were invited to provide feedback on the Preferred Concept Design.

Comments from the outreach meetings are summarized in the following pages and incorporated into the suggestions presented in this report. The report itself is a part of the input process intended to allow interested parties to examine the issues surrounding the existing performance space, and respond as the design of the project develops.

VOLUNTEER PARK TRUST - STEWARD OF COMMUNITY PROCESS

ORA worked closely with the Volunteer Park Trust and Seattle Parks and Recreation to develop the overall engagement and interview process, with a focus on assuring that as many perspectives as possible were identified and explored throughout the first phase of Schematic Design and review process. The Volunteer Park Amphitheater Project Task Force was actively involved in nearly all the interviews and outreach, providing strong continuity and insights, with deep understanding and responsiveness to community concerns.

A representative from Parks and Recreation was also actively involved in key reviews and community meetings as well as the monthly Task Force meetings, maximizing the collaborative discovery process and assuring that Seattle Parks was aware of and responsive to community concerns and operational issues.
INTERVIEWS: PERFORMANCE GROUPS

One focus meeting for performance groups was held at the ORA office on July 25th to review the concept development. Groups interviewed included: 12th Avenue Arts, Seattle Shakespeare Company, and Seattle Chamber Music Society.

The comments from the performing arts groups often overlapped, with the synthesized feedback summarized as follows:

Stage

• Surface - The theater groups requested that the stage surface be more resilient than concrete for performances. The music performers don’t mind a concrete surface, but a more resilient surface would not be objectionable. Options discussed for the surface were rubberized surface similar to those found in some outdoor play grounds and Skatelite/Richlite, a high durability outdoor product made of a partially recycled paper composite.

• Shape - The base assumption for the stage space is a 30 x 40 foot rectangle of clear space, but three different shapes for the stage were presented. The performers indicated that all shapes would work. For theater, a stage with a curved front seemed most preferable. The Chamber music society indicated that they would prefer a stage shape that discouraged people from sitting to the side of the performers, making the seats in front of the stage more preferable to create a more compact audience.

Roof & Systems

• Cover - Some sort of roof cover from the elements was unanimously important.

• Attachments - The framework of the for rigging lights and speakers was highly desirable as well. Details such as stage screws, etc. for rigging were noted as important elements as the design moves forward.

• Systems - It was discussed to what extent the amphitheater design should incorporate sound and lighting systems. All performance groups indicated that incorporated sounds systems were undesirable. The groups prefer to bring their own systems than to rely upon a system installed in place and would worry about the life of that system as there are frequent advancements in the field. A basic lighting system would be desirable, but more complex stage lights could be provided by the performers if needed.

Backstage Support

Options for enclosed backstage area and open were both presented. There was positive response to the open backstage area all around. The flexibility of operable backdrop excited the performers as staging could either have a traditional, closed back stage, or do something creative with the visibility through the amphitheater to the park behind.

Access

There were comments regarding the loading area in terms of turn around and parking. The preferred option would be to have some sort of loading area on the north side of the stage so that if the backstage was left open, trucks would not be visible through. It would also be best if the grasscrete drive to the backstage allowed for pull through instead of just turn around. This is especially important for events like the Seattle Outdoor Theater Festival where groups overlap set up and break down back stage for smooth transitions between performances.

COMMUNITY ENGAGEMENT  Volunteer Park Amphitheater Project
INTERVIEW: FRIENDS OF SEATTLE’S OLMSTED PARKS

The team did a presentation of the Preferred Concept Design to the Friends of Seattle’s Olmsted Parks on August 1, 2016 to get them involved in the design process. Overall opinion of the design development was positive and the group seemed excited about the potential of the new space. The reintroduction of the original Olmsted path was the most desirable element of the design and siting.

INTERVIEWS: NEIGHBORS

A meeting was held for neighbors of the park in the lawn in front of the existing performance stage. Those interviewed use the amphitheater facility frequently for a variety of activities ranging from walking past it with their dogs, to stopping by for various events, to playing on the stage itself.

As the meeting was in the park, most of the discussion during this meeting was in regards to the siting of the stage and the amphitheater’s impact on the park. The primary issues discussed were as follows:

Sun angle

As the regrading requirements restrict the rotation of the stage to the north, there was concern that the sun angle was not as ideal as projected in the feasibility study. The sun angle is better for afternoon performances from 1-4 PM, but the sunset in the summer is far enough north to cause glare in the late evening. Those in attendance felt that the other benefits for the park and performance space outweighed the

Location

Although the new site was preferred to the old one, there were a few comments on the site plan:

• The two trees behind the stage are not very healthy and one neighbor wondered if the trees were removed, could the amphitheater be moved closer to the loop road for better access there and simpler loading. During the concept development with Walker Macy, it was determined that the further down the hill, the more difficult ADA access to the front of the stage would be, so moving the site would have to be carefully considered.

• There was also concern about the rotation of the stage, as mentioned above. Again, grading was the determining factor, so this may be challenging to shift much further.

• There was a comment about the amount of and complexity of paths and access to the amphitheater and public restrooms off of the primary circulation. This will need to be addressed more carefully in Schematic Design.

Roof

There was some discussion of the roof in terms of size, transparency, and retractability. All were in favor of minimizing the impact of the park, but there was concern about maintenance of a transparent roof. Although the concern of campers on the stage was expressed, there was an understanding that a retractable roof would pose maintenance issues, so the design of the space will need to be carefully thought out to encourage active, positive uses and discourage inactive, negative uses of the space.

Power

Power and lighting at the stage was discussed as a must as well as the potential for a second location for power near the back of the audience area as long as it did not the way of active play in the lawn.

Restrooms and Safety

There was some question as to how the restrooms should function, especially with respect to the performance space. It seemed to some that although the new location is better, keeping the restroom in the backstage would recreate the safety issues of the current space as well as awkward access during performances.
PUBLIC MEETING

Volunteer Park Trust, ORA, and Walker Macy solicited community feedback on the results of Schematic Design: Phase I at Miller Community Center on August 31, 2016. The team collected community feedback through comments, questions and dialogue following the initial presentation. The most frequently expressed concern centered on improving acoustics and minimizing noise impacts beyond the amphitheater area. A few attendees expressed concern that some amplified events are too loud and disruptive, but other neighbors of the park refuted that concern, so the perceived effects on the neighborhood are varied.

There was a consistent desire that physical changes and management of the space be compatible with the pastoral character of the park. Equally important was maintaining flexible use of the space for non-event use. The large open green space is a desirable spot for fun and relaxation in the park and should not be compromised.

SUMMARY OF DESIGN-RELATED REQUESTS AND COMMENTS:

Acoustics and Noise Control
- Improve acoustics to focus sound within amphitheater space minimize event audibility beyond space
- Enhance the acoustics for quieter events (theater, spoken word, chamber music)

Character and Quality of Preferred Option
- Positive reaction to the openness and flexibility of the space for non-event use
- Audience members seemed to like the curves of the roof that related to the landscape
- There were questions about intended materials for the amphitheater, with the comment that although the concept of the program pieces being grounded and the roof floating above, the entire structure should feel like one piece within the park.
- Concern was expressed regarding maintenance of a translucent roof material
- Comments noted the design should fit with the historic structures in the park without being too deferential.

Safety
- Visibility to the public restrooms is positive
- Address safety concerns regarding campers on stage, perhaps with lighting

SUMMARY OF MANAGEMENT-RELATED REQUESTS AND COMMENTS:

- Request more vigilant enforcement of decibel restrictions
- Request greater diversity of programs and possible limits on single type of events
- Requests to improve procedures for event management and communication with neighbors
- Minimize temporary impacts on park use during construction
ACOUSTICAL ANALYSIS OF EXISTING AMPHITHEATER

Decibel levels were recorded by placing microphones in four locations in the park for three events that represent the typical range of performances occurring at the amphitheater. The determinations from observation and from the decibels recorded were provided by the Stantec acoustic consultant, Michael Yantis, as follows:

Results of the measurements are as follows:

1. Concerts were sufficiently loud in the audience area, ranging from over 90 dBA near the stage to 75 dBA at the rear of the audience area.
2. Corresponding sound levels at the park boundaries varied between 50 to 60 dBA depending on the concert (and the corresponding sound amplification system).
3. Qualitatively, concert sound levels at the property boundary were audible but blended in with the other background sounds. Local voices cars and in particular, aircraft flyovers were most often more noisy than the music. Listeners at the microphone location could tell when the music was performed but it was not loud enough to identify the music content.
4. The existing [performance facility] does not provide significant (if any) reduction of sound to the property boundaries. Amplification speakers were all located at the front edge of the stage and were not shielded by the [structure] from any measurement locations other than perhaps the West Boundary Location 2. Sound levels measured at this location might have been a couple [decibels] less than sound levels measured at West Boundary Location 1, but the perceived music levels in comparison with other ambient sounds was the same.
5. The opinion of the people monitoring the microphone locations during each concert was that resulting sound levels, although audible, were benign and there was no need for additional mitigation of the concert music levels. Correspondingly, there is not a significant need to incorporate sound mitigation in the design of the new [amphitheater].
CONCEPT DESIGN PROCESS

STAGE STRUCTURE PRECEDENTS:

The images below were assembled during the Feasibility Study to explore community and user reactions to a range of potential stage and roof configurations. The images which consistently evoked the most positive response are the images on the top row. The combination of a sense of lightness and relatively low profile were noted as especially appealing within the Volunteer Park context. These images helped guide the concept design studies.
CONCEPT DESIGN PROCESS - CONTINUED

DESIGN STUDIES

A series of hand sketches and models as well as computer generated plan studies and models were generated to explore all of the ideas gathered through analysis and input. Several alternatives were developed showing options for varying levels of enclosure, backstage program organization and overall form. These options were presented and refined throughout the process. The design team, Volunteer Park Trust and Seattle Parks and Recreation agreed upon the final Preferred Concept Design.

The studies began with a site model that shows the contrast between the existing grading and the proposed grading based on the new site location. This model was built to allow the portion with the changed grading to be removed to see impacts of the new grading. Models and sketches are shown below and on the following pages.

TREES ON SITE

Trees and topography are key for the site model to test how the form of the amphitheater fits within the existing context.

BRAINSTORMING ON PAPER

The team did lots of hand sketching over the topography plan to explore section, elevation and plan options.

EARLY STUDY MODELS

The process was highly iterative, exploring as many variations as possible; brainstorming in 3d.
EXISTING SITE TOPOGRAPHY

PROPOSED SITE TOPOGRAPHY
STUDY MODELS

CURVED STRUCTURE

TREE LATTICE STRUCTURE

CURVED ROOF - BUTTERFLY
DEVELOPMENT OF CONCEPTS

LANDFORM - FOLDING

After the iterative modeling and sketching process, a few of the most promising concepts were developed in the computer to test the look and feel of the proposed space during a performance and for daily use. The scheme below was based on the idea of a folded landform. The asymmetrical roof folds down to meet the landscape. The backstage is a space enclosed in glass walls. The difficulty with this scheme was the large expanse of roof as a folded structure. There was specific concern about people being able to scale the roof.

[Diagram of the folded landform concept]

[Images of the proposed space during a performance and for daily use]
DEVELOPMENT OF CONCEPTS - CONTINUED

ORGANIC - ASYMMETRICAL

The plan of this scheme concentrated all of the solid program elements on one side near the path instead of splitting them like the other schemes. This allowed for a flexible corner space with a wider view of the park. The organic roof form was intended to gesture to the greater lawn and to work with the curves of the landscape. The enclosed room was strongly discouraged by Seattle Parks & Recreation as management of the space would be difficult and potentially create a building that would be closed most of the time. Exposed parking was also considered problematic.
DEVELOPMENT OF CONCEPTS - CONTINUED

FLOATING ROOF - 'TREE' LATTICE STRUCTURE

This concept sparked the idea of opening up the backstage area. The concept was a pavilion with enclosed program elements serving as a base for a light roof floating above. The program elements are intended to be “of the earth” and the roof references the filtered light of a tree canopy. Elements of this scheme informed the Preferred Concept Design and a more organic version of the lattice structure may be incorporated into the final design.
PREFERRED CONCEPT DESIGN

FLOATING ROOF - CURVED BUTTERFLY

This concept builds upon the idea of the pavilion, but uses a butterfly roof to gesture to both sides and reduce the feeling that there is a back side. The curve of the roof echoes the curves of the rolling pastoral landscape. The plan shows a Grasscrete pull through, access for loading and service as requested by Seattle Parks & Recreation as well as performance groups. Refinement of landscape will be part of the next phase.
PREFERRED CONCEPT DESIGN - CONTINUED

IMPACT ON THE PARK

There was some concern expressed that the large roof covering the stage would have a negative visual impact on the park by blocking views, etc. When examined from across the lawn, however, it can be seen that the new siting of the stage actually seems to reduce the overall impact of the amphitheater on the lawn. The new creates an eddy of activity to the side of the lawn and opens up the view to the trees from the central drive.
VIEW 1: EXISTING AMPHITHEATER (looking northwest - fall)

VIEW 1: PROPOSED AMPHITHEATER (looking northwest - fall)
VIEW 2: EXISTING AMPHITHEATER (looking southwest - summer)

VIEW 2: PROPOSED AMPHITHEATER (looking southwest - summer)
LANDMARKS PRESERVATION BOARD - ARCHITECTURAL REVIEW COMMITTEE

Following the Public Meeting presentation, the design team presented the progress of the design to the Architectural Review Committee (ARC) of the Landmarks Preservation Board on September 2nd, 2016. Although the existing stage was not part of the original park design, the entirety of Volunteer Park was designated as a landmark following the construction of the stage, so any modifications to it require Board approval. The ARC was very receptive to the Preferred Concept Design presented, particularly where there was opportunity to restore original elements of the Olmsted design intent including restoration of the original curved Olmsted pathway at west edge of the lawn, shown in View 1 on the previous page, and the expanded view to the trees from the main Concourse, shown in View 2 opposite.

The ARC also appreciated that the stage design has developed as a distinctly modern structure while also blending with the surrounding landscape. They liked the curved butterfly roof, gesturing to both sides of the park and the openness of the pavilion concept. They felt that the development to this point fit well with the park’s iconic historic structures without being overly referential. They commented that materials and maintainability will be key considerations moving forward with the design.
ATTACHMENT:

- Acoustical Report by Michael Yantis / Stantec (8pp)
Volunteer Park Concerts Sound Level Measurements

Executive Summary
In the process of the design of a new band shell for Volunteer Park, some concern has been expressed regarding the effect of concerts in the part on residents surrounding the park. To gather information that would inform the design team, measurements of sound levels produced by three concerts at Volunteer Park in Seattle, Washington were conducted during the months of July and August, 2016.

Results of the measurements are as follows:
1. Concerts were sufficiently loud in the audience area, ranging from over 90 dBA near the stage to 75 dBA at the rear of the audience area.
2. Corresponding sound levels at the park boundaries varied between 50 to 60 dBA depending on the concert (and the corresponding sound amplification system).
3. Qualitatively, concert sound levels at the property boundary were audible but blended in with the other background sounds. Local voices cars and in particular, aircraft flyovers were most often more noisy than the music. Listeners at the microphone location could tell when the music was performed but it was not loud enough to identify the music content.
4. The existing band shell does not provide significant (if any) reduction of sound to the property boundaries. Amplification speakers were all located at the front edge of the stage and were not shielded by the band shell from any measurement locations other than perhaps the West Boundary Location 2. Sound levels measured at this location might have been a couple less than sound levels measured at West Boundary Location 1, but the perceived music levels in comparison with other ambient sounds was the same.
5. The opinion of the people monitoring the microphone locations during each concert was that resulting sound levels, although audible, were benign and there was no need for additional mitigation of the concert music levels. Correspondingly, there is not a significant need to incorporate sound mitigation in the design of the new band shell.

Introduction and Description of Measurements
Measurements were taken at five locations on or around the park, to document the sound levels in the audience area and at the edges of the park.

The three concerts that were measured are as follows:

Seattle Peace Concert  July 24, 2016
Seattle Chamber Orchestra  July 27, 2016
Vibrations Summer Music Festival  August 28, 2016

Measurement locations are documented in Figure 1. The Reference Location was only used at the Vibrations Summer Music Festival. The other four locations were used for all three concerts.

Each measurement was taken using a calibrated Type 1 Sound Level Meter. Three Larson Davis LXT Sound Level Meters and one Larson Davis 831 Sound Level Meter were used for the four locations common to every measurement. A Brul & Kjaer Model 2250 Sound Level Meter was used for the Reference Location measurement on the 28th of August.
Sound levels at each measurement location were sampled continuously and digitally recorded within the sound level meters in one-second intervals. The result is a digital “strip chart” of sound levels versus time for each of the measurement locations. Although the meters recorded the maximum, minimum and average sound levels, only the average sound levels for each second are reported here. The average sound levels are reported using the common acoustic metric $L_{eq}$, the Equivalent Noise Level. $L_{eq}$ is an average noise level, but technically it averages the actual pressure levels at the microphone rather than after they have been converted to the logarithmic scale (decibels). The result is that it weights higher sound levels more than lower ones. For example, the arithmetic average of 60 dB and 70 dB is 65 dB, but the $L_{eq}$ is 67. All sound levels within this report are A-weighted decibels (dBA). A-weighting applies amplitude versus frequency weighting curve to the measured sound levels to conform them to the sensitivity of the human ear.

**Measurement Results**

Measured sound levels for each concert are documented in Figures 2, 3 and 4. For each concert, roughly a half hour period of sound is reported, representative of the concert levels.
Figure 2: Measured Sound Levels during the Seattle Peace Concert

Figure 3: Measured Sound Levels during the Seattle Chamber Orchestra Concert
Figure 4: Measured Sound levels During the Vibrations Music Festival Concert

Figure 5: Measured Sound levels During the Vibrations Music Festival Concert - Reference Location
Each concert was amplified. The types of speakers used and their arrangement either on stage or in the audience varied from concert to concert. Photos of each amplification system were taken and are documented in Figures 6, 7 and 8. The speakers used in the Seattle Chamber Orchestra Concert were more directional than those used for the Seattle Peace Concert and the Vibrations Summer Music Festival. In addition, the Seattle Chamber Orchestra used another set of the same speakers positioned part way into the audience area, minimizing the volume needed out of the speakers. Not shown in the figures for the Seattle Chamber Orchestra and Vibrations summer Music Festival are the subwoofers that were present for each concert.

Figure 6: Speakers (one of two pairs) on Stage for the Seattle Peace Concert
Figure 7: Speakers (one of two pairs) on Stage for the Seattle Chamber Orchestra Concert
Sound levels measured at the boundaries of the park during the three concerts were a little higher than the ambient sound levels without the concert. The best example of this can be seen in Figure 2, the Seattle Peace Concert, at the beginning of the graph. The live music in very apparent at the Rear Audience Location and the corresponding sound levels at the park boundaries can be seen to be roughly 5 dBA higher than the sound levels without the music present. The music sound levels at the boundary locations during this time of the concert averaged a little less than 55 dBA. Most of the other concerts, including later music at the Peace Concert, had less difference between when the music was present and when it was not and averaged closer to 50 dBA.

At each park boundary location, it was possible to tell that the concert music was present but it was not loud enough to identify the title of the song, even if one was familiar with the music. Cars passing nearby, people talking nearby, or planes flying overhead were generally more easily audible than the concert music. Applause during the Seattle Chamber Music Orchestra was louder than the concert music and was more easily audible.
In almost all cases, the higher sound levels at the park edges were produced by aircraft flyovers. They occurred every few minutes during all of the concerts. A good example of these events can be seen in Figure 3, the Seattle Chamber Orchestra Concert, between the time of 19:45 and 19:54. The regularly spaced peaks were flyovers in the midst of the concert. It should be noted, however, that all of the concert charts, for the entire length of the time measured, also document regular aircraft flyovers.

During the final concert, the Vibrations Summer Music Festival, an additional measurement was taken to compare the music volume to that allowed by the Seattle Parks Department. The park’s permit application documents the requirement as follows: “SMC 25.08.520 (A) makes it unlawful for any person to cause or allow sound from an officially sanctioned outdoor musical event originating in a park to exceed an “Leq” of 95 dB(A) for one minute as measured 50 feet from the source.” As can be seen from Figure 4, although the measured sound level at 50 feet from the speakers did on one occasion exceed 95 dBA, the one minute average (Leq) level did not. Comparing the Rear Audience Location data taken that same day to data at the same location taken at the previous concerts, it can be concluded that the previous concerts would also have been in compliance with the park’s sound level limits.

The existing band shell provided little if any shielding of noise at the park boundaries. All of the sound was created by the amplified speakers and the band shell did not obstruct the speakers from the boundary locations, with the possible exception of the West Boundary Location #2 which was located almost directly behind the band shell. Even at that location, the person monitoring the microphones did not perceive a difference between its sound and that of the West Boundary Location #1.

Conclusions
Several conclusions can be drawn from the measurements. Primarily, the concert sound levels at the park boundaries were not a major aspect of the ambient environment. Although the music was audible, it was subtle. The opinion of the people monitoring the microphone locations was that the concert levels were compatible with the environment and no additional mitigation was needed.

Since mitigation of concert levels at the park boundaries does not appear to be warranted, the design of the new band shell does not need to stress mitigation of sound in its design. If mitigation can be easily achieved without adversely affecting the appearance or cost, then it would make sense to take advantage of the additional sound reduction. It does not, however, need to be a significant requirement of the design.