Home / Council Documents

819-2023

Report

Accept Halprin Landscape Conservancy Keller Auditorium Renovation Design Concept report

Accepted

Date: September 11, 2023

To: City Council

From: Mike Jordan, Chief Administrative Officer

Karl Lisle, Spectator Venues Program Manager

Lauren Broudy, Spectator Venues Program Coordinator

Re: September 27, 2023 City Council Agenda Item—Accept Halprin Landscape

Conservancy's Keller Auditorium Renovation Design Concept Report (Report;

Grant Agreement No. 32003038)

Karen Whitman, Executive Director, Halprin Landscape Conservancy, will join John Russell, Developer, Scott Andrews, Principal Broker Melvin Mark Brokerage Company, and Tim Eddy, President, Hennebery Eddy Architects, to present their work on a potential renovation of the Keller Auditorium.

Halprin Landscape Conservancy's report documents their feasibility study for rehabilitating and expanding the Keller.

This report is required by the Halprin's grant agreement with the City to explore a renovation concept in further detail. The grant agreement required a $200,000 investment from both the City and Metro and a $200,000 private match from the Halprin Landscape Conservancy.

While this report details a design concept for a renovated Keller, other options including potential replacement of the venue on an alternative site will be considered. City staff will have more information regarding the exploration of a new build on another site in the coming months.

At this time, no decisions have been made on the future of the Keller Auditorium and no capital funding has been identified to pay for a major

Introduced by

Mayor Ted Wheeler

Bureau

Management and Finance

Contact

Karl Lisle
Spectator Venues Program Manager

karl.lisle@portlandoregon.gov

503-823-5876

Lauren Broudy
Spectator Venues Program Coordinator

lauren.broudy@portlandoregon.go

503-823-6202

Requested Agenda Type

Time Certain

Date and Time Information

Requested Council Date
September 27, 2023
Requested Start Time
2:00 pm
Time Requested
1 hour

renovation or replacement.

Documents and Exhibits

Report (https://www.portland.gov/sites/default/files/council-documents/2023/keller-feasibility-study-project-final-report-230830.pdf) 24.56 MB

Report Appendices (https://www.portland.gov/sites/default/files/council-documents/2023/keller-feasibility-study-project-final-report-appendices_0.pdf) 35.24 MB

Impact Statement

Purpose of Proposed Legislation and Background Information

This report from the Halprin Landscape Conservancy ("Halprin") captures Halprin's work with Hennebery Eddy Architects and a larger consultant team for a potential renovation of the Keller Auditorium. This report is a requirement of Halprin's grant agreement with the City.

In March of 2020, the City of Portland completed the Keller Seismic Analysis Summary Report that outlined the structural deficiencies of the Auditorium and potential options to consider for the future. The report was released in 2021. The key options include different scales of work: option 1(b) which is a building renovation that addresses seismic upgrades, option (2) which is a major renovation including new additions and option (3) which is a new facility on the existing site or an alternative site.

In 2017, a private design competition spearheaded by Halprin was held to conceptualize what might be possible for a grand scale Keller renovation on site. This cohort of private design professionals became interested in continuing this work and requested that the City and Metro contribute to their "option 2(b)" exploration to see what would be feasible. This report documents Halprin's feasibility study for rehabilitating and expanding the Keller.

The Keller Auditorium is known as the workhorse of the Portland'5 Centers for the Arts venues, hosting nearly 400,000 guests each year and providing the only stage in the region capable of hosting large-scale theatrical performances such as Broadway productions, ballet, operas and more.

While the Halprin report details one design concept option for a renovated Keller, there are still other options to consider including a new facility on a different site. The biggest hurdle a Keller renovation faces is figuring out how to generate revenue and preserve jobs and economic benefits if the Keller were to close for two years during renovation. As such, the City is exploring potential sites for a new performing arts facility, which is currently underway. More information will be available about this parallel effort in the coming months.

Financial and Budgetary Impacts

Investment into this project totaled over $600,000:

- The City of Portland invested $200,000 in special appropriations funds from the Mayor's Office;
- Metro invested $200,000; and
- Halprin raised over $200,000 to meet the match obligations of this agreement and spent over this minimum requirement to complete the report.

Community Impacts and Community Involvement

The work led by Halprin has not involved the community at large. In their work, they met with current users of the building as they developed the renovation concept.

However, the report acknowledges the need to more broadly engage with key stakeholders and the greater community regarding the future of this important venue. Halprin identifies an equity strategy in their report, which breaks down a process to incorporate five steps: (1) inform (provide community with relevant information), (2) consult (gather input from the community), (3) involve (ensure community needs and assets are integrated into process and inform planning), (4) collaborate (ensure community capacity to play a leadership role in implementation of decisions) and (5) defer to (foster democratic participation and equity by bridging the divide between community and governance, through community decision-making).

Community engagement and equity-centered work will be undertaken prior to making any final decisions about the renovation.

100% Renewable Goal

The report details how the renovation concept would strive to meet both the City of Portland Green Building Policy and Metro's Sustainable Building & Sites policy. Specifically for the City, it addresses what it would take to achieve LEED Gold and ILFI Core Certification, the potential for embodied carbon reduction and the opportunity for renewable energy generation through solar panels. The report states that by reusing the existing building foundations, 17,800 tons of carbon emissions can be avoided.

The report found that the renovation concept would not likely be able to support an ecoroof on top of the building due to a combination of the portions of the building that are unreinforced masonry dating back to the original 1917 construction, a large portion of the main roof level being supported by trusses over the auditorium space that are already loaded to near capacity and the fact that an ecoroof would locate substantial mass at the top of the building that would not be desirable from a seismic force perspective.

Budget Office Financial Impact Analysis

No fiscal impact to accept the report. At this time, no decisions have been made on the future of the Keller Auditorium and no capital funding has been identified to pay for a major renovation or replacement. To complete the report, the City invested $200,000 in Special Appropriations funds while Metro also invested $200,000; and Halprin raised over $200,000 to meet the match obligations of this agreement and spent over this minimum requirement to complete the report. The report identified 3 options: 1) The construction cost for the Baseline option is roughly $174.9 million, with soft costs estimated at $61.2 million. 2) The construction cost of an Accelerated Schedule is $197.9 million, with soft costs estimated at $69.3 million. 3) The cost for a New Facility, not including land acquisition, is $517.4 million.

Agenda Items

819 Time Certain in September 27, 2023 Council Agenda (https://www.portland.gov/council/agenda/2023/9/27)

Accepted

Motion to accept the report: Moved by Ryan and seconded by Gonzalez.

Commissioner Rene Gonzalez Yea

Commissioner Mingus Mapps Absent

Commissioner Carmen Rubio Yea

Commissioner Dan Ryan Yea

Mayor Ted Wheeler Yea

A Keller Renaissance: Final Report

KELLER AUDITORIUM FEASIBILITY STUDY

30 August 2023

SPONSORS & PARTICIPANTS

Marking Keller Group
Private nearby property owners and other interested parties.
- John Russell
- Scott Andrews
- Karen Whitman
- Don Stastny

Halrpin Landscape Conservancy
501(c)3 nonprofit led by a partnership of public and private interests, and the sponsor of this study.
- Karen Whitman, Executive Director
- Bob Naito, Treasurer

City of Portland
Owner of both the Portland'5 venues and the Portland Open Space Sequence properties.
Spectator Venues, Office of Management and Finance
- Karl Lisle, External Partnerships and Programs Manager
- Lauren Broudy, Program Coordinator

Portland Parks & Recreation
- Lauren McGuire, Development Program Manager

Metro
Regional government and operator of parks and visitor venues.
- Steve Faulstick, General Manager - Visitor Venues
- Nancy Strening, Senior Capital Projects Manager

Portland'5 Centers for the Arts
A Metro agency operating five theater venues, including Keller Auditorium.
- Robyn Williams, Executive Director
- Ed Williams, Director of Operations

Users & Stakeholders
Public patrons, employees, visiting performers and productions crews, and resident companies.
- Broadway Across America
- Oregon Ballet Theatre
- Portland Opera

More information about the project sponsors and participants can be found in Section 1: Introduction.

DESIGN TEAM

Hennebery Eddy Architects
Prime Architect | Portland, OR
- Tim Eddy
- Andrew Smith
- Erica Thompson
- Jason Smith
- Mackenzie Pratt
- Kari Hayenga

PLACE
Landscape Architect | Portland, OR
- Carol Kekez
- Dylan Morgan
- Mauricio Villarreal

Grummel Engineering
Structural Engineer | Portland, OR
- Bob Grummel
- Jesse Wolfe
- Eric Pfau

STUFISH Entertainment Architects
Entertainment Design Architect | London, UK
- Maciej Woroniecki
- Simone Plekkepoel
- Hui Hui Teoh
- Daniel Langstaff
- Ricardo Lopez

Michael Curry Design
Creative Consultant | Scappoose, OR
- Michael Curry
- Marcus Gannuscio

The Shalleck Collaborative
Theater Consultant | Berkeley, CA
- Adam Shalleck

KPFF Consulting Engineers
Civil Engineer | Portland, OR
- Mark Reuland
- Josh Yun

Hoffman Construction Company
General Contractor/Estimator | Portland, OR
- Han-Mei Chiang
- Matthew Thompson

More information about the design team can be found in the appendix.

Table of Contents

(page intentionally left blank)

Executive Summary

VISION

The Keller Auditorium has served the greater Portland region for more than 100 years as a venue for events such as concerts, theater performances, presidential speeches, and high school graduations. Owned by the City of Portland and operated by the Portland'5 Centers for the Arts, a service of Metro, the Keller is the largest theatrical auditorium in Oregon and is the only theater in the Portland area capable of hosting Broadway performances, large operas, and ballet productions. Built in 1917 and substantially modernized in the mid-1960s, after five and half more decades of service, the Keller Auditorium needs to be rehabilitated to current standards.

Purpose

Revitalize the iconic Keller to meet the needs of a modern, world-class performing arts venue while realizing the benefits of its centralized location, surrounding infrastructure, existing structure and materials, and potential to energize its neighborhood and take better advantage of its physical relationship to the world-renowned Keller Fountain.

Context

A seismic study commissioned by the City of Portland in 2018 and published in 2020 confirmed that, like many older civic buildings, the Keller was not built to withstand a major earthquake. The early structural study was prepared in the absence of programming and conceptual design, or material testing and geotechnical engineering information. A preliminary program was prepared separately by a consultant engaged by the City.

This report, "A Keller Renaissance," documents a comprehensive, six-month, multidisciplinary feasibility study for rehabilitating and expanding the Keller Auditorium (including programming, architectural, structural and geotechnical engineering, urban design, and construction cost and schedule). This work incorporates programming direction from the arts groups that use the Keller, along with those who manage and maintain it. This in-depth feasibility analysis utilized geotechnical information and structural testing of existing concrete and brick masonry walls not available to the early study commissioned by the City, rendering it a reliable guide for redevelopment of the facility; it should be considered to supersede the 2018 studies.

Rendering: Keller Auditorium and Third Avenue Plaza

Principles

1. Revitalization
2. Safety & Functionality
3. Inclusivity & Participation
4. Stewardship

Process

A partnership among dedicated Portlanders, this project includes both public and private interests, design and planning professionals, and entertainment experts. Over the course of several years, the process has included engineering and programming studies, an aspirational design competition, and collaborative concept refinement.

Findings

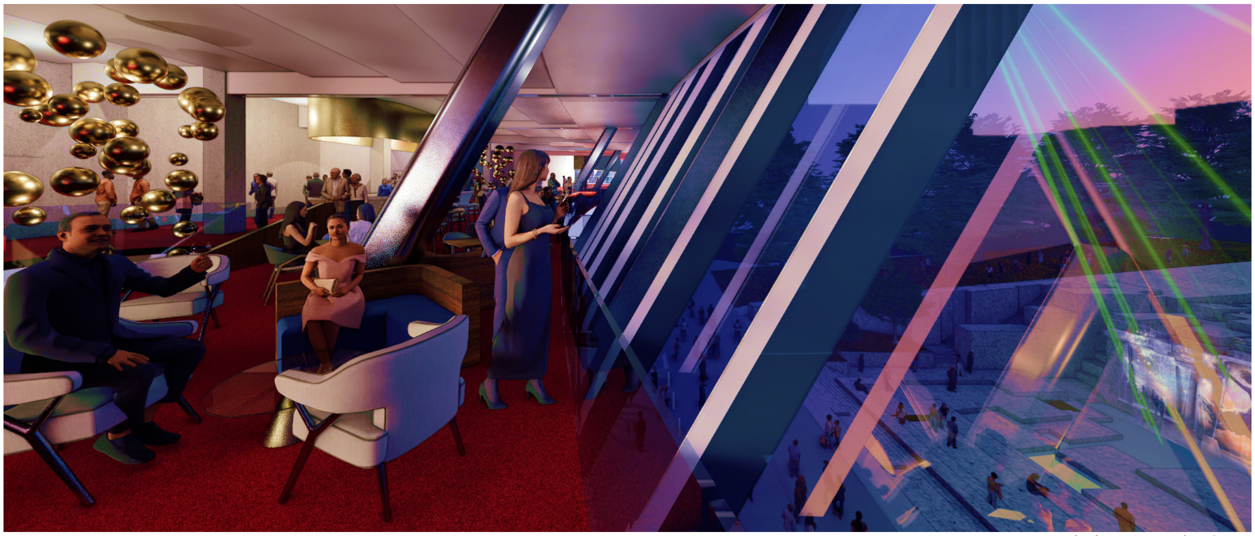
A series of programming and design workshops engaged the design team, project sponsors, operators, and users in February, May, and June 2023. Through the workshops, participants identified a variety of needs at the Keller, summarized as follows.

1. *The building's structure is not designed to current seismic resilience standards.*
2. *The two existing loading bays are insufficiently sized, steeply sloped, difficult to maneuver into and out of, and don't meet current City code requirements.*
3. *Public lobbies at the orchestra and balcony levels are constricted, not allowing adequate space for concessions, dining, congregating, and circulating.*
4. *Dressing rooms and other backstage spaces are cramped and difficult to navigate.*
5. *The quantity and quality of restroom fixtures are obsolete and insufficient relative to the capacity of the auditorium.*
6. *Building systems are near or past useful life expectancy.*
7. *Connections between front-of-house and backstage spaces are limited, resulting in circuitous and inefficient circulation.*
8. *The orchestra pit does not meet modern standards for size, exiting, and mechanization of the lifts.*
9. *Accessible seating positions within the auditorium space do not meet code requirements for either quantity or distribution.*
10. *The acoustics within the auditorium are substandard and not adaptable to different performance needs.*
11. *Interior finishes throughout the auditorium are outdated and in various states of disrepair.*
12. *The north, south, and east building facades are mostly solid concrete panels that are inhospitable to pedestrians and do little to enliven the surrounding streetscapes.*
13. *The Keller Auditorium and the adjacent Keller Fountain are disconnected from one another, and from the remainder of the Halprin Open Space Sequence, by automobile-dominated streets.*

Through the duration of the study, the project team developed and tested solutions for each of the identified needs. The resulting concept design resolves all of the Keller Auditorium's current shortcomings and achieves the following:

1. *Expands the building footprint east and west.*
2. *Includes a dramatic, curving, sloped glass curtainwall addition on the west, which creates public lobby space at all levels that is commensurate with the scale of the auditorium while embracing, and directing views toward, the Keller Fountain.*
3. *Creates a programmable urban plaza connecting the Keller Auditorium to the Keller Fountain across Third Avenue, incorporating interactive elements and digital display glass.*
4. *Features an addition at the east side of the building housing an enlarged loading facility, reconstructed dressing rooms, additional rehearsal space, and other naturally lit backstage program areas.*
5. *Provides for a structural retrofit of the building to bring it to the standard of a newly constructed theater.*
6. *Raises the stage elevation and restructures the orchestra pit to eliminate current safety hazards and enhance accessibility.*
7. *Incorporates an electronic acoustic enhancement system to provide better acoustical performance and accommodate a wider range of performance demands.*
8. *Overframes the orchestra level to maintain superior sightlines, gain additional accessible seating positions distributed throughout the auditorium, and create a void for implementation of state-of-the-art displacement ventilation for the auditorium space.*
9. *Preserves most of the embodied carbon in the existing structure, providing for a carbon-efficient facility.*

This study has concluded that it is feasible to upgrade the Keller Auditorium to the standards of a state-of the-art, 21st-century performance venue and to resolve all of the facility's current physical and operational challenges.



Rendering: Second Balcony

Sustainable and Equitable Design

Modernization of the Keller Auditorium will be required to meet the City of Portland Green Building Policy and Metro Sustainable Building and Sites Policy. By enhancing the building envelope, reducing lighting loads, and installing high-efficiency HVAC systems, overall energy usage will be markedly reduced. In addition, the proposed rooftop solar array will provide 50-70% of the Keller's resulting annual energy demand.

Embodied carbon refers to the amount of energy already expended in the construction of an existing building. Based on a comparative analysis of embodied carbon using the Carbon Avoided: Retrofit Estimator (CARE) tool, retaining and modernizing the Keller results in a carbon impact that is nearly 48% lower than a new construction performance venue. If the new venue is located at a site that requires an associated parking structure, that carbon savings jumps to an 83% reduction in avoided carbon emissions.

As a publicly owned and community-used facility, it is imperative that the community is meaningfully engaged in the planning, design, and implementation process. Successful outreach during the project must involve an intentional shift in approach from not simply informing and consulting with community stakeholders, but involving and collaborating with them in the decision making process. In addition, the project team seeks to support diverse regional partners by acknowledging past harms and investing in a diverse and inclusive team including Disadvantaged Business Enterprise (DBE) trade partners and vendors.

Construction Cost and Schedule

The project team has identified two approaches to carrying out the Keller construction phase. The baseline option assumes a 28-month construction schedule, including commissioning and start-up procedures, during which the facility would be out of service. The construction cost for the Baseline option is roughly $174.9M. Soft costs for this option are estimated at $61.2 M.

Because of the impact a shutdown will have on performances and operations at the Keller, the project team developed an accelerated schedule approach. By utilizing double shifts and overtime work, construction can be accomplished in 19 months. The resulting construction cost for the accelerated schedule is $197.9M. Soft costs for this option are estimated at $69.3 M.

NEXT STEPS

Building on the findings of this conceptual design and feasibility study, the design team has identified several supplemental tasks that will establish a comprehensive set of information for Portland City Council to consider in their decision-making process. The next step in the process will be focused on planning for equity and community engagement and comprehensively evaluating the economics of and funding for creating a state-of-the-art, 21st-century performance venue at the Keller Auditorium. Additionally, it is recommended that the entitlement process for the proposed rehabilitation and expansion project be further vetted with the City of Portland. The proposed next steps during the October 2023 through April 2024 timeframe include the following tasks.

Equity

Meaningful community engagement is critical to the success of the project. The next steps in the equity and inclusion process will be to: establish the level of engagement and a transparent decision-making protocol; identify participants, with a particular emphasis on communities that have been historically excluded; and hold initial informational sessions with these groups to discuss what an equitably designed and inclusive Keller Auditorium could look like from a variety of community perspectives.

Economics

Beyond the projected hard construction costs and other project-related soft costs included in this report is a larger economic picture of a revitalized Keller Auditorium. To give City Council greater confidence in their decisions regarding the Keller Auditorium, the design team recommends a comprehensive economic analysis of the proposed rehabilitation and expansion project be completed, including at a minimum:

1. The economic impact of a fully modernized Keller Auditorium on downtown Portland, the city as a whole, the Portland region, and beyond;
2. The economic impact of a fully modernized Keller on nearby downtown Portland facilities such as hotel nights generated and parking and restaurant revenue;
3. A comparative economic analysis of a revitalized Keller versus a new venue elsewhere in Portland;
4. The potential economic harm to the core of downtown Portland if the Keller is fully closed; and
5. The economic impact of the temporary shutdown of the Keller during construction of the improvements.

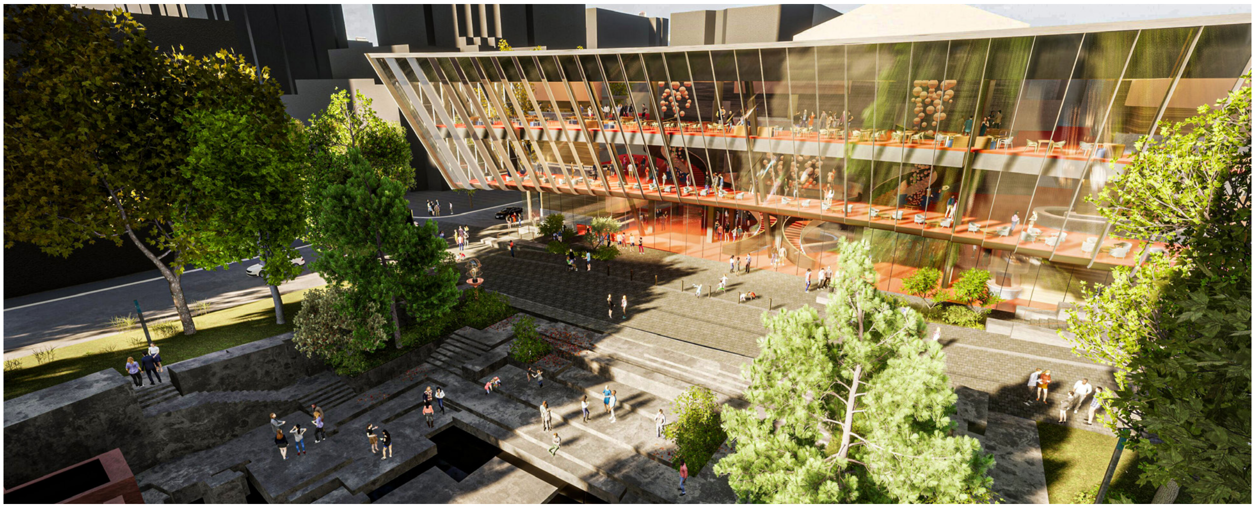
Project Funding

As part of the next steps, we recommend that the City of Portland conduct an analysis of potential public sources of funding for the rehabilitation and expansion of the Keller Auditorium as well as the addition of a new performing arts facility located elsewhere. This effort should consider all public sources of funding (local, regional, state, and federal) as well as potential funding from philanthropic sources.

It is anticipated that the rehabilitation and expansion of the Keller Auditorium will attract substantial philanthropic support as a result of many decades of broad community attachment to the facility, its physical relationship to Halprin's internationally renowned masterwork of the Keller Fountain, and its location, embedded in the core of downtown Portland.

Based on the accelerated schedule Option 2B, overall funding needs are estimated at $267.2M for the rehabilitation and expansion of the Keller Auditorium with construction starting in 2027.

Overall funding needs for Option 3 are estimated at $517.4M for a new facility with structured parking starting construction in 2029. This figure does not include land acquisition.



Rendering: Keller Fountain Park, Third Avenue Plaza, and Keller Auditorium

Entitlements

Early Assistance Meeting

To more fully engage City of Portland bureaus and departments in this planning effort, an Early Assistance meeting should be conducted. This will provide an opportunity for the design team to review the fundamentals of the proposed rehabilitation and expansion project with city agencies such as Bureau of Development Services, Bureau of Planning and Sustainability, Bureau of Transportation (PBOT), Urban Forestry, Bureau of Environmental Services, and the Water Bureau. The responses received from these regulatory stakeholders will be valuable in demonstrating the feasibility of achieving approval for the proposed improvements and giving City Council greater certainty in their decision-making process.

Street Vacation / Encroachment

While the design team has received favorable feedback on the proposed project to date, gaining approval from PBOT and other city agencies on the proposed right-of-way modifications – particularly at Second and Third Avenues – will require a detailed traffic study. The design team recommends commissioning such a study to quantify traffic counts, broad traffic patterns in the neighborhood, the trips generated by the modernized venue, and the specific traffic pattern changes expected by the narrowing and closure of adjacent streets.

Design Advice Request

Because of the scope and scale of the proposed Keller alterations, the project will ultimately require a Type III Land Use approval, which is processed through a public hearing with the City of Portland Design Commission. Acquiring early feedback on the proposed design from the Design Commission will be valuable in demonstrating the feasibility of ultimately achieving the Commission's full approval for the project and giving City Council greater certainty in their decision-making process. As such, the design team recommends scheduling a Design Advice Request (DAR) – a type of design dialogue prior to submission of a land use application – with the Design Commission. Members of the public would also be able to comment on the design proposal at the DAR hearing. The proposed interventions into the National Register-listed Keller Fountain Park may prompt a joint DAR including both the Design Commission and the Historic Landmarks Commission.

(page intentionally left blank)

1. Project Overview & Background

PROJECT SPONSORS & PARTICIPANTS

Marking Keller Group

The Marking Keller (MK) Group originally comprised private building and property owners surrounding Keller Auditorium and along the Halprin Open Space Sequence; the group has since expanded to include other nearby stakeholders. The name "Marking Keller" originated from the group's aspiration of "marking" the Keller as a centerpiece of the neighborhood. This group sponsored the 2017 design competition that resulted in a bold new vision for the Keller and selected the Portland firm, Hennebery Eddy Architects, to lead the overall design team via an RFQ process in 2022.

The City of Portland and Metro acknowledged the new vision for the Keller put forth by the Marking Keller Group by including it as a component of Option 2B, one of the options they are evaluating for the future of the Keller Auditorium – Option 2b is the subject of this feasibility analysis effort. The group has also contributed private funding for this project.

Halprin Landscape Conservancy

Halprin Landscape Conservancy was formed in 2008 to advance the original vision of the Portland Open Space Sequence — which includes Keller Fountain, Lovejoy Fountain, Pettygrove Park, the Source Fountain, and a connected series of pedestrian pathways — designed by Lawrence Halprin and Associates in the 1960s.

This 501(c)3 nonprofit is led by a partnership of public, private, and broader neighborhood interests dedicated to revitalizing these beloved and internationally recognized public open spaces. The conservancy serves as the coordinating and contracting entity for the Marking Keller Group and this project.

City of Portland

The City of Portland is the owner of the Keller Auditorium and the Portland Open Space Sequence properties, including Keller Fountain. The city does not operate the properties; operation and maintenance are the purview of Metro and the Halprin Landscape Conservancy, respectively. Portland Parks and Recreation shares the management and activation of the Portland Open Space Sequence with the Halprin Landscape Conservancy. The city is a grant funding partner for this project.

Metro

Metro is the regional government for the Portland metropolitan area, covering Multnomah, Washington, and Clackamas Counties. Metro helps coordinate and manage regional planning, infrastructure, and growth; the agency also operates visitor venues in the region, including Portland'5 through the Metropolitan Exposition and Recreation Commission (MERC). Metro is a grant funding partner for this project.

Portland'5 Centers for the Arts

As the fifth-largest performing arts center in the country, the Portland'5 comprises five venues, owned by the City of Portland and managed by Metro and the Metropolitan Exposition Recreation Commission: The Keller Auditorium, Arlene Schnitzer Concert Hall, Winningstad Theatre, Newmark Theatre, and Brunish Hall.

Users & Stakeholders

The Keller Auditorium has many users: public patrons who come to see performances, the many people employed by Portland'5 to operate the venue, the visiting performers and production crews (including Broadway shows staged by Broadway Across America), and the resident companies for which the auditorium is their primary venue: Portland Opera and Oregon Ballet Theatre.

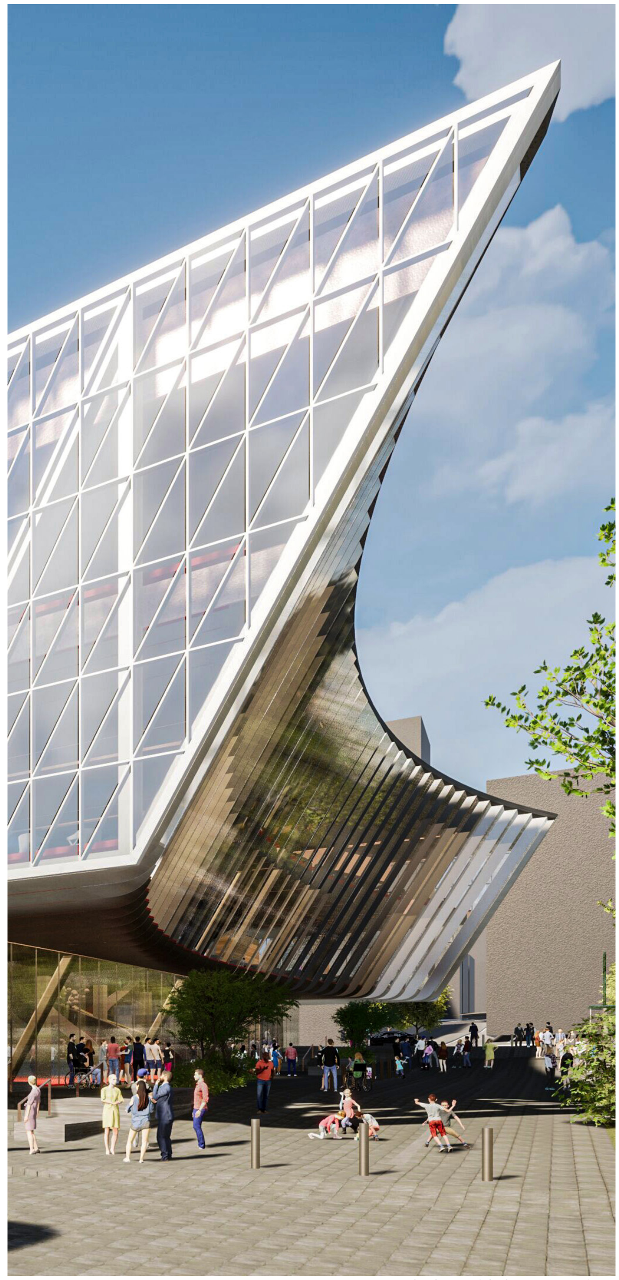
PROJECT STORY: WHY THIS WORK IS IMPORTANT

One way to look at the potential renovation of the Keller Auditorium is to consider this question: “What does the Keller Auditorium bring to Portland?” For more than 100 years, the central city has been the cultural center for performing and visual arts for Portland, the metro area, and the greater region. This is due in no small part to the energy and influence that the Keller Auditorium brings to downtown Portland and the performing and visual arts community.

Called the “workhorse” by Portland’5 Centers for the Arts, the Keller hosts a diverse range of performances, including Broadway, Oregon Ballet Theatre, Portland Opera, family events, and many others. The five venues of the Portland’5 theaters bring more than 1,000 performances to the city every year and more than 1 million visitors. All of this in the very core of one of the greatest urban places in the United States.

Another way to look at the Keller’s renovation is locational: “What does Portland bring to the Keller?” The auditorium is strategically located, not necessarily by design, but by how the city has grown around the Keller over the past century. This unique place is supported by its proximity to Portland State University, an abundance of supporting hospitality and retail spaces, unparalleled public transit access, pedestrian connectivity, parking infrastructure, and other arts and cultural institutions (including the other Portland’5 venues within walking distance).

This renovation project is more than a perfunctory building upgrade. The proposed project is a full and complete reinvention of the Keller into a state-of-the-art, 21st-century performance venue and civic gathering space integrated with the world-class Keller Fountain, designed by renowned American landscape architect Lawrence Halprin as the forecourt to the Auditorium.



Rendering: Third Avenue Plaza

Keller’s renaissance will be a catalyst for Portland’s renaissance, embracing and activating the community while creating vibrant and safe spaces for all. Investment in the Keller is a symbol of optimism and commitment to Portland’s future.

VISION & GOALS

The Marking Keller Project is a significant opportunity to mark not only the auditorium's next 50 years but a new act in the life of Portland. In one project, the city can put resilience front and center — for the building, but also for the users, the neighborhood, and the people of Portland. Safety, equity, and sustainability will all contribute to make this effort a catalyst for reactivation of a key Portland neighborhood.

Revitalization

- Embrace the iconic Keller Fountain and Halprin Sequence.
- Prioritize the pedestrian to activate foot traffic.
- Welcome visitors with improvements to surrounding outdoor spaces.
- Create a destination with new food service and other amenities.
- Serve as a symbol and catalyst for Portland's renaissance.

Safety & Functionality

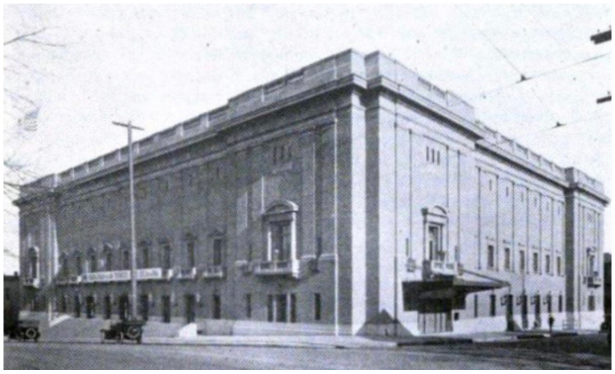
- Fully upgrade Keller's structure to current code to save lives in an earthquake.
- Integrate universal accessibility to welcome and serve all people.
- Better accommodate all through expanding the front-of-house and restrooms.
- Establish safe, off-street loading for over-the-road trucks.
- Incorporate flexibility to support Portland's performing arts for the next 50 years.
- Expand the back-of-house to meet the needs of modern performances.
- Improve daylighting, wayfinding, and circulation for healthier work environments.

Inclusivity & Participation

- Purposefully engage the public in the design process for the project.
- Seek opportunities to advance and integrate human equity in the design.
- Create opportunities for public engagement in the performance experience.
- Connect the performance experience to the public realm at the Keller Fountain.
- Eliminate physical, emotional, and psychological barriers to attending performances and accessing the arts.
- Provide equal access, both indoors and out.
- Programming of the exterior plaza can support/engage artists from across the city/region.

Stewardship

- Retain the good bones of a landmark structure.
- Take advantage of the significant embodied carbon of the existing building.
- Preserve the site and history of a longtime development.
- Take advantage of a site uniquely accessible by foot, bike, and transit.
- Modernize building systems to greatly reduce energy and water use.



Historic Photo of Public Auditorium

Current Photo of Keller Auditorium

KELLER AUDITORIUM HISTORY

Opened as the Public Auditorium on July 4, 1917, the Keller Auditorium building has been a Portland landmark for more than 100 years. The original structure was built at a cost of about $600,000 and seated more than 4,000. The Portland Symphony Orchestra (now the Oregon Symphony) first performed there in October 1917. Over its first few decades, the Auditorium functioned as a concert hall, movie house, meeting hall and, grimly, as a makeshift hospital and morgue during the 1918 flu pandemic.

Several presidential candidates held campaign events at the Auditorium – most notably Franklin D. Roosevelt in 1932, Dwight Eisenhower in his 1956 bid for re-election, and then-Senator John F. Kennedy in 1960. However, by the early 1960s, the building had been dubbed by Portlanders as the "Old Grey Lady." The performance space was crowded and suffered from poor sightlines and acoustics. The mechanical systems were inadequate, and life safety was a serious concern.

After a successful ballot initiative in the mid-1960s, the re-named Civic Auditorium was reinvented as part of the South Auditorium District Urban Renewal project. This Modern urban renewal architecture program transformed the building's external character, replacing the traditional brick facade with concrete and quartz panels and a grand arcade facing Third Avenue. Also part of the South Auditorium District redevelopment, Lawrence Halprin's Portland Open Space Sequence was born, providing an open space network of parks and pathways that set the stage for large scale, suburban-type office buildings and housing. The Civic, in its new configuration, remained as the center of the evolving renewal district, which became the touchstone for a number of new development initiatives throughout downtown.

The South Auditorium project was the first initiative of the Portland Development Commission, the city's urban renewal agency which implemented much of the redevelopment downtown and in neighborhoods beyond. The first Chair of the Portland Development Commission was Ira Keller, for whom both the auditorium and the Halprin-designed Keller Fountain are now named.

In recent decades, the Keller has hosted many local high school graduation ceremonies, and served as the home of Broadway in Portland, the Oregon Ballet Theater, the Portland Opera, and Oregon Children's theater, among others.

PROJECT BACKGROUND

Marking Keller Design Competition

In 2016, the Halprin Landscape Conservancy organized a group of neighborhood property owners whose mission was to improve the neighborhood. The group worked with the City of Portland to create a local improvement district to raise money for open space improvements. Later in the year, nearby building owner, John Russell organized an international design competition, managed by local architect Don Stastny, aimed at exploring options for the Keller Auditorium's restoration. The design competition and group became known as "Marking Keller" in recognition of the group's desire to "mark" the Keller Auditorium as the centerpiece of the Fountain District which sought to raise the neighborhood profile and maintain the sense of place provided by the Auditorium and adjacent Keller Fountain.

The winning entry came from a partnership between London-based STUFISH Entertainment Architects and Portland-based production designer Michael Curry Design — a compelling concept that would reinforce the public realm by increasing transparency, improving the relationship to the neighborhood, and taking the best parts of the Keller into the future.

City-Directed Seismic & Feasibility Study

In 2017, a parallel effort to determine how to address the Keller's seismic deficiencies was commissioned by the City of Portland. The City engaged a team including Merryman Barnes Architects, LMN Architects, Miller Consulting Engineers, and other consultants to perform conceptual feasibility studies to determine baseline costs and schedule implications of different options. These options included varying levels of intervention, from a basic "brute force" seismic upgrade of the existing facility (Option 1) to a more comprehensive renovation (Option 2), as well as a completely new building on a new site (Option 3). The report concluded that a major renovation or an entirely new building were preferred options when weighing the disruption, costs, and life-safety benefits along with the long-term functional and programmatic requirements of a first-rate performing arts venue for the metro area.

A detailed summary of the report options, objectives, and outcomes can be found in the appendix.

Integration of Design Concept with Seismic Study

In 2018, the City documented its recognition of the STUFISH/Curry design concept for expanding the front-of-house with permission to pursue a peer review of the Miller Engineering study which was being performed to further understand the project's feasibility. Thus, "Option 2B" was formed which includes a major renovation of the Keller that would be built to the same safety and programmatic standards of a new building constructed on a different site.

Structural Analysis

In 2018, the Marking Keller Group hired Grummel Engineering to perform a peer review of the engineering study prepared in 2017. Additionally, a proposal was solicited, but not acted on, to conduct a non-linear structural engineering study.

The analysis of Option 2B includes developing a structural design to make the building comply with the provisions of the Oregon Structural Specialty Code for a new building while accommodating the STUFISH/Curry design proposal for the front-of-house and full reconfiguration of the auditorium and expanded back-of-house. This study, involving current geotechincal information and structural material testing should be a reliable guide for redevelopment of the facility, superceding the earlier report. A non-linear analysis of the full design of the facility will be performed in the future as part of refining the structural design proposed in this feasibility analysis.

WHERE WE ARE NOW

The Marking Keller project paused during the COVID-19 pandemic and began to gather momentum again in 2022. Supported in part by grant funding from City of Portland and Metro, the Marking Keller Group (via Halprin Landscape Conservancy)solicited proposals to select a "collaborating architect" to assemble a design team and complete concept refinement and further structural analysis of Option 2B. Portland-based Hennebery Eddy Architects was selected to lead the overall design team for the feasibility analysis and to collaborate with STUFISH Entertainment Architects in advancing the design to include functional imperatives, resiliency concerns, universal access, urban design integration with the City of Portland, and community relations aspects unique to Portland. This report represents the culmination of the efforts from January -August 2023.

Methodology / Approach

Option 2B builds on the city-directed seismic feasibility study and integrates the STUFISH/Curry design concept. The combined efforts were presented to various user/operator stakeholder groups through a series of hybrid and in-person collaborative events. Nine bi-weekly meetings were held with the City, Metro, and Halprin Landscape Conservancy stakeholders to review progress milestones, action items, and deliverables. In addition to the bi-weekly meetings, user groups including The Oregon Ballet, Portland Opera, and Broadway Across America, along with representatives from Portland'5 facilities, operations and food services were engaged in a series of workshops to assess the viability of the design concept. These efforts are documented by two progress reports and summarized in this final report.

The first design workshop, held in February 2023, included a facilities tour, focused on programmatic needs assessment, used the 2018 programming materials to establish a baseline for the new study, and elicited feedback on how operations have evolved over the ensuing years. At Workshop 2, held in May 2023, the group discussed updates including resolved feedback from the first workshop, program revisions, and development of the exterior design concept. The final workshop, held in June 2023, summarized the design efforts, outlined future community engagement goals, and included an analysis of the sustainability approach of reusing the existing building compared to a newly constructed facility.

PROJECT TIMELINE

2016
- Marking Keller Design Competition
- City of Portland Completes Assessment of over 1600 unreinforced masonry buildings

2017
- Fountain District named
- STUFISH/Curry awarded jury selection
- City of Portland releases unreinforced masonry building policy committee report
- City starts seismic study of Keller with Miller Engineering

2018
- City cites integration of STUFISH/Curry concept
- NDA agreement / seismic peer review

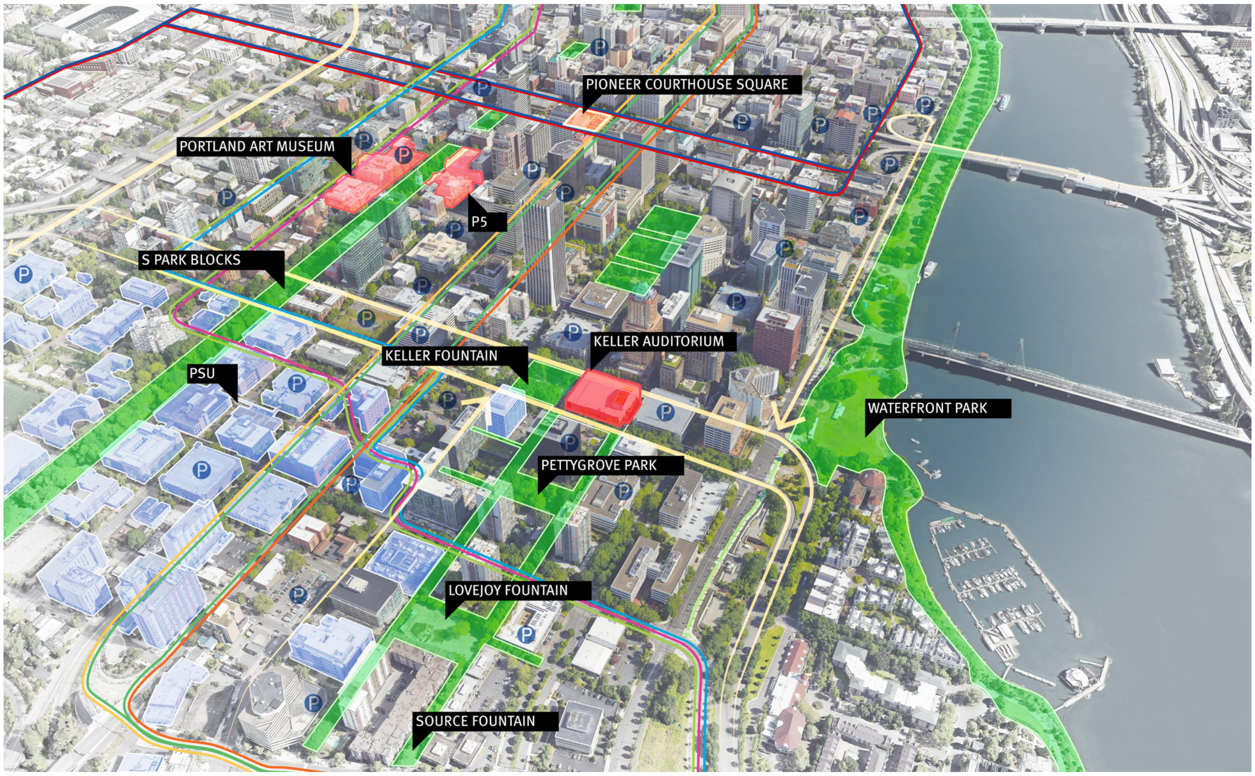
2020
- Grummel non-linear proposal to City
- City postpones release of seismic study and additional analysis proposal

2022
- Marking Keller re-start
- MK Group re-organized
- Public-private partnership: $600,000 project goal
- City seismic summary report released
- Metro / City / HLC partnership discussions
- HLC releases RFQ / interview conducted
- Hennebery Eddy Architects selected

2023
- City / Metro grant agreements approved
- HLC signs Hennebery Eddy Architects contract / team selection
- Workshops, bi-monthly meetings, tours
- Users, operators, HLC, Metro, other stakeholders
- Grant agreement extension to July 31, 2023
- Confirmation of City Council presentation in September

2024
- Tentative City Council decision to renovate Keller or build new

2. Site Context



Aerial Map of Downtown Portland

As Portland has continued to evolve, one characteristic of the city's development is predominant: urban development evolves from a fulcrum. The downtown core evolves around Pioneer Courthouse Square, the Pearl District evolves around a series of planned parks and open spaces, and the Fountain District evolves around the Keller Auditorium. A common thread to Portland urban development is that places become more than a geographic location — assuming an almost spiritual quality that is embedded in the identity and civic ownership of a place or space. The Keller Auditorium and fountain complex is exemplar of a civic icon that forms an anchor in its evolving neighborhood of south downtown.

As an organizing element of the Fountain District, the Keller Auditorium has the potential to reach out in the community, supporting physical change and cultural activity. Portland State University, another evolving anchor in the area, is undertaking a placemaking initiative, buoyed by the idea that a strong cultural and educational core can be a primary building block for an evolving city. Building on the Portland Open Space Sequence as an internationally recognized connector and activator of the neighborhood, a Market Street connector will link PSU's Lincoln Hall and the planned amphitheater in Tom McCall Waterfront Park. Fourth Avenue, from the Keller complex to I-405, will evolve into a zipper, joining together public and private development into a cohesive neighborhood. Each of these city-building activities are contingent upon the continuing role of the Keller Auditorium and fountain as the centerpiece of south downtown, functionally and culturally.

The Marking Keller initiative strives to maximize the immediate and long-term value of the auditorium and fountain complex — not only as a singular facility, but as a cultural hub that represents our values as a city and as citizens.

SITE CONSTRAINTS

The City of Portland's typical block structure limits building footprints to a 200-foot by 200-foot grid. This represents a challenge for buildings that require a larger footprint to meet program needs, like a modern theater. The only way to expand outside the standard grid is to encroach into, vacate or span the adjacent right-of-way.

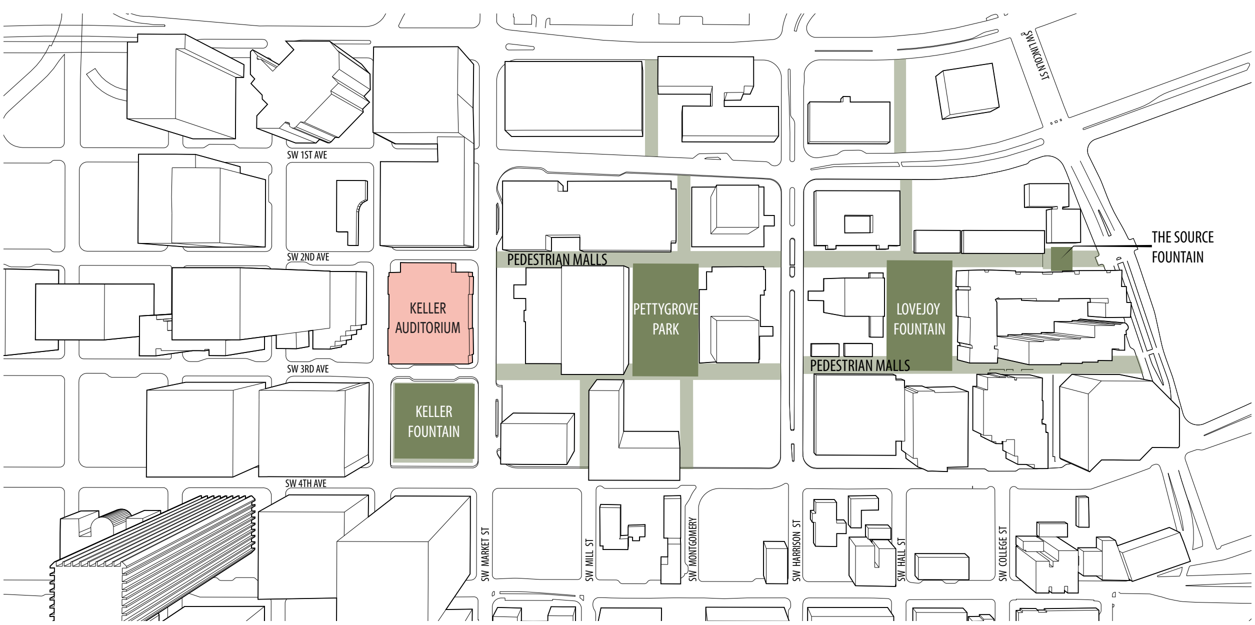
When the Keller Auditorium was redesigned in 1966, the existing adjacent rights-of-way were partially vacated to provide a 249-foot by 202-foot buildable parcel. The westerly property line was moved 29 feet west, reducing the right-of-way width of SW Third Avenue from 80 feet to 51 feet. The easterly property line was moved 20 feet east, reducing the right-of-way width of SW Second Avenue from 60 feet to 40 feet. The property lines on SW Market and Clay Streets were both moved out 1 foot.

KELLER FOUNTAIN & HALPRIN SEQUENCE

Keller Fountain Park is the northernmost part of a collection of parks and plazas known as the Portland Open Space Sequence. These spaces were designed by Lawrence Halprin and Associates in the late 1960s and include Lovejoy Fountain, Pettygrove Park, Keller Fountain, and the Source Fountain. The design and construction of these public amenities profoundly shaped the Portland that emerged from the 1960s. Halprin fused public space, fountains, and sculpture into a new kind of inviting, interactive urban space that made Portland a place to enjoy and have fun.

PEDESTRIAN EXPERIENCE

In its current state, the Keller Auditorium does little to enhance the pedestrian experience on three of its four street frontages. A significant percentage of the building's façades consist of beveled quartz panels from the sidewalk to the roof parapet with little to no transparency or visual interest. In addition to the panels being in a state of significant decay, the lack of fenestration results in a heavy monolithic facade.



Aerial plan of the Halprin Sequence

Southwest Market & Clay Streets

The facades along SW Market and SW Clay Streets are nearly identical. Except for two groups of three double egress doors, the façades are entirely composed of opaque quartz panels. This results in a massive, dark and lifeless façade that extends 60 to 70 up feet from the sidewalk — creating a negative pedestrian experience with dark and unwelcoming spaces.

Façade along Southwest Market Street at Southwest Third Avenue

Southwest Second Avenue

Along SW Second Avenue, the sidewalk directly abuts the concrete wall of the backstage and loading dock. The sidewalk is only 8.5 feet wide, including the street tree planting zone, and does not meet the 10-foot-minimum right-of-way as outlined in the current PBOT Development Review Manual. Despite a mural painted on the concrete façade, the lack of fenestration, coupled with the very narrow sidewalk, creates an uncomfortable pedestrian experience.

Southwest Market Street at Southwest Second Avenue

The path emerging from the Halprin sequence to the South does not directly align with either sidewalk in the Keller block, resulting in a forked crosswalk at the intersection on SW Market Street and Second Avenue.

Southwest Second Avenue

Southwest Third Avenue

The facade on Third Avenue consists mostly of glass curtain wall set behind a tall collonade and is much more pedestrian friendly than the other three sides. However, there are significant opportunities to improve this building frontage by better connecting it to the Keller Fountain Park. SW Third Avenue currently bifurcates the auditorium and fountain sites, disconnecting the two urban places. There is an opportunity for the fountain Plaza and auditorium to blend together by remaking Third Avenue as a pedestrian-first plaza. This approach would improve the sense of place for both landmarks while increasing pedestrian safety.

Southwest Third Avenue

(page intentionally left blank)

3. Programming

Design team members tour the Keller Auditorium

Starting in January 2023, the design team worked with project stakeholders to develop a building space program that supports the variety of events staged at the Keller and their associated audiences, staff, and crew. The program from the previous study was referenced as a starting point, with an acknowledgement that some of the facility needs had changed during the intervening five years — particularly due to the impact of the COVID-19 pandemic. Through a series of interviews that took place during the February 2023 workshops and subsequent follow-ups, the team developed a new set of requirements, taking the aspirational design ideas of the STUFISH/Curry design concept and grounding them in programming needs to create a feasible proposal.

As part of this needs assessment discussions, stakeholders outlined two primary areas of concern: seismic safety and visitor experience. Specific needs and challenges are outlined in the following sections.

FRONT OF HOUSE

Every user group expressed concerns with traffic and egress flow due to overcrowding in the lobby. This issue adversely affects safety and visitor experience. Visitors often wait in lines throughout an event, including while entering the building, using the restrooms during peak times, purchasing drinks and other concessions, and even returning to the auditorium after intermission.

During a performance, there are currently no interior connections between the front-of-house and back-of-house areas — meaning staff and crew must go outside to move between these areas of the facility. Particularly in the Northwest climate, an interior connection is critical.

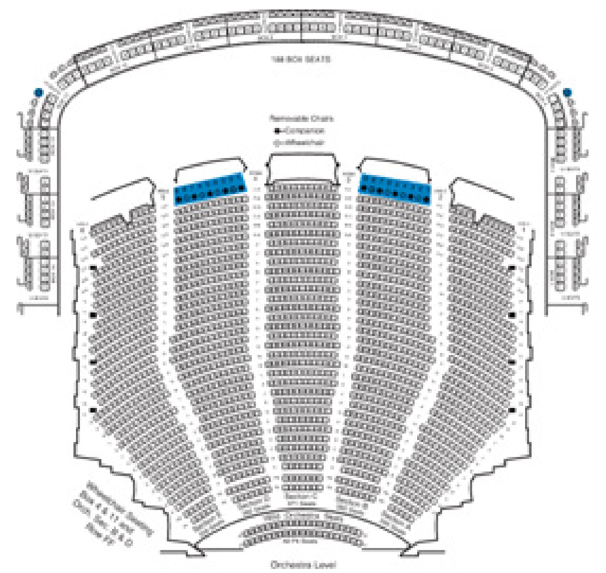
Food Service

A primary takeaway from the food service workshop is there are not enough points of service in the existing facility. There are issues with traffic flow, including long lines for the restrooms and bottlenecks of people inadvertently gathering in corners; these behaviors not only limit patrons' ability to buy concessions during intermission but also create unsafe conditions in the event of an emergency. User groups recommended several different bar locations, with longer bars, to allow more efficient service.

Another shortcoming is the absence of a kitchen. Currently, only food warming is available on-site, which significantly limits catering and food service opportunities. Within an expanded front-of-house space, an opportunity will exist to create a full service restaurant with dramatic views of the Keller Fountain and extended operating hours — further activating the Keller and surrounding neighborhood.

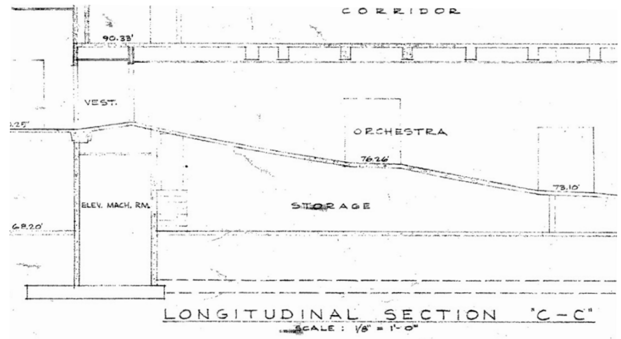
Accessibility

The Keller Auditorium is significantly lacking in equitable access for people of differing abilities. Each user group expressed similar concerns about accessibility. Specific concerns include limited quantity and distribution of accessible seating within the auditorium. Mobility devices are currently restricted to the rear of the orchestra level and very limited positions in the boxes. Additionally, there is no accessible route to the orchestra pit, limiting the participation of musicians. Further concerns include the rigidity of the general seating and spacing of the seating rows, which present barriers for people with a variety of mobility issues. In short, there are not enough seats to accommodate the volume or diversity of needs. Users have expressed a desire for more flexibility in the seating, such as removable chairs and arm rests.



The blue areas on this plan indicate the only wheelchair-accessible seating in the current auditorium.

At the orchestra-level seating entrance, sloped concrete at the aisles creates a tripping hazard for the audience, and people often fall when entering the auditorium. The existing aisles exceed the maximum running slope allowed by building codes for non-



This section illustrates the steep grade at the orchestra level aisles

egress pedestrian ramps. Another concern was the barriers for the hearing or visually impaired. Suggested solutions included integrated technology for closed captioning.

Access to & from aisles creates a hazardous condition

BACK OF HOUSE

There is a desire to improve the back-of-house functionality and loading areas for both performance and facilities staff so that the spaces can be used by both groups simultaneously. Users described the loading and staging before a show as “chaotic.” In general, back-of-house spaces are disconnected, insufficiently sized and difficult to navigate. Circulation within the dressing tower is circuitous and dressing rooms are dark and cramped. The existing ramp connecting the backstage area with the basement level storage is steep with an irregular, warping slope, creating a hazardous condition for staff rolling crates and other storage items.

Restrooms

There are not enough restrooms in the facility to accommodate the demand of a performance. Further, the layout presents challenges to traffic flow during intermissions due to the proximity of restrooms to the lobby and circulation areas, resulting in long lines, bottlenecks, and clusters of people in corners — all detrimental to the visitor experience. Additionally, there are no accommodations for private family restrooms or all-user options.

Ticketing

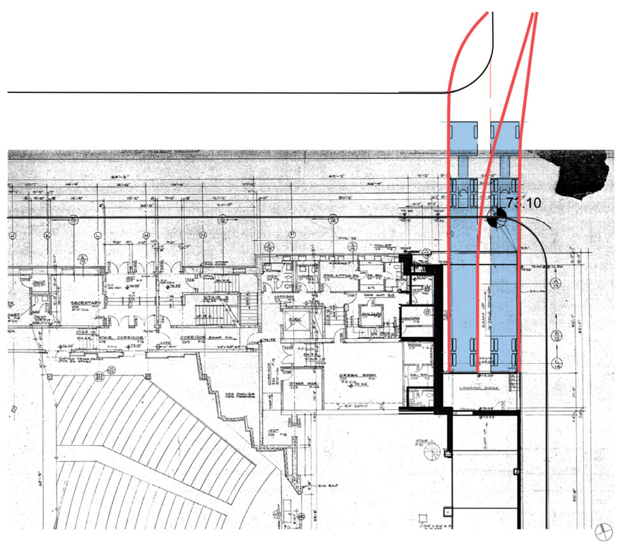
The current box office has an inadequate number of ticket windows which are situated within the northern entry vestibule along Third Avenue. Often, the result of this configuration is congestion at the entrance and a merging of the queueing lines for will call and ticket scanning.

Loading

The existing loading dock dates to the 1966 facility renovation and does not meet modern industry standards — posing logistical and safety concerns for staff and crews, and negatively impacting the surrounding urban environment.

Of the primary user groups, Broadway shows have the most demanding loading requirements, but most events use WB-67 trucks for loading. The current facility dimensions and layout require special maneuvering, specific timing for trucks to arrive at the dock, personnel for flagging, and partial closure of SW Clay Avenue while trucks back across the right-of-way into the dock. The dock dimensions only allow for one truck to maneuver at a time and, when parked for unloading, truck tractors must be detached from the trailers to minimize impact to the right-of-way. Even with the tractors detached, the shallow depth means a portion of the trailer extends across the sidewalk and the parking lane on the street. The shallow dock, combined with the length of modern trailers, means the slope of parked trailers is between 7% and 8% — exceeding the maximum recommended slope and posing safety issues during loading and unloading.

Because there is only one loading area, all goods arriving for operations and all deliveries for performances must be received at the same location. This leads to the SW Third Avenue entry lobby often being used as a secondary loading and staging location while the primary dock is in use. The separation of these loading activities is further complicated by the lack of direct connection between the front and back of house areas.



This plan illustrates the truck loading path impacts to the right-of-way

Current loading conditions

(page intentionally left blank)

4. Marking Keller Design Concept

Rendering: Third Avenue plaza and ground-floor facade

THE KELLER RENAISSANCE

Cultural vitality is the heartbeat of a city. The guiding principles for the Marking Keller project are to create a destination district for culture and entertainment in Portland that is welcoming, safe, inclusive, and accessible. The goal is to facilitate a complete visitor experience, whether this includes a theatrical performance or simply a visit to the fountain. The proposed design concept aims to turn the theater inside out — creating opportunities for the surrounding environment to, itself, be theatrical. Working together, the Keller Auditorium and Keller Fountain will be powerful public attractors. Strategic design moves will facilitate a variety of features to surprise and delight visitors, while the environment encourages exploration and leisure for the broader community. Above all, the project will create an inviting space that welcomes all Portlanders and visitors to experience communal art and culture. Great cities have magnetic public spaces that sustain the wellbeing of the community. The Marking Keller project and Fountain District will be a centerpiece of that renaissance for Portland.

Rendering: Southwest facade

A Unique & Intentional Form

The key design concept of the Marking Keller vision manifests most visibly in the west façade, which faces the Keller Fountain Park. The new glass façade carries the revitalized spaces within, extends beyond the existing concrete colonnade, cantilevers over the new pedestrianized plaza of SW Third Avenue, and engages with the park. This gently curving façade displays the performative wonders from inside the auditorium stage, connecting the spaces to the outside and infusing the fountain and the surrounding spaces with new energy.

The facades along SW Clay and SW Market are transformed from monolithic, lifeless planes to multi-use canvases that are inviting, engaging, and placemaking for both pedestrians and passing vehicles. Where there are active interior spaces behind the facade, the triangular panels will be made of transparent glass or perforated metal, allowing views both inside and out. This will help to enliven the façade and connect the public with the activities inside.

The west façade angles outward 30 degrees from the Level 1 balcony up to the roof. This façade is made up primarily of vision glass to enhance the visual link from the auditorium to the fountain plaza, and vice-versa. The north and south façades are clad with a lattice of metal and glass panels supported by a new exo-skeleton framework. The angled gesture of the west façade and the vertical language of the east façade are propagated into the shape of the metal and glass panels found on the north and south façades; this allows these facades to be broken down into smaller modular panels of equal size — around 5 feet wide and 10 feet high — making them more cost effective. The gently curving façade embraces and extends the performative wonders from inside the auditorium stage to the outside, infusing the fountain and the surrounding spaces with new energy.

Rendering: Northwest facade and Third Avenue plaza

This angled west façade literally brings the auditorium space closer to the Keller Fountain and creates a multitude of differing vantage points to experience the fountain while inside the auditorium. This gesture also provides a more intimate visual connection to the auditorium while experiencing the park. This connection increases transparency for both internal and external events, blends the lines between auditorium and fountain, and re-energizes the site and district.

The west façade's unique shape provides passive shading opportunities as well as an acoustical benefit to the park. The gentle curvature extends westward on the north and south creating "fins" which, in conjunction with the 30-degree angle slope, passively shades the sun through the afternoon hours when sunlight is the most intense. This geometry reduces solar gain in the warm months, and therefore energy demand, making the building more efficient.

Additionally, this unique curving façade form will reverberate the sound emanating from performances and evening shows held outside at the Keller plaza and fountain, creating a memorable experience for attendees and passersby.

By capturing, reflecting, and amplifying the activities and energy of both the fountain and auditorium, the reconstruction and renaissance of this place will enhance the goals and achievements intended for the district, starting in the 1960s. Through the combined design proposals outlined in this report, the Keller will emerge anew, giving Portlanders an invitation to gather again as observers, participants, and performers joining in the Keller Renaissance. From enhancing the experience of the urban fabric to more structured performances inside and outside, the revitalized Keller will extend its legacy by marking the Fountain District for the next 50 years and beyond.

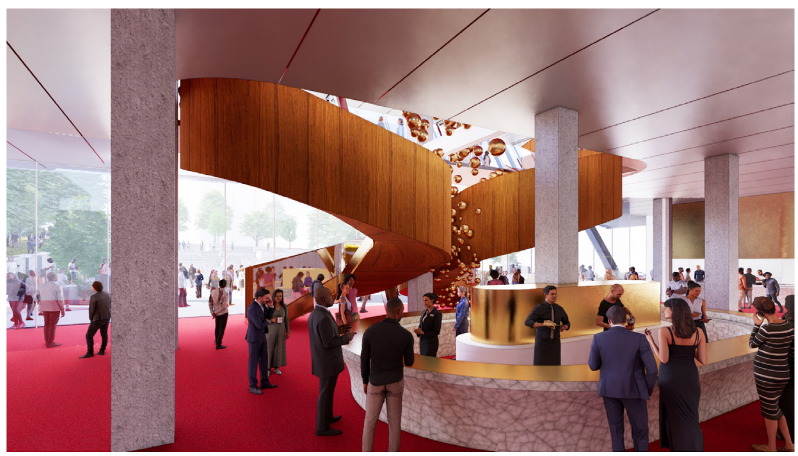
PROGRAM IMPROVEMENTS

Front-of-House

The existing interior lobby is not of adequate size for a 3,000-seat performance theater. Today, the lobby is primarily used for circulation, and it performs poorly. The proposed design adds more than 18,000 square feet of new lobby and circulation distributed over three floors. The façade angle allows the circulation and front-of-house areas to increase as visitors ascend through the building.

The ground floor includes a westward expansion of the lobby area, enclosing a portion of the existing porch and colonnade, adding 1,675 square feet to the ground floor, for a total of nearly 9,500 square feet of enclosed lobby area. The expansion and redesign allows for several improvements, including three separate concession areas with expansive bars providing several points of service that will significantly reduce lines. The lobby expansion also includes a relocation of the box office to the northwest corner as well as a separate ticketing booth on the south side along SW Market Street.

Before



Rendering: Ground foyer bar

Before

Rendering: Feature stair

The first balcony area increases by more than 5,100 square feet to a total of more than 11,200 square feet, with an opportunity to incorporate a café/bar/lounge as well as two large concessions stations on opposite sides of the open space. There are also opportunities for private, leasable rooms as well as more front-of-house storage space and ushers' meeting rooms.

The second balcony lobby, which is currently very constricted, increases by more than 7,300 square feet for a total of more than 11,600 square feet. This level includes an opportunity for an extensive flexible event space with an open commercial kitchen, a prime restaurant opportunity, as well as an improved VIP experience in a donor's room on the northwest side of the space. Also planned are two additional bar/concession areas and a second kitchen in the back-of-house area along the south facade.

Before

Rendering: First balcony

Before

Rendering: Second balcony

The Auditorium

The proposed design concept includes several enhancements for the auditorium audience: ease of circulation, maintenance of sightlines, and improvements to accessibility and comfort, all while maintaining a seating capacity necessary to support demand and revenue. The target seat count, influenced largely by Broadway and popular entertainment, is 2,700 with a full orchestra pit in use. An additional 40 to 100+ seats can be deployed on the orchestra lifts when segments of the pit are not required. As a new audience offering, 30 standing-room spots are available at the rear of the parterre.

By elevating the auditorium orchestra level and stage approximately 18 inches, a new cross aisle is configured with an accessible route from the main level of the lobby, reducing the steep aisle angle at the rear of the parterre. Wheelchair positions are provided at various points at the cross aisle, at the front of the auditorium and at the rear of the parterre directly accessed from the main lobby level. The auditorium's excellent sightlines are retained and made more equitable throughout the orchestra level.

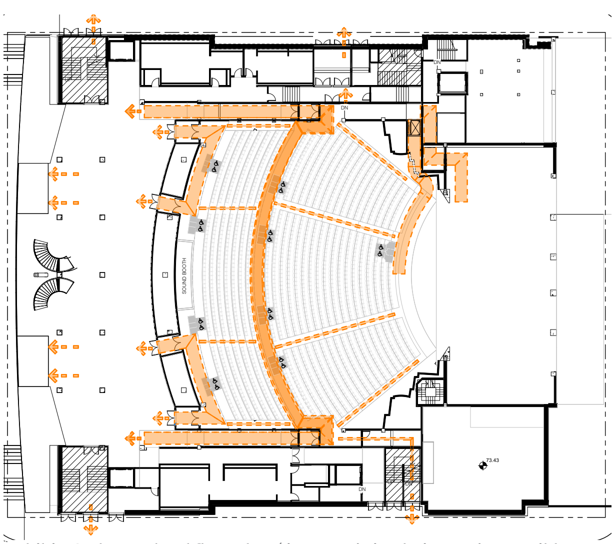


Exhibit: Orchestra-level floor plan / improved circulation and accessible seats

During the 1960's the building code had a limitation on the number of seats allowed between aisles. This requirement is the reason for the number of aisles and narrow rows found in the configuration of the auditorium today. Recent theatre design standards and building code have evolved so that the clear space between rows is a more relevant aspect for access and egress.

In keeping with these best practices, the proposed configuration widens the rows, employs more contemporary seats that have narrower seat envelopes and provides the ability to fill in some of the aisles. The row spacing is increased from the existing 34 inches per row to 36 inches per row, and the risers are made regular in the parterre. Patrons will not have to cross more than 15 seats to get to an aisle; a similar arrangement can be found at the Portland'5 Newmark Theatre.

Forward of the cross aisle, the aisles and rows are sloped, and all awkward swale conditions at the aisles are eliminated. New, comfortable seating is provided throughout, with the seats staggered from row to row to optimize sightlines. The reconfigured auditorium allows space to be reassigned for audience amenities and production accommodations between the auditorium and lobbies. A dedicated in-house audio mix position is configured at the rear of the orchestra level, and an expansion of control booths are provided above the first balcony. See the accompanying diagrams and appendix for audience flow, seat count distribution and sightline analysis. A comprehensive interior architecture design effort was not performed within the scope of this study.

The removal and replacement of the plaster auditorium ceiling is predicated by several factors. As it exists, it represents a seismic risk due to its weight and insufficient lateral stability. Above the ceiling, the roof structure contains hazardous materials, which require

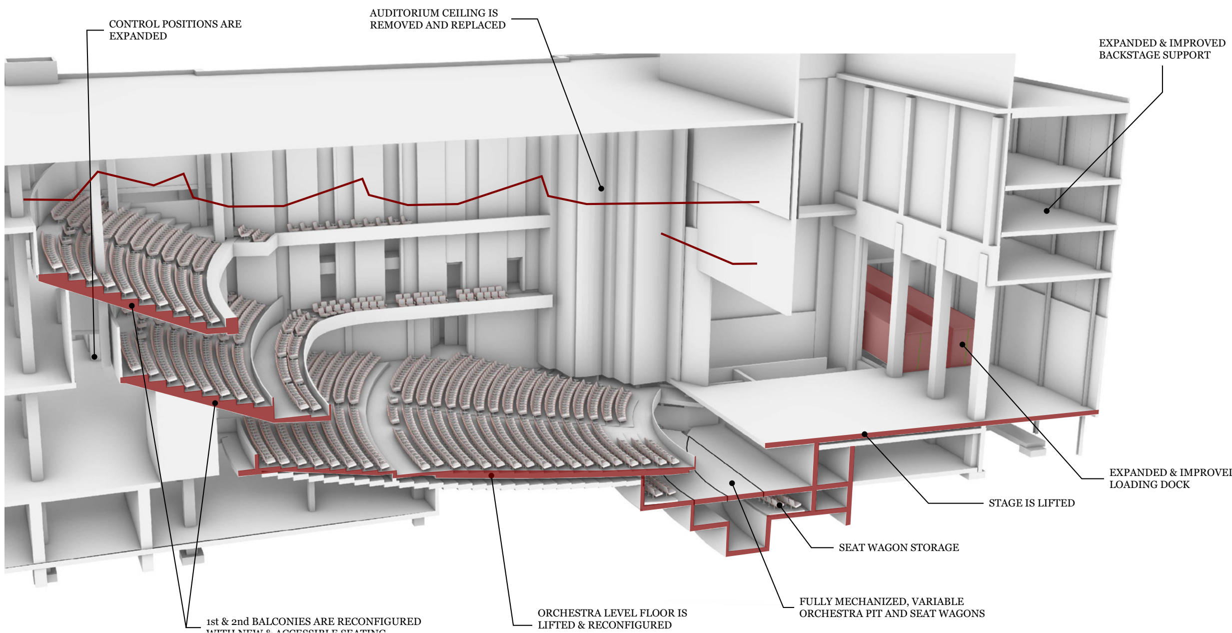


Exhibit: Building cutaway

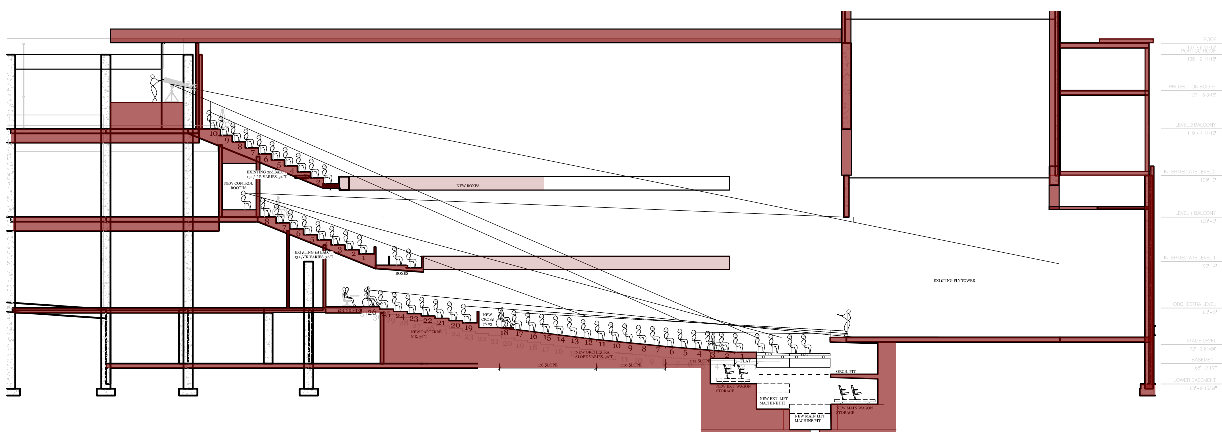


Exhibit: Building section with lifted stage and orchestra, enlarged pit and improved sight lines

abatement; removal of the ceiling provides access for that work. The replacement auditorium ceiling will likely be of a lighter material, which provides a credit to the capacity of the roof structure to support a solar panel array (see more on this in Section 5).

The solution also benefits the approach to the acoustics in the auditorium. Because the Keller is used for amplified and un-amplified uses (e.g. ballet and opera), its acoustic range could be improved in the same manner as was done at the Arlene Schnitzer Concert Hall and in Silva Auditorium at the Hult Center in Eugene, with an electronic acoustic enhancement system. To best accommodate the use of such a system, architectural finishes in the space would be generally absorptive and therefore weigh less than the existing plaster.

Restrooms

The design team studied options to significantly increase the number of restrooms on each floor and address the challenges inherent with the current layout, including queueing lines. Family-use rooms and lactation spaces were considered as well as all-user options. Significant effort was made to reconfigure bathroom entries to keep lines outside of the public lobby and circulation areas, which will further reduce traffic congestion.

BACK-OF-HOUSE IMPROVEMENTS

Dressing Tower/Support Spaces

The proposed upgrades to the dressing tower add nearly 23,000 square feet of usable area, primarily focused on increases to performer support spaces. The bulk of the existing back-of-house space is located in the dressing tower north of the stage and has limited connection to the south stage and rehearsal areas. In contrast, the newly proposed design bridges across the backstage area and connects north and south. Vertical and horizontal circulation within these spaces is reconfigured to provide more direct connections between spaces and shifts the occupied areas of the back of house toward the building exterior, allowing the opportunity for natural daylighting.

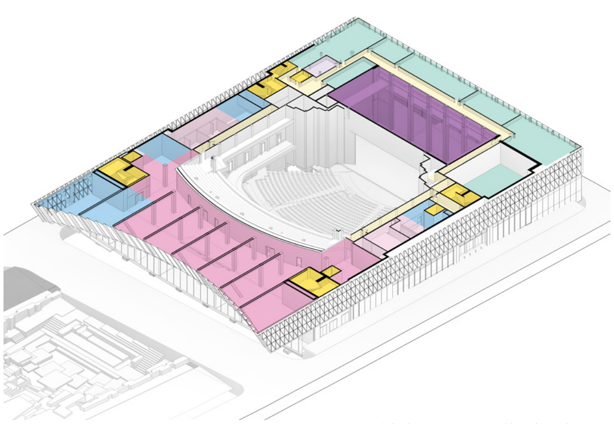


Exhibit: Program distribution

Loading

The proposed new loading facility is a substantial upgrade and meets current best practices and industry standards for loading dock design. The new configuration expands beyond the existing east exterior wall, creating a simpler turning movement into and out of the loading docks and allowing two WB-67 trucks to move independently, and load and unload simultaneously. In addition, the dock is recessed further into the building, providing for trucks to park completely out of the right-of-way and allow overhead doors to seal the dock opening.

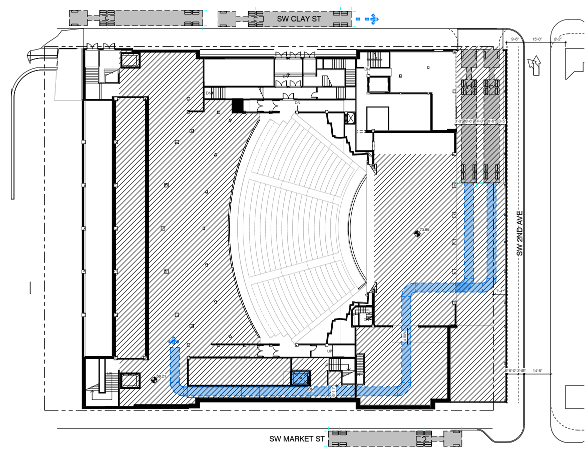


Exhibit: Event loading diagram

By raising the stage floor 18 inches, the newly reconfigured loading dock will be flush with the stage floor, and the slope of a parked trailer will be reduced to less than 5%. The reconfiguring of the loading at stage level create an opportunity for staging to be consolidated to the east and south of stage, allowing direct loading and loading to trucks. When production materials are required to be stored on-site for longer terms, the access ramp to the basement has also been adjusted to create a safer route for the movement of objects.

New facilities and event staff loading locations on SW Clay and Market will divert the additional loading activities away from the front of house and allow discrete connection from front- to back-of-house without needing to pass though the orchestra or exterior of the building.

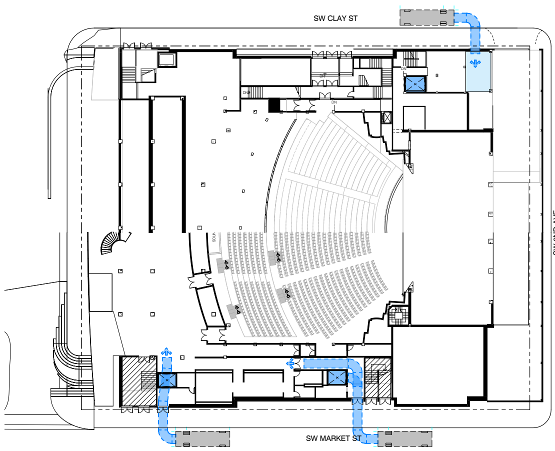


Exhibit: General loading diagram

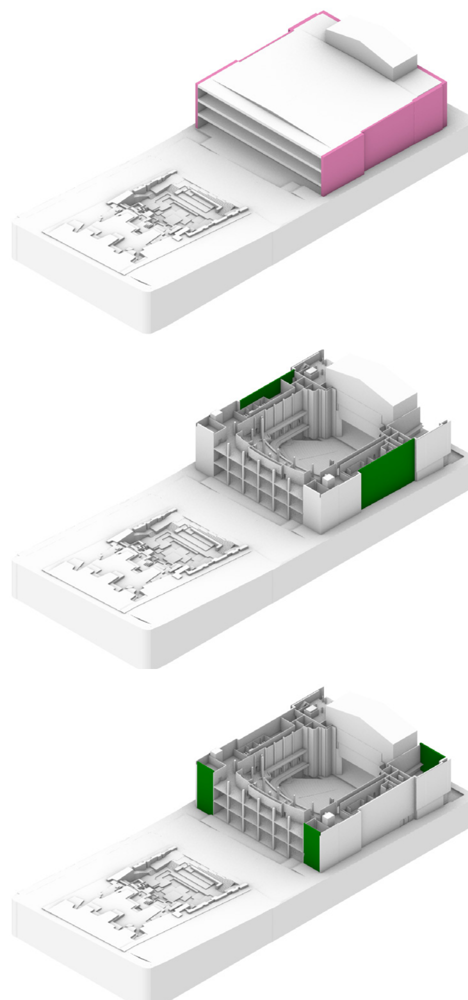
STRUCTURAL APPROACH

The structural scope includes alterations to the building for programmatic changes, expansion to the front- and back-of-house, and a complete seismic upgrade to a standard equivalent of new construction — all seeking to minimize impact to the existing structure and the associated costs.

Seismic Upgrades

The 1966 Keller remodel added reinforced concrete shear walls, foundations, and floor structure. To determine what further retrofits are necessary to meet current code and safety standards, the design team completed a structural evaluation, geotechnical study, and materials testing. The geotechnical study found stiff soils with no risk of liquefaction; as a result, foundation upgrades are minimal and mainly pertain to new gravity loads imposed by the additions. Unreinforced masonry walls can be upgraded in-place with a combination of steel and carbon fiber; the steel doubles as a support for a new lightweight cladding system. Design team analysis identified several wall lines of high-stress concentrations, which can be reinforced with shotcrete. Enhancing existing elements minimizes the need for additional material and shoring and reduces overall construction cost, compared to replacement.

In the event of an earthquake, Non-structural components might be damaged to the extent that they cannot immediately function but are secured in place. Access to life safety systems would remain available. The building would be repairable.

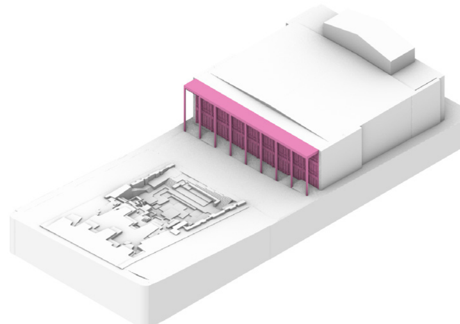


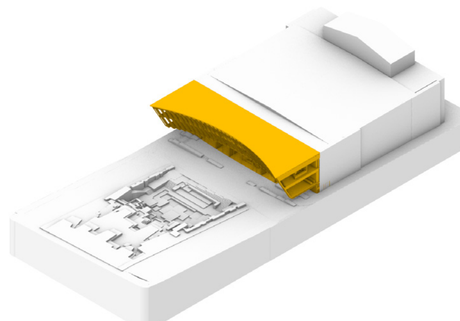
Auditorium Alterations

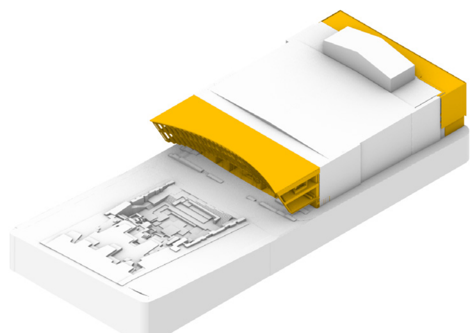
The elevated seating conceived for the auditorium's main floor can be achieved with lightweight framing over the existing structure. The existing wood stage structure can be largely retained by elevating it with new support posts, while modernization of the orchestra pit can be achieved with a split-level pit to minimize impact to the structure.

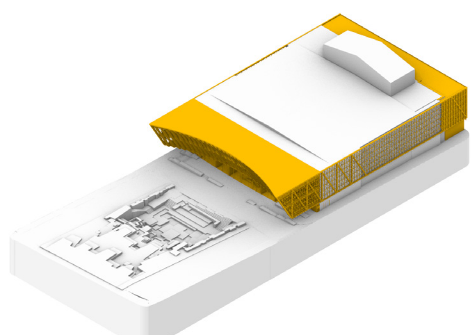
Building Additions

The planned west addition support structure uses efficient, deep trusses along the north and south elevation. Between trusses, loads are concentrated on three canted columns. This minimizes the need for new foundations and the impact to existing foundations. At the east addition, conventional framing methods will be used: steel column-and-beam lines with metal decking and concrete topping. Added structure at the east will also double as a seismic improvement for deficiencies at the back stage. Steel columns will reinforce existing piers, and a new wall line will support lateral loads. The new floor space will act as a diaphragm for transferring seismic forces to resisting elements.









More Analysis Required

The analysis in this conceptual study was based on a linear static procedure, which provides a good understanding of the global forces and how they relate to the current lateral system. The design team consulted with City of Portland Bureau of Development Services' structural team along with several experts in the field of non-linear analysis. Due to geometric irregularities, a non-linear analysis will be required, providing additional understanding of the seismic effects on various members. The result of further analysis will narrow work to specific locations requiring upgrades.

More information regarding the structural design is detailed in the full engineering report in the appendix, which includes schematic plans, geotechnical findings, lateral calculations, and material testing.

OTHER PROPOSED IMPROVEMENTS

Stage Production Systems

Most of the backstage production systems of the Keller are approaching the end of their useful life. A significant renovation is an opportunity to bring all of these systems up to current standards, incorporating significant advancements in technology and the high demands of current touring and local productions. Creating flexibility in production efficiency is key to the Keller meeting its goals for delivery of a wide range of exceptional artistic experiences.

The stage rigging system that supports the elements that are raised and lowered into the fly tower above the stage will be replaced with a manual, counterweight system with front-loading arbors and compensating chains to make the system easier to use, as readily flexible as touring productions expect, and widely serviceable.

The stage lighting system will be updated to provide controlled, constant power relays, as has become appropriate for LED stage lighting sources and power connections for touring equipment. The audio-visual system will include a substantial amount of cable path and digital infrastructure, and house systems.

“MARKING” THE FOUNTAIN DISTRICT

Keller Auditorium lies at the intersection of several community assets. It is the active heart of the Fountain District. Market and Clay Streets connect the Keller to arts institutions along SW Broadway, such as PSU’s Lincoln Hall, the Portland’5 venues at Antoinette Hatfield Hall and Arlene Schnitzer Concert Hall. Along with Keller Fountain, the auditorium marks the northern and most visible end of the Portland Open Space Sequence. To the south, superblocks limit vehicle access and place additional focus on the site’s ability to invite visitors further into the sequence. In recent years, the Halprin Landscape Conservancy has highlighted the need for additional lighting, event power, and wayfinding within the historic parks and pedestrian malls. Portland Parks & Recreation should consider the renovation of the Auditorium as an opportunity to undertake any deferred maintenance, infrastructure updates, and any further improvements to the Keller Fountain and Portland Open Space Sequence. Plans for “marking” the Keller include

Strategic signage along the Open Space Sequence helps to identify and tie together The Fountain District lighting and wayfinding to complement the existing design. These concepts can support the Keller, the Portland Open Space Sequence, and define the Fountain District as a whole, without physically altering the design of the parks and maintaining the historic integrity of the elements.`

Poetic Kinetics

Another way to improve wayfinding and further energize and identify the district is through aerial activation with a kinetic art installation along some of these connecting pathways. Skynet installations by Poetic Kinetics, or a similar artist, are a way to inspire and engage pedestrians to use these connections and further activate the Fountain District. The kinetic sculptures are lightweight, colorful, and subtle yet awe-inspiring and will connect people to the environment and draw them into and through these outdoor spaces.

Keller Fountain and Plaza Activation

Halprin intended the Keller Fountain to be an artistic expression reflecting on the intersection between nature and the arts. This project's design and programming continue to embrace and expand on that relationship with the aim of reactivation. The pedestrianization of Third Avenue — the Forecourt Plaza — will connect the Keller Auditorium to the fountain. Together, this space will not only be the prologue and epilogue to every performance at the Keller, it will be a standalone attraction — a strong piece of public art on its own that becomes a true destination in combination with a revitalized plaza and auditorium.

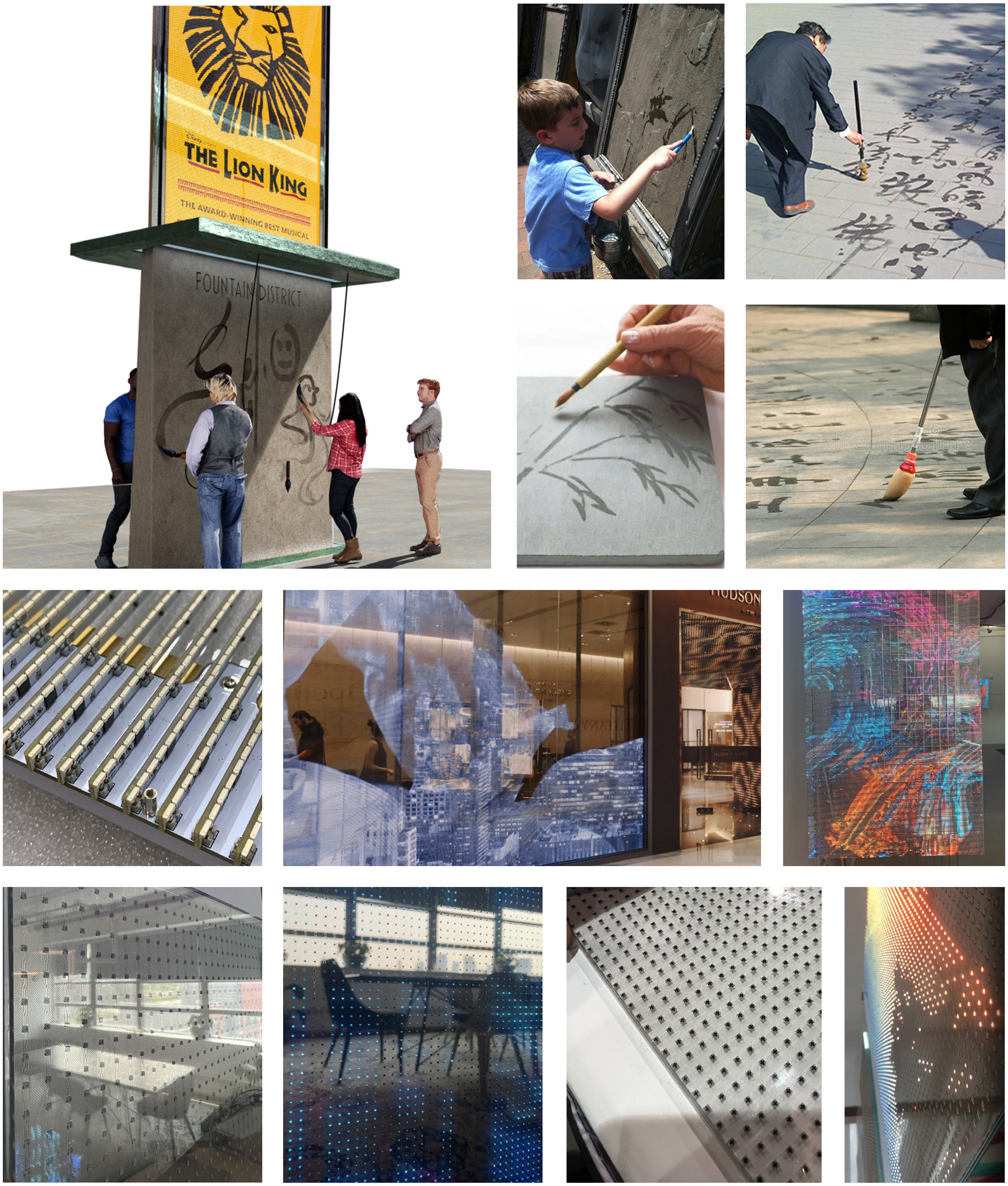
Rotating programming — such as a nightly fountain projection show, live entertainment, and art installations — will keep this space vital throughout the year. In addition, a proposed new lighting concept will promote both safety and beauty. This space will become a public area for both entertainment and reflection, accessible to our diverse community. Activation in this space in turn will spur vibrancy for the entire neighborhood — encouraging foot traffic, new businesses, restaurants, and more.

Skynet installations by Poetic Kinetics enhance the identity of a place while drawing the pedestrian along a path and further energizing the district.

Interactive Installations & Public Performance

There are opportunities for public performance throughout the Fountain District and along the Portland Open Space Sequence. Programmed performances will strengthen the identity of the district, giving visitors the sense they have entered a special place within Portland.

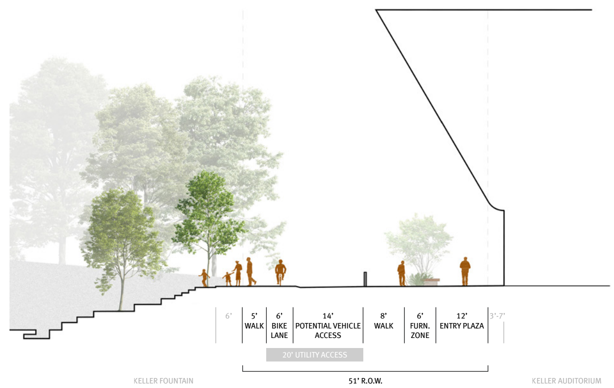
Examples of the possible outdoor programming include an oversized "Ghost Light" sculpture, with classical music and other curated performances staged near the fountain. At dusk, an audio-visual show will play live, projected onto the fountain.



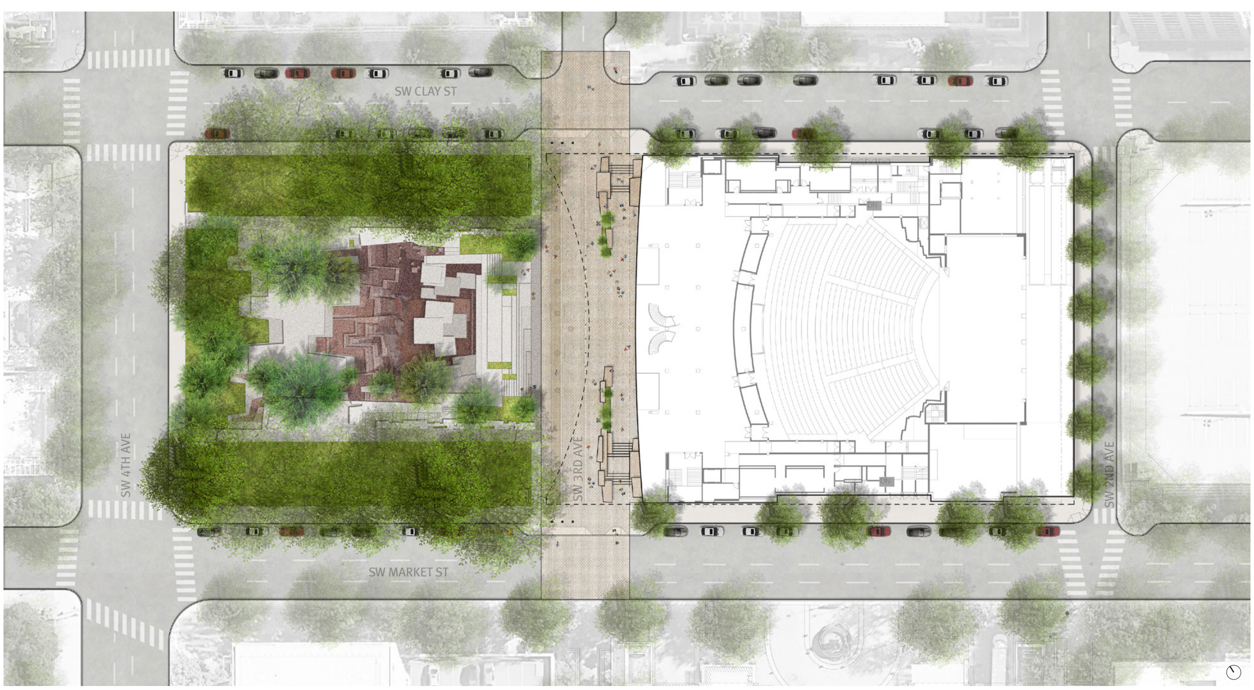
Examples of activating the plaza include interactive art pieces where the public can paint with a water brush on concrete or stone, which would disappear after a minute or two. Fountain District signage and theming could integrate transparent LED film or lattice, programmable content.

Connecting SW Third Avenue & Keller Fountain

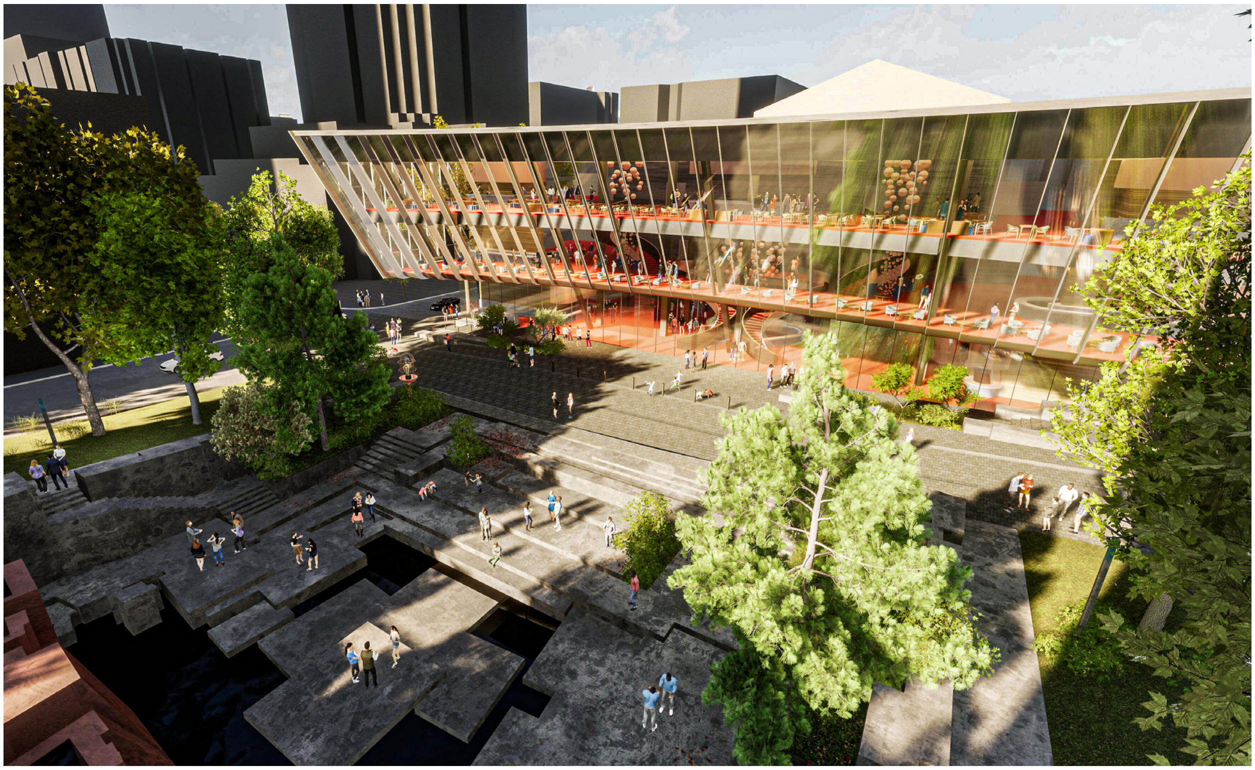
SW Third Avenue is envisioned as a pedestrian-focused street plaza that unites auditorium and fountain. Continuous special paving within the street, including the Clay and Market intersections, extends the Portland Open Space Sequence pedestrian mall and welcomes visitors. Curb extensions improve safety for those arriving from north and south. Regrading of SW Third Avenue improves accessibility to the auditorium and the fountain and provides the ability for programs to spill out from both sides. Landforms inspired by Keller Fountain navigate grade differences at the street edge and provide seating opportunities. While the current concept retains space for a vehicle lane, there is a possibility to completely pedestrianize Third Avenue between Clay and Market and create programming opportunities in the street plaza. Further analysis, including a traffic study will be required to determine the feasibility of closure to 3rd ave and the impacts to the surrounding blocks.



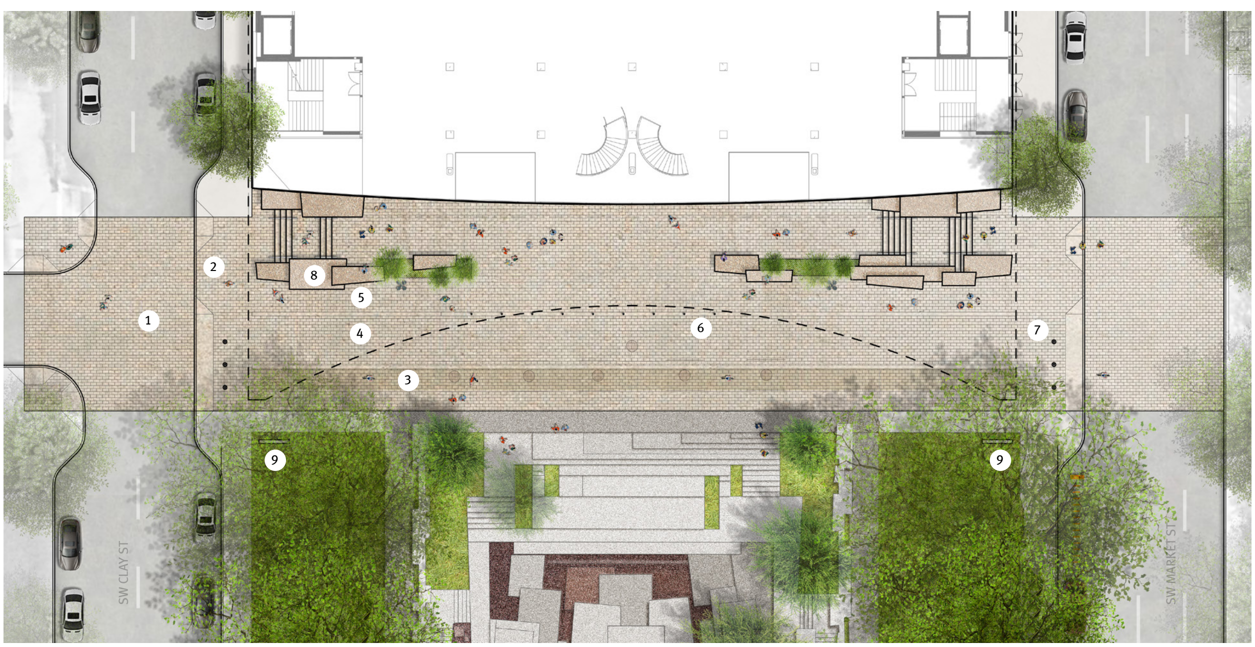
Illustrative site section



Illustrative site plan



Rendering: Keller Fountain and plaza from the west



1. UNIT PAVING
2. CURB EXTENSION
3. BIKE LANE
4. POTENTIAL VEHICLE LANE
5. SIDEWALK
6. REMOVABLE BOLLARDS
7. HYDRAULIC BOLLARDS
8. CONCRETE SEATS
9. INTERACTIVE SIGNAGE

Illustrative plan for Third Avenue plaza

(page intentionally left blank)

5. SUSTAINABLE & EQUITABLE DESIGN

SUSTAINABLE DESIGN REQUIREMENTS

The Marking Keller Group and design team have worked closely with the City of Portland, Metro and Portland'5, and the Halprin Landscape Conservancy to ensure we are meeting the sustainable and equitable design goals of the stakeholders and community. The following summarizes the City and Metro policies on sustainable and equitable design that this project will follow.

CITY OF PORTLAND GREEN BUILDING POLICY

The intent of Portland's Green Building Policy is to "incorporate green building practices into design, construction, and remodeling and operation of all city-owned facilities." For new, occupied, City-owned buildings with more than 20,000sf and/or a construction budget of more than $5M, the following requirements should achieved or exceeded.

- LEED BD+C Gold certification and/or Living Building Challenge.
- 15% energy savings beyond Oregon Energy Efficiency specialty code.
- Onsite renewable energy systems / meet Oregon's 1.5% green technology requirement.
- Earn or meet LEED's advanced energy metering credit requirements to support ongoing energy monitoring and commissioning.
- Earn or meet LEED's enhanced commissioning credit requirements.
- Use native and/or non-invasive drought-tolerant plants / use no potable water for irrigation, except for the first two years to establish plantings, or in cases of drought.
- Select WaterSense-labeled products for all eligible fixtures / reduce total potable water use by at least 20% over the building's estimated baseline.
- Cover the entire available roof, excluding mechanical access structures, with ecoroof. Exemptions to this requirement must be approved by the commissioner-in-charge.
- Incorporate stormwater management and related watershed-enhancement strategies that support Salmon Safe certification during construction and after project completion.
- Incorporate measures to reduce bird strikes and fatal light attraction, including treatment of exterior glass and glazed surfaces, lighting design, best management practices, and other applicable measures as specified in Appendix B.
- Provide covered and secure bicycle parking for employees and visitors at an amount equal to the 25% mode share target in the City's Climate Action Plan, unless and until replaced by mode share targets in the 2015 Transportation System Plan.
- Follow construction waste prevention guidelines in Section 3.
- Follow space allocation standards and space planning guidelines in Appendix C.

Note: Guidelines related to parking are not applicable because there is currently no on-site parking at the Keller Auditorium, and none is being proposed.

METRO SUSTAINABLE BUILDING & SITES

"The purpose of the Metro Sustainable Buildings and Sites Policy is to set standards for design, construction, operations and maintenance of Metro buildings and developed properties that support achievement of Metro's five sustainability goals and the Strategic Plan to Advance Equity, Diversity, and Inclusion."

- Reduce direct and indirect greenhouse gas emissions to 80% below 2008 levels by 2050.
- Eliminate the use or emission of persistent bioaccumulative toxics (PBTs) and other priority toxic and hazardous substances by 2025.
- Recover all waste for recycling or composting and reduce overall generation of waste by 2025.
- Reduce water use to 50% below 2008 levels by 2025.
- Ensure that Metro's parks, trails, and developed properties positively contribute to healthy, functioning urban ecosystems and watershed health and that Metro's natural areas are healthy, functioning ecosystems.

The Keller renovation falls under Section 4 of Metro's Sustainable Buildings and Sites Policy in the category of "New Construction and Major Renovations." Minimum requirements for this category include the following.

- Core Green Building Certification
- SITES Gold Certification
- Project Planning: Ensure budget accounts for resources required to properly plan for the requirements of this policy.
- Green Energy Technology: Spend an amount equal to at least 1.5% of the total contract price for the inclusion of appropriate green energy technology in the building.
- Fossil Fuel Infrastructure: Exclude the use of fossil fuels and dedicated fossil fuel infrastructure and fossil gas combustion.
- Electrification Infrastructure: Include vehicle electrification infrastructure consistent with requirements for the Core Green Building Certification.
- Bird-Friendly Design: Incorporate, including window treatments, reducing light attractants, and other measures.
- Materials carbon reduction
- Sustainable Roof Requirements: Evaluate and implement environmental benefit based on the hierarchy below:
  - Solar photovoltaics (solar panels)
  - Ecoroof
  - High-reflectance roofs

Feasibility of LEED Gold and ILFI Core Certification

As a part of the City's Green Building Policy, this project must pursue a third-party certification either for U.S. Green Building Council's (USGBC) LEED Gold status, or International Living Future Institute's (ILFI) Core Green Building Certification. A primary difference between these two systems is a prescriptive (LEED) versus performance-based (ILFI) approach. The design team has evaluated the feasibility of both certifications, including possible opportunities and specific limitations. Many of the requirements of both rating systems are jumpstarted by section 1.1 of the City's Green Building Policy. However, a combination of this program type and the reuse of an existing building make for unique challenges in using these rating systems that will require dialogue with either USGBC or ILFI.

The path to LEED certification requires collecting a certain number of points; while these points are divided into categories, the total number determines certification. Given the project site, this approach could be helpful because some credits will be easier to achieve, allowing the project to leverage the specific strengths in the Location and Transportation categories. Feasibility of certification will likely depend on operational energy reduction, ultimately, as this single credit accounts for the most available points.

The ILFI Core certification requires projects to meet 10 Core Imperatives, or as few as seven for existing buildings. Unlike LEED, all of the imperatives must be met, and leveraging certain categories is not feasible, for a more holistic approach. Some of the imperatives also provide an opportunity to demonstrate success in equity-based design strategies, which could be an opportunity for this project. Imperative 3: Responsible Water Use may be a sticking point for certification. This imperative requires 100% of stormwater be managed onsite, and due to the city's Combined Sewer Overflow system, stormwater detention may be needed as well. Imperative 4: Energy + Carbon Reduction requires energy reduction similar to LEED energy points.

A third certification that may fit with the reuse of an existing building is the ILFI's Zero Carbon program, which addresses operational energy reductions and embodied carbon emissions as well.

PROPOSED SUSTAINABILITY STRATEGIES

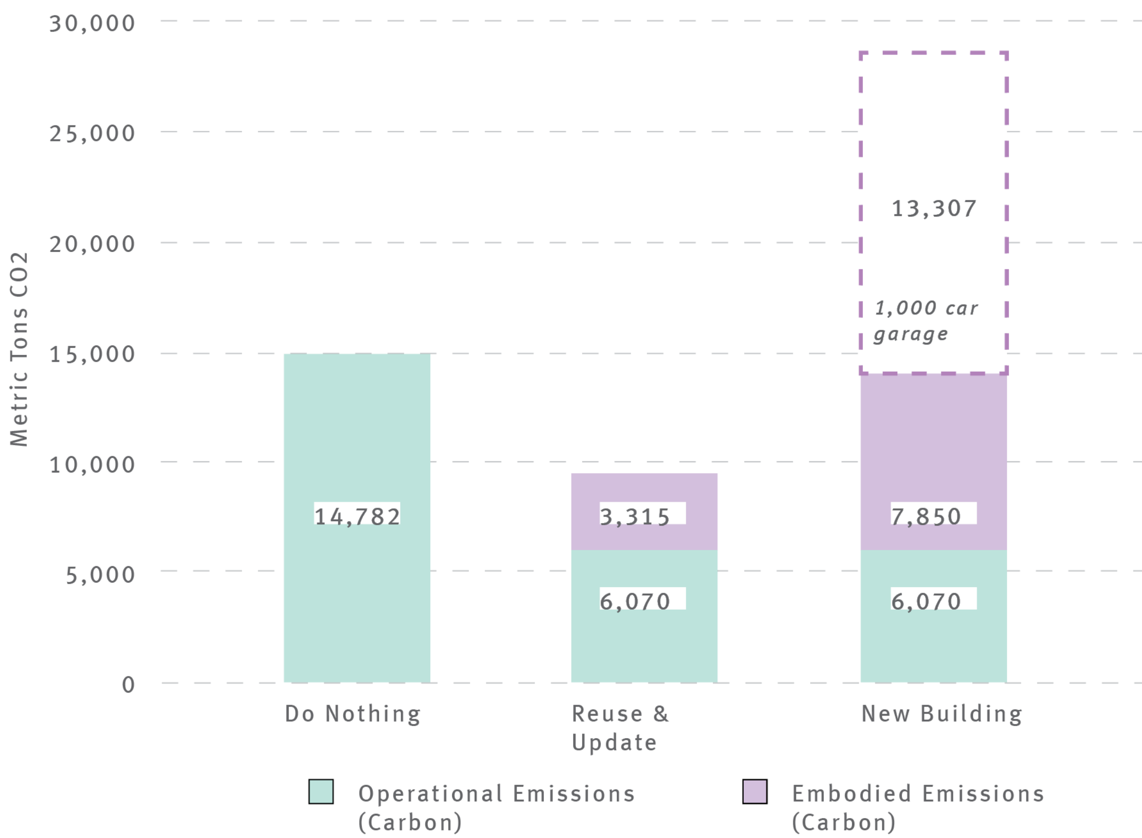
Reduction in the operational energy use of the auditorium will hinge on three primary categories: envelope, lighting, and HVAC efficiency. Because the building has not been updated for many years, an improved envelope brought up to current code or beyond will likely have a significant impact. Updating the current lighting to a more efficient system with occupancy and daylight controls will reduce energy consumption and unwanted heat gain. Lastly, an updated HVAC system and smart building controls provide an opportunity to further reduce energy consumption.

To track operational energy reductions, a baseline must be set; a common industry baseline is the Commercial Buildings Energy Consumption Survey (CBECS) compiled by the U.S. Energy Information Administration. This database establishes a baseline for energy use based on building location and program type. Designing to current Oregon code requirements would reduce operational energy by 50% from the CBECS baseline. Given the third-party certifications targeted for this project, the design team assumes a total reduction of 70% to be feasible.

Potential for Embodied Carbon Reduction

The most sustainable building is typically the one that already exists. This phenomenon is largely attributed to the embodied carbon of a building — that is, the large amount of energy that was already expended to construct it from raw materials. As buildings become more efficient, operational energy and emissions are reduced; couple this with the decarbonization of the energy grid, and carbon emissions associated operational energy represent a small part of the building's life-cycle emissions — while the building's embodied carbon becomes a much larger part of its emissions. To understand this and the unique opportunity of reusing, updating, and retrofitting existing buildings, the design team analyzed three scenarios — as-is, reuse, and new build — using the Carbon Avoided: Retrofit Estimator (CARE) tool. The calculator uses embodied carbon benchmarks to calculate cradle-to-gate embodied emissions intensities for new buildings and renovated buildings. For renovated buildings, the tool covers structure, envelope, interiors, mechanical, electrical, and plumbing (MEP) systems. Total Embodied Emissions Intensity for a New Building or an Addition (which is equivalent to New Building in Emissions Intensity) is based on the Type of Structure selected because structural systems and materials have the largest impact on embodied carbon. The calculator does not factor in carbon emissions related to land development. In addition to the expenditure of embodied carbon for a new building, it is assumed that a new facility will need a new parking garage to accommodate patrons. Parking garages adjacent to the Keller Auditorium currently sell about 1,300 spaces for a full-house event, assuming some existing parking, 1,000 stalls was used as benchmark for a new facility. By extensively reusing the existing building foundations and rather than building new, 17,800 tons of carbon emissions can be avoided — equivalent to all vehicle miles travelled in the metro region from 2013 to 2017.

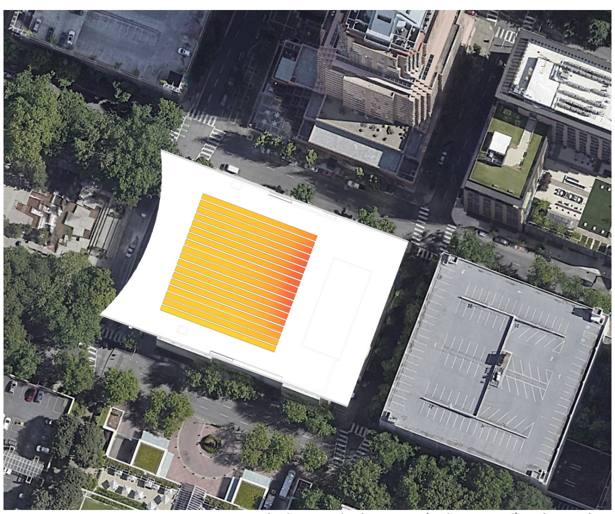
More information regarding the CARE tool data and methodology is detailed at: https://caretool.org/data-and-methodology/



Source: Carbon Avoided Retrofit Estimator (CARE).

Renewable Energy

While operational and embodied carbon will be reduced through the strategies described, a source of renewable energy will help offset what remains. Given the Keller's urban location and roof area, a photovoltaic array (solar panels) was determined to be most efficient means to achieve these goals. Based on the structural analysis determination that the existing roof structure has adequate capacity to support solar loads, the design team identified two primary strategies for such an array. The first strategy assumes solar panels are angled for maximum efficiency. The main drawback of this approach is losing roof space due to the self-shading effect of the angled panels. A second strategy assumes panels are set nearly flat on the roof. This approach produces more energy due to maximum coverage but sacrifices efficiency due to the panel's angle. Assuming an area of 12,000 square feet is used for solar panels, the array will meet roughly 50-70% of the annual energy needs, depending on the final layout.



Proposed photovoltaic array (solar panel) orientation

Bird-Safe Glass

The design team as well as stakeholders of the Keller are committed to protecting the more than 200 species of birds that stop in Portland annually. The project will follow all achievable Best Management Practices (BMPs) outlined in the City of Portland's Green Building Policy for City Owned Buildings including Bird Safe Glass. In addition to the City's policy, the project will be designed to qualify for LEED Innovation Credit: Bird Collision Deterrence. Since most of the east and west facades are made up of clear glass, we will design either fritted patterns or UV coatings that achieve a threat score of 30 or less on all facades with glazing. For the opaque portions of the façade, we will ensure that they are constructed entirely of materials with a threat score value of 30 or less as well.

EcoRoof

As a part of the City's Green Building Policy renovation projects that include roof replacements are required to include an ecoroof. The inclusion of an ecoroof was studied as part of this effort and determined that an exemption would likely be sought as the installation of an ecoroof would be particularly challenging for several reasons. Portions of the building structure are unreinforced masonry, dating to the original 1917 construction, which was not designed for ecoroof roof loads. A large portion of the main roof level is supported by long-span trusses over the auditorium space. The trusses are already loaded to near capacity and would need to be retrofit to withstand the weight of saturated soils. Finally, an ecoroof would locate substantial mass at the top of the building which is highly undesirable from a seismic force perspective. These extensive upgrades to the roof structure would likely be prohibitively expensive. Similarly, when the roof was replaced in 2016 upgrading the structure ecoroof was deemed cost prohibitive and instead utilized light-weight roofing materials anticipating the addition of future solar panels. As a result, the comparatively lightweight proposed solar panel array is a more economical and effective use of the existing roof area.

PROPOSED EQUITY STRATEGY

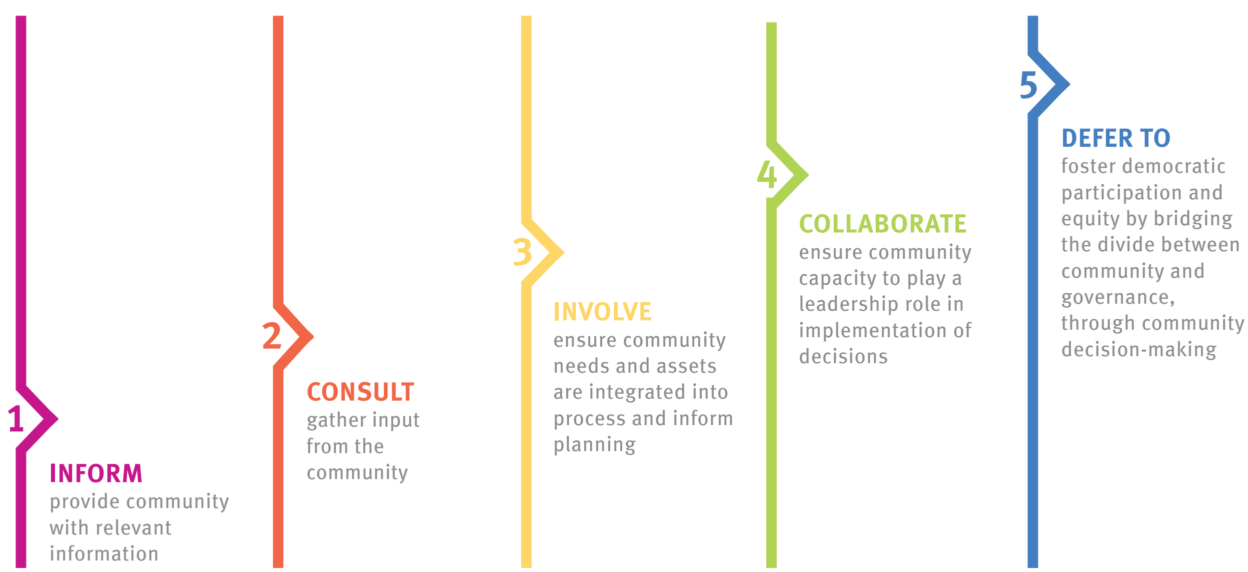
Equity is integral to a sustainable future. The design for the renovated Keller Auditorium should prioritize creating a safe and welcoming place for people of all abilities and backgrounds focused on bringing the community together around the performing arts. To achieve an equitable design that embodies this vision, an equitable process is required. Because design is iterative, equity should be woven throughout the design phases. The equity strategy for the Keller Auditorium should engage meaningfully, support diverse regional partners, and invest in equity.

Engage Meaningfully

Both the City and Metro have identified goals to address inequities and racial disparities in Portland through meaningful outreach. As such, successful outreach for the Keller Auditorium must involve an intentional shift in decision-making and relationship-building. Referencing the "Levels of Engagement" diagram, this project should go beyond "Inform," which does not provide opportunity for community voices, as well as "Consult," which does not offer any commitments back to the community. Instead, the bar for future engagement should be held to a level such as "Involve," "Collaborate," or "Defer To."

Each of these levels have different benefits and drawbacks in terms of schedule, logistics, and authentic feedback. It is also possible that an appropriate strategy for a project as complex as the Keller Auditorium would include a combination of engagement at different levels. In any case, the key to success will require moving beyond the extractive idea of engagement and into building reciprocal relationships. In other words, rather than asking how to extract sufficient information for the benefit of the project, the process should ask how the engagement relationship will benefit the community.

In most cases, it is appropriate to compensate participants for their time and feedback because they are providing a service to the project. To create a space for authentic feedback, the process should also consider questions such as "What are the physical barriers to participation?" (e.g. time, location) and "What are the emotional barriers to participation?" (e.g. historic trauma).



Credit: Rosa Gonzalez, Facilitating Power, and Movement Strategy Center

Particularly when approaching communities of color, it is important to acknowledge that other — potentially similar — outreach or revitalization processes may have inflicted physical or emotional harm on their communities. To avoid a similar outcome, it is critical to focus on building a reciprocal relationship both with transparency about how the community will impact the decision-making process and with follow-through on commitments made during engagement.

The following are examples of what meaningful engagement could look like at each level.

Involve
Facilitate multiple workshops throughout early design phases. Include people of color and differing abilities who have been historically excluded. Provide enough time in the project schedule to collect broad community input (being sensitive to the needs of each specific community), integrate feedback into the design, and report back for accountability. Compensate participants for their time with food or gift cards.

Collaborate
Create a decision-making panel that includes members of the community as paid consultants, particularly emphasizing voices that have been historically excluded. Rely on the networks of these community consultants to help form broader outreach (such as workshops).

Defer To
Provide an opportunity for the broader community to vote on a design element. Establish clear parameters for input and be transparent about the outcome. Compensate participants with food or raffled gift cards.

Support Diverse Regional Partners
Supporting regional partners who have experienced injustice and inequity requires acknowledging the past and planning for a shared future.

The land where the Keller Auditorium now sits was not taken peacefully. The Portland metro area occupies the traditional land of many Indigenous tribes, including the Multnomah, Wasco, Cowlitz, Kathlamet, Clackamas, Bands of Chinook, Tualatin, Kalapuya, and Molalla. These Indigenous peoples faced genocide, relocation, and assimilation due to Portland's settlement. Both the City and Metro acknowledge that there are ongoing impacts of colonization on these tribes today and are working to respect and recognize their place in the community as the land's original stewards.

In addition, the development of the Keller Auditorium directly harmed the immigrant community. The South Auditorium Renewal Project, which created space for the Keller Auditorium in the 1960s, did so by clearing away an ethnically diverse neighborhood of lower-class immigrants (Wollner, Provo, and Schablisky, Brief History of Urban Renewal in Portland, Oregon). Residents included Jewish, Italian, Irish, Chinese, and Greek immigrants who unsuccessfully fought the leveling of their homes, businesses, and places of worship.

While the site's history has caused much harm, this project has the unique opportunity to facilitate healing in the community through performing arts. Portland is still home to many Native peoples and immigrants, many of whom live in parts of the city that do not have the same access to the arts as neighborhoods closer to the urban center. Their voices — along with others — have often been ignored over the history of the city's development. An equitable process to revitalize the Keller Auditorium and Fountain District could help to reverse this trend and start to rebuild trust with diverse regional partners. The equitable vision should not end with the date of construction completion, though. While meaningful engagement can lay the foundation for a reciprocal relationship, it is the continued support of these communities that will create a better future for the entire Portland region. One key area of ongoing support could be the programming of the new plaza. This space has the potential to make art more accessible to a wider audience, give a platform to diverse performing groups, and create a shared future for Portland that emphasizes justice and equity through the arts.

Invest in Equity

This project will require substantial resources, which can be used to advance equity within the community. The largest cost for the revitalization will fall under construction costs for materials and labor, so the most effective way to reinvest in the community is to specify materials, finishes, furniture, and equipment that support community priorities and the equity vision. The City of Portland's Sustainable Procurement Policy outlines guiding principles that should be referenced in this process, but which include considerations for how everything is connected, providing fair opportunities, and upholding accountability.

When making product selections, disadvantaged business enterprise (DBE) vendors and trade partners should be prioritized and supported. It is important to note that supporting DBEs goes beyond hiring for the project. Since many of these businesses are smaller, they might not have the experience or resources of larger businesses, which means that investing in equity involves coming alongside DBEs to provide opportunities for them learn. The construction specifications should be examined for inclusive language, making sure that the project's requirements do not create unnecessary barriers to DBEs.

In addition, DBEs are often also small or emerging businesses that have different capacity levels than other businesses. With DBE requirements increasing for public projects across the region, many DBEs find they are at their capacity limit. One solution for the Keller Auditorium, which could have many complexities as a larger project, is to encourage partnerships between DBEs and larger businesses. This arrangement allows DBEs to have a seat at the table while also learning from the larger business and utilizing their deeper capacity to accomplish the work.

Given the challenges that DBEs currently face, it is especially critical to invest in their growth now and work toward a future where diverse businesses have equal footing. With the substantial resources that will be needed to revitalize the Keller Auditorium, this project is uniquely situated to make a significant contribution to the growth of these DBE vendors and trade partners across the region.

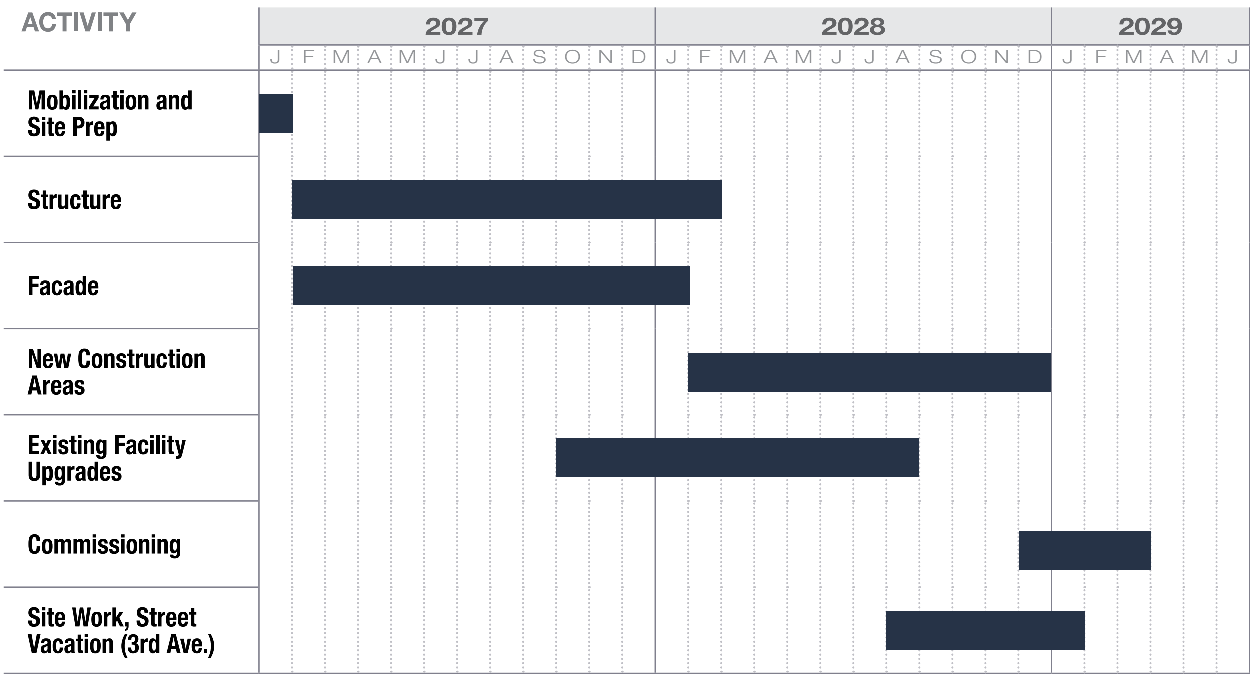
(page intentionally left blank)

6. Construction Cost, Schedule, and Approach

BASELINE CONSTRUCTION APPROACH

Baseline Schedule

The Project Schedule reflects a 28-month duration, including four months of commissioning. The City of Portland's downtown holiday moratorium (which restricts street and sidewalk closures between mid-November and mid-January) is taken into account, as coordination will be required with the proposed traffic lane closures and the project sequencing and schedule. No overtime is included in the baseline schedule.



Baseline Cost Estimate

The project cost estimate reflects a 28-month construction schedule, and a construction start date during Q1 2027. The estimate is broken down into the following categories: demo, building, façade/site.

An escalation rate of 25% has been added, which breaks down to 5% per year to the approximate midpoint of construction. Given the conceptual nature of the current proposal, a 20% design and estimating contingency is also included. There may be opportunities to improve this based on the final design, seismic retrofit, and demo requirements.

Baseline Construction Cost: $174.9M

HOFFMAN CONSTRUCTION COMPANY

Project Name	Marking Keller
Client Name	Keller
Location	Portland, OR
Date	8/8/2023

UNI-FORMAT COST SUMMARY

SCHEMATIC ESTIMATE

	System Description	Demo 151,011 S.F. Total	Demo $/S.F.	Bldg 194,813 S.F. Total	Bldg $/S.F.	Facade Total	Site 32,739 Total	TOTAL 194,813 gsf Total	TOTAL $/S.F.
A	**SUBSTRUCTURE**	**$0**	**$0.00**	**$967,431**	**$4.97**	**$0**	**$0**	**$967,431**	**$4.97**
A10	Foundations	$0	$0.00	$493,020	$2.53	$0	$0	$493,020	$2.53
A20	Basement Construction	$0	$0.00	$474,411	$2.44	$0	$0	$474,411	$2.44
B	**SHELL**	**$0**	**$0.00**	**$12,617,267**	**$64.77**	**$14,129,350**	**$0**	**$26,746,617**	**$137.29**
B10	Superstructure	$0	$0.00	$11,739,267	$60.26	$182,000	$0	$11,921,267	$61.19
B20	Exterior Enclosure	$0	$0.00	$0	$0.00	$13,947,350	$0	$13,947,350	$71.59
B30	Roofing	$0	$0.00	$878,000	$4.51	$0	$0	$878,000	$4.51
C	**INTERIORS**	**$0**	**$0.00**	**$15,588,055**	**$80.02**	**$0**	**$0**	**$15,588,055**	**$80.02**
C10	Interior Construction	$0	$0.00	$3,871,306	$19.87	$0	$0	$3,871,306	$19.87
C20	Stairs	$0	$0.00	$1,295,000	$6.65	$0	$0	$1,295,000	$6.65
C30	Interior Finishes	$0	$0.00	$10,421,749	$53.50	$0	$0	$10,421,749	$53.50
D	**SERVICES**	**$0**	**$0.00**	**$31,671,181**	**$162.57**	**$0**	**$0**	**$31,671,181**	**$162.57**
D10	Conveying	$0	$0.00	$900,000	$4.62	$0	$0	$900,000	$4.62
D20	Plumbing	$0	$0.00	$4,998,270	$25.66	$0	$0	$4,998,270	$25.66
D30	HVAC	$0	$0.00	$11,913,127	$61.15	$0	$0	$11,913,127	$61.15
D40	Fire Protection	$0	$0.00	$1,558,504	$8.00	$0	$0	$1,558,504	$8.00
D50	Electrical	$0	$0.00	$12,301,280	$63.14	$0	$0	$12,301,280	$63.14
E	**EQUIPMENT & FURNISHINGS**	**$0**	**$0.00**	**$17,413,285**	**$89.38**	**$0**	**$0**	**$17,413,285**	**$89.38**
E10	Equipment	$0	$0.00	$14,234,250	$73.07	$0	$0	$14,234,250	$73.07
E20	Furnishings	$0	$0.00	$3,179,035	$16.32	$0	$0	$3,179,035	$16.32
F	**SPECIAL CONSTRUCTION & DEMO**	**$5,019,792**	**$33.24**	**$0**	**$0.00**	**$0**	**$0**	**$5,019,792**	**$25.77**
F10	Special Construction	$0	$0.00	$0	$0.00	$0	$0	$0	$0.00
F20	Selective Building Demolition	$5,019,792	$33.24	$0	$0.00	$0	$0	$5,019,792	$25.77
G	**SITEWORK**	**$120,450**	**$0.80**	**$342,800**	**$1.76**	**$0**	**$2,115,818**	**$2,579,068**	**$13.24**
G10	Site Preparation	$120,450	$0.80	$342,800	$1.76	$0	$0	$463,250	$2.38
G20	Site Improvements	$0	$0.00	$0	$0.00	$0	$1,340,818	$1,340,818	$6.88
G30	Site Mechanical Utilities	$0	$0.00	$0	$0.00	$0	$475,000	$475,000	$2.44
G40	Site Electrical Utilities	$0	$0.00	$0	$0.00	$0	$300,000	$300,000	$1.54
Z	**Other Project Costs**	**$128,525**	**$0.85**	**$1,965,287**	**$10.09**	**$353,285**	**$52,903**	**$2,500,000**	**$12.83**
Z90	Other General Requirements	$128,525	$0.85	$1,965,287	$10.09	$353,285	$52,903	$2,500,000	$12.83
	Sub-Total	**$5,268,766**	**$34.89**	**$80,565,307**	**$413.55**	**$14,482,635**	**$2,168,721**	**$102,485,429**	**$526.07**
	Contingencies / Allowances	**$2,634,383**	**$17.44**	**$40,282,653**	**$206.78**	**$7,241,318**	**$1,084,361**	**$51,242,715**	**$263.04**
5.0%	Construction Contingency	$263,438	$1.74	$4,028,265	$20.68	$724,132	$108,436	$5,124,271	$26.30
25.0%	Design & Estimating Contingency	$1,317,191	$8.72	$20,141,327	$103.39	$3,620,659	$542,180	$25,621,357	$131.52
20.0%	Escalation to Midpoint	$1,053,753	$6.98	$16,113,061	$82.71	$2,896,527	$433,744	$20,497,086	$105.21
	TOTAL DIRECT COSTS	**$7,903,149**	**$52.33**	**$120,847,960**	**$620.33**	**$21,723,953**	**$3,253,082**	**$153,728,144**	**$789.11**
	GC'S / Insurance	**$741,233**	**$4.91**	**$11,334,274**	**$58.18**	**$2,037,479**	**$305,105**	**$14,418,090**	**$74.01**
	Supervision	$385,574	$2.55	$5,895,861	$30.26	$1,059,856	$158,709	$7,500,000	$38.50
	Preconstruction	$25,705	$0.17	$393,057	$2.02	$70,657	$10,581	$500,000	$2.57
1%	Subcontractor Default Insurance	$80,296	$0.53	$1,227,815	$6.30	$220,715	$33,051	$1,561,878	$8.02
	Street Use Fees	$18,610	$0.12	$284,574	$1.46	$51,156	$7,660	$362,000	$1.86
0.66%	Construction bond	$59,335	$0.39	$907,299	$4.66	$163,098	$24,423	$1,154,156	$5.92
0.31%	Builder's risk	$27,869	$0.18	$426,156	$2.19	$76,607	$11,472	$542,103	$2.78
1.6%	Project Insurance - GL CCIP	$143,843	$0.95	$2,199,512	$11.29	$395,390	$59,208	$2,797,953	$14.36
4.00%	**CONTRACTOR FEE**	**$345,775**	**$2.29**	**$5,287,289**	**$27.14**	**$950,457**	**$142,327**	**$6,725,849**	**$34.52**
	TOTAL CONTRACT COST	**$8,990,157**	**$59.53**	**$137,469,523**	**$705.65**	**$24,711,889**	**$3,700,514**	**$174,872,084**	**$897.64**

Escalation has been figured at 5% / year to the midpoint of construction (5 years x 5%/year = 25%)

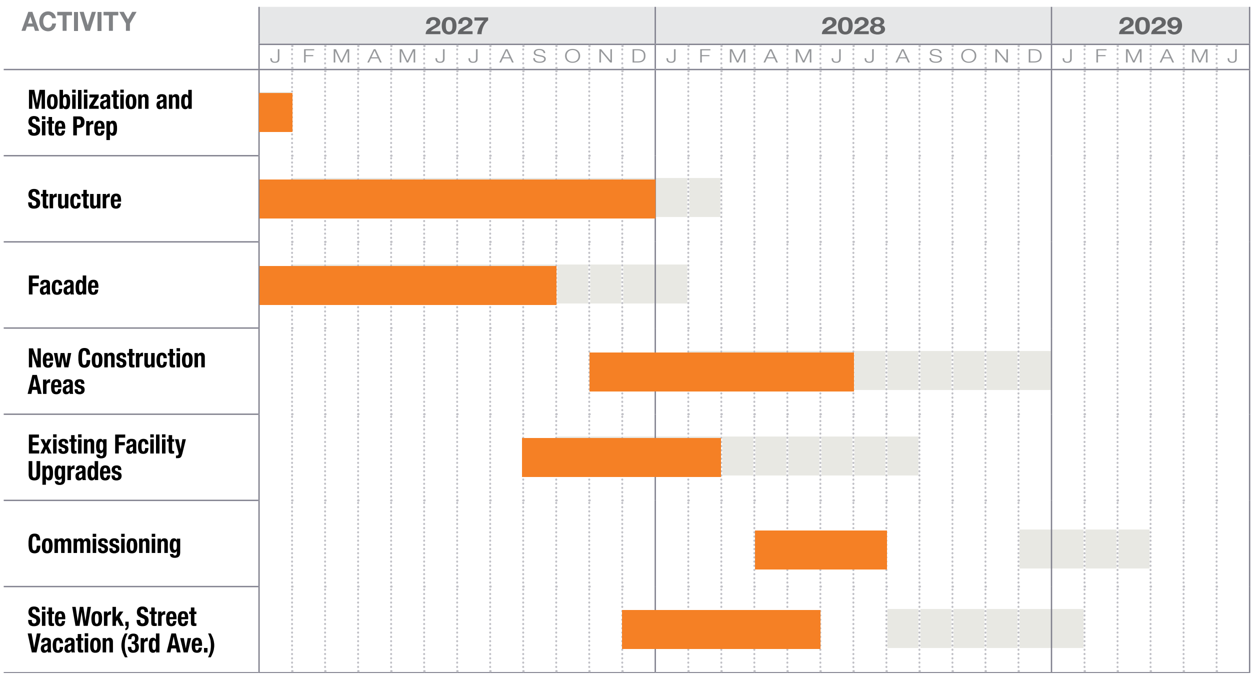
This assumes a Q1 start in 2027. Additional construction costs for start of construction beyond Q1 of 2027 are as follows:

Q1 - 2028	$5,531,226
Q1 - 2029	$11,062,452

ACCELERATED CONSTRUCTION APPROACH

Accelerated Schedule

In recognition of the significant impact a shut-down of the Keller will have on public agencies, performance groups and the surrounding neighborhood, an accelerated schedule option is included, completing construction within 19 months. Considerations for noise variances and the downtown holiday moratorium are included in this option.



Accelerated Cost Estimate

An alternate estimate reflecting the 19-month accelerated construction schedule was prepared. This option assumes construction begins at the same time, during Q1 2027, and finishes 9 months sooner than the baseline. While there are some savings associated with the shorter construction duration, the overall cost of this option is higher due to utilizing double shifts and overtime to complete the work.

Accelerated Construction Cost: $197.9M

OVERALL FUNDING COMPARISON

The Option 2 and Option 3 cost estimates completed as part of the 2018 study consist of direct construction costs only and included figures escalated to a July 2024 construction start date. As part of the cost estimating exercise for this 2b study, completed by Hoffman Construction, the provided figures were escalated to reflect a Q1 2027 start date in order to provide a comparison between the three studies. The comparison assumes 35% of the construction costs as the soft costs for Options 1b, 2, and 2b and 40% for Option 3 due to the increased timeline. The softcost estimate encompasses project management, permits, legal, accounting and design fees.

Option 1b
Building renovation intended primarily to address structural deficiencies, but not other desirable functional and operational enhancements. This option generally preserves current configuration, amenities, and the internal and external appearance of the building. This structural study was prepared in the absence of programming and conceptual design, or material testing and geotechnical engineering information. Option 1b assumes a seismic upgrade that meets the requirements of an existing building. By contrast, Option 2b meets the structural code requirements of a new building.

Option 2
Building renovation intended to address structural deficiencies as well as strategic improvements to improve the patron and performer experience, meet current accessibility requirements, and meet audience amenity expectations. This option includes modest expansions of the building area at the front (west) and rear (east) and significantly updates the internal configuration and functionality as well as the external appearance. Accessibility, comfort, sightlines, and acoustics for patrons would be improved. This study was prepared using a preliminary program prepared by a consultant engaged by the City and in the absence of material testing and geotechnical engineering information. Option 2 assumes a seismic upgrade that meets the requirements of an existing building. By contrast, Option 2b meets the structural code requirements of a new building.

Option 3
Full replacement of the auditorium with a new state-of-the-art facility. This option includes a conceptual “ideal” space plan meeting current industry standards and patron expectations. This replacement facility could be built at an alternate location, ideally with a larger footprint than the current site, which would allow continued operation of the existing facility during construction; it could also be located on the current site, though the small footprint presents challenges. The estimate shown does not include the cost to procure a new site.

More information regarding the cost estimate and comparison studies is included in the appendix.

OVERALL FUNDING COMPARISON

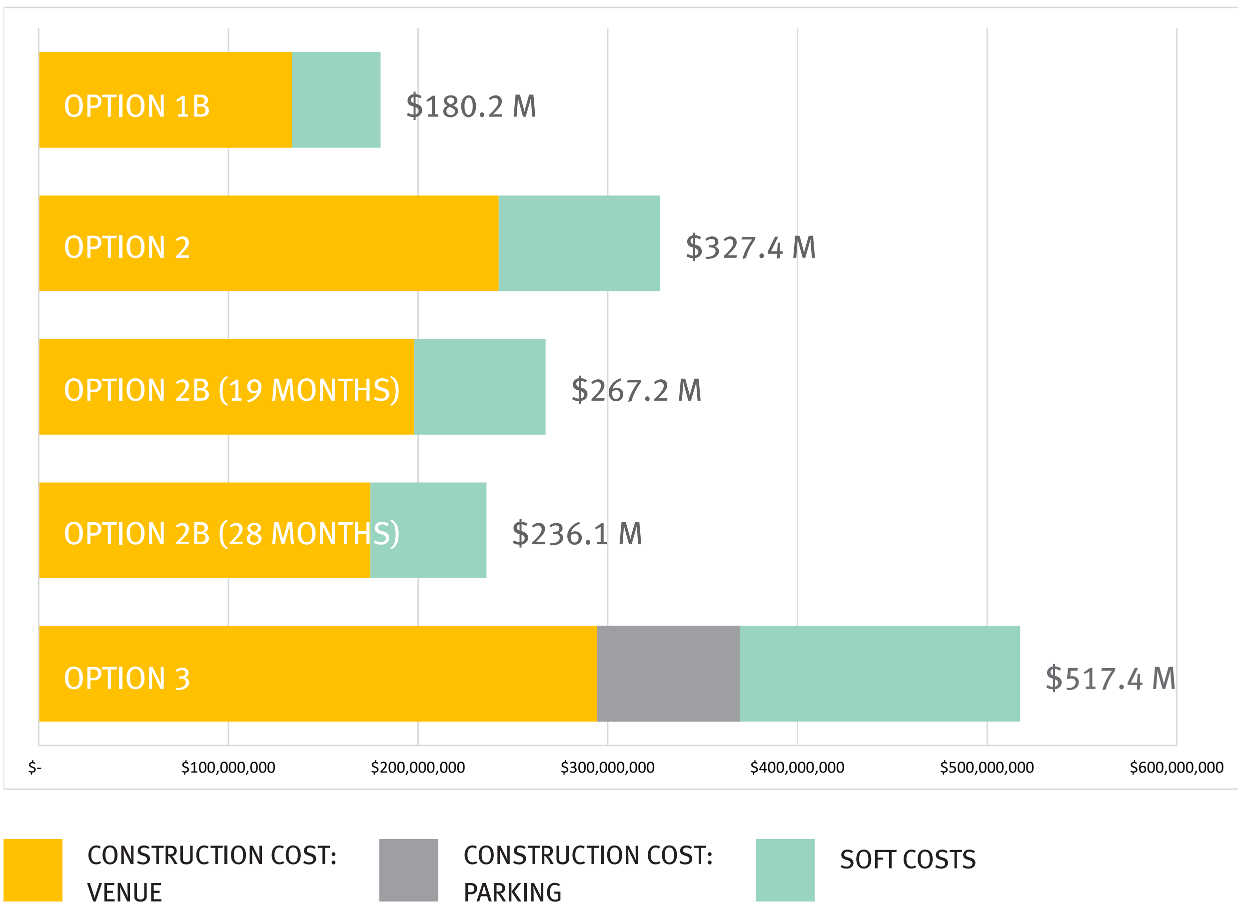
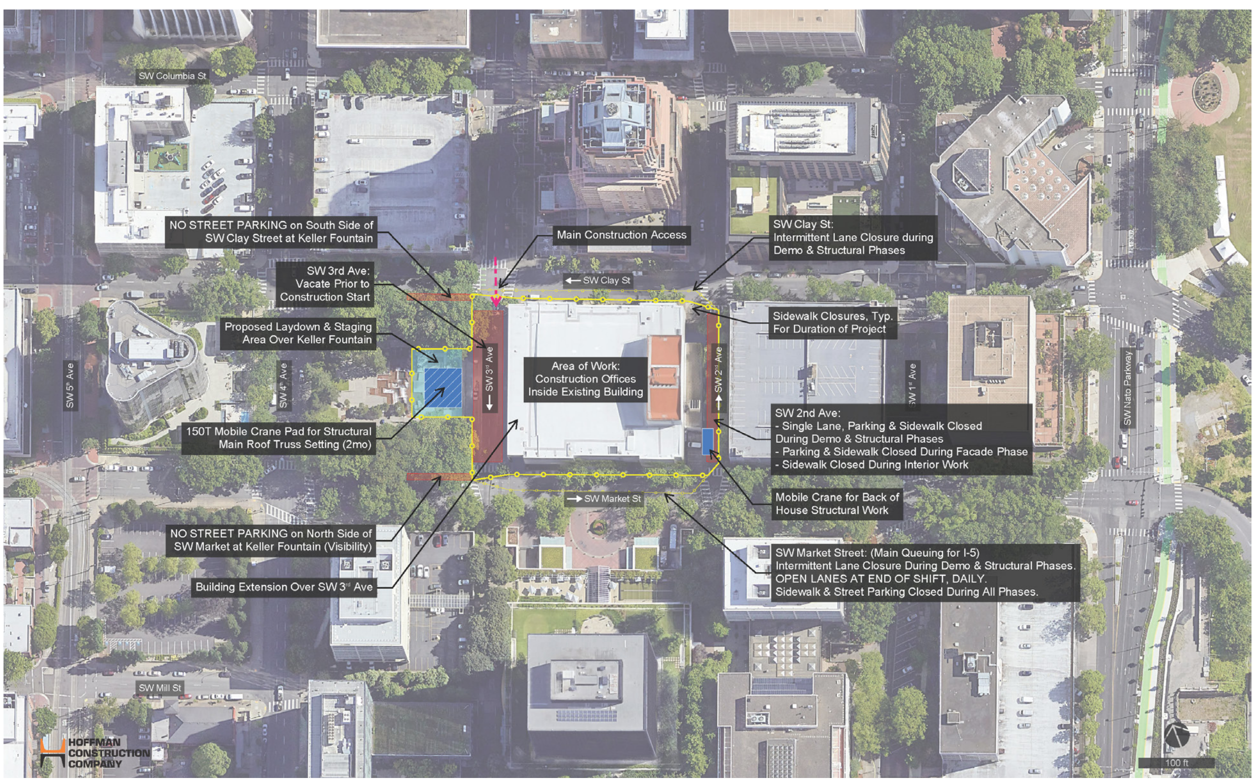


Exhibit: Overall Funding Comparision

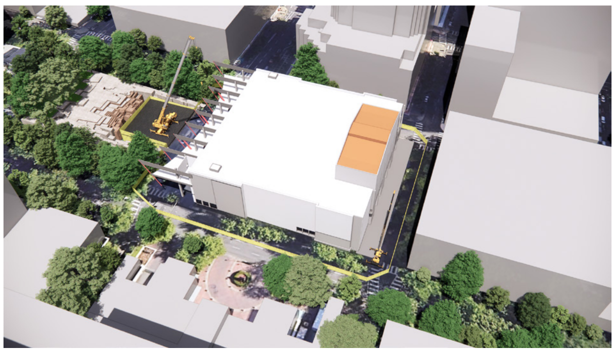
SITE LOGISTICS

A comprehensive logistics plan is critical to the success of projects within an urban environment. Our goal is to develop a plan that will minimize impacts to the surrounding businesses and public by utilizing the following strategies:

- The site is bounded on the north and south by SW Clay and SW Market. These streets are main arteries for I-5 access, and considerations have been made regarding the location of the project fence line.
- Clear sightlines for vehicles, bikes, and pedestrians are key safety aspects during construction. The site logistics plan includes closing SW Third Avenue to use as the project site's main construction entrance and exit. On SW Clay and SW Market, the sidewalks and adjacent parking lane will be closed.
- During the structure phase, SW Clay and SW Market will be required to have the adjacent traffic lane closed for public safety. Along SW Second Avenue, the sidewalk and western traffic lane will also be closed for public safety and project access.
- A mobile crane will be staged off SW Third Ave and into the Keller Fountain Park during the demo and structure phases. Coordination with Portland Parks & Recreation and Halprin Landscape Conservancy will be required.
- A small mobile crane will also be used along SW Second Avenue during the structure phase.



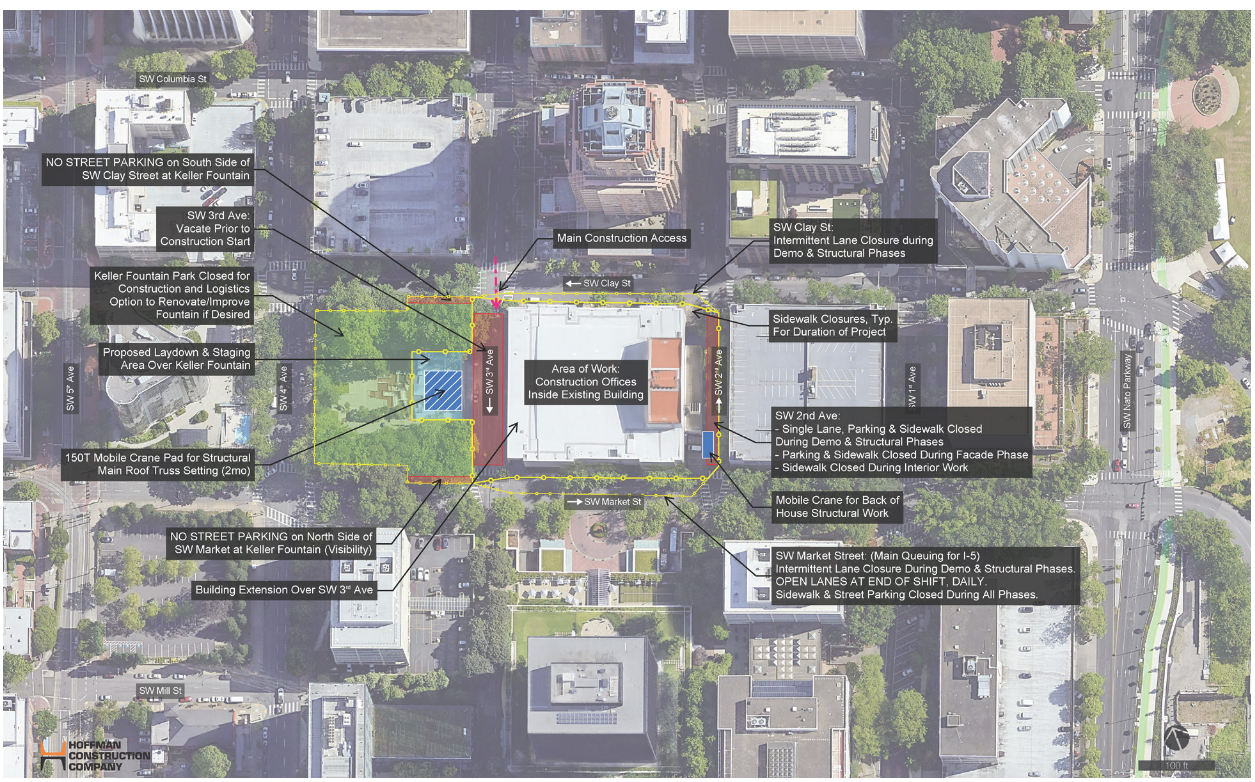
Site logistics plan condensed area



Renderings: Initial site logistics and staging

Alternate Option

The existing Keller Auditorium extends to the sidewalks on all sides of the block. This allows for very little laydown space and access for construction activities. We see an opportunity to utilize the Keller Fountain Park as a staging and laydown area. By fencing it in and including it in the overall project site, a larger public presence is created and allows for the unveiling of an improved Keller Auditorium and a revitalized Keller Fountain Park. Additional discussions with Portland Parks & Recreation would be required, but this option provides a chance to perform any needed maintenance or improvements to the park during the renovation of the Keller Auditorium.



Site logistics plan alternate option

(page intentionally left blank)

7. Project Impacts & Next Steps

NEXT STEPS

Building on the findings of this conceptual design and feasibility study, the design team has identified several supplemental tasks that will establish a comprehensive set of information for Portland City Council to consider in their decision-making process. The next step in the process will be focused on planning for equity and community engagement and comprehensively evaluating the economics of and funding for creating a state-of-the-art, 21st-century performance venue at the Keller Auditorium. Additionally, it is recommended that the entitlement process for the proposed rehabilitation and expansion project be further vetted with the City of Portland. Specifically, the proposed effort for the October 2023 through April 2024 timeframe is summarized as follows.

Equity

Meaningful community engagement is critical to the success of the project. The next steps in the equity and inclusion process will be to: establish the level of engagement and a transparent decision-making protocol; identify participants, with a particular emphasis on communities that have been historically excluded; and hold initial informational sessions with these groups to discuss what an equitably designed and inclusive Keller Auditorium could look like from a variety of community perspectives.

Economics

Beyond the projected hard construction costs and other project-related soft costs included in this report is a larger economic picture of a revitalized Keller Auditorium. To give City Council greater confidence in their decisions regarding the Keller Auditorium, the design team recommends a comprehensive economic analysis of the proposed rehabilitation and expansion project be completed, including at a minimum:

1. The economic impact of a fully modernized Keller Auditorium on downtown Portland, the city as a whole, the Portland region, and beyond;
2. The economic impact of a fully modernized Keller on nearby downtown Portland facilities such as hotel nights generated and parking and restaurant revenue;
3. A comparative economic analysis of a revitalized Keller versus a new venue elsewhere in Portland;
4. The potential economic harm to the core of downtown Portland if the Keller is fully closed; and
5. The economic impact of the temporary shutdown of the Keller during construction of the improvements.

Project Funding

As part of the next steps, we recommend that the City of Portland conduct an analysis of potential public sources of funding for the rehabilitation and expansion of the Keller Auditorium as well as the addition of a new performing arts facility located elsewhere. This effort should consider all public sources of funding (local, regional, state, and federal) as well as potential funding from philanthropic sources.

It is anticipated that the rehabilitation and expansion of the Keller Auditorium will attract substantial philanthropic support as a result of many decades of broad community attachment to the facility, its physical relationship to Halprin's internationally renowned masterwork of the Keller Fountain, and its location, embedded in the core of downtown Portland.

Based on the accelerated schedule Option 2B, overall funding needs are estimated at $267.2M for the rehabilitation and expansion of the Keller Auditorium with construction starting in 2027.

Overall funding needs for Option 3 are estimated at $517.4M for a new facility with structured parking starting construction in 2029. This figure does not include land acquisition.

Engagement

Over the past several months, the Marking Keller Group and design team have held meetings with many of the stakeholders of the project, which included some of the public entities that will be involved in the entitlement process. Further engagement with all of the public entities will be required, including but not limited to the following:

- Parks and Recreation and Spectator Venues: Ongoing engagement with Parks and Recreation as well as Spectator Venues relating to any proposed improvements with the Keller Fountain Park and Keller Auditorium property lines, respectively.
- Bureau of Development Services (BDS): Coordination with BDS to determine the requirements of the land use process.
- Bureau of Planning and Sustainability (BPS): Further engagement with BPS to establish how the City Green Building Policy requirements will impact this project.
- Portland Bureau of Transportation (PBOT): Ongoing engagement with PBOT related to the proposed encroachments into and vacations of the SW Second and Third Avenue rights-of-way. The project traffic engineer will help scope the required traffic impact analysis.
- Urban Forestry: Discuss the required street tree removals and replanting.
- Bureau of Environmental Services (BES): Coordination with BES regarding stormwater points of connection and stormwater management requirements.
- Portland Water Bureau (PWB): Engagement to understand system impacts of removing the SW Third Avenue water main and determining if replacement is required.

Entitlement

Early Assistance Meeting

To more fully engage City of Portland bureaus and departments in this planning effort, an Early Assistance meeting should be conducted. This will provide an opportunity for the design team to review the fundamentals of the proposed rehabilitation and expansion project with city agencies such as Bureau of Development Services, Bureau of Planning and Sustainability, Bureau of Transportation (PBOT), Urban Forestry, Bureau of Environmental Services, and the Water Bureau. The responses received from these regulatory stakeholders will be valuable in demonstrating the feasibility of achieving approval for the proposed improvements and giving City Council greater certainty in their decision-making process.

Street Vacation / Encroachment

While the design team has received favorable feedback on the proposed project to date, gaining approval from PBOT and other city agencies on the proposed right-of-way modifications – particularly at Second and Third Avenues – will require a detailed traffic study. The design team recommends commissioning such a study to quantify traffic counts, broad traffic patterns in the neighborhood, the trips generated by the modernized venue, and the specific traffic pattern changes expected by the narrowing and closure of adjacent streets.

Design Advice Request

Because of the scope and scale of the proposed Keller alterations, the project will ultimately require a Type III Land Use approval, which is processed through a public hearing with the City of Portland Design Commission. Acquiring early feedback on the proposed design from the Design Commission will be valuable in demonstrating the feasibility of ultimately achieving the Commission’s full approval for the project and giving City Council greater certainty in their decision-making process. As such, the design team recommends scheduling a Design Advice Request (DAR) – a type of design dialogue prior to submission of a land use application – with the Design Commission. Members of the public would also be able to comment on the design proposal at the DAR hearing. The proposed interventions into the National Register-listed Keller Fountain Park may prompt a joint DAR including both the Design Commission and the Historic Landmarks Commission.

Establish Community Engagement Goals and Equitable Process

This report has established that the revitalized Keller Auditorium should be a safe and welcoming place for people of all abilities and backgrounds to enjoy performing arts. In full transparency, engagement for the project to date has not yet extended into the broader community. As such, meaningful engagement should be a priority for the next phases, because an equitable process is critical to project success. This type of engagement will require:

- Establishing a level of engagement early to be transparent about who makes what decisions.
- Identifying participants, particularly seeking people of color and differing abilities who have been historically excluded from similar processes.
- Creating a schedule that allows enough time to build trust with these diverse communities, respectfully integrate their feedback, and clearly communicate the impact of this feedback on the decision-making process.

But equity for the project must reach beyond engagement during design phases. Instead of perpetuating or ignoring past harms done to people of color and differing abilities through exclusionary practices, the project should support a diverse network of regional partners who can contribute to the shared future of the Keller Auditorium, centered around healing community divides through performing arts. The project should also invest its resources in the growth of diverse vendors and trade partners, who can build the stage for this shared future using thoughtful construction and procurement strategies. Through these next steps—engaging meaningfully, supporting diverse regional partners, and investing in equity—this project has the potential to create a lasting, positive impact in the community.

Fountain Programming

A current five-year Stewardship Agreement between the Halprin Landscape Conservancy (HLC) and the City of Portland, through Portland Parks & Recreation, recognizes the HLC mission to activate, educate, and protect the Portland Open Space Sequence comprised of the Keller Fountain, the Lovejoy Fountain, the Source Fountain, and Pettygrove Park.

The HLC Board of Directors shares the management responsibilities of the public spaces within the Portland Open Space Sequence with Portland Parks & Recreation. This responsibility includes management of cleaning, maintenance, and activation of the open spaces within the Open Space Sequence.

The renovation plan envisions the creation of a neighborhood destination that strengthens the connection of the Keller Auditorium and the Keller Fountain through the development of a programmable community plaza located on SW Third Avenue. Discussions to date have identified the collaborative programming possibilities in support of this vision. Further discussions will address the current Keller Auditorium management structure, the Keller Fountain Management structure and the new management structure of the community plaza toward the comprehensive management goals.

Exploration of Temporary Venue

The Keller Auditorium is currently the only venue in the metropolitan area that has the seating capacity, stage area and support spaces for Broadway-scale productions. Through stakeholder meetings, the idea emerged for a temporary performance venue that would serve as a base for Broadway in Portland, Portland Opera, Oregon Ballet Theater, and other local and touring shows during the Keller construction phase.

Through its work on the ABBA Voyage Arena in London, STUFISH has experience with design of a demountable and movable temporary theater. If a suitable site can be identified, a similar structure could be considered as an interim performance solution. Once Keller construction is complete, the temporary structure could be disassembled, sold, moved, and repurposed by another municipality. Additional study will be required to determine the feasibility of this option.

The appendix includes a full case study describing STUFISH's award-winning ABBA Voyage Arena, a temporary facility in London.

(page intentionally left blank)

APPENDIX

Table of Contents

(page intentionally left blank)

Design Team Members and Roles

Design Team

ARCHITECT: HENNEBERY EDDY ARCHITECTS
Portland, Oregon
Hennebery Eddy Architects designs to inspire, embrace, and renew. Founded and headquartered in Portland for 30 years, we take personal ownership in enhancing the important places in our city. Rooted in inquiry, our design approach results in refined architecture of its place and a net-positive outcome for people and planet. Hennebery Eddy led the assembled design team through the 2023 conceptual design and feasibility process to refine a design competition-winning vision into an achievable project according to local goals and regulations.

ENTERTAINMENT ARCHITECT:
STUFISH ENTERTAINMENT ARCHITECTS
London, United Kingdom
STUFISH is a team of entertainment architects with ambitious and pioneering work, exploring new ways to inspire audiences and visitors, from musical experiences to theatrical shows, exhibitions, and buildings. Our philosophy is grounded in fusing creativity and expertise to push the boundaries of audience expectation. Based in London, STUFISH works around the world with the biggest names in entertainment. Together with Michael Curry Design, STUFISH proposed the winning design competition vision in 2017 and continues to inform the conceptual design with expertise in world-class performing arts venues.

LANDSCAPE ARCHITECT: PLACE
Portland, Oregon
PLACE is a design studio engaging landscape architecture, planning, art, and urban design to make the world a better place. We embrace environmental stewardship, amplify design excellence, and provide experiences for generations to enjoy. PLACE is headquartered in Portland and is certified as a minority-owned and disadvantaged business enterprise.

CREATIVE CONSULTANT: MICHAEL CURRY DESIGN
Scappoose, Oregon
Michael Curry Design is a worldwide leader in custom theatrics and attractions, creating some of the most iconic forms of puppetry, set design, and spectacle. Our in-house design and production teams are sought out by the world's foremost entertainment companies. Michael Curry Design incorporates innovative technologies while being grounded in traditional theatrical techniques to create exemplary entertainment experiences. Together with STUFISH, Michael Curry proposed the winning design competition vision in 2017 and continues to inform the conceptual design with...

THEATER CONSULTANT:
THE SHALLECK COLLABORATIVE
Berkeley, California

Leading experts in theater space planning and design, The Shalleck Collaborative works exclusively on facilities for the performing arts, including design and integration of all forms of theater production and AV systems.

STRUCTURAL ENGINEER: GRUMMEL ENGINEERING
Portland, Oregon

With a range of projects, including commercial developments, creative and unique art installations, and solar, Grummel Engineering specializes in structural design, including concrete, timber, steel, masonry, and unreinforced masonry (U.R.M.) structures.

CIVIL ENGINEER: KPFF CONSULTING ENGINEERS
Portland, Oregon

KPFF Civil is the go-to consultant for navigating development in downtown Portland, having built a reputation as creative and innovative engineers focused on excellence.

GENERAL CONTRACTOR / ESTIMATOR:
HOFFMAN CONSTRUCTION COMPANY
Portland, Oregon

Hoffman Construction Company has grown to be the largest general contractor headquartered in the Pacific Northwest, with the ability to plan and execute complex projects across a range of markets.

(page intentionally left blank)

City of Portland/Metro Letter to HLC

City of Portland | Metro

September 14, 2022

Ms. Karen Whitman, Executive Director
Halprin Landscape Conservancy
PO BOX 28367
Portland, OR 97228

Dear Ms. Whitman,

On behalf of the City of Portland and Metro, we extend our gratitude for your interest in the Keller Auditorium Seismic review. The information that was included in the 2020 Seismic Study provided a high-level overview of select options and was not designed as an all-inclusive evaluation. We are entering the next evaluation phase for renovation or replacement of the venue.

Included in this next phase will be opportunity for public input, co-led by the City and Metro, focused on how Keller Auditorium fits into the greater context of performing arts and spectator venues within the Portland region, and collection of additional technical feasibility of options, including option 2B, as outlined in the 2018 Comparative Evaluations document.

The City of Portland and Metro have committed $400K in total for the further development of option 2B, led by the Halprin Landscape Conservancy (501c3). We understand there is an additional $200K secured from other sources.

The timeline for disbursement of these funds is forthcoming and will be considered as the public process is being developed.

Tentative timeline

October 2022 – April 2023	*Stakeholder engagement*
January – May 2023	*2B Feasibility Study and other possible options*
June – July 2023	*Review of all options and* stakeholder engagement
July – December 2023	*Additional public input and discussion*
Spring 2024	*Council decision*

We look forward to your continued engagement in this process. Please reach out with any questions or concerns.

Sincerely,

Ted Wheeler
Mayor

Lynn Peterson
Metro Council President

(page intentionally left blank)

(page intentionally left blank)

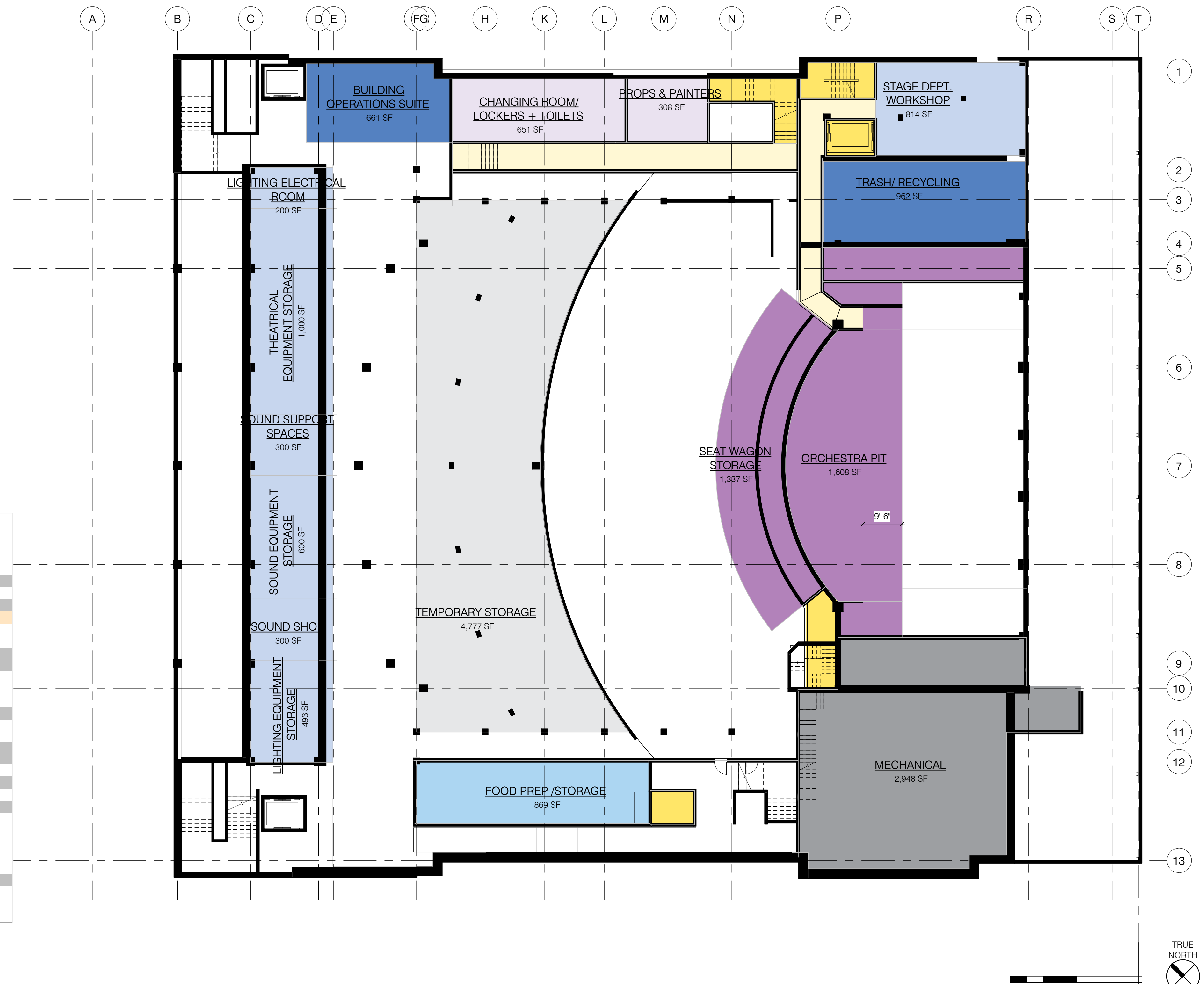
Programming Diagrams and Space Summary

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:45:57 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE			
COUNTERWEIGHT PIT	0 SF	400 SF	407 SF
ORCHESTRA PIT	1,562 SF	1,600 SF	1,608 SF
ORCHESTRA PIT STORAGE	0 SF	300 SF	297 SF
SEAT WAGON STORAGE	0 SF	1,750 SF	1,337 SF
	1,562 SF	4,050 SF	3,649 SF
STAGE SUPPORT SPACES			
CHANGING ROOM/ LOCKERS + TOILETS	321 SF	400 SF	651 SF
PROPS & PAINTERS	0 SF	300 SF	308 SF
	321 SF	700 SF	960 SF
WORKSHOPS			
STAGE DEPT. WORKSHOP	0 SF	500 SF	814 SF
THEATRICAL EQUIPMENT STORAGE	0 SF	1,000 SF	1,000 SF
LIGHTING EQUIPMENT STORAGE	0 SF	500 SF	493 SF
SOUND SHOP	0 SF	250 SF	300 SF
SOUND EQUIPMENT STORAGE	0 SF	500 SF	600 SF
SOUND SUPPORT SPACES	0 SF	300 SF	300 SF
LIGHTING ELECTRICAL ROOM	0 SF	200 SF	200 SF
	0 SF	3,250 SF	3,708 SF
SERVICES			
TEMPORARY STORAGE	0 SF	1,100 SF	4,777 SF
	0 SF	1,100 SF	4,777 SF
ADMINISTRATION			
BUILDING OPERATIONS SUITE	0 SF	500 SF	661 SF
TRASH/ RECYCLING	0 SF	800 SF	962 SF
	0 SF	1,300 SF	1,623 SF
	1,883 SF	10,400 SF	14,716 SF



1 LOWER BASEMENT
1/16" = 1'-0"

Henneberry Eddy Architects

Copyright 2021 Henneberry Eddy Architects, Inc.

MARKING KELLER | 05/15/2023

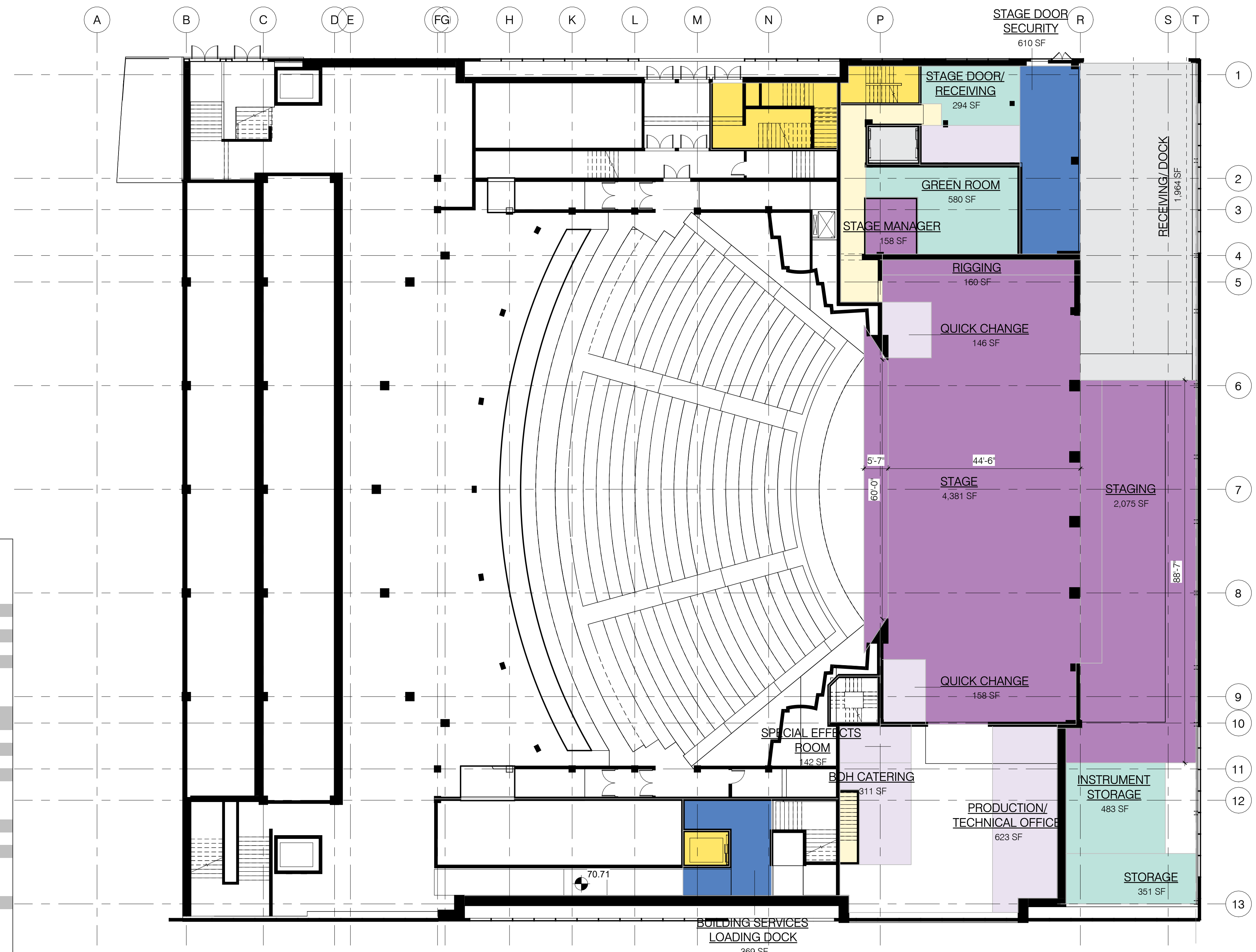
SPACE PLANNING

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:00 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE			
STAGE	5,646 SF	6,000 SF	4,381 SF
STAGING	2,081 SF	1,500 SF	2,075 SF
APRON	0 SF	350 SF	375 SF
CROSSOVER AISLE	0 SF	0 SF	328 SF
RIGGING	0 SF	0 SF	160 SF
STAGE MANAGER	0 SF	120 SF	158 SF
	7,727 SF	7,970 SF	7,477 SF
STAGE SUPPORT SPACES			
PRODUCTION/ TECHNICAL OFFICE	0 SF	600 SF	623 SF
BOH CATERING	0 SF	300 SF	311 SF
BACKSTAGE TOILETS	104 SF	600 SF	212 SF
QUICK CHANGE	0 SF	300 SF	304 SF
SPECIAL EFFECTS ROOM	0 SF	100 SF	142 SF
	104 SF	1,900 SF	1,593 SF
PERFORMER SUPPORT			
STAGE DOOR/ RECEIVING	257 SF	300 SF	294 SF
GREEN ROOM	450 SF	600 SF	580 SF
INSTRUMENT STORAGE	0 SF	400 SF	483 SF
STORAGE	260 SF	250 SF	351 SF
	967 SF	1,550 SF	1,708 SF
SERVICES			
FREIGHT ELEVATOR	0 SF	150 SF	110 SF
RECEIVING/ DOCK	795 SF	2,000 SF	1,964 SF
	795 SF	2,150 SF	2,073 SF
ADMINISTRATION			
BUILDING SERVICES LOADING DOCK	0 SF	350 SF	369 SF
STAGE DOOR SECURITY	0 SF	100 SF	610 SF
	0 SF	450 SF	979 SF
	9,593 SF	14,020 SF	13,830 SF



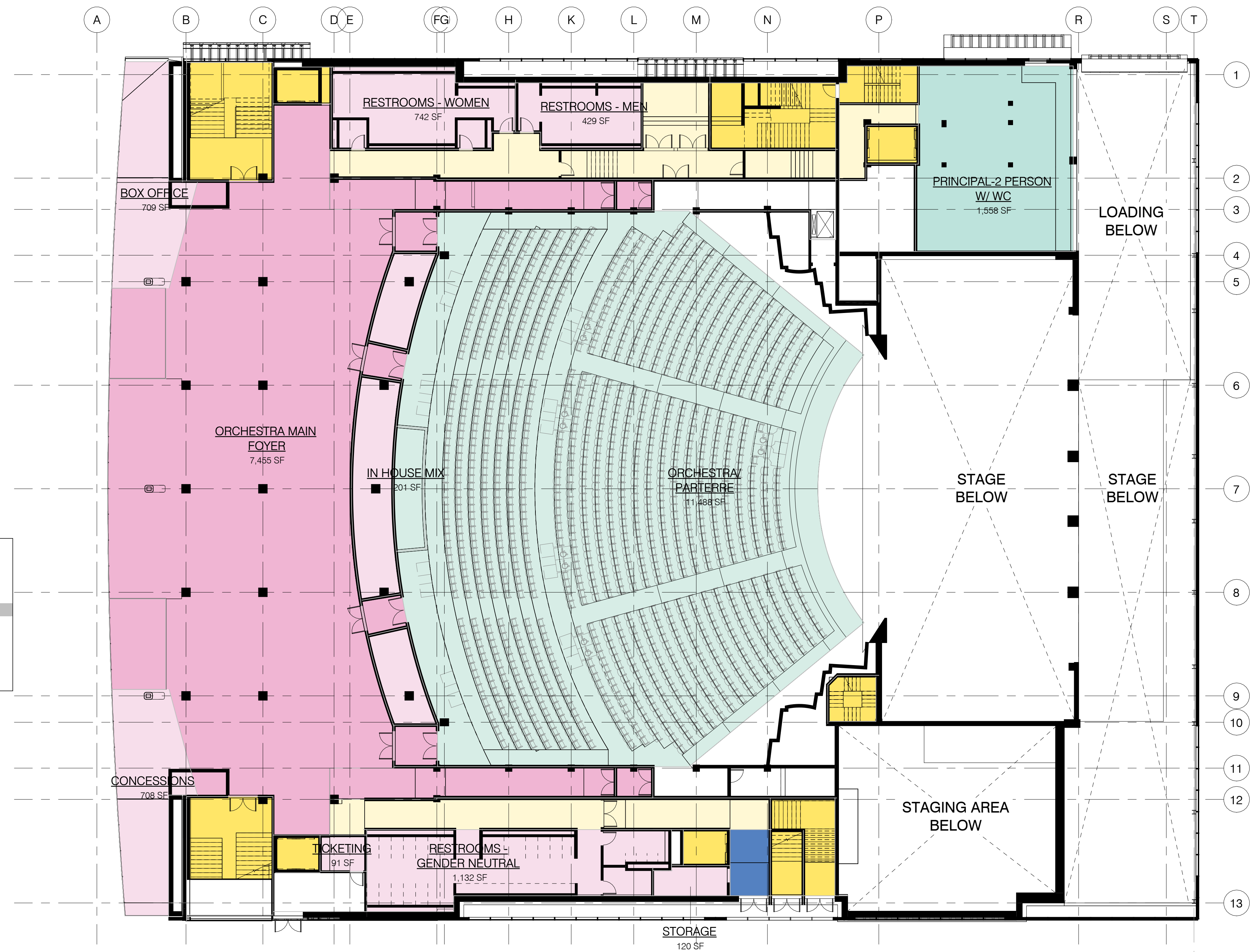
1 STAGE
1/16" = 1'-0"

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:04 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
PERFORMER SUPPORT			
PRINCIPAL-2 PERSON W/ WC	0 SF	1,400 SF	1,558 SF
	0 SF	1,400 SF	1,558 SF
ADMINISTRATION			
BUILDING SERVICES LOADING DOCK	0 SF	150 SF	143 SF
	0 SF	150 SF	143 SF
	0 SF	1,550 SF	1,701 SF



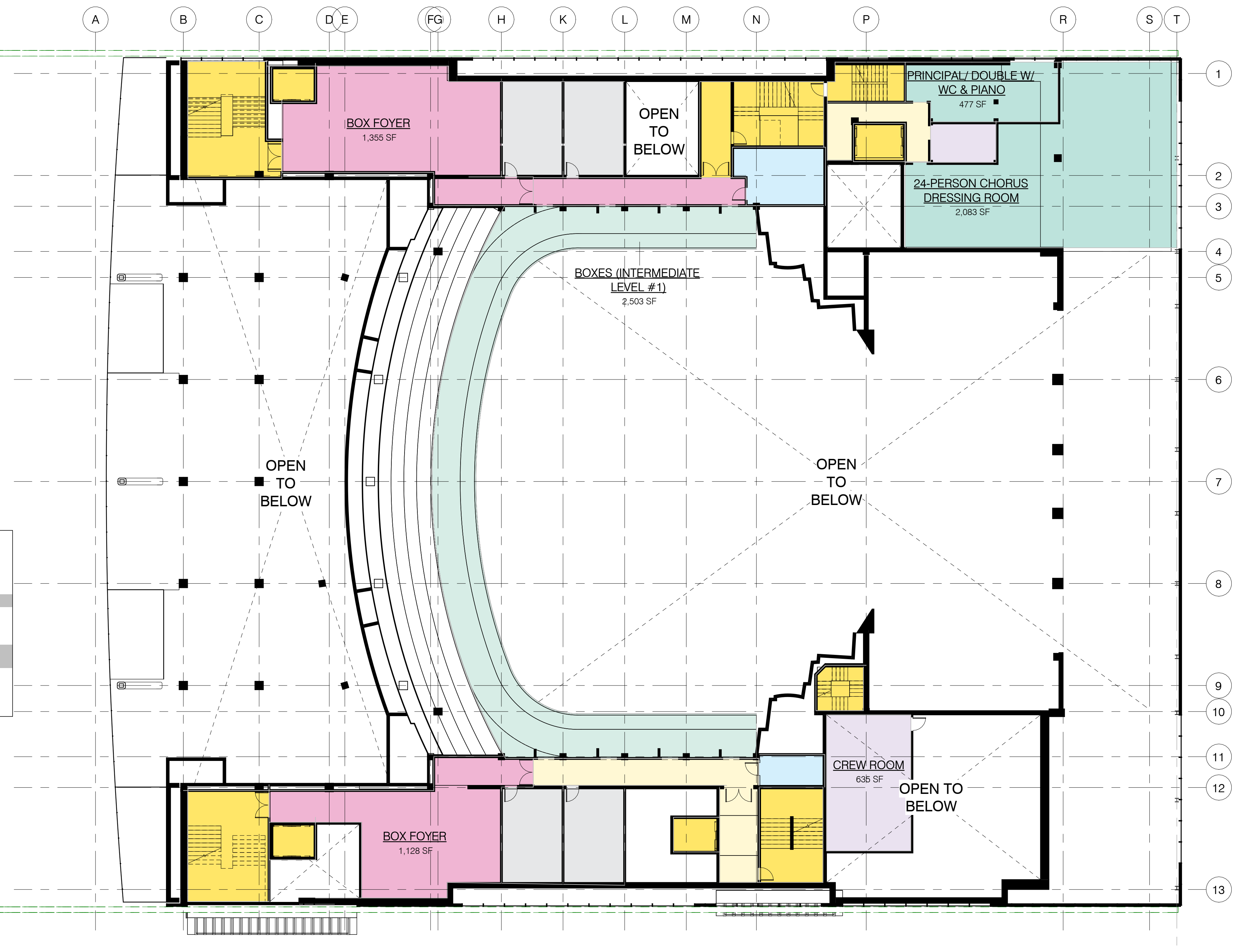
1 GROUND FLOOR FOYER
1/16" = 1'-0"

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:06 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE SUPPORT SPACES			
CREW ROOM	0 SF	600 SF	635 SF
BACKSTAGE TOILETS	104 SF	0 SF	147 SF
	104 SF	600 SF	782 SF
PERFORMER SUPPORT			
PRINCIPAL/ DOUBLE W/ WC & PIANO	0 SF	440 SF	477 SF
24-PERSON CHORUS DRESSING ROOM	268 SF	1,800 SF	2,083 SF
	268 SF	2,240 SF	2,560 SF
	372 SF	2,840 SF	3,341 SF



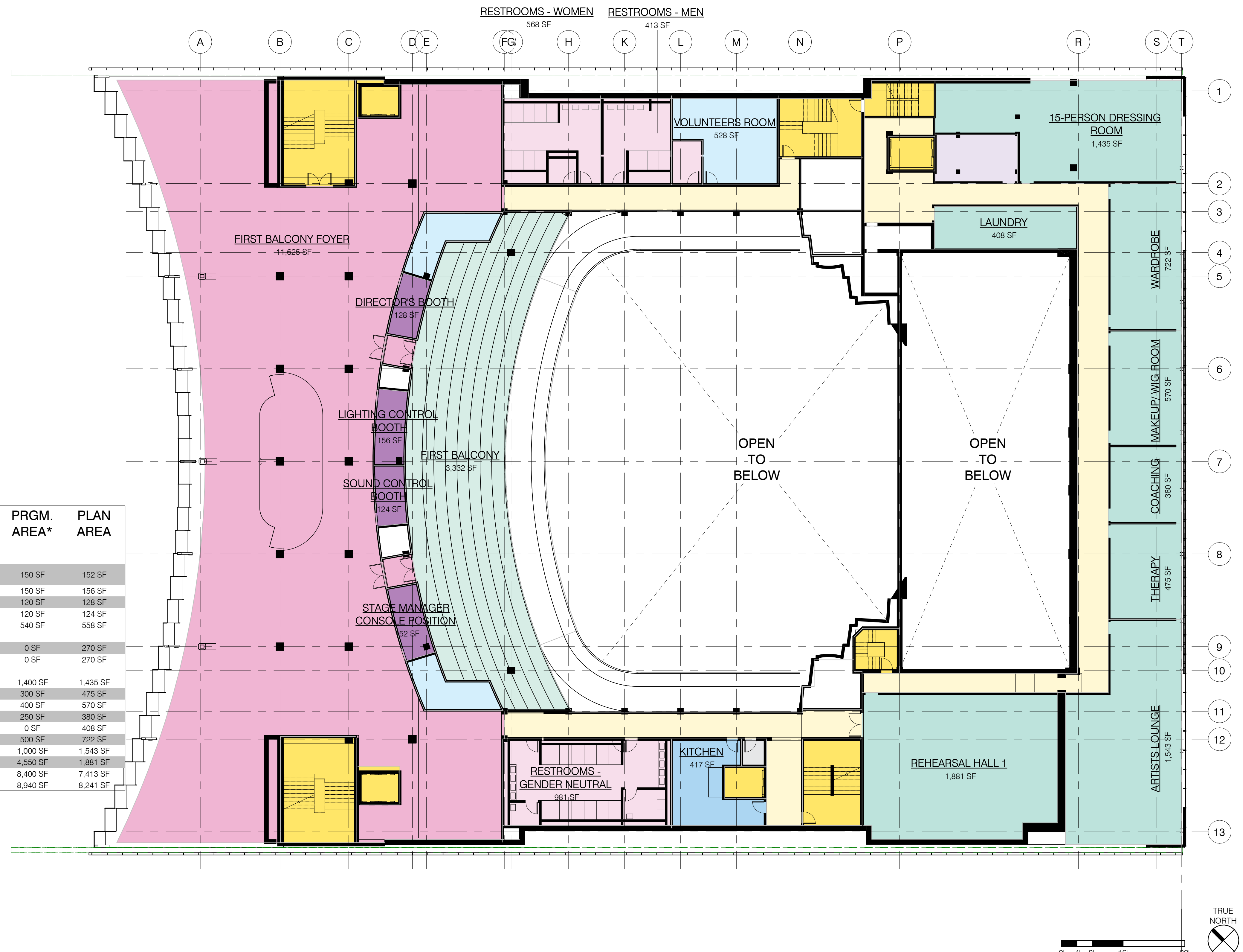
1 INTERMEDIATE LEVEL 1
1/16" = 1'-0"

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:08 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE			
STAGE MANAGER CONSOLE POSITION	136 SF	150 SF	152 SF
LIGHTING CONTROL BOOTH	0 SF	150 SF	156 SF
DIRECTOR'S BOOTH	0 SF	120 SF	128 SF
SOUND CONTROL BOOTH	375 SF	120 SF	124 SF
	511 SF	540 SF	558 SF
STAGE SUPPORT SPACES			
BACKSTAGE TOILETS	104 SF	0 SF	270 SF
	104 SF	0 SF	270 SF
PERFORMER SUPPORT			
15-PERSON DRESSING ROOM	268 SF	1,400 SF	1,435 SF
THERAPY	0 SF	300 SF	475 SF
MAKEUP/ WIG ROOM	0 SF	400 SF	570 SF
COACHING	0 SF	250 SF	380 SF
LAUNDRY	0 SF	0 SF	408 SF
WARDROBE	0 SF	500 SF	722 SF
ARTISTS LOUNGE	495 SF	1,000 SF	1,543 SF
REHEARSAL HALL 1	4,622 SF	4,550 SF	1,881 SF
	5,385 SF	8,400 SF	7,413 SF
	6,000 SF	8,940 SF	8,241 SF



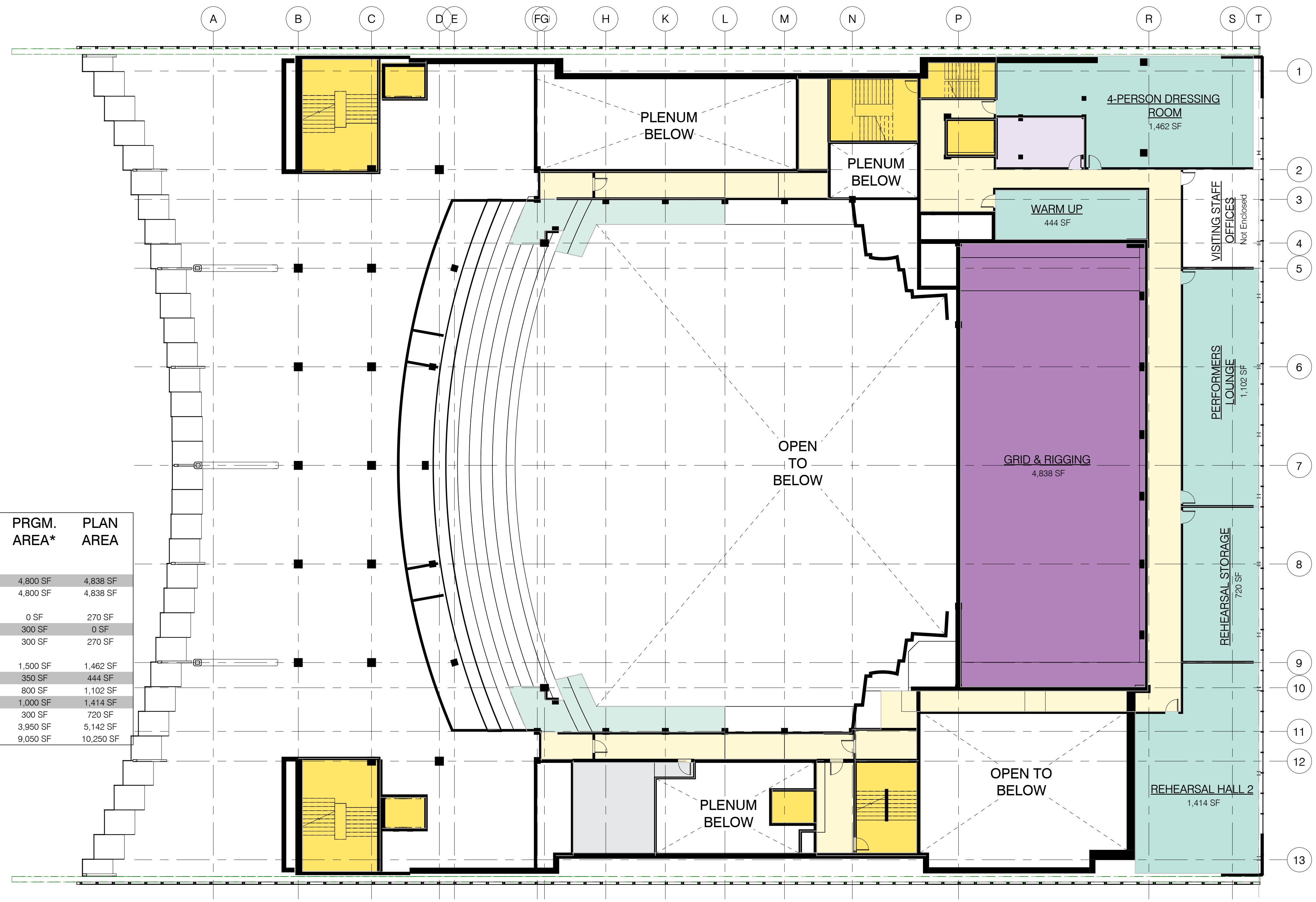
1 FIRST BALCONY
1/16" = 1'-0"

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:11 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE			
GRID & RIGGING	4,838 SF	4,800 SF	4,838 SF
	4,838 SF	4,800 SF	4,838 SF
STAGE SUPPORT SPACES			
BACKSTAGE TOILETS	104 SF	0 SF	270 SF
VISITING STAFF OFFICES	0 SF	300 SF	0 SF
	104 SF	300 SF	270 SF
PERFORMER SUPPORT			
4-PERSON DRESSING ROOM	0 SF	1,500 SF	1,462 SF
WARM UP	0 SF	350 SF	444 SF
PERFORMERS LOUNGE	0 SF	800 SF	1,102 SF
REHEARSAL HALL 2	0 SF	1,000 SF	1,414 SF
REHEARSAL STORAGE	210 SF	300 SF	720 SF
	210 SF	3,950 SF	5,142 SF
	5,152 SF	9,050 SF	10,250 SF



TRUE NORTH

1 INTERMEDIATE LEVEL 2
1/16" = 1'-0"

Henneberry Eddy Architects

Copyright 2021 Henneberry Eddy Architects, Inc.

MARKING KELLER | 05/15/2023

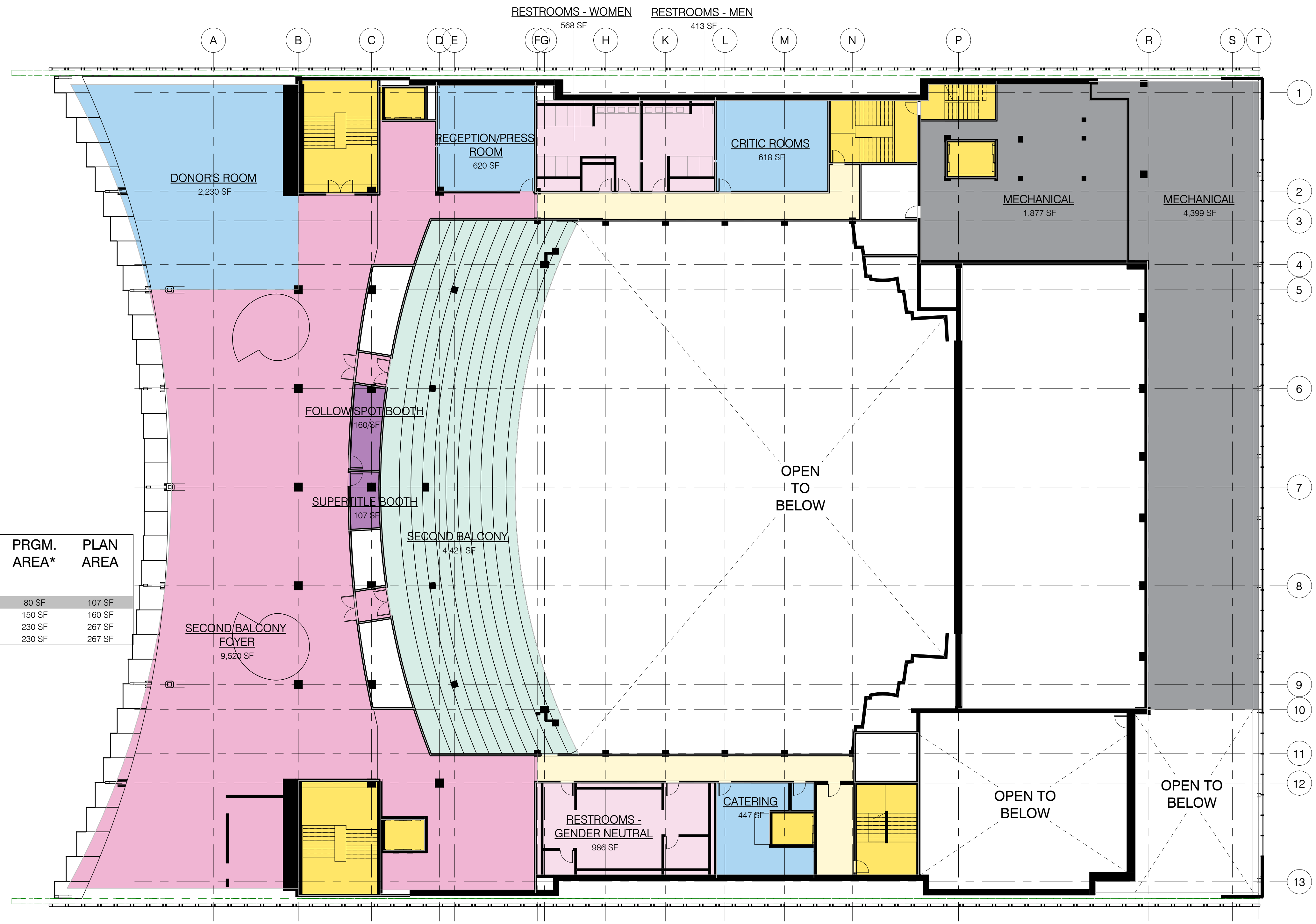
SPACE PLANNING

(page intentionally left blank)

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt 7/14/2023 2:46:13 PM

- ADMINISTRATION
- ADMINISTRATION - SUPPORT
- CIRCULATION / OPEN PLAN 1
- CIRCULATION / OPEN PLAN 3
- PERFORMACE SPACES - AUDITORIUM
- PERFORMER SUPPORT
- PUBLIC SPACES - LOBBY
- PUBLIC SPACES - LOBBY SUPPORT
- PUBLIC SPACES - RECEPTION AREAS
- PUBLIC SPACES - STAFF SUPPORT
- SERVICES
- SERVICES - MECHANICAL
- STAGE
- STAGE SUPPORT SPACES
- WORKSHOPS

NAME	(e) AREA	PRGM. AREA*	PLAN AREA
STAGE			
SUPERTITLE BOOTH	0 SF	80 SF	107 SF
FOLLOW SPOT BOOTH	0 SF	150 SF	160 SF
	0 SF	230 SF	267 SF
	0 SF	230 SF	267 SF

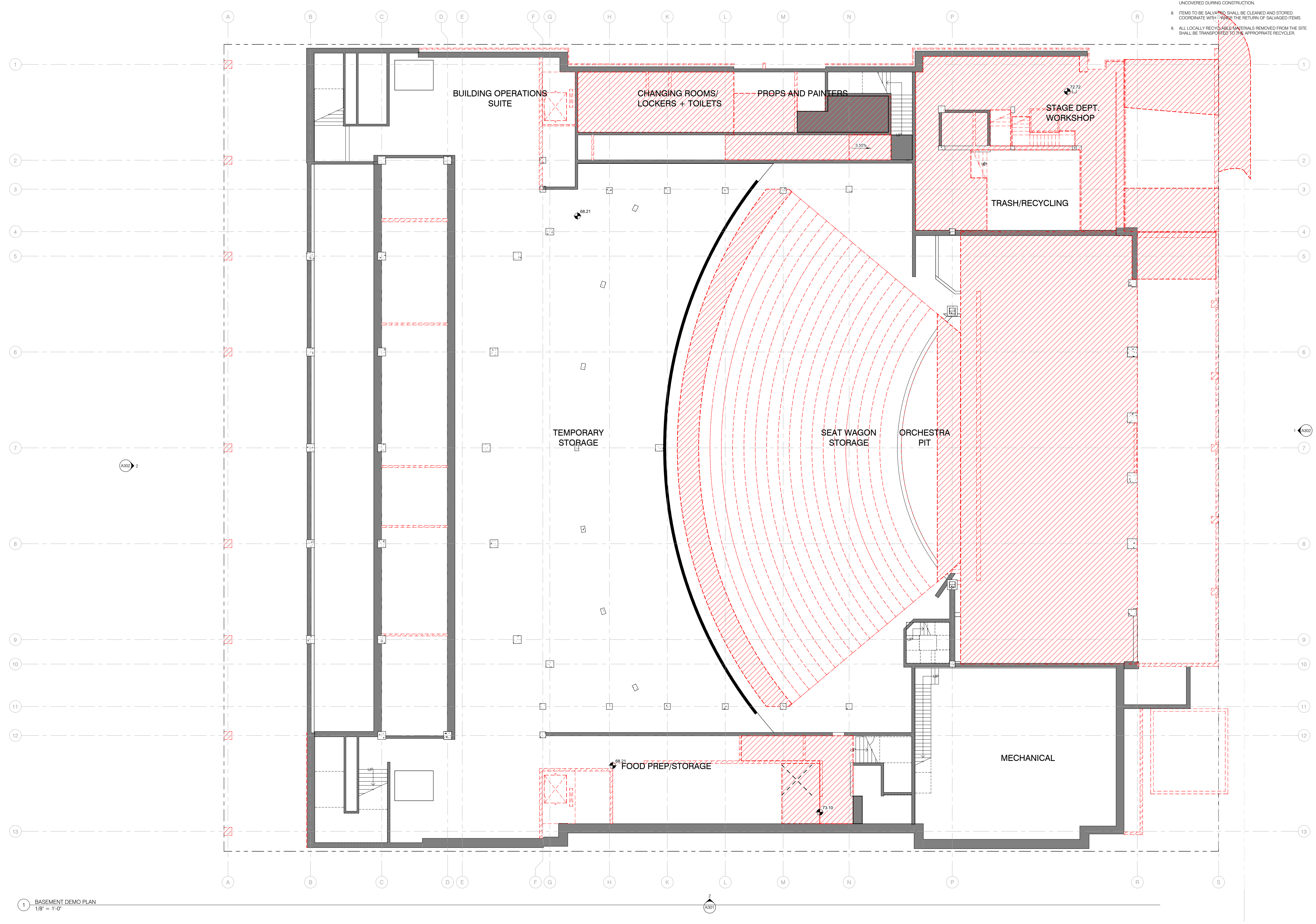


1 SECOND BALCONY
1/16" = 1'-0"

(page intentionally left blank)

Architectural Concept Drawings

(page intentionally left blank)



1 BASEMENT DEMO PLAN
1/8" = 1'-0"

DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
BASEMENT DEMO PLAN

PRICING SET

A101

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

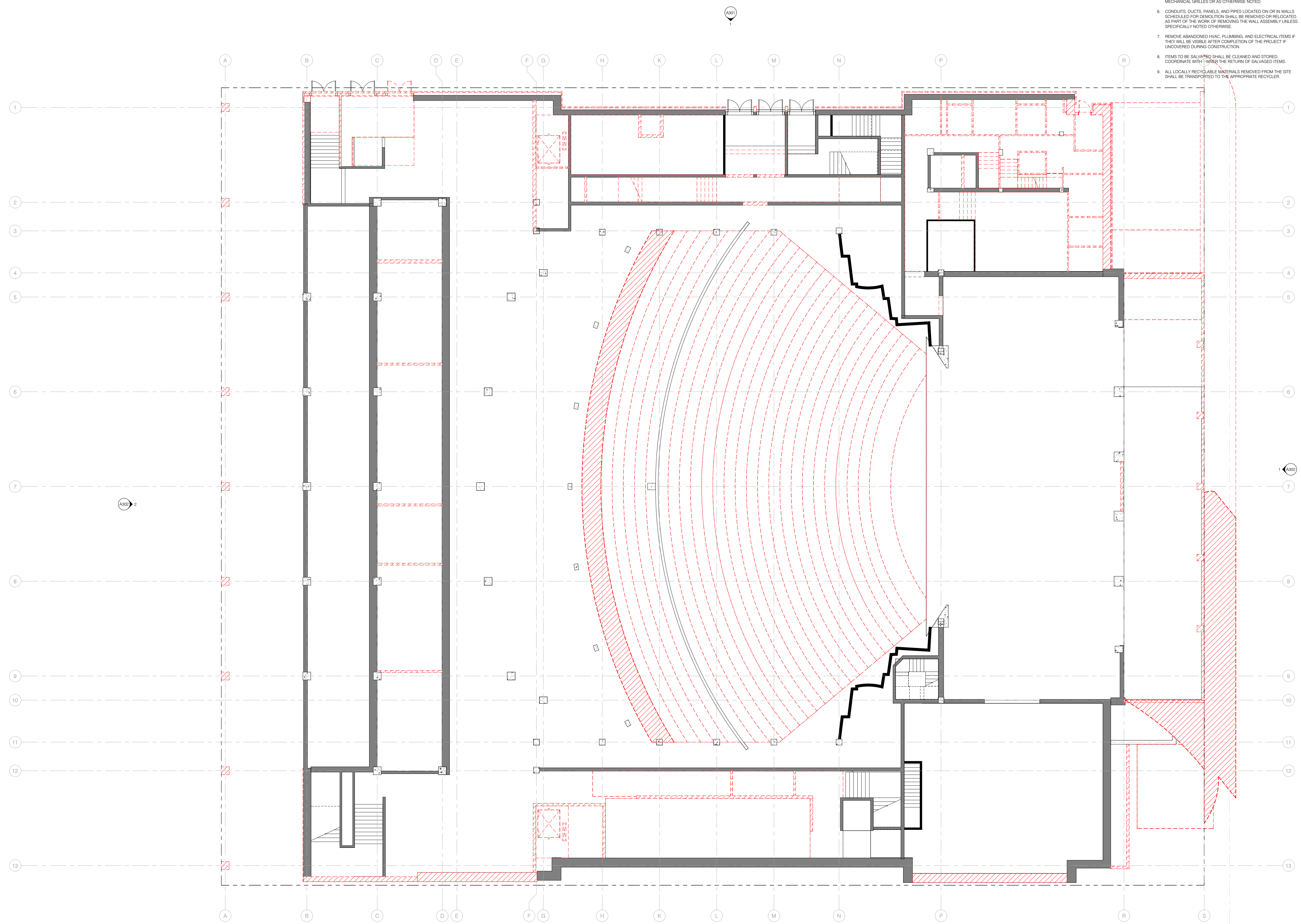
DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 STAGE LEVEL DEMO PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
STAGE LEVEL DEMO PLAN

PRICING SET

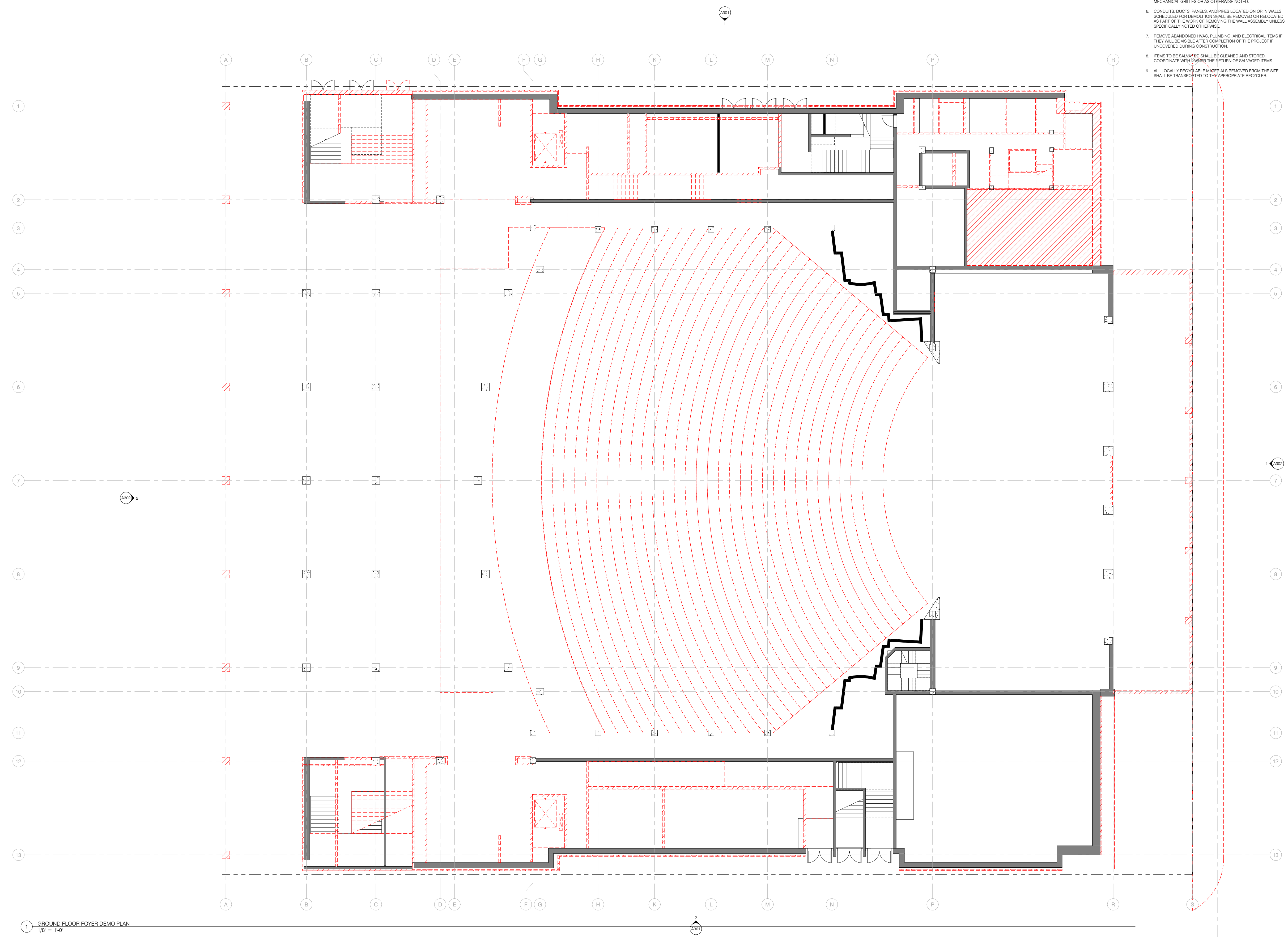
A102

Copyright 2022 Hennebery Eddy Architects, Inc.

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt
6/30/2023 12:39:05 PM

SETTINGS FOR VIEWING AND PRINTING CONTENT ARE OPTIMIZED WHEN ALL THREE DOTS ARE VISIBLE. THE ADJACENT SAMPLES SHOW THREE LEVELS OF SHADING. THIS GUIDANCE IS FOR REFERENCE ONLY.
BLACK
DARK GRAY
LIGHT GRAY

(page intentionally left blank)



GROUND FLOOR FOYER DEMO PLAN
1/8" = 1'-0"

DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

GROUND FLOOR FOYER DEMO PLAN

PRICING SET

A103

A31

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP

1 INTERMEDIATE LEVEL 1 DEMO PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

INTERMEDIATE LEVEL 1 DEMO PLAN

A33

PRICING SET

A104

Copyright 2022 Hennebery Eddy Architects, Inc.

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt

6/30/2023 12:39:07 PM

THE ADJACENT SAMPLES SHOW THREE LEVELS OF SHADING. SETTINGS FOR VIEWING AND PRINTING CONTENT ARE OPTIMIZED WHEN ALL THREE DOTS ARE VISIBLE. THIS GUIDANCE IS FOR REFERENCE ONLY.

LIGHT GRAY DARK GRAY BLACK

(page intentionally left blank)

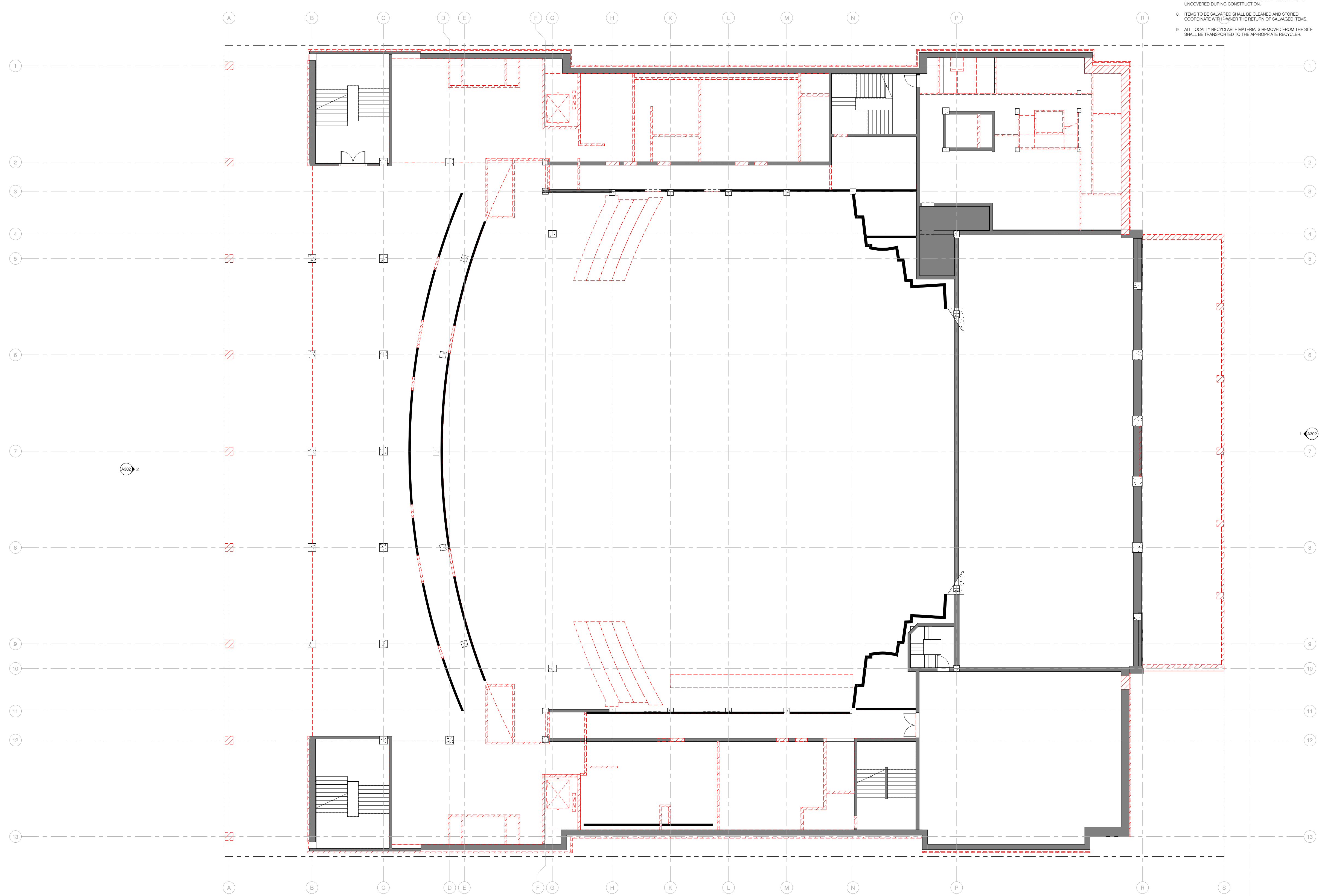
DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 FIRST BALCONY DEMO PLAN
1/8" = 1'-0"

6/30/2023 12:39:08 PM Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt
THE ADJACENT SAMPLES SHOW THREE LEVELS OF SHADING. SETTINGS FOR VIEWING AND PRINTING CONTENT ARE OPTIMIZED WHEN ALL THREE DOTS ARE VISIBLE. THIS GUIDANCE IS FOR REFERENCE ONLY.
BLACK DARK GRAY LIGHT GRAY

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

FIRST BALCONY DEMO PLAN

PRICING SET

A105

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

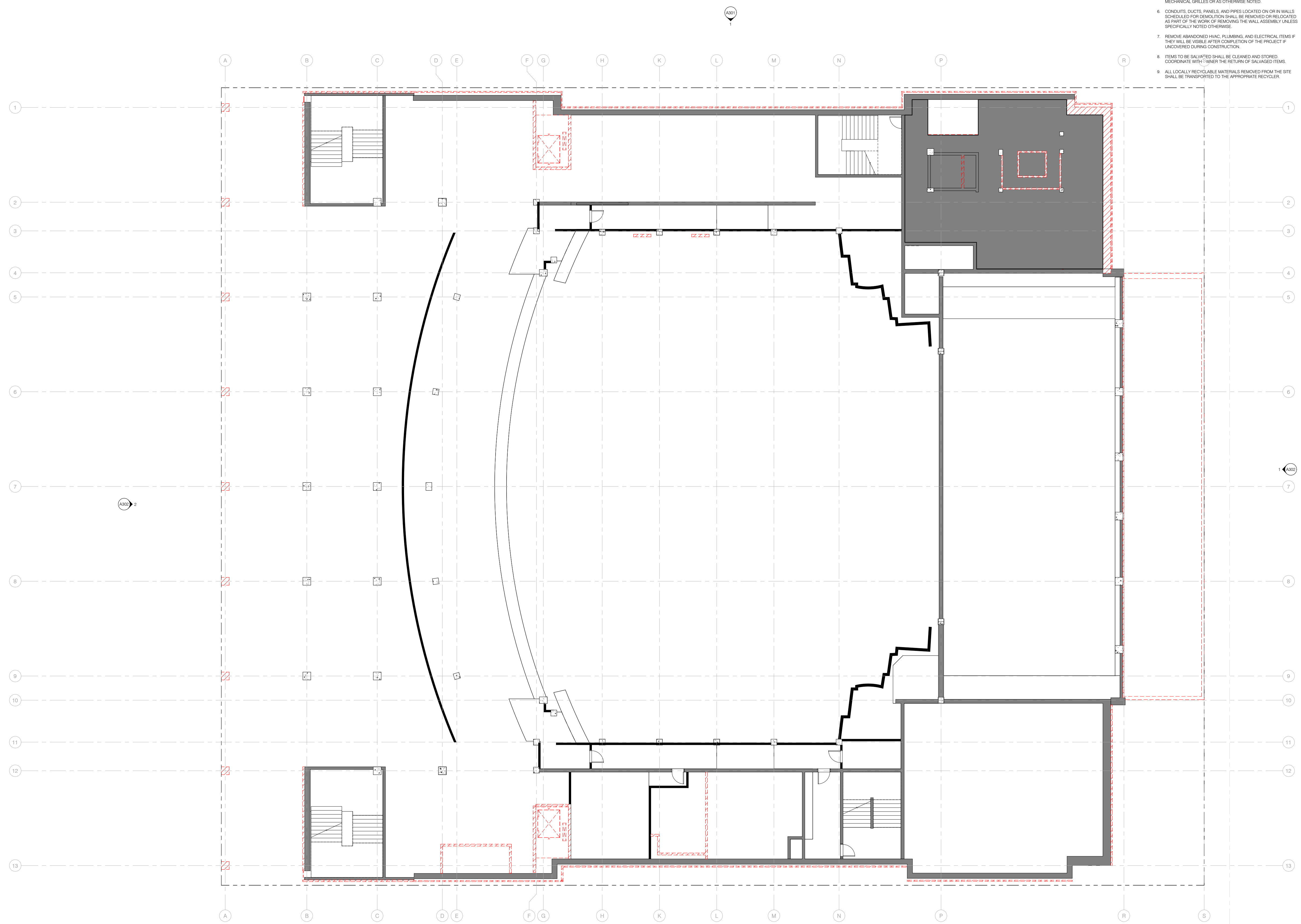
DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 INTERMEDIATE LEVEL 2 DEMO PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

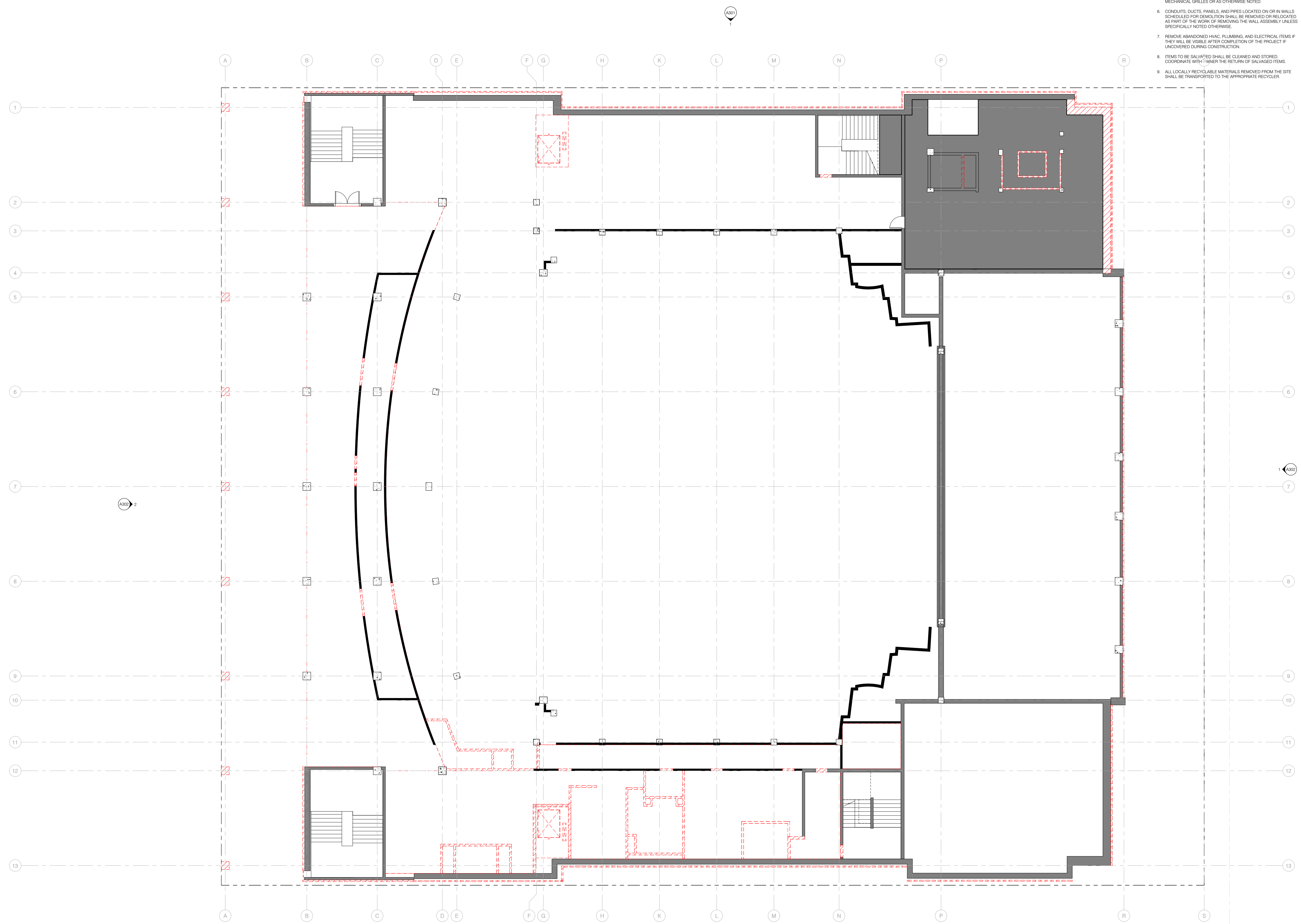
INTERMEDIATE LEVEL 2 DEMO PLAN

PRICING SET

A106

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)



1 SECOND BALCONY DEMO PLAN
1/8" = 1'-0"

DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
SECOND BALCONY DEMO PLAN

PRICING SET

A107

A39

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

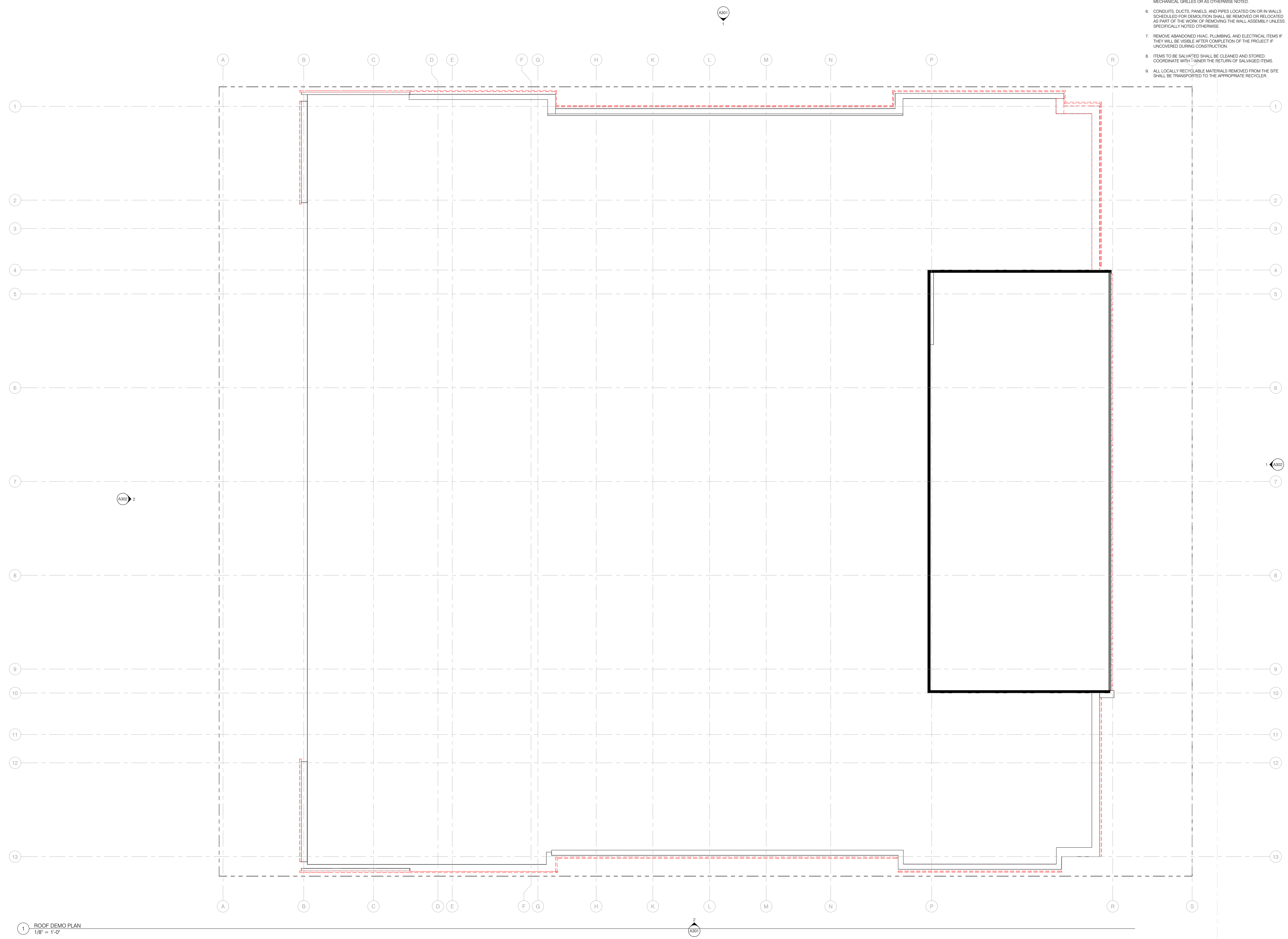
DEMOLITION PLAN LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTNG COMPONENT TO BE REMOVED

DEMOLITION PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. WHERE NOTES IN THE DRAWINGS REQUIRE THE REMOVAL OF A BUILDING ELEMENT OR SYSTEM OR A COMPLETE COMPONENT COMPRISED OF MULTIPLE ELEMENTS, THE CONTRACTOR SHALL DISASSEMBLE AND COMPLETELY REMOVE FROM THE SITE EACH ITEM IN ITS ENTIRETY SO AS TO ACCOMMODATE THE INSTALLATION OF THE NEW WORK TO FOLLOW.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF THE ACTUAL AMOUNT OF SLAB THAT NEEDS TO BE REMOVED AND REINSTALLED FOR THE CONSTRUCTION OF NEW PLUMBING LINES FROM NEW PLUMBING FIXTURES TO EXISTING PLUMBING LINES.
4. THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH EXISTING SYSTEMS SUCH AS STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS.
5. WHERE CEILING IS CALLED TO BE DEMOLISHED REMOVE ITEMS SUCH AS LIGHT FIXTURES, VENTS, GRILLES, HEATING ELEMENTS, MECHANICAL GRILLES OR AS OTHERWISE NOTED.
6. CONDUITS, DUCTS, PANELS, AND PIPES LOCATED ON OR IN WALLS SCHEDULED FOR DEMOLITION SHALL BE REMOVED OR RELOCATED AS PART OF THE WORK OF REMOVING THE WALL ASSEMBLY UNLESS SPECIFICALLY NOTED OTHERWISE.
7. REMOVE ABANDONED HVAC, PLUMBING, AND ELECTRICAL ITEMS IF THEY WILL BE VISIBLE AFTER COMPLETION OF THE PROJECT IF UNCOVERED DURING CONSTRUCTION.
8. ITEMS TO BE SALVAGED SHALL BE CLEANED AND STORED. COORDINATE WITH OWNER THE RETURN OF SALVAGED ITEMS.
9. ALL LOCALLY RECYCLABLE MATERIALS REMOVED FROM THE SITE SHALL BE TRANSPORTED TO THE APPROPRIATE RECYCLER.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 ROOF DEMO PLAN
1/8" = 1'-0"

Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt

6/30/2023 12:39:10 PM

THE ADJACENT SAMPLES SHOW THREE LEVELS OF SHADING. SETTINGS FOR VIEWING AND PRINTING CONTENT ARE OPTIMIZED WHEN ALL THREE DOTS ARE VISIBLE. THIS GUIDANCE IS FOR REFERENCE ONLY.

BLACK | DARK GRAY | LIGHT GRAY

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

ROOF DEMO PLAN

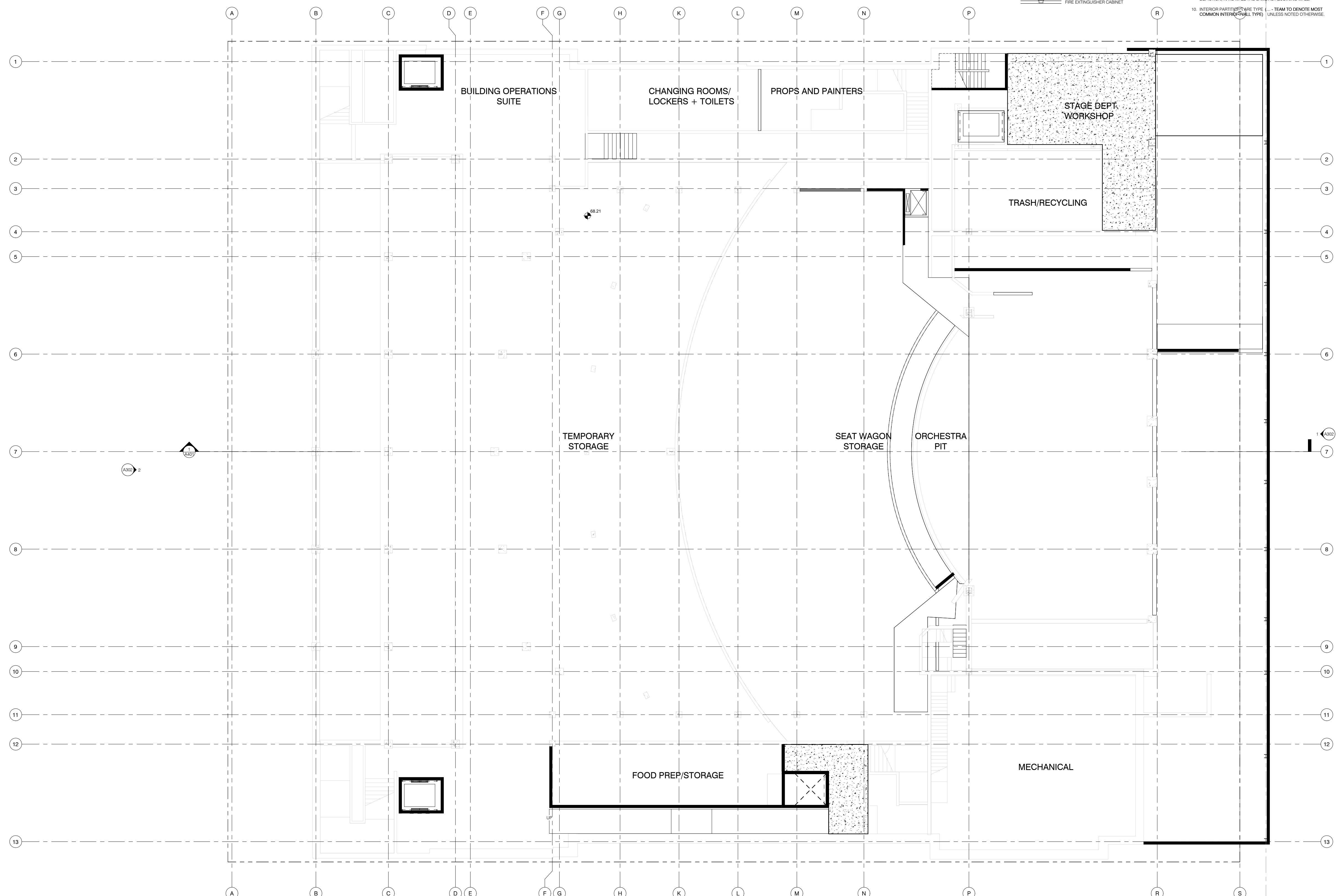
A41

PRICING SET

A108

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)



1 BASEMENT PLAN
1/8" = 1'-0"

FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG — CORNER GUARD
- FE — FIRE EXTINGUISHER
- FEC — FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO (EDIT PROJECT SPECIFIC) :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE) UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
BASEMENT PLAN

A43

PRICING SET

A201

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

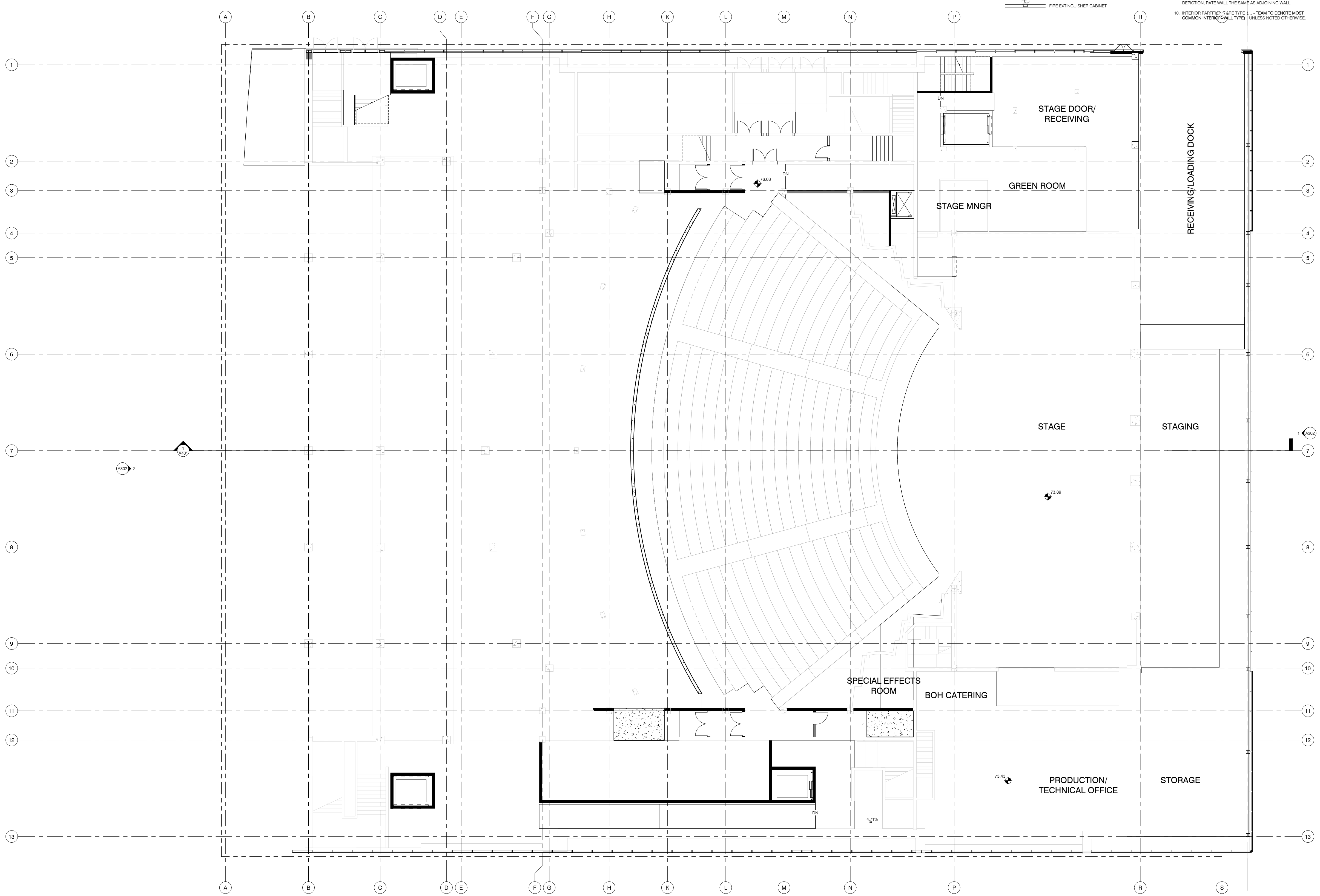
FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL
  - FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900
- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG — CORNER GUARD
- FE — FIRE EXTINGUISHER
- FEC — FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO **(EDIT PROJECT SPECIFIC)** :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE **(... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE)** UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 STAGE LEVEL PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
STAGE LEVEL PLAN

PRICING SET

A202

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

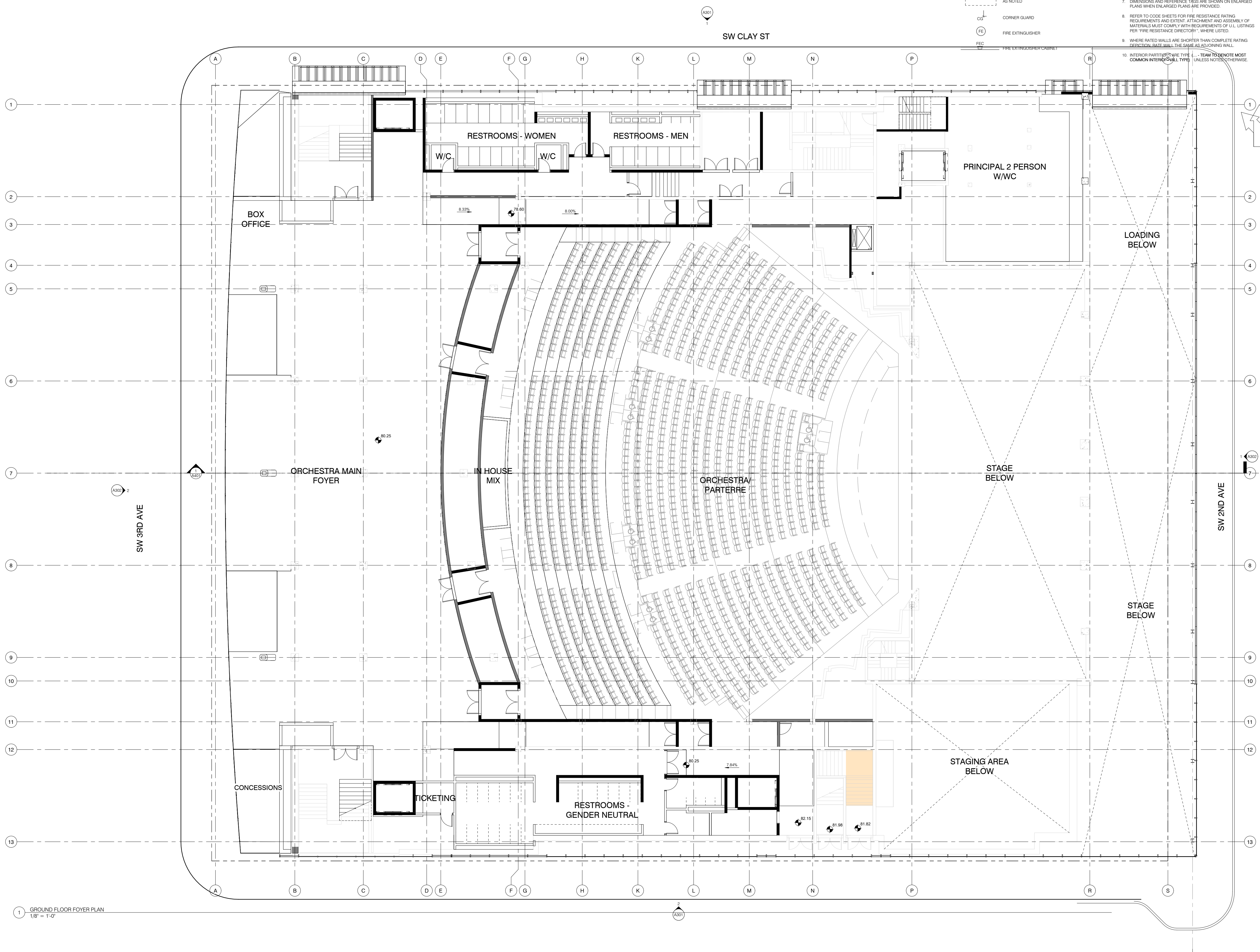
(FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900)

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG — CORNER GUARD
- FE — FIRE EXTINGUISHER
- FEC — FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO (EDIT PROJECT SPECIFIC) :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE) UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 GROUND FLOOR FOYER PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

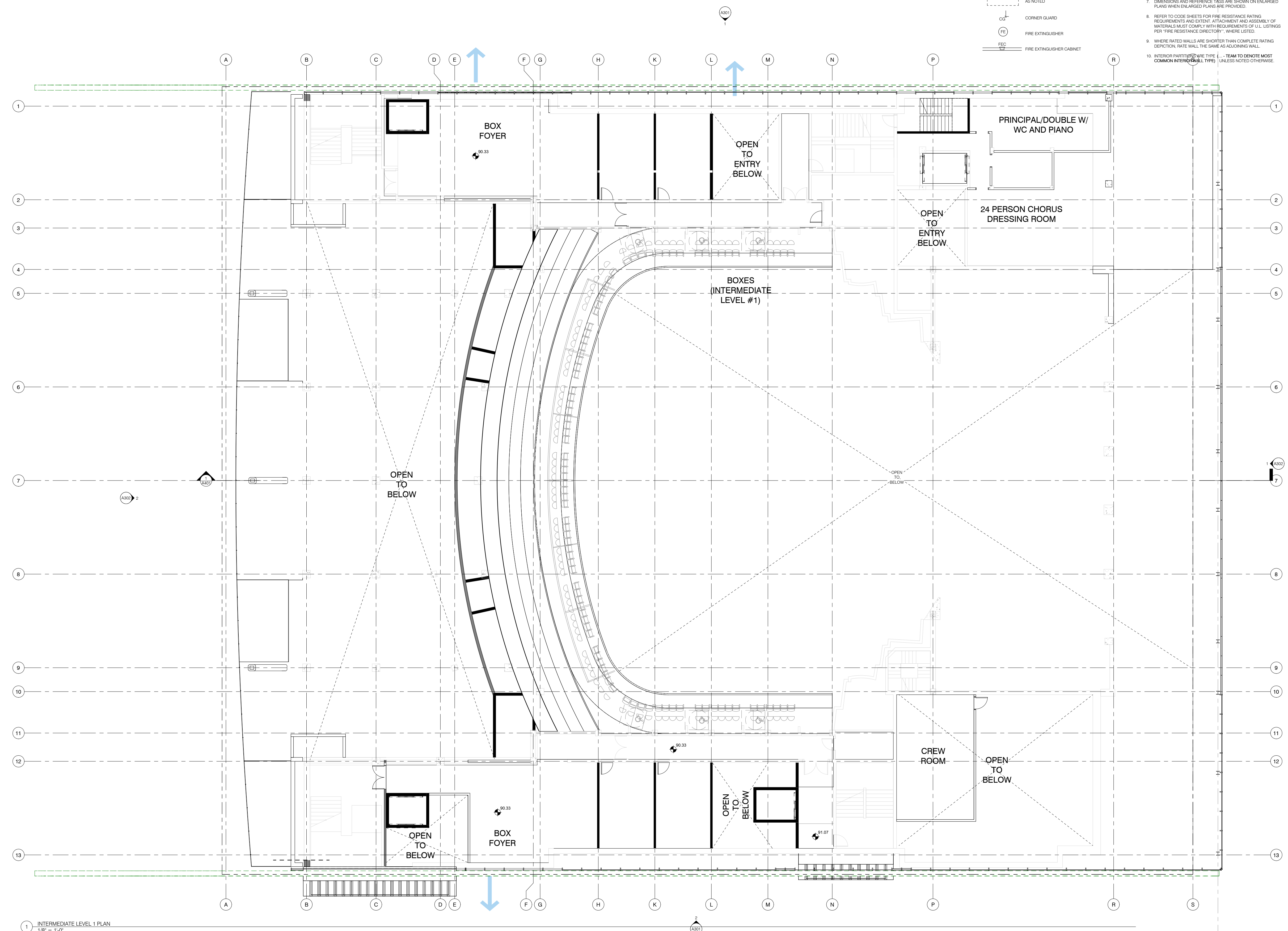
Drawn by: Author
Checked by: Checker
Sheet:
GROUND FLOOR FOYER PLAN

A47

PRICING SET
A203

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)



FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

(FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900)

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG — CORNER GUARD
- FE — FIRE EXTINGUISHER
- FEC — FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO (EDIT PROJECT SPECIFIC) :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE) UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

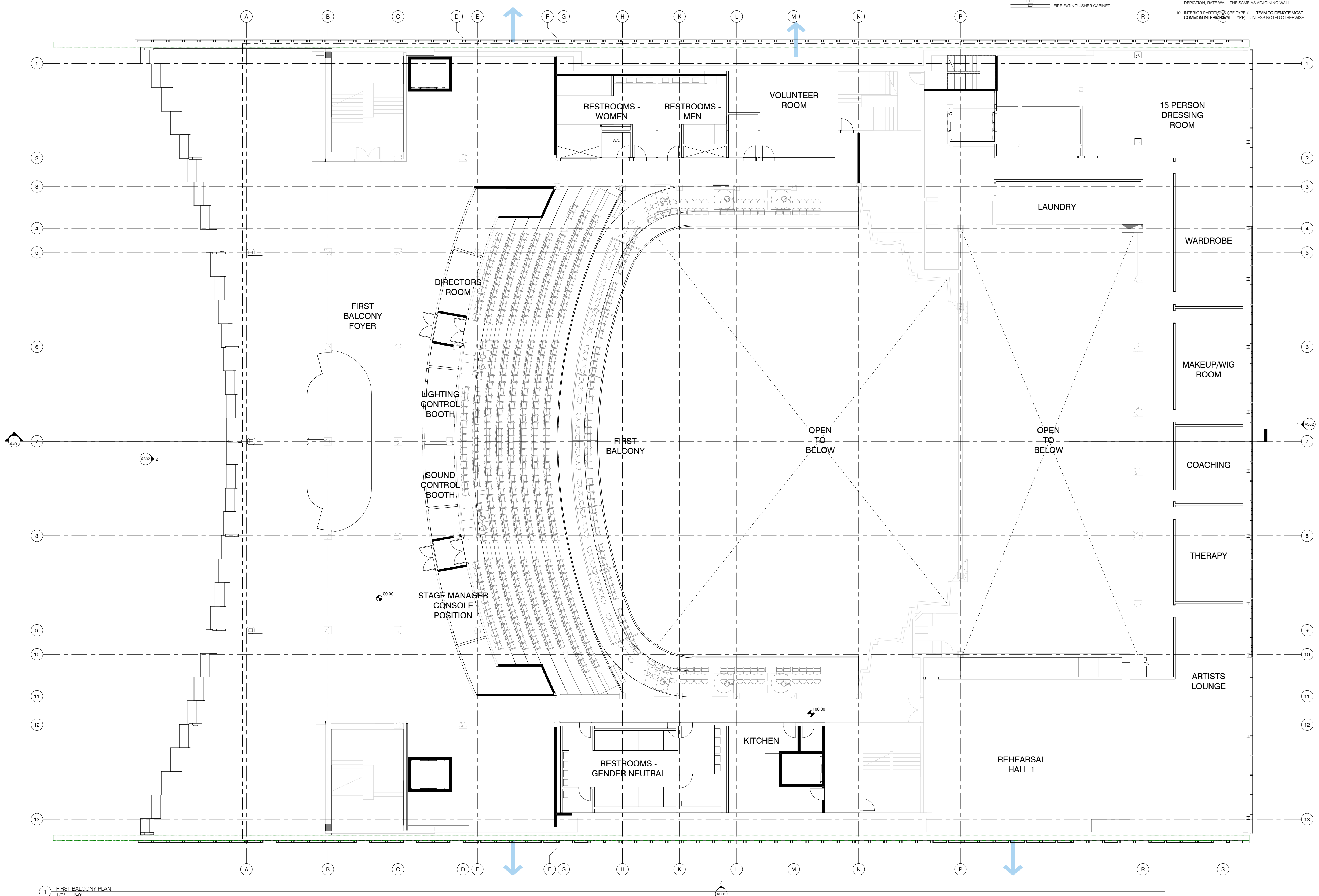
INTERMEDIATE LEVEL 1 PLAN

PRICING SET

A204

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)



1 FIRST BALCONY PLAN
1/8" = 1'-0"

FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG CORNER GUARD
- FE FIRE EXTINGUISHER
- FEC FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO (EDIT PROJECT SPECIFIC) :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE) UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
FIRST BALCONY PLAN

PRICING SET
A205

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

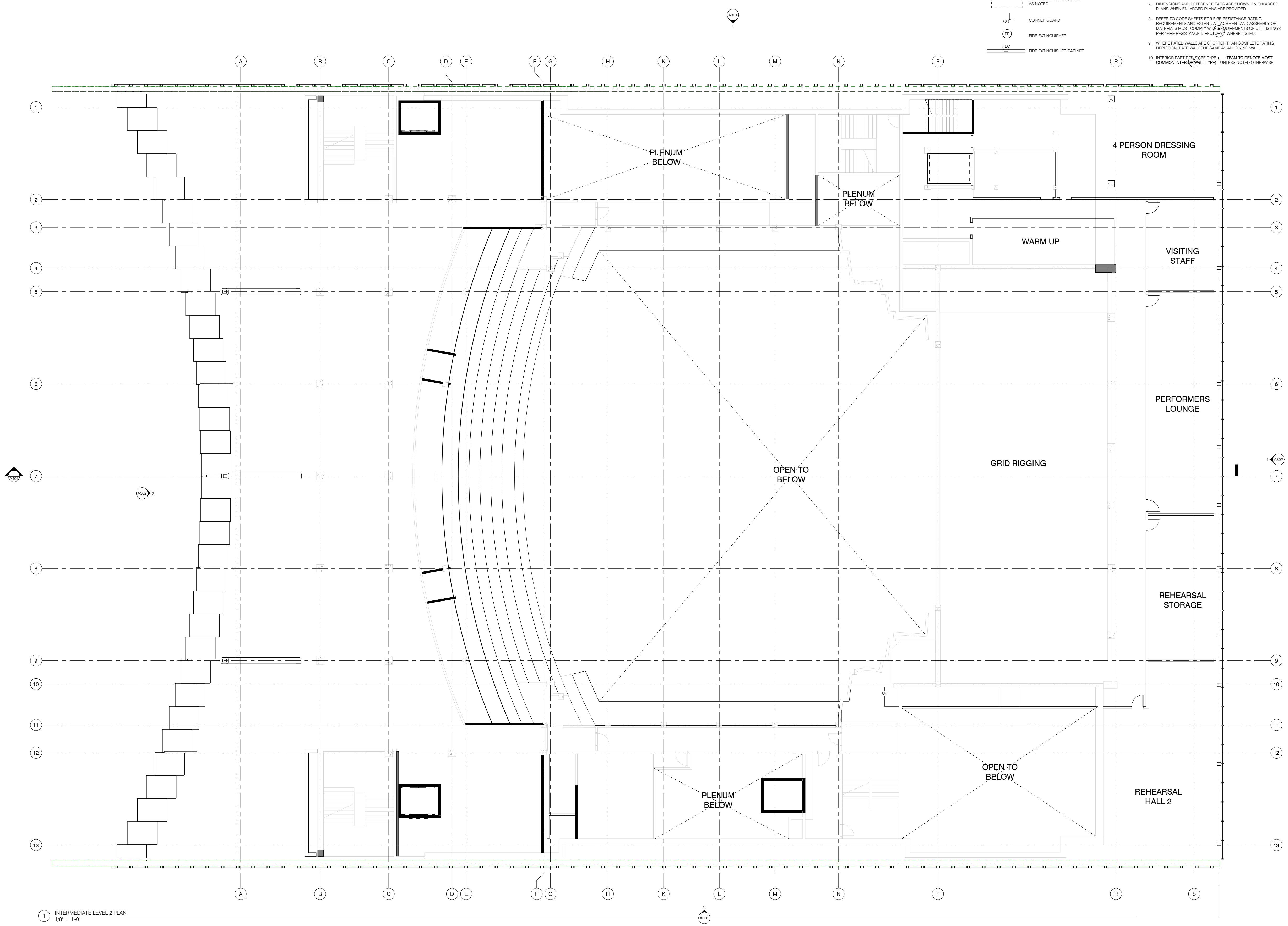
FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG — CORNER GUARD
- FE — FIRE EXTINGUISHER
- FEC — FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO (EDIT PROJECT SPECIFIC) :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE) UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 INTERMEDIATE LEVEL 2 PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

INTERMEDIATE LEVEL 2 PLAN

PRICING SET

A206

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

FLOOR PLAN LEGEND

- PARTITION WALL
- 1 HR FIRE BARRIER WALL
- 2 HR FIRE BARRIER WALL
- 3 HR FIRE BARRIER WALL
- 1 HR FIRE PARTITION WALL

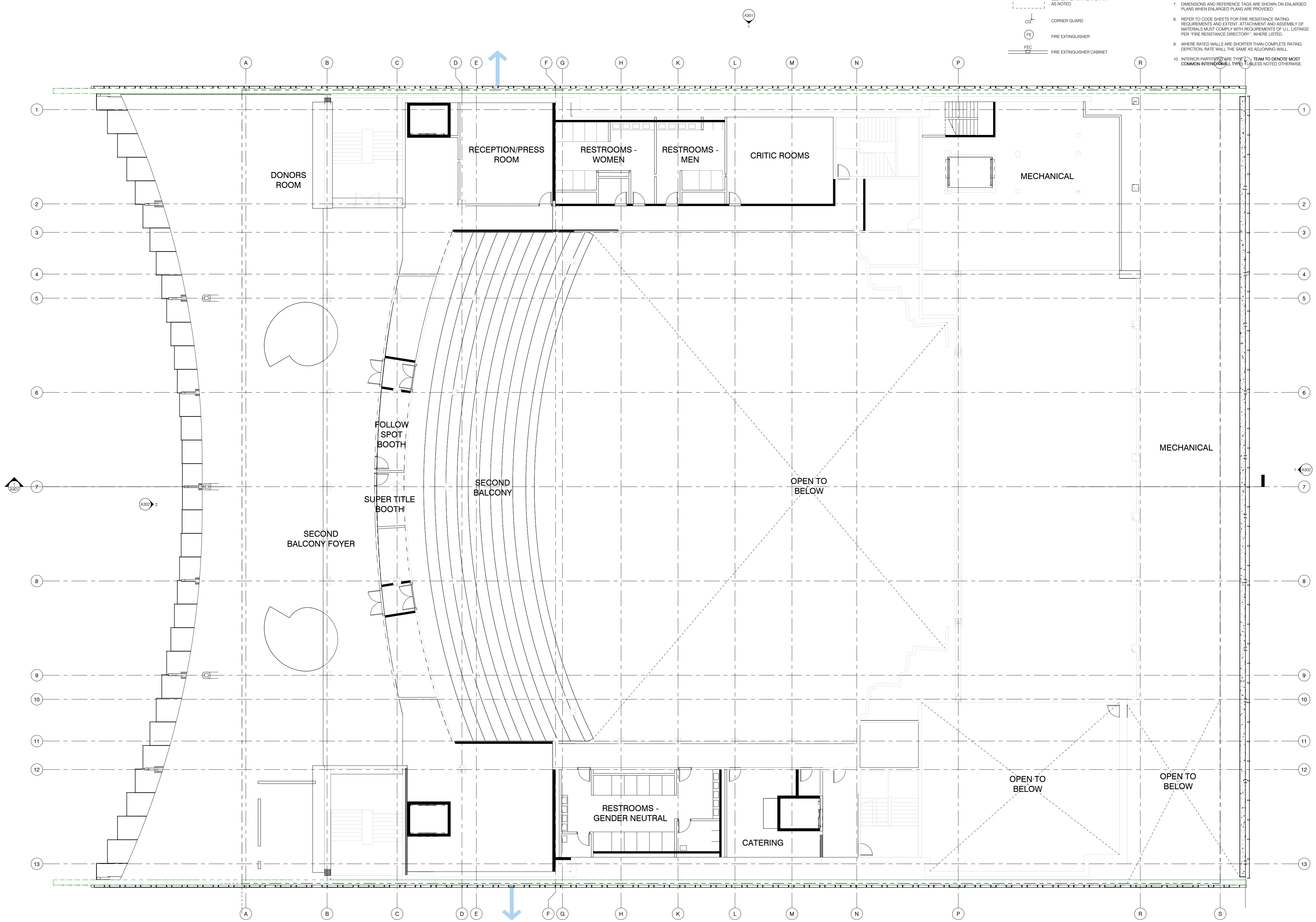
(FIRE RATING DESIGN # PER PARTITION TYPES ON SHEET A900)

- SMOKE PARTITION
- INTERIOR WINDOW/SIDELIGHT
- ELEMENT BY OWNER/TENANT AS NOTED
- CG CORNER GUARD
- FE FIRE EXTINGUISHER
- FEC FIRE EXTINGUISHER CABINET

FLOOR PLAN NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. SEE SHEET AG01 FOR TYPICAL ACCESSIBILITY CLEARANCE REQUIREMENTS.
3. SEE SHEET A900 FOR INTERIOR PARTITION TYPES.
4. SEE SHEET A910 FOR DOOR SCHEDULE.
5. SEE INTERIOR ELEVATIONS FOR VERTICAL DIMENSIONS AND TYPICAL FIXTURE AND ACCESSORY MOUNTING HEIGHTS.
6. DIMENSIONS ARE TO **(EDIT PROJECT SPECIFIC)** :
   A. FACE OF EXISTING FINISH.
   B. FACE OF EXTERIOR FINISH.
   C. FACE OF STUD.
   D. GRIDLINE.
   E. FACE OF MASONRY.
   F. FACE OF SHEATHING.
7. DIMENSIONS AND REFERENCE TAGS ARE SHOWN ON ENLARGED PLANS WHEN ENLARGED PLANS ARE PROVIDED.
8. REFER TO CODE SHEETS FOR FIRE RESISTANCE RATING REQUIREMENTS AND EXTENT. ATTACHMENT AND ASSEMBLY OF MATERIALS MUST COMPLY WITH REQUIREMENTS OF U.L. LISTINGS PER "FIRE RESISTANCE DIRECTORY", WHERE LISTED.
9. WHERE RATED WALLS ARE SHORTER THAN COMPLETE RATING DEPICTION, RATE WALL THE SAME AS ADJOINING WALL.
10. INTERIOR PARTITIONS ARE TYPE (... - **TEAM TO DENOTE MOST COMMON INTERIOR WALL TYPE)** UNLESS NOTED OTHERWISE.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 SECOND BALCONY PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
SECOND BALCONY PLAN

PRICING SET

A207

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

ROOF PLAN LEGEND

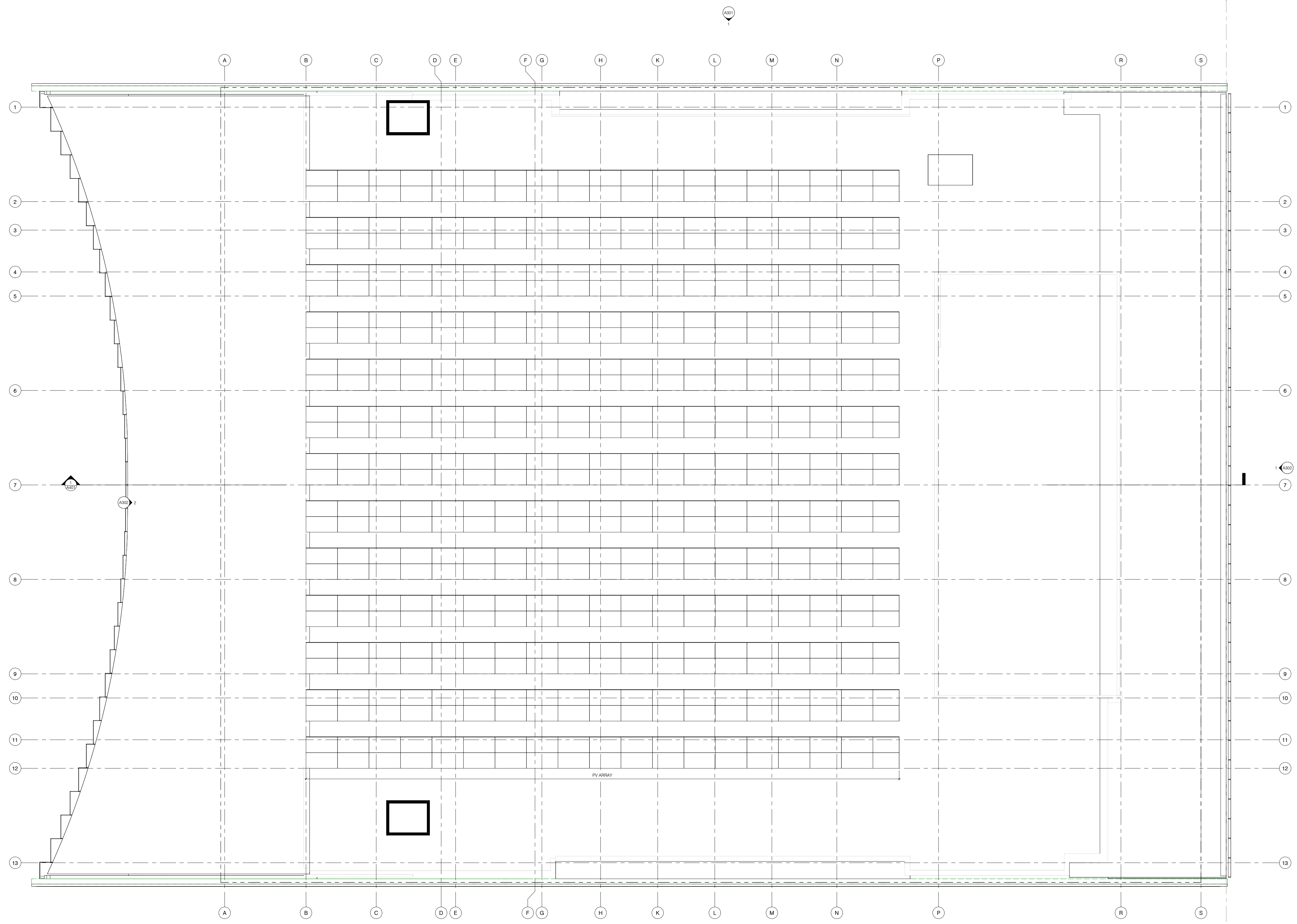
THE FOLLOWING SYMBOLS ARE SHOWN ONLY WHERE LAYOUT IS CRITICAL FOR AESTHETICS. THE ACTUAL DESIGN MAY CALL FOR MORE THAN WHAT IS SHOWN. NOT ALL SYMBOLS MAY BE USED.

DS	DOWNSPOUT
RD OD	ROOF DRAIN AND OVERFLOW DRAIN
SLOPE	ROOF SLOPE (1/4" / 12" MIN.)

ROOF PLAN NOTES

1. CONFIRM LOCATION OF ALL PENETRATIONS BEFORE BEGINNING WORK.
2. MAINTAIN 12 INCHES CLEAR BETWEEN ALL ROOF ITEMS TO ALLOW SUFFICIENT ROOM FOR PROPER PENETRATION INSTALLATION.
3. NOT EVERY PARAPET WALL COPING, CURB AND FLASHING CONDITION IS ILLUSTRATED OR DETAILED. ROOFING BLOCKING, FLASHING, REGLETS, COPING ETC. SHALL BE INSTALLED FOR A FULLY WATERPROOF ASSEMBLY IN ACCORDANCE WITH THE ROOFING MANUFACTURERS' RECOMMENDATIONS AND THE DESIGN AND REFERENCE STANDARDS OF SMACNA'S ARCHITECTURAL SHEET METAL MANUAL CURRENT EDITION.
4. REFER TO DOCUMENTS OF OTHER TRADES FOR AS NOTED BUT NOT LIMITED TO ADDITIONAL CURBS, HOUSEKEEPING PADS, EQUIPMENT PADS, ROOF DRAINS, CUT-OUTS, BOX-OUTS, BLOCK-OUTS, SLAB OPENINGS, PENETRATIONS NOT SHOWN ON ARCHITECTURAL PLANS. REFER TO ALL DOCUMENTS FOR COORDINATION AND EXTENT OF ADDITIONAL WORK.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 ROOF PLAN
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
ROOF PLAN

A57

PRICING SET
A208

Copyright 2022 Hennebery Eddy Architects, Inc.

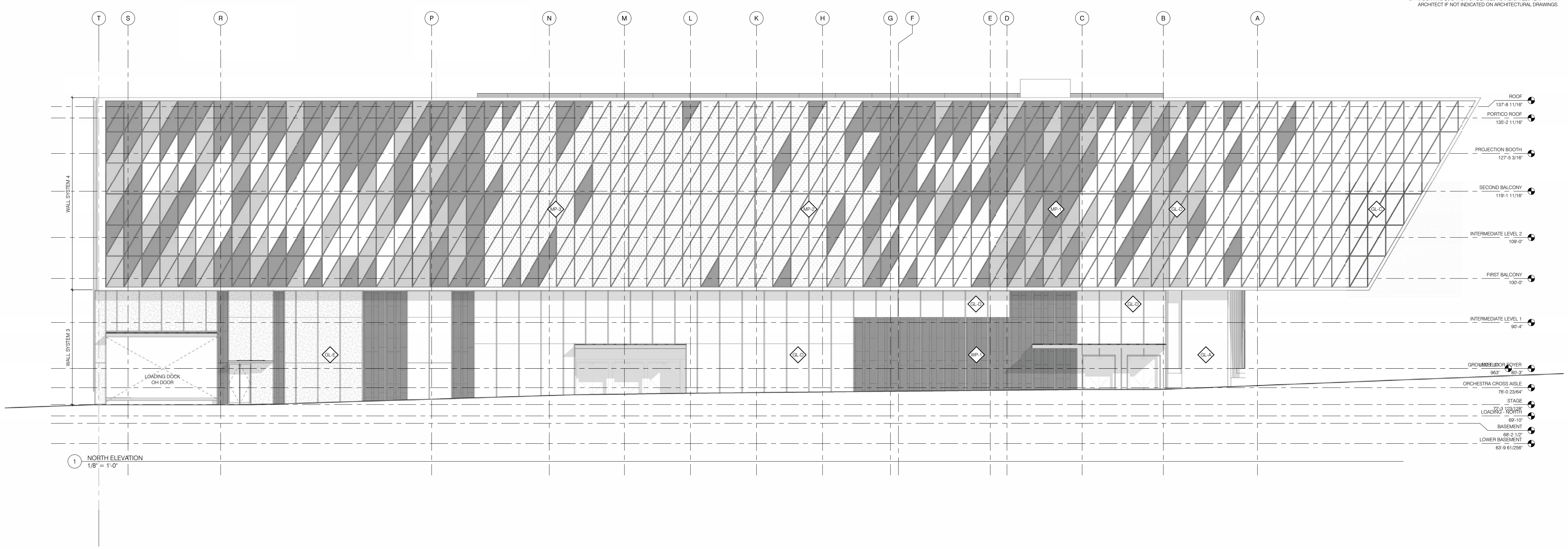
Autodesk Docs://22_083P - Marking Keller/22083 - Marking Keller.rvt
6/30/2023 12:39:19 PM
THE ADJACENT SAMPLES SHOW THREE LEVELS OF SHADING.
SETTINGS FOR VIEWING AND PRINTING CONTENT ARE OPTIMIZED WHEN ALL THREE DOTS ARE VISIBLE.
THIS GUIDANCE IS FOR REFERENCE ONLY.
BLACK DARK GRAY LIGHT GRAY

(page intentionally left blank)

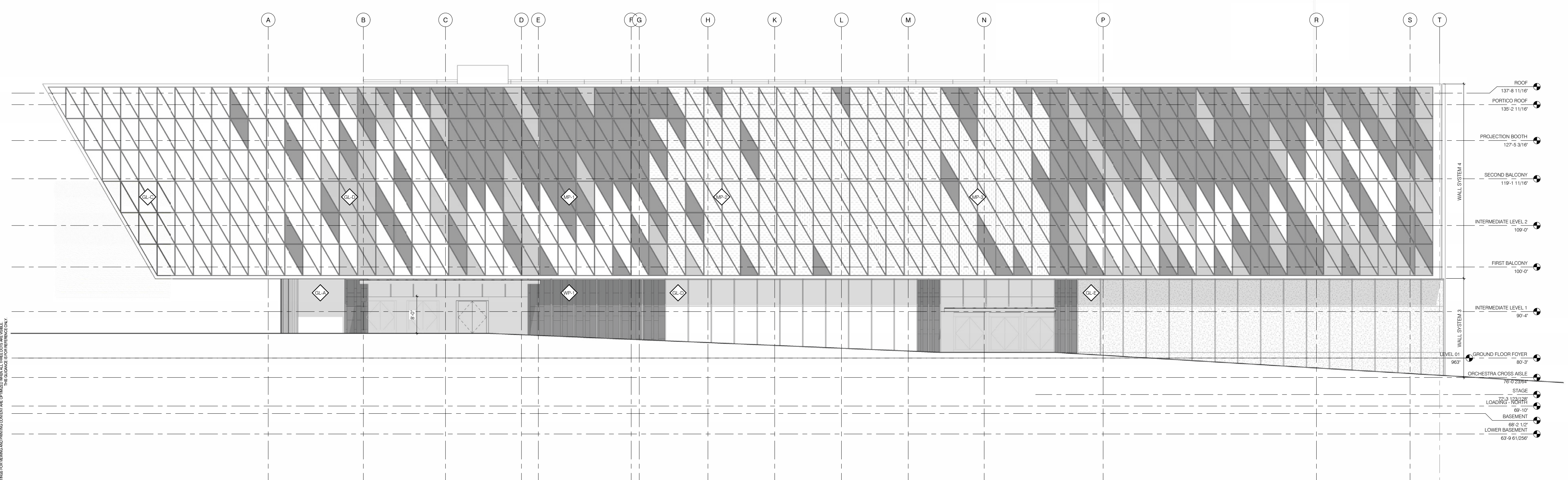
EXTERIOR ELEVATION NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. GRADE LINES INDICATED ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR GRADING INFORMATION.
3. LINE OF FOUNDATIONS (SHOWN DASHED) ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. REFER TO STRUCTURAL DRAWINGS FOR FOOTING ELEVATIONS.
4. DIMENSIONS ARE SHOWN TO DIMENSION POINT OF REFERENCED DETAIL WHERE APPLICABLE.
5. ALIGN MATERIAL, CONTROL AND EXPANSION JOINTS VERTICALLY AND HORIZONTALLY WITH ADJACENT JOINTS AND DOOR, WINDOW AND LOUVER HEADS/JAMBS/SILLS AS INDICATED ON THE DRAWINGS. VERIFY DIMENSIONS WITH DETAIL CONDITIONS. VERIFY LOCATION AND ALIGNMENT WITH ARCHITECT.
6. MOUNTING LOCATION OF DEVICES AS INDICATED, VERIFY WITH ARCHITECT IF NOT INDICATED ON ARCHITECTURAL DRAWINGS.

LEAVE BLANK FOR CITY APPROVAL STAMP



1 NORTH ELEVATION
1/8" = 1'-0"



2 SOUTH ELEVATION
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET

Revisions:

Drawn by: Author
Checked by: Checker
Sheet:

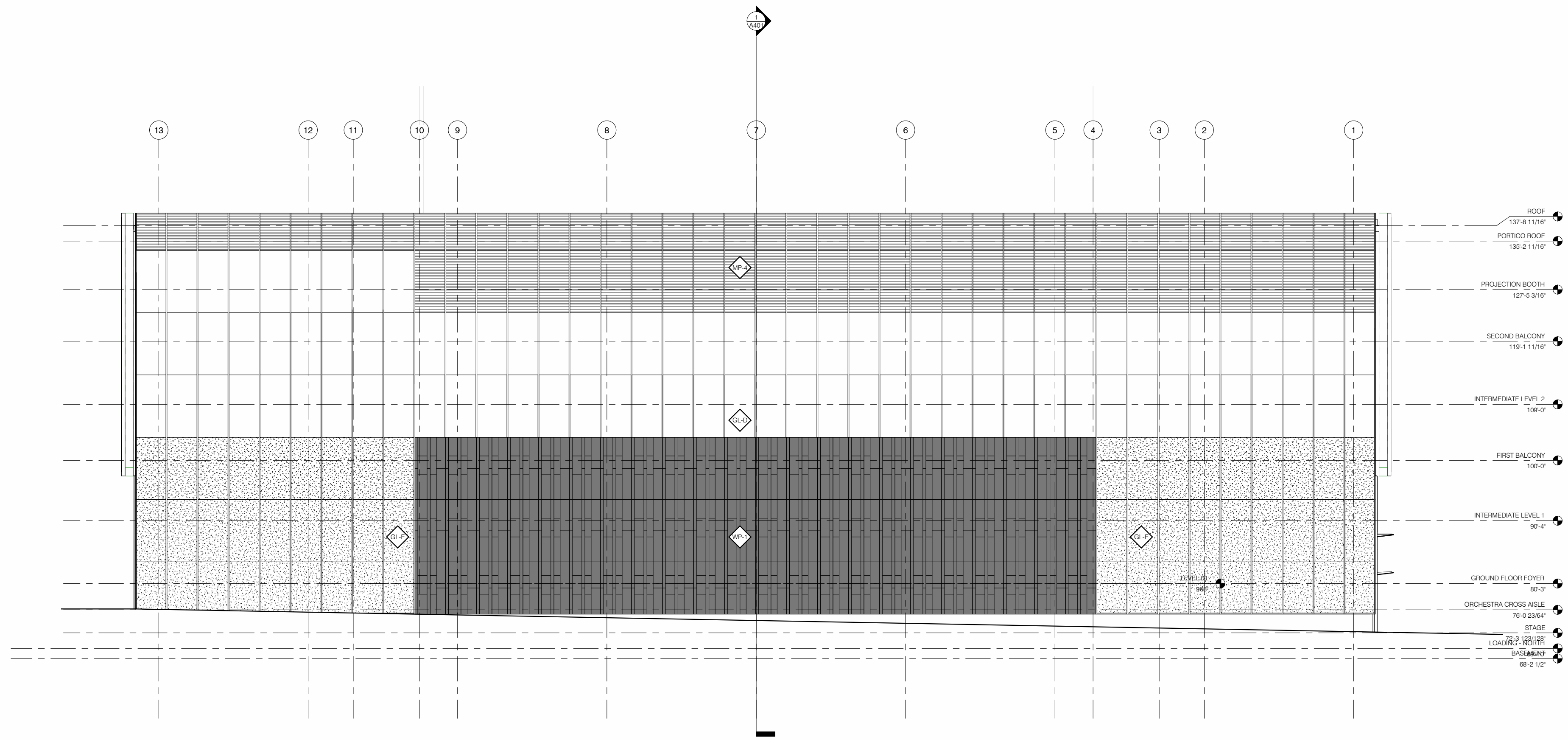
EXTERIOR ELEVATIONS

PRICING SET

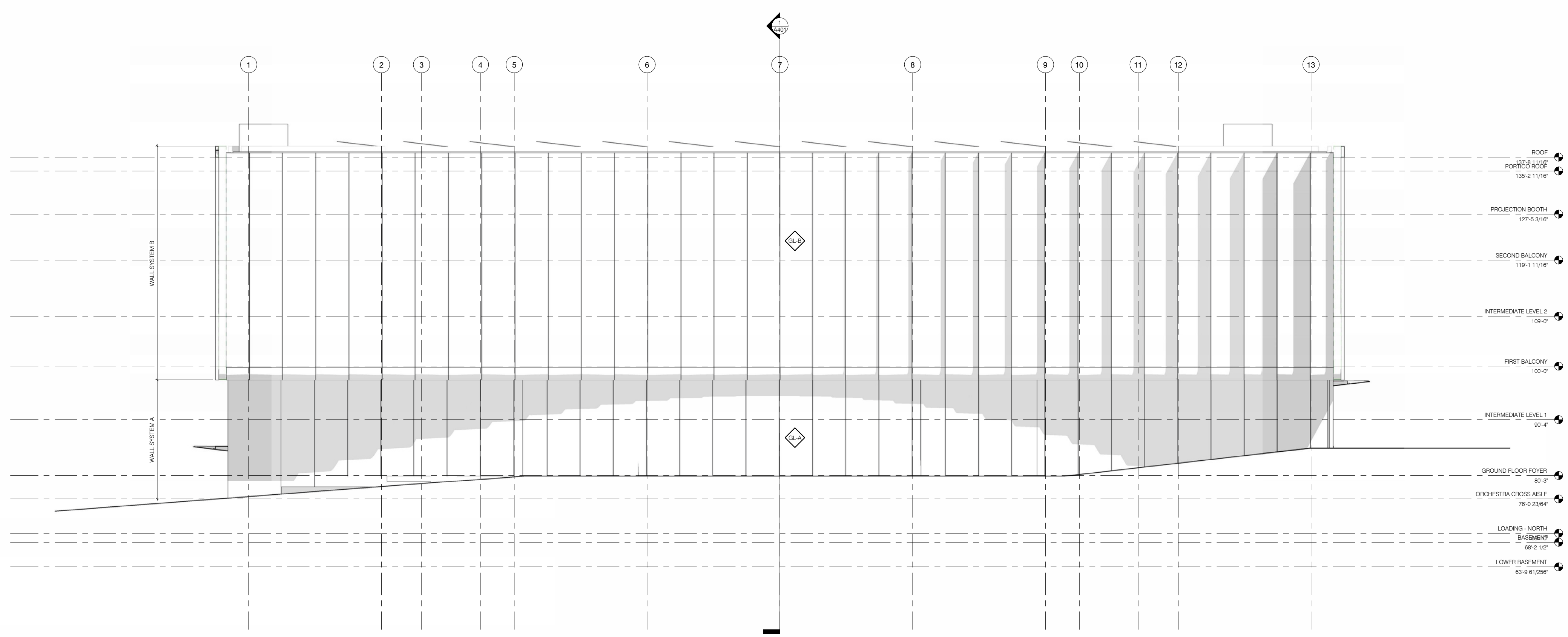
A301

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)



1 EAST ELEVATION
1/8" = 1'-0"



2 WEST ELEVATION
1/8" = 1'-0"

EXTERIOR ELEVATION NOTES

1. SEE SHEET AG00 FOR GENERAL NOTES.
2. GRADE LINES INDICATED ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR GRADING INFORMATION.
3. LINE OF FOUNDATIONS (SHOWN DASHED) ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. REFER TO STRUCTURAL DRAWINGS FOR FOOTING ELEVATIONS.
4. DIMENSIONS ARE SHOWN TO DIMENSION POINT OF REFERENCED DETAIL WHERE APPLICABLE.
5. ALIGN MATERIAL, CONTROL AND EXPANSION JOINTS VERTICALLY AND HORIZONTALLY WITH ADJACENT JOINTS AND DOOR, WINDOW AND LOUVER HEADS/JAMBS/SILLS AS INDICATED ON THE DRAWINGS. VERIFY DIMENSIONS WITH DETAIL CONDITIONS. VERIFY LOCATION AND ALIGNMENT WITH ARCHITECT.
6. MOUNTING LOCATION OF DEVICES AS INDICATED, VERIFY WITH ARCHITECT IF NOT INDICATED ON ARCHITECTURAL DRAWINGS.

LEAVE BLANK FOR CITY APPROVAL STAMP

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B
FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
EXTERIOR ELEVATIONS

A61

PRICING SET

A302

Copyright 2022 Hennebery Eddy Architects, Inc.

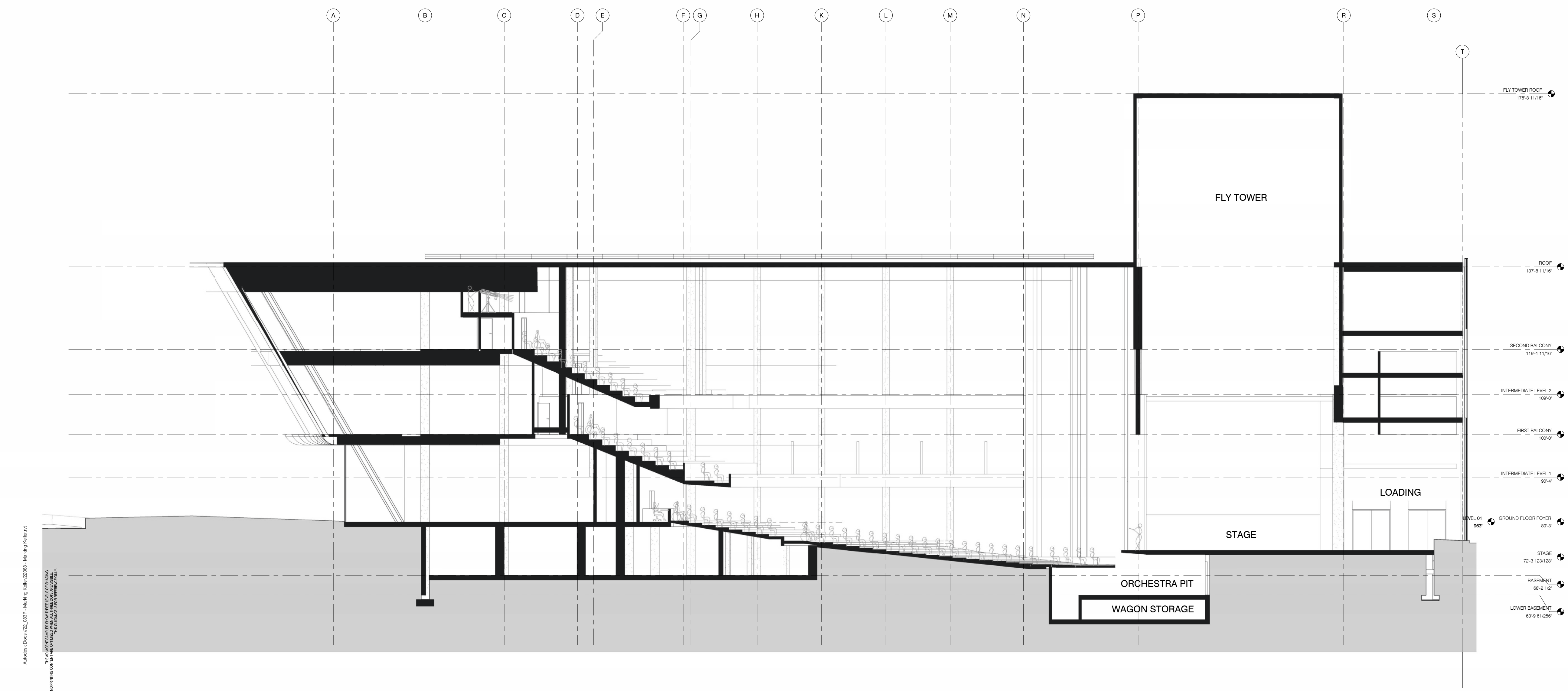
(page intentionally left blank)

BUILDING SECTION NOTES

1. BUILDNG SECTIONS ARE DIAGRAMMATIC. REFER TO DETAILS WHERE INDICATED FOR CONSTRUCTION INFORMATION.
2. LEVELS X THRU X ARE BASED ON ORIGINAL CONSTRUCTION DRAWINGS DATED 19XX. LEVELS HAVE BEEN PLACED AT ASSUMED T.O. FLOOR SLABS OR AS NOTED. CONTRACTOR TO FIELD VERIFY PRIOR TO START OF CONSTRUCTION AND NOTIFY ARCHITECT OF ANY DISCREPANCIES.

NOTE #2 IS FOR EXISTING BUILDING/RENOVATION PROJECTS ONLY. EDIT FOR PROJECT

LEAVE BLANK FOR CITY APPROVAL STAMP



1 SECTION D-D
1/8" = 1'-0"

CONSULTANT LOGO HERE

PRELIMINARY, NOT FOR CONSTRUCTION

Hennebery Eddy Architects

HENNEBERY EDDY ARCHITECTS, INC.

PORTLAND OFFICE
921 SW WASHINGTON ST, SUITE 250
PORTLAND OREGON 97205
503 227 4860 TEL
503 227 4920 FAX

BEND OFFICE
1465 SW KNOLL AVE, SUITE 210
BEND OREGON 97702
541 313 6779 TEL

BOZEMAN OFFICE
109 NORTH ROUSE AVE, SUITE 1
BOZEMAN MONTANA 59715
406 585 1112 TEL

www.henneberyeddy.com

MARKING KELLER

MARKING KELLER - 2B FEASIBILITY STUDY
Enter address here

HEA Project no. 22083
Date: Issue Date
PRICING SET
Revisions:

Drawn by: Author
Checked by: Checker
Sheet:
BUILDING SECTIONS

A63

PRICING SET

A401

Copyright 2022 Hennebery Eddy Architects, Inc.

(page intentionally left blank)

Structural Report

Keller Auditorium

Structural Evaluation

August 11, 2023

Grummel Job No. 223051

Prepared By:

Jesse Wolfe, P.E.
Grummel Engineering
920 SW 3rd, Suite 200
Portland. OR 97204
(503) 244-7014

Submitted To:

Hennebery Eddy
Halprin Landscape Conservancy

Keller Auditorium

Table of Contents

Introduction:

The following is a structural review of Keller Auditorium in Portland, Oregon. The purpose of this study is to provide a structural evaluation of the building and identify any structural deficiencies of the vertical and lateral system. Evaluation of the lateral system has been performed using ASCE41-17 Tier 1 screening protocol for existing buildings. Evaluation of the vertical system has been performed using IBC/OSSC forces for new construction.

The current occupancy of the building is a Type A occupancy with approximately 3,000 occupants. This corresponds to a risk category III building. Proposed modifications to the existing building include an expansion to the east and west side of the building. At the interior there will be extensive modifications for seating and access including new stairs, ramps, and elevators. The City of Portland's Title 24.85 identifies several triggers that require a seismic evaluation and upgrade. Although the new expansion will be under 1/3 of the existing area, the cost trigger will certainly be met. This would require an ASCE 41 BPOE improvement standard (Basic Performance Objective for Existing Buildings). Given the cost of public investment and potential for loss of life, the design team has selected BPON with a risk category III as the improvement standard (Basic Performance objective for new Buildings). Design level forces would be equivalent to those used for construction of a new building. This is defined as damage control and position retention. In the event of an earthquake, Non-structural components might be damaged to the extent that they cannot immediately function but are secured in place. Access to life safety systems would remain available. The building would be repairable.

Existing Building Structural Description:

The existing building has an approximate 200 ft x 200 ft footprint. Primary levels include a partial basement, main entry level, 1st balcony, and second balcony. The balcony levels are 19 feet in height. Partial, intermediate levels exist along the north and south corridors. The existing grade slopes roughly 8 feet with a high point at the southwest corner and low point at the northeast corner. The main roof height is 63 feet above average grade. A 48 foot x 110 foot fly tower extends to 95 feet above average grade.

Construction was performed in two phases. The original theatre construction took place in 1916. Building materials included unreinforced brick masonry, concrete, and steel. The concrete was reinforced with embedded steel sections. The roof consists of 4" reinforced concrete over large spanning steel trusses. The trusses are currently encased in fireproofing. In 1966, an extensive remodel took place. During this period much of the original floor framing, at all levels, was replaced with reinforced concrete. The 1966 addition saw the construction of reinforced concrete corridor and stair walls. These walls were strategically placed to resist lateral forces with walls oriented in orthogonal directions. Designed was based on Seismic Zone 2 of the UBC. Existing footings were underpinned and new foundations were installed under concrete shear walls. Of the original 1916 construction, remaining structure includes the main roof, the fly tower and its walls, and approximately 150 linear feet of masonry walls along the north and south elevation. The 1966 structured slabs were dowelled and embedded into the remaining masonry walls.

The existing cladding consists of six-inch-thick concrete panels along the north, south, and east elevation that was part of the 1966 remodel. The existing west elevation consists of a storefront system covered by a precast roof overhang. The precast components will be replaced in the proposed design.

In 2016 a re-roof was performed. Per the requirements of Title 24.85, seismic upgrades were made to the roof. This involved the attachment of the roof to the existing walls for both in plane and out plane forces. A continuous angle was installed along the walls for attachment purposes but also as a chord element. Parapet bracing was installed at URM parapets.

Geotechnical Description:

A BPON upgrade requires the evaluation of existing soils for liquefaction. On April 26, 2023, Columbia West geotechnical performed a boring at the northeast corner of the building. Soils susceptible to liquefaction and lateral spreading were not encountered. This is consistent with investigations in the vicinity of the Keller site. Stiff soils were encountered. Favorable bearing values were provided for evaluation of new and existing footings. The west addition will be supported by several columns with highly concentrated loads. To minimize earthwork in this area, Columbia West has provided recommendations for deep pile foundations. Our conceptual plans have 12 pile locations.

List of Parameters:

Performance Level Paths: BSE-2N (Limited Safety) & BSE-1N (damage control)
Building Occupancy: Assembly
Level of Seismicity: "High" defined by Section 2.5
Soil Type: Site Class C
Testing: GPR testing, brick shear testing, and geotechnical borings performed
Original Documents: 1916 and 1966 drawings available
$S_{xs,BSE\text{-}2N} = 1.016g$
$S_{1,BSE2N} = 0.396g$
LL = 100 psf

Gravity System and Recommendations:

New gravity loads will be supported by structures meeting the IBC/OSSC requirements for new construction. The following is a list and brief description of new gravity supported elements:

1) Main floor seating: The proposed access plan and new stage loading requires the main level seating to be raised from 0 to 18 inches. An evaluation of the existing structured slab determined that this may be achieved with over framing using a lightweight topping slab over light gage framing. This framing can also double as a plenum for air below the seating.
2) West addition: The west addition will add roughly 12,800 square feet of new floor space at the 1st and 2nd balcony. The new roof will extend 70 feet beyond Grid B at its furthest point. The addition will be supported by existing columns along Grid B, three new canted columns at the west and a deep truss at the north and south

elevation. Construction will consist of steel framing with composite steel decking and concrete topping slabs. The west elevation will have a glass, ventricular façade. A feature stair will run through the center of the addition. The Grid B columns will be upgraded with Carbon fiber wrap. Foundations below the three canted columns and trusses will consist of deep piers. The use of piers will minimize earthworks and impact to existing structure.

3) <u>East Addition</u>: The east addition will bump out 5 feet from its current location into the existing sidewalk. This accommodates two trucks in the loading dock. There will be a new concrete wall supported by a continuous footing running the length of the East elevation (200 feet). The concrete wall terminates at the first balcony level with columns above it. The ground floor will consist of a slab on grade construction with a new loading dock. The addition will be 26 to 30 feet in width. There will be four structured floor levels (the two intermediate levels and the two balcony levels). The framing will consist of steel beams with composite steel decking and concrete topping. There will also be new transfer beams to support the existing floor where exterior walls are to be removed. At the existing wall line, the backside of the stage, new steel posts will support new framing. These posts will also reinforce the wall for out of plane seismic loads.
4) <u>Roof Framing & Solar at Existing Roofs</u>: The roof is from the original 1916 construction. Embedded steel I-beams were cast into a 4” slab at 6’-8” on center. The 10” and 12” deep I-beams were evaluated for additional solar loads. They had adequate capacity. We recommend spacing solar attachments to align with the I-beams since the concrete is unreinforced. The roof trusses which are spaced at 16 to 18 feet on center were not evaluated. Their cross sections are covered with fireproofing which prevents evaluation. However, if the ceiling is removed and replaced with a lighter system, the net weight, including solar, would be negative.
5) <u>New Cladding at North and South Elevation</u>: Steel columns with light gage framing are proposed for support of new cladding. The steel will also support out of plane seismic loads for the existing masonry walls.

<u>Lateral Deficiencies and Recommendations for an ASCE41-17 BPON Upgrade:</u>

A Tier 1 screening and Tier 2 evaluation was performed using a linear static procedure (LSP). For forces in the east to west direction, the lateral system is robust, with long full height walls symmetrically oriented along the north and south. The diaphragm has continuity in this direction. Forces in the north and south direction generate torsion on the diaphragm due to the offset between the center of mass and the center of rigidity. High stresses were found on the westernmost walls.

The following is a list of seismic deficiencies with strengthening recommendations. This information can also be found in the conceptual design plan.

1) <u>In Plane Shear Forces</u>
    a. <u>URM walls along north and south:</u> The maximum expected shear stress in the brick masonry along the north and south walls was calculated at 62 psi. The masonry tests performed in this study found capacities exceeding the demand. However, masonry has very little ductility. As the masonry

deforms inelastically, forces would re-distribute to stiffer elements within the building during an earthquake. This could lead to deformations in other elements. To increase ductility and reduce post-earthquake repair we recommend strengthening the walls with fiber reinforced cementitious matrix (FRCM). The FRCM can be applied to the outside face of the existing masonry.

   b. Concrete walls at gridline B: A large contribution of the forces in the north to south direction are resisted by the two western stairwell walls. These walls were constructed in 1966. The existing walls are 30 feet in length with three mats of reinforcement and run the full height of the building. The proposed west addition along with its torsional component will increase the lateral demand on these walls slightly beyond their current capacity. We recommend shotcreting the face of these walls to increase their capacity.
   c. URM wall at the R lower level: The East wall of the stage largely goes away at the lowest level where it is supported by piers. This creates a weak story. To the north and south of the stage are URM walls. Removal of the north wall is proposed for access. Therefor we propose shotcreting the remaining gridline R wall to the south of the stage.

2) Out of plane wall forces
   a. URM walls along north and south: There is a combined 350 linear feet of masonry wall requiring strengthening for out of plan seismic forces. We recommend steel strongbacks be placed along the outside of the wall at 8 feet on center. It is possible to attach the strongbacks to the existing wall anchors. The steel may double as vertical support for new cladding.
   b. Unreinforced concrete walls at stage and fly tower: Similar to the brick walls at the north and south, strengthening is required for out of plane wall forces. We recommend steel strongbacks. Along the east these can support new vertical loads for the east addition.
3) Footings below concrete shearwalls at grid F & M. We recommend connecting the existing footings with new concrete grade beams to help resist overturning forces and reduce stresses on the subgrade.
4) Diaphragm continuity at 2nd Balcony Level: At the southeast end of the building there is a large opening creating a diaphragm diconinuity. We recommend infilling this with a concrete deck system as part of the east addition.
5) Drag and Chord Connections. Around the stair an elevator openings we recommend plates or FRP straps to develop diaphragm chord forces. Drag straps are also proposed in other locations to transfer forces into lateral force resisting elements.

Previous Seismic Studies and Comparison of Results

In 2017, the City of Portland retained the services of Miller Engineering for a seismic evaluation of the Keller Auditorium in its current state per the ASCE 41-13 standard. The final report was titled option 1B. The building was analyzed using a finite element program called STAAD.pro. The basic performance objective was a BPOE upgrade. The associated force levels were a BSE-2E(limited safety) and a BSE-1E(damage control). The analysis procedure selected was a linear dynamic analysis, LDP. Adjustments were made to the analysis model, including the removal of structural and non-structural elements in order to achieve a 90 percent mass participation. Roughly 750 modes were required. A schematic plan was submitted. The following upgrades were recommended in the 2017 report:

Recommendations in 2017 Report	Recommendations in this Report
Removal of Exterior concrete panels	Concrete cladding to be replaced with new lightweight cladding
Remove exterior URM walls and replace with 8” concrete walls	Upgrade existing URM with steel strongbacks for out of plane strengthening.
Demo all brick dividing walls in dressing tower	Dressing tower to be reconfigured. Existing demising walls to be removed.
Add concrete to walls surrounding stage	Steel strongbacks to be installed. Shotcrete to be added to wall south of stage.
Cut ceiling into 2500 sections with new bracing	Ceiling to be removed for asbestos remediation and replaced with flexible, lightweight system
Add concrete to lower east roof	Strengthen with steel drag straps
Removal and replacement of stairs with slip joints	Existing concrete stairs to remain
460 piles under existing walls	No piles to be added following results of geotechnical study
Thicken and lengthen Grid B walls with additional concrete	Shotcrete Grid B walls

<u>**Non-Linear analysis and further Seismic Evaluation**</u>

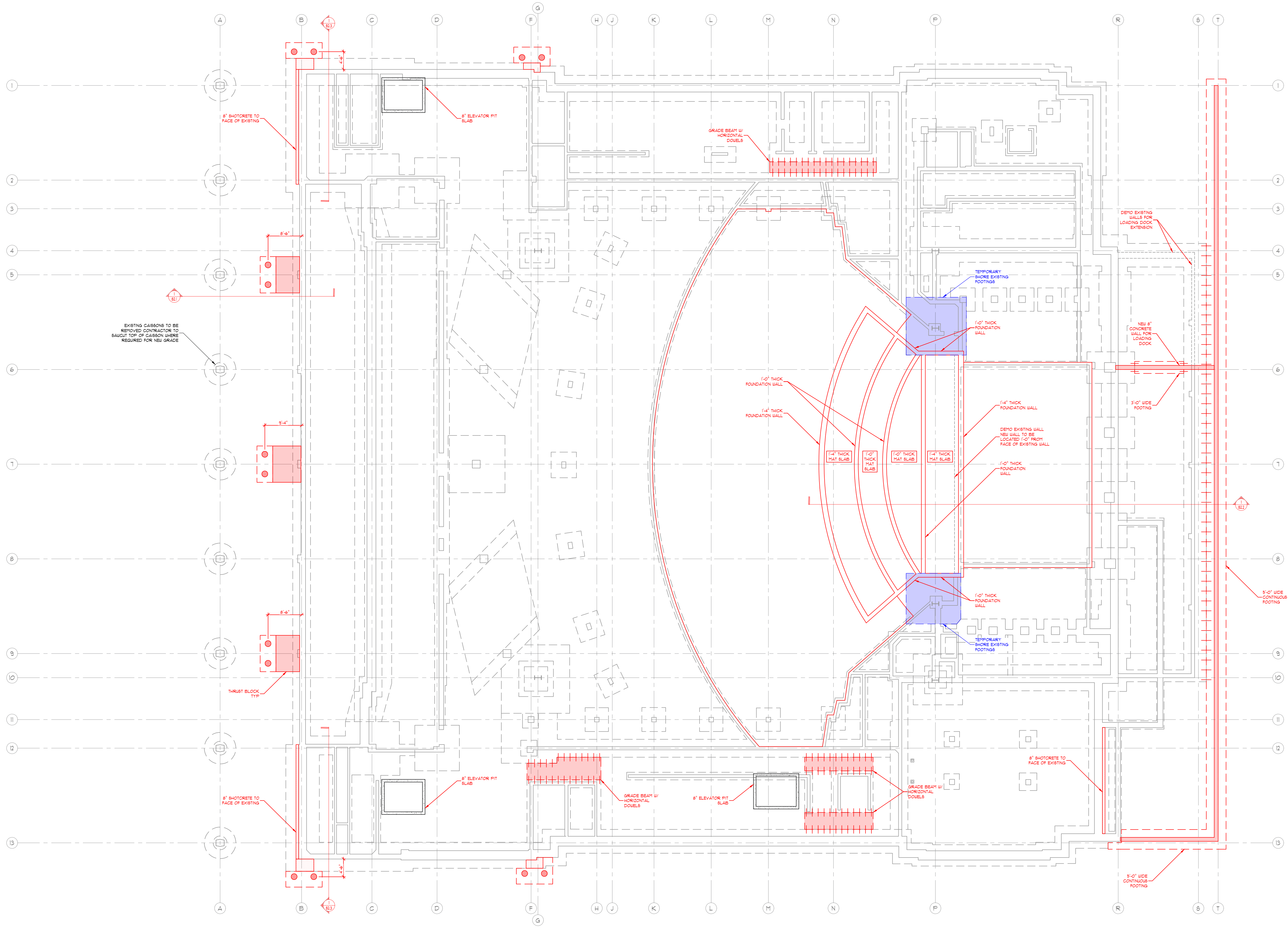
This evaluation was based on a Tier 1/Tier 2 screening and a deficiency based evaluation. Base shears were calculated using linear static procedures, LSP. Forces to lateral elements were distributed based on relative stiffness and torsion. Some data collection was performed.

A BPON seismic upgrade will require a Tier 3 evaluation. The Tier 3 evaluation will involve systematic data collection. More testing will be necessary to meet the minimum requirements. In addition, we anticipate that a non-linear analysis will be performed. A non-linear analysis is likely required due to torsional irregularities and some discontinuous wall elements. A non-linear analysis computes the structural response beyond the elastic range including strength and stiffness changes associated with large displacements. The goal of a non-linear analysis is to better understand the behavior of the structure under cyclic seismic loading. This will more accurately distribute loading based on the stiffness within the inelastic range. It will help refine the recommended upgrades.

APPENDIX A

CONCEPT PLAN & DETAILS

(page intentionally left blank)



1 / S1.1 FOUNDATION

SCALE: 1/8" = 1'-0"

PLAN NOTES

INDICATES CONCRETE PILE CAP CONTAINING (2) 18" DIAMETER x46 FOOT DEEP CONCRETE PILES (APPROXIMATELY 500 KIP CAPACITY).

DESIGN WAS BASED ON SOILS REPORT BY COLUMBIA WEST DATED MAY 23, 2023.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

MARKING KELLER

222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051

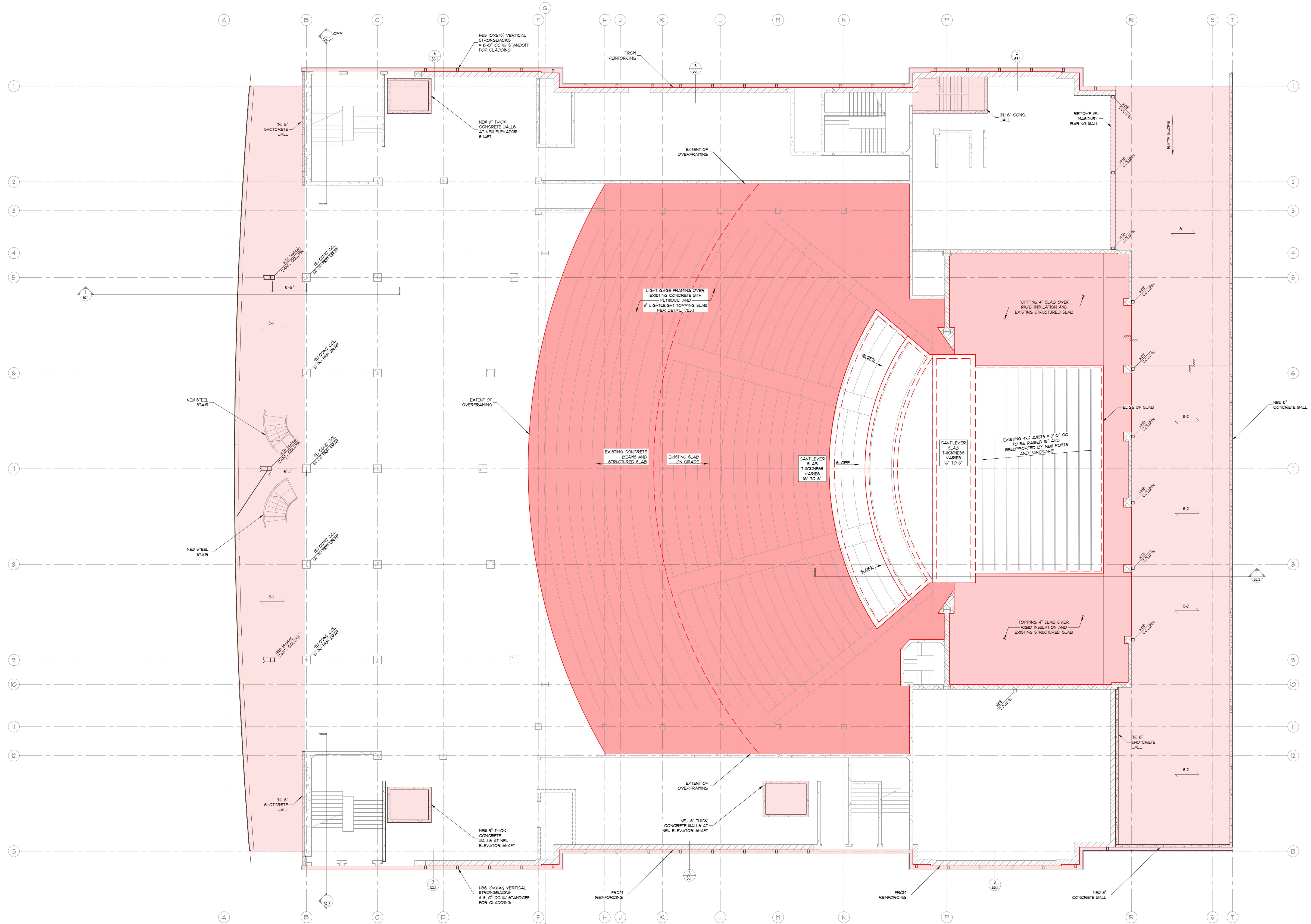
ENGINEER: JJW

DRAWN BY:

FOUNDATION LEVEL

S1.1

(page intentionally left blank)



1 S1.3 ORCHESTRA LEVEL
SCALE: 1/8" = 1'-0"

LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

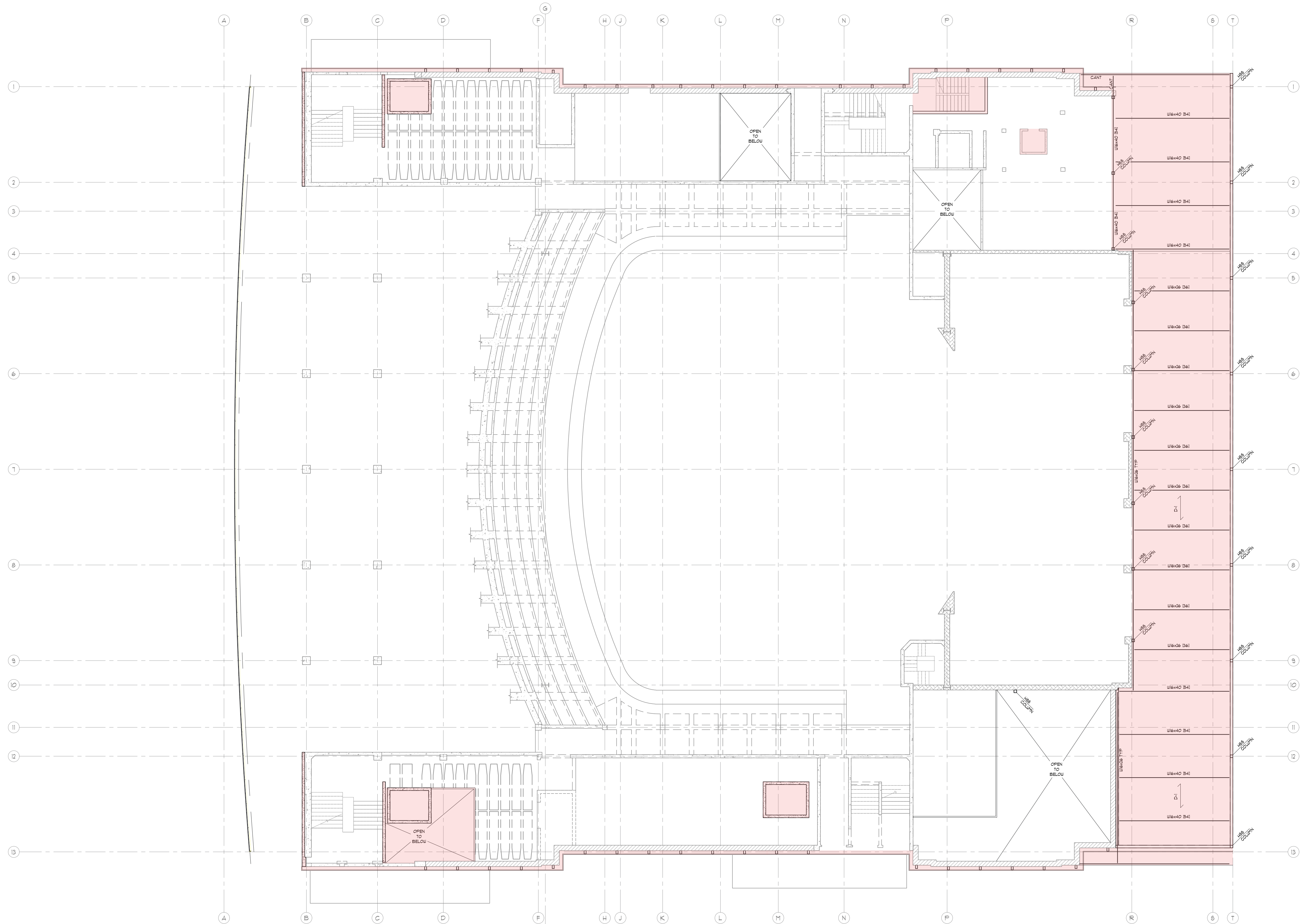
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
ORCHESTRA LEVEL

S1.3

(page intentionally left blank)



1 S1.4 INTEMEDIATE LEVEL NO.1
SCALE: 1/8" = 1'-0"

LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
D-1	INDICATES 3"x18 GAGE COMPOSITE DECK W/ 3" CONCRETE TOPPING (6" TOTAL) AND 6x6-W1.4xW1.4.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

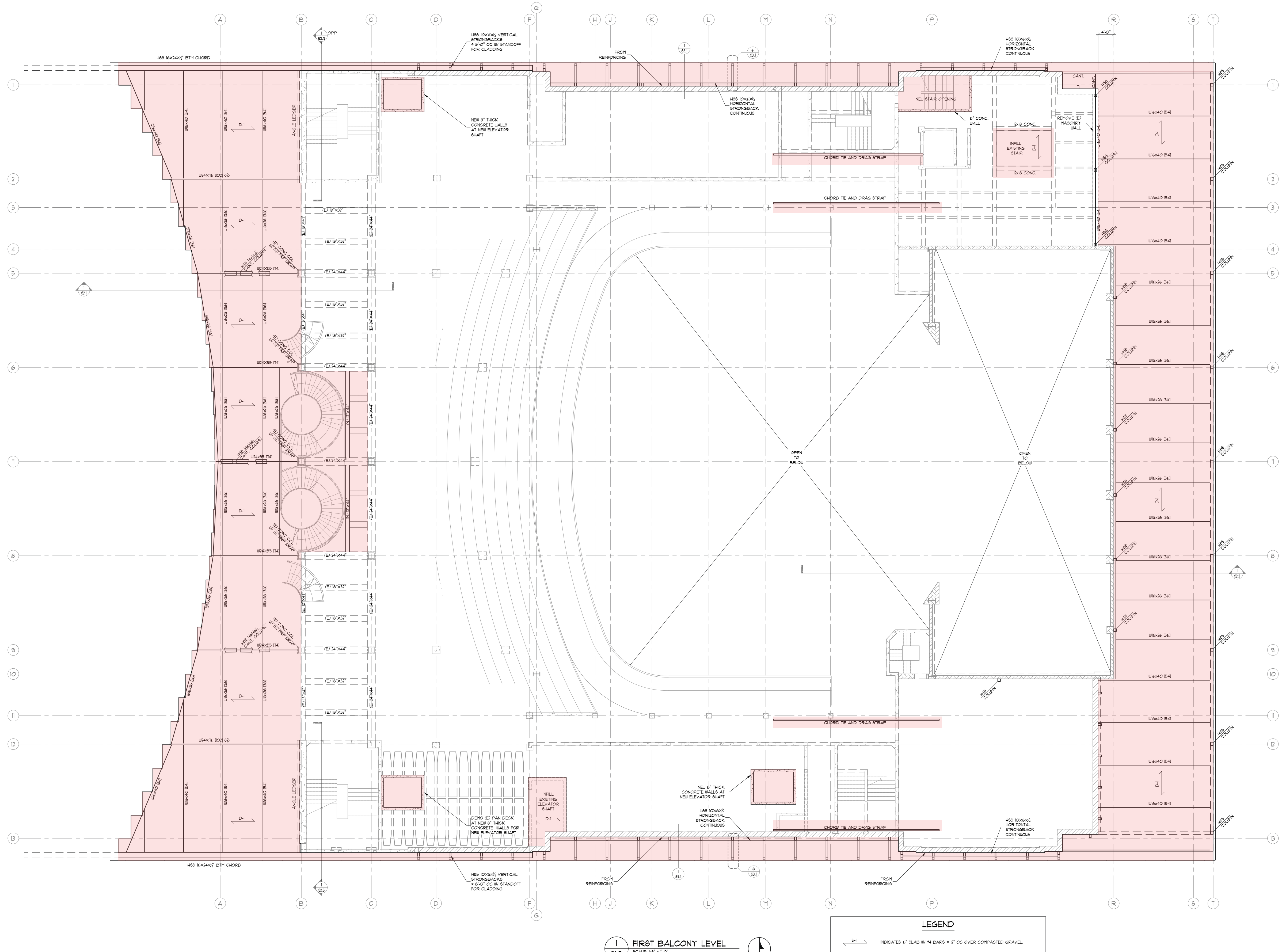
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
INTERMEDIATE NO.1

S1.4

(page intentionally left blank)



LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
D-1	INDICATES 3"x18 GAGE COMPOSITE DECK W/ 3" CONCRETE TOPPING (6" TOTAL) AND 6x6-W1.4xW1.4.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

MARKING KELLER
222 SW Clay St.
Portland, OR 97201

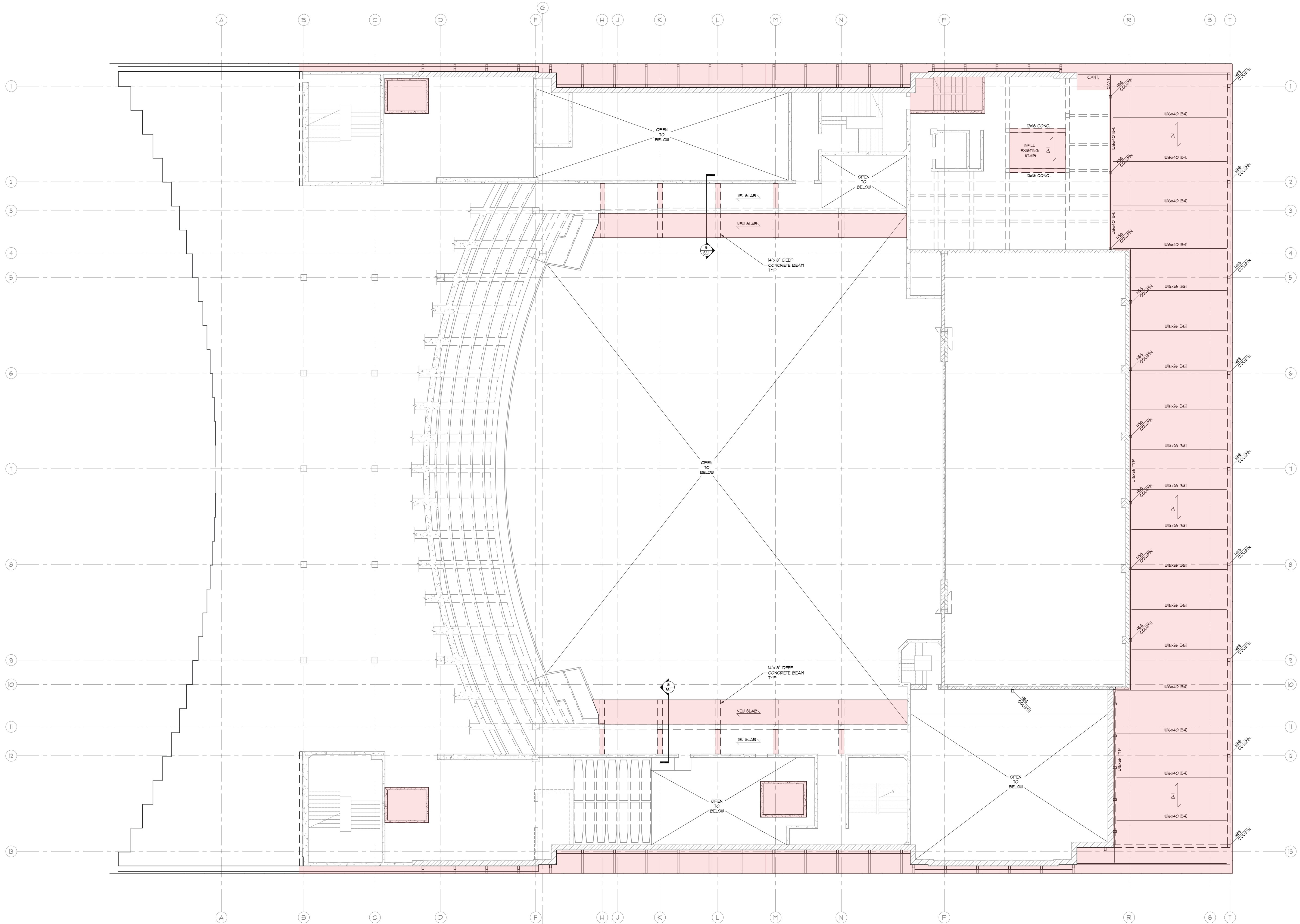
4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
FIRST BALCONY

S1.5

A81

(page intentionally left blank)



1
S1.6
INTERMEDIATE LEVEL NO.2
SCALE: 1/8" = 1'-0"

LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
D-1	INDICATES 3"x18 GAGE COMPOSITE DECK W/ 3" CONCRETE TOPPING (6" TOTAL) AND 6x6-W1.4xW1.4.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

MARKING KELLER
222 SW Clay St.
Portland, OR 97201

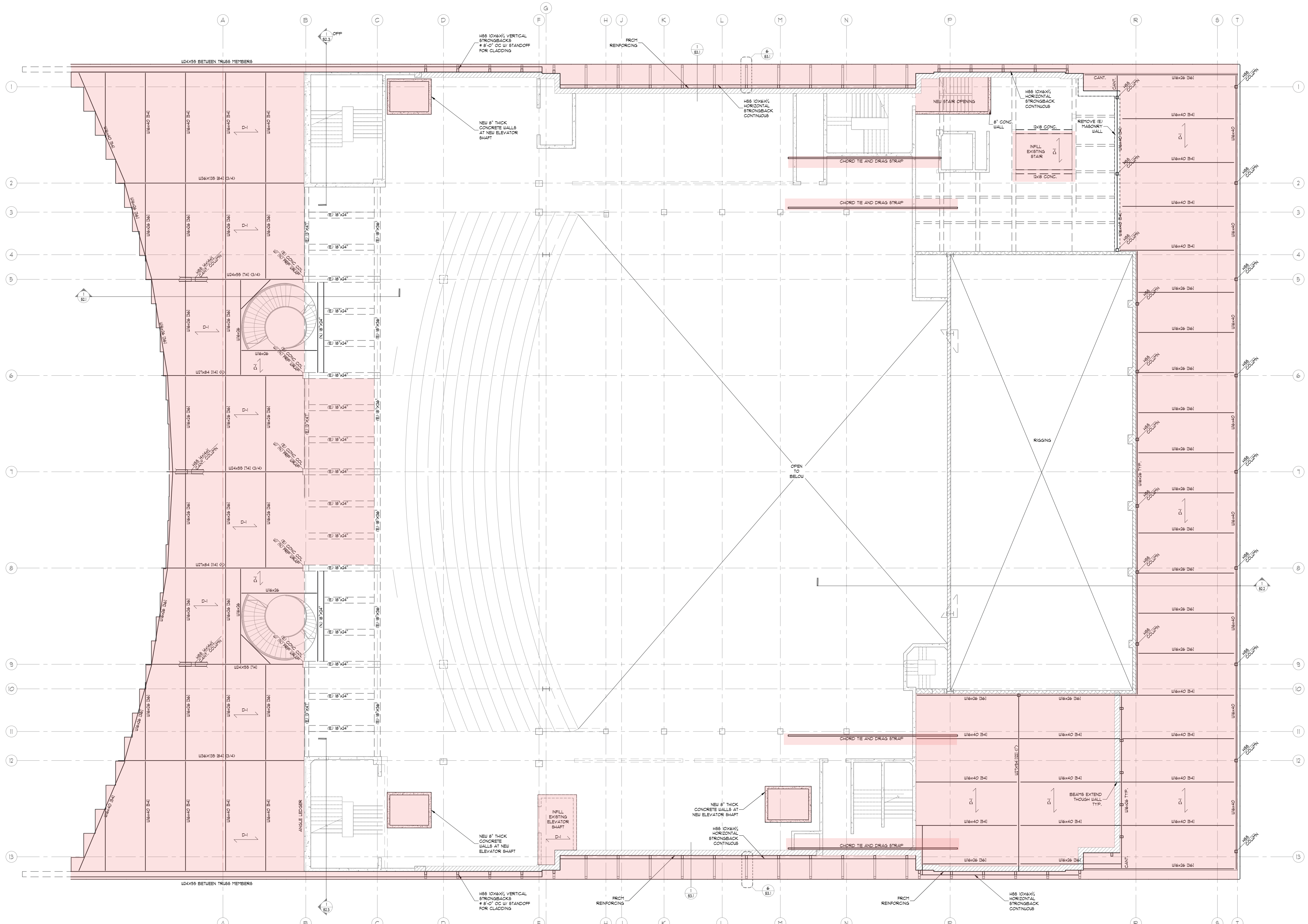
4/21/2023

PROJECT NUMBER:
223051
ENGINEER: JJW
DRAWN BY:
INTERMEDIATE NO.2

S1.6

A83

(page intentionally left blank)



SECOND BALCONY LEVEL

1/S1.7 SCALE: 1/8" = 1'-0"

LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
D-1	INDICATES 3"x18 GAGE COMPOSITE DECK W/ 3" CONCRETE TOPPING (6" TOTAL) AND 6x6-W1.4xW1.4.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

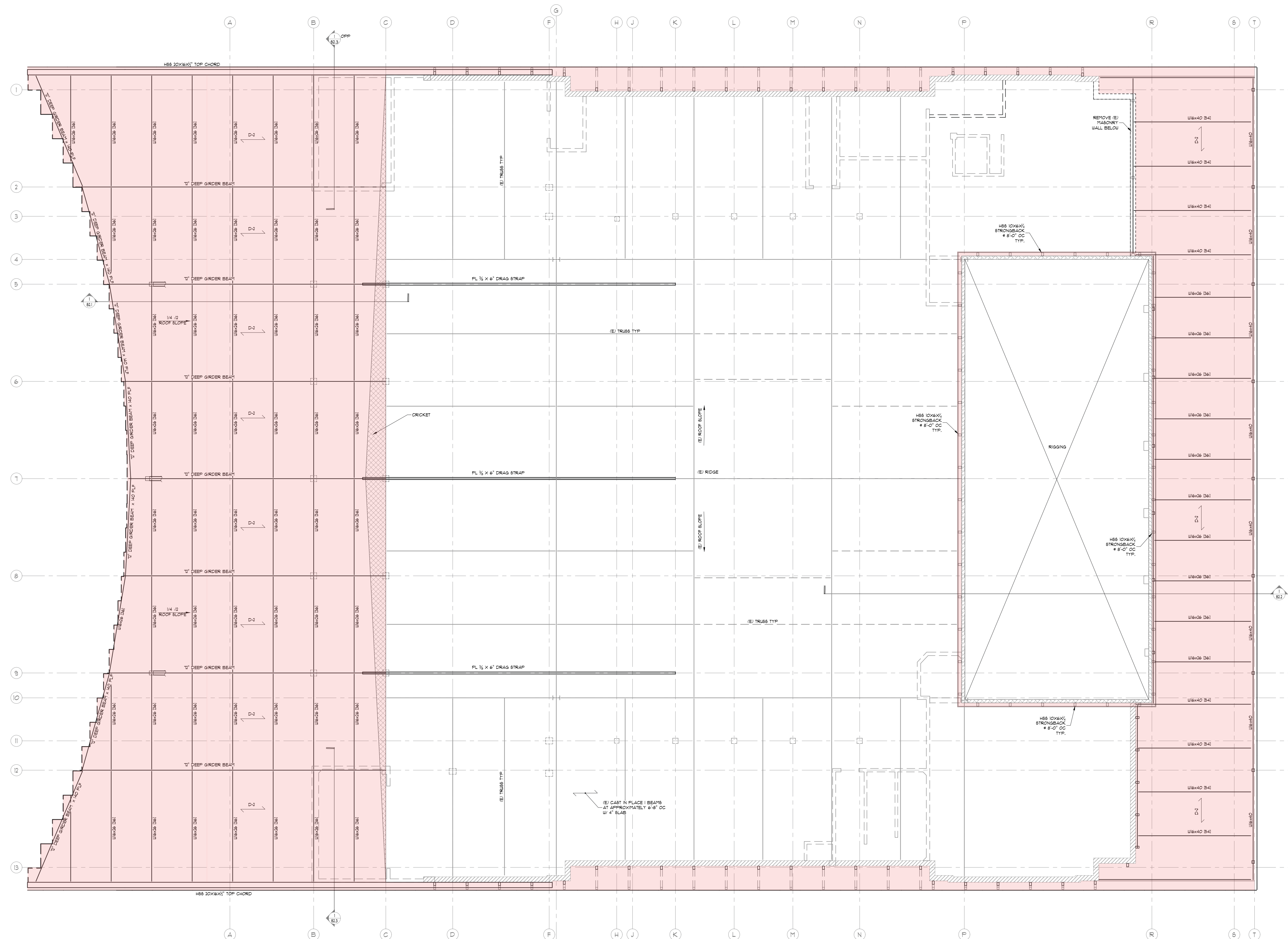
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
SECOND BALCONY

S1.7

(page intentionally left blank)



1
S1.8
ROOF LEVEL
SCALE: 1/8" = 1'-0"

LEGEND

S-1	INDICATES 6" SLAB W/ #4 BARS @ 12" OC OVER COMPACTED GRAVEL.
S-2	INDICATES 4" SLAB W/ #4 BARS @ 18" OC OVER COMPACTED GRAVEL.
D-2	INDICATES 2"x18 GAGE COMPOSITE DECK W/ 2" CONCRETE TOPPING (4" TOTAL) AND 6x6-W1.4xW1.4.
	INDICATES (E) UNREINFORCED BRICK WALLS.
	INDICATES (E) UNREINFORCED CONCRETE WALLS 1916.
	INDICATES REINFORCED CONCRETE WALLS 1966.
	INDICATES NEW REINFORCED CONCRETE WALLS.

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

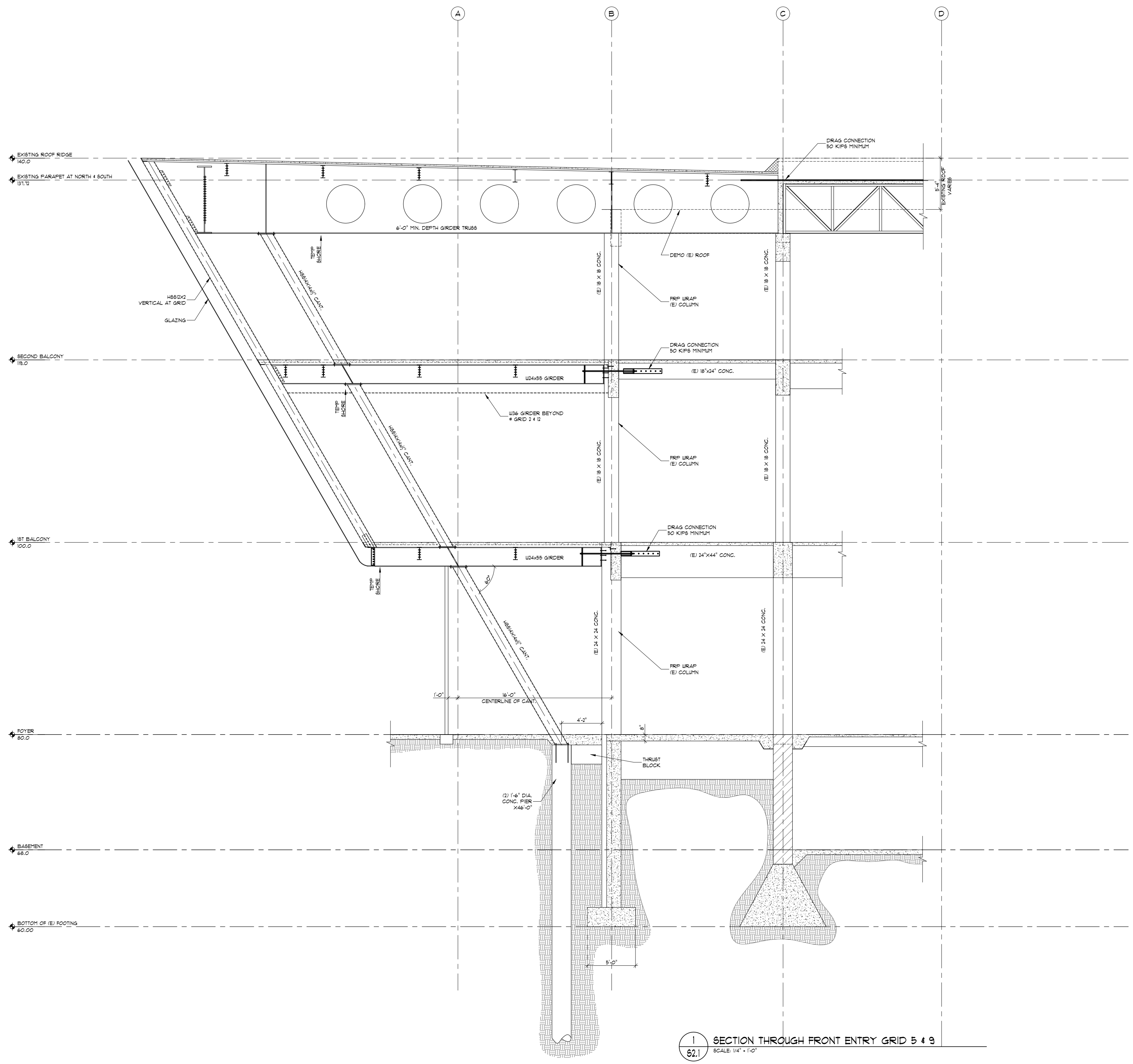
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
ROOF

S1.8

(page intentionally left blank)



1
S2.1
SECTION THROUGH FRONT ENTRY GRID 5 & 9
SCALE: 1/4" = 1'-0"

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

MARKING KELLER
222 SW Clay St.
Portland, OR 97201

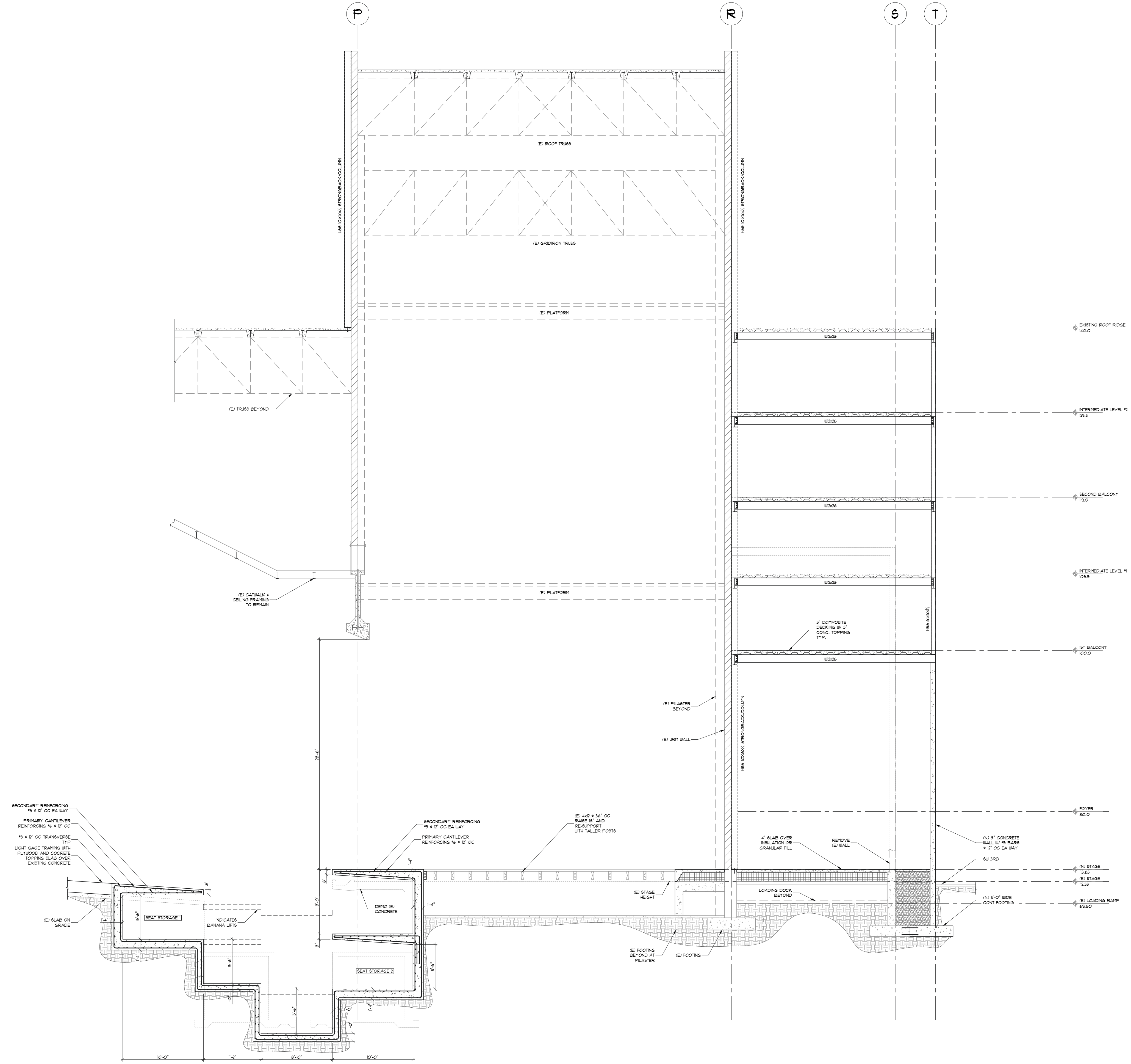
4/21/2023

PROJECT NUMBER:
223051
ENGINEER: JJW
DRAWN BY:
FRONT ENTRY SECTION

S2.1

A89

(page intentionally left blank)



1 / S2.2 SECTION AT ORCHESTRA PIT
SCALE: 1/4" = 1'-0"

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 · (503) 244-7014
www.grummelengineering.com

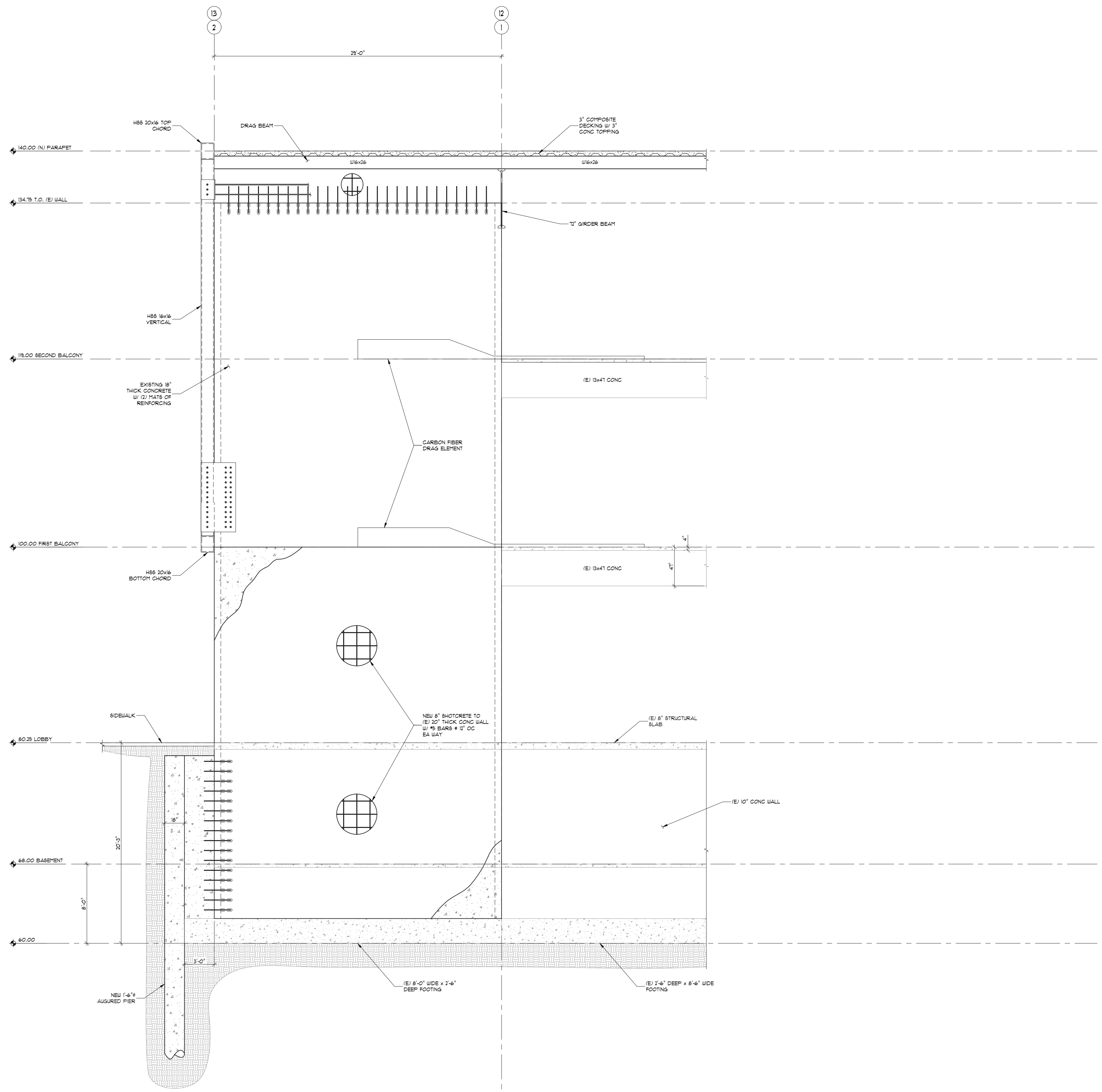
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
PARTIAL SECTIONS

S2.2

(page intentionally left blank)



1
S2.3
GRID "B" WALL
SCALE: 1/4" = 1'-0"

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

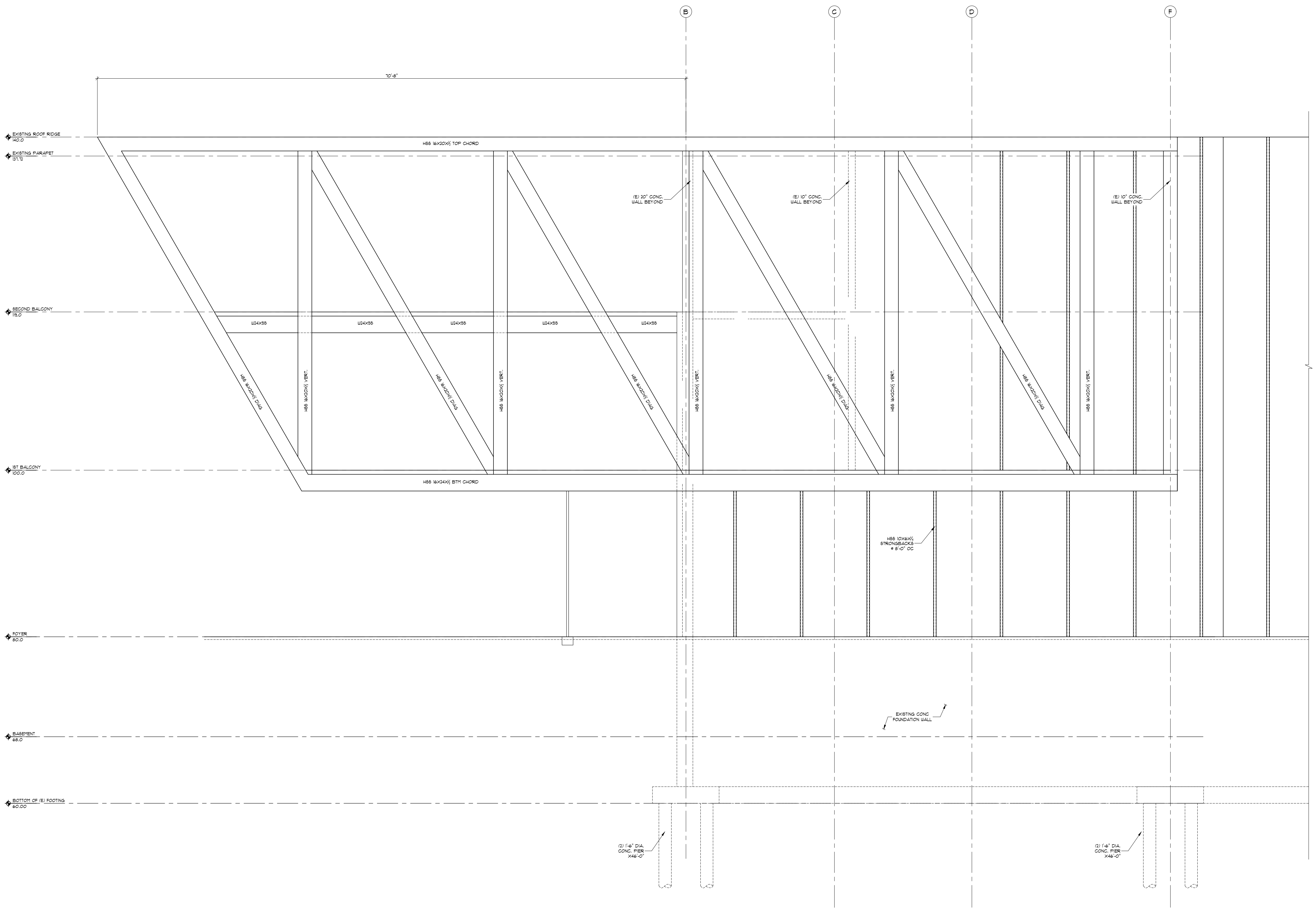
MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
PARTIAL SECTIONS

S2.3

(page intentionally left blank)



1 / S2.4 PARTIAL SOUTH ELEVATION WITH TRUSS
SCALE: 1/4" = 1'-0"

REVIEW SET
NOT FOR
CONSTRUCTION

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 - (503) 244-7014
www.grummelengineering.com

MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

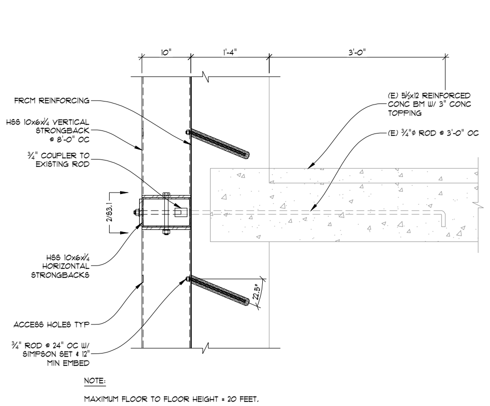
PROJECT NUMBER:
223051
ENGINEER: JJW
DRAWN BY:

TRUSS ELEVATION
S2.4

A95

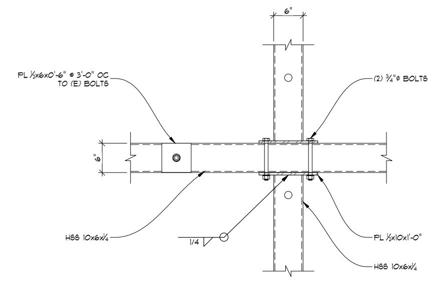
(page intentionally left blank)

REVIEW SET
NOT FOR
CONSTRUCTION

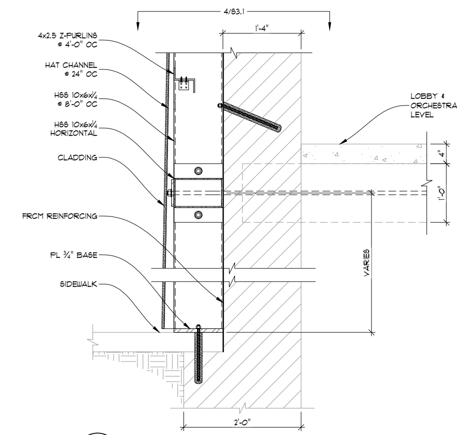


NOTE:
MAXIMUM FLOOR TO FLOOR HEIGHT = 20 FEET.

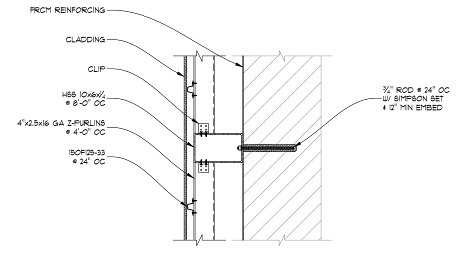
1 / S3.1 TYPICAL STRONGBACK TO FLOOR
SCALE: 1" = 1'-0"



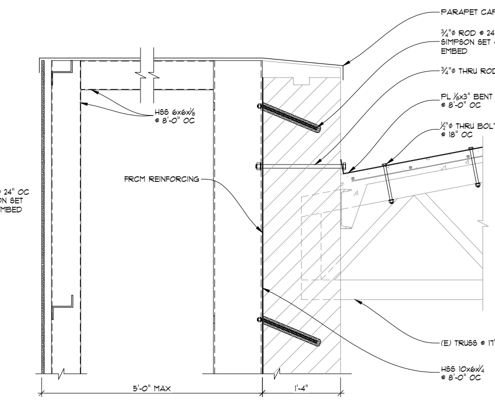
2 / S3.1 VERTICAL STRONGBACK TO HORIZONTAL
SCALE: 1" = 1'-0"



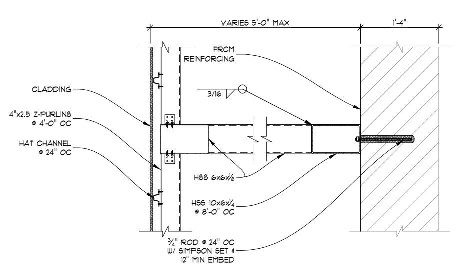
3 / S3.1 STRONGBACK BASE DETAIL
SCALE: 1" = 1'-0"



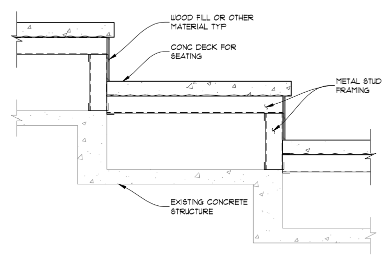
4 / S3.1 PLAN VIEW OF STRONGBACK AT LOWER LEVEL
SCALE: 1" = 1'-0"



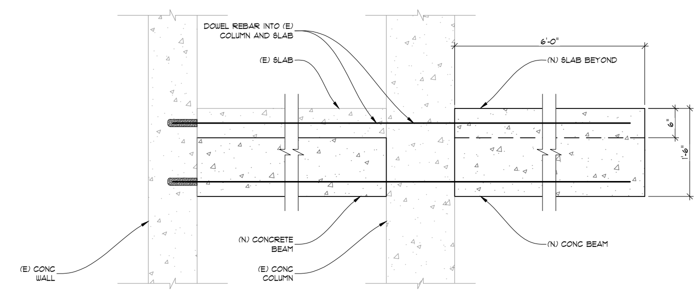
5 / S3.1 STRONGBACK AT ROOF
SCALE: 1" = 1'-0"



6 / S3.1 STRONGBACK PLAN VIEW AT UPPER LEVELS
SCALE: 1" = 1'-0"



7 / S3.1 RAISED SEATING SECTION
SCALE: 1" = 1'-0"



8 / S3.1 NEW CONCRETE BEAMS
SCALE: 1" = 1'-0"

GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 · (503) 244-7014
www.grummelengineering.com

MARKING KELLER
222 SW Clay St.
Portland, OR 97201

4/21/2023

PROJECT NUMBER:
223051
ENGINEER: JJW
DRAWN BY:
DETAILS

S3.1

APPENDIX B

ASCE41-17 TIER 1- CHECKSHEETS

Table 17-1. Very Low Seismicity Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Structural Components			
C NC N/A U	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1
C NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-2. Collapse Prevention Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low Seismicity			
Building System—General			
C NC N/A U	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1
C NC N/A U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity.	5.4.1.2	A.2.1.2
C NC N/A U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. WALLS CARRY INTERMEDIATE LEVEL FORCES TO LEVEL ABOVE AND BELOW	5.4.1.3	A.2.1.3
Building System—Building Configuration			
C NC N/A U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. GRID R LOWER LEVEL BEHIND STAGE, ADD CONCRET TO WALL AT SOUTH	5.4.2.1	A.2.2.2
C NC N/A U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above.	5.4.2.2	A.2.2.3
C NC N/A U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	5.4.2.3	A.2.2.4
C NC N/A U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines.	5.4.2.4	A.2.2.5
C NC N/A U	MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered.	5.4.2.5	A.2.2.6
C NC N/A U	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension.	5.4.2.6	A.2.2.7

continues

Table 17-2 *(Continued)*. Collapse Prevention Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Moderate Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)			
Geologic Site Hazards			
C NC N/A U	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building.	5.4.3.1	A.6.1.1
C NC N/A U	SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure.	5.4.3.1	A.6.1.2
C NC N/A U	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated.	5.4.3.1	A.6.1.3
High Seismicity (Complete the Following Items in Addition to the Items for Moderate Seismicity)			
Foundation Configuration			
C NC N/A U	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$.	5.4.3.3	A.6.2.1
C NC N/A U	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. ADD FOUNDATION TIES	5.4.3.4	A.6.2.2

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-24. Collapse Prevention Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low and Moderate Seismicity			
Seismic-Force-Resisting System			
C NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
C NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$. ADD SHOTCRETE OR FURTHER ANALYSIS	5.5.3.1.1	A.3.2.2.1
C NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. WALLS AT STAGE AND FLY-TOWER, NC	5.5.3.1.3	A.3.2.2.2
Connections			
C NC N/A U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls.	5.7.2	A.5.2.1
C NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation. WALLS AT STAGE AND FLY-TOWER NC	5.7.3.4	A.5.3.5
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)			
Seismic-Force-Resisting System			
C NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. MANY FINISHES TO BE REPLACED	5.5.2.5.2	A.3.1.6.2
C NC N/A U	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC N/A U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning.	5.5.3.2.1	A.3.2.2.3
Diaphragms (Stiff or Flexible)			
C NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. DIAPHRAGMS SLOPE AND ARE DISCONTINUOUS IN AREAS	5.6.1.1	A.4.1.1
C NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. OPENINGS AT STAIRS	5.6.1.3	A.4.1.4
Flexible Diaphragms			
C NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC N/A U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC N/A U	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1.	5.6.2	A.4.2.3
C NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC N/A U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
C NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
C NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
C NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC N/A U SEE ABOVE	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
C NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC N/A U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
C NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
C NC N/A U SEE ABOVE	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
C NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC N/A U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
C NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC N/A U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5
C NC N/A U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
C NC N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
C NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
C NC N/A U SEE ABOVE	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
C NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
C NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC N/A U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC N/A U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC N/A U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC N/A U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-36. Collapse Prevention Structural Checklist for Building Types URM and URMa

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low and Moderate Seismicity			
Seismic-Force-Resisting System			
C NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A U	SHEAR STRESS CHECK: The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 30 lb/in.^{2} (0.21 MPa) for clay units and 70 lb/in.^{2} (0.48 MPa) for concrete units. HIGHER AT LOWER LEVELS SEE TESTING REPORT	5.5.3.1.1	A.3.2.5.1
Connections			
C NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C NC N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2
C NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls.	5.7.2	A.5.2.1
C NC N/A U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)			
Seismic-Force-Resisting System			
C NC N/A U	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than the following: Top story of multi-story building 9 First story of multi-story building 15 All other conditions 13 ADD STRONGBACKS	5.5.3.1.2	A.3.2.5.2
C NC N/A U	MASONRY LAYUP: Filled collar joints of multi-wythe masonry walls have negligible voids.	5.5.3.4.1	A.3.2.5.3
Diaphragms (Stiff or Flexible)			
C NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length.	5.6.1.3	A.4.1.4
C NC N/A U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long.	5.6.1.3	A.4.1.6
Flexible Diaphragms			
C NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2

continues

APPENDIX C

TESTING REPORTS

CONTENTS

Bend Office (541) 330-9155
Geotechnical Office (503) 601-8250
Eugene Office (541) 345-0289
Salem Office (503) 589-1252
Tigard Office (503) 684-3460

Carlson Testing, Inc.

July 13, 2023
T2301930
179606

Grummel Engineering LLC – Bob Grummel
920 SW 3rd Ave
Portland OR 97204

RE: **COMPRESSIVE STRENGTH OF DRILLED CONCRETE CORES (ASTM C42)**
KELLER AUDITORIUM – MATERIAL TESTING
222 SW CLAY ST PORTLAND

As requested, Carlson Testing Inc. (CTI) has completed compression testing on twelve (12) concrete core specimens that were extracted from the above-mentioned project. The samples were obtained by core drilling on July 7, 2023 by our representative from various locations of the structure. Please refer to the second page for coring locations. The ends of the cores were trimmed using a wet diamond blade sawing process. The core specimens were placed into sealed bags on July 5, 2023 where they remained for five days prior to testing. Testing was completed on July 12, 2023. The results are as follows:

COMPRESSIVE STRENGTH OF DRILLED CONCRETE CORES – ASTM C42:

Specimen number	**1**	**2**	**3**	**4**	**5**	**6**
Age of Specimen (days) from date cored	5	5	5	5	5	5
Date and Time tested	07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023
Nominal Maximum Aggregate Size (in.)	-	-	-	-	-	-
Length of Specimen as Received (in.)	-	-	-	-	-	-
Length of specimen prior to capping (in.)	5.90	6.70	5.05	5.35	5.50	5.80
Length of specimen after capping (in.)	6.10	6.90	5.20	5.55	5.70	5.95
Direction of load in respect to placement	P	P	P	P	P	P
Moisture condition at time of testing	Dry	Dry	Dry	Dry	Dry	Dry
Average diameter of core specimen (in.)	3.30	3.27	3.27	3.28	3.27	3.28
Length to diameter ratio (l/d) *	1.85	2.11	1.59	1.69	1.74	1.81
Applied load at specimen failure (lbs.)	25195	32770	30195	30110	34150	36930
Specimen area (sq.in.)	8.55	8.40	8.40	8.45	8.40	8.45
Uncorrected unit (psi)	2947	3901	3598	3563	2875	4370
Strength correction factor *	1	1	0.97	0.98	0.98	1
Corrected unit psi (psi)	2950	3900	3490	3490	2820	4370
Type of Fracture	B	B	B	B	B	B
Density lb/ft^3	137	143	143	140	137	144

Specimen number	**7**	**8**	**9**	**10**	**11**	**12**
Age of Specimen (days) from date cored	5	5	5	5	5	5
Date and Time tested	07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023
Nominal Maximum Aggregate Size (in.)	-	-	-	-	-	-
Length of Specimen as Received (in.)	-	-	-	-	-	-
Length of specimen prior to capping (in.)	6.20	6.40	6.30	3.40	4.20	4.00
Length of specimen after capping (in.)	6.40	6.60	6.50	3.55	4.40	4.20
Direction of load in respect to placement	P	P	P	P	P	P
Moisture condition at time of testing	Dry	Dry	Dry	Dry	Dry	Dry
Average diameter of core specimen (in.)	3.27	3.28	3.28	3.30	3.28	3.28
Length to diameter ratio (l/d) *	1.96	2.01	1.98	1.08	1.34	1.28
Applied load at specimen failure (lbs.)	23960	20080	31780	32845	41950	25515
Specimen area (sq.in.)	8.40	8.45	8.45	8.55	8.45	8.45
Uncorrected unit (psi)	2852	2376	3761	3842	4964	3020
Strength correction factor *	1	1	1	0.89	0.94	0.93
Corrected unit psi (psi)	2850	2380	3760	3420	4670	2810
Type of Fracture	B	B	B	B	B	B
Density lb/ft^3	142	144	139	137	143	127

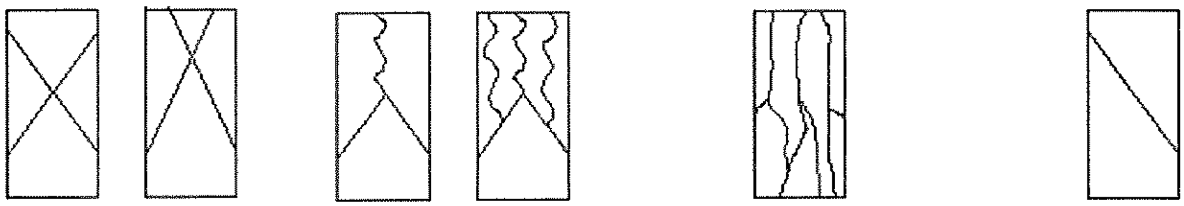
*P – Perpendicular *L – Parallel *N/R – Not Requested
*Strength correction factor applied when length to diameter ratio is equal to or less than 1.75

Informational purposes only.

Tests 5 had a small piece of wood in the specimen after breaking and test 12 had lots of air in the specimen.

CORE SPECIMEN LOCATION:

Specimen #1	Northwest stairwell, basement level.
Specimen #2	Southwest stairwell, basement level.
Specimen #3	Southwest stairwell, basement level.
Specimen #4	Wall near ramp on grid 12.
Specimen #5	North wall near ramp, grid 2.
Specimen #6	Wall between grids N and P, chiller room stairs.
Specimen #7	Vault room grid 2 and 12.
Specimen #8	South stage wall.
Specimen #9	South side of stage, proscenium wall.
Specimen #10	Back stage wall, east side.
Specimen #11	Hallway wall north side, orchestra pit level.
Specimen #12	Stair landing wall, north side, grid N, level 5.



Type 1
Reasonable well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps

Type 2
Well-Formed cone on one end, vertical cracks running through caps, no well-defined cone on other end

Type 3
Columnar vertical cracking through both ends, no well-formed cones

Type 4
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1

Our reports pertain to the material tested/inspected only. Information contained herein is not to be reproduced, except in full, without prior authorization from this office. Under all circumstances, the information contained in this report is provided subject to all terms and conditions of CTI's General Conditions in effect at the time this report is prepared. No party other than those to whom CTI has distributed this report shall be entitled to use or reply upon the information contained in this document.

If there are any further questions regarding this matter, please do not hesitate to contact this office.

Respectfully submitted,
CARLSON TESTING, INC.

Tim Suess
Project Manager

tlm

CC: GRUMMEL ENGINEERING LLC - BOB GRUMMEL BGRUMMEL@MSN.COM

Carlson Testing, Inc.

Bend Office (541) 330-9155
Geotechnical Office (503) 601-8250
Eugene Office (541) 345-0289
Salem Office (503) 589-1252
Tigard Office (503) 684-3460

July 10, 2023
T2301930
Permit No. NOT APPLICABLE

FIELD INSPECTION REPORT

DATES COVERED: June 30, 2023

PROJECT: KELLER AUDITORIUM - MATERIAL TESTING
ADDRESS: 222 SW CLAY ST PORTLAND
INSPECTOR: Timothy Suess – WABO #S102142

06/30/2023 – Ground Penetrating Radar (GPR)

As requested by the client, CTI was on-site to collect radar scans at the core locations to avoid rebar and document the rebar spacing and depth of the reflective objects. The following is a list of information collected at each of the core locations:

Location 1 Double mat spaced at 12 inches on center vertically and horizontally. Concrete cover for vertical bars are 2 ½" and 14" deep and horizontal bars are 3 1/4" and 14" deep. Concrete Thickness is 16-18" thick.

Location 2 Double mat with vertical bars at 12" on center and horizontal bars at 10" on center. Concrete cover for vertical bars is 3" and 14" and horizontal bars are 3 ¾" and 15". Concrete thickness is 16-18" thick.

Location 3 Double mat with vertical and horizontal bars at 16" on center. Concrete cover for vertical bars are 2" and 13 ½" and horizontal bars are 3" and 12". Concrete thickness is approximately 16" thick.

Location 4 Double mat with vertical and horizontal bars at 16" on center. Concrete cover for vertical bars are 1 3/4" and 7 ½" and horizontal bars are 2 1/2" and 6 1/2". Concrete thickness is approximately 10" thick.

Location 5 Double mat spaced at 16" on center vertically and horizontally. Concrete cover for vertical bars are 1 ¾" and 5 1/4" deep and horizontal bars are 2 ¼" and 5 1/2 "deep. Concrete Thickness is 9 ¾".

Location 6 Double mat spaced at 16" on center in both directions. Concrete cover for vertical bars are 2 7/8" and 6" deep and horizontal bars are 2 1/2" and 6 1/2" deep. Concrete Thickness is 9" thick.

Location 7 No rebar was detected in this area. The concrete thickness was physically measured at 22 ½" thick.

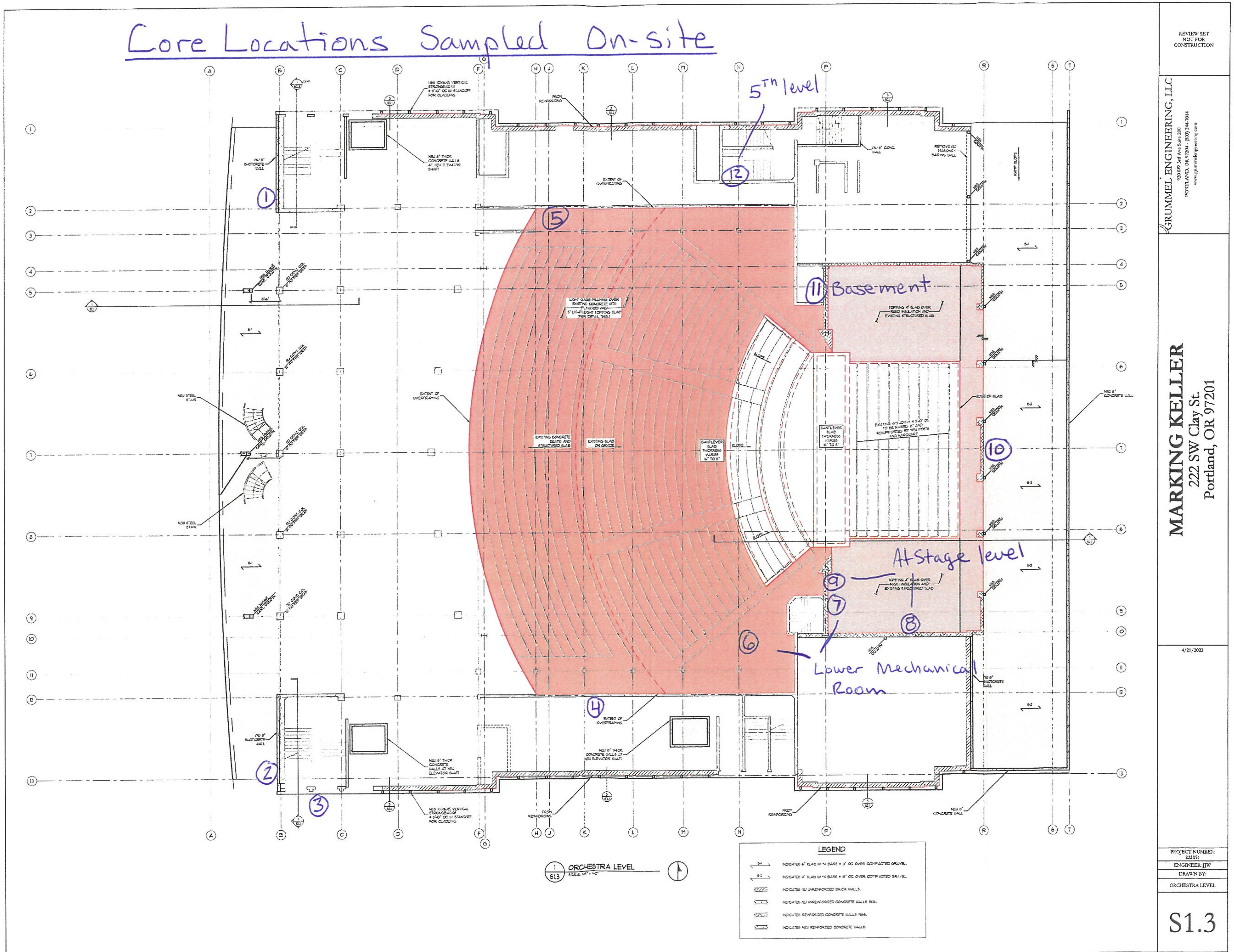
Location 8 Single mat of reinforcing steel without equally spaced bars. Four vertical bars were indicated with spacing at 12", 40" and 24" on center. Horizontal bars were observed at 1' and 4' above the floor. Concrete cover for vertical and horizontal bars are 10" and 11". Concrete thickness is 16".

Location 9 Single mat of reinforcing at 12" on center vertically and horizontally at a depth of 5 ½" and 6", respectively. The concrete thickness is 10"

Location 10 Single mat with no vertical bars. Horizontal bars are spaced at 16" and 36" with varying depths of 2 ¾", 4" and 8". The concrete thickness is 16" thick.

Location 11 Double mat of reinforcing at 16" on center vertically and horizontally. Concrete cover for vertical bars at 2" and 6 ½" and the horizontal bars are 2 ½" and 5 ¾" deep. The concrete thickness is 8".

(page intentionally left blank)

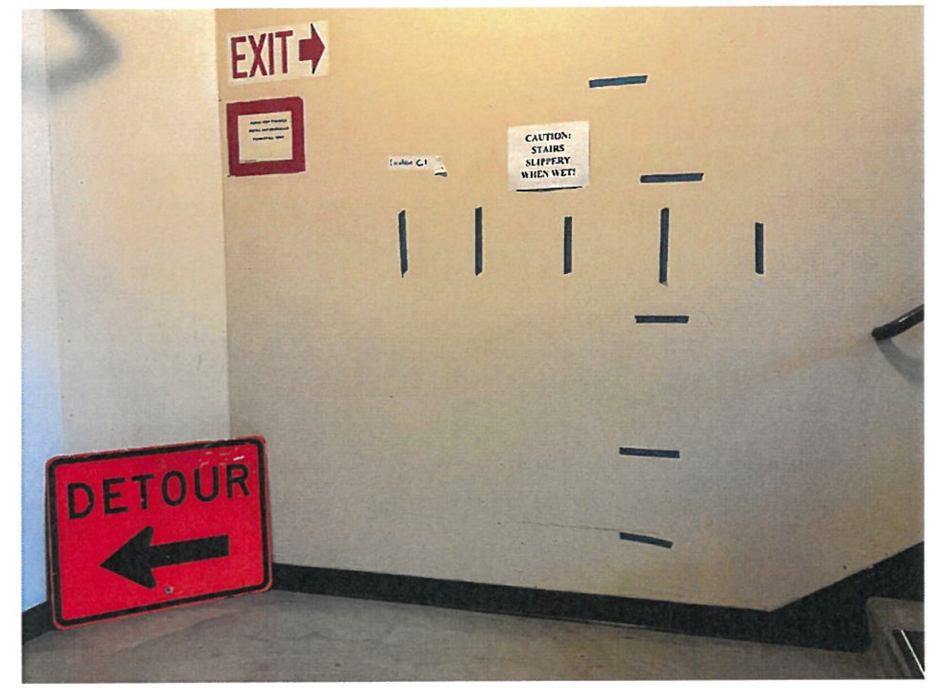


Core Locations Sampled On-site
5th level
Basement
At Stage level
Lower Mechanical Room
1
2
3
4
6
7
8
9
10
11
12
15
ORCHESTRA LEVEL
LEGEND
REVIEW SET NOT FOR CONSTRUCTION
GRUMMEL ENGINEERING, LLC
920 SW 3rd Ave Suite 200
PORTLAND, OR 97204 · (503) 244-7014
www.grummelengineering.com
MARKING KELLER
222 SW Clay St.
Portland, OR 97201
4/21/2023
PROJECT NUMBER: 223051
ENGINEER: JJW
DRAWN BY:
ORCHESTRA LEVEL
S1.3

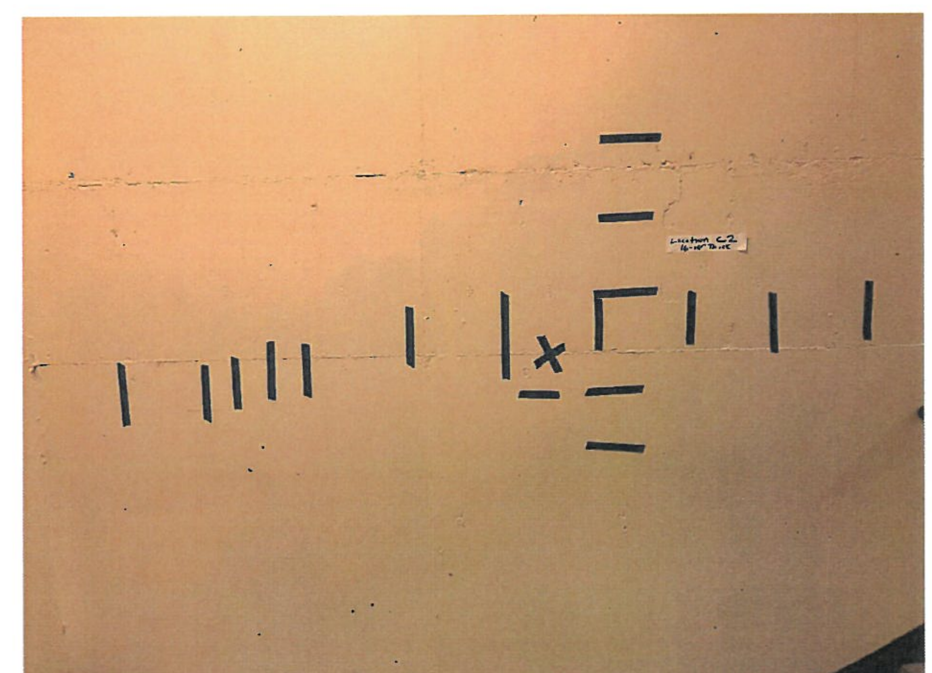
A111

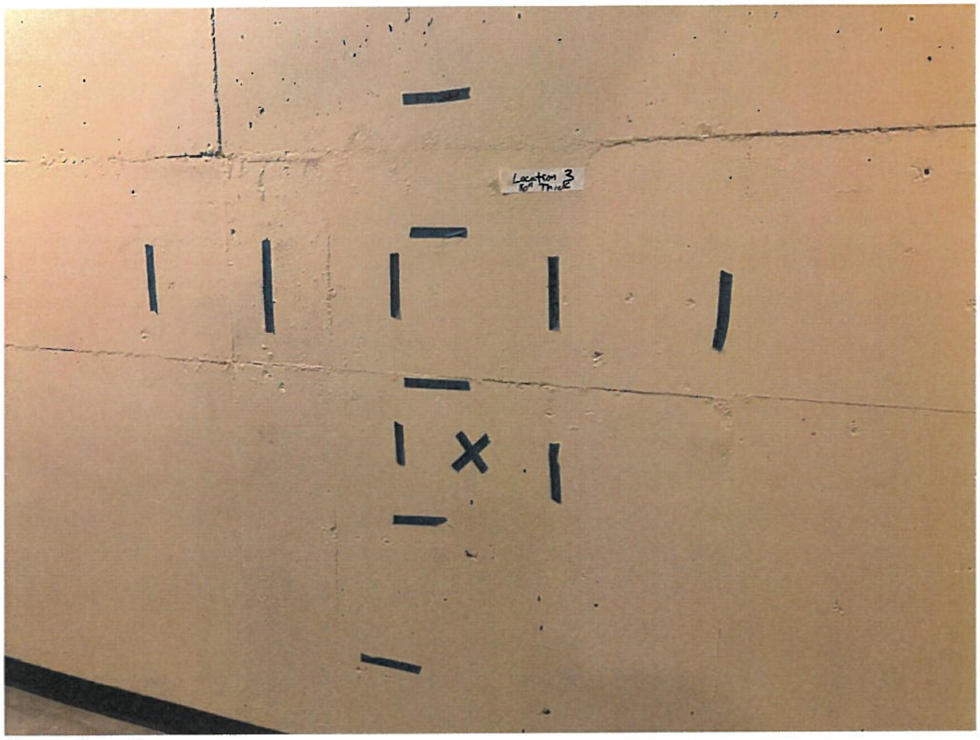
Bend Office	(541) 330-9155
Geotechnical Office	(503) 601-8250
Eugene Office	(541) 345-0289
Salem Office	(503) 589-1252
Tigard Office	(503) 684-3460

ON-SITE PHOTOS FOR KELLER AUDITORIUM



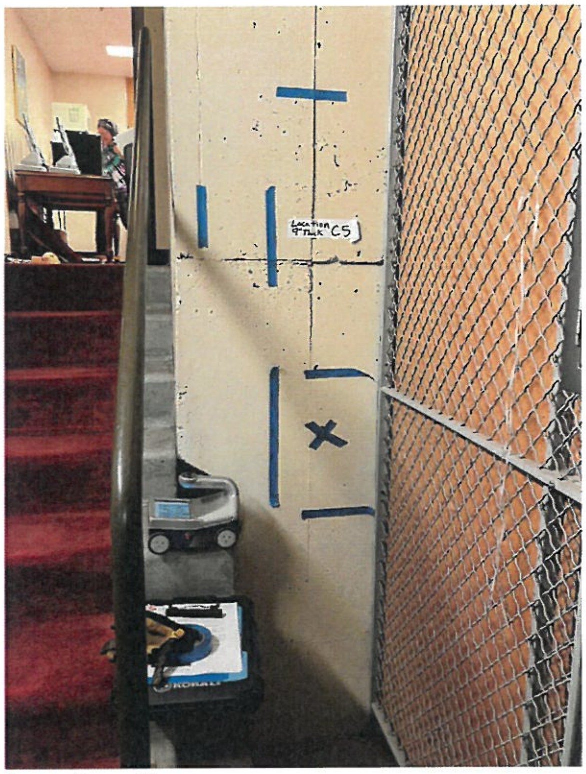
Location 1


Location 2

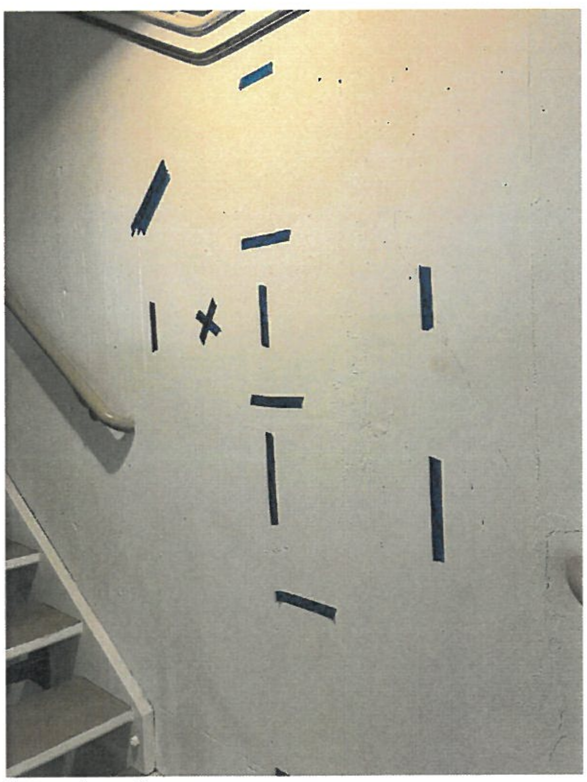


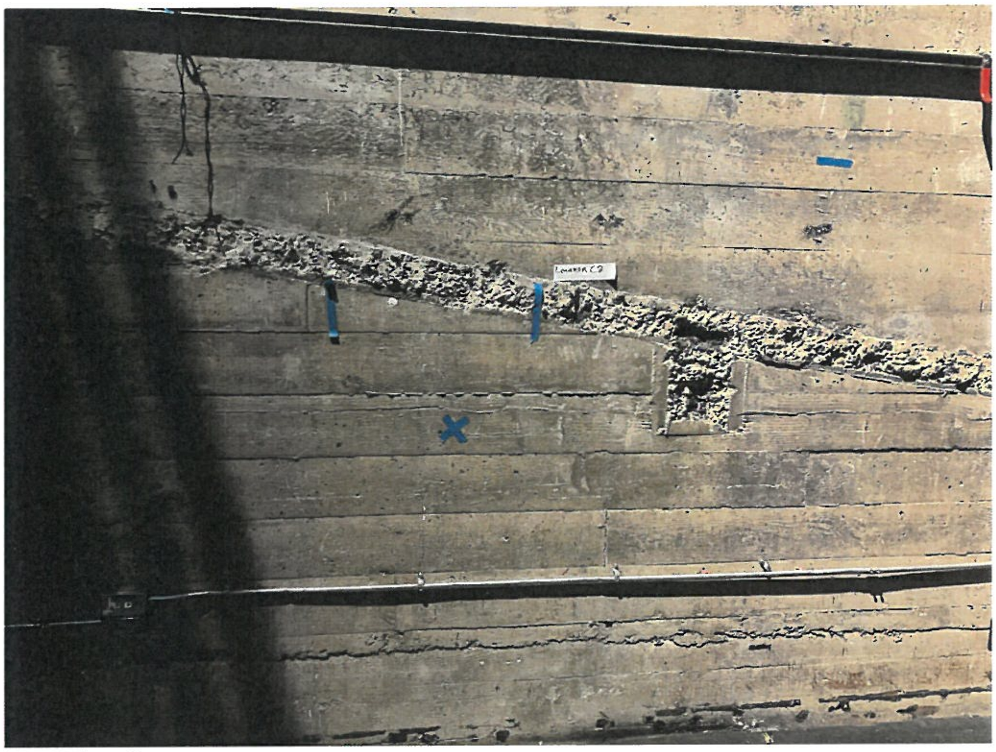
Lcaotion 3

Location 4

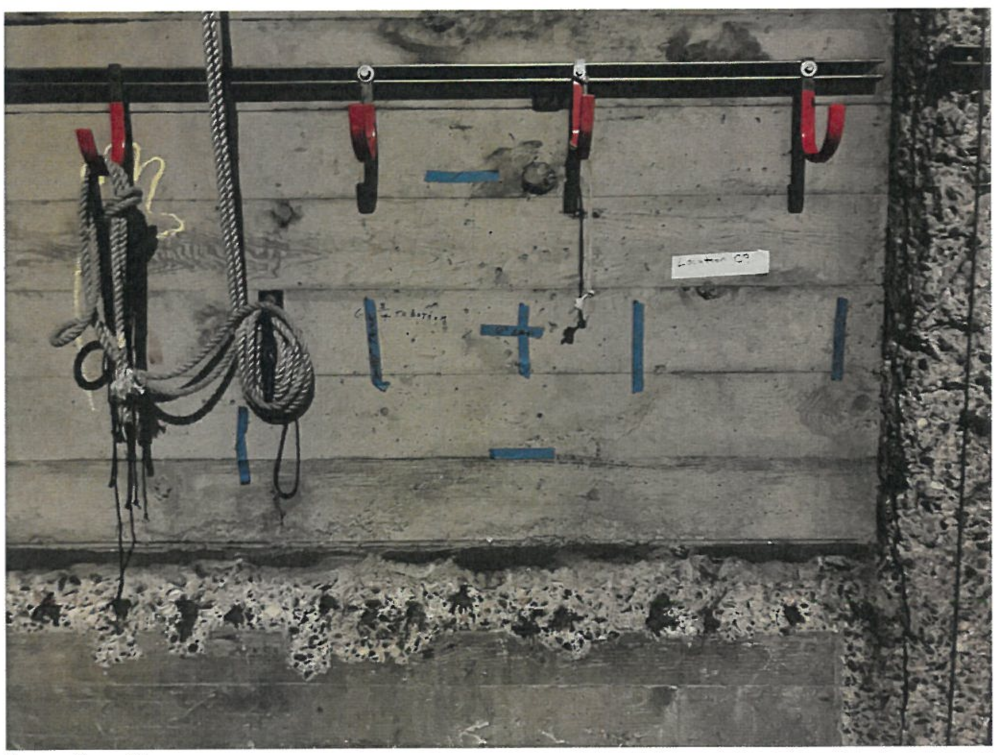


Lcaotion 5

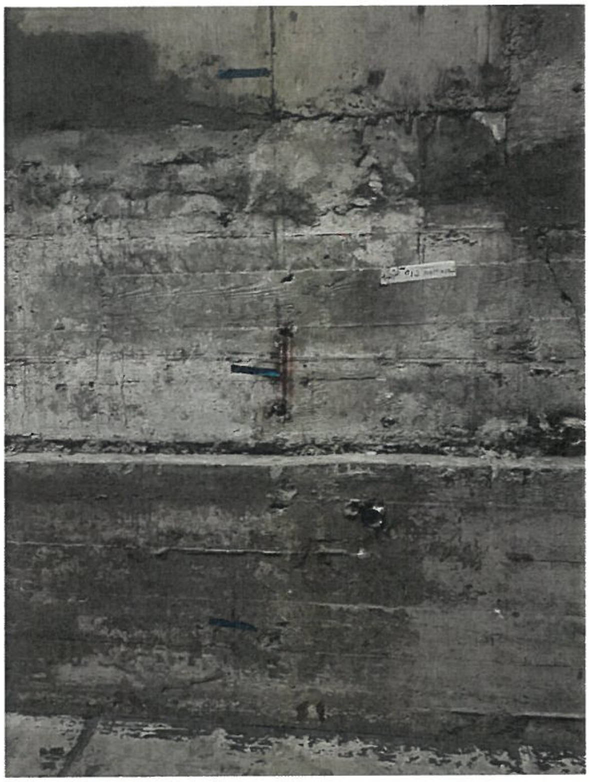

Location 6



Location 8

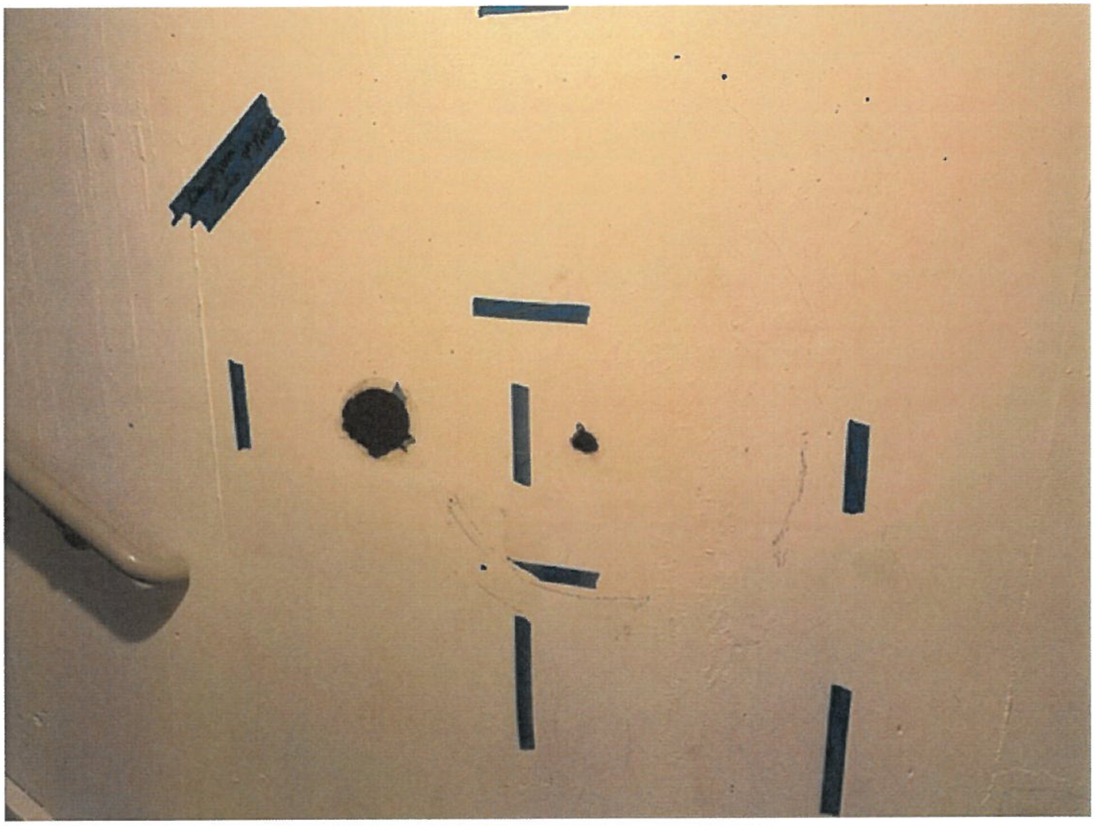


Location 9



Location 10

Location 11



Locatoin 12

Carlson Testing, Inc.

Bend Office (541) 330-9155
Geotechnical Office (503) 601-8250
Eugene Office (541) 345-0289
Salem Office (503) 589-1252
Tigard Office (503) 684-3460

July 10, 2023
T2301930
Permit No. NOT APPLICABLE

FIELD INSPECTION REPORT

DATES COVERED: June 29, 2023 – June 30, 2023,
July 3, 2023, July 5, 2023

PROJECT: KELLER AUDITORIUM - MATERIAL TESTING
ADDRESS: 222 SW CLAY ST PORTLAND
INSPECTOR: K. Wright – WABO #SI02613, N. Gordon – ACI#01243846, ODOT#49329

06/29/2023-06/30/2023, 07/03/2023, 07/05/2023 – Concrete Core Drilling & Brick Shear Testing

As requested, CTI representative was on site and met Will of Portland's Centers for the Arts who gave CTI representatives access to the building. CTI representatives took (12) compressive strength samples. All samples were taken with a 3.5" Ø core drill bit. All core locations were scanned with a GSSI Ground Penetrating Radar (GPR) unit before any sampling was performed (see CTI report from Tim Suess dated 06/30/2023). All core drilling was performed per ASTM C42 and brought back to CTI lab for testing. Core holes were patched with grout before leaving the site.

Additionally, CTI representatives performed a brick shear test at (3) locations, see results below. CTI representatives patched removed bricks using Type S Mortar before leaving the site.

CTI Brick Shear Worksheet

Test Nº	Floor	Wall	Location	Brick Dimension			BSB %	Bond Area sq/in	Load lbs	V-Test/Ab	Additional Info	PSI
				Height	Length	Width						
1	6	North	B5-3 6th floor Mech. Room	2 ¼"	8"	4"	100%	64	8,640	135		3,300
2	6	North	B5-2 6th floor Mech. Room	2 ¼"	8"	4"	50%	64	11,621	181.58		4,400
3	5	North	B5-1 5th floor Stairwell	2 ¼"	8"	4"	0%	64	5,117	79.95		2,000

*BSB = Back Side Bond in %, must be filled in from 0% to 100%
*BSB is not used in the calculation of the V-Test shear
*All failures are the mortar bond unless otherwise specified in additional info

*** CHECK ONE BOX ONLY ***	YES	NO
1. This is a preliminary inspection only. – OR –	☒	
2. The work inspected conforms to acceptance criteria listed above. If "No," the portions of the work that are non-conforming items are clearly stated above and will be added to the NCL. Remaining portions of the work, which are not preliminary in nature, are to be considered as conforming.	☐	☐

Our reports pertain to the material tested/inspected only. Information contained herein is not to be reproduced, except in full, without prior authorization from this office. Under all circumstances, the information contained in this report is provided subject to all terms and conditions of CTI's General Conditions in effect at the time this report is prepared. No party other than those to whom CTI has distributed this report shall be entitled to use or rely upon the information contained in this document.

APPENDIX D

TIER 2 - LATERAL CALCULATIONS

CONTENTS

D.1 - MASS SUMMATION

High Roof Mass

Main Roof

Total Area 5000 sf

Component	Unit Wt	
i12x32 @ 6 ft	6.0	psf
trusses	4.0	psf
girder trusses	4.0	psf
4" structured slab	50.0	psf
insulation	2.0	psf
membrane	1.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**70.0**	**psf**

Total Mass 350.0 kips ($A*q_{DL}$)

GRUMMEL ENGINEERING, LLC

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	

Roof Mass

Main Roof

Total Area 31900 sf

Component	Unit Wt	
i12x32 @ 6 ft	6.0	psf
trusses @ 18 ft	4.0	psf
girder trusses @ 38 ft	4.0	psf
4" structured slab	50.0	psf
insulation	2.0	psf
membrane	1.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**70.0**	**psf**

Total Mass 2233.0 kips ($A*q_{DL}$)

Hung Ceiling over theatre

Total Area 15300 sf

Component	Unit Wt	
L4x4x1/4 @ 6 ft	2.0	psf
metal catwalk	5.0	psf
light gage metal framing	3.0	psf
1" plaster ceiling	13.0	psf
misc.	5.0	psf
q_{DL} TOTAL	**28.0**	**psf**

Total Mass 428.4 kips ($A*q_{DL}$)

Dropped ceiling all other areas

Total Area 16600 sf

Component	Unit Wt	
ceiling wt	5.0	psf
q_{DL} TOTAL	**5.0**	**psf**

Total Mass 83.0 kips ($A*q_{DL}$)

NEW ROOF AT WEST

Total Area 14,400 sf

Component	Unit Wt	
W12X26 @ 10 FT	3.0	psf
girder beams at 24 feet	8.0	psf
4" composite deck	40.0	psf
built up insulation	5.0	psf
hung ceiling	5.0	psf
membrane	1.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**65.0**	**psf**

Total Mass	936.0	kips	($A*q_{DL}$)

NEW ROOF AT EAST

Total Area 5,000 sf

Component	Unit Wt	
W12X26 @ 10 FT	3.0	psf
4" composite deck	40.0	psf
built up insulation	5.0	psf
hung ceiling	5.0	psf
membrane	1.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**57.0**	**psf**

Total Mass	285.0	kips	($A*q_{DL}$)
Total Mass	**3965.4**	kips	

Intermediate Mezzanine #2 Mass

Mezzanines & Stairs

Total Area 2500 sf

Component	Unit Wt	
4" slab	50.0	psf
10"x12" beams @ 3'-0"	42.0	psf
30"x12" beam @ 12 ft	32.0	psf
partition	10.0	psf
ceiling	5.0	psf
finished flooring	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**147.0**	**psf**

Total Mass 367.5 kips ($A*q_{DL}$)

NEW FLOOR AT EAST

Total Area 5,000 sf

Component	Unit Wt	
W16X26 @ 10 FT	3.0	psf
6" composite deck	65.0	psf
hung ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**76.0**	**psf**

Total Mass 380.0 kips ($A*q_{DL}$)

TOTAL MASS 747.5 kips

Second Balcony Mass

Second Balcony

Total Area 19600 sf

Component	Unit Wt	
4" slab	50.0	psf
10"x12" beams @ 3'-0"	42.0	psf
18" x 36" beams @ 8 ft	85.0	psf
18x48 girts @ 18 ft	50.0	psf
partition	10.0	psf
ceiling	5.0	psf
finished flooring	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**250.0**	**psf**

Total Mass 4900.0 kips ($A*q_{DL}$)

Gridiron

Total Area 7400 sf

Component	Unit Wt	
2 x boards	5.0	psf
W8x18 steel beams @3'6"	5.0	psf
ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**18.0**	**psf**

Total Mass 133.2 kips ($A*q_{DL}$)

NEW FLOOR AT WEST

Total Area 7,500 sf

Component	Unit Wt	
W16X26 @ 10 FT	3.0	psf
girder beams at 24 feet	8.0	psf
6" composite deck	65.0	psf
hung ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**84.0**	**psf**

Total Mass 630.0 kips ($A*q_{DL}$)

NEW FLOOR AT EAST

Total Area	5,000	sf

Component	Unit Wt	
W16X26 @ 10 FT	3.0	psf
6" composite deck	65.0	psf
hung ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**76.0**	**psf**

Total Mass	380.0	kips	($A*q_{DL}$)

TOTAL MASS	**6043.2**	**kips**

Intermediate Mezzanine #1 Mass

Mezzanines & Stairs

Total Area 5900 sf

Component	Unit Wt	
4" slab	50.0	psf
10"x12" beams @ 3'-0"	42.0	psf
30"x12" beam @ 12 ft	32.0	psf
partition	10.0	psf
ceiling	5.0	psf
finished flooring	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**147.0**	**psf**

Total Mass 867.3 kips ($A*q_{DL}$)

GRUMMEL ENGINEERING, LLC

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	

First Balcony Mass

First Balcony

Total Area 24600 sf

Component	Unit Wt	
4" slab	50.0	psf
10"x12" beams @ 3'-0"	42.0	psf
18" x 36" beams @ 8 ft	85.0	psf
18x48 girts @ 18 ft	50.0	psf
partition	10.0	psf
ceiling	5.0	psf
finished flooring	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**250.0**	**psf**

Total Mass 6150.0 kips (A*q_{DL})

NEW FLOOR AT WEST

Total Area 5,280 sf

Component	Unit Wt	
W16X26 @ 10 FT	3.0	psf
girder beams at 24 feet	8.0	psf
6" composite deck	65.0	psf
hung ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**84.0**	**psf**

Total Mass 443.5 kips (A*q_{DL})

NEW FLOOR AT EAST

Total Area 5,000 sf

Component	Unit Wt	
W16X26 @ 10 FT	3.0	psf
6" composite deck	65.0	psf
hung ceiling	5.0	psf
Misc.	3.00	psf
q_{DL} TOTAL	**76.0**	**psf**

Total Mass 380.0 kips (A*q_{DL})

TOTAL MASS 6973.5 kips

Wall Mass - Ground to 1st Balcony

Wall Height 25 ft

Wall	Length (ft)	Material	Unit wt pcf	Thickness (in)	Total Weight (kips)	
Grid 1 & 13 (brick)	350	brick	120	16	1400	
Grid 1 & 13 (conc.)	60	conc.	150	8	150	
Grid 1.6 (stair 3 & elev)	40	conc.	150	8	100	
Grid 2 & 12	292	conc.	150	10	913	
Grid 3 & 11	36	conc.	150	10	113	
Grid 4 & 10	118	conc.	150	12	443	R to S removed
Grid B	58	conc.	150	18	326	
Grid C	58	conc.	150	8	145	
Grid F (elevator)	76	conc.	150	8	190	
Grid G.6 (stair 3&4 not n.5)	92	conc.	150	8	230	
Grid N.5	104	conc.	150	10	325	
Grid P	54	conc.	150	18	304	
Grid P.2 (elevator & shaft)	50	conc.	150	8	125	
Grid P.9	84	brick	120	16	336	
Grid R	46	conc.	150	12	173	average thickness
Grid S	0	conc.	150	8	0	wall to be removed
New Grid T	200	conc.	150	8	500	
new cladding (4-sides)	910	glass	10	psf	228	
				TOTAL	5999	

GRUMMEL ENGINEERING, LLC

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	

Wall Mass - 1st Balcony to 2nd Balcony

Wall Height 19 ft

Wall	Length (ft)	Material	Unit wt pcf	Thickness (in)	Total Weight (kips)	
Grid 1 & 13 (brick)	350	brick	120	16	1064	
Grid 1 & 13 (conc.)	60	conc.	150	8	114	
Grid 1.6 (stair 3 & elev)	40	conc.	150	8	76	
Grid 2 & 12	276	conc.	150	10	656	
Grid 3 & 11	36	conc.	150	10	86	
Grid 4 & 10	118	conc.	150	12	336	R to S removed
Grid B	58	conc.	150	18	248	
Grid C	58	conc.	150	8	110	
Grid F (elevator)	76	conc.	150	8	144	
Grid G.6 (stair 3&4 not n.5)	92	conc.	150	8	175	
Grid N.5	104	conc.	150	10	247	
Grid P	54	conc.	150	18	231	
Grid P.2 (elevator & shaft)	30	conc.	150	8	57	
Grid P.9	84	brick	120	16	255	
Grid R	110	conc.	150	12	314	average thickness
Grid S	0	conc.	150	8	0	wall to be removed
new cladding (4-sides)	910	glass	10	psf	173	
				TOTAL	4285	

Wall Mass - 2nd Balcony to Main Roof

Wall Height 19 ft

Wall	Length (ft)	Material	Unit wt pcf	Thickness (in)	Total Weight (kips)	
Grid 1 & 13 (brick)	350	brick	120	16	1064	
Grid 1 & 13 (conc.)	60	conc.	150	8	114	
Grid 1.6 (stair 3 & elev)	40	conc.	150	8	76	
Grid 2 & 12	72	conc.	150	10	171	
Grid 4 & 10	118	conc.	150	12	336	R to S removed
Grid B	58	conc.	150	18	248	
Grid C	58	conc.	150	8	110	
Grid F (elevator)	76	conc.	150	8	144	
Grid G.6 (stair 3&4 not n.5)	92	conc.	150	8	175	
Grid N.5	104	conc.	150	10	247	
Grid P (thick)	54	conc.	150	18	231	
Grid P	56	conc.	150	10	133	
Grid P.2 (elevator & shaft)	30	conc.	150	8	57	
Grid P.9	84	brick	120	16	255	
Grid R	110	conc.	150	12	314	average thickness
Grid S	0	conc.	150	8	0	wall to be removed
new cladding (4-sides)	910	glass	10	psf	173	
				TOTAL	3848	

Wall Mass -Main Roof to Upper roof

Wall Height 32 ft

Wall	Length (ft)	Material	Unit wt pcf	Thickness (in)	Total Weight (kips)
Grid 4 & 10	94	conc.	150	12	451
Grid P	110	conc.	150	12	528
Grid R	110	conc.	150	12	528
				TOTAL	1507

Mass Summary

Summary of Floor Mass

Level	Avg Elev (ft)	Height (ft)	Floor Mass (kips)
Ground	75	0	
Intermediate #1	90	15	867
1st Balcony	100	25	6,974
Intermediate #2	110	35	368
2nd Balcony	119	44	6,043
Main Roof	138	63	3,965
High Roof	170	95	350
			18,567

Mass Per Level (kips)

Level	Floor Mass	Intermed Below	Intermed Above	Wall Mass	**Total Mass**
1st Balcony	6,974	520	174	5,142	**12,810**
2nd Balcony	6,043	193	0	4,067	**10,303**
Main Roof	3,965	0	0	2,678	**6,643**
High Roof	350	0	0	754	**1,104**
	17,332	714	174	12,640	**30,860**

D.2 - LATERAL FORCES USING LSP

USE BSE-1N & BSE-2N,

Risk Category than the building would be assigned.

2.2.4 Basic Performance Objective Equivalent to New Building Standards (BPON). When selected, the Basic Performance Objective Equivalent to New Building Standards (BPON), which is a specific performance objective to be used only with Tier 3 systematic evaluation or retrofit that varies with Risk Category, shall be in accordance with Table 2-3.

Table 2-3. Basic Performance Objective Equivalent to New Building Standards (BPON)

Risk Category	Seismic Hazard Level	
	BSE-1N	BSE-2N
I and II	Life Safety Structural Performance	Collapse Prevention Structural Performance
	Position Retention Nonstructural Performance (3-B)	Hazards Reduced Nonstructural Performance[a] (5-D)
III	Damage Control Structural Performance	Limited Safety Structural Performance
	Position Retention Nonstructural Performance (2-B)	Hazards Reduced Nonstructural Performance[a] (4-D)
IV	Immediate Occupancy Structural Performance	Life Safety Structural Performance
	Operational Nonstructural Performance (1-A)	Hazards Reduced Nonstructural Performance[a] (3-D)

[a] Compliance with ASCE 7 provisions for new construction is deemed to comply.

retrofit based on the Limited Safety Structural Performance Level shall be taken halfway between those for Life Safety Structural Performance Level (S-3) and the Collapse Prevention Structural Performance Level (S-5).

This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

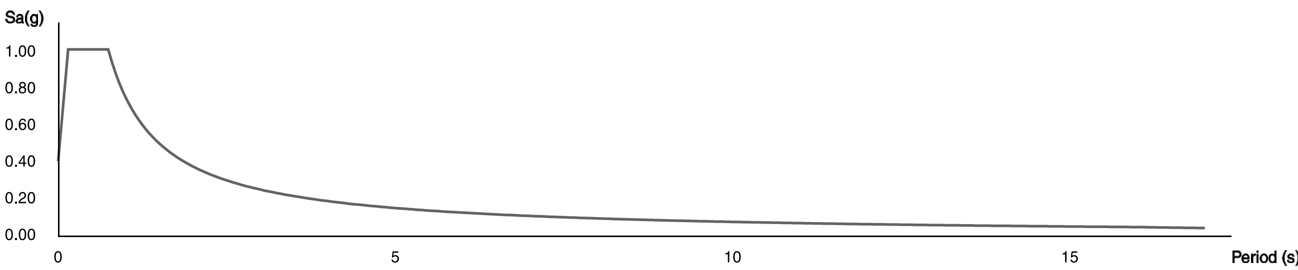
The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

ATC Hazards by Location

Search Information

Address:	222 SW Clay St, Portland, OR 97201, USA
Coordinates:	45.5125091, -122.6782123
Elevation:	81 ft
Timestamp:	2023-05-18T16:14:16.572Z
Hazard Type:	Seismic
Reference Document:	ASCE41-17
Site Class:	D
Custom Probability:	

Horizontal Response Spectrum - Hazard Level BSE-2N



Hazard Level BSE-2N

Name	Value	Description
SsUH	0.999	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR_S	0.889	Coefficient of risk (0.2s)
SsRT	0.888	Probabilistic risk-targeted ground motion (0.2s)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S_S	0.888	MCE_R ground motion (period=0.2s)
F_a	1.145	Site amplification factor at 0.2s
S_{XS}	1.016	Site modified spectral response (0.2s)
S1UH	0.456	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR_1	0.87	Coefficient of risk (1.0s)
S1RT	0.396	Probabilistic risk-targeted ground motion (1.0s)
S1D	0.6	Factored deterministic acceleration value (1.0s)
S_1	0.396	MCE_R ground motion (period=1.0s)
F_v	1.904	Site amplification factor at 1.0s
S_{X1}	0.755	Site modified spectral response (1.0s)

Hazard Level BSE-1N

Name	Value	Description
S_{XS}	0.678	Site modified spectral response (0.2s)
S_{X1}	0.503	Site modified spectral response (1.0s)

Hazard Level BSE-2E

Name	Value	Description
S_S	0.627	MCE_R ground motion (period=0.2s)
F_a	1.298	Site amplification factor at 0.2s

S_{XS}	0.814	Site modified spectral response (0.2s)
S_1	0.279	MCE_R ground motion (period=1.0s)
F_v	2.043	Site amplification factor at 1.0s
S_{X1}	0.569	Site modified spectral response (1.0s)

Hazard Level BSE-1E

Name	Value	Description
S_S	0.24	MCE_R ground motion (period=0.2s)
F_a	1.6	Site amplification factor at 0.2s
S_{XS}	0.384	Site modified spectral response (0.2s)
S_1	0.087	MCE_R ground motion (period=1.0s)
F_v	2.4	Site amplification factor at 1.0s
S_{X1}	0.209	Site modified spectral response (1.0s)

T_L Data

Name	Value	Description
T_L	16	Long-period transition period (s)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

Table 11-3. Linear Static Procedure: *m*-Factors for URM In-Plane Walls, Wall Piers, and Spandrels

Limiting Behavioral Mode	Performance Level				
	Primary			Secondary	
	IO	LS	CP	LS	CP
Wall and Wall Pier Rocking[a,b]	$1 \leq 1.5h_{eff}/L \leq 1.5$	$1.5 \leq 3h_{eff}/L^b \leq 3.75$	$2 \leq 4h_{eff}/L^b \leq 5$	$2 \leq 4h_{eff}/L^b \leq 5$	$3 \leq 6h_{eff}/L^b \leq 8$
Wall and Wall Pier Bed-joint sliding	1	3	4	6	8
Spandrels with Prismatic Lintels	1	1.7	2.2	7.5	10
Spandrels with Shallow Arch Lintels	1	1.7	2.2	4.2	5.6

[a] All rocking-controlled walls and wall piers shall comprise a minimum thickness of 6 in. and, for solid brick masonry, a minimum of two wythes. Multi-wythe solid brick masonry walls and wall piers shall be connected with bonded solid headers.
[b] *m*-factors for rocking apply only for walls and wall piers with f_a/f'_m ratios less than or equal to 4%, unless it can be demonstrated by analysis using moment curvature or other acceptable means that toe crushing does not occur at the expected pier drift; otherwise, walls and wall piers shall be considered force controlled. Alternatively, nonlinear procedures and acceptance criteria should be used, in accordance with Section 11.3.2.3.2.

FORCE DISTRIBUTION

Seismic Information:

C1 C2=	1.0	(ASCE41-13, Table 7-3)	
Cm	1.0	(ASCE41-13, Table 7-4)	
Sa =	1.016	BSE-2N	
V_{BASE} =	31,354	kip	(ASCE41-13, Eq 7-21)

Building Geometry:

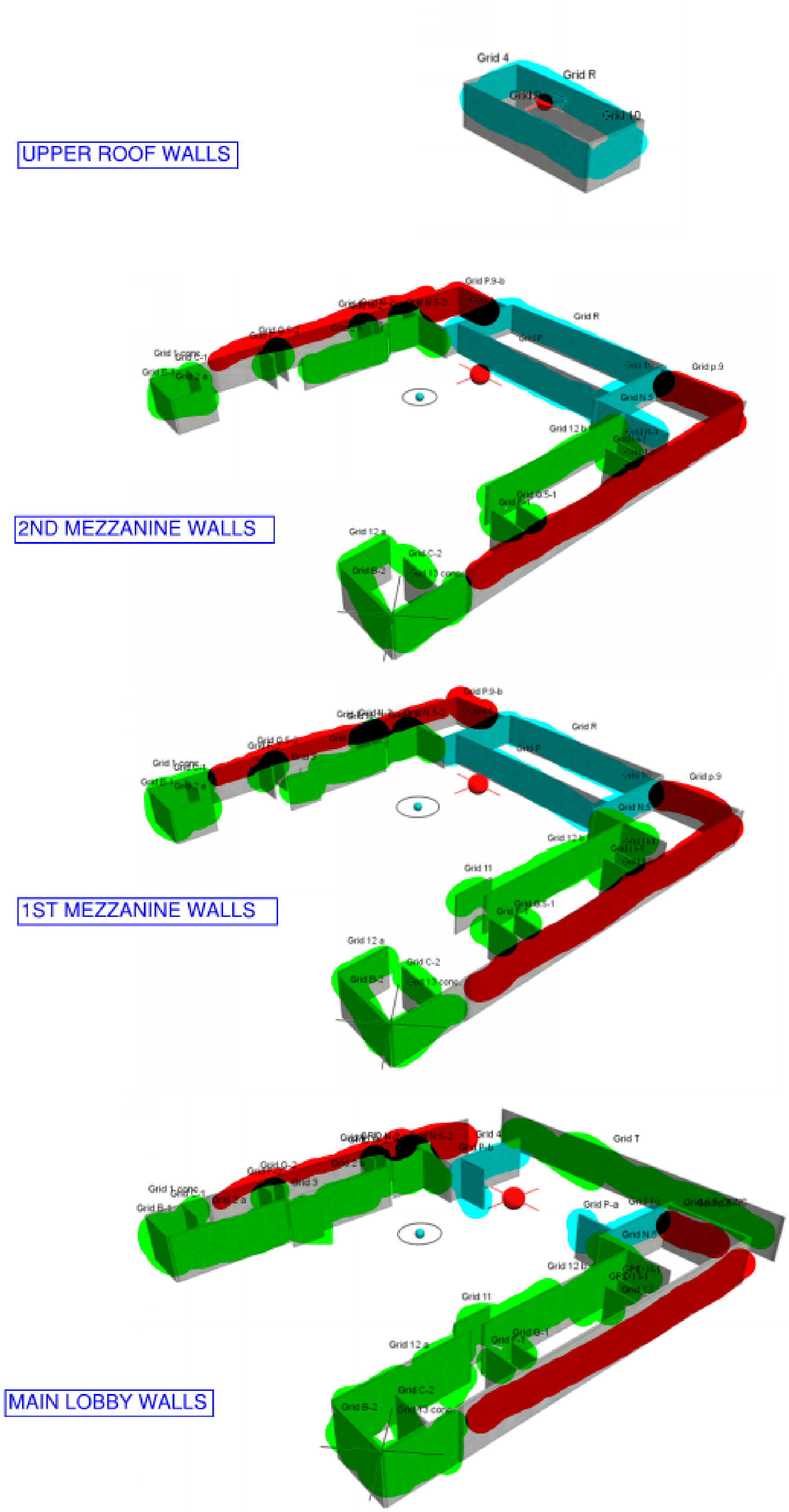
hn =	95	
L =	300	ft
W =	200	ft
Ct =	0.02	
β =	0.75	
Ta =	0.61	(Equation 7-18)
k =	1	

Force Distribution

Level	h_x (ft)	W_x (kip)	$W_x h_x$^k	C_{xx}	F_{px} (kip)
1st Balcony	25	12,810	320246	0.247	**7742**
2nd Balcony	44	10,303	453349	0.350	**10960**
Main Roof	63	6,643	418517	0.323	**10118**
High Roof	95	1,104	104842	0.081	**2535**
		30860	1296954	1.000	**31354**

Project: Keller Auditorium
222 SW Clay St.
Portland, OR 97201
Client: Hennebery Eddy Architects

Date:
Page:
By:
Job #: 223051



DIAGRAGM KEY

INDICATES UNREINFORCED CONCRETE FROM 1916

INDICATES UNREINFORCED BRICK FROM 1916

INDICATES REINFORCED CONCRETE FROM 1966

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	

PERFORMANCE LEVEL	BSE-2N -Life Safety	
BRICK MASONRY m-FACTOR	3.0	(TABLE 11-3, LINEAR STATIC)
PLAIN CONCRETE m-FACTOR	3.0	(TABLE 11-3, LINEAR STATIC)
REIN. CONCRETE m-FACTOR	3.0	(Table 10-21 LINEAR STATIC CONVENTIONAL CONFORMING REINFORCEMENT)

v = (TOT. FORCE) /[(THICKNESS)(LENGTH*12)(m)]

WALL FORCES N-S Roof

Wall ID	Material	m-factor #	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid P	plain conc	3	1	12	110	1,739	1,739	36.6
Grid R	plain conc	3	1	8	110	1,094	1,094	34.5

WALL FORCES N-S 2nd balcony

Wall ID	Material	m-factor #	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid B	reinf conc	3	2	18	56	2,938	2,938	81.0
Grid C	reinf conc	3	2	8	36	682	682	65.8
Grid F	reinf conc	3	2	10	34	718	718	58.7
Grid G.5	reinf conc	3	2	10	26	446	446	47.6
Grid M	reinf conc	3	2	10	32	564	564	49.0
Grid N	reinf conc	3	2	10	32	560	560	48.6
Grid N.5	reinf conc	3	2	8	82	1,680	1,680	71.1
Grid P	plain conc	3	1	12	110	2,458	719	51.7
Grid P.9	URM	3	2	16	86	1,948	1,948	39.3
Grid R	plain conc	3	1	8	110	2,759	1,665	87.1

WALL FORCES N-S 1st balcony

Wall ID	Material	m-factor #	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid B	reinf conc	3	2	18	56	5,286	2,348	145.7
Grid C	reinf conc	3	2	8	36	1,232	550	118.8
Grid F	reinf conc	3	2	10	34	1,312	594	107.2
Grid G.5	reinf conc	3	2	10	26	816	370	87.2
Grid M	reinf conc	3	2	10	32	1,050	486	91.1
Grid N	reinf conc	3	2	10	32	1,044	484	90.6
Grid N.5	reinf conc	3	2	8	82	3,140	1,460	133.0
Grid P	plain conc	3	1	12	110	4,569	2,111	96.1
Grid P.9	URM	3	2	16	86	3,652	1,704	73.7
Grid R	plain conc	3	1	8	110	4,174	1,415	131.8

WALL FORCES N-S Main Lobby

Wall ID	Material	m-factor #	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)	
Grid B	reinf conc	3	2	18	56	7,598	2,312	209.4	
Grid C	reinf conc	3	2	8	36	1,606	374	154.9	
Grid F	reinf conc	3	2	10	34	1,644	332	134.3	
Grid G.5	reinf conc	3	2	10	26	946	130	101.1	
Grid M	reinf conc	3	2	10	32	1,230	180	106.8	
Grid N	reinf conc	3	2	10	32	1,200	156	104.2	
Grid N.5	reinf conc	3	2	8	82	3,802	662	161.0	
Grid P	plain conc	3	2	20	110	2,834	-1,735	35.8	
Grid P.9	URM	3	1	16	43	2,310	-1,342	93.3	
Grid P.9	reinf conc.	3	1	8	43	2,410	-1,764	194.6	new shotcrete
Grid R	plain conc	3	0	0	0	0	-4,174		no grid R wall
Grid T	reinf conc	3	1	8	200	13,586	13,586	235.9	new wall

GRUMMEL ENGINEERING, LLC

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	

PERFORMANCE LEVEL	BSE-2N -Life Safety	
BRICK MASONRY m-FACTOR	3.0	(TABLE 11-3, LINEAR STATIC)
PLAIN CONCRETE m-FACTOR	3.0	(TABLE 11-3, LINEAR STATIC)
REIN. CONCRETE m-FACTOR	3.0	(Table 10-21 LINEAR STATIC CONVENTIONAL CONFORMING REINFORCEMENT)

v = (TOT. FORCE) /[(THICKNESS)(LENGTH*12)(m)]

WALL FORCES N-S Roof

Wall ID	Material	m-factor	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid 4	plain conc	3	1	12	46		1,428	0.0
Grid 10	plain conc	3	1	12	46		1,428	0.0

WALL FORCES N-S 2nd balcony

Wall ID	Material	m-factor	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid 1	URM	3	1	16	174	2,849	2,849	28.4
Grid 1 conc.	reinf conc.	3	1	10	30	565	565	52.3
Grid 1.8	reinf conc.	3	1	10	22	371	371	46.8
Grid 2a	reinf conc.	3	1	10	20	322	322	44.7
Grid 2b	reinf conc.	3	1	10	55	1,107	1,107	55.9
Grid 4	plain conc	3	1	12	56	1,338	1,338	55.3
Grid 10	plain conc	3	1	12	56	1,320	1,320	54.6
Grid 12a	reinf conc.	3	1	10	20	317	317	44.0
Grid 12b	reinf conc.	3	1	10	86	1,742	1,742	56.3
Grid 13	URM	3	1	16	174	2,789	2,789	27.8
Grid 13 conc.	reinf conc.	3	1	10	30	554	554	51.3

WALL FORCES N-S 1st balcony

Wall ID	Material	m-factor	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid 1	URM	3	1	16	174	5,193	2,344	51.8
Grid 1 conc.	reinf conc.	3	1	10	30	1,031	466	95.5
Grid 1.8	reinf conc.	3	1	10	22	673	302	85.0
Grid 2a	reinf conc.	3	1	10	20	584	262	81.1
Grid 2b	reinf conc.	3	1	10	55	2,009	902	101.5
Grid 3	reinf conc.	3	1	10	18	496	496	76.5
Grid 4	plain conc	3	1	12	56	2,419	1,081	100.0
Grid 10	plain conc	3	1	12	56	2,386	1,066	98.6
Grid 11	reinf conc.	3	1	10	18	528	528	81.5
Grid 12a	reinf conc.	3	1	10	20	574	257	79.7
Grid 12b	reinf conc.	3	1	10	86	31,557	29,815	1019.3
Grid 13	URM	3	1	16	174	5,079	2,290	50.7
Grid 13 conc.	reinf conc.	3	1	10	30	1,008	454	93.3

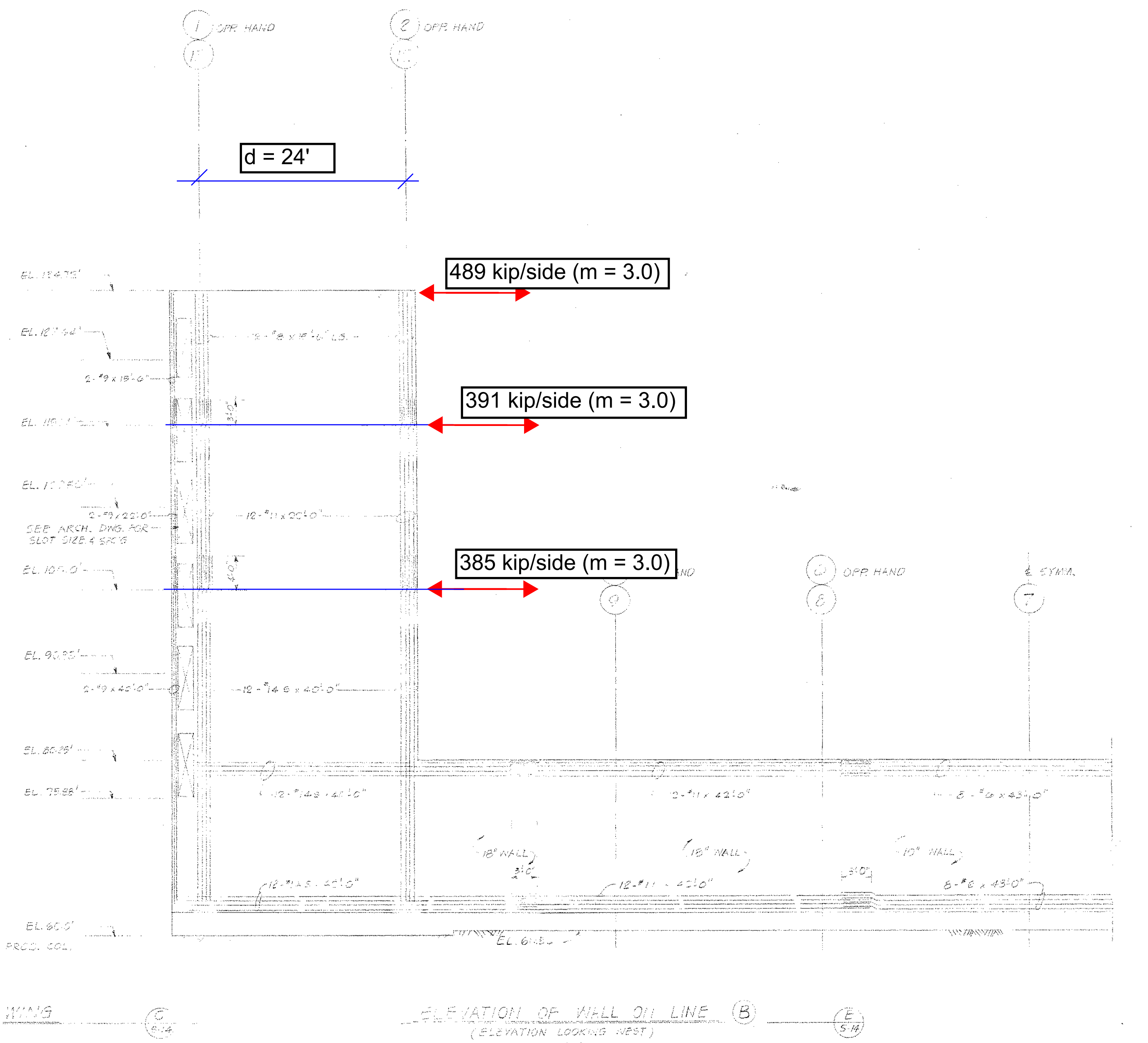
WALL FORCES N-S Main Lobby

Wall ID	Material	m-factor	Segments #	Thickness in	Tot. Length ft	Force Lvl. (kips)	delta level (kips)	shear (v) (psi)
Grid 1	URM	3	1	16	174	6,265	3,921	62.5
Grid 1 conc.	reinf conc.	3	1	10	30	1,148	682	106.3
Grid 1.8	reinf conc.	3	1	10	22	712	410	89.9
Grid 2a	reinf conc.	3	1	10	60	2,608	2,346	120.7
Grid 2b	reinf conc.	3	1	10	55	2,366	1,464	119.5
Grid 3	reinf conc.	3	1	10	18	501	5	77.3
Grid 4	plain conc	3	1	12	56	2,854	1,773	118.0
Grid 10	plain conc	3	1	12	56	2,815	1,749	116.4
Grid 11	reinf conc.	3	1	10	18	492	-36	75.9
Grid 12a	reinf conc.	3	1	10	60	2,562	2,305	118.6
Grid 12b	reinf conc.	3	1	10	86	3,778	-26,037	122.0
Grid 13	URM	3	1	16	174	6,125	3,835	61.1
Grid 13 conc.	reinf conc.	3	1	10	30	1,123	669	104.0

Project: Keller Auditorium
222 SW Clay St.
Portland, OR 97201
Client: Hennebery Eddy Architects

Date:
Page:
By:
Job #: 223051

GRID B WALLS



SHEAR CAPACITY

$\phi V_n = \phi[V_c + V_s]$

$\phi = 0.75$

$V_c = 2bd\sqrt{f'c}$

$b = 18"$

$d = 288"$

$f'c \approx 3{,}000$

$V_c = 568$ KIPS

$V_s = \frac{A_v f_y d}{s}$

$A_v = (2)\#4 = 0.40 in^2$ (PER S-1)

$f_y = 60$ KSI (PER S-1)

$S = 12"$ OC (PER S-1)

$V_s = 576$ KIPS

$\phi V_n = 858$ KIPS

$V_u = 1{,}266$ KIPS (@ BASE)

$V_u = 881$ KIPS (@ 1ST BALCONY)

ADD SHOTCRETE TO FACE

FLEXURE @ BASE

$M_u = (489^k)(55 FT) + (391^k)(39 FT) + (385^k)(20 FT)$

$M_u = 49{,}844$ K-FT

$\phi M_n = A_s F_y d$

$F_y = 60$ KSI (PER S-1)

$d = 24$ FT

$A_s = (12)\#14$ BARS $= 28.86 in^2$

$\phi M_n = 41{,}563$ K-FT $\leq 49{,}844$

ADD ADDDITIONAL FLEXURAL STEEL

D.3 - OUT OF PLANE WALL DESIGN

OUT OF PLANE WALL DESIGN (URM)

WALL FORCE (ASCE 7-16, 12.11.1)

$q_U = 0.4 S_{DS} I_e W_P$

$S_{DS} = 0.71$

$I_e = 1.25$

$W_P = (120 pcf)(1.33) = 160 psf$

$q_U = 142 psf$

LEVEL	H	H/t
1	10.25	7.7
2	9.66	7.3
3	19.25	14.5
4	16.0	12.0

t = 1.33 FT (ALL LEVELS)

WORST CASE FLEXURE (H = 19.25 - LEVEL 3)

$M_U = \frac{q_U H^2}{8} = 6.6$ K-FT/FT

ACI 440.7R-10 - CHAPTER 9

$M_n = A_f f_{fe} \left(d_f - \frac{\beta_1 c}{2}\right) + P_U \left(\frac{t}{2} - \frac{\beta_1 c}{2}\right) \geq M_U \times 12$

$d_f = 16"$

$c =$ GUESS 2"

$\beta_1 = 0.80$

$f_{fe} = 0.55 f_{fu} = 0.55 (150 ksi) = 83 ksi$

SIMPSON CSS V-WRAP

$P_U = 0.9 P_{DL} = 0.9 (7091) = 6,382 PLF = 6.38 KLF$

$t = 16"$ $= 0.53 ksi$

$M_n = A_f (1262) + (3.8 k\text{-}in) \geq 79.2 k\text{-}in/FT$

$A_f \geq 0.06 in^2/FT$

BOND TO MASONRY

$\tau = (0.06 in^2/FT)(83 ksi)\left(\frac{1"}{12}\right) = 415 psi$

Project:	Keller Auditorium	**Date:**
	222 SW Clay St.	**Page:**
	Portland, OR 97201	**By:**
Client:	Hennebery Eddy Architects	**Job #:** 223051

MASONRY AXIAL LOAD (N/S WALLS)

USE H/2 FOR SELF WT. (16" WALLS)

(137.72) PARAPET

LEVEL	H (ft)	P_{WALL} LEVEL	TRIB FLOOR/ROOF	WEIGHT FLOOR	P_{FLOOR}	P(G)	P_{TOT} LEVEL $\sum P_{LV}$
4 (119.14)	16 +2.5 PARAPET	1680	20	70 psf	1400	3080	3080
3 (100)	19.14	2811	12	100	1200	4011	7091
2 (90.33)	9.66	2304	12	100	1200	3504	10,595
1 (80.25)	10.08	1579	12	100	1200	2779	13,374
0 (68.20)	12.05	1770	12	100	1200	2970	16,344
		Σ 10,144			Σ 6,200	Σ 16,344	

STEEL STRONGBACKS

FLEXURE – WORST CASE 19.25 FT

$q_u = 142$ psf

TRIB = 8 FT

$W_u = 1136$ PLF

$M_U = W_U \ell^2/8 = 52.6$ K-FT

STEEL SECTION

$$Z_{REQ'D} = \frac{M_U \times 12}{F_Y(0.9)} = 15.3 \text{ in}^3$$

DEFLECTION (ASD)

$$\Delta = \frac{5 w \ell^4}{384 EI}(0.7) \leq \frac{\ell}{240} = 0.96$$

$I \geq 88 \text{ in}^4$

W8x28

$Z_x = 27.2 \text{ in}^3$
$I_x = 98.0 \text{ in}^4$

HSS10x6x1/4

$Z_x = 23.6 \text{ in}^3$
$I_x = 96.9 \text{ in}^4$

W10x19

$Z_x = 21.6 \text{ in}^3$
$I_x = 96.3 \text{ in}^4$

WT12x31

$Z_x = 28.4 \text{ in}^3$

$I_x = 131 \text{ in}^4$

ANCHORS TO WALL

$F_P = (80)\left(\frac{19.25 + 16}{2}\right)(3\text{ FT O.C.}) = 7.5^K$

EXISTING 3/4" Ø A.B @ 3'-0" O.C.

$\phi T_n \approx (0.75)(0.44)(36\text{ ksi}) = 11.9^K$

EXISTING 6x6 PLATE WASHER

$\sigma = \frac{F_P}{36\text{ in}^2} = 208\text{ psi}$

CLADDING SUPPORT BETWEEN STRONGBACKS (L = 96")

- ASSUME 48" O.C.

VERTICAL

$q \approx 10\text{ psf}$

$w = 40\text{ PLF}$

$\Delta = \frac{5wl^4}{384EI} \leq \frac{l}{360} = 0.27"$

$I_Y \geq 0.471\text{ in}^4$

HORIZONTAL

$q \approx 15\text{ psf}$

$w = 60\text{ PLF}$

$\Delta \leq \frac{l}{240} = 0.40"$

$I_X \geq 0.471\text{ in}^4$

TRY 4" x 2.5 x 16 GA Z-PURLINS

$I_X = 1.571\text{ in}^4$

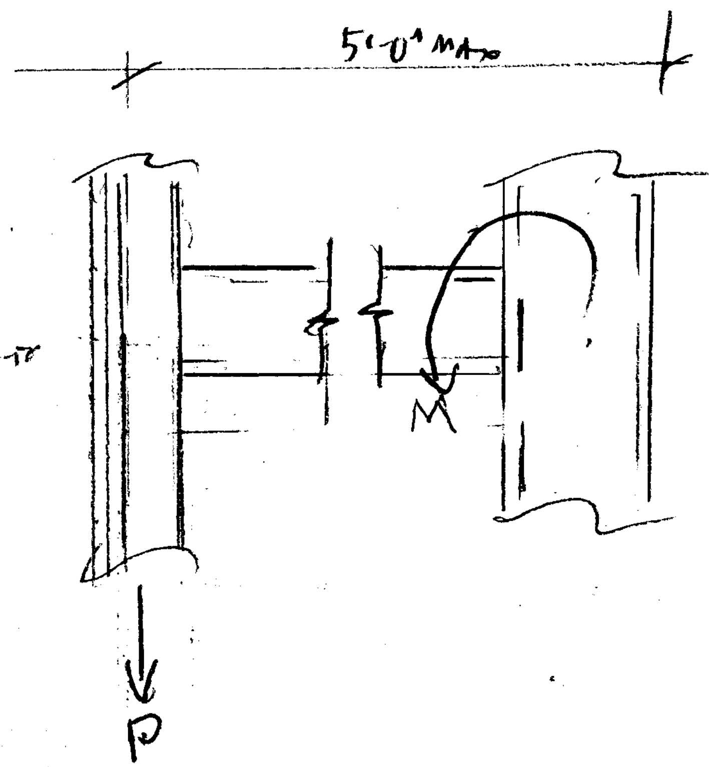
$I_Y = 0.487\text{ in}^4$

CLADDING HUNG FROM STRONGBACK

$P = (10\text{ psf})(8\text{ ft oc})(20\text{ ft trib})$

$P = 1600\text{ lb}$

$M_{DL} = P \times 5 = 8\text{ k-ft}$



STRONGBACK (HSS16×6×1/4)

$M_{TOT} = M_{DL} + M_{SEISMIC}$

$M_{U_{DL}} = 1.2(8) = 9.6\text{ k-ft}$

$M_{SEISMIC} = 52.6\text{ k-ft}$

$M_{TOT} = 62.2\text{ k-ft}$

$\phi M_n = 81.1\text{ k-ft}$

STANDOFF

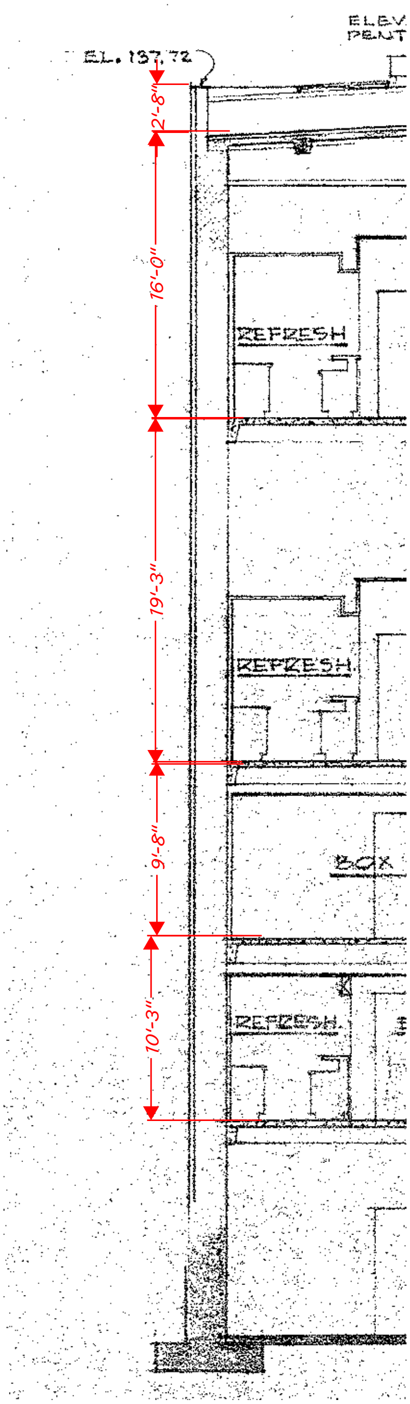
$Z \geq \dfrac{M_{DL} \times 12}{46(0.9)} = 2.3$

HSS 6×6×1/8

$Z_x = 5.92\text{ in}^3$

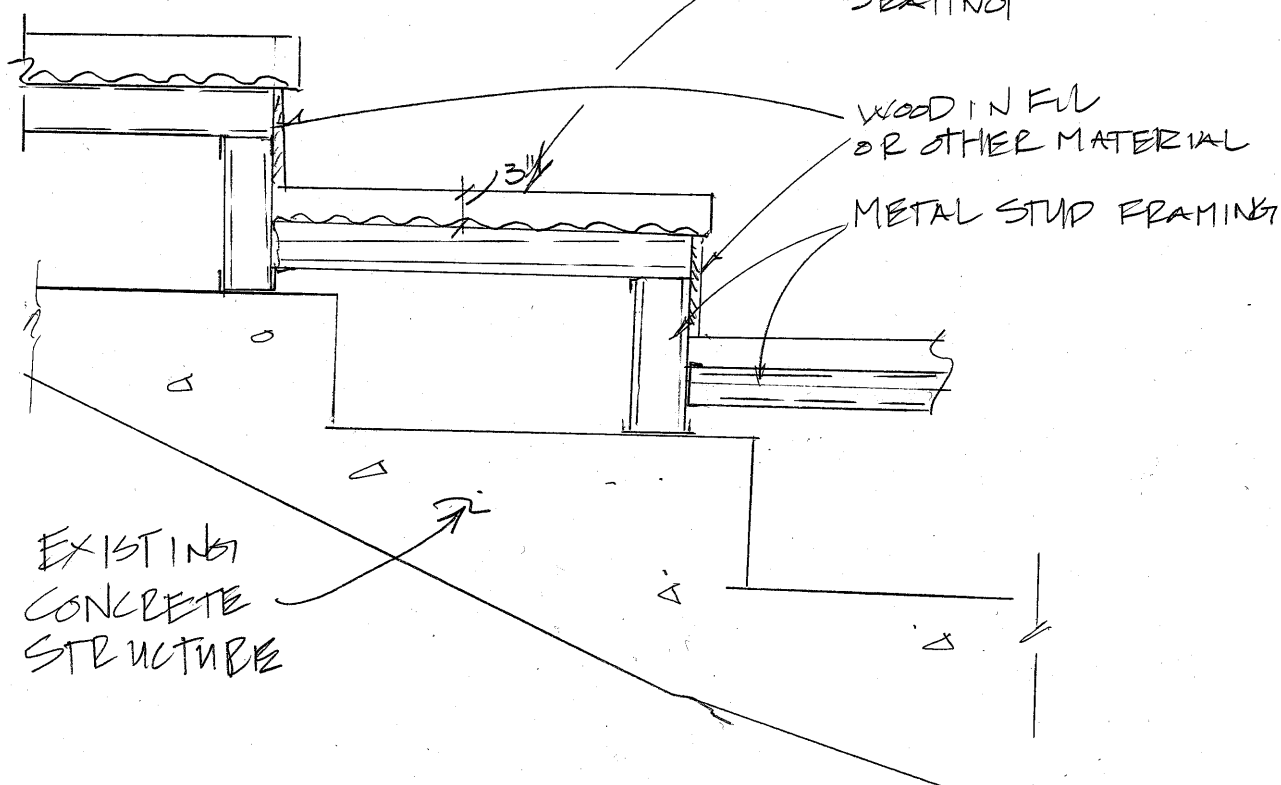
Project: Keller Auditorium
222 SW Clay St.
Portland, OR 97201
Client: Hennebery Eddy Architects

Date:
Page:
By:
Job #: 223051



D.4 - GRAVITY DESIGN AT SEATING

Project:	Keller Auditorium	**Date:**	
	222 SW Clay St.	**Page:**	
	Portland, OR 97201	**By:**	
Client:	Hennebery Eddy Architects	**Job #:**	223051



RAISED SEATING.
SECTION

Project: Keller Auditorium
222 SW Clay St.
Portland, OR 97201
Client: Hennebery Eddy Architects

Date:
Page:
By:
Job #: 223051

CONCRETE:

1. For construction joints (C.J.) not otherwise shown see Specification.
2. Pour column footings and caps in one operation after setting anchor bolts and/or dowels.
3. Stone concrete shall have minimum compressive strengths at 28 days (plus 15% for test cylinders) as follows:

Individual Columns	- 5000 psi
First & Second Balcony Beams	- 5000 psi
Pilaster Columns	- 3000 psi
All Other Stone Concrete	- 3000 psi

4. Lightweight concrete (except where used as fill only) - 3000 psi (plus 15% for test cylinder).
5. Pour concrete walls, beams, joists and slabs in one continuous operation except as noted otherwise.
6. Contractor to furnish pickup details for precast elements.
7. Electrical juncti n boxes must not be placed in joists. Provide non-structural 4" wide headers with 1 #4 bar 1" above top of junction box.

REINFORCING:

1. All reinforcing steel shall be detailed, fabricated and placed per ACI Manual 315 and Code 318-63.
2. Reinforcing steel shall have the following minimum yield strengths:

All Columns & Pilasters	- f_y = 50,000 psi
Wall Reinforcing Shown on Dwg. S-14	- f_y = 60,000 psi
All Other Reinforcing	- f_y = 40,000 psi

See "Specifications" for applicable ASTM Standards.

Except in those areas where additional reinforcing is called for on the drawings, all concrete walls shall be reinforced as follows:

6" Wall - #4 @ 12" Horizontal & Vertical Centered in wall
8" Wall - #5 @ 15" Horizontal & Vertical Centered in wall
10" Wall - #4 @ 16" Horizontal & Vertical Each Face
12" Wall - #4 @ 12" Horizontal & Vertical Each Face

For wall thicknesses other than those listed, standard reinforcing shall be 1/4 of 1% horizontal and vertical, walls larger than 10" shall have the reinforcing placed in two curtains.

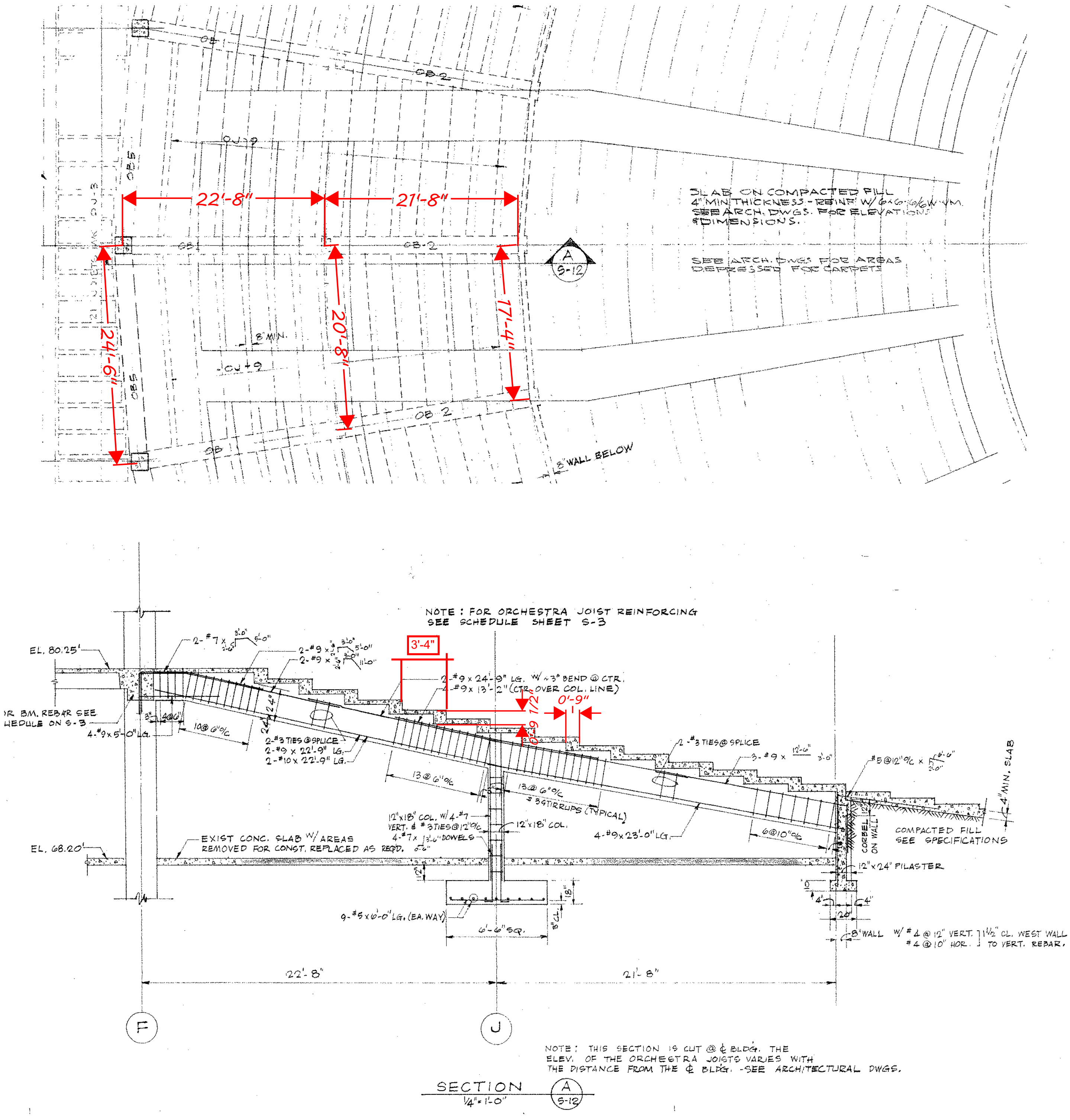
3. Concrete protection for reinforcing shall conform to ACI Standard 318-63:
4. Provide 2'-0" x 2'-0" corner bars for all horizontal wall steel at corners and intersections. Bar lap 30 diameters or 2'-0" minimum.
5. Unless noted otherwise, place 2 - #6 over, 2 - #5 under and 2 - #5 each side all openings; Vertical bars story height plus 2'-0", horizontal bars opening width plus 2'-0" each end. Place 2 - #6 bottom of all walls and 2 - #5 at all discontinuous wall ends except where noted otherwise.
6. Terminate non-continuous, bent, reinforcing bars in standard hook to within 3" of opposite face of concrete. Straight bars to extend to within 3" of opposite face of concrete at end spans.
7. Provide wall footing dowels to match wall reinforcing. Dowels to extend to within 3" of bottom of footing and lap 30 diameter or 2'-0" with wall reinforcing.
8. Where not otherwise shown, provide 0.2 of 1% temp. reinf. in slabs, placed at right angles to main reinforcing.
9. Where not noted or detailed, #4 @ 12" top bars from all slabs into concrete walls or beams, 2'-6" into slabs plus anchorage to within 2" of opposite face of wall plus standard hook.
10. Unless noted otherwise, all joist slabs to be reinf. with 4 x 12 - 8/12 W.W.M. with #8 wires perp. to joists. Place 3/4" clr. of top over joists and 3/4" clr. bottom between joists.

STRUCTURAL STEEL:

1. Structural steel shall be ASTM A-36 except as noted. Detail and fabricate to AISC Spec. (Latest Edition.)
2. All welding shall conform to AWS Standards and shall be done by certified welders - E70 electrodes low hydrogen.
3. All light gauge steel shall conform to ASTM A-245 (Latest Edition). Detail and fabricate to AISI Standards for light gauge steel construction.

Project: Keller Auditorium
222 SW Clay St.
Portland, OR 97201
Client: Hennebery Eddy Architects

Date:
Page:
By:
Job #: 223051

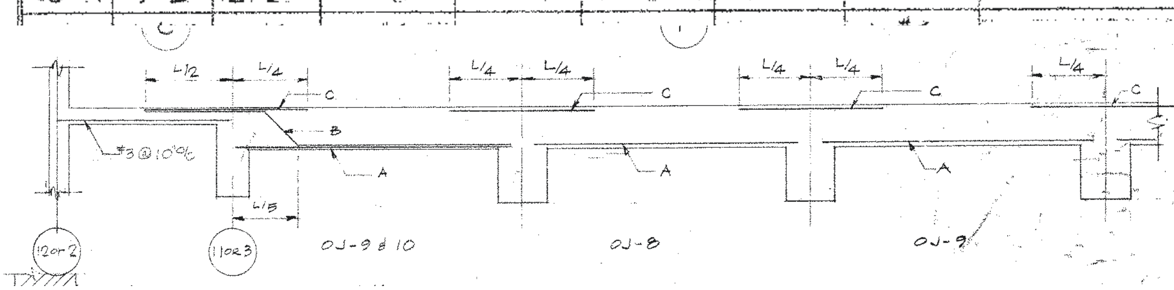


BEAM SCHEDULE

MARK	BEAM SIZE	CTR. TO CTR.	REINFORCING Nº	SIZE	LENGTH	BEND	LOCATION	REMARKS	STIRRUPS N or E END	S or W END
OB-1	24x24		FOR REINFORCING SEE SECTION (A / S-12)							
OB-2	24x24		SEE SECTION (A / S-12)							
OB-10	16x22	16'-8"	3	7	10'-4"	6T 9'-4"	TOP	LAP@MIDSPAN	#3 TORSION TIES	
			3	7	9'-4"		BOT	LAP@COL	@ 9" O/C	
OB 11	16x22	14'-6"	3	7	17'-7"		TOP	LAP@MIDSPAN		
			3	7	16'-6"		BOT	LAP@COL		

JOIST SCHEDULE

MARK	WIDTH	DEPTH	REINFORCING A	B	C	D	E	REMARKS
J-1	5½"	12+3	1-#6		1-#5*	1-#5		*OMIT WHEN ADJ. TO OJ-3
OJ-2	5½"	12+3	1-#6		1-#6	1-#5		
OJ-3	5½"	12+3	1-#4		1-#6*	1-#4		*CENTER ON SPAN
OJ-4	5½"	12+3	1-#4		1-#5	1-#4		
OJ-5	5½"	12+3	1-#5		1-#6	1-#5		
OJ-6	5½"	12+3	1-#6		1-#6	1-#6		
OJ-7	8" MIN.	10½" MIN.	2-#6	2-#5	1-#6			
OJ-8		W/ 3" SLAB	2-#6		3-#6			
OJ-9			2-#7		3-#7			
OJ-10								
OJ-11	5½"	12+3	1-#10	1-#5	1-#6		1-#10	12-#2x U@6" O/C EA END



Project:	Keller Auditorium 222 SW Clay St. Portland, OR 97201	**Date:** **Page:** **By:**	
Client:	Hennebery Eddy Architects	**Job #:** 223051	

EXISTING "CJ9"

MAXIMUM SPAN = 24'-0" (BEAM CNTR) ← MAX

MAXIMUM CLR SPAN = 22'-0"

SPACING = 3'-4" MAX.

DEAD LOAD

EXISTING:
- $[10" \times 10" + 30" \times 3"](150\ PCF)\left(\frac{1\ ft^2}{144\ in^2}\right) = 198\ PLF\ (59\ psf)$
- SEATING ≈ 5 psf
- MISC. CARPET = 1 psf
- Total: 65 psf

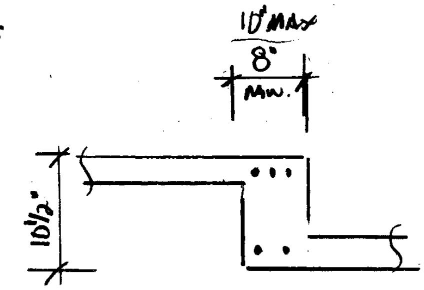
NEW:
- 3" L.W. CONC. = $\left(\frac{3}{12}\right)(110\ pcf) = 28\ psf$
- LIGHT GAGE FRAMING = 5 psf
- Total: 33 psf

LIVE LOAD = 60 psf (FIXED SEATS), 100 psf (CORRIDORS) — USE 80 psf

$q_{TOT} = 178\ psf$, $\Delta = 23\%$

$q_U = 1.2DL + 1.6LL = 246\ psf$

$W_U = 819\ PLF$



FLEXURE

$M_u^- = W_u l^2/11 = 42.9\ k\text{-}ft = 514\ k\text{-}in$ (FACE OF INTERIOR SPANS)

$M_u^+ = W_u l^2/16 = 29.5\ k\text{-}ft = 354\ k\text{-}in$ (INTERIOR SPANS)

CAPACITY

$\phi M_n^- = 0.9 F_y (d - a/2) A_s$

$A_s = (3)(0.60\ in^2) = 1.80\ in^2$

$F_y = 40\ ksi$

$(d - a/2) \approx 8\frac{1}{2}"$

$\phi M_n^- = 551\ k\text{-}in \geq 514$ OK

$\phi M_n^+ = [A_s = (2)(0.60) = 1.20\ in^2]$

$= 367\ k\text{-}in \geq 354$ OK

SHEAR (CLEAR SPAN)

$V_u = W_u l/2 = 9.0\ K$

$\phi V_n = 0.75\ (2) A \sqrt{f'_c}$

$A = (30" \times 3) + (9.5" \times 8")$

$A = 166\ in^2$

$f'_c = 3\ ksi$

$\phi V_n = 13.6\ K$ OK

EXISTING "CJB"

MAXIMUM SPAN = 17'-6 (BM CNTR.)
MAXIMUM CLR. SPAN = 15'-6"

w_u = 819 PLF (FROM PREVIOUS)

FLEXURE

$M_u^- = w_u l^2/10 = 25.1$ K-FT = 301 K-in (END CND)

$M_u^+ = w_u l^2/12 = 20.9$ K-FT = 251 K-in (END CND)

CAPACITY

$\phi M_n^- = 0.9 F_y (d - a/2) A_s$

$A_s = (3)(0.44 in^2) = 1.32 in^2$

$(d - a/2) = 8\frac{1}{2}"$

F_y = 40 KSI

ϕM_n^- = 404 K-in ≥ 301 OK

$\phi M_n^+ = [A_s = (2)(0.44) = 0.88 in^2]$

= 269 K-in ≥ 251 OK

BEAM "CB1" & "CB2"

LOADS

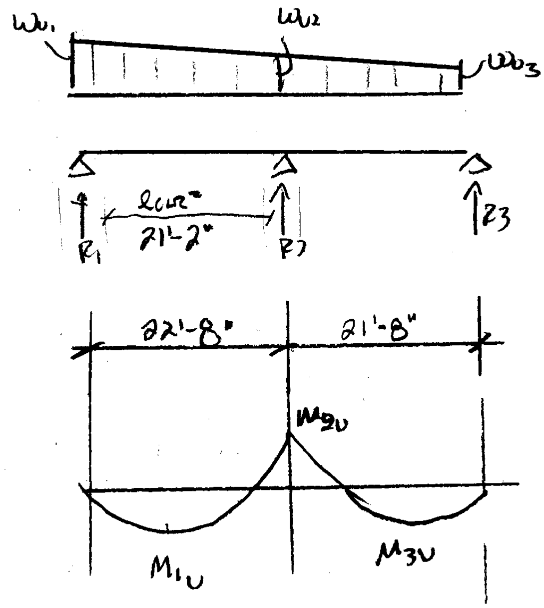
$q = 178$ psf, $q_u = 246$ psf (FROM JOISTS)

SELF WT. = [2'×2'](150) = 600 PLF

$W_{u,SELF}$ = 720 PLF

TRIB 1 = 24.5
TRIB 2 = 20.66
TRIB 3 = 17.33

W_{U1} = 6.75 KLF
W_{U2} = 5.80 KLF (INCLUDES SELF)
W_{U3} = 4.98 KLF



FLEXURE (FROM RISA)

$M_{1U}^+ = 246.5$ K-FT = 2958 K-in

$M_{2U}^- = -356.8$ K-FT = 4282 K-in

$M_{3U}^+ = 161.2$ K-FT = 1934 K-in

CAPACITY

$\phi M_{n1} = 0.9 F_y (d - a/2) A_s$

$F_y = 50$ ksi, $f'_c = 5$ ksi

$A_s = (2)(1.0) + (2)(1.23) = 4.46$ in²

$d = [24" + 4" - 2" \text{CLR.}] = 26"$

$a \approx 1"$ (FLANGE)

ϕM_{n1} = 5118 K-in ≥ 2958 OK

ϕM_{n2} = [$A_s = (6 EA)(1.0) = 6.0$ in²; $d \approx 22"$; $a = \frac{(50)A_s}{0.85(5)(24)} = 2.94$ in]

ϕM_{n2} = 5543 K-in ≥ 4282 OK

ϕM_{n3} = [$A_s = (4EA)(1.0) = 4.0$]
= 4590 K-in ≥ 1934 OK

SHEAR

$V_u = 71$ K

$\phi V_n = 0.75 [V_c + V_s]$

$V_c = 2(24 \times 22)\sqrt{5 \text{ksi}}$

$V_c = 74.7$ K

$V_s = \frac{A_s F_y d}{s}$

$A_s = (2)(0.11) = 0.22$
$F_y = 40$
$d = 22$
$s = 6"$ O.C.

$V_s = 32.3$

$\phi V_n = 80.3$ K ≥ 71

OK

EXISTING 12" x 18" COLUMN

$L_B = 5'6"$

$\phi P_n = 0.80(0.65)[0.85 f'c (Ag - Ast) + f_y Ast]$

$f'_c = 5$ ksi
$Ag = 12 \times 18 = 216$ in²
$Ast = (4)(0.60$ in²$) = 2.4$ in²
$F_y = 50$ ksi

$\phi P_n = 534$ K
$P_u = 162$ K (FROM RISA)
OK

EXISTING FOOTING

$A = 6'6"$ SQ $= 42$ SF

$f_{u_{SOIL}} = \frac{P_U}{A} = 3.8$ KSF

$f_{SOIL\,(ASD)} = \frac{P}{A} = 2.9$ KSF

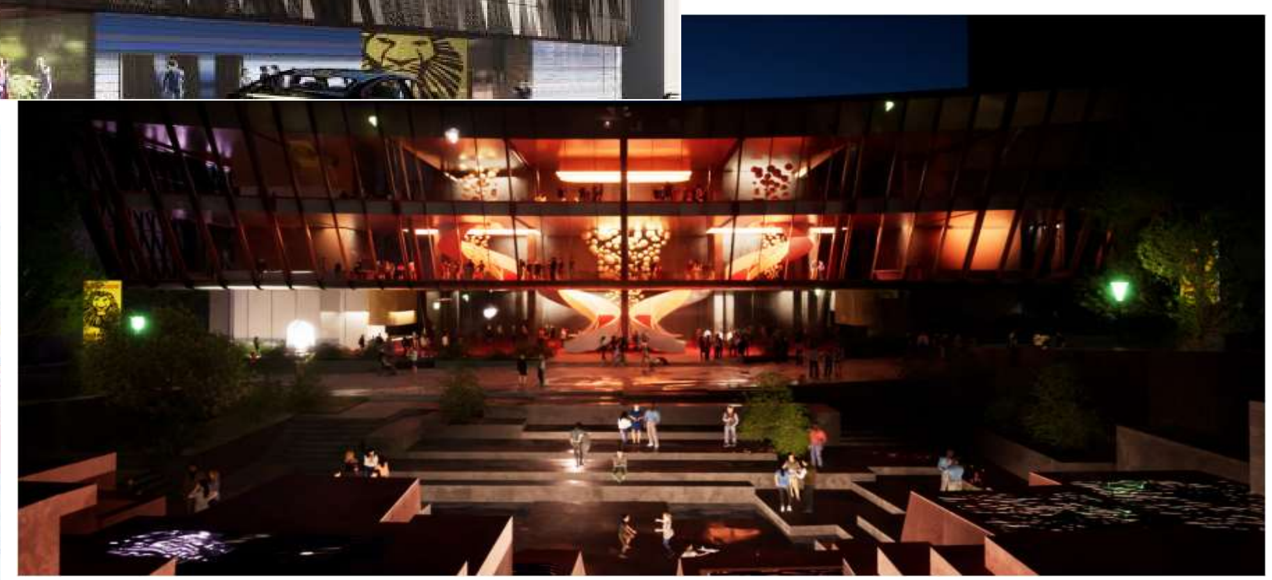
CONFIRM WITH GEOTECH

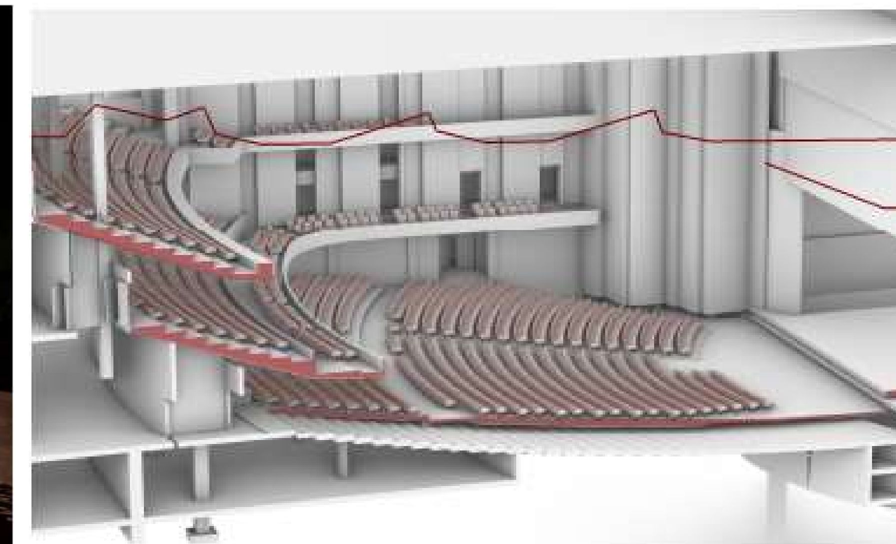
$P_{SERV.} = 120$K

(page intentionally left blank)

(page intentionally left blank)

Cost Estimate





Marking Keller

Schematic Esitmate

Preconstruction Report

DATE:	PROJECT #:	ADDRESS:	OWNER:
8/8/2023		Portland, OR	Keller

DESIGNER:	AUTHOR:
Hennebery Eddy Architects	MT / HMC

HOFFMAN CONSTRUCTION COMPANY

(page intentionally left blank)

ESTIMATE EXECUTIVE SUMMARY

The current estimate for this project is $174.9 M.

The estimate has been broken down into the following categories:
*__Demo__ - Selective demoiltion in the existing Keller Auditorium
*__Building__ - All new construction within the building.
*__Facade__ - All exterior Curtainwall and Metal Panels
*__Site__ - Includes all site improvement, incl. Site Utility updgrades

CONTINGENCY

20% Design/Estimating Contingency and 5% Construction Contingency have been included.

ESCALATION

Escalation is identified as a separate line in the attached summaries. The national and regional markets are currently in flux with different issues pushing costs both up and down. We are carrying 25% on top of the cost estimate for a Q1-2027 start date for the building.

SCHEDULE

Schedule has been figured at 28 months. An accelerated option, using overtime and/or multiple shifts has been figured at 19 months. The estimated premium for this accelerated schedule is rougly +$23M.

DESCRIPTION	TOTAL
Demo	**$8,990,157**
Existing Buiding GSF	151,011
Subtotal - Demo	$8,990,157
Building	**$137,469,523**
New Building GSF	194,813
Subtotal - Building Construction	$137,469,523
Facade	**$24,711,889**
Subtotal - Façade	$24,711,889
Building Subtotal	**$171,171,569**
Total SF	194,813
Cost/sf	$878.65
Site Develop	**$3,700,514**
Total SF	32,739
Cost/sf	$113.03
Project Total	**$174,872,084**
Total GSF	194,813
Cost/gsf	$897.64

(page intentionally left blank)

ESTIMATE CLARIFICATIONS

GENERAL ESTIMATE NOTES
Pricing is based on a Q1-2027 start date of construction

ALLOWANCES
The following allowances have been included:
- Hazardous Material Abatememt - $1,000,000
- Misc Seismic Structure Upgrades - $1,000,000
- Spray Applied Fireproofing Patching - $250,000
- Overhead Rigging Steel - $100,000
- Site Electrical Utilities + Vault - $250,000
- Storm, Sanitary, Water Utility Upgrades - $450,000
- Shoring @ 2nd Ave - $127,500

ALTERNATES (not included in Estimate)
Portland Open Space Park updgrades - $536,000

GENERAL CONDITIONS
- Plan review and permit costs are excluded
- Utility SDC charges are excluded
- Design fees for mechanical and electrical are excluded
- Power company fees for new service are not included
- Utility fees are included for construction use
- Impacts associated with archeological finds are excluded
- Testing fees are excluded

DOCUMENT BASIS
- Marking Keller - Pricing Set - 230630 (Architectural)
- Structural Pricing Set 220351
- Keller Workshop 3 - 230621

CLARIFICATIONS
Cost-of-Work Items
- Upgrades to Keller Park Fountain are excluded
- Cost premiums associated with additional Covid-19 are excluded
- Current commodity price spikes are excluded
- Budget does not consider FM Global criteria or recommendations
- Dump fees for contaminated soils are excluded
- Hazardous waste removal is excluded
- Traffic control devices (signals) are excluded
- Onsite UL testing not included
- Permanent dewatering system not included

ESCALATION
The estimate is based upon a Q1 start in 2027. 25% in escalation has been added to the estimate, 5% per year to the approximate midpoint of the project. 20% design and estimating contingency has also been included.

(page intentionally left blank)

HOFFMAN CONSTRUCTION COMPANY

Project Name	Marking Keller
Client Name	Keller
Location	Portland, OR
Date	8/8/2023

UNI-FORMAT COST SUMMARY

SCHEMATIC ESTIMATE

	System Description	Demo 151,011 S.F. Total	$/S.F.	Bldg 194,813 S.F. Total	$/S.F.	Facade Total	Site 32,739 Total	TOTAL 194,813 gsf Total	$/S.F.
A	**SUBSTRUCTURE**	**$0**	**$0.00**	**$967,431**	**$4.97**	**$0**	**$0**	**$967,431**	**$4.97**
A10	Foundations	$0	$0.00	$493,020	$2.53	$0	$0	$493,020	$2.53
A20	Basement Construction	$0	$0.00	$474,411	$2.44	$0	$0	$474,411	$2.44
B	**SHELL**	**$0**	**$0.00**	**$12,617,267**	**$64.77**	**$14,129,350**	**$0**	**$26,746,617**	**$137.29**
B10	Superstructure	$0	$0.00	$11,739,267	$60.26	$182,000	$0	$11,921,267	$61.19
B20	Exterior Enclosure	$0	$0.00	$0	$0.00	$13,947,350	$0	$13,947,350	$71.59
B30	Roofing	$0	$0.00	$878,000	$4.51	$0	$0	$878,000	$4.51
C	**INTERIORS**	**$0**	**$0.00**	**$15,588,055**	**$80.02**	**$0**	**$0**	**$15,588,055**	**$80.02**
C10	Interior Construction	$0	$0.00	$3,871,306	$19.87	$0	$0	$3,871,306	$19.87
C20	Stairs	$0	$0.00	$1,295,000	$6.65	$0	$0	$1,295,000	$6.65
C30	Interior Finishes	$0	$0.00	$10,421,749	$53.50	$0	$0	$10,421,749	$53.50
D	**SERVICES**	**$0**	**$0.00**	**$31,671,181**	**$162.57**	**$0**	**$0**	**$31,671,181**	**$162.57**
D10	Conveying	$0	$0.00	$900,000	$4.62	$0	$0	$900,000	$4.62
D20	Plumbing	$0	$0.00	$4,998,270	$25.66	$0	$0	$4,998,270	$25.66
D30	HVAC	$0	$0.00	$11,913,127	$61.15	$0	$0	$11,913,127	$61.15
D40	Fire Protection	$0	$0.00	$1,558,504	$8.00	$0	$0	$1,558,504	$8.00
D50	Electrical	$0	$0.00	$12,301,280	$63.14	$0	$0	$12,301,280	$63.14
E	**EQUIPMENT & FURNISHINGS**	**$0**	**$0.00**	**$17,413,285**	**$89.38**	**$0**	**$0**	**$17,413,285**	**$89.38**
E10	Equipment	$0	$0.00	$14,234,250	$73.07	$0	$0	$14,234,250	$73.07
E20	Furnishings	$0	$0.00	$3,179,035	$16.32	$0	$0	$3,179,035	$16.32
F	**SPECIAL CONSTRUCTION & DEMO**	**$5,019,792**	**$33.24**	**$0**	**$0.00**	**$0**	**$0**	**$5,019,792**	**$25.77**
F10	Special Construction	$0	$0.00	$0	$0.00	$0	$0	$0	$0.00
F20	Selective Building Demolition	$5,019,792	$33.24	$0	$0.00	$0	$0	$5,019,792	$25.77
G	**SITEWORK**	**$120,450**	**$0.80**	**$342,800**	**$1.76**	**$0**	**$2,115,818**	**$2,579,068**	**$13.24**
G10	Site Preparation	$120,450	$0.80	$342,800	$1.76	$0	$0	$463,250	$2.38
G20	Site Improvements	$0	$0.00	$0	$0.00	$0	$1,340,818	$1,340,818	$6.88
G30	Site Mechanical Utilities	$0	$0.00	$0	$0.00	$0	$475,000	$475,000	$2.44
G40	Site Electrical Utilities	$0	$0.00	$0	$0.00	$0	$300,000	$300,000	$1.54
Z	**Other Project Costs**	**$128,525**	**$0.85**	**$1,965,287**	**$10.09**	**$353,285**	**$52,903**	**$2,500,000**	**$12.83**
Z90	Other General Requirements	$128,525	$0.85	$1,965,287	$10.09	$353,285	$52,903	$2,500,000	$12.83
	Sub-Total	**$5,268,766**	**$34.89**	**$80,565,307**	**$413.55**	**$14,482,635**	**$2,168,721**	**$102,485,429**	**$526.07**
	Contingencies / Allowances	**$2,634,383**	**$17.44**	**$40,282,653**	**$206.78**	**$7,241,318**	**$1,084,361**	**$51,242,715**	**$263.04**
5.0%	Construction Contingency	$263,438	$1.74	$4,028,265	$20.68	$724,132	$108,436	$5,124,271	$26.30
25.0%	Design & Estimating Contingency	$1,317,191	$8.72	$20,141,327	$103.39	$3,620,659	$542,180	$25,621,357	$131.52
20.0%	Escalation to Midpoint	$1,053,753	$6.98	$16,113,061	$82.71	$2,896,527	$433,744	$20,497,086	$105.21
	TOTAL DIRECT COSTS	**$7,903,149**	**$52.33**	**$120,847,960**	**$620.33**	**$21,723,953**	**$3,253,082**	**$153,728,144**	**$789.11**
	GC'S / Insurance	**$741,233**	**$4.91**	**$11,334,274**	**$58.18**	**$2,037,479**	**$305,105**	**$14,418,090**	**$74.01**
	Supervision	$385,574	$2.55	$5,895,861	$30.26	$1,059,856	$158,709	$7,500,000	$38.50
	Preconstruction	$25,705	$0.17	$393,057	$2.02	$70,657	$10,581	$500,000	$2.57
1%	Subcontractor Default Insurance	$80,296	$0.53	$1,227,815	$6.30	$220,715	$33,051	$1,561,878	$8.02
	Street Use Fees	$18,610	$0.12	$284,574	$1.46	$51,156	$7,660	$362,000	$1.86
0.66%	Construction bond	$59,335	$0.39	$907,299	$4.66	$163,098	$24,423	$1,154,156	$5.92
0.31%	Builder's risk	$27,869	$0.18	$426,156	$2.19	$76,607	$11,472	$542,103	$2.78
1.6%	Project Insurance - GL CCIP	$143,843	$0.95	$2,199,512	$11.29	$395,390	$59,208	$2,797,953	$14.36
4.00%	**CONTRACTOR FEE**	**$345,775**	**$2.29**	**$5,287,289**	**$27.14**	**$950,457**	**$142,327**	**$6,725,849**	**$34.52**
	TOTAL CONTRACT COST	**$8,990,157**	**$59.53**	**$137,469,523**	**$705.65**	**$24,711,889**	**$3,700,514**	**$174,872,084**	**$897.64**

Escalation has been figured at 5% / year to the midpoint of construction (5 years x 5%/year = 25%)

This assumes a Q1 start in 2027. Additional construction costs for start of construction beyond Q1 of 2027 are as follows:

Q1 - 2028	$5,531,226
Q1 - 2029	$11,062,452

(page intentionally left blank)

MARKING KELLER	194,813 gsf		103,250 gsf		156,020 gsf		215,656 gsf	
System Description			**Task 1B Seismic**		**Task 2 Estimate**		**JMB New Keller**	
A - SUBSTRUCTURE	$ 967,431	$ 4.97	$ 8,904,300	$ 86.24	$ 6,766,441	$ 43.37	$ 10,518,629	$ 48.78
B - SHELL	$ 26,746,617	$ 137.29	$ 21,938,898	$ 212.48	$ 45,579,387	$ 292.14	$ 52,018,143	$ 241.21
C - INTERIORS	$ 15,588,055	$ 80.02	$ 20,260,148	$ 196.22	$ 19,743,733	$ 126.55	$ 29,351,027	$ 136.10
D - SERVICES	$ 31,671,181	$ 162.57	$ 10,371,334	$ 100.45	$ 28,888,559	$ 185.16	$ 50,181,664	$ 232.69
E - EQUIPMENT & FURNISHINGS	$ 17,413,285	$ 89.38	$ 4,716,668	$ 45.68	$ 18,110,558	$ 116.08	$ 19,991,921	$ 92.70
F - SPECIAL CONSTRUCTION & DEMO	$ 5,019,792	$ 25.77	$ 10,840,223	$ 104.99	$ 20,527,876	$ 131.57	$ -	$ -
G - SITEWORK	$ 2,579,068	$ 13.24	$ -	$ -	$ 1,222,099	$ 7.83	$ 8,877,897	$ 41.17
Z - Other Project Costs	$ 2,500,000	$ 12.83	$ 3,662,419	$ 35.47	$ 8,402,090	$ 53.85	$ 5,043,178	$ 23.39
Sub-Total	**$ 102,485,429**	**$ 526.07**	**$ 80,693,990**	**$ 781.54**	**$ 149,240,744**	**$ 956.55**	**$ 175,982,459**	**$ 816.03**
Contingencies / Allowances	$ 30,745,629	$ 157.82	$ 18,898,368	$ 183.04	$ 28,355,740	$ 181.74	$ 30,770,185	$ 142.68
GC'S / Insurance	$ 14,418,090	$ 74.01	$ 9,394,653	$ 90.99	$ 20,658,893	$ 132.41	$ 18,186,707	$ 84.33
CONTRACTOR FEE	$ 6,725,849	$ 34.52	$ 4,359,102	$ 42.22	$ 6,938,939	$ 44.47	$ 8,063,648	$ 37.39
TOTAL CONTRACT COST (today's $'s)	**$ 154,374,998**	**$ 792.43**	**$ 113,346,112**	**$ 1,097.78**	**$ 205,194,316**	**$ 1,315.18**	**$ 233,003,000**	**$ 1,080.44**
Escalation to Midpoint (+4 years)	$ 20,497,086	$ 105.21	$ 20,173,498	$ 195.38	$ 37,310,186	$ 239.14	$ 61,593,861	$ 285.61
Total w/ Escalation	**$ 174,872,084**	**$ 897.64**	**$ 133,519,610**	**$ 1,293.17**	**$ 242,504,502**	**$ 1,554.32**	**$ 294,596,861**	**$ 1,366.05**

Estimate Name: Marking Keller
Estimate Number: SD Report DRAFT 08022023
Estimate Date: Wednesday, August 02, 2023

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
A - SubStructure						
	A10 - Foundations					
	03 31 00 - Structural Concrete					
	Concrete - Foundations	175	cy	$977.38	$171,042	
	Concrete - Mat Slabs (Orch Pit)	2,416	sf	$25.20	$60,883	
	Concrete - SOG	8,695	sf	$20.77	$180,595	
	31 63 00 - Bored Piles					
	18" Drilled Piers	644	lf	$125.00	$80,500	
		Subtotal A10 - Foundations			**$493,020**	
	A20 - Basement Construction					
	03 31 00 - Structural Concrete					
	Concrete - Basin Walls (Orch Pit)	2,972	sf	$102.09	$303,411	
	07 14 00 - Fluid-Applied Waterproofing					
	Waterproofing - Below Grade Walls	4,500	sf	$8.00	$36,000	
	Waterproofing - Elevator Pits	3	ea	$2,500.00	$7,500	
	31 41 00 - Shoring					
	Shoring allow @ Basement	1,500	sf	$85.00	$127,500	
		Subtotal A20 - Basement Construction			**$474,411**	
		Subtotal A - SubStructure			**$967,431**	
B - Shell						
	B10 - Superstructure					
	03 24 00 - Fibrous Reinforcing					
	FRP Wrap @ Existing Columns	2,080	sf	$100.00	$208,000	
	03 31 00 - Structural Concrete					
	Concrete - Beams	328	lf	$305.08	$100,067	
	Concrete - Concrete Walls (incl. Shotcrete)	27,321	sf	$68.83	$1,880,504	
	Concrete - Drill & Epoxy Dowels @ Shotcrete Walls (12" oc)	3,500	ea	$100.00	$350,000	
	Concrete - Elevated Slabs	3,265	sf	$87.45	$285,529	
	Concrete - Pads and Curbs allow	1	ls	$250,000.00	$250,000	
	Concrete - SOMD - 3" topping over 3" deck	39,432	sf	$9.53	$375,787	
	Concrete - SOMD - Roof 2" topping over 2" deck	20,418	sf	$8.22	$167,836	
	Concrete - Topping Slabs (incl. overbuild)	14,638	sf	$24.91	$364,633	
	05 12 00 - Structural Steel Framing					
	Structural Steel - Cant Columns	10	tons	$8,000.00	$76,250	

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
B - Shell						
B10 - Superstructure						
05 12 00 - Structural Steel Framing						
	Structural Steel - End trusses	105	tons	$8,000.00	$839,989	
	Structural Steel - First Balcony Level	21	tons	$8,000.00	$164,873	
	Structural Steel - First Balcony Level Drag Connections	7	ea	$2,500.00	$17,500	
	Structural Steel - First Balcony Level Drag Strips	399	lf	$250.00	$99,750	
	Structural Steel - Hoisting	456	tons	$1,000.00	$455,662	
	Structural Steel - HSS 12x2 Façade Support @ 5' oc	20	tons	$8,000.00	$159,815	
	Structural Steel - LD Columns	4	tons	$8,000.00	$31,464	
	Structural Steel - LD First Balcony Level	12	tons	$8,000.00	$98,302	
	Structural Steel - LD Intermediate Level	14	tons	$8,000.00	$112,120	
	Structural Steel - LD Intermediate Level #2	17	tons	$8,000.00	$138,294	
	Structural Steel - LD Roof Level	17	tons	$8,000.00	$134,026	
	Structural Steel - LD Second Balcony Level	25	tons	$8,000.00	$200,707	
	Structural Steel - Misc Seismic Upgrades allow	1	allow	$1,000,000.00	$1,000,000	
	Structural Steel - Roof Level	74	tons	$8,000.00	$590,585	
	Structural Steel - Roof Level Level Drag Connections	7	ea	$2,500.00	$17,500	
	Structural Steel - Second Balcony Level	33	tons	$8,000.00	$260,162	
	Structural Steel - Second Balcony Level Drag Connections	7	ea	$2,500.00	$17,500	
	Structural Steel - Standoffs for Cladding	14	tons	$12,500.00	$171,612	
	Structural Steel - Stongbacks Epoxy Bolts	3,071	ea	$75.00	$230,325	
	Structural Steel - Stongbacks to (e) Concete	91	tons	$8,000.00	$728,873	
05 31 00 - Steel Decking						
	Metal Deck - First Balcony Level	5,888	sf	$8.00	$47,104	
	Metal Deck - First Balcony Level Infills	338	sf	$25.00	$8,450	
	Metal Deck - LD First Balcony Level	5,771	sf	$8.00	$46,168	
	Metal Deck - LD Intermediate Level	5,523	sf	$8.00	$44,184	
	Metal Deck - LD Intermediate Level /32	5,756	sf	$8.00	$46,048	
	Metal Deck - LD Second Balcony Level	8,196	sf	$8.00	$65,568	
	Metal Deck - Second Balcony Level	7,802	sf	$8.00	$62,416	
	Metal Roof Deck - LD Roof Level	5,744	sf	$7.00	$40,208	
	Metal Roof Deck - Roof Level	14,674	sf	$7.00	$102,718	

Estimate Name: Marking Keller
Estimate Number: SD Report DRAFT 08022023
Estimate Date: Wednesday, August 02, 2023

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
B - Shell						
B10 - Superstructure						
05 41 00 - Structural Metal Stud Framing						
	Riser Overframing - horiz	11,772	sf	$25.00	$294,300	
	Riser Overframing - plywood	15,372	sf	$7.00	$107,604	
	Riser Overframing - vert	3,600	lf	$25.00	$90,000	
05 45 00 - Metal Support Assemblies						
	Misc Metals - Allow	194,813	gsf	$3.00	$584,439	
06 11 00 - Wood Framing						
	Raise (e) Stage 18", w/ New Posts	1,675	sf	$40.00	$67,000	
	Theater Flooring	1,675	sf	$35.00	$58,625	
07 81 00 - Applied Fireproofing						
	Spray Applied Fireproofing - Existing Repair Allow	1	allow	$250,000.00	$250,000	
	Spray Applied Fireproofing - First Balcony Level	5,888	sf	$5.00	$29,440	
	Spray Applied Fireproofing - LD First Balcony Level	5,771	sf	$5.00	$28,855	
	Spray Applied Fireproofing - LD Intermediate Level	5,523	sf	$5.00	$27,615	
	Spray Applied Fireproofing - LD Intermediate Level #2	5,756	sf	$5.00	$28,780	
	Spray Applied Fireproofing - LD Roof Level	5,744	sf	$5.00	$28,720	
	Spray Applied Fireproofing - LD Second Balcony Level	8,196	sf	$5.00	$40,980	
	Spray Applied Fireproofing - Roof Level	14,674	sf	$5.00	$73,370	
	Spray Applied Fireproofing - Second Balcony Level	7,802	sf	$5.00	$39,010	
	Subtotal B10 - Superstructure				**$11,739,267**	
B30 - Roofing						
07 52 00 - Modified Bituminous Membrane Roofing						
	Membrane Roofing @ Expansion	20,500	sf	$36.00	$738,000	
	Roofing - Patching allow at (existing)	1	ls	$75,000.00	$75,000	
07 71 00 - Roof Specialties						
	Roof Fall Protection	1	ls	$50,000.00	$50,000	
	Roof Specialties	1	ls	$15,000.00	$15,000	
	Subtotal B30 - Roofing				**$878,000**	
	Subtotal B - Shell				**$12,617,267**	
C - Interiors						

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
C - Interiors						
	C10 - Interior Construction					
	09 29 00 - Gypsum Board					
	Basement Partitions and Doors	32,671	gsf	$3.00	$98,013	
	First Balcony Partitions and Doors	38,344	gsf	$20.00	$766,880	
	Ground Floor Foyer Partitions and Doors	22,854	gsf	$50.00	$1,142,700	
	Intermediate Level 1 Partitions and Doors	15,755	gsf	$10.00	$157,550	
	Intermediate Level 2 Partitions and Doors	19,939	gsf	$10.00	$199,390	
	Lower Basement Partitions and Doors	3,120	gsf	$3.00	$9,360	
	Second Balcony Partitions and Doors	34,667	gsf	$20.00	$693,340	
	Stage Level Partitions and Doors	27,463	gsf	$20.00	$549,260	
	10 14 00 - Signage					
	Signage	194,813	gsf	$1.00	$194,813	
	10 28 00 - Toilet, Bath, and Laundry Accessories					
	Toilet Accessories	1	ls	$60,000.00	$60,000	
				Subtotal C10 - Interior Construction	**$3,871,306**	
	C20 - Stairs					
	05 51 00 - Metal Stairs					
	Foyer Stairs	4	flt	$250,000.00	$1,000,000	
	Spiral Stair to Fly Tower	1	ls	$25,000.00	$25,000	
	Stairs - BOH	6	flt	$25,000.00	$150,000	
	Stairs - Misc BOH	1	ls	$20,000.00	$20,000	
	Stairs - Misc FOH rework as req'd	10	flt	$10,000.00	$100,000	
				Subtotal C20 - Stairs	**$1,295,000**	
	C30 - Interior Finishes					
	09 05 00 - Common Work Results for Finishes					
	Acoustical Ceiling Panels	1	ls	$500,000.00	$500,000	
	Basement Ceiling Finishes	32,671	gsf	$5.00	$163,355	
	Basement Floor Finishes	32,671	gsf	$4.00	$130,684	
	Basement Wall Finishes	32,671	gsf	$2.00	$65,342	
	First Balcony Ceiling Finishes	38,344	gsf	$35.00	$1,342,040	
	First Balcony Floor Finishes	38,344	gsf	$20.00	$766,880	
	First Balcony Wall Finishes	38,344	gsf	$10.00	$383,440	
	Ground Floor Foyer Ceiling Finishes	22,854	gsf	$50.00	$1,142,700	

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
C - Interiors						
	C30 - Interior Finishes					
	09 05 00 - Common Work Results for Finishes					
	Ground Floor Foyer Finishes	22,854	gsf	$20.00	$457,080	
	Ground Floor Foyer Wall Finishes	22,854	gsf	$10.00	$228,540	
	Intermediate Level 1 Ceiling Finishes	15,755	gsf	$5.00	$78,775	
	Intermediate Level 1 Floor Finishes	15,755	gsf	$10.00	$157,550	
	Intermediate Level 1 Wall Finishes	15,755	gsf	$2.00	$31,510	
	Intermediate Level 2 Ceiling Finishes	19,939	gsf	$5.00	$99,695	
	Intermediate Level 2 Floor Finishes	19,939	gsf	$10.00	$199,390	
	Intermediate Level 2 Wall Finishes	19,939	gsf	$2.00	$39,878	
	Lower Basement Ceiling Finishes	3,120	gsf	$5.00	$15,600	
	Lower Basement Floor Finishes	3,120	gsf	$4.00	$12,480	
	Lower Basement Wall Finishes	3,120	gsf	$2.00	$6,240	
	Second Balcony Ceiling Finishes	34,667	gsf	$35.00	$1,213,345	
	Second Balcony Floor Finishes	34,667	gsf	$20.00	$693,340	
	Second Balcony Wall Finishes	34,667	gsf	$10.00	$346,670	
	Stage Level Ceiling Finishes	27,463	gsf	$20.00	$549,260	
	Stage Level Floor Finishes	27,463	gsf	$20.00	$549,260	
	Stage Level Wall Finishes	27,463	gsf	$10.00	$274,630	
	09 91 00 - Painting					
	Painting	194,813	gsf	$5.00	$974,065	
				Subtotal C30 - Interior Finishes	**$10,421,749**	
				Subtotal C - Interiors	**$15,588,055**	
D - Services						
	D10 - Conveying					
	14 21 00 - Electric Traction Elevators					
	Elevator - BOH	1	ea	$300,000.00	$300,000	
	Elevator - FOH	2	ea	$300,000.00	$600,000	
				Subtotal D10 - Conveying	**$900,000**	
	D20 - Plumbing					
	22 05 00 - Common Work Results for Plumbing					
	02 - Fuel Oil Piping	194,183	gsf	$1.72	$333,995	
	03 - Waste Drainage Systems	194,183	gsf	$8.06	$1,565,115	

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
D - Services						
	D20 - Plumbing					
	22 05 00 - Common Work Results for Plumbing					
	04 - Domestic Hot & Cold Water	194,183	gsf	$4.86	$943,729	
	05 - Plumbing Fixtures/Commercial	194,183	gsf	$10.26	$1,992,318	
	06 - Condensate Piping	194,183	gsf	$0.12	$23,302	
	07 - Plumbing Equipment	194,183	gsf	$0.72	$139,812	
				Subtotal D20 - Plumbing	**$4,998,270**	
	D30 - HVAC					
	23 05 00 - Common Work Results for HVAC					
	09 - Insulation	194,183	gsf	$4.00	$776,732	
	10 - Chilled Water Piping	194,183	gsf	$3.85	$747,605	
	11 - Condenser Water Piping	194,183	gsf	$4.50	$873,824	
	12 - Heating Water Piping	194,183	gsf	$3.00	$582,549	
	13 - Hydronic Piping & Equipment	194,183	gsf	$13.00	$2,524,379	
	14 - Piping Connections	194,183	gsf	$2.00	$388,366	
	15 - Air Handling Units / Fans	194,183	gsf	$12.00	$2,330,196	
	16 - Sup/Ret/Gen Exh Duct	194,183	gsf	$5.00	$970,915	
	17 - Air Distribution Devices	194,183	gsf	$1.00	$194,183	
	18 - DDC Controls	194,183	gsf	$8.00	$1,553,464	
	19 - Air & Water Balancing	194,183	gsf	$5.00	$970,915	
				Subtotal D30 - HVAC	**$11,913,127**	
	D40 - Fire Protection					
	21 05 00 - Common Work Results for Fire Suppression					
	01 - Fire Protection	194,813	gsf	$8.00	$1,558,504	
				Subtotal D40 - Fire Protection	**$1,558,504**	
	D50 - Electrical					
	26 05 00 - Common Work Results for Electrical					
	21 - Electrical	194,813	gsf	$60.00	$11,688,780	
	26 31 00 - Photovoltaic Collectors					
	PV Arrays	175	kW	$3,500.00	$612,500	
				Subtotal D50 - Electrical	**$12,301,280**	
				Subtotal D - Services	**$31,671,181**	
E - Equipment & Furnishings						
	E10 - Equipment					

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
E - Equipment & Furnishings						
E10 - Equipment						
05 45 00 - Metal Support Assemblies						
	Loading Galleries	750	sf	$150.00	$112,500	
	Loading Gallery Railing	300	lf	$75.00	$22,500	
	Overhead Rigging Steel allow	1	allow	$100,000.00	$100,000	
	Temp Cable Paths / PVC pipe	1	ls	$50,000.00	$50,000	
	Theatrical Catwalk Railing	600	lf	$75.00	$45,000	
	Theatrical Catwalks w/ supports	1,200	sf	$100.00	$120,000	
11 13 00 - Loading Dock Equipment						
	Loading Dock Equipment	1	ls	$40,000.00	$40,000	
11 59 00 - Exhibit Equipment						
	Fountain Projection Show - projectors w/ infrastructure	1	ls	$500,000.00	$500,000	
	Ghost Light 1 - illuminated sculpture	1	ls	$215,000.00	$215,000	
	Ghost Light 1 - pedestal allow	1	allow	$25,000.00	$25,000	
	Marquee (featured atop water Painting Walls)	2	ea	$80,000.00	$160,000	
	Water Painting Walls	2	ea	$118,000.00	$236,000	
11 61 00 - Broadcast, Theater, and Stage Equipment						
	Electronic Variable Acoustics - Main Theater	1	ls	$3,000,000.00	$3,000,000	
	Fixed Theater Seating - Main Theater	2,805	ea	$650.00	$1,823,250	
	Orchestra Pit Lifts - Main Theater	1	ls	$900,000.00	$900,000	
	Portable AV Equipment - FF&E	1	ls	$350,000.00	$350,000	
	Production Light Fixtures -FF&E	1	ls	$1,000,000.00	$1,000,000	
	Production Lighting Control - Main Theater	1	ls	$400,000.00	$400,000	
	Production Lighting Control - South Rehearsal Hall	1	ls	$75,000.00	$75,000	
	Production Rigging - Main Theater	1	ls	$2,300,000.00	$2,300,000	
	Seating Wagons - Main Theater	1	ls	$450,000.00	$450,000	
	Stage Draperies - FF&E	1	ls	$250,000.00	$250,000	
27 41 00 - Audio-Video Systems						
	Production AV Systems - Main Theater	1	ls	$2,000,000.00	$2,000,000	
	Production AV Systems - South Rehearsal Hall	2	ls	$10,000.00	$60,000	
				Subtotal E10 - Equipment	**$14,234,250**	
E20 - Furnishings						

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Bldg						
E - Equipment & Furnishings						
E20 - Furnishings						
09 05 00 - Common Work Results for Finishes						
	Basement Casework/Millwork	32,671	gsf	$1.00	$32,671	
	First Balcony Casework/Millwork	38,344	gsf	$25.00	$958,600	
	Ground Floor Foyer Casework/Millwork	22,854	gsf	$30.00	$685,620	
	Intermediate Level 1 Casework/Millwork	15,755	gsf	$6.00	$94,530	
	Intermediate Level 2 Casework/Millwork	19,939	gsf	$6.00	$119,634	
	Lower Basement Casework/Millwork	3,120	gsf	$3.00	$9,360	
	Second Balcony Casework/Millwork	34,667	gsf	$25.00	$866,675	
	Stage Level Casework/Millwork	27,463	gsf	$15.00	$411,945	
				Subtotal E20 - Furnishings	**$3,179,035**	
				Subtotal E - Equipment & Furnishings	**$17,413,285**	
G - Building Sitework						
G10 - Site Preparation						
31 23 00 - Excavation and Fill						
	Excavation @ Basement/Loading Dock	1,185	bcy	$80.00	$94,800	
	Excavation @ Footings	350	bcy	$100.00	$35,000	
	Excavation @ Orchestra Pit	1,413	bcy	$80.00	$113,000	
	Footing / SOG Backfill	800	bcy	$75.00	$60,000	
31 41 00 - Shoring						
	Temp Shore (e) Footings @ Orch. Pit	4	ea	$10,000.00	$40,000	
				Subtotal G10 - Site Preparation	**$342,800**	
				Subtotal G - Building Sitework	**$342,800**	
					Subtotal Bldg	**$78,600,020**

Estimate Name: Marking Keller
Estimate Number: SD Report DRAFT 08022023
Estimate Date: Wednesday, August 02, 2023

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Demo						
F - Special Construction & Demolition						
	F20 - Selective Building Demolition					
	02 41 00 - Demolition					
	02 - Demolition - Structural	151,011	gsf	$10.00	$1,510,110	
	08 - Demo - Mechanical	151,011	gsf	$1.00	$151,011	
	08 - Demolition - Interior	151,011	gsf	$15.00	$2,265,165	
	20 - Demo - Electrical	151,011	gsf	$0.50	$75,506	
	Remove (e) Caissons	9	ea	$2,000.00	$18,000	
	02 54 00 - Biological Decontamination					
	22 - Hazardous Material Abatement	1	allow	$1,000,000.00	$1,000,000	
	Subtotal F20 - Selective Building Demolition				**$5,019,792**	
	Subtotal F - Special Construction & Demolition				**$5,019,792**	
G - Building Sitework						
	G10 - Site Preparation					
	02 41 00 - Demolition					
	AC Remvoal & Disposal	19,274	sf	$2.50	$48,186	
	Concrete Sidewalk Demo	13,465	sf	$3.00	$40,394	
	Curb Demo	1,374	lf	$5.00	$6,870	
	Misc Site Demo	1	ls	$25,000.00	$25,000	
	Subtotal G10 - Site Preparation				**$120,450**	
	Subtotal G - Building Sitework				**$120,450**	
					Subtotal Demo	**$5,140,241**

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Facade						
B - Shell						
	B10 - Superstructure					
	07 41 00 - Roof Panels					
	Metal Canopy - Complete	910	sf	$200.00	$182,000	
				Subtotal B10 - Superstructure	**$182,000**	
	B20 - Exterior Enclosure					
	07 42 00 - Wall Panels					
	Flashing & Sheetmetal	1	ls	$150,000.00	$150,000	
	Metal Wall Panels w/ Z-furring @ Fly Tower (system)	11,270	sf	$80.00	$901,600	
	08 33 00 - Coiling Doors and Grilles					
	Overhead Coiling Doors	1	ls	$25,000.00	$25,000	
	08 41 00 - Entrances and Storefronts					
	Storefront Doors	12	pr	$25,000.00	$300,000	
	08 44 00 - Curtain Wall and Glazed Assemblies					
	Curtainwall - Horiz/Soffits	3,980	sf	$200.00	$796,000	
	Curtainwall - Typical	49,850	sf	$185.00	$9,222,250	
	Curtainwall - West Elevation	10,210	sf	$250.00	$2,552,500	
				Subtotal B20 - Exterior Enclosure	**$13,947,350**	
				Subtotal B - Shell	**$14,129,350**	
					Subtotal Facade	**$14,129,350**

Estimate Name: Marking Keller
Estimate Number: SD Report DRAFT 08022023
Estimate Date: Wednesday, August 02, 2023

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Site						
G - Building Sitework						
	G20 - Site Improvements					
	10 14 00 - Signage					
	Signage - Exterior Monument Signage	1	ls	$50,000.00	$50,000	
	32 11 00 - Base Courses					
	Prep AC Paving	1,760	sf	$2.00	$3,520	
	Prep Concrete Sidewalks	11,370	sf	$2.00	$22,740	
	Prep Curbs	1,459	lf	$7.00	$10,213	
	Prep Pavers/Veh. Concrete	14,730	sf	$3.00	$44,190	
	Prep Stairs	225	lf rsr	$10.00	$2,250	
	32 12 00 - Flexible Paving					
	AC Paving Patching @ Existing	1,760	sf	$6.00	$10,560	
	32 13 00 - Rigid Paving					
	Curbs - Concrete 12"	1,056	lf	$30.00	$31,680	
	Curbs - Concrete 12", Flush	80	lf	$30.00	$2,400	
	Curbs - Concrete 12", Rolled	322	lf	$30.00	$9,660	
	Paving - Concrete Sidewalk	10,541	sf	$10.00	$105,410	
	Paving - Concrete Sidewalk Ramps	828	sf	$10.00	$8,285	
	Paving - Concrete Stairs, LED Illuminated, Wide	225	lf rsr	$150.00	$33,750	
	Paving - Vehicular Concrete under Pavers	14,730	sf	$15.00	$220,951	
	32 14 00 - Unit Paving					
	Paving - Bituminous Set Concrete Pavers	14,730	sf	$30.00	$441,900	
	32 17 00 - Paving Specialties					
	Hydraulic Bollards, Stainless Steel	6	ea	$12,500.00	$75,000	
	Removable Bollards, Stainless Steel	9	ea	$2,500.00	$22,500	
	32 33 00 - Site Furnishings					
	Bike Racks, QTY TBD	1	allow	$4,000.00	$4,000	
	Bubbler, Existing, Relocate	2	ea	$5,000.00	$10,000	
	Handrails, Stainless Steel, Exterior	66	lf	$500.00	$33,000	
	Paving - Concrete Seats, Exposed Aggregate Finish, Custom	910	sf	$200.00	$182,000	
	Repaint Traffic Signal Pole, Existing	2	ea	$1,000.00	$2,000	
	32 91 00 - Planting Preparation					
	Planting Area with Automatic Irrigation	187	sf	$15.00	$2,810	
	32 93 00 - Plants					

HOFFMAN CONSTRUCTION COMPANY

WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Site						
G - Building Sitework						
	G20 - Site Improvements					
	32 93 00 - Plants					
	Street Trees	8	ea	$1,500.00	$12,000	
				Subtotal G20 - Site Improvements	**$1,340,818**	
	G30 - Site Mechanical Utilities					
	33 11 00 - Water Utility Distribution Piping					
	Water Utilities	1	allow	$100,000.00	$100,000	
	33 31 00 - Sanitary Utility Sewerage Piping					
	Sanitary Sewer Utilities	1	allow	$100,000.00	$100,000	
	33 41 00 - Storm Utility Drainage Piping					
	Storm Sewer Utilities	1	allow	$250,000.00	$250,000	
	33 51 00 - Natural-Gas Distribution					
	Gas Utilities	1	allow	$25,000.00	$25,000	
				Subtotal G30 - Site Mechanical Utilities	**$475,000**	
	G40 - Site Electrical Utilities					
	26 56 00 - Exterior Lighting					
	Site Lighting	1	ls	$50,000.00	$50,000	
	33 71 00 - Electrical Utility Transmission and Distribution					
	Electrical Utility - vault and service	1	allow	$250,000.00	$250,000	
				Subtotal G40 - Site Electrical Utilities	**$300,000**	
				Subtotal G - Building Sitework	**$2,115,818**	
					Subtotal Site	**$2,115,818**

Estimate Name: Marking Keller
Estimate Number: SD Report DRAFT 08022023
Estimate Date: Wednesday, August 02, 2023

HOFFMAN CONSTRUCTION COMPANY

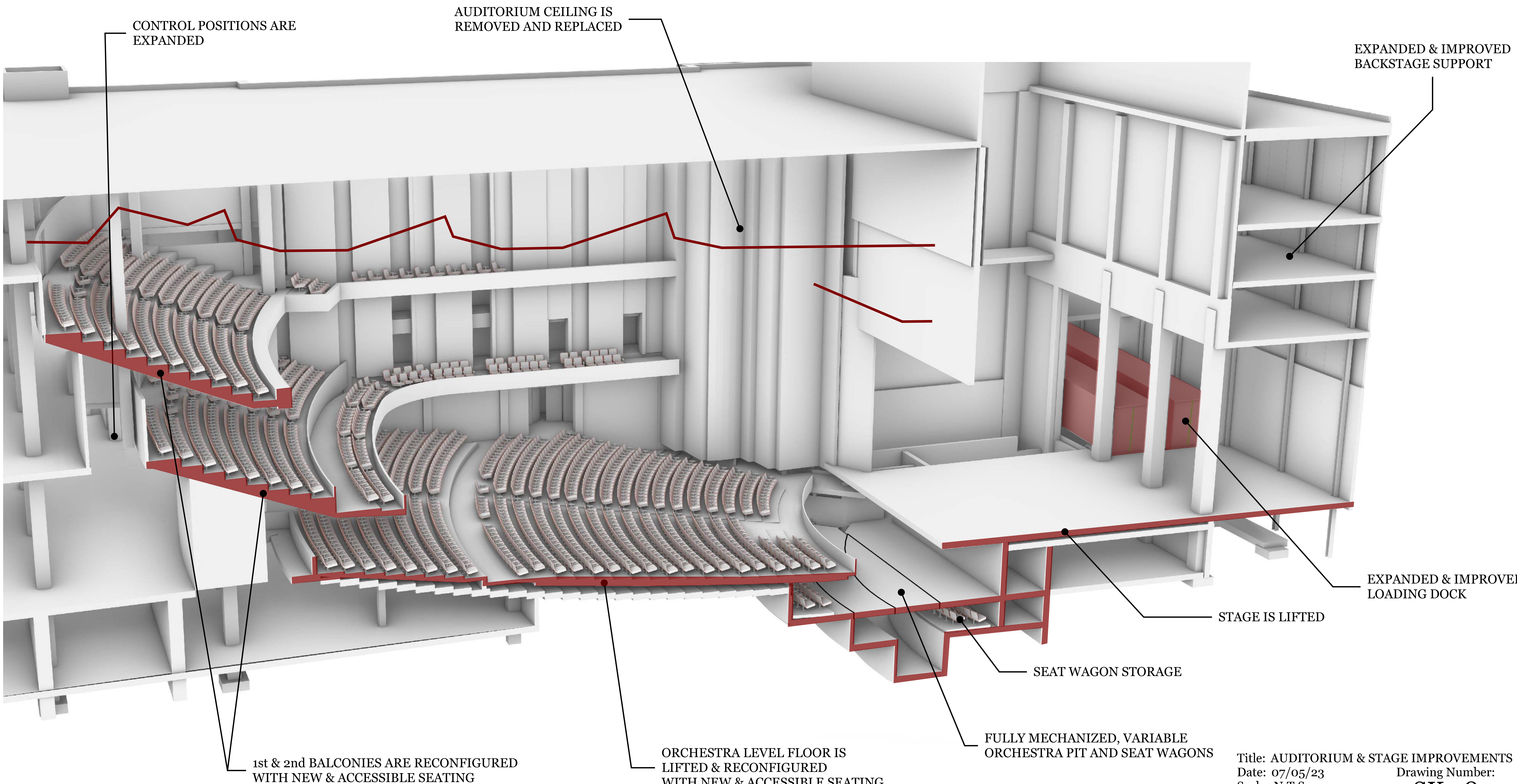
WBS	Description	Qnty	Unit	Unit Price	Aggregate	Comments
Alternate						
E - Equipment & Furnishings						
E10 - Equipment						
11 59 00 - Exhibit Equipment						
	Portland Open Space Park Lamposts (allow, 8)	8	ea	$17,000.00	$136,000	
	Portland Open Space Park Marquees(Cast Concrete)	4	ea	$80,000.00	$320,000	
	Portland Open Space Park Marquees(Illuminated Glass)	4	ea	$20,000.00	$80,000	
				Subtotal E10 - Equipment	**$536,000**	
				Subtotal E - Equipment & Furnishings	**$536,000**	
					Subtotal Alternate	**$536,000**

(page intentionally left blank)

(page intentionally left blank)

Theatrical Improvements & Equipment Budget

(page intentionally left blank)



Title: AUDITORIUM & STAGE IMPROVEMENTS
Date: 07/05/23
Scale: N.T.S.
Drawn By: KAJ/AmS

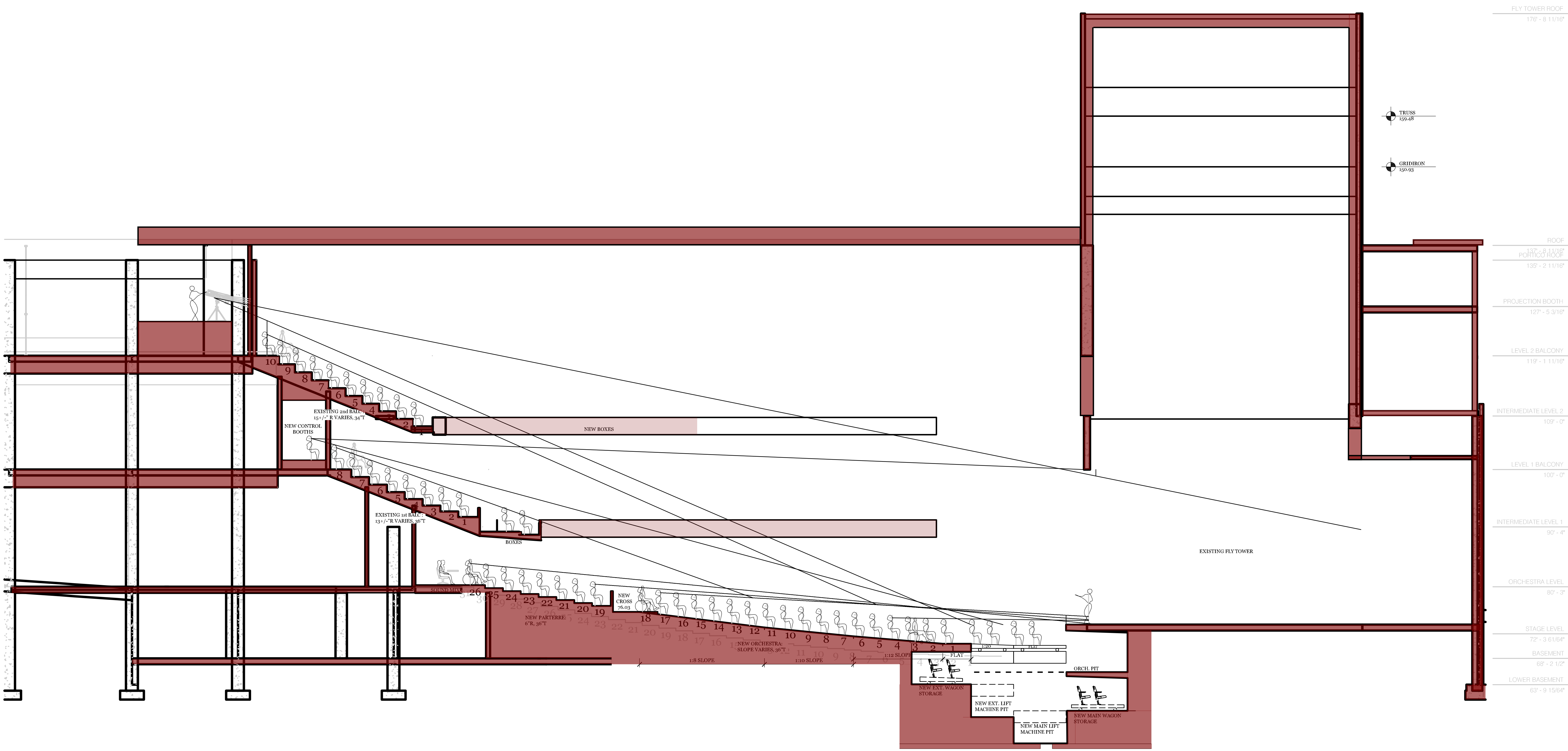
Drawing Number:
SK-18

The Shalleck Collaborative Inc.

Planning and Design of Theatres and Production Systems

1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)



1 CENTERLINE SECTION - RAISE ORCHESTRA & STAGE, PRESERVE BALCONIES
1/16"=1'-0"

Title: CENTERLINE SECTION
Date: 03/24/23
Scale: 1/16"=1'-0"
Drawn By: AmS/ECC

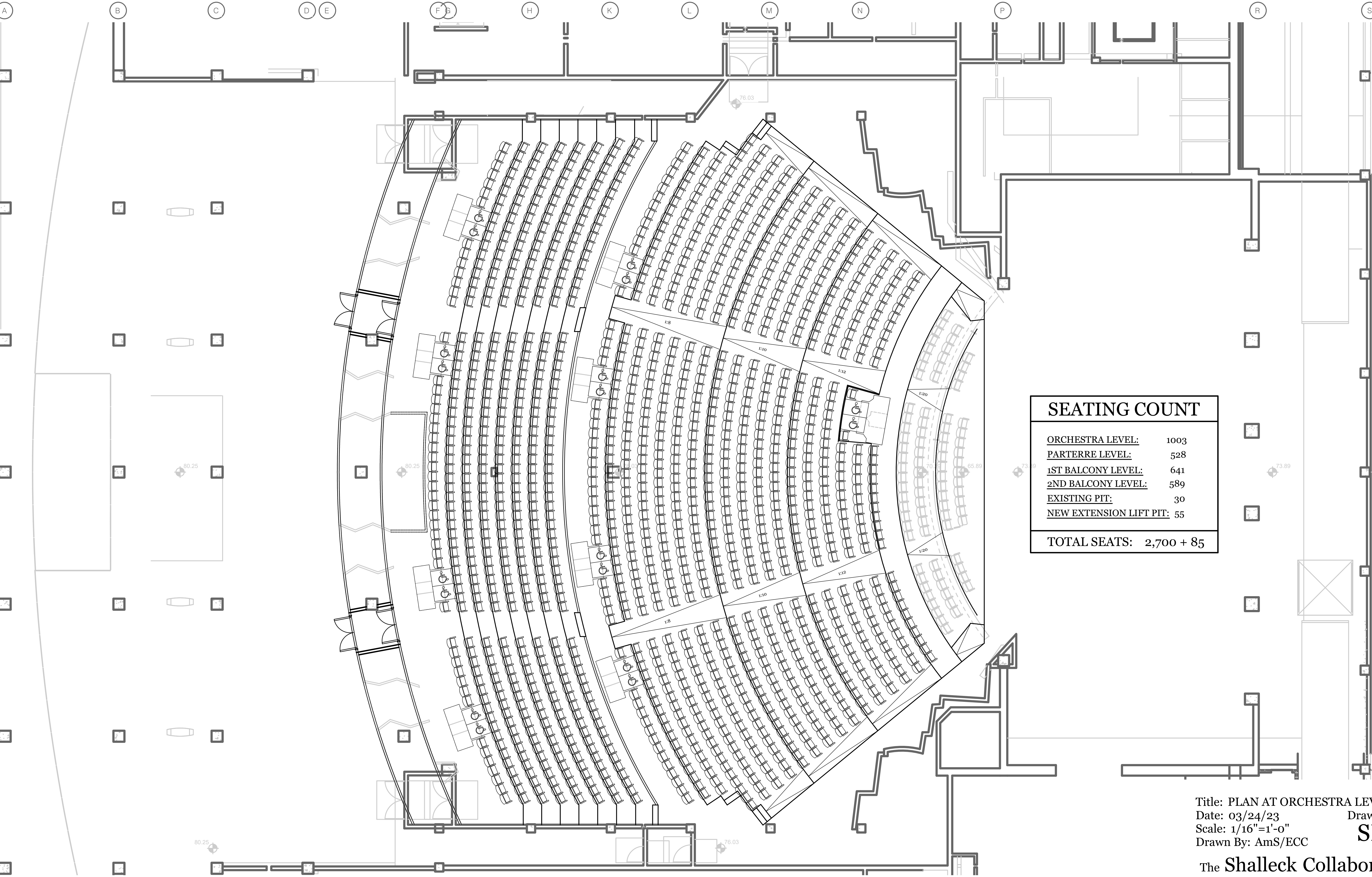
Drawing Number:
SK-13a

The Shalleck Collaborative Inc.

Planning and Design of Theatres and Production Systems

1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)



SEATING COUNT

ORCHESTRA LEVEL:	1003
PARTERRE LEVEL:	528
1ST BALCONY LEVEL:	641
2ND BALCONY LEVEL:	589
EXISTING PIT:	30
NEW EXTENSION LIFT PIT:	55
TOTAL SEATS:	2,700 + 85

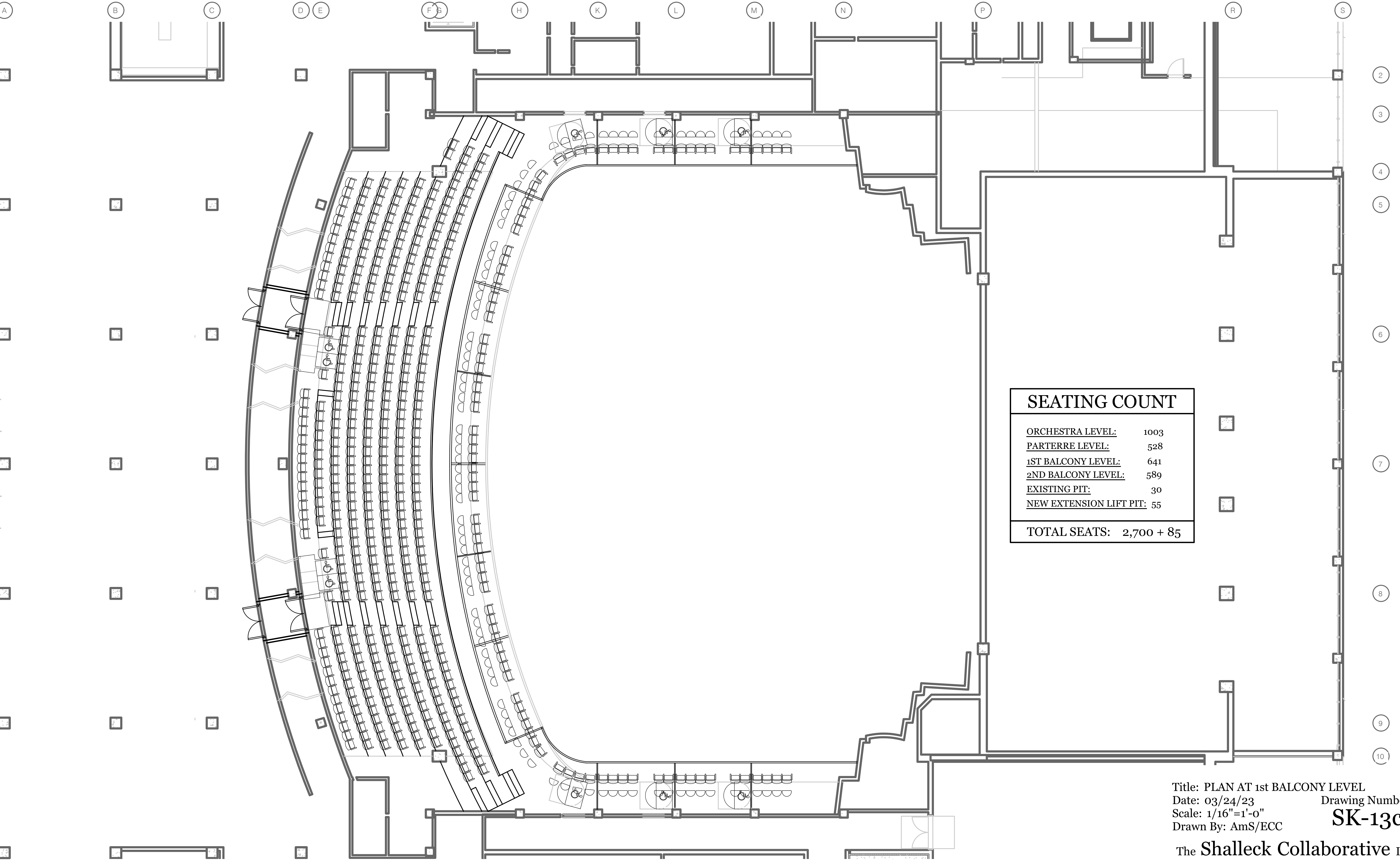
Title: PLAN AT ORCHESTRA LEVEL
Date: 03/24/23
Scale: 1/16"=1'-0"
Drawn By: AmS/ECC

Drawing Number:
SK-13b

The Shalleck Collaborative Inc.
Planning and Design of Theatres and Production Systems
1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

1 PLAN AT ORCHESTRA LEVEL
1/16"=1'-0"

(page intentionally left blank)



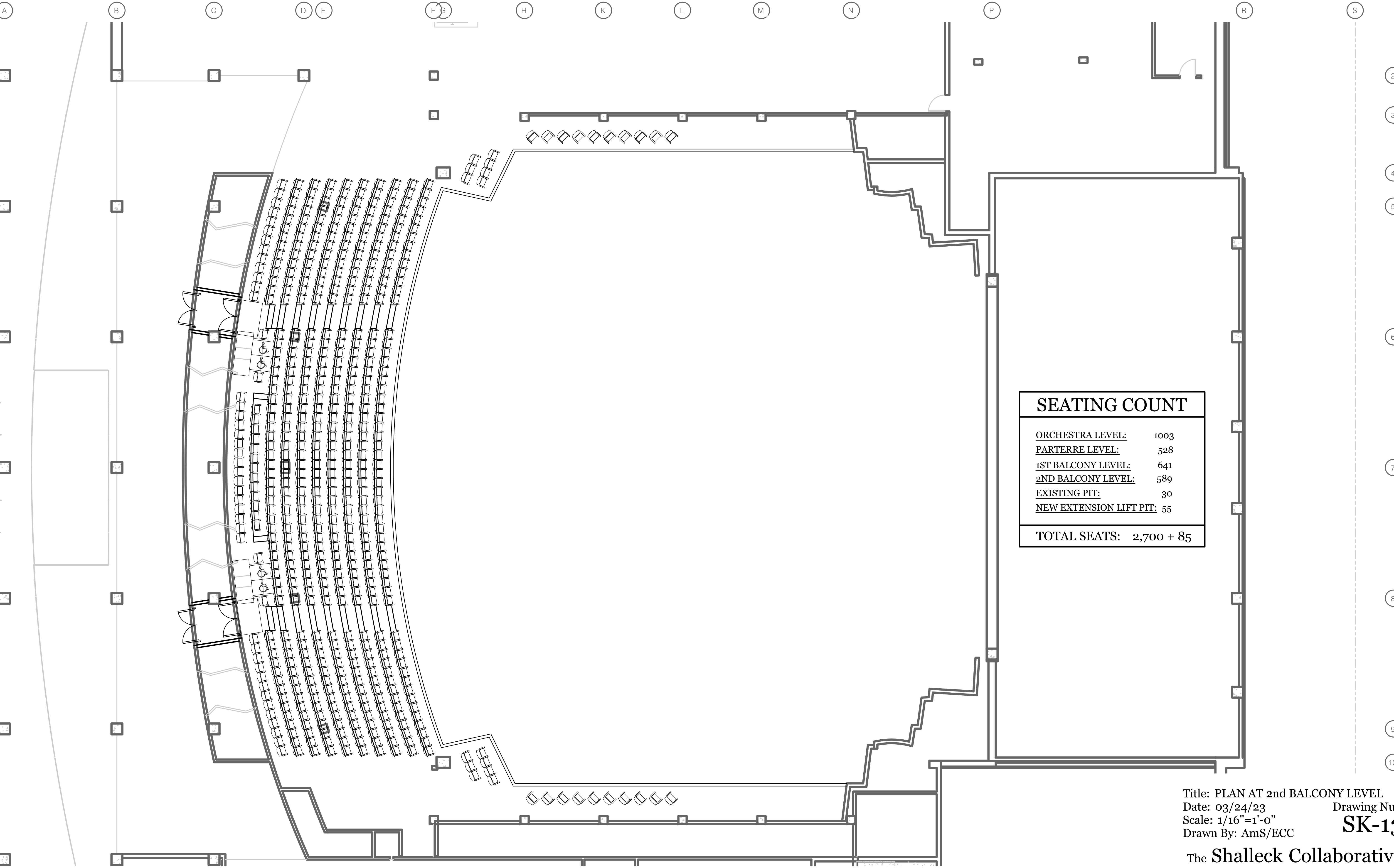
SEATING COUNT	
ORCHESTRA LEVEL:	1003
PARTERRE LEVEL:	528
1ST BALCONY LEVEL:	641
2ND BALCONY LEVEL:	589
EXISTING PIT:	30
NEW EXTENSION LIFT PIT:	55
TOTAL SEATS:	2,700 + 85

1 PLAN AT 1st BALCONY LEVEL
1/16"=1'-0"

Title: PLAN AT 1st BALCONY LEVEL
Date: 03/24/23
Scale: 1/16"=1'-0"
Drawn By: AmS/ECC
Drawing Number: SK-13c

The Shalleck Collaborative Inc.
Planning and Design of Theatres and Production Systems
1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)



SEATING COUNT

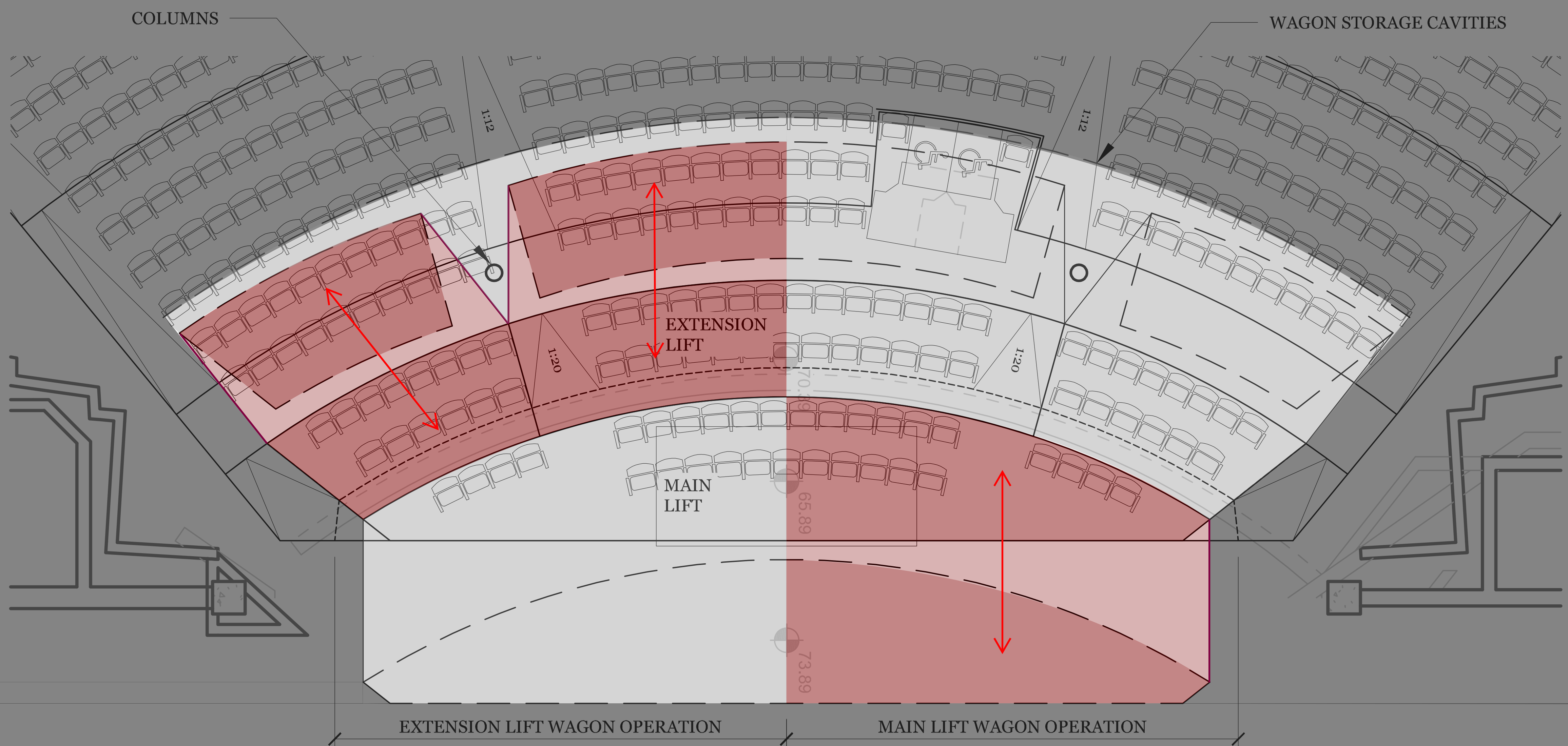
ORCHESTRA LEVEL:	1003
PARTERRE LEVEL:	528
1ST BALCONY LEVEL:	641
2ND BALCONY LEVEL:	589
EXISTING PIT:	30
NEW EXTENSION LIFT PIT:	55
TOTAL SEATS:	2,700 + 85

1 PLAN AT 2nd BALCONY LEVEL
1/16"=1'-0"

Title: PLAN AT 2nd BALCONY LEVEL
Date: 03/24/23
Scale: 1/16"=1'-0"
Drawn By: AmS/ECC
Drawing Number:
SK-13d

The Shalleck Collaborative Inc.
Planning and Design of Theatres and Production Systems
1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)



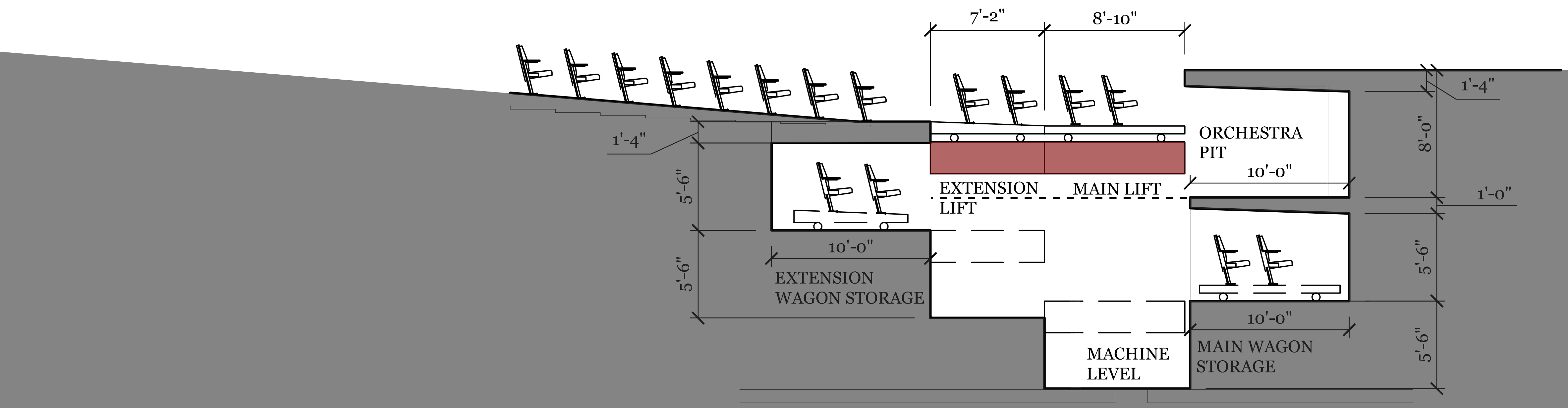
1 PLAN AT ORCHESTRA PIT
1/8"=1'-0"

Title: PLAN ORCHESTRA PIT
Date: 06/15/23
Scale: 1/8"=1'-0"
Drawn By: KAJ

Drawing Number:
SK-17a

The Shalleck Collaborative Inc.
Planning and Design of Theatres and Production Systems
1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)



Title: ORCHESTRA PIT SECTION
Date: 06/16/23
Scale: 1/8"=1'-0"
Drawn By: KAJ

Drawing Number:
SK-17b

The Shalleck Collaborative Inc.

Planning and Design of Theatres and Production Systems

1553 Martin Luther King Jr. Way
Berkeley, CA 94709
tel 415-956-4100
www.shalleck.com

(page intentionally left blank)

TRANSMITTAL / MEMO

Project:	Keller Auditorium		
Date:	June 16, 2023	*Via:*	e-mail
		Fax:	
To:	Mackenzie Pratt Henneberry Eddy Architects	*Tel:*	
From:	Adam Shalleck, FAIA Ian Hunter, CTS-D		
Re:	Production Systems Budget Report Conceptual Phase	*# of pgs. including cover:*	4

Below are listed the budget recommendations for production systems at the Keller Auditorium renovation project. Please forward this to the Cost Estimators for the project for inclusion in the total estimate. It is important to note that not all sections represent a complete and installed cost. In particular, the Cost Estimator(s) who is/are responsible for structural and electrical costs will need to include production systems infrastructure and installation (in the case of electrical) that normally falls under Divisions 5 and 26. Those major needs are described below.

The recommendations below are listed in 2023 dollars and do not include General Contractors mark-up and general conditions or overall contingencies.

1. Main Theatre

Production Rigging – Section 11 61 33 **$2.3m**
Budget includes (76) general purpose battens and (4) side battens – manual counterweight with compensating chains, (3) traveler tracks, motorized framed proscenium fire safety curtain, installed.
Related Exclusions: Structural accommodations (see fly tower configuration & loading diagram SK-7), motorized smoke hatches in 5% of stage area, electrical installation for motors & controls:
(1) 5 HP motor connection for fire curtain; 480 VAC, low voltage control infrastructure

Orchestra Pit Lifts – Section 11 61 53 **$900,000**
Budget includes (1) main orchestra pit and (1) extension lift, electro-mechanical, non-production speed (“LinkLift” or “Spiralift”), installed.
Related Exclusions: Concrete, stage flooring and surrounding safety carpentry & railings, electrical installation for motors & controls:
(4) x 15 HP motors, 480 VAC
Low voltage control infrastructure

Seating Wagons – Section 11 61 64 **$450,000**
Budget includes motor-driven, rolling seat wagons and accessories, used to provide quickly deployable fixed audience seating on the orchestra pit lifts.
Related Exclusions: Electrical service and connections for power, and control/safety systems, audience flooring, seating (listed below) and surrounding safety carpentry.

Production Lighting Control – Section 11 61 83 **$400,000**
Includes (288) 20A, 2.4kw relays for LED production lighting, relays for architectural house and work lighting. Control consoles and peripherals; architectural control processor and network components, control and circuit wiring devices. Equipment only.
Related Exclusions: *Electrical work including infrastructure, architectural lighting fixtures, emergency lighting/transfer, distribution and control wire, conduit, and complete installation.*
Note: Existing electrical load capacity will be sufficient.

Fixed Theatre Seating – Section 12 61 00 **$1.825m**
Budget includes 2,805 upholstered theatre chairs (fixed and loose), installed at $650 /chair.
Related Exclusions: Electrical connection for aisle lighting.

Production AV Systems – Section 27 41 16 **$2m**
Comprehensive system to include wiring infrastructure, video projection, digital mixing console, wireless mics, loudspeaker system, control system, production intercom, monitoring to all technical areas, mixing in booth and in-house, FM assistive listening, wire, pull and system integration and installation.
Related Exclusions: Electrical work including power systems and conduit/backboxes, see below.

Electronic Variable Acoustics – Section 11 61 34 **$3m**
Allowance to include wiring infrastructure, processing and controls, mics, loudspeaker system, wire, pull and system integration, installation and design/commissioning services.
Related Exclusions: Acoustical absorption for low reverberation time, electrical work including power systems and conduit/backboxes – allow $2m

2. South Rehearsal Hall

Production Lighting Control – Section 11 61 83 **$75,000**
Includes (24) 20A, 2.4kw relays for LED production lighting. Small control console. Control processor and network components, control and circuit wiring devices. Equipment only.
Related Exclusions: *Electrical work including infrastructure, architectural lighting control system and fixtures, emergency lighting, distribution and control wire, conduit, and complete installation.*

Production AV Systems – Section 27 41 16 **$50,000**
Small system for rehearsal use, including audio playback, wireless mics, simple controls.
Related Exclusions: Electrical work including power systems and conduit/backboxes, see below.

3. Building-Wide AV

Production AV Systems – Section 27 41 16 **$100,000**
Allowance for front-of-house and donor area AV systems.
Related Exclusions: Electrical work including power systems and conduit/backboxes, see below.

4. Fixtures, Furniture & Equipment

Stage Draperies **$250,000**
Allowance to include main curtain/border, 5 sets legs/borders, black backdrop, midstage traveler, cyc, heatstop borders

Production Lighting Fixtures **$1m**
LED and other source ellipsoidals, fresnels, moving fixtures, cyc lights, follow spotlights and accessories.

Portable AV Equipment **$350,000**
Allowance to include portable AV equipment, such as mics, stands, speakers, cables, etc.

5. Miscellaneous Aspects To Be Included In Other Sections

Electrical & Mechanical Accommodations

Electrical infrastructure and connections as listed above
(6) 400A, 3-phase, 120/208VAC camlock company switch service and devices
(2) 200A, 3-phase, 120/208VAC isolated ground camlock company switch service and devices
(8) 100A, 3-phase, 120/208VAC interlocked pin and sleeve company switch service and devices

Mechanical: significant production loads with air managed at low velocities for very low noise criteria conditions

Specialty Architectural Lighting

Public area high bay, signature lighting design

Technical Circulation:

Catwalks/railings – Approx. 300 LF technical & lighting catwalk, 4' width, railings comprised of (3) runs of 1-1/2" schedule 40 steel pipe (one of which is vertically adjustable on Unistrut), 4" toe kick, and vertical supports on 6' to 8' centers.
Stage Galleries and Gridiron – 150 LF fly and loading galleries on stage, 5'-0" wide with rails and fly tower gridiron of hangers, purlins, well channels and load rated grating walking surface and new overhead rigging steel as shown in SK-7. If gunite is applied to the inside of the fly tower walls, the existing fly galleries, loading gallery and "headblock beam" will need to be relocated and the gridiron modified. If not, existing galleries and gridiron may be conceived with some reinforcements.
Stair – Assume spiral stair to top of fly tower

Portable/Temporary Cable Paths:

Loading dock to basement below stage – 10" PVC pipe
Stage to House Mix position – 10" PVC pipe
House Mix position to Control Booth – 10" PVC pipe
Stage Area Wall Penetrations – (6), each 10" diameter
Stage Area Floor Penetrations – (4), each 10" diameter

AV Low-Voltage Conduit System (by elec):

Dedicated K-13 transformer, isolated ground system and distribution

The low-voltage portion of the AV system will comprise a significant amount of EMT conduit. The AV system is divided into five signal groups, which EACH requires its own conduit raceway:

A: Mic, B: Line, C: Video & Communications, D: Loudspeaker, E: Empty

As becomes clear, the amount of conduit becomes a significant cost factor, and should be accounted for accordingly. General guidelines:

Stage to Booth: 10 home runs, each ~250' length x 5 conduits, 1.5" typical
On stage panels: 10 panels, each with ~100' length x 5 conduits, 1.5" typical to JB
Catwalk / Grid panels: 10 panels, each with ~100' length x 5 conduits, 1.5" typical to JB
Misc Panels: 20 panels, each with ~50' length x 5 conduits, 1.5" typical to JB

Millwork: allowance for cabinets, storage racks

Dressing Rooms, Green Room & Lounges – counters, mirrors, shelves
Makeup, Wig, Wardrobe
Control Booth
Storage Rooms & Shops

Specialty Floors:

Theatre - "utility" floor assembly of:

1" dropped tongue and groove hardwood blind nailed over
2 layers ¾" A/C plywood over
2x4 treated sleepers at 16" o.c. over
shims over
concrete

End of Report

(page intentionally left blank)

(page intentionally left blank)

Geotechnical Report

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900
www.columbiawestengineering.com

August 3, 2023

Grummel Engineering, LLC
920 SW 3rd Avenue, Suite 200
Portland, Oregon 97204

Attn: Robert Grummel, PE, SE

**Re: Geotechnical Site Investigation Report
Keller Auditorium Retrofit
222 SW Clay Street
Portland, Oregon
CWE Project Number 23090**

1.0 INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) is pleased to submit this geotechnical site investigation report for the proposed Keller Auditorium Retrofit in Portland, Oregon. This letter is subject to the limitations expressed below in Section 6.0, *Limitations.*

1.1 Project Understanding

Keller Auditorium is located at 222 SE Clay Street in Portland, Oregon. It occupies a full city block bound by SW 3rd Avenue, SW 2nd Avenue, SW Market Street and SW Clay Street. The building was originally constructed in 1917 and renovated in 1968. The structure is approximately 55 feet tall, except on the east side where it approaches a height of 90 feet. Plans show that the building is supported on spread footings that are at a depth of approximately 20 feet beneath surrounding site grades. We are informed that the footings are experiencing a dead load of 1,200 psf and 2,000 psf if including live and snow loads.

1.2 Scope of Services

Columbia West's scope of services was outlined in a proposal dated March 6, 2023. The purpose of our service is to provide geotechnical engineering services for use in retrofitting the building. In accordance with our proposal, we performed the following services:

- Researched and reviewed the COP archives and our in-house files for pertinent geotechnical site information, including existing nearby facilities.
- Conducted a site reconnaissance that includes the following:
  - Drilled one boring to a depth of 70 feet below ground surface (BGS).
  - Installed a vibrating wire piezometer in the boring at a depth of 70 feet BGS.
- Performed laboratory testing on select soil samples obtained from the boring.
- Prepared this geotechnical site investigation report that includes the following:
  - Summary of subsurface conditions at the site.
  - Laboratory test reports.
  - A discussion of seismic activity near the site, liquefaction potential and anticipated deformations, and recommendations for seismic design coefficients in accordance with the procedures in ASCE 41-17.
  - Establish a shear wave velocity profile based on existing shear wave velocity measurements near the site.
  - Produce the following site-specific response spectra in accordance with ASCE 7-16, Chapter 16:
    - Serviceability Level: 72-year return period with 1.5 percent damping
    - Risk-targeted maximum considered earthquake: 2,475-year return period
    - Short- and long-period CMS for the site

- Soil parameters for use in computing soil spring stiffness and strength of soil bearing in accordance with ASCE 41-17 Chapter 8.
- Passive soil resistance recommendations similar to that in Figure 8-6 of ASCE 41-17.
- Pile foundation recommendations including:
    - Axial capacity in tension and compression of 12-inch and 18-inch augered cast-in-place (ACIP) piles
    - Soil input parameters for computing lateral pile response with the LPILE program

2.0 GEOTECHNICAL INVESTIGATION

2.1 Regional Geology

Review of published geologic literature indicates the site in underlain by fine-grained facies (Pleistocene-aged) alluvium deposited by catastrophic Missoula floods (Ma et al., 2012). The alluvium includes deposits of silt and sand. Underlying the alluvium in the site vicinity are the very dense sand and gravel deposits of the Troutdale Formation. Beneath the Troutdale Formation is the Grande Ronde Basalt, a member of the CRBG (Middle Miocene).

2.2 Subsurface Exploration Program

This study included drilling one boring (B-1) drilled to a depth of 70.25 feet BGS with a truck-mounted drill on April 26, 2023. A vibrating wire piezometer (P-1) was installed in the boring at a depth of 70 feet BGS. The boring location is indicated on Figure 2.

Disturbed samples were collected from the boring at representative depth intervals using 1½-inch diameter split-barrel samples during the performance of standard penetration tests (SPTs) in general accordance with ASTM D1586. The sampler was driven into the soil with a 140-pound hammer free falling 30 inches. The sampler was driven a total distance of 18 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the exploration log, unless otherwise noted. The hammer was lifted using an automatic hammer with a reported efficiency of 77.5 percent. A copy of the hammer calibration report is on file at our office. Sampling methods and intervals are shown on the exploration log. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications.

The boring was drilled through an existing 5.5-inch concrete slab. Underlying the concrete, alluvial deposits that consist of stiff lean clay, loose to medium dense silty sand, and very stiff sandy silt were observed to approximately 46 feet BGS where the Troutdale Formation was encountered. The Troutdale Formation encountered in the boring consists of very dense gravel with silt and sand to a depth of 65 feet BGS underlain by very hard sandy lean clay to the terminal depth of the boring at 70.25 feet BGS.

Groundwater was not observed during drilling activities due to mud rotary drilling conditions. A vibrating wire piezometer (VWP) was installed in the boring at the time of drilling. We measured groundwater at a depth of approximately 59 feet BGS on May 5, 2023,

The boring log is presented in Appendix A. Laboratory test results on samples obtained from the boring are presented in Appendix B. Soil and rock classification information is provided in Appendix C. A photo log is presented in Appendix D.

3.0 REGIONAL SEISMICITY

3.1 Earthquake Sources

Three earthquake sources were considered for this study consistent with the local seismic Setting. Two of the possible earthquake sources are associated with the CSZ, and the third source is a shallow, local crustal earthquake that could occur in the North American Plate. The three earthquake sources are discussed below.

3.2 Regional Events

The CSZ, which is the convergent boundary between the North America Plate and the Juan de Fuca Plate, lies offshore on the west coast of the United States from northern California to southern British Columbia. The two plates are reportedly converging at a rate of approximately 3 to 4 centimeters (approximately 2 inches) per year. In addition, the northward-moving Pacific Plate is pushing the Juan de Fuca Plate north, causing complex seismic strains to accumulate.

Earthquakes are caused by the abrupt release of this slowly accumulated strain. Evidence suggests that CSZ earthquakes are capable of producing magnitudes up to approximately Mw 9.0 and are generally thought to occur on average every 500 years. The recurrence interval, however, has apparently been irregular, as short as approximately 100 years and as long as approximately 1,100 years. The last of these great earthquakes occurred in the Pacific Northwest in January 1700. Two types of subduction zone earthquakes are possible and considered in this study:

1. An interface event earthquake on the seismogenic part of the interface between the Juan de Fuca Plate and the North American Plate within the CSZ. This source is capable of generating earthquakes with an Mw as large as 9.0.
2. A deep intraplate earthquake on the seismogenic part of the subducting Juan de Fuca Plate. These events typically occur at depths between 30 and 60 km. This source is capable of generating an event of up to Mw 7.5.

3.3 Local Events

A significant earthquake could occur on a local fault near the site within the design life of the facility. Such an event would cause ground shaking at the site that could be more intense than the postulated CSZ events, although the duration would be shorter. The closest and most significant fault in the site vicinity is the Portland Hills fault.

The Portland Hills fault has a mapped length of 49 km and is mapped beneath the site. The northwest-striking Portland Hills fault forms the prominent linear northeastern margin of the Tualatin Mountains (Portland Hills) and the southwestern margin of the Portland Basin; this basin may be a right-lateral, pull-apart basin in the forearc of the CSZ or a piggyback synclinal basin formed between antiformal uplifts of the Portland fold belt. The fault is part of the Portland Hills-Clackamas River structural zone, which controlled the deposition of Miocene CRBG lavas in the region. The crest of the Portland Hills is defined by the northwest-striking Portland Hills anticline. Sense of displacement on the Portland Hills fault is poorly known and controversial. The fault was originally mapped as a down-to-the-northeast normal fault. The fault has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults and as a steep escarpment caused by asymmetrical folding above a southwest-dipping blind thrust. Reverse displacement with a right-lateral, strike-slip component may be most consistent with the tectonic setting, mapped geologic relations, aeromagnetic data, and microseismicity in the area. Fault scarps on surficial Quaternary deposits have not been described along the fault trace, but some geomorphic (steep, linear escarpment, triangular facets, over-steepened, and knick-pointed tributaries) and geophysical (aeromagnetic, seismic reflection, and ground penetrating radar) evidence suggest

Quaternary displacement. Because the location of the fault is poorly known and controversial, it is our opinion that the risk of fault rupture at the site is low.

3.4 Liquefaction and Lateral Spreading

Soils susceptible to liquefaction and associated lateral spreading were not encountered in the boring. This is consistent with our experience in the site vicinity.

4.0 FOUNDATION SUPPORT RECOMMENDATIONS

4.1 Shallow Foundation Recommendations

4.1.1 Bearing Capacity

Footings founded on the native soil should be proportioned for a maximum allowable soil bearing pressure of 4,000 pounds per square foot (psf) or an ultimate bearing capacity of 12,000 psf. A safety factor of 3 was applied to the ultimate bearing capacity. These values assume foundation elevation is 20 feet beneath the surrounding street grade.

We recommend that new isolated column and continuous wall footings have minimum widths of 18 and 16 inches, respectively. The bottom of exterior footings should be founded at least 18 inches below the lowest adjacent grade. Interior footings should be founded at least 12 inches below the bottom of the floor slab. We recommend that a Columbia West representative evaluate all new footing subgrade before concrete forms are placed.

4.1.2 Lateral Resistance

Lateral loads can be resisted by passive earth pressure on the sides of footings and by friction on the base of footings. We recommend that a friction coefficient of 0.35 be used to compute the frictional resistance for footings bearing on native soil.

A maximum equivalent fluid unit weight of 350 pounds per cubic foot is recommended to compute passive earth pressure acting on footings constructed in direct contact with compacted structural fill or native soil. It will require some translation of the footing to mobilize the maximum passive resistance. Figure 3 can be used to compute the mobilize passive force based on lateral footing displacement.

The passive resistance value provided above is based on the assumptions that the adjacent, confining structural fill or native soil is level and that groundwater remains below the base of the footing. The top 1 foot of soil should be neglected when calculating lateral earth pressures unless the foundation area is covered with pavement or inside a building.

4.1.3 Settlement

Assuming maximum column loads of 300 kips we estimate that the total foundation settlement for new footings will be less than 1 inch. Differential settlement of ½ inch should be expected between footings with similar loads. These values were estimated assuming that the footing subgrade is prepared in accordance with the recommendations provided in this report and that the subgrade does not contain significant pockets of unsuitable material within the depth of influence of any footings.

4.1.4 Foundation Stiffness Parameters

Foundation stiffness parameters were based on nearby shear wave velocity measurements from the collected by others at the Columbia Development located at 140 SW Columbia Street as well as the boring drilled for this project. Results of the shear wave velocity testing are presented in Appendix C

Foundation stiffness parameters were determined in general conformance with the procedures and recommendations of in Section 8.4 of ASCE 41-17 and the NCHRP 368. The nonlinear variation of soil stiffness with applied bearing stress has been accounted for using a model calibrated in well-instrumented field load tests on shallow spread footings. The results of this analysis provide a hyperbolic stress – displacement relationship; therefore, soil nonlinearity is included in the assessment of foundation stiffness. It is our understanding that the dynamic structural response model simulates the foundation stiffness using springs with displacement-dependent secant moduli from the trilinear fit to the hyperbolic stress – displacement curves. Figure 4 provides the best estimate bearing stress – displacement trends from which the foundation stiffness parameters for varying spread footings sizes can be determined.

Upper- and lower-bound stiffnesses are required to bound dynamic analysis. It is important to note that the bounding exercise is required to specifically assess the structural response of foundations and is not a geotechnically required exercise to determine appropriate soil bearing. ASCE 41-17 and current practice suggests that a factor of 2 on the upper- and lower-bound limits is generally appropriate in lieu of explicit evaluation. The commentary in Section 8.4.2 suggests that the bounding range could be narrowed to that defined by multiplying and dividing by (1 +Cv) where Cv is the coefficient of variation. The commentary states that in no case should Cv be taken to be less than 0.5 for foundations controlled by sliding or bearing deformations. In our opinion, a bounding factor of 2 for upper- and lower-bound stiffness is overly conservative and can be reduced to 1.5, as suggested in the commentary of ASCE 41-17 (Section C8.42). This assessment is based on the following considerations:

1. The consistency of the subsurface conditions observed in the explorations in the depth intervals of interest for the spread footings.
2. The site-specific shear wave velocity testing at the site, which provides low-strain stiffness or the foundation soils (i.e., correlations with secondary geotechnical parameters have not been used to estimate the low-strain stiffness, thereby reducing uncertainty).
3. The foundation soil is not cyclically degradable.
4. Rate effects on the stiffness and strength of foundation soil are negligible.
5. Nonlinear soil behavior has been approximated using procedures commonly applied for shallow foundations, which provide a more refined and site-specific trend in foundation stiffness with applied bearing stress than would be obtained using the procedures in Chapter 8 of ASCE 41 (e.g., effective shear modulus approximation, stiffness, and Kz computed using the formulas based on elastic solutions [Figure 8-2]).

In our opinion, the lower bound for structural analysis should be 0.85 times the best estimate stiffness on Figure 4. The upper bound for structural analysis should be 1.5 times the best estimate stiffness on Figure 4.

4.2 PILE FOUNDATION RECOMMENDATIONS

4.2.1 Allowable Vertical Pile Load Capacity

Cast in place concrete piles can be used for support of structural features. Piles will achieve their capacity from end bearing and friction in the underlying gravel. Figure 5 presents the allowable bearing capacities for 12- and 18-inch diameter cast in place concrete piles. We recommend the tips of all piles penetrate at least 5 feet into the very dense gravel unit encountered at approximately 46 feet BGS. Our estimates of allowable capacities include a factor of safety of 3 in compression and 2.0 in tension.

Computed pile capacities presented in this report are based only on a soil-pile relationship. The structural capacity of individual piles and their connections to transmit these loads and any connections with the piles and structures, especially in tension, should be determined by a structural engineer.

4.2.2 Pile Settlement

We estimate settlement of cast in place concrete piles will be negligible beyond the elastic compression of the pile.

4.2.3 Lateral Pile Resistance

Resistance to lateral loads can be developed by passive pressure on the face of pile caps, grade beams, tie beams, and other buried foundation elements. Sliding friction on the base of pile-supported foundation elements should be ignored. Assuming a minimum translation of 1.0 inch, the allowable passive resistance on the face of buried foundation elements may be computed using an equivalent fluid pressure of 300 pcf for foundation elements above groundwater.

Recommended soil input parameters for computing lateral pile response with the LPILE program are presented below in Table 1. Columbia West should be consulted regarding the use of these parameters prior to being used at other locations or for other purposes at the site. We have prepared these soil parameters under the assumption the LPILE analyses will be performed using cyclic loading conditions. If static loading conditions are used, Columbia West should be contacted to provide additional recommendations. Columbia West is available to review the final results of the LPile analysis, if needed.

Table 1. Recommended LIPLE Soil Input Parameters

Layer No.	Recommended p-y Curve Type	Depth to Top of Soil Layer (feet BGS)	Depth to Bottom of Soil Layer (feet BGS)	Effective Unit Weight (pcf)	Friction Angle (degrees)	Undrained Shear Strength (psf)	Soil Modulus Parameter, k (pci)	Soil Strain Parameter, E50 (unitless)
1	Stiff Clay with Free Water (Reese)	0	10	110	0	1,200	200	0.007
2	Sand (Reese)	10	46	115	30	0	60	-
3	Sand (Reese)	46	59	135[1]	35	0	225	-

[1] Effective unit weight values presented in this table are for soil layers above the groundwater table. Subtract 62.5 pcf for soil layers below the groundwater table (59 feet BGS at the location of our boring).

Lateral reduction factors should be applied to closely-spaced pile foundations. Table 2 presents our recommended reduction factors.

Table 2. Lateral Pile Response Reduction Factors

Pile Center to Center Spacing (in direction of lateral load)	Lead Row	Row 2	Row 3
3D	0.70	0.50	0.35
4D	0.85	0.65	0.50
5D	1.0	0.85	0.70
6D	1.0	1.0	1.0

4.2.4 Installation of Cast-in-Place Concrete Piles

Prior to installation of any grout, the grout pump should be calibrated in units of volume per stroke. In addition, grout pressure and volume should be recorded for every 5 feet of installation. Finally, the theoretical volume of grout should be compared to the total grout volume used for each pile to determine the percent over theoretical volume. The volume of grout placed for any segment should be greater than the theoretical volume by at least 10 percent.

Augercast piles should be made by rotating a continuous flight hollow shaft auger into the ground to the necessary depth in order to develop the required load capacity. The auger should be continuous without gaps or breaks and should have a uniform diameter throughout its length. Considering augercast pile lengths shown on Figure 5 exceed 40 feet, we recommend a middle guide be used. Adjacent piles should not be installed until the pile has set for a sufficient period, as determined by the structural engineer, to withstand earth pressures exerted by the installation process. Normally, a minimum 24-hour set time is recommended.

If reinforcing cages are used, they should be centered in the bore hole by the use of centralizers or other systems. Cross bracing within the reinforcing cage should not be allowed in order to minimize the potential for void development in the concrete.

The grout should be designed to provide adequate strength to support the anticipated design load. The grout head should be at least 5 feet higher than the fluid levels in the bore hole and/or the bottom of the auger at all times. The grout should be placed continuously from bottom to top while the auger rotates during withdrawal.

5.0 SEISMIC ANALYSIS

As requested, we have provided seismic coefficients in accordance with ASCE 41-17. Our scope of work also included a probabilistic seismic hazard analysis (PSHA) to produce the following response spectra for the site:

- Service level earthquake (SLE): 72-year return period with 1.5 percent damping
- Risk-targeted maximum considered earthquake (MCE_R): 2,475-year return period.
- Short- and long-period conditional mean spectra (CMS) for the site

5.1 Shear Wave Velocity

The building has a one level below grade basement and the footings are approximately 20 feet below surrounding street grade. We computed the Vs30 at a depth of approximately 10 feet beneath surrounding street grade. We compute a Vs30 = 1,618 feet per second for use in the PHSA. This value was determined using shear wave velocity profiles collected at the Columbia Development located at 140 SW Columbia Boulevard and the Multnomah County Courthouse. The shear wave velocity for the silt and sand alluvium was taken from a cone penetration test (CPT) conducted for the Columbia Development and the shear wave velocity for the underlying gravel is from a surface wave study conducted for the Multnomah County Courthouse. Appendix E presents the shear wave velocity studies from these two sites. The shear wave velocity profile used in this study is presented in Table 3.

Table 3. Shear Wave Velocity Profile

Depth Interval[1] (feet)	Vs (fps)
0 to 6.5	704
6.5 to 13	885
13 to 19.5	920
19.5 to 26	907
26 to 37	1900
37 to 100	2500

1: Depth below basement floor

5.2 Code Based Seismic Coefficients

Based on the elevation of the structure's basement indicated on the as-built drawings and the results of our explorations, the soil profile is consistent with Site Class is C. We understand that the seismic upgrades will be designed and constructed in accordance with the procedures outlined in ASCE 41-17. Base shear forces can be computed using the parameters in Table 4.

Table 4. ASCE 41-17 Seismic Design Coefficients

Seismic Hazard Level	S_s (g)	S_1 (g)	S_{XS} (g)	S_{X1} (g)
BSE-1N	N/A	N/A	0.710	0.503
BSE-2N	0.888	0.396	1.065	0.755
BSE-1E	0.240	0.087	0.384	0.209
BSE-2E	0.627	0.279	0.814	0.569

BSE: Basic Safety Earthquake
g: gravitational acceleration (32.2 feet/second^2)

5.3 PHSA

The PSHA was conducted using the EZ-FRISK 8.07 application to determine the uniform hazard spectra (UHS) for the site for 2,475- and 72-year return periods.

5.4 Seismic Sources and GMPE's

Characterization of significant faults used in the ground motion evaluation was adopted from the 2014 USGS version of the National Seismic Hazard Mapping Project (NSHMP). The maximum fault search was 200 km. The level of seismic shaking at the site was determined using the ground motion predicter equations (GMPEs) and weights shown in Table 5.

Table 5. Selected GMPE's and Weights for Seismic Sources

Faulting Type	GMPE	Weight
Subduction CSZ	BC Hydro (Abrahamson et al., (2012)	0.34
	Atkinson and Macias (2009)	0.33
	Zhao et al. (2006)	0.33
Deep Intraslab Deep - Oregon Gridded Deep – Pacific NW Gridded	BC Hydro (Abrahamson et al., 2012)	0.5
	Zhao et al. (2006)	0.5
Deep Intraslab Deep - Pacific NW Gridded Mod	BC Hydro (Abrahamson et al., (2012)	0.34
	Atkinson and Macias (2009)	0.33
	Zhao et al. (2006)	0.33
Shallow Crustal Faults	Abrahamson et al. (2014)	0.25
	Boore et al. (2014)	0.25
	Campbell and Bozorgnia (2014)	0.25
	Chiou and Youngs (2014)	0.25

5.5 Service Level Earthquake

The SLE is associated with a 72-year return period event. The PHSA conducted using EZ-Frisk 8.07 produced the UHS with a damping of 5 percent. The 72-year return period SLE UHS was converted from 5.0 percent damping to 1.5 percent damping using the PEER spectral damping scaling factor relationships (PEER, 2012). The mean magnitude and distance earthquake from deaggregation at the 0.5-second period was used to determine the damping scaling factors. This corresponds with the approximate fundamental period of the building. Figure 6 provides a plot of the unadjusted UHS and the damping-adjusted UHS for the 72-year return period.

5.5.1 Risk Targeted Maximum Considered Earthquake (MCE_R)

Figure 7 shows the MCE_R response spectrum which the UHS spectrum that has been adjusted with maximum direction factors and uniform risk factors as described below.

5.5.2 Maximum Direction Factors

Maximum direction factors were applied to convert the UHS from the average to the maximum rotated component (MRC). We used the maximum direction factors in accordance with ASCE 7-16. ASCE 7-16 Section 21.2 recommends a factor of 1.1 at periods less than or equal to 0.2, 1.3

at a period of 1.0 second, and 1.5 at 5.0 seconds and greater; ASCE 7-16 permits linear interpolation between these periods.

5.6 Uniform Risk Factors

ASCE 7-16 Section 21.2.1.1 requires that the spectral ordinates obtained from the PSHA be multiplied by corresponding risk coefficients in order to adjust the response spectrum from uniform hazard to uniform risk. A risk coefficient of C_{RS} = 0.889 was applied to the spectrum at periods of 0.2 second or less and a risk coefficient of C_{R1} = 0.870 was applied to the spectrum at periods of 1.0 second or more. Linear interpolation was used to compute risk coefficients between periods of 0.2 and 1.0 second.

5.7 CMS

CMS is an alternative approach for dynamic structural response described in Baker (2011). CMS provides the expected response spectrum, conditioned on occurrence of a target spectral acceleration value at the period of interest. We are informed that the fundamental period of the building is 0.51 seconds, and the period range of interest is 0.2 x T to 2 x T, or 0.1 to 1 second.

The CMS approach is based on the belief that earthquakes do not generate uniformly high ground motions across all spectral periods and spectra generated using the UHS approach have unrealistic shapes. For example, in the Portland, Oregon, and Seattle, Washington, areas, spectral accelerations are controlled by crustal earthquakes at short periods and the megathrust event at long periods.

The CMS uses deaggregation information (magnitude, distance, epsilon) as well as empirically based correlation functions to predict spectral shape. The approach maintains the probabilistic rigor of the PSHA and produces a spectrum that is not overly conservative. We used the procedure outlined below to compute the CMS.

1. Calculate the CMS at 0.1 and 1.0 second using the CMS calculation feature in EZ-FRISK. Figure 6 shows the CMS for periods of 0.1 and 1 second. EZ-Frisk used the method developed by Baker (Baker 2011) to compute the CMS.

2. EZ-FRISK does not apply the MRC and risk factors therefore all spectral accelerations from the EZ-FRISK CMS are scaled by a single factor to match the MCE_R at the CMS period of interest.

3. To produce a single CMS spectrum of the period range of interest (0.1 to 1.0 second) the upper envelope of the periods at the short and long period CMS and the MCE_R modes can used as the CMS. This is shown in Figure 8. For comparison purposes we have also plotted the response spectrum computed in accordance with ASCE 7-16 Section 11.4.7 for Site Class C. The CMS should not be lower than 80 percent of the response spectrum determined by Section 11.4.7 of ASCE 7-16.

6.0 LIMITATIONS

We have prepared this report for use by Grummel Engineering, LLC and other members of the design and construction team for the proposed project. The data and report can be used for design purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Explorations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary.

If there are changes in the site grades or location, configuration, design loads, or type of construction, the conclusions and recommendations presented may not be applicable. If the design changes are made, we should be retained to review our conclusions are recommendations are to provide a written evaluation or modification.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor’s methods, techniques, sequences, or procedures, except as specifically described in the report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

We appreciate the opportunity to be of service to you. Please call if you have any questions concerning this report or if we can provide additional services.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Jason F. Merritt, PE
Senior Project Engineer

REGISTERED PROFESSIONAL ENGINEER
56207
OREGON
July 11, 2000
BRETT A. SHIPTON
EXPIRES: 6/30/24

Brett A. Shipton, PE, GE
Principal

Attachments: Figures 1 through 9
Appendix A – Subsurface Exploration Program
Appendix B – Nearby Well Logs
Appendix C – Soil and Rock Classification Information
Appendix D – Photo Log
Appendix E – Shear Wave Velocity Studies

REFERENCES

ASCE 7-16, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 2016.

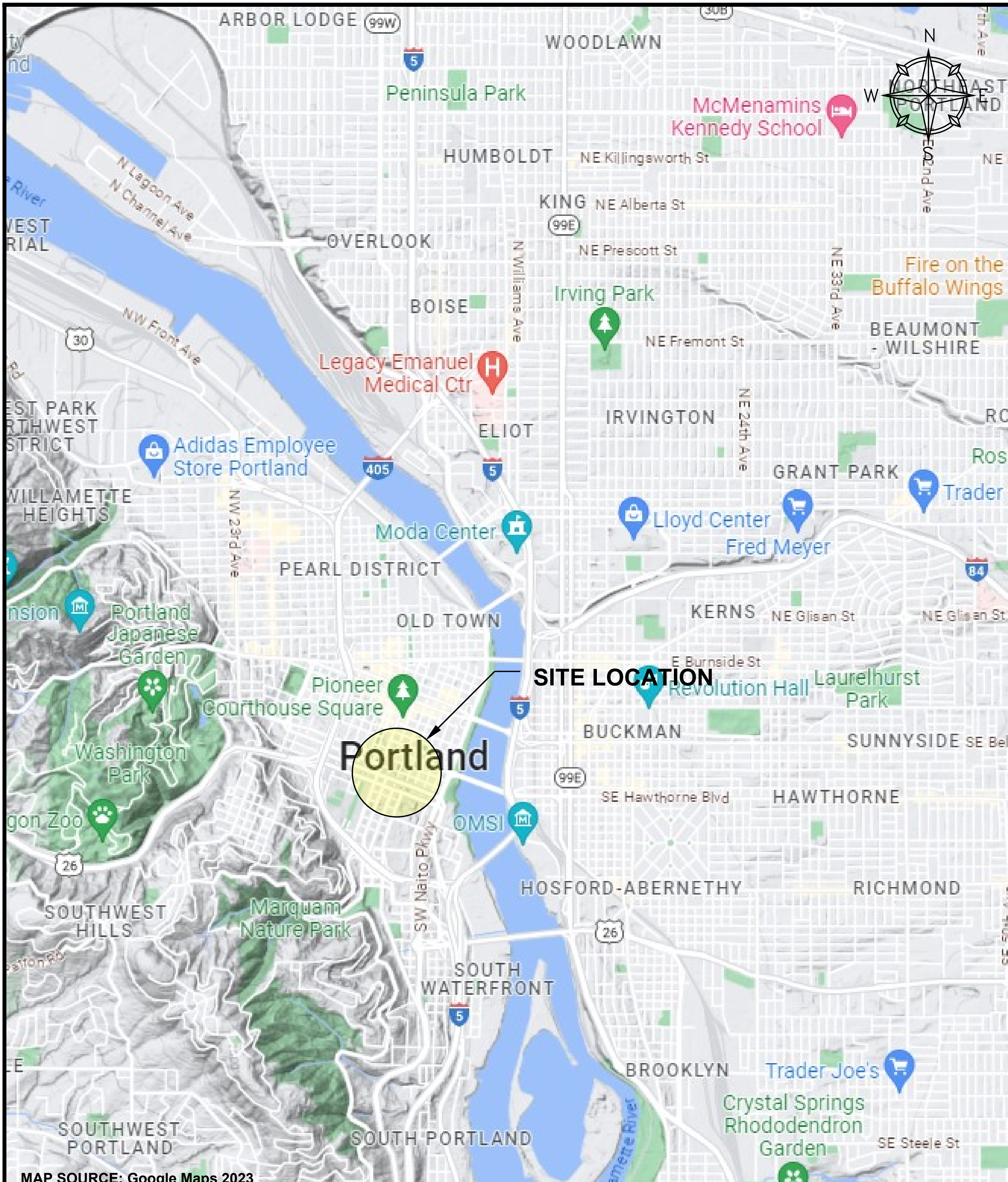
ASCE 41-17, Seismic Evaluation and Retrofit of Existing Buildings, American Society of Civil Engineers, 2017

Conditional Mean Spectrum: Tool for Ground Motion Selection, Jack W. Baker, 2017

Ma, Lina and Ian P. Madin, Serin Duplantis, Kendra J. Williams, 2012, *Lidar-Based Surficial Geologic Map and Database of the Greater Portland, Oregon, Area, Clackamas, Columbia, Marion, Multnomah, Washington, and Yamhill Counties, Oregon, and Clark County, Washington,* Oregon Department of Geology and Mineral Industries, Open File Report O-12-02.

PBS Engineering + Environmental, 2015. *Additional Geotechnical Engineering Services – Feasibility Assessment; Due Diligence Services – Multnomah County Courthouse; Block 128, Portland, Oregon,* dated March 26, 2015. PBS Project No. 15194.869 Task 004.

FIGURES



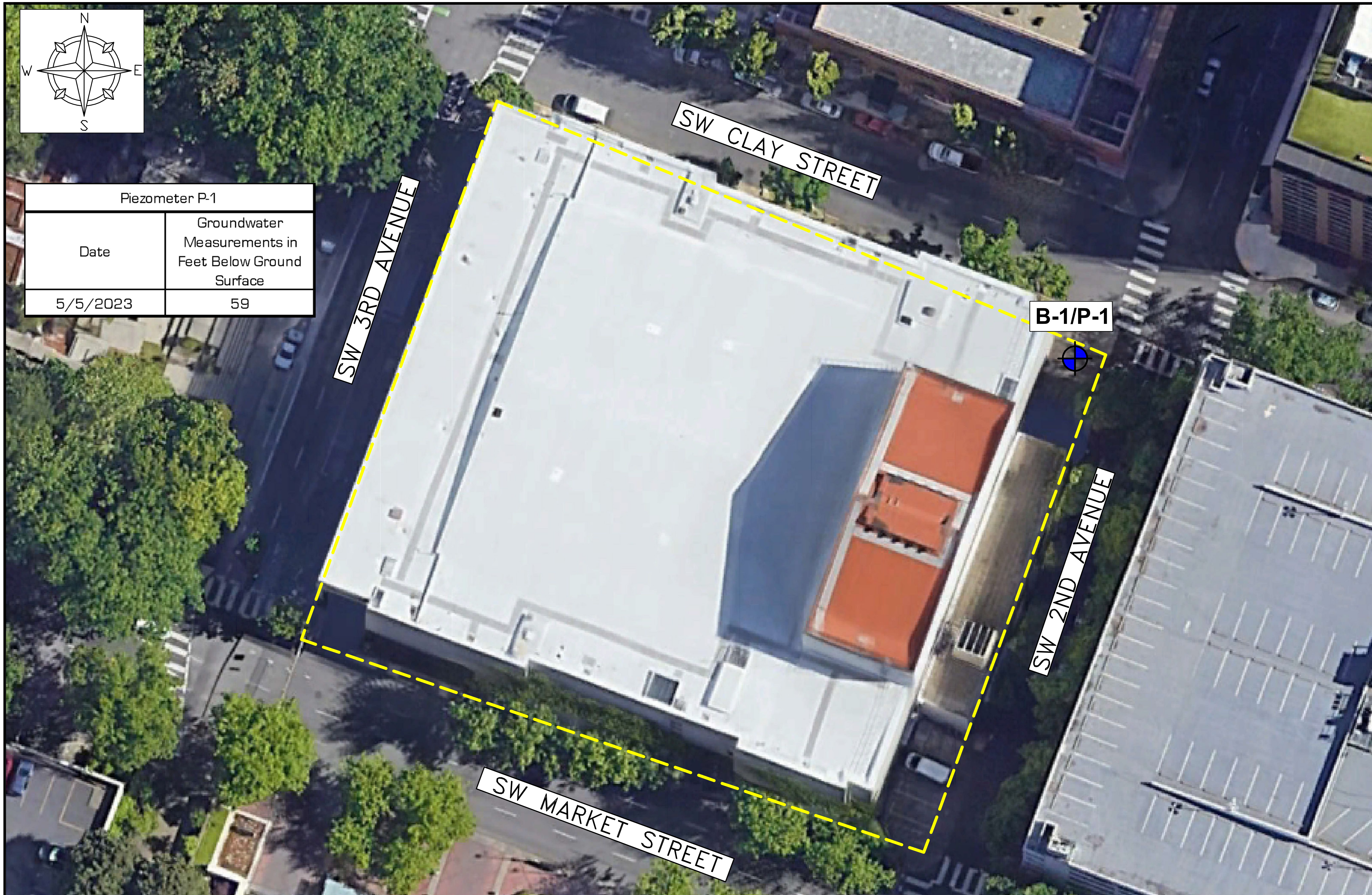
Geotechnical ■ Environmental ■ Special Inspections
Columbia West
Engineering, Inc

Job No: 23090
Date: 5/1/23
Drawn: EMU
Checked: BAS

SITE LOCATION MAP
KELLER AUDITORIUM RETROFIT
PORTLAND, OREGON

FIGURE
1

(page intentionally left blank)



Piezometer P-1	
Date	Groundwater Measurements in Feet Below Ground Surface
5/5/2023	59

APPROXIMATE SITE BOUNDARY

APPROXIMATE LOCATION OF BORING AND VIBRATING WIRE PIEZOMETER

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West
Engineering, Inc

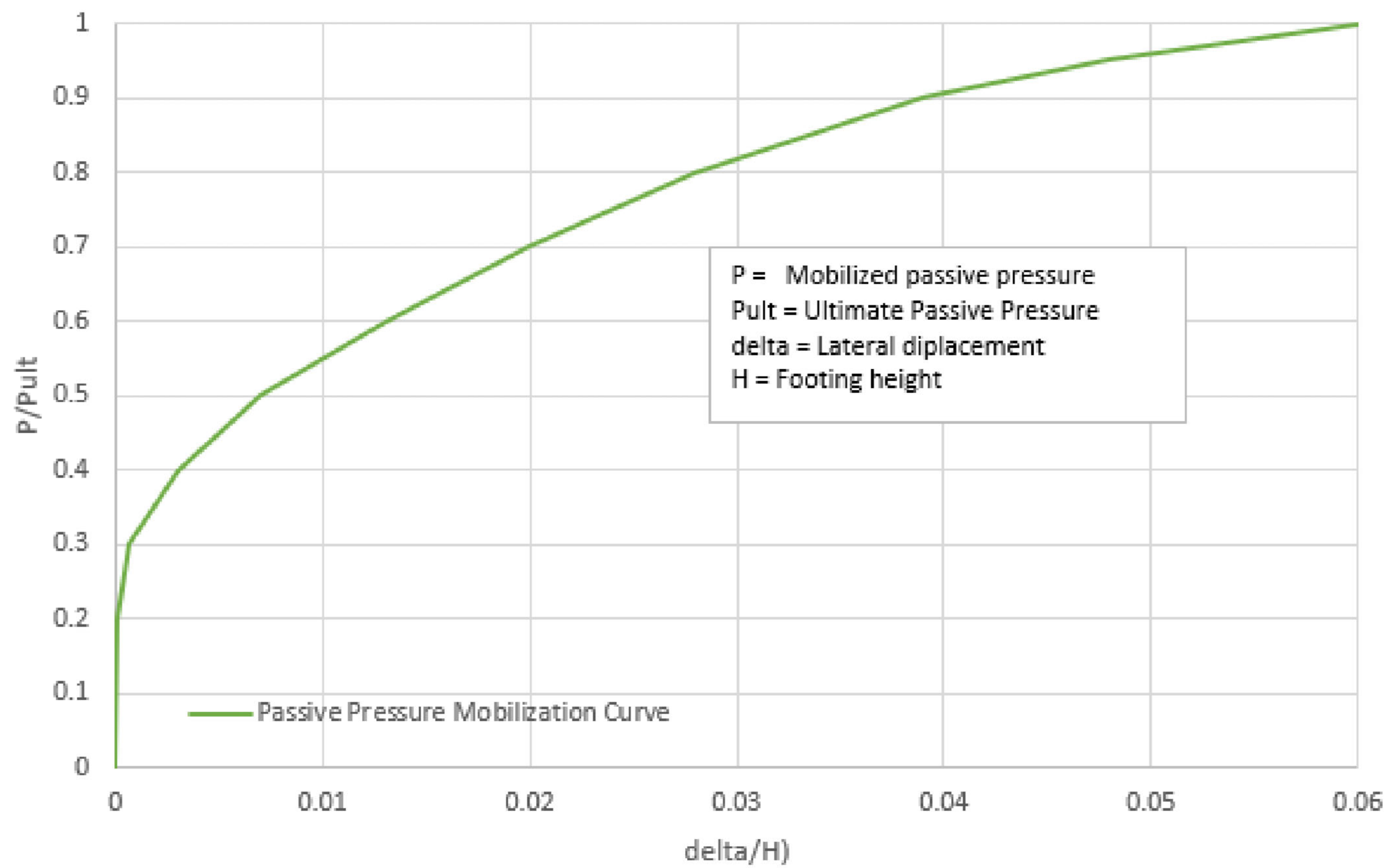
Job No: 23090
Date: 05/22/23
Drawn: EMU
Checked: JFM

EXPLORATION LOCATION MAP
KELLER AUDITORIUM RETROFIT

NOTES:
1. SITE LOCATION: 222 SW CLAY STREET IN PORTLAND, OREGON.
2. SITE CONSISTS OF TAX PARCEL R246214, TOTALING APPROXIMATELY 1.15 ACRES.
3. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
4. EXPLORATION LOCATION IS APPROXIMATE AND NOT SURVEYED.
5. BORING BACKFILLED WITH BENTONITE ON APRIL 26, 2023.
6. VIBRATING WIRE PIEZOMETER INSTALLED IN BORING B-1 AT A DEPTH OF APPROXIMATELY 70 FEET BGS.

FIGURE 2

(page intentionally left blank)



Geotechnical ▪ Environmental ▪ Special Inspections

Columbia West Engineering, Inc

Job No: 23090
Date: 05/22/23
Drawn: JFM
Checked: BAS

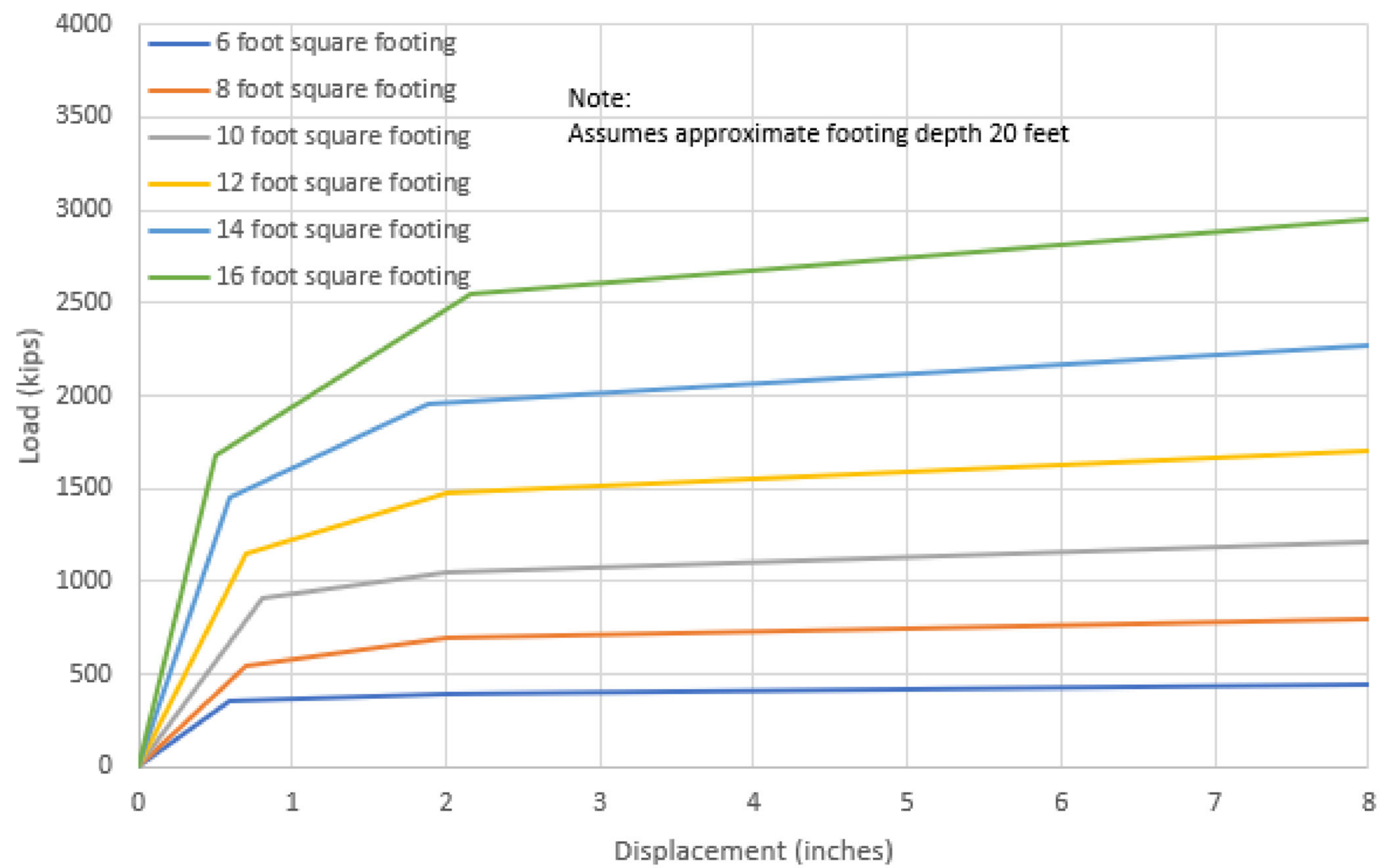
PASSIVE PRESSURE MOBILIZATION CURVE

KELLER AUDITORIUM RETROFIT

NOTES:

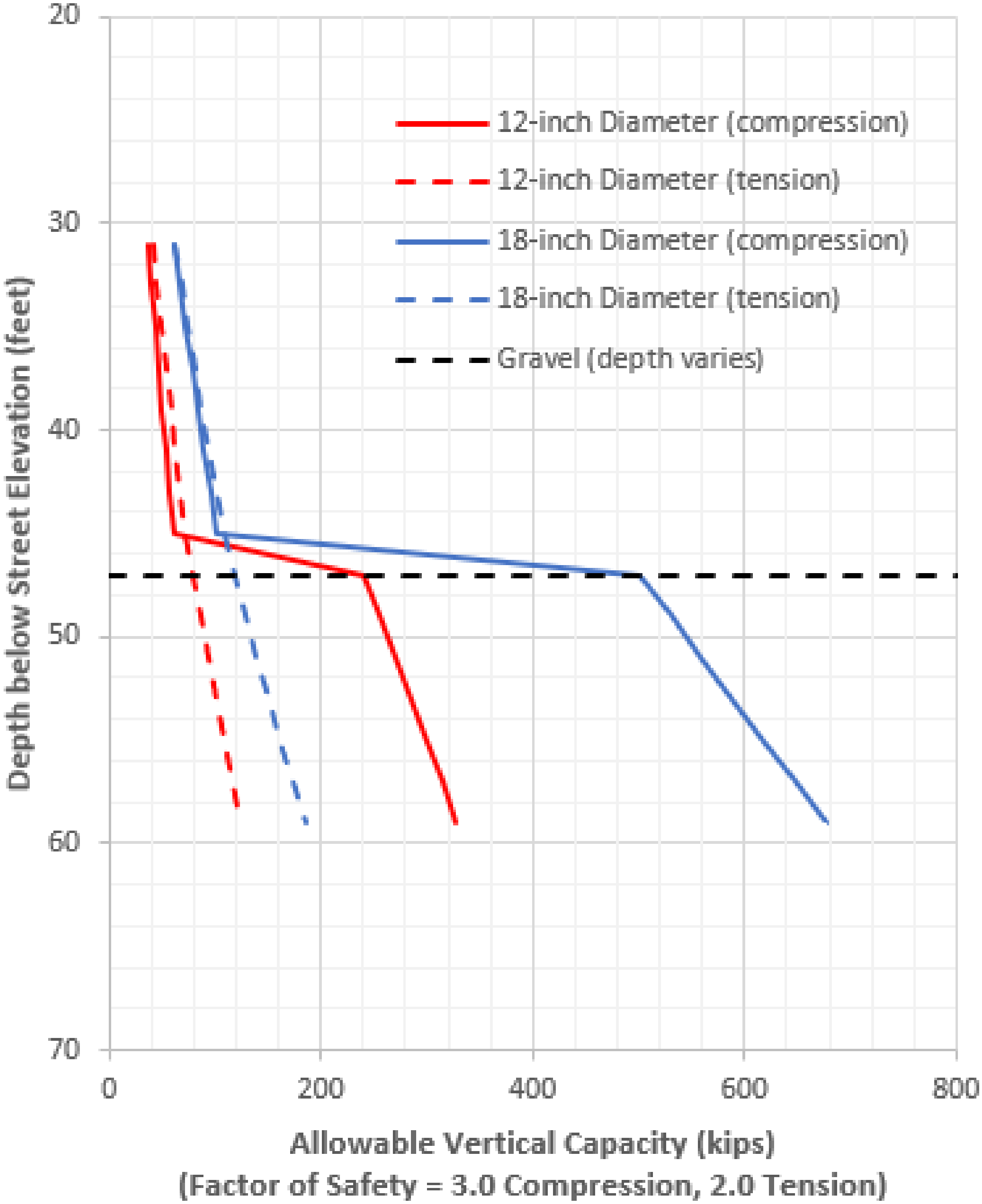
FIGURE 3

(page intentionally left blank)



Geotechnical ▪ Environmental ▪ Special Inspections Columbia West Engineering, Inc	Job No: 23090 Date: 05/22/23 Drawn: JFM Checked: BAS	FOOTING BEARING STRESS VS. DISPLACEMENT KELLER AUDITORIUM RETROFIT	NOTES:	FIGURE 4

(page intentionally left blank)



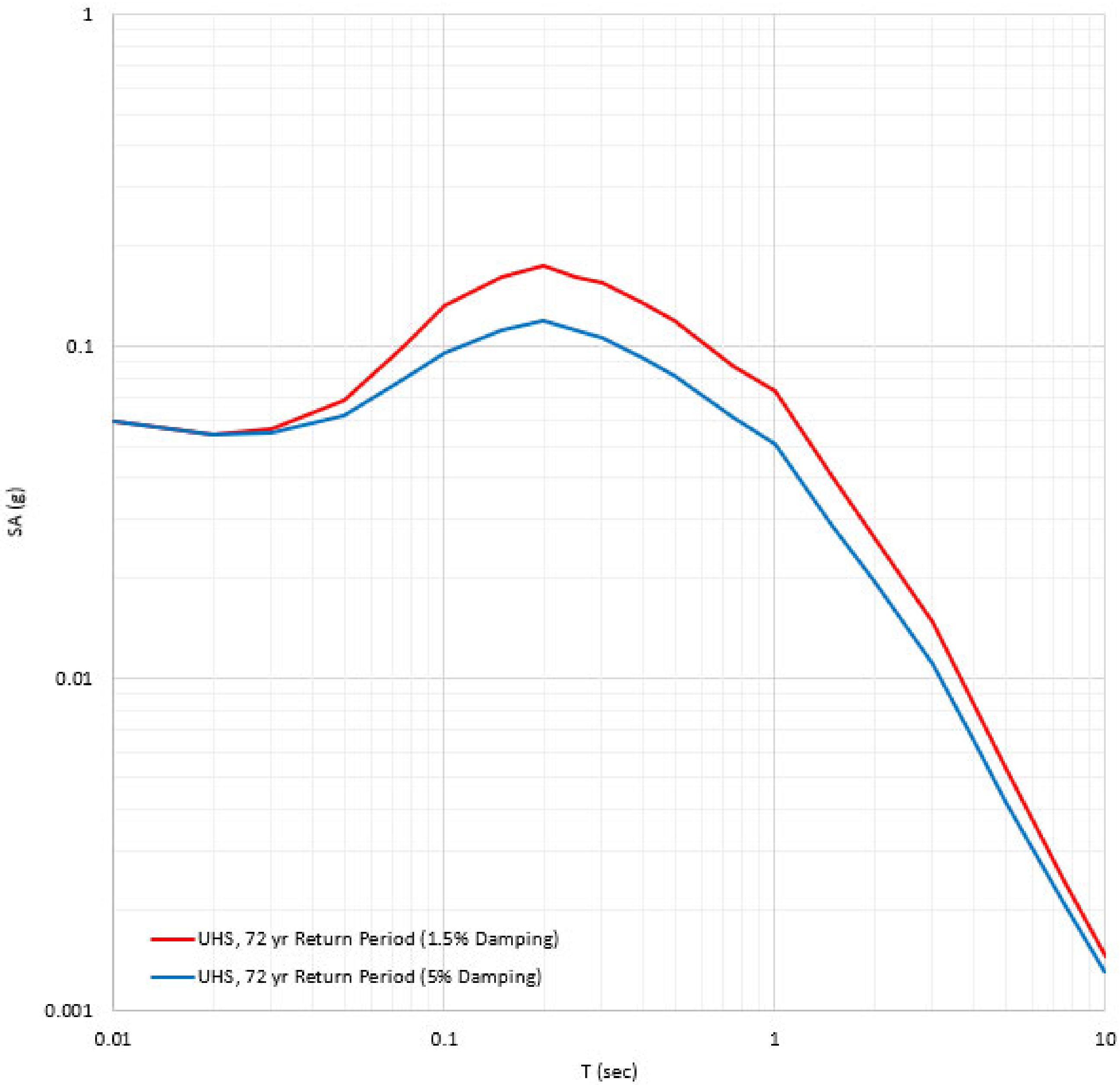
Geotechnical • Environmental • Special Inspections
Columbia West Engineering, Inc

Project: 23090
Date: 05/22/23
Drawn: JFM
Checked: BAS

ALLOWABLE AUGERCAST VERTICAL PILE LOAD CAPACITY
KELLER AUDITORIUM RETROFIT

NOTES:
1. ALLOWABLE PILE LOAD CAPACITIES PRESENTED ON THIS FIGURE DO NOT INCLUDE THE WEIGHT OF THE PILE.
2. USE OF A FACTOR OF SAFETY OF 3 ASSUMES STATIC LOAD TESTS ARE NOT PERFORMED. IF CAPACITIES ARE VERIFIED BY STATIC LOAD TESTS, A FACTOR OF SAFETY OF 2 MAY BE USED.

FIGURE 5



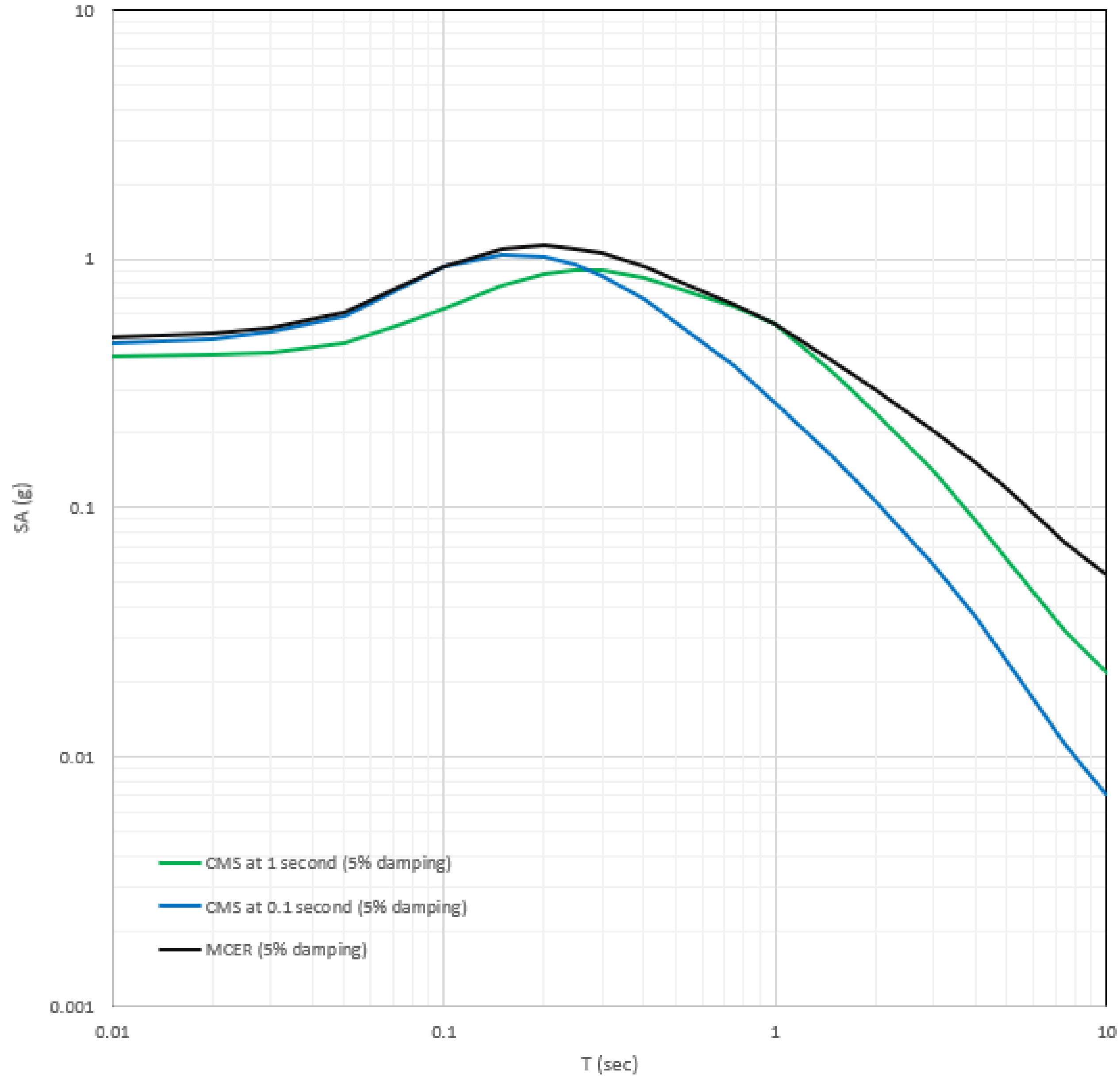
Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

Project: 23090
Date: 05/22/23
Drawn: JFM
Checked: BAS

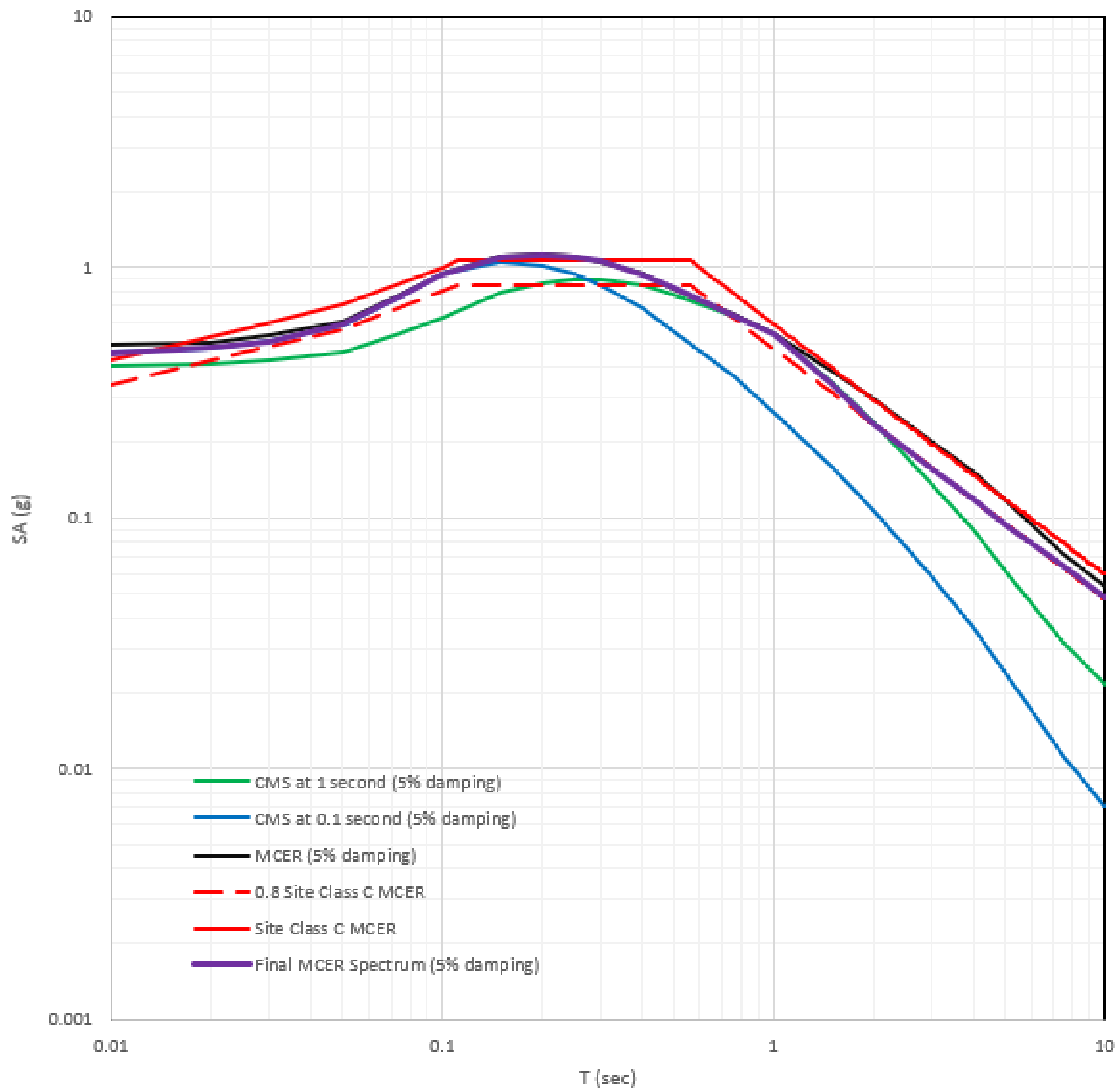
UNIFORM HAZARD SPECTRA
KELLER AUDITORIUM RETROFIT

NOTES:

FIGURE 6



Geotechnical ▪ Environmental ▪ Special Inspections Columbia West Engineering, Inc	Project: 23090 Date: 05/22/23 Drawn: JFM Checked: BAS	MCER AND CMS RESPONSE SPECTRA KELLER AUDITORIUM RETROFIT	NOTES:	FIGURE 7



Geotechnical • Environmental • Special Inspections **Columbia West** Engineering, Inc	Project: 23090 Date: 05/22/23 Drawn: JFM Checked: BAS	CMS FOR PERIOD RANGE OF INTEREST KELLER AUDITORIUM RETROFIT	NOTES:	FIGURE 8

APPENDIX A
SUBSURFACE EXPLORATION PROGRAM

GENERAL

We explored subsurface conditions at the site by drilling one boring using a truck-mounted drill rig. The boring was drilled by Western States Soil Conservation, Inc on March 6, 2023, to a maximum depth of 70.25 feet BGS. The soil boring log is presented in this appendix.

SOIL SAMPLING

Disturbed samples were collected from the boring at representative depth intervals using 1½-inch diameter split-barrel samples during standard penetration testing (SPT) in general accordance with ASTM D1586. The sampler was driven into the soil with a 140-pound hammer free falling 30 inches. The sampler was driven a total distance of 18 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the exploration log, unless otherwise noted. The hammer was lifted using an automatic hammer with a reported efficiency of 77.5 percent. A copy of the hammer calibration report is on file at our office. Sampling methods and intervals are shown on the exploration log.

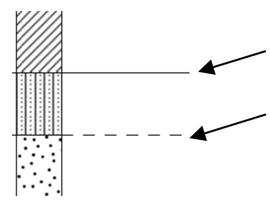
SOIL CLASSIFICATION

The soil samples were classified in accordance with the Unified Soil Classification System presented in Appendix C. The exploration log indicates the depths at which the soil or their characteristics change, although the change actually could be gradual. If the change occurred between sample locations, the depth was interpreted. Soil classifications are shown on the exploration logs.

EXPLORATION LEGEND

Symbol	Description
SPT	Sample obtained from the indicated depth in general accordance with ASTM D1586, *Standard Penetration Test and Split-Barrel Sampling of Soils*
SHELBY	Sample obtained from the indicated depth using thin-wall Shelby tube in general accordance with ASTM D1587, *Thin-Walled Tube Sampling of Fine-Grained Soils*
D&M 300	Sample obtained from the indicated depth using Dames & Moore sampler and 300-pound hammer or pushed
D&M 140	Sample obtained from the indicated depth using Dames & Moore sampler and 140-pound hammer or pushed
CSS	Sample obtained from the indicated depth using 3-inch-outer-diameter California split-spoon sampler and 140-pound hammer
GRAB	Grab sample obtained from the indicated depth
CORE	Rock core interval at the indicated depth
	Water level observed during exploration

Graphical Log of Subsurface Lithology



Geotechnical Acronyms			
AASHTO	American Association of State Highway and Transportation Officials	P	Push Sample
ASTM	American Society for Testing and Materials	PP	Pocket Penetrometer
ATT	Atterberg Limits	PSF	Pounds Per Square Foot
BGS	Below Ground Surface	P200	Percent Passing No. 200 Sieve
CBR	California Bearing Ratio	RES	Resilient Modulus
CON	Consolidation Test	SIEV	Sieve Analysis
DCPT	Dynamic Cone Penetration Test	SPT	Standard Penetration Test
DD	Dry Density	TS	Torvane Shear
DS	Direct Shear	UC	Unconfined Compressive Strength
HYD	Hydrometer	UU	Unconsolidated Undrained Triaxial Test
IR	Infiltration Rate	USCS	United Soil Classification System
MC	Moisture Content	VS	Vane Shear
MD	Moisture-Density Relationship	WD	Wet Density
OC	Organic Content		

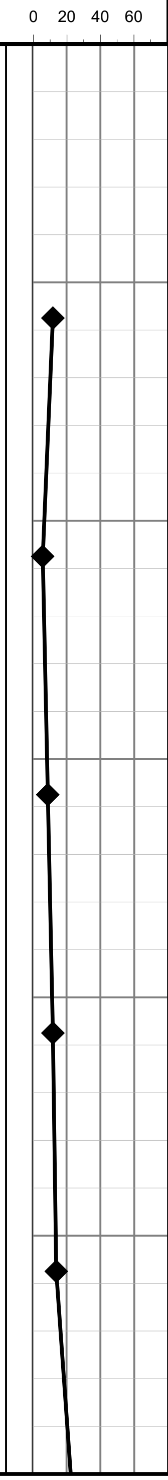
11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

SOIL BORING LOG

PROJECT NAME	CLIENT		PROJECT NO.	BORING NO.
Keller Auditorium Retrofit	Grummel Engineering, LLC		23090	B-1
PROJECT LOCATION	DRILLING CONTRACTOR	DRILL RIG	ENGINEER	PAGE NO.
Portland, Oregon	Western States	CME75 Truck 4	EMU	1 of 3
BORING LOCATION	DRILLING METHOD	SAMPLING METHOD	START DATE	START TIME
See Figure 2	Mud Rotary	SPT	4/26/2023	0800
REMARKS		GROUNDWATER DEPTH	FINISH DATE	FINISH TIME
None		See Text	4/26/2023	1530

Depth (ft)	Field ID + Sample Type	SPT N-value (uncorrected)	DRIVE (in)	RECOVERY (in)	USCS Soil Type	LITHOLOGIC DESCRIPTION AND REMARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	INSTALLATION AND COMMENTS
0						5.5-inch concrete slab.						Flush-mount monument with 1 foot of concrete surface seal.
0.5					CL	Lean CLAY, brown, moist, stiff, low plasticity.						
5	SPT B1.1	12	18	18				38.0				
10	SPT B1.2	6	18	12	SM	Silty SAND, brown, moist, loose, silt is nonplastic to low plasticity, fine- to medium-textured sand.		30.0				
15	SPT B1.3	9	18	12				23.0	31			
20	SPT B1.4	12	18	12		Becomes medium dense at 20 feet.		23.0	34			
25	SPT B1.5	14	18	12		Becomes gray and brown at 25 feet.		23.0				



11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

SOIL BORING LOG

PROJECT NAME	CLIENT		PROJECT NO.	BORING NO.
Keller Auditorium Retrofit	Grummel Engineering, LLC		23090	B-1
PROJECT LOCATION	**DRILLING CONTRACTOR**	**DRILL RIG**	**ENGINEER**	**PAGE NO.**
Portland, Oregon	Western States	CME75 Truck 4	EMU	2 of 3
BORING LOCATION	**DRILLING METHOD**	**SAMPLING METHOD**	**START DATE**	**START TIME**
See Figure 2	Mud Rotary	SPT	4/26/2023	0800
REMARKS		**GROUNDWATER DEPTH**	**FINISH DATE**	**FINISH TIME**
None		See Text	4/26/2023	1530

Depth (ft)	Field ID + Sample Type	SPT N-value (uncorrected)	DRIVE (in)	RECOVERY (in)	USCS Soil Type	LITHOLOGIC DESCRIPTION AND REMARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	INSTALLATION AND COMMENTS
30	SPT B1.6	24	18	12	SM	Silty SAND, gray and tan, moist, medium dense, silt is nonplastic to low plasticity, fine- to medium-textured sand.						
35	SPT B1.7	18	18	12	ML	Sandy SILT, gray and tan, moist, very stiff, nonplastic to low plasticity, fine- to medium-textured sand.		26.0	56			
40	SPT B1.8	21	18	12	SM	Silty SAND, gray and tan, moist, medium dense, silt is nonplastic to low plasticity, fine- to medium-textured sand. Driller indicated interbedded loose and dense layers.						
45	SPT B1.9	24, 50/1"	13	10								
46					GM-GP	Poorly-graded GRAVEL, with sand and silt, brown and gray, moist, very dense, silt is nonplastic, fine- to coarse-textured sand, fine- to coarse-textured and fractured gravels.						
50	SPT B1.10	50/3"	3	3				10.0	9			
55	SPT B1.11	50/1"	1	1		Become brown, gray, and orange at 55 feet.						
59			▼			Groundwater measured at 59 feet bgs on 5/5/23.						
60												

SPT N-value scale: 0 20 40 60

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

SOIL BORING LOG

PROJECT NAME	CLIENT		PROJECT NO.	BORING NO.
Keller Auditorium Retrofit	Grummel Engineering, LLC		23090	B-1
PROJECT LOCATION	**DRILLING CONTRACTOR**	**DRILL RIG**	**ENGINEER**	**PAGE NO.**
Portland, Oregon	Western States	CME75 Truck 4	EMU	3 of 3
BORING LOCATION	**DRILLING METHOD**	**SAMPLING METHOD**	**START DATE**	**START TIME**
See Figure 2	Mud Rotary	SPT	4/26/2023	0800
REMARKS		**GROUNDWATER DEPTH**	**FINISH DATE**	**FINISH TIME**
None		See Text	4/26/2023	1530

Depth (ft)	Field ID + Sample Type	SPT N-value (uncorrected) 0 20 40 60	DRIVE (in)	RECOVERY (in)	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	INSTALLATION AND COMMENTS
60	SPT B1.12	50/2"	2	2	GM-GP		Poorly-graded GRAVEL, with sand and silt, brown and gray, moist, very dense, silt is nonplastic, fine- to coarse-textured sand, fine- to coarse-textured and fractured gravels.						
65	SPT B1.13	77	17.75	17.75	CL		Sandy Lean CLAY, orange and brown, moist, very hard, fine- to medium-textured sand.		35.0	53			
68							Becomes orange, black, and brown with fine- to coarse-textued sand at 70 feet.						
70	SPT B1.14	50/3"	3	2									Vibrating wire piezometer installed at 70 feet bgs.
70.25							Boring completed at 70.25 feet bgs. Groundwater was measured at a depth of 59 feet BGS on 5/5/23.						

Depth scale: 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90

APPENDIX B
LABORATORY TESTING

CLASSIFICATION

The soil samples collected in the field were classified in the laboratory to confirm field classifications. The laboratory classifications are shown on the exploration logs if those classifications differed from the field classifications.

MOISTURE CONTENT

We determined the natural moisture content of select soil samples in general accordance with ASTM D2216. The natural moisture content is a ratio of the weight of the water to soil in a test sample and is expressed as a percentage. The test results are presented in this appendix.

PARTICLE-SIZE ANALYSIS

We completed particle-size analyses on select soil samples in general accordance with ASTM D6913. This test is a quantitative determination of the soil particle size distribution expressed as a percentage of dry soil weight. The test results are presented in this appendix.

ATTERBERG LIMITS

We determined the Atterberg Limits on selected samples in general accordance with ASTM D4318. Atterberg limits include the liquid limit, plastic limit, and the plasticity index of soils. These index properties are used to classify soils and for correlation with other engineering properties of soils. The test results are presented in this appendix.

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

MOISTURE CONTENT, PERCENT PASSING NO. 200 SIEVE BY WASHING

PROJECT	CLIENT	PROJECT NO.	REPORT DATE
Keller Auditorium Retrofit 222 SW Clay Street Portland, Oregon 97201	Grummel Engineering, LLC 920 SW 3rd Avenue, Suite 200 Portland, OR 97204	23090	05/08/23
		DATE SAMPLED: 04/26/23	
		SAMPLED BY: EMU	

LABORATORY TEST DATA

TEST PROCEDURE
ASTM D2216 - Method A, ASTM D1140

LAB ID	CONTAINER MASS	MOIST MASS + PAN	DRY MASS + PAN	AFTER WASH DRY MASS + PAN	MATERIAL DESCRIPTION	FIELD ID	SAMPLE DEPTH	MOISTURE CONTENT	PASSING NO. 200 SIEVE
S23-0520	86.96	291.16	235.05	-	brown Lean CLAY	B1.1	5 feet	38%	-
S23-0521	87.75	300.74	251.48	-	brown Silty SAND	B1.2	10 feet	30%	-
S23-0522	548.58	847.98	791.68	715.71	brown Silty SAND	B1.3	15 feet	23%	31%
S23-0523	541.88	823.19	770.06	692.41	brown Silty SAND	B1.4	20 feet	23%	34%
S23-0524	86.75	286.38	249.38	-	brown-gray Silty SAND	B1.5	25 feet	23%	-
S23-0525	540.92	838.11	777.48	645.92	gray-tan Sandy SILT	B1.7	35 feet	26%	56%
S23-0526	548.14	772.84	751.83	733.14	brown-gray GRAVEL with Silt and Sand	B1.10	50 feet	10%	9%
S23-0527	556.05	847.20	771.86	657.70	orange-brown Sandy Lean CLAY	B1.13	65 feet	35%	53%

NOTES:
Sample weight received for Lab ID: S23-0526 did not meet the minimum size requirements; entire sample used for analysis.

DATE TESTED	TESTED BY
05/05/23	MRS/BTT

COLUMBIA WEST ENGINEERING, INC. authorized signature

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

APPENDIX C
SOIL AND ROCK CLASSIFICATION INFORMATION

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

COMPONENT	ASTM/USCS		AASHTO	
	size range	sieve size range	size range	sieve size range
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve

Consistency for Cohesive Soil

CONSISTENCY	SPT N-VALUE (BLOWS PER FOOT)	D&M N-VALUE (BLOWS PER FOOT)	POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)
Very Soft	Less than 2	Less than 3	less than 0.25
Soft	2 to 4	3 to 6	0.25 to 0.50
Medium Stiff	4 to 8	6 to 12	0.50 to 1.0
Stiff	8 to 15	12 to 25	1.0 to 2.0
Very Stiff	15 to 30	25 to 65	2.0 to 4.0
Hard	30 to 60	65 to 145	greater than 4.0
Very Hard	greater than 60	greater than 145	-

RELATIVE DENSITY	SPT N-VALUE (BLOWS PER FOOT)	D&M N-VALUE (BLOWS PER FOOT)
Very Loose	0 to 4	0 to 11
Loose	4 to 10	11 to 26
Medium Dense	10 to 30	26 to 74
Dense	30 to 50	74 to 120
Very Dense	more than 50	More than 120

Relative Density for Granular Soil

Moisture Designations

TERM	FIELD IDENTIFICATION
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

Additional Constituents

Percent	Silt and Clay In:		Percent	Sand and Gravel In:	
	Fine-Grained Soil	Coarse-Grained Soil		Fine-Grained Soil	Coarse-Grained Soil
< 5	trace	trace	< 5	trace	trace
5 – 12	minor	with	5 – 15	minor	minor
> 12	some	silty/clayey	15 – 30	with	with
			> 30	sandy/gravelly	with Indicate approx. percentage

(page intentionally left blank)

ROCK CLASSIFICATION INFORMATION

ROCK HARDNESS	DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH (PSI)
Extremely Soft (R0)	Easily indented and scratched by fingernail - soil like texture	<100
Very Soft (R1)	Scratched with fingernail, peeled by knife, indented by rock pick	100 - 200
Soft (R2)	Peeled by knife, indented by rock pick (moderate difficulty)	200 - 800
Moderately Soft (R3)	Peeled by knife, indented by rock pick (with difficulty)	800 - 1,800
Moderately Hard (R4)	Scratched by knife or rock pick, cannot be peeled	1,800 - 7,300
Hard (R5)	Scratched by knife or rock pick (with difficulty)	7,300 - 14,500
Very Hard (R6)	Cannot be scratched with knife or rock pick	14,500 - 36,300
Extremely Hard (R7)	Can only be chipped, not broken by repeated blows with rock pick	> 36,300

ROCK WEATHERING	DESCRIPTION
Decomposed	Completely decomposed - mass structure is disintegrated to a soil
Completely Weathered	Completely decomposed - mass structure is largely intact
Highly Weathered	> 50% of rock is decomposed, fresh or discolored rock is present
Moderately Weathered	< 50% of rock is decomposed, fresh or discolored rock is present
Slightly Weathered	Discoloration indicates weathering and discontinuity surfaces
Fresh	No visible weathering, slight discoloration on discontinuity surfaces

ROCK QUALITY	RQD (%)
Very poor (Completely weathered rock)	<25%
Poor (Weathered rocks)	25 to 50%
Fair (Moderately weathered rocks)	51 to 75%
Good (Hard Rock)	76 to 90%
Very Good (Fresh rocks)	91 to 100%

Rock Quality Designation (RQD) is a measure of quality of rock core taken from a borehole. The length of core pieces is measured along center line of the pieces. All pieces of intact rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run to obtain RQD value

ROCK JOINT SPACING	DESCRIPTION
Very Close	< 0.2 foot
Close	0.2 foot - 1 foot
Moderately Close	1 foot - 3 feet
Wide	3 feet - 10 feet
Very Wide	> 10 feet

ROCK FRACTURING	DESCRIPTION
Very Intensely Fractured	Chips, fragments, with scattered short core lengths
Intensely Fractured	0.1 foot - 0.3 foot with scattered fragments
Moderately Fractured	0.3 foot - 1 foot
Slightly Fractured	1 foot - 3 feet
Very Slightly Fractured	> 3 feet
Unfractured	No fractures observed

ROCK HEALING	DESCRIPTION
Not Healed	Discontinued surface, fractured zone, sheared material, filling is not cemented
Partly Healed	Fractured/sheared material - bonded is < 50%
Moderately Healed	Fractured/sheared material - bonded is > 50%
Totally Healed	All fragments are bonded

(page intentionally left blank)

APPENDIX D
PHOTO LOG

KELLER AUDITORIUM RETROFIT

Portland, Oregon

Drilling Boring B-1

APPENDIX E
SHEAR WAVE VELOCITY STUDIES

SOURCE: © 2011 GOOGLE EARTH PRO, © 2012 GOOGLE

LEGEND

B-1	BORING NUMBER AND LOCATION FROM GEOCON REPORT DATED MAY 2001
CPT-1	CPT NUMBER AND LOCATION DATED FEBRUARY 2015

0' 30' 60' 120'

SCALE: 1" = 60'

PREPARED FOR: MULTNOMAH COUNTY

PBS	PROJECT # 15194.869 PHASE: 2-TASK:4	SITE PLAN	FIGURE
	DATE MAR 2015	BLOCK 128 PORTLAND, OREGON	2

L:\Projects\15000\15194 Mult. Co\15194.869_NewCentralCourthouse\Phase 0002 Geotech\Task 4 - Block128\DWG\15194.869_0002_004.dwg Mar 04, 2015 09:47am Jimb

PBS Engineering and Environmental, Inc.
4412 SW Corbett Avenue
Portland, Oregon 97239
www.pbsenv.com

Project: 15194.869 Multnomah County Courthouse
Location: Block 128

CPT: 15015 CPT-1 Text File
Total depth: 43.31 ft, Date: 3/18/2015
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

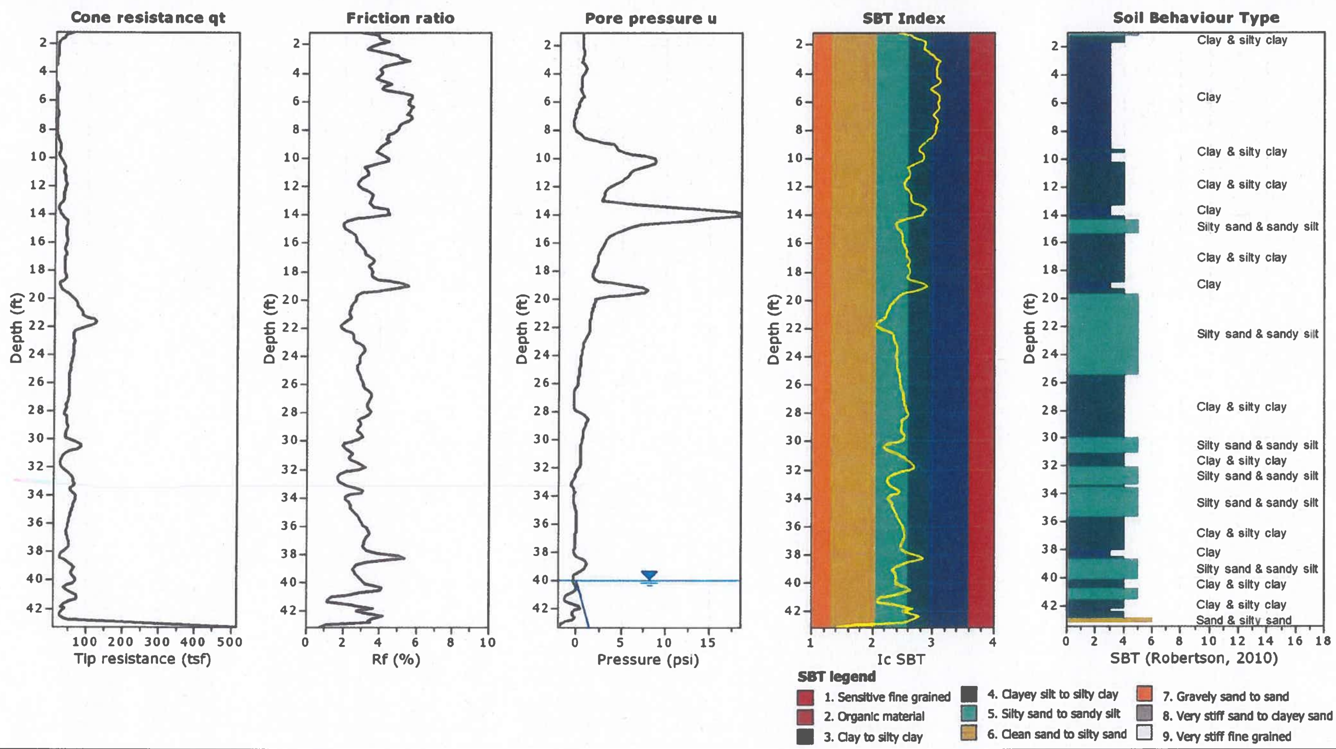


FIGURE A1

PBS Engineering and Environmental, Inc.
4412 SW Corbett Avenue
Portland, Oregon 97239
www.pbsenv.com

Project: 15194.869 Multnomah County Courthouse
Location: Block 128

CPT: 15015 CPT-2 Text File
Total depth: 46.92 ft, Date: 3/18/2015
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

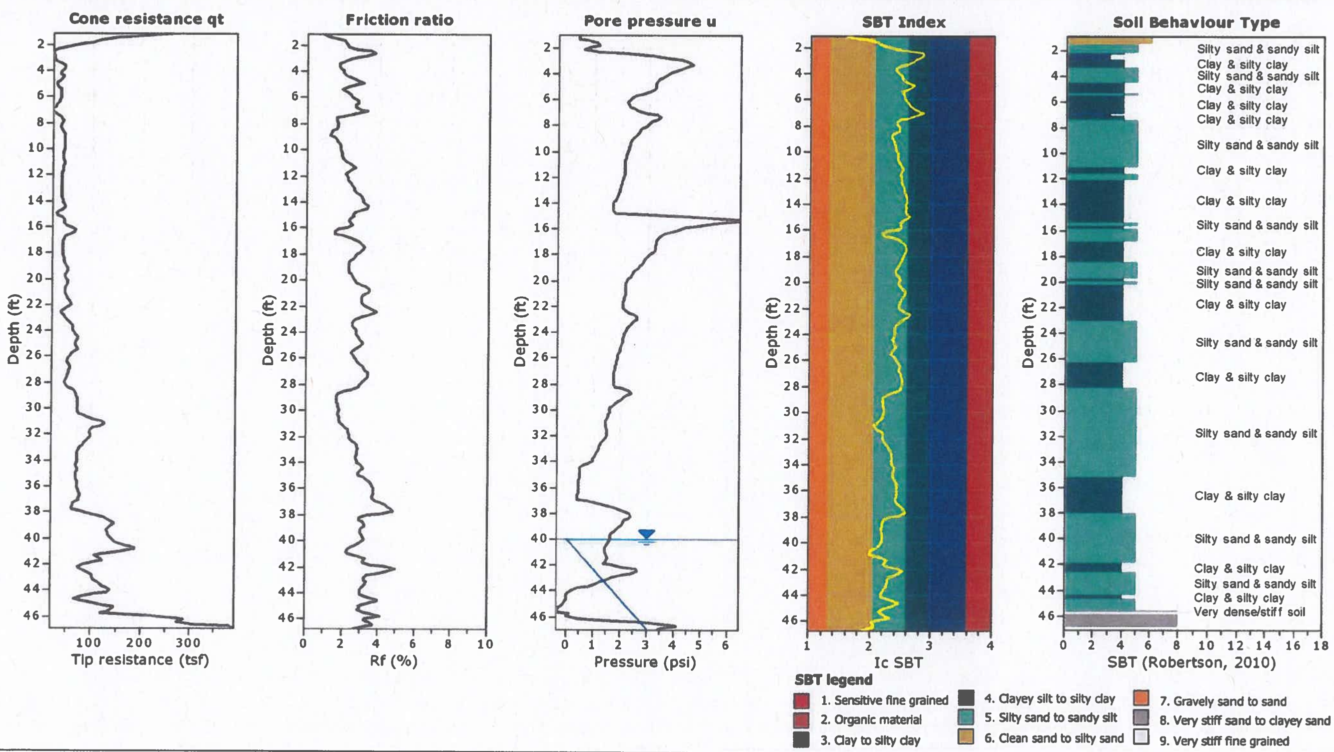
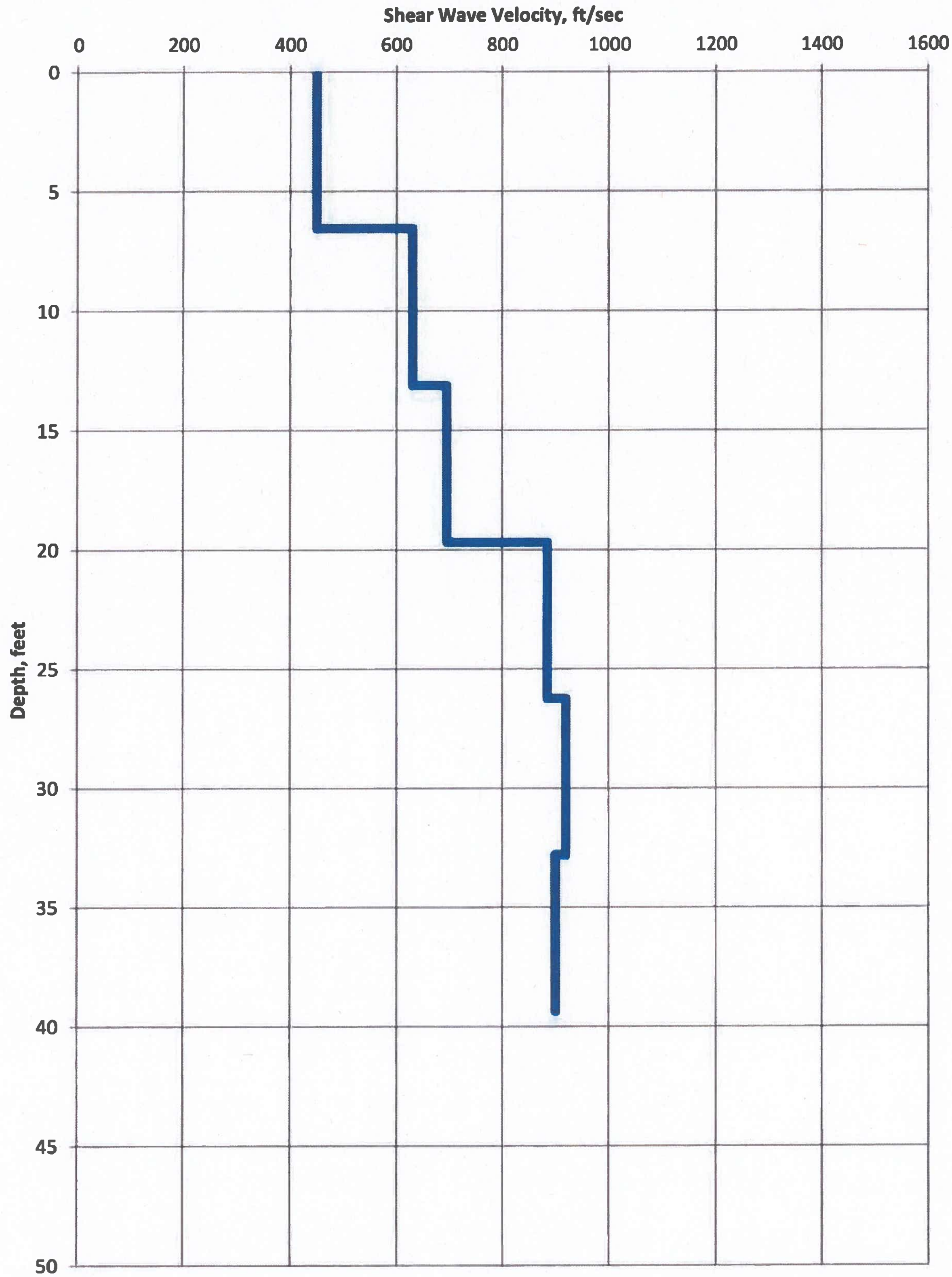


FIGURE A2



PREPARED FOR: MULTNOMAH COUNTY

PBS	PROJECT # 15194.869	SHEAR WAVE VELOCITY PROFILE	FIGURE
	DATE MAR 2015	BLOCK 128 PORTLAND, OREGON	A3

GEOVision geophysical services

REPORT

SURFACE WAVE MEASUREMENTS

1200 SW 1ST AVENUE
PORTLAND, OREGON

GEO*Vision* Project No. 16326

Prepared for

GeoDesign, Inc.
703 Broadway Street, Suite 650
Vancouver, WA 98660
(360) 693-8416

Prepared by

GEO*Vision* Geophysical Services, Inc.
1124 Olympic Drive
Corona, California 92881
(951) 549-1234

Report 16326-01

September 1, 2016

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

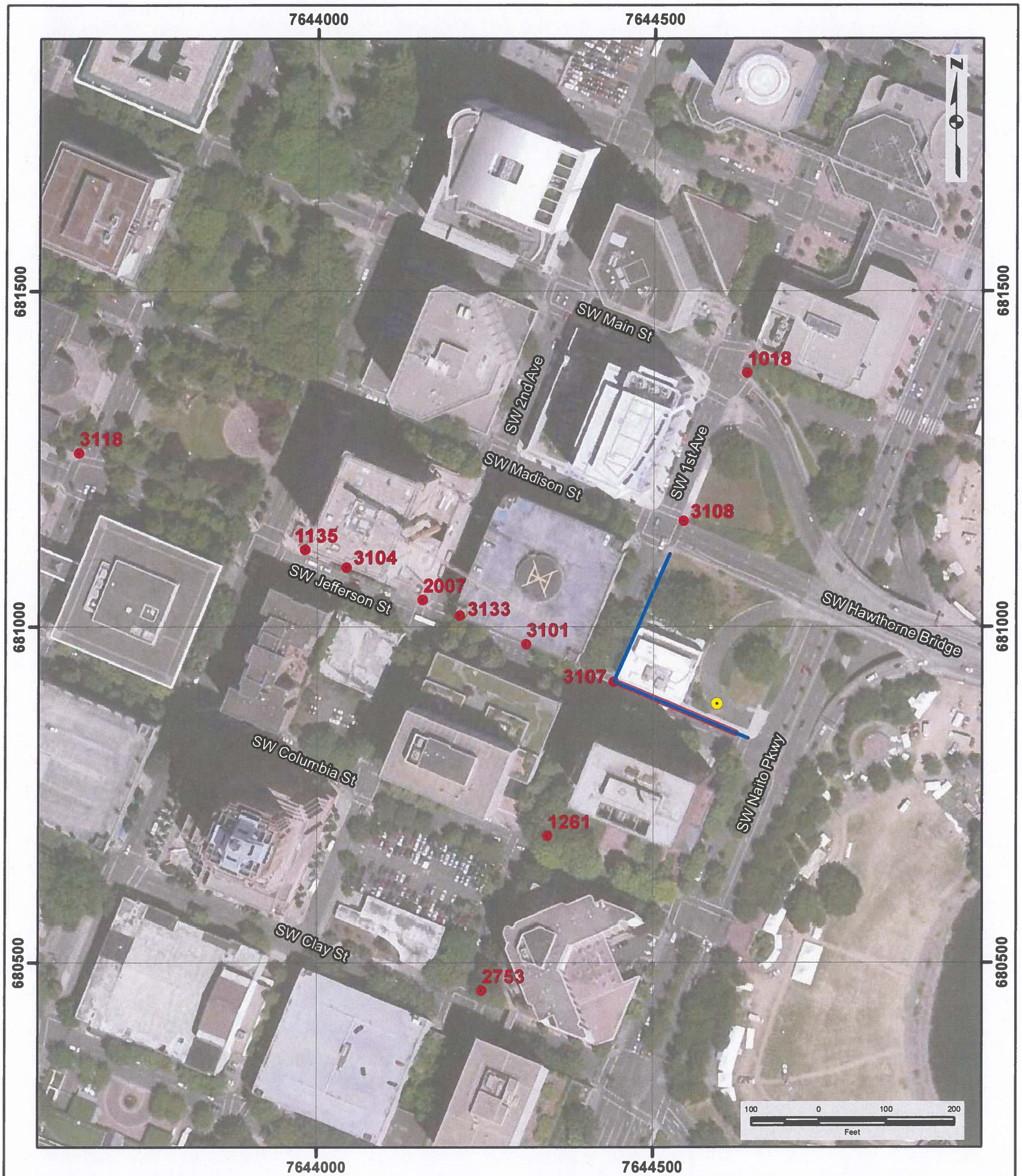
In-situ seismic measurements using active and passive surface wave techniques were performed at 1200 SW 1st Avenue, Portland, Oregon on August 22nd and 23rd, 2016. The purpose of this investigation was to provide a shear (S) wave velocity profile to a depth of 500 ft. The active surface wave technique utilized during this investigation consisted of the multi-channel analysis of surface waves (MASW) method. The passive surface wave technique consisted of the array microtremor method. The locations of the active and passive surface wave arrays are shown on Figure 1.

The average shear wave velocity of the upper 30 m (V_{S30}) is used in the NEHRP provisions and the Uniform Building Code (UBC) to separate sites into classes for earthquake engineering design (BSSC, 1994). The average shear wave velocity of the upper 100 ft (V_{S100ft}) is used in the International Building Code (IBC) for site classification. These site classes are as follows:

Class A – hard rock – $V_{S30} > 1500$ m/s (UBC) or $V_{S100ft} > 5{,}000$ ft/s (IBC)
Class B – rock – $760 < V_{S30} \leq 1500$ m/s (UBC) or $2{,}500 < V_{S100ft} \leq 5{,}000$ ft/s (IBC)
Class C – very dense soil and soft rock – $360 < V_{S30} \leq 760$ m/s (UBC)
or $1{,}200 < V_{S100ft} \leq 2{,}500$ ft/s (IBC)
Class D – stiff soil – $180 < V_{S30} \leq 360$ m/s (UBC) or $600 < V_{S100ft} \leq 1{,}200$ ft/s (IBC)
Class E – soft soil – $V_{S30} < 180$ m/s (UBC) or $V_{S100ft} < 600$ ft/s (IBC)
Class F – soils requiring site-specific evaluation

At many sites, active surface wave techniques (MASW) with the utilization of portable energy sources, such as hammers and weight drops, are sufficient to obtain a 30 m (100 ft) S-wave velocity sounding. At sites with high ambient noise levels and/or very soft soils, these energy sources may not be sufficient to image to 30 m and a larger energy source, such as a bulldozer, is necessary. Alternatively, passive surface wave techniques, such as the array microtremor technique or the refraction microtremor method of Louie (2001), can be used to extend the depth of investigation at sites that have adequate ambient noise conditions. It should be noted that two-dimensional passive surface wave arrays (e.g. triangular, circular or L-shaped arrays) will perform better than linear arrays.

This report contains the results of the active and passive surface wave measurements conducted at the site. An overview of the surface wave methods is given in Section 2. Field and data reduction procedures are discussed in Sections 3 and 4, respectively. Interpretation and results are presented in Section 5 and Section 6 presents our conclusions. References and our professional certification are presented in Sections 7 and 8, respectively.



Legend

- Active Surface Wave Array (MASW)
- Passive Surface Wave Array
- Sensor Location for Large Passive Surface Wave Array 2
- HVSR Measurement Location

NOTES:
1. Oregon State Plane Coordinate System, NAD 83, North (3601), US Survey Feet
2. Base map source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

GEOVision geophysical services

Date:	9/1/2016
GV Project:	16326
Developed by:	A Martin
Drawn by:	T Rodriguez
Approved by:	A Martin
File Name:	16326_1.MXD

FIGURE 1
AREA 1
SITE MAP

SITE LOCATED AT
1200 SW 1st AVENUE
PORTLAND, OREGON

PREPARED FOR
GEODESIGN, INC.

2 OVERVIEW OF THE SURFACE WAVE METHODS

A discussion of active and passive surface wave methods is provided in the technical note included as Appendix A. Active surface wave techniques include the spectral analysis of surface waves (SASW) and multi-channel array surface wave (MASW) methods. Passive surface wave techniques include the array and refraction microtremor methods.

The basis of surface wave methods is the dispersive characteristic of Rayleigh and Love waves when propagating in a layered medium. The Rayleigh wave phase velocity, V_R, depends primarily on the material properties (V_S, mass density and Poisson's ratio or compression wave velocity) over a depth of approximately one wavelength. The Love wave phase velocity, V_L, depends primarily on V_S and mass density. Rayleigh and Love wave propagation are also affected by damping or seismic quality factor (Q).

Waves of different wavelengths, λ, (or frequencies, f) sample different depths. As a result of the variance in the shear stiffness of the layers, waves with different wavelengths travel at different phase velocities; hence, dispersion. A surface wave dispersion curve (dispersion curve) is the variation of V_R or V_L with λ or f.

The SASW and MASW methods are in-situ seismic method for determining shear wave velocity (V_S) profiles (Stokoe et al., 1994; Stokoe et al., 1989; Park et al., 1999a and 1999b, Foti, 2000). Surface wave techniques are non-invasive and non-destructive, with all testing performed on the ground surface at strain levels in the soil in the elastic range (< 0.001%). SASW testing consists of collecting surface wave phase data in the field, generating the dispersion curve, and then using iterative forward or inverse modeling to calculate the shear stiffness profile. MASW testing consists of collecting multi-channel seismic data in the field, applying a wavefield transform to obtain the dispersion curve, and data modeling.

A detailed description of the SASW field procedure is given in Joh, 1996. A vertical dynamic load is used to generate horizontally-propagating Rayleigh waves and a horizontal force is used to generate Love waves. The ground motions are monitored by two, or more, vertical (Rayleigh wave) or horizontal (Love wave) receivers and recorded by the data acquisition system capable of performing both time and frequency-domain calculations. Theoretical, as well as practical considerations, such as attenuation, necessitate the use of several receiver spacings to generate the dispersion curve over the wavelength range required to evaluate the stiffness profile. To minimize phase shifts due to differences in receiver coupling and subsurface variability, the source location is reversed. To develop a V_S model to a 30 meter depth using Rayleigh wave methods, energy sources typically include: small hammers (rock hammer or 3 lb hammer) for short receiver intervals; 10 to 20 lb sledgehammers for intermediate separations, and accelerated weight drops (AWD) or an electromechanical shaker for larger spacings. More energetic sources, such as bulldozers or seismic vibrators (Vibroseis^{TM}), can be used to conduct characterize velocity structure to depths of 100 m or more. Energy sources for shallow imaging using Love waves include a hammer and horizontal traction plank, portable hammer impact aluminum source, and inclined or horizontal accelerated weight drop systems. Energy sources for deeper imaging using Love waves include horizontal seismic vibrators. Generally, high frequency (short wavelength) surface waves are recorded across receiver pairs spaced at short intervals, whereas low frequency (long wavelength) surface waves require greater spacing between receivers. Dispersion data averaged across greater distances are often smoother because effects of localized heterogeneities are averaged.

After the time-domain motions from the two receivers are converted to frequency-domain records using the Fast Fourier Transform, the cross power spectrum and coherence are calculated. The phase of the cross power spectrum, $\phi_w(f)$, represents the phase differences between the two receivers as the wave train propagates past them. It ranges from $-\pi$ to π in a wrapped form and must be unwrapped through an interactive process called masking. Phase jumps are specified, near-field data (wavelengths longer than two times the distance from the source to first receiver) and low-coherence data are removed. The experimental dispersion curve is calculated from the unwrapped phase angle and the distance between receivers by:

$$V_{R/L} = f * d_2/(\Delta\phi/360°)$$

where V_R = Rayleigh wave phase velocity
V_L = Love wave phase velocity
f = frequency
d_2 = distance between receivers
$\Delta\phi$ = the phase difference in degrees

A detailed description of the MASW method is given by Park, 1999a and 1999b. Ground motions are recorded by 24 or more geophones spaced 1 to 3 m apart and aligned in a linear array and connected to a seismograph. Energy sources are the same as those outlined above for SASW testing. When applying the MASW technique to develop a one-dimensional (1-D) V_S model, the surface-wave data preferably is acquired using multiple-source offsets at both ends of the array. Rayleigh and Love wave MASW acquisition can easily be combined with P- and S-wave seismic refraction acquisition, respectively. A wavefield transform is applied to the time-history data to convert the seismic record from time-offset space to phase velocity-frequency space in which the surface-wave dispersion curve can be easily identified. Common wave-field transforms include the frequency-wavenumber (f-k) transform, slant-stack transform (τ-p), frequency domain beamformer, and phase-shift transform.

A detailed discussion of the array microtremor method can be found in Okada, 2003. This technique uses 4, or more receivers aligned in a 2-dimensional array. Triangle, circle, semi-circle, and "L" shaped arrays are commonly used, although any 2-dimensional arrangement of receivers can be used. For investigation of the upper 100 m, receivers typically consist of 1 to 4.5 Hz geophones. The triangle array, which consists of several embedded equilateral triangles, is often used as it provides good results with a relatively small number of geophones. With this array, the outer side of the triangle should be at least equal to the desired depth of investigation. The "L" array is useful at sites located at the corner of perpendicular intersecting streets. Typically 20, or more, 30-second noise records are acquired for analysis. The surface wave dispersion curve is typically estimated from array microtremor data using various f-k methods such as beam-forming (Lacoss, *et al.*, 1969) and maximum-likelihood (Capon, 1969); and the spatial-autocorrelation (SPAC) method, which was originally based on work by Aki, 1957. The SPAC method has since been extended and modified (Ling and Okada, 1993 and Ohori *et al.*,

2002) to permit the use of noncircular arrays, and is now collectively referred to as extended spatial autocorrelation (ESPAC or ESAC).

The refraction microtremor technique (ReMi™), a detailed description of which can be found in Louie, 2001, differs from the more established array microtremor technique in that it uses a linear receiver array rather than a two dimensional array. Unlike the SASW method, which uses an active energy source (i.e. hammer), the microtremor technique records background noise emanating from ocean wave activity, wind noise, traffic, industrial activity, construction, etc. Refraction microtremor field procedures typically consist of laying out a linear array of 24, or more, 4.5 Hz geophones and recording 20, or more, 30 second noise records. These noise records are reduced using the software package SeisOpt® ReMi™ v2.0 by Optim™ Software and Data Services. This package is used to generate and combine the slowness (p) – frequency (f) transform of the noise records. The surface wave dispersion curve is picked at the lower envelope of the surface wave energy identified in the p-f spectrum. It should be noted that other data reduction techniques such as seismic interferometry and extended spatial autocorrelation (ESAC) can also be used to extract surface wave dispersion curves from linear array, passive surface wave data.

The horizontal-to-vertical spectral ratio (H/V spectral ratio or HVSR) technique was first introduced by Nogoshi and Igarashi (1971) and popularized by Nakamura (1989). This technique utilizes single-station recordings of ambient vibrations (microtremor or noise) made with a three-component seismometer. In this method, the ratio of the Fourier amplitude spectra of the horizontal and vertical components is calculated to determine the frequency of the maximum HVSR response (HVSR peak frequency), commonly accepted as an approximation of the fundamental frequency (f_0) of the sediment column overlying bedrock. The HVSR peak frequency associated with bedrock is a function of the bedrock depth and S-wave velocity of the sediments overlying bedrock. The theoretical HVSR response can be calculated for an S-wave velocity model using modeling schemes based on surface wave ellipticity, vertically propagating body waves, or diffuse wavefields containing body and surface waves. The HVSR frequency peak can also be estimated using the quarter-wavelength approximation:

$$f_0 = \frac{\overline{V}_S}{4z}$$

where f_0 is the site fundamental frequency and $\overline{V}_S$ is the average shear-wave velocity of the soil column overlying bedrock at depth z.

The active and passive surface wave techniques complement one another as outlined below:

- SASW/MASW techniques image the shallow velocity structure which cannot be imaged by the microtremor technique and is needed for an accurate V_{S30}/V_{S100ft} estimate.
- Microtremor techniques work best in noisy environments where SASW/MASW depth investigation may be limited.
- In a noisy environment the microtremor technique will usually extend the depth of an SASW/MASW sounding.
- The degree of fit in the overlapping portion of the dispersion curves from the two techniques provides a level of confidence in the results.

The dispersion curves generated from the active and passive surface wave soundings are generally combined and modeled using iterative forward and inverse modeling routines. The final model profile is assumed to represent actual site conditions. Several options exist for the Rayleigh wave forward solution: a formulation that takes into account only fundamental-mode Rayleigh wave motion; one that includes all stress waves and incorporates receiver geometry in an SASW test named the 3-D solution (Roesset et al., 1991); one that computes an effective mode for an MASW test but assumes a plane Rayleigh wave and no body wave effects and a multi-mode solution that models different Rayleigh wave modes. Both fundamental mode and multi-mode forward solutions are available for modeling of Love wave data.

The theoretical model used to interpret the dispersion assumes horizontally layered, laterally invariant, homogeneous-isotropic material. Although these conditions are seldom strictly met at a site, the results of active and/or passive surface wave testing provide a good "global" estimate of the material properties along the array. The results may be more representative of the site than a borehole "point" estimate.

It may not always be possible to develop a coherent, fundamental mode dispersion curve over sufficient frequency range for modeling from MASW or SASW data due to dominant higher modes with the higher modes not clearly identifiable for multi-mode modeling. It may, however, be possible to identify the Rayleigh wave phase velocity of the fundamental mode at 40 m wavelength (V_{R40}) in which case V_{S30} can at least be estimated using the Brown et al., 2000 relationship:

$$V_{S30} = 1.045 V_{R40}$$

This relationship was established based on statistical analysis of a large number of surface wave data sets from sites with control by velocities measured in nearby boreholes and has been further tested by Martin and Diehl, 2004, and Albarello and Gargani, 2010.

As with all surface geophysical methods, inversion of surface wave dispersion data does not yield a unique V_S model and there are multiple possible solutions that may equally well fit the experimental data. Based on our experience at other sites, the shear wave velocity models (V_S and layer thicknesses) determined by surface wave testing are within 20% of the velocities and layer thicknesses that would be determined by other seismic methods [Brown, 1998]. The average velocity of the upper 30 m or 100 ft, however, is much more accurate, often to better than 5%, because it is not sensitive to the layering in the model. V_{S30} does not appear to suffer from the non-uniqueness inherent in V_S models derived from surface wave dispersion curves (Martin et al., 2006, Comina et al., 2011). Therefore, V_{S30} is more accurately estimated from inversion of surface wave dispersion data than the resulting V_S models.

3 FIELD PROCEDURES

The surface wave sounding locations at the site were established by **GEO***Vision* personnel and are shown in Figure 1. Active surface wave data were acquired using the MASW technique. Passive surface wave data were acquired using the array microtremor method with "L" shaped arrays and "T" shaped arrays.

A typical MASW field layout is shown in Appendix A. MASW equipment used during this investigation consisted of one Geometrics Geode signal enhancement seismograph, 4.5 Hz vertical geophones, seismic cable a 4 lb hammer, 12- and 20 lb sledgehammers, and an aluminum plate. MASW data were acquired along a linear array of 48 geophones spaced 4 ft apart on August 22nd, 2016. Shot points were generally located 4 to 16 ft from the end geophone locations, depending upon available space, and shot points were located at 32 ft intervals in the interior of the array. The 4 lb hammer and 12 lb sledgehammer were used for the 4 ft offset source locations and the center shot. The 12 lb sledgehammer was also used at other interior source locations and the 20 lb sledgehammer was used for all off-end source locations. Data from the transient impacts (hammers) were averaged 10 times, or more, to improve the signal-to-noise ratio. Photographs of typical MASW equipment are presented in Appendix A. All field data were saved to hard disk and documented on field data acquisition forms.

The passive surface wave equipment consisted of two Geometrics Geode signal enhancement seismographs, 11 prototype Geometrics Atom single channel wireless seismographs, 1 Hz vertical geophones, 4.5 Hz vertical geophones, and seismic cables. Passive surface wave data were acquired along an "L" shaped array consisting of 48, 4.5 Hz geophones spaced 9 ft apart with the linear legs of the array being 216 and 207 ft long, respectively on August 22nd, 2016. Ambient noise measurements were made along this array for 1.5 hours at a 2 ms sample rate (200, 30 second records). Passive surface wave data were also collected on August 22nd, 2016 along a large 11 sensor "T" shaped array, as shown on Figure 1. This array consisted of 11, 1 Hz geophones connected to Geometrics Atom wireless seismographs and a maximum geophone offset of about 1,000 ft. An attempt was also made to acquire passive surface wave data along a larger array on August 23rd, 2016 but the data did not yield additional information and was not used for site characterization. All passive surface wave data were stored on a laptop computer for later processing. The field geometry and associated files names were documented in field data acquisition forms.

HVSR data were acquired at a single location on site (Figure 1) using a Nanometrics Trillium Compact 120 second seismometer coupled to a Nanometrics Taurus data acquisition unit (referred to herein as Trillium). HVSR measurements were made for the duration of array microtremor acquisition on August 23rd, 2016 (> 1.5 hours) with ambient noise data recorded at 200 samples per second. Microtremor data were stored in the Taurus data acquisition system and downloaded as miniseed format files at the end of data acquisition.

4 DATA REDUCTION AND MODELING

HVSR data were reduced using the Geopsy Version 2.9.1 software package (http://www.geopsy.org) developed by Marc Wathelet, ISTerre, Grenoble, France with the help of many other researchers.

Microtremor data recorded by the Trillium were exported to miniseed format. The data file was then loaded into the Geopsy software package, where data file columns containing the vertical and horizontal (north and east) components and the sample rate were specified. HVSR was typically calculated over a frequency range dependent upon the observed site response and using a time window length of 150 to 200 s. Time windows were automatically picked. Fourier amplitude spectra were calculated after applying a 5% cosine taper and smoothed by the Konno and Ohmachi filter with a smoothing coefficient value of 30. The vertical amplitude spectra were divided by the root-mean-square (RMS) of the horizontal amplitude spectra to calculate the HVSR for each time window and the average HVSR. Time windows containing clear transients (nearby foot or vehicular traffic) or yielding poor quality results were then deleted and the computations repeated. The average HVSR peak frequency and standard deviation from all time windows used for analysis were computed and presented along with the standard deviation of the HVSR amplitudes for all time windows.

The MASW data were reduced using the software Seismic Pro Surface V8.0 developed by Geogiga using the following steps:

- Input seismic record into software.
- Enter receiver spacing, geometry, offset range used for analysis, etc.
- Apply wavefield transform to seismic record to convert the data from time – offset to frequency – phase velocity space.
- Identify and pick Rayleigh wave dispersion curve.
- Repeat for all seismic records.
- Apply near-field criteria (maximum wavelength equal 1 to 1.3 times the source to midpoint of receiver array distance for Rayleigh wave data and 1.5 times the source to midpoint of receiver array distance for Love wave data).
- Merge multiple dispersion curves extracted from the MASW data collected along each seismic spread (different source types, source locations, different receiver offset ranges, etc.).
- Convert dispersion curves to required format for modeling.
- Calculate a representative dispersion curve for the combined MASW dispersion data using a moving average polynomial curve fitting routine.

A unique data acquisition and data reduction procedure used by **GEO***Vision* for 1-D MASW soundings is the use of multiple source types and source locations during data acquisition and the extraction of multiple dispersion curves from the different source locations, and limited offset range receiver gathers associated with each source location. The use of such a data acquisition and processing strategy ensures that the modeled dispersion curve covers as wide a frequency/wavelength range as possible and is representative of average conditions beneath the array.

The array microtremor data were reduced using the software Seisimager SW developed by Oyo Corporation/Geometrics, Inc. and the following steps:

The processing sequence for implementation of the ESAC method in the SeisImager software package is as follows:

- Input all seismic records for a dataset into software.
- Load geometry (x and y positions) for each channel in seismic records.
- Calculate the SPAC coefficients for each seismic record and average.
- For each frequency calculate the RMS error between the SPAC coefficients and a Bessel function of the first kind and order zero over a user defined phase velocity range and velocity step.
- Plot an image of RMS error as a function for frequency (f) and phase velocity (v).
- Identify and pick the dispersion curve as the continuous trend on the f-v image with the lowest RMS error.
- Convert dispersion curves to appropriate format for modeling.
- Combine multiple passive dispersion curves, as appropriate.
- Calculate a representative dispersion curve for the passive dispersion data using a moving average polynomial curve fitting routine.

The representative dispersion curves from the active and passive surface wave data at each sounding location were combined and the moving average polynomial curve fitting routine in WinSASW V3 was used to generate a composite representative dispersion curve for modeling. During this process the active surface wave data were given equal weight to the combined passive surface wave data in the overlapping wavelength range. An equal logarithm wavelength sample rate was used for the representative dispersion curve to reflect the gradual loss in model resolution with depth.

The final composite representative dispersion curve was loaded into a forward or inverse modeling software package to develop a V_S model. Rayleigh wave dispersion data were modeled using the effective mode solution in the WinSASW V3. During this process an initial velocity model was generated based on general characteristics of the dispersion curve and the forward or inverse modeling routine utilized to adjust the layer V_S until an acceptable agreement with the observed data was obtained. Layer thicknesses were adjusted and the inversion process repeated until a V_S model was developed with low RMS error between the observed and calculated dispersion curves. Data inputs into the modeling software include layer thickness, S-wave velocity, P-wave velocity or Poisson's ratio, and mass density. P-wave velocity and mass density only have a very small influence (i.e. less than 10%) on the S-wave velocity model generated from a surface wave dispersion curve. However, realistic assumptions for P-wave velocity, which is significantly impacted by the location of the saturated zone, and mass density will slightly improve the accuracy of the S-wave velocity model.

Constant mass density values of 106 to 144 lb/ft^3 were used in the profile for subsurface soils/rock depending on P- and S-wave velocity. Within the normal range encountered in geotechnical engineering, variation in mass density has a negligible (±2%) affect on the estimated V_S from surface wave dispersion data. During modeling of Rayleigh wave dispersion data, the compression wave velocity, V_P, for unsaturated sediments was estimated using a Poisson's ratio, v, of 0.3 and the relationship:

$$V_P = V_S\,[(2(1-v))/(1-2v)]^{0.5}$$

Poisson's ratio has a larger affect than density on the estimated V_S from Rayleigh wave dispersion data. Achenbach (1973) provides approximate relationship between Rayleigh wave velocity (V_R), V_S and v:

$$V_R = V_S\,[(0.862 + 1.14\,v)/(1+v)]$$

Using this relationship, it can be shown that V_S derived from V_R only varies by about 10% over possible 0 to 0.5 range for Poisson's ratio where:

$$V_S = 1.16V_R \text{ for } v = 0$$
$$V_S = 1.05V_R \text{ for } v = 0.5$$

The realistic range of the Poisson's ratio for typical unsaturated sediments is about 0.25 to 0.35. Over this range, V_S derived from modeling of Rayleigh wave dispersion data will vary by about 5%. An intermediate Poisson's ratio of 0.3 was selected for modeling to minimize any error associated with the assumed Poisson's ratio.

To reduce errors associated with expected high Poisson's ratio of saturated sediments, the saturated zone was anchored at a depth of 30 ft based on information provided by the client. Poisson's ratio of the saturated zone was set to between 0.35 and 0.45 depending on the modeled S-wave velocity (e.g. higher velocity sediments expected to have a lower Poisson's ratio in the saturated zone).

The predicted HVSR response based on the diffuse field assumption was computed for all V_S models using the software package *HV-Inv* Release 1.0 Beta, which is summarized in García-Jerez, et al., 2016, and compared to the observed HVSR peaks. The final model accepted for the purpose of site characterization reasonably well fit both the dispersion data and the HVSR peaks.

5 INTERPRETATION AND RESULTS

The observed HVSR data is presented as Figure 2. Two peaks are observed in the HVSR data: one at a frequency of about 6 Hz, which is expected to be associated with a near surface high velocity sediment layer, and the other at a frequency of about 1.5 Hz, which is expected to be associated with the competent basalt unit at depth. The low amplitude HVSR response between the two peaks, indicates that a velocity inversion (expected weathered basalt unit) may occur between the two high velocity geologic units giving rise to the HVSR peaks.

The fit of the theoretical dispersion curve to the experimental data collected at the site and the modeled V_S profile for the surface wave sounding is presented as Figure 3. The resolution decreases gradually with depth due to the loss of sensitivity of the dispersion curve to changes in V_S at greater depth. The V_S profile used to match the field data is provided in tabular form as Table 1. A comparison of the observed HVSR response to the calculated HVSR response for the presented V_S model is presented as Figure 4.

Table 1 V_S Model

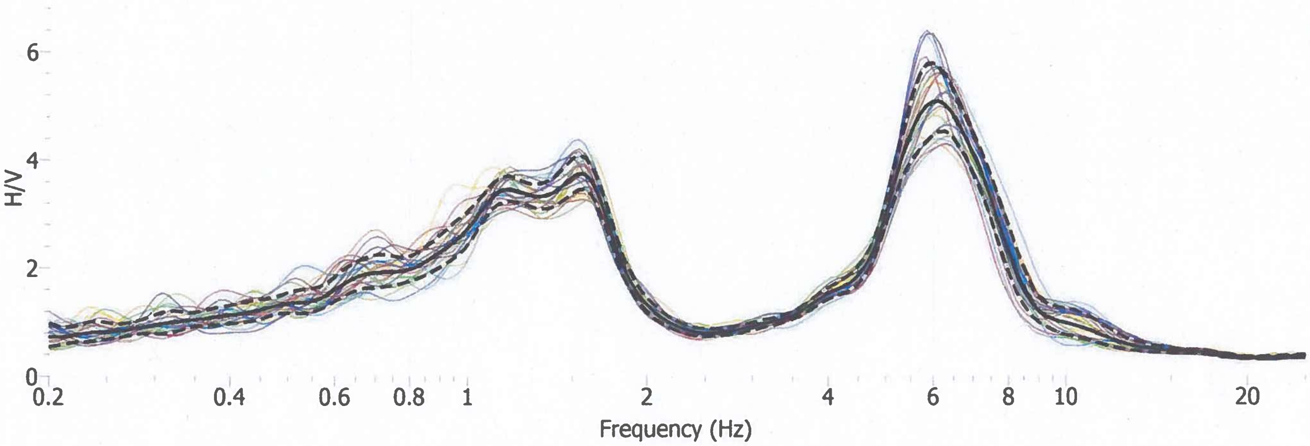
Depth to Top of Layer (ft)	Layer Thickness (ft)	S-Wave Velocity (ft/s)	Inferred P-Wave Velocity (ft/s)	Assumed Poisson's Ratio	Assumed Density (lb/ft^3)
0	0.25	4500	8419	0.300	144
0.25	4.75	430	804	0.300	106
5	10	650	1216	0.300	112
15	15	825	1543	0.300	115
30	20	1900	6302	0.450	128
50	50	2500	5204	0.350	131
100	100	2800	5829	0.350	134
200	115	1800	4984	0.425	125
315	125	3950	7390	0.300	137
440	>60	4750	8886	0.300	144

The Rayleigh wave phase velocities from the passive surface wave arrays are generally in excellent agreement with those from the MASW data in the regions of overlapping wavelength. The estimated depth of investigation for the combined active and passive surface wave sounding is about 500 ft.

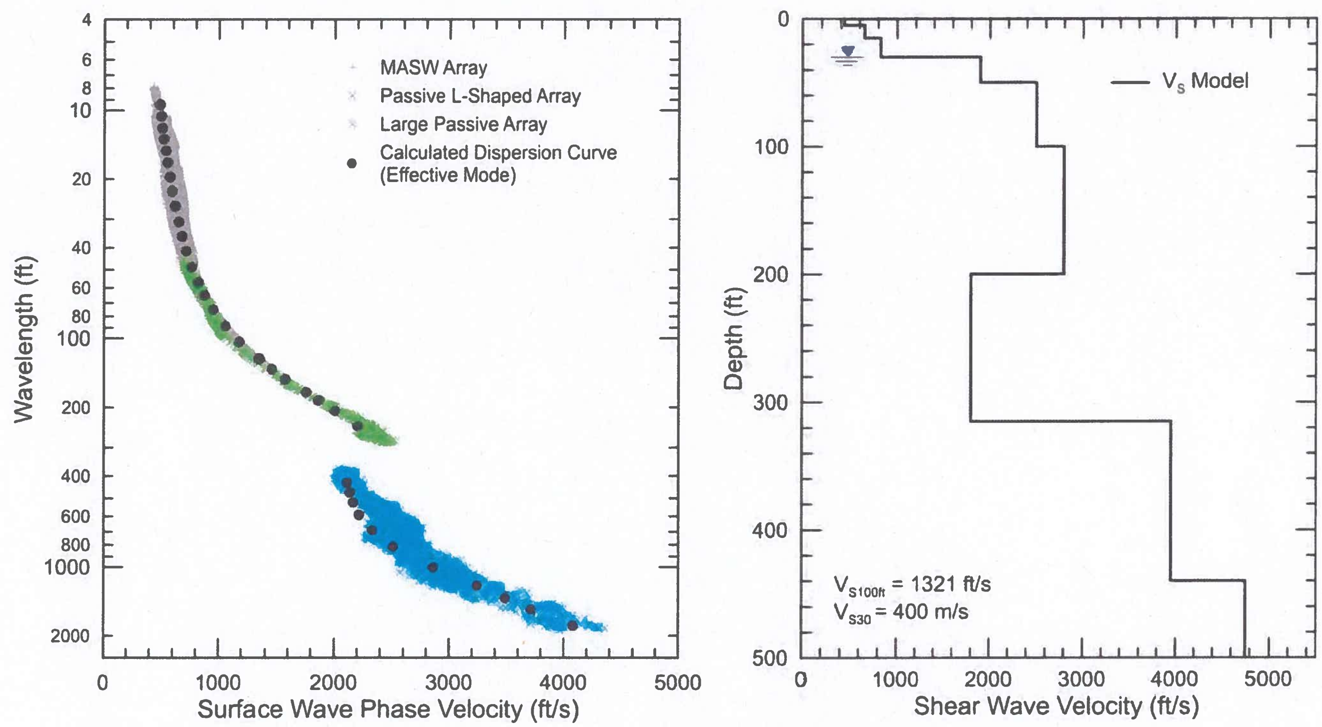
The V_S model (Figure 3 and Table 1) was developed from the surface wave dispersion data derived from an MASW array, 48 channel "L" shaped passive surface wave array, and large 11 channel "T" shaped passive surface wave array and HVSR data. A V_S model was developed that both fit the observed surface wave dispersion data and HVSR peak frequency and amplitude as well as possible.

The V_S model has a thin asphalt/concrete layer to reflect the fact that the HVSR and surface wave measurements were made on paved surfaces. No attempt was made to recover surface wave dispersion data at the small wavelengths impacted by this layer and the presence or absence of this layer does not have a significant effect on the presented V_S model. However, it was necessary to insert this layer in the model to more accurately estimate HVSR amplitudes at high frequencies. Below the asphalt layer, V_S of the sediments gradually increases with depth from about 430 ft/s to 825 ft/s at a depth of 15 ft. There is an abrupt increase in V_S to over 1,900 ft/s at a depth of 30 ft, which is associated with the approximate 6 Hz HVSR peak. Between a depth of 30 and 200 ft, V_S is in the approximate 1,900 to 2,800 ft/s range. At a depth of about 200 ft, V_S abruptly decreases to about 1,800 ft/s in what is expected to be a weathered basalt unit. V_S increases to over 3,950 ft/s at a depth of about 315 ft in what is expected to be more competent basalt and likely continues to increase with depth as the weathering of the basalt decreases. The competent basalt unit is the source of the approximate 1.5 Hz HVSR peak. There is significant non-uniqueness associated with the velocity inversion between 200 and 315 ft where the thickness of the unit can be adjusted and compensated for by adjusting the velocity of the unit or bounding units.

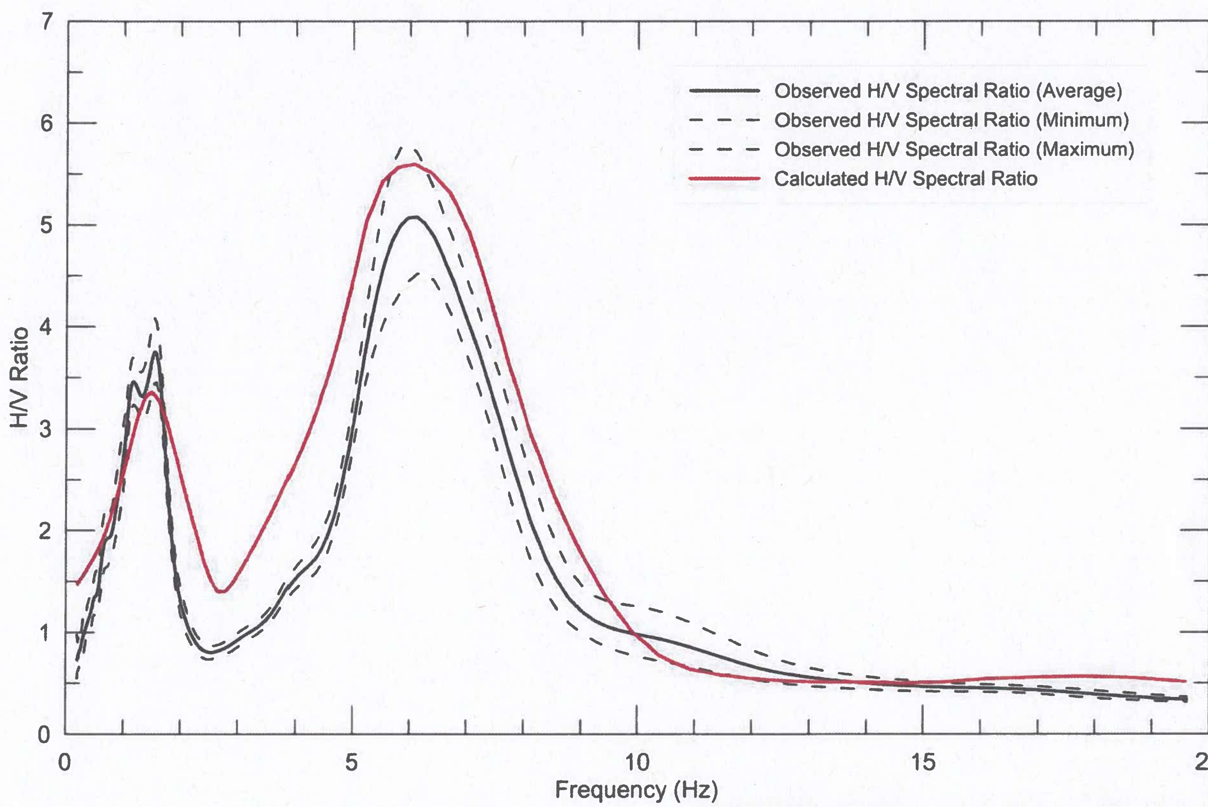
The average shear wave velocity to a depth of 30 m (V_{S30}), computed after replacing the V_S of the thin asphalt/concrete layer by that of the underlying unit, is 400 m/s. The average shear wave velocity to a depth of 100 ft, V_{S100ft}, is 1,321 ft/s. Therefore, according to the NEHRP provisions of the Uniform Building Code, the site is classified as Site Class C, very dense soil and soft rock.



GEOVision geophysical services	FIGURE 2 OBSERVED H/V SPECTRAL RATIO
Project No: 16326 Date: SEP 1, 2016	1200 SW 1ST AVENUE PORTLAND, OREGON
Drawn By: A MARTIN Approved By: Antony J Martin R:\GVProjects\2016\16326GeoDesign\report\Figure2.cdr	PREPARED FOR GEODESIGN, INC.



GEOVision geophysical services	FIGURE 3 SURFACE WAVE MODEL
Project No: 16326 Date: SEP 1, 2016	1200 SW 1ST AVENUE PORTLAND, OREGON
Drawn By: A MARTIN Approved By:	PREPARED FOR GEODESIGN, INC.



GEOVision geophysical services	FIGURE 4 OBSERVED AND CALCULATED H/V SPECTRAL RATIO
Project No: 16326 Date: SEP 1, 2016	1200 SW 1ST AVENUE PORTLAND, OREGON
Drawn By: A MARTIN Approved By:	PREPARED FOR GEODESIGN, INC.

6 CONCLUSIONS

Active and passive surface wave measurements were made in the vicinity of the property located at 1200 SW 1st Avenue, Portland, Oregon to develop a S-wave velocity profile to a depth of 500 ft. The locations of the geophysical testing arrays are presented in Figure 1.

The surface wave dispersion data and V_S model are presented as Table 1 and Figure 3. Depth of investigation at this site is over 500 ft. A comparison of the observed HVSR data and calculated HVSR response for the presented V_S model is presented as Figure 4.

The V_S model has a thin asphalt/concrete layer to reflect the fact that the HVSR and surface wave measurements were made on paved surfaces. V_S is about 430 ft/s below this layer and gradually increases with depth to about 825 ft/s at a depth of 15 ft and abruptly increases to over 1,900 ft/s at a depth of about 30 ft, the source of the 6 Hz HVSR peak. V_S is between about 1,900 and 2,800 ft/s between 30 and 200 ft and then abruptly decreases to about 1,800 ft/s in what is expected to be weathered basalt. Competent basalt with V_S of about 3,950 ft/s is modeled at a depth of about 315 ft. The V_S of the basalt increases to about 4,750 ft/s at a depth on the order of 440 ft and may continue to increase with depth as weathering decreases in the basalt unit.

V_{S30} and V_{S100ft} are 400 m/s and 1,321 ft/s, respectively. In computing these parameters the velocity of the thin surface asphalt/concrete layer was replaced with that of the underlying layer. Therefore, according to the Uniform and International Building Codes, the area in the vicinity of the surface wave arrays is classified as Class C, very dense soil and soft rock.

7 REFERENCES

Achenbach, J.D., 1973, Wave Propagation in Elastic Solids, Elsevier, Amsterdam, The Netherlands.

Aki, K. (1957). Space and time spectra of stationary stochastic waves, with special reference to microtremors. *Bull. Earthq. Inst. Univ. Tokyo*, v. 35, pp. 415–457.

Albarello, D. and G. Gargani, 2010, "Providing NEHRP soil classification from the direct interpretation of effective Rayleigh-wave dispersion curves", *Bulletin of the Seismological Society of America,* Vol. 100, No. 6, p 3284-3294.

Brown, L.T., 1998, "Comparison of V_S profiles from SASW and borehole measurements at strong motion sites in Southern California", Master's thesis, University of Texas, Austin.

Brown, L. T., Diehl, J. G., and R. L. Nigbor (2000). A simplified method to measure average shear-wave velocity in the top 30 m (V_s30), Proc. 6th International Conference on Seismic Zonation, pp. 1–6.

BSSC, 2003, *NEHRP recommended provisions for seismic regulations for new buildings and other structure (FEMA 450), Part I: Provisions*, Building Seismic Safety Council, Federal Emergency Management Agency, Washington D.C.

Capon, J. (1969). High-resolution frequency-wavenumber spectrum analysis, Proc. Institute of Electrical and Electronics Engineers (IEEE), v. 57, no. 8, pp. 1408–1418.

Comina, C., S. Foti, D. Boiero, and L. V. Socco (2011). Reliability of $V_{S,30}$ evaluation from surface-wave tests, J. Geotech. Geoenviron. Eng., pp. 579–586.

Foti, S., 2000, "Multistation Methods for Geotechnical Characterization using Surface Waves", Ph.D. Dissertation, Politecnico di Torino, Italy.

García-Jerez A, Piña-Flores J, Sánchez-Sesma F, Luzón, F, Perton, M, 2016, A computer code for forward computation and inversion of the H/V spectral ratio under the diffuse field assumption, Computers & Geosciences, In Press.

Imai, T., Fumoto, H., and Yokota, K., 1976, "P- and S-Wave Velocities in Subsurface Layers of Ground in Japan", Oyo Corporation Technical Note N-14.

International Committee of Building Officials, 2000 International Building Code, ICC, Hauppauge, NY, Section 1615.1.1

Joh, S.H., 1996, "Advances in interpretation and analysis techniques for spectral-analysis-of-surface-waves (SASW) measurements", Ph.D. Dissertation, University of Texas, Austin.

Joh, S.H., 2002, "WinSASW V2.0, Data Interpretation and Analysis for SASW Measurements", Department of Civil Engineering, Chung-Ang University, Anseong, Korea.

Lacoss, R. T., E. J. Kelly and M. N. Toksöz (1969). Estimation of seismic noise structure using arrays, *Geophysics*, v. 34, pp. 21-38.

Ling, S. and H. Okada (1993). An extended use of the spatial correlation technique for the estimation of geological structure using microtremors, Proc. the 89th Conference Society of Exploration Geophysicists Japan (SEGJ), pp. 44–48 (in Japanese).

Louie, J.N., 2001, "Faster, Better: Shear-Wave Velocity to 100 Meters Depth from Refraction Microtremor Arrays", Bulletin of the Seismological Society of America, vol. 91, no. 2, p. 347-364.

Martin, A. J. and J. G. Diehl, 2004, "Practical experience using a simplified procedure to measure average shear-wave velocity to a depth of 30 meters (V_S30)", *Proceedings of the 13th World Conference on Earthquake Engineering*, Vancouver, B.C., Canada, August 1-6, 2004, Paper No. 952.

Martin, A. J., J. B. Shawver and J. G. Diehl, 2006, "Combined use of Active and Passive Surface Wave Techniques for Cost Effective UBC/IBC Site Classification", *Proceedings of the 8th National Conference on Earthquake Engineering*, San Francisco, California, Paper No. 1013.

Nakamura Y, 1989, A method for dynamic characteristics estimation of subsurface using microtremor on the ground surface, *Quart. Reprt Rail. Tech. Res. Inst.*, Vol. 30, no. 1, p 25–33.

Nogoshi M and Igarashi T, 1971, On the amplitude characteristics of microtremor (part 2), *J. Seismol. Soc. Japan*, Vol. 24, p 26–40 (in Japanese).

Ohori, M., A. Nobata, and K. Wakamatsu (2002). A comparison of ESAC and FK methods of estimating phase velocity using arbitrarily shaped microtremor arrays, *Bull. Seismol. Soc. Am.*, v. 92, no. 6, p. 2323–2332.

Okada, H, 2003, "The Microtremor Survey Method," Society of Exploration Geophysics Geophysical Monograph Series, Number 12, 135p.

Park, C.B., Miller, R.D. and Xia, J., 1999a, "Multimodal analysis of high frequency surface waves", *Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems '99*, 115-121.

Park, C.B., Miller, R.D. and Xia, J., 1999b, "Multichannel analysis of surface waves", Geophysics, Vol 64, No. 3, 800-808.

Rix, G.J., 1988, "Experimental study of factors affecting the spectral-analysis-of surface-waves method", Ph.D. Dissertation, University of Texas, Austin.

Roesset, J.M., Chang, D.W. and Stokoe, K.H., II, 1991, "Comparison of 2-D and 3-D Models for Analysis of Surface Wave Tests," *Proceedings*, 5th *International Conference on Soil Dynamics and Earthquake Engineering*, Karlsruhe, Germany.

Stokoe, K.H., II, Rix, G.L. and S. Nazarian, 1989, "In situ seismic testing with surface waves" *Proceedings, Twelfth International Conference on Soil Mechanics and Foundation Engineering, Vol. 1,* Rio de Janeiro, Brazil, pp. 330-334.

Stokoe, K.H., II, Wright, S.G., Bay, J.A. and Roesset, J.M., 1994, "Characterization of Geotechnical Sites by SASW Method," *ISSMFE Technical Committee 10 for XIII ICSMFE*, Geophysical Characteristics of Sites, A.A. Balkema Publishers/Rotterdam & Brookfield, Netherlands, pp. 146.

8 CERTIFICATION

All geophysical data, analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by a **GEO*Vision*** California Professional Geophysicist.

Prepared by

9/1/2016

Antony J. Martin — Date

California Professional Geophysicist, P. Gp. 989

GEO*Vision* Geophysical Services

* This geophysical investigation was conducted under the supervision of a California Professional Geophysicist using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing interpretation and reporting. All original field data files, field notes and observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations or ordinances.

(page intentionally left blank)

(page intentionally left blank)

STUFISH Temporary Venue Case Study

EXPLORATION OF TEMPORARY VENUE IDEA

At the kick-off and stakeholders' meetings in February 2023, it became apparent that a solution needs to be found to temporarily rehome the stakeholders of the Keller while the Keller is closed for renovation. At the meeting, it was mentioned that a buyout for not performing is not an option. Also, currently, there are no suitable alternative theatres that have comparable seating capacity or BOH facilities for the shows to move to.

Stufish Entertainment Architects suggested a moveable and demountable theatre as the temporary home for the stakeholders during the closure of the Keller. A proper feasibility study and preliminary design would be required to determine suitability for this project in its own geographical environment, local rules and regulations, requirements for the number of desired moves, and requirements of the stakeholders.

If a suitable site can be found and an interim theatre can be built, it would allow the Keller stakeholders to continue performing and operating while the Keller is shut for the upgrading works. When the stakeholders move back into the newly refurbished Keller, the building can either be leased or sold on to another group or city that undergoes a similar situation, extending the legacy of the Keller project to a wider audience and perhaps even providing access to new audiences for shows they usually have to travel long distances for.

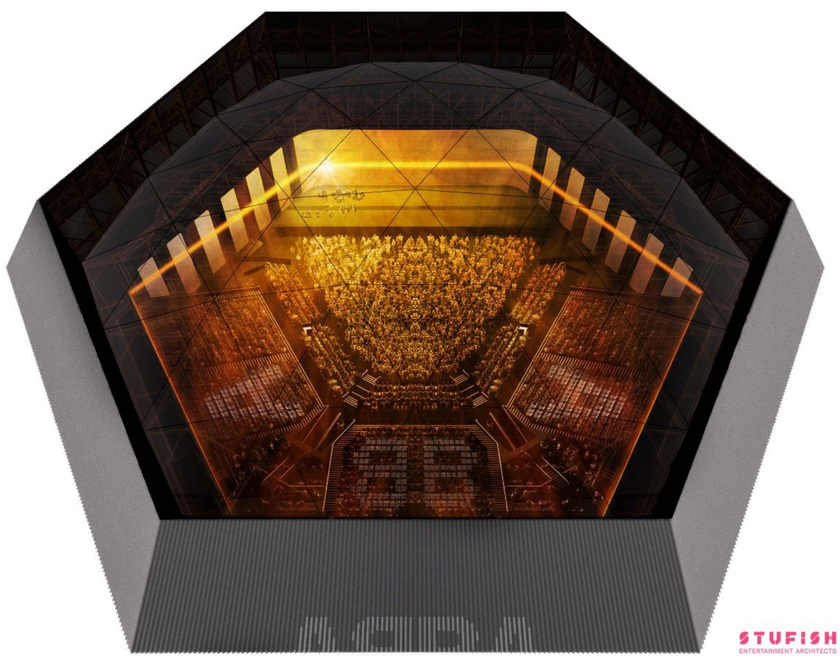
To generate an understanding of the possibilities, we will use a case study below of the award-winning demountable Abba Voyage Arena we recently completed in London.

TEMPORARY VENUE CASE STUDY: ABBA ARENA

Overview

1. STUFISH designed the ABBA Arena as a state-of-the-art 3000 capacity venue for ABBA Voyage; a revolutionary concert that blends physical and digital worlds to bring ABBA back on stage after 40 years. The arena has brought a cutting-edge entertainment offering to a vacant site in East London on a temporary basis while it awaits future development. The show has drawn over 1 million visitors in its first year and continues to enhance London's status as a leading centre for visual effects, entertainment, and film.

2. Conceived to feel like a mysterious object has landed on the East London site; its brutalist hexagonal form is softened by timber synonymous with Swedish design. The natural feel of the timber cladding is intended to contrast with the high-tech show inside – internally show effects wrap around the entire auditorium creating an immersive, yet incredibly intimate environment. The structure was designed to create an internal clear span of 70m to allow for the 360° immersive production. The arena layout follows a hexagonal geometry, with seating for 1,650 people wrapping around a central dance floor for 1,350 people so the audience can share the joy and emotion of the show with each other.



Site

• In London, the site for the Abba Arena is leased on a temporary basis as a ‘meantime’ use. The site was previously used as a parking lot and is earmarked for redevelopment as part of a mixed-use masterplan that forms part of the legacy of the 2012 Olympic Games.

• Planning permission was granted for a limited period to allow for the construction, show run, demounting process, and reinstatement to the original state.

• The building has been designed to take into account the physical context of the London site, but also be adaptable to other future sites, subject to certain constraints.

• Key considerations for the site are visitor access (ideally via public transport), acoustic constraints, ground conditions, and neighboring properties.

• The London site has good public transport links, and although it is outside of the main theatre district, it has other nearby cultural and residential neighbors.

Construction

- The Abba Arena is split into five areas with separate construction methods, all of which are designed to speed up construction and ensure its suitability for demounting and onward transportation.

  o The main arena building is a steel construction with bolted joints and an innovative construction methodology. This structure allows for a 70m clear span over the auditorium, and therefore requires below ground foundations. These are minimized by ensuring that the structure is as lightweight as possible.

  o The seating structure is a CLT construction that sits independently to the arena envelope and has no below ground foundations.

o The stage and screen structure are constructed from a scaffold / stage deck system.

o The Front of House accommodation and canopy are CLT constructions sitting on a lightweight steel deck. No below ground foundations are used for this area. These elements are modular and can be re-configured to suit the spatial requirements of a future site.

o The Back of House offices and performer facilities are separate from the main arena building and comprise rented pre-fabricated modular buildings with minimal foundations.

Sustainability

• Key considerations for the sustainability of the Abba Arena are minimizing embodied carbon, maximizing energy efficiency, and minimizing transportation weight for the onwards moves.

• Mass timber has been used where possible. Not only does it help with reducing embodied carbon, it also functions both structurally and as an attractive final finish.

• Where it is necessary to use a steel structure to achieve the large clear span roof, it has been engineered to be as efficient as possible in order to minimise the weight of steel used. All elements are sized to be containerised for efficient onward transportation, with bolted connections for efficient demounting.

• Energy efficiency has been maximized by reducing the area of the 'conditioned' internal space. The Front of House facilities at the Abba Arena are all external and naturally ventilated. The main arena building uses air-source heat pumps and has a high level of insulation for both thermal and acoustic reasons.

• There is a carbon cost to moving the building from site to site. This compares favorably to leaving the building in place and finding another use for it and then constructing a new venue from scratch in a new location. It is not a 'throw away' building – it has a long design life.

Technology/Production equipment

- The Abba Arena was designed specifically for a single and very specific show. The high end and innovative technical and production equipment were able to be integrated into the building during construction to speed up installation.

Timeline

- The Abba Arena took approximately 3 years from concept design to show opening

(Noting unique circumstances including Covid, Brexit and the Suez Canal blockage)

Finance

- Construction costs depend on numerous factors and also on the ambition of the client with regards to design.

- Like the Abba Arena, the temporary Keller theatre would be its own unique project that has its own challenges, technical complexities, and identities.

- We have endeavoured to give a ballpark number to give a rough idea of potential costs in consultation with our UK cost consultant. Construction costs including MEP but excluding groundworks or show related costs are roughly estimated between £4,000/m2 to £7,500/m2 for a demountable theatre. Please note that no USA factor has been applied in the above numbers and that it is based on UK material costs and fees.

(page intentionally left blank)

City-Funded Seismic and Feasibility Study Summary

CITY-FUNDED SEISMIC & FEASIBILITY STUDY

In January 2017, the City of Portland engaged Merryman Barnes Architects, LMN Architects, Miller Consulting Engineers, and other consultants to perform conceptual feasibility studies to determine baseline costs and schedule implications of different options for the Keller Auditorium. These options are summarized below; the complete study report is also appended.

Option 1A: "Brute Force" Seismic Upgrade Only

Objective: The objective of this study was to establish a general scope and cost to bring the Keller Auditorium up to current building and zoning codes.

Outcome: Although this option achieves the goal of making the Keller safer in the case of a major earthquake, it does not improve the functionality and programmatic elements that are considered necessary to keeping Keller Auditorium a competitive, world-class performing arts theater. This option also misses out on an opportunity to create momentum and energy to provide a catalyst for the much-needed renaissance for the Portland region.

Option 1B: Seismic Upgrade with Required Sustaining Projects

Objective: To "strengthen the building sufficiently to prevent collapse and save lives with an understanding that the building may need major repairs or replacement after a major seismic event."

Outcome: The report concluded that "the costs are great and the disruption profound – with no significant improvements to the theatrical, functional and programmatic elements that are generally considered necessary for a venue of this type to continue to be competitive for the next 20+ years."

Option 2: Major Renovation

Objective: This option explored a potential renovation and addition to substantially improve the Keller Auditorium, transforming the urban experience while also elevating the performing arts scene in Portland. This option included significant improvements to the building program and would bring the facility into compliance with current codes.

Outcome: Although this option would be costly and would include a significant period of facility closure, it would make significant improvements to the theater that would allow it to remain a viable structure and venue for the future.

Option 3: New Theater Building

Objective: This high-level programming study was done primarily to establish a cost benchmark that would help inform the City of Portland's decision process. Two plans were developed: One that used optimum site dimensions for a theater program, and another that was designed to fit within Portland's 200-foot-block city grid. Both plans had the same elements and 218,756 total square footage.

Outcome: The report concluded that "the cost for construction is the highest of the options studied – but the cost per square foot is less than a major renovation of the existing Keller. And a totally new facility will be the safest option and can be designed and built to modern theatrical standards, ensuring that the money spent will not be wasted because the new facility will be viable for a very long time."

PROJECT IMPACTS

Right-of-Way Use

The proposed building will extend significantly out over the SW 3rd Avenue right-of-way. The building will also be built approximately 8 feet into the SW 2nd Avenue right-of-way. The City of Portland has several rules and policies that address building encroachments or vacations of the public right-of-way, some of which are noted later in this section. The impact of these policies on the design will need to be coordinated in the city in the next phase of this project.

Southwest Third Avenue

The proposed design extends out over the SW 3rd Avenue right-of-way. The proposed project envisions a reduction in vehicular traffic on SW 3rd Avenue between SW Clay and Market Streets. The existing 51-foot-wide right-of-way includes, from east to west:

8’ sidewalk | 8’ loading zone | 12’ traffic lanes x 2 | 3’ bike lane | 5’ loading zone | 3’ sidewalk

The 3-foot sidewalk on the west side of SW 3rd Avenue is supplemented by 5 feet of sidewalk on the Keller Fountain site. The project considered several traffic reduction alternatives for SW 3rd Avenue. The most restrictive consideration would be full closure of SW 3rd Avenue to vehicular traffic, with removable bollards at Market and Clay to allow for special access scenarios. The least restrictive consideration was to maintain a single lane of traffic on the west side of SW 3rd Avenue for through vehicular traffic. All scenarios would maintain pedestrian and bicycle access on Third between Clay and Market.

The proposed expansion into the SW 3rd Avenue right-of-way will also impact existing utilities located below this street.

There is an existing 12-inch public water main located at the approximate centerline of SW 3rd Avenue. The 6-inch domestic water and 8-inch fire protection service for Keller Auditorium branch off the 12-inch main, as well as the 4-inch water service to Keller Fountain. There is also a fire hydrant on the northwest corner of SW 3rd and SW Clay that comes off the main.

We anticipate the water main will need to be abandoned or relocated to allow for construction, and the services will need to be relocated. New services for the auditorium could be taken from the existing 12-inch main in Market Street, while new service for the fountain could be taken from the 6-inch main in Clay Street. Coordination with the Portland Water Bureau is required to determine if the main can be abandoned or needs to be reconstructed. The final scenario will be dependent on the outcome of the encroachment or vacation, as there are rules associated with public water mains and private water lines related to public and private property and crossing property lines.

There is a large, shared communication duct bank located on the east side of SW 3rd Avenue. The shared facility was built in the 2000s and includes a shared duct bank and six large vaults for each carrier to access their fiber lines separately. Carriers with infrastructure in SW 3rd Avenue include Lumen, Century Link, Level 3, Zayo, Windstream, Verizon, and potentially others. Relocation of this infrastructure is not feasible. The project proposed to reserve a 20-foot-wide area on the west side of SW 3rd Avenue; this area will be accessible by the communication providers. A 20-foot-high clear space will be maintained over the existing area to allow for construction and maintenance equipment to access the existing vaults.

An existing Pacific Power transformer vault is located at the SE corner of the site beneath a small building operations parking area. The infrastructure contained within is likely outdated and undersized for a new facility. With the reconfiguration of the east portion of the building, it is anticipated that a new vault will need to be incorporated into the site design. Details of the vault will need to be coordinated with Pacific Power in the next phase of the project.

Southwest Second Avenue

The proposed expansion to the loading encroaches about 8 feet into the SW 2nd Avenue right-of-way. This requires a reduction in the width of the Second Avenue right-of-way. The existing 40-foot-wide right-of-way includes, from east to west:

8' sidewalk | 16' traffic lane | 8' parking | 8' sidewalk

Reducing the right-of-way width to 32 feet would eliminate the parking strip on the east side of the street. Based on the most recent Pedestrian Design Guide, the following is proposed:

10' sidewalk | 14' traffic lane | 8' sidewalk

The existing 8-foot-wide sidewalk on the east side of Second Avenue is supplemented by an on site sidewalk area under the existing parking garage structure.

Relevant City of Portland Policies Regarding Encroachments Into the Right-of-Way

City of Portland Policy No. TRN-8.08, Encroachments in the Right-of-Way, has a section on Encroachments and Building Projects as Per Building Code. Section 3202.3.2 discusses balconies and architecture features. The proposed encroachment does not meet the IBC regulations for Oriel windows and balconies. The section notes, "Oriel windows and balconies that do not meet these IBC regulations are considered "Major Encroachment" and require a lease. They are only allowed on a limited basis, are strongly discouraged, may require Design Review, and must be approved by City Council."

City of Portland Policy No. TRN-8.01, Major Encroachments, outlines the relevant approval process, criteria, and standards. The policy doesn't anticipate an encroachment like the one proposed for Third Avenue by this project. Generally, the proposed encroachment would be classified as an at-grade and an above-grade encroachment and do not implicitly meet the approval criteria and standards outlined in the policy; a street vacation may be an alternate path to approval. The proposed encroachment on Second Avenue does not meet the intent of an encroachment and would likely require a street vacation.

City of Portland Policy No. TRN-1.06, Street Vacations, is the manual most recently updated by the City in April 2021. A street vacation is a lengthy and complicated process, as outlined in the following steps and timeline.

Step in Street Vacation Process	Time Limit
Early Assistance & Preliminary Investigation (Phase 1)	One (1) year from date of EA Review Summary Report to submit the street vacation application.
Petition and Preparation (Phase 2)	Six (6) months from the date the petition is sent to the Petitioner.
Formal Investigation (Phase 3)	Ninety (90) days
Bureau Director's Report	Ninety (90) days
Repeal of Ordinance	Six (6) months after Council approval. OR Eighteen (18) months after Council approval.

(page intentionally left blank)

2020 Keller Auditorium Seismic Analysis Summary

KELLER AUDITORIUM

SEISMIC ANALYSIS SUMMARY

March 2020

OMF OFFICE OF MANAGEMENT AND FINANCE

For over 100 years, the Keller Auditorium has remained one of Portland's largest and most popular performing arts venues, hosting nearly 400,000 guests each year for musical performances, Broadway shows, and civic events. Along with four other venues, the Keller Auditorium is owned by the City and operated by the Portland'5 Centers for the Arts.

Like thousands of older civic buildings up and down the West Coast, the Keller Auditorium was not built with the structural features needed to withstand major earthquakes. Although more than 80 percent of the original brick and terra cotta building was removed when the auditorium was renovated in 1968, the exterior walls were left intact behind a new façade, doing little to improve the building's structural resilience.

Building codes and knowledge about structural engineering have changed significantly over the past 50 years, raising questions about the ability of older civic buildings like the Keller Auditorium to withstand a major earthquake. After the Keller Auditorium was placed on the City's master list of unreinforced masonry buildings, the City, Portland'5 Centers for the Arts, and a consultant team began a structural assessment of the Keller Auditorium in 2017.

The structural assessment revealed that the building requires significant structural enhancements to withstand a major seismic event. Beyond the building's structural and seismic issues, the operators report that the facility has serious shortcomings that detract from guest comfort, limit accessibility, pose complications for productions, limit revenue-generating opportunities, increase operating costs, and make maintenance difficult.

Like thousands of older civic buildings up and down the West Coast, the Keller Auditorium was not built with the structural features needed to withstand major earthquakes.

For performers, the theater has inadequate dressing room space, poor on-stage air conditioning, and no access from the backstage area to the lobby, compared to venues of similar size around the country. For event attendees, the current slope of the aisles is too steep, the number and location of accessible seating areas do not meet ADA standards, and restrooms are inadequate, creating long waits. Materials containing asbestos are common throughout the building and older equipment, such as house lights, lack back-up systems that are needed to improve safety and operational predictability. Overall, the facility is severely outdated when compared to similar venues in peer cities.

Portland'5 is actively addressing maintenance safety issues through operations policy and targeted maintenance investments, but the facility is poorly suited to continue as Portland's premier performing arts venue.

To better understand the scope, scale, and cost of the needed enhancements, the City worked with Portland'5 and consultants to develop a preliminary series of options for the Keller's future:

Option	Desription	Estimated Construction Closure	Estimated Construction Cost
1(b)[2]	Building renovation intended primarily to address structural deficiencies, but not other desirable functional and operational enhancements. This option generally preserves current configuration, amenities, and the internal and external appearance of the building.	1-2 years	$119 million
2	Building renovation intended to address structural deficiencies as well as strategic improvements to improve the patron and performer experience, meet current accessibility requirements, and meet audience amenity expectations. This option includes modest expansions of the building area at the front (west) and rear (east) and significantly updates the internal configuration and functionality as well as the external appearance. Accessibility, comfort, sightlines, and acoustics for patrons would be improved.	2 years	$215 million
3	Full replacement of the auditorium with a new state-of-the-art facility. This option includes a conceptual "ideal" space plan meeting current industry standards and patron expectations. This replacement facility could be built at an alternate location, ideally with a larger footprint than the current site, which would allow continued operation of the existing facility during construction; it could also be located on the current site, though the small footprint presents challenges.	2.5 years	$245 million

[1] All cost estimates assume construction begins in 2024.

[2] Option 1(a) was an early conceptual approach to seismic strengthening that would reinforce all structurally questionable walls with additional concrete. This option was quickly deemed infeasible because of the numerous impacts on the building's interior that would render many hallways and existing spaces unusable. This option is also more expensive than the Option 1(b) that was subsequently developed and modeled. Option 1(a) was not further developed and is not considered viable.

The following project summary report includes:

- The building's history
- Construction information
- The Keller's role in the regional performing arts scene
- Details regarding the three options for renovation or replacement

Additional technical information on the structural analysis and renovation or replacement options is available upon request from the Office of Management & Finance's Spectator Venues Program.

No funding is currently identified to support major construction at the Keller, including any of the options described above. The focus of the City's effort to date has been to fully understand the current condition of the building and the options for renovations or replacement.

Next steps will include discussions with elected officials, community leaders, and arts organizations, including major tenants and users of the Keller to develop a strategy for action. The Keller will remain in use for the foreseeable future.

BUILDING HISTORY & CONSTRUCTION

Located between SW Clay and SW Market Streets, and SW 2nd and SW 3rd Avenues, the Keller Auditorium was constructed by the City of Portland in 1916-1917 as the Public (or Municipal) Auditorium.

Later renamed the Civic Auditorium, the building underwent a major renovation and modernizing remodel in 1967-1968 during the implementation of the South Auditorium Urban Renewal Plan, which demolished and redeveloped the neighborhood immediately to the south. The renovation transformed the auditorium from a utilitarian multi-purpose facility with a gently sloping orchestra floor and large wrap-around balcony to the steeply sloped orchestra with two balconies that are present today.

The late-1960s renovation was extensive and completely removed and rebuilt the interior, the front (west) façade, and the stage end (east) part of the building. However, the primary structural system holding up the roof, the masonry brick walls running east-to west along the north and south sides of the building, and the roof structure itself were not replaced and remain intact today.

Unaltered since 1968, the auditorium structure consists of concrete floors that are supported by either concrete or steel beams with a mixture of concrete, brick, and concrete masonry unit (CMU) walls. The layout of the existing structure consists of a basement under the building at two different final grades. The remainder of the existing building is defined by the main orchestra floor which slopes to connect the two basement grades. There are two existing balcony levels. All existing floor levels have access to the main elevators and stairwell.

The portion of the existing building that is around the stage end is laid out differently than the public access areas. There are two levels of rehearsal rooms with high ceilings on the south side and seven levels of dressing rooms with low ceilings on the north side. The roof structure is supported by large, open web steel trusses that support steel beams encased with concrete which support the 4-inch concrete roof slab.

The overall dimensions of the Keller Auditorium are 249 feet in the east-west direction by 192 feet in the north-south direction. During the 1960s renovations, the stage was enlarged and extended partially into the right-of-way of SW 2nd Avenue.

KELLER TODAY

The Keller Auditorium is owned by the City of Portland and operated by Portland'5, which is part of Metro. It is overseen by the Metropolitan Exposition and Recreation Commission.

At 102 years old, the Keller continues to play a key role in the region's performing arts landscape, hosting nearly 400,000 guests annually. Seating approximately 3,000, the Keller is the largest theatrical auditorium in the state and the only one in the metropolitan area capable of hosting travelling Broadway performances, large opera shows, and ballet productions.

Within the portfolio of venues operated by Portland'5, the Keller plays an especially important role, as commercial productions and concerts are among the more profitable shows: they represent approximately half of the organization's total annual revenue. The financial success of large commercial shows at the Keller helps Portland'5 support the Keller's resident companies and the operation of the smaller theaters, making local productions more feasible and affordable.

Very limited changes have been made to the Keller since the 1968 major renovation and modernization. However, building codes have changed significantly over the past 50 years and awareness of the region's seismic vulnerability has increased. As a result, we now have questions regarding the Keller's structural resiliency and ability to withstand a major earthquake.

Because the building is a mix of structural systems built in 1917 and 1968, it can be partially considered an unreinforced masonry (URM) building. Amid renewed interest in regulatory approaches to address the City's unreinforced masonry buildings, the City, Portland'5 Centers for the Arts, and a consultant team began a comprehensive structural assessment of the Keller Auditorium in 2017.

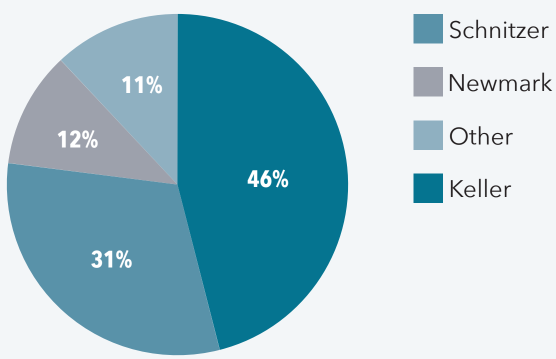
The financial success of large commercial shows at the Keller helps Portland'5 support the Keller's resident companies and the operation of the smaller theaters, making local productions more feasible and affordable.

TOP TEN PORTAND'5 PERFORMANCES BY REVENUE (FY 2018-19)

1	Aladdin	$895,527	Keller	Broadway
2	Phantom of the Opera	$646,032	Keller	Broadway
3	The Nutcracker	$454,515	Keller	Oregon Ballet Theatre
4	The King & I	$361,937	Keller	Broadway
5	Wicked	$355,753	Keller	Broadway
6	Come From Away	$341,746	Keller	Broadway
7	My Favorite Murder	$339,379	Schnitzer	Commerical Show
8	Waitress	$333,427	Keller	Broadway
9	School of Rock	$314,043	Keller	Broadway
10	The Lightning Thief	$297,773	Keller	Commerical Show
		$4,340,132		

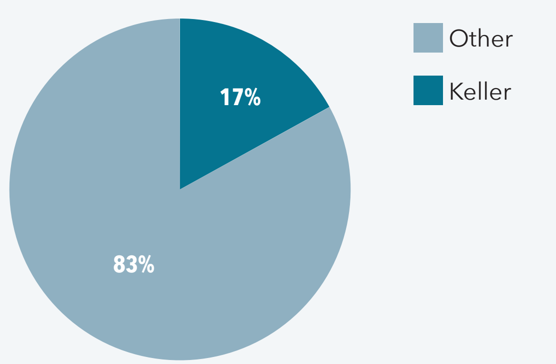
In FY 2018-19, the top ten highest-grossing events for Portland'5 brought in over $4.3 million. Of those ten shows, the Keller hosted nine and generated $4 million, or 92%.

PORTLAND'5 EVENT REVENUE BY VENUE (FY 2018-19)



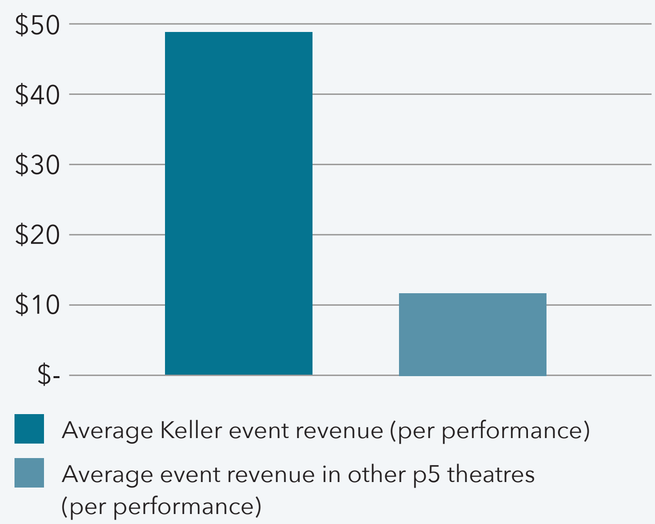
In FY 2018-19, events held at the Keller generated over $8 million, accounting for 46% of all revenue from Portland'5 venues.

PORTLAND'5 PERFORMANCES BY VENUE (FY 2018-19)



In FY 2018-19, the Keller hosted 17% of the 983 performances held across all Portland'5 venues.

PORTLAND'5 EVENT REVENUE BY PERFORMANCE



In FY 2018-19, the Keller generated average revenue of $48,000 per performance. During the same period, the other Portland'5 theaters generated average revenue of $12,000 per performance.

STRUCTURAL ASSESSMENT & MODELING

The City retained Miller Consulting Engineers (MCE) to develop a partial Tier 3 ASCE 41-13 structural analysis of the building[3].

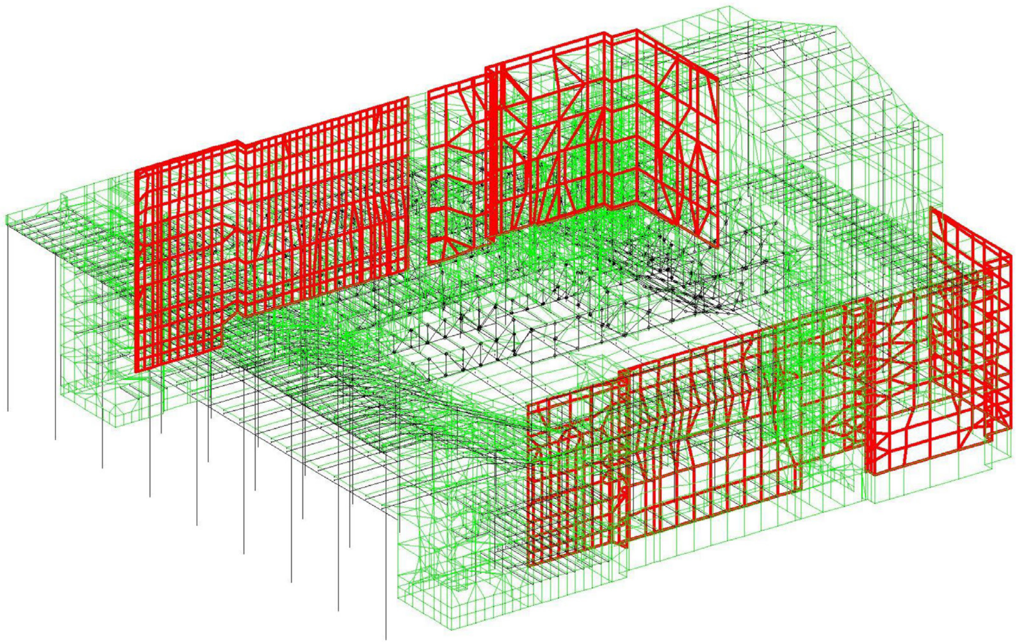
Miller's initial scope of work consisted of relying on partially legible drawings from 1917, 1966, and exploratory site visits to develop a digital structural model. The scope of the analysis was limited to the main structural systems in the building, particularly shear walls and diaphragms.

The model was used to test the building's structural capacity in close to 600 different mode scenarios to develop an understanding of its behavior. The model produced loads in all the walls that were used as lateral resistance elements and, even though the walls added in 1966 are more rigid, a significant portion of the lateral load is transferred to the 1917 brick masonry exterior walls. The modeling demonstrated that the structure of the building, in its current configuration is vulnerable to failure in a number of different seismic scenarios.

The modeling demonstrated that the structure of the building, in its current configuration is vulnerable to failure in a number of different seismic scenarios.

[3] The building was analyzed by MCE according to building code standards for the seismic rehabilitation of existing buildings created by the American Society of Civil Engineers (ASCE 41). In their analysis, MCE followed the recommendations of ASCE 41 for both force levels and acceptance criteria. The force levels that were used for this analysis are BSE-2E and BSE-1E with their acceptance criteria being "Limited Safety" and "Damage Control" respectively.

Brick Shear Wall Location



To help understand a rough order of magnitude of the necessary upgrades, Miller developed an engineering cost estimate. This estimate was based on repairs to strengthen the concrete and masonry walls adding reinforced pneumatically placed concrete to the inside face of the wall to resist the missing shear capacity, as well as provide additional out-of-plane capacity. Masonry partition walls were expected to either be braced or removed and replaced with metal stud walls.

The costs of this approach were estimated to be over $50M and did not include any of the associated architectural or mechanical work that would be required. In addition, this approach to the repairs would render the building unusable because of the added thickness to many walls in areas where there is not adequate space. This approach to the seismic enhancements is not a viable option and was not pursued further.

RETROFIT REFINEMENT & DEVELOPMENT OF OPTIONS

Whatever the future holds for the Keller, seismic improvements must be made to ensure safety for building occupants. However, seismic improvements alone will not improve the building's aging infrastructure, outdated design, lack of amenities for patrons and performers, and lack of accessibility.

In this phase of study, the City and Portland'5 expanded the consultant team to include architects, theater experts, cost consultants, and mechanical engineers to develop a better understanding of what a Keller renovation and retrofit project would include.

After the initial seismic modeling, Miller conducted additional analysis to find more efficient seismic solutions. These options included programmatic and architectural revisions along with more efficient solutions to address the building's structural deficiencies.

FIGURE 1, KELLER AUDITORIUM: RENOVATION AND REPLACEMENT OPTIONS COMPARISON.

	Option 1B*	Option 2	Option 3	Option 3
	Renovation of existing building to address seismic deficiencies only	Renovation of existing building to address seismic deficiencies and improve operations, accessibility, and theater experience	Replacement of existing building with state-of-the art facility on current site	Replacement of existing building with state-of-the art facility on alternative site
Estimated cost (construction only, assumes construction begins in 2024)	**$119 million**	**$215 million**	**Not estimated**	**$245 million** *does not include demolition*
Estimated cost per square foot	**$896**	**$1,318**	**Not estimated**	**$1,137**
Number of seats	**3,000**	**2,500**	**2,800-2,900**	**2,800-2,900**
Improves seismic safety and resiliency	2 **Better**	2 **Better**	1 **Best**	1 **Best**
Meets modern safety and accessibility requirements	✕	✓	✓	✓
Improves functionality for guests and performers	✕	✓	✓	✓
Improves aesthetics and amenities	✕	✓	✓	✓
Allows for Broadway and local performances during construction	✕	✕	✕	✓
Allows facility to serve the community for 50+ years	✕	✓	✓	✓

KEY

1 2 — Rating for relative Seismic Safety after renovation; 1, 2, or 3 (1 being best)

✓ — Identifies options that DO meet the criteria of the category

✕ — Identifies options that DO NOT meet the criteria of the category

* Option 1A is not included in this evaluation because it was a preliminary engineering exercise only and did not result in a project that was operationally or financially feasible.

Option 1(b) – Seismic Upgrade with Required Sustaining Projects (estimated $119 million)

The model for Option 1(a)[4] was used as the starting point for the modelling for Option 1(b). This option presents a solution to the seismic issues present at the Keller that limits the work areas and reduces costs as much as possible.

The goal of this option is to strategically select the lateral elements of the building that were going to be upgraded, repaired, or replaced due to deterioration, in order to produce the greatest structural and cost benefits. This process of analysis was structurally driven and only those areas of the building impacted by necessary structural work receive architectural enhancement. One of the early decisions that provided a significant benefit to this analysis was the removal of the existing concrete facade panels and replacement of the building's unreinforced masonry exterior walls with new walls and lightweight cladding.

One of the advantages to this option was that most of the primary structural systems were based on modern materials. Design and analysis based on these modern materials allows for better structural capacities to be used for comparison.

In addition to the structural work, this option includes costs to rebuild areas of the building affected by the structural modifications. It also includes costs associated with building system upgrades that will need to be done to keep the building operational for another 20 to 30 years. The project would require closing the building for up to two years during construction.

In summary, the cost for this option is substantial and although less expensive than the other two options, the disruption to everyday business operations is profound. There are no significant improvements to the theatrical, functional, and programmatic elements that are generally considered necessary for a venue of this type to continue to be competitive for the next 20-plus years.

---

[4] As described in the summary, Option 1(a) was an early conceptual approach to seismic strengthening that would reinforce all structurally questionable walls with additional concrete. This option was quickly deemed infeasible and was not further developed, but it did result in the model that was used in Option 1(b).

Option 2 — Major Renovation Including New Additions (estimated $215 million)

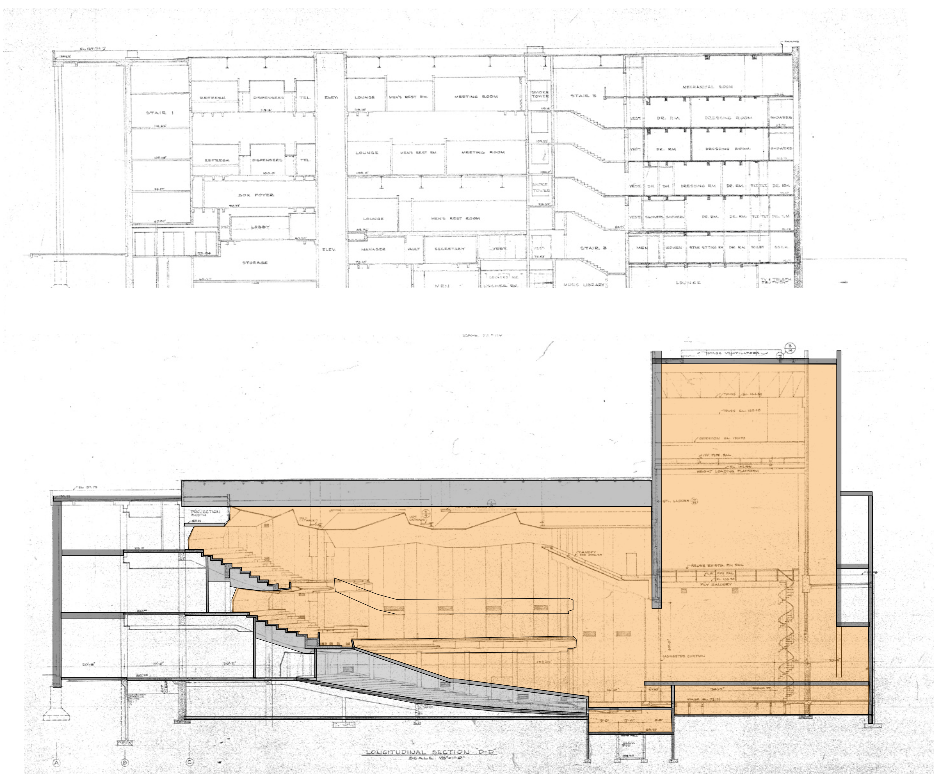
Option 2 was developed to not only strengthen the building to prevent collapse (while recognizing that the building may need major repairs or replacement after a major seismic event), but also to upgrade the facility to 21st century standards to the maximum extent possible. The purpose of developing this option was to test the concept of reinventing the Keller into a state-of-the-art Broadway-capable theater able to serve the Portland region for another 50 years.

The structural model for Option 2 used the model that had been developed through Options 1(a) and 1(b). However, because this option was directed primarily by the attempts to address the programmatic needs of the building, the structural changes to the building were extensive.

As with Option 1(b), Option 2 proposes demolishing unreinforced masonry walls and replacing them with new steel and concrete structures, bracing the auditorium ceiling, bracing structural walls, expanding the building's footprint at the NE and SE corners and over the current arcade on the west, extending the second balcony and adding additional box seating, improving acoustics, rebuilding the orchestra, changing the stage height, completely rebuilding the dressing room tower, adding a full kitchen and other guest experience amenities, fully addressing ADA accessibility issues, and adding a three-truck loading dock at the stage level on the north-east corner of the building. Mechanical and electrical modifications are extensive and intended to bring the building fully up to modern standards for efficiency and comfort. Theatrical technical equipment improvements include total replacement of the production rigging system, new orchestra pit lifts, new seating, and other enhancements.

Due to the space constraints within the building, the seating count of the auditorium is reduced from 3,000 seats to around 2,500 in this option. Because of the extensive changes to the auditorium and changes in almost every part of the building, the project would require closing the building for approximately two years during construction.

In summary, as with Option 1(b), the cost for this option is high and the disruption to everyday business operations is profound. However, unlike Option 1(b), this option makes significant improvements to the theatrical and functional elements that are needed for a modern venue to continue to be viable for the next 50 years.



OPTION 2 SECTION
August 30, 2018

Option 3 – New Theater Building on Alternate Site (estimated $245 million)

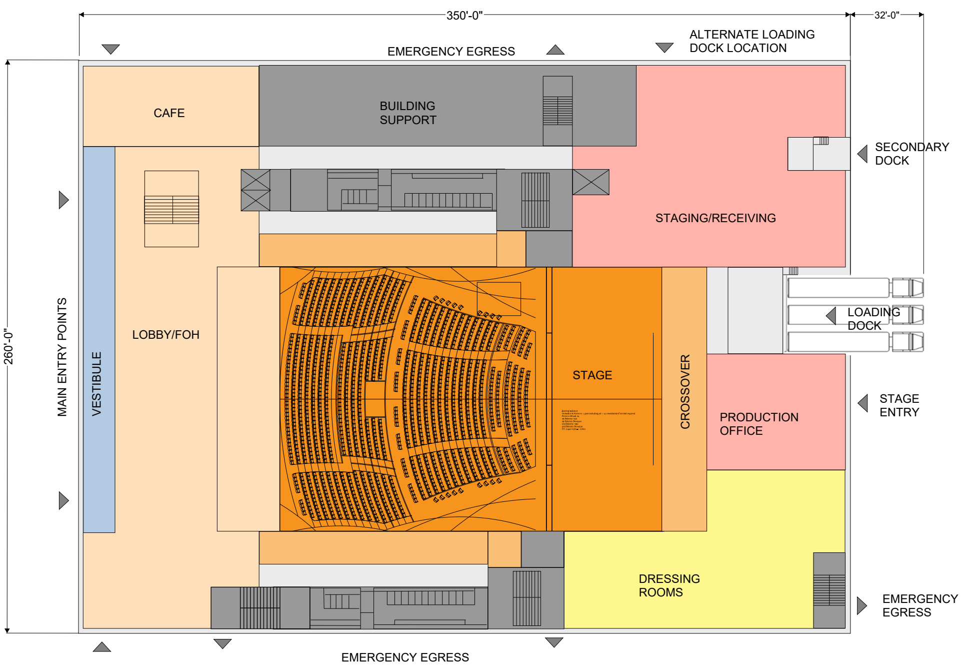
This option would replace the Keller Auditorium with a new facility that serves the needs of Portland'5 and the community, creating a new a state-of-the-art home for opera, ballet, and traveling Broadway productions. The option assumes a 2,800-seat auditorium built on an undetermined site located somewhere in central Portland.

This option was developed by LMN Architects with input from The Shalleck Collaborative, who are theater consultants. Because it is entirely new construction, the building would be expected to conform to whatever version of the Oregon Structural Specialty Code (OSSC) is in effect when the project is permitted. This option is the most likely to survive a major seismic event with little or no damage and can be expected to be usable sooner after an earthquake than either of the other options.

A preliminary room list was developed which details the ideal location, square footage, and amenities required for each element of a new auditorium (e.g., public space such as the lobby, lobby support, reception areas, staff support areas, performance space such as the auditorium, stage, stage support spaces, performer support, workshops, services, administrative areas, etc.). The room list and square footage calculations were used to develop the cost estimate for this project. Note that the estimate does not include costs for land/land acquisition; however, building in a different location would free up the current site for sale and redevelopment.

A major new facility could be an anchor and catalyst for neighborhood growth and encourage additional public/private investment. It would also allow the existing Keller to remain in operation during the construction of the new building. Construction of a new building is estimated to take 2.5 years to complete.

In summary, the cost is the highest of the options studied. However, because the building is larger, the cost per square foot is less than a major renovation and upgrade of the existing Keller Auditorium (Option 2). An entirely new facility would also be the safest option and can be designed and built to modern theatrical standards ensuring a long lifespan.



OPTION 3 GROUND FLOOR FOOTPRINT

August 30, 2018

MOVING FORWARD

The structural studies and conceptual options developed by the City and Portland'5 over the last two years are the first steps of a more comprehensive community conversation about the best path forward for the Keller Auditorium and Portland'5 Centers for the Arts.

The scale of the need at the Keller is still being assessed and stakeholders will need time to digest information and consider options for either renovating or replacing the building.

In the meantime, it is important that the Keller continue to operate successfully while the City and Portland'5 work with the community to determine of the best path forward. The Keller meets all current fire, life, safety code requirements and, apart from questions about its performance in a major seismic event, can be considered safe, even if lacking in modern amenities.

Given the Keller Auditorium's seismic issues and the building's unique ability among the region's venues to accommodate large shows and Broadway productions, the need for renovation or replacement is clear.

However, there are no current funding sources identified for a project of this magnitude and scale. As shown by the options described in this report, there are multiple ways the City and Portland'5 could proceed that would ensure the region has a large performing arts venue that can accommodate educational programs, cultural events, and world-class performances for years to come. However, renovation options that would put Broadway, opera, ballet, and independent performance productions out of commission for two years or more would harm Portland'5's operational sustainability as well as severely stress the resident companies.

Given the Keller Auditorium's seismic issues and the building's unique ability among the region's venues to accommodate large shows and Broadway productions, the need for renovation or replacement is clear.

COMMUNITY INTEREST IN IMPROVEMENTS

Over the past several years, a group of interested property owners in the surrounding neighborhood hosted an international design competition to envision what an updated Keller Auditorium would entail.

The proposals focused exclusively on the exterior of the Keller and were not intended to address the many existing seismic, structural and guest/performer experience deficiencies of the building, but to reimagine its image from the outside and improve its relationship to the surrounding area. Operational and financial parameters were not placed on the respondents.

Stufish Entertainment Architects was selected as the winner of the design competition for their captivating proposal to transform the face of the Keller Auditorium with a large, multi-level glass addition to the west, into and over SW 3rd Avenue toward the Ira Keller Fountain. While the project as proposed would not address all structural or operational deficiencies of the existing building, it demonstrates the community's recognition of the Keller's importance and shows a desire from neighboring property owners and businesses to participate in conversations about the future of the facility.

Next Steps

Over the coming months, the City and Portland'5 will engage in discussions about this information with decisionmakers, potential donors, tenants, and users of the Keller Auditorium. Determining a process for how to move forward and developing a funding strategy will be the focus of these conversations.

Additional Information

More detailed project information is available upon request from the Spectator Venues Program.

(page intentionally left blank)