EXHIBIT L

OSU Cascades Academic Building

100% Schematic Design Narrative

14002

BOORA Architects, Inc.
April 11, 2014

Index

OSU Cascades Academic Building
Final Schematic Design Cost Package
Architectural Design and Materials Narrative

The following narratives provide a description of the architectural design and material quality, character and finishes for the OSU Cascade Academic Building to be used for Schematic Design pricing. Accompanying this narrative are the 100% Schematic Design drawings.

Design Statement

The new Academic Building will replace current spaces at Cascades Hall and will serve as the main building for the new 4-year OSU Cascades campus. Located on the west end of the new 10-acre site, the academic building will have great views to the future campus and mountains beyond.

The building will provide spaces that meet the immediate needs of the growing institution and will include: 8 new classrooms, 3 science labs, administrative and faculty offices. As the campus continues to grow, the space needs might evolve and the building should be flexible to adapt to future program adjustments. The 3-story building is 46 feet in height, with a mechanical area on the roof which is set back and screened on all sides.

LEED Silver equivalency is targeted for this project. Thus, resource efficiency and indoor air quality will be essential criteria in the selection of interior construction and finish materials.

Alternates:

See sheet G001 for a list of alternates.

Classrooms

There are eight classrooms throughout the building, ranging from a 25-seat flat floor to 80 person classroom.

The following is a description of rooms and material finishes:

80-seat Flat Floor Classroom

Overview:
The 80-seat flat floor classroom provides a flexible and interactive learning environment with movable tables and loose seating on casters that foster in-class discussions or can be arranged in a formal lecture format. The teaching wall provides large format information display and traditional writing surfaces. The instructor uses a digital writing surface and electronic display to present information to the class.

Footprint: Approx. 64'-0" x 31'-0"

Floor:

- Flat floor with carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Painted gyp board ceiling
- Flat absorptive tile ceiling covering 75% of ceiling area (ACT -3: Armstrong Optima Tegular 24x60 (3265PB) or equal)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with painted MDF base, recessed to be co-planar w/gyp board above, on north and south walls
- 1" thick sound absorptive acoustical wall panels approx. 280sf
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Doors:

- 36" wide by 7'-0" high solid wood doors, acoustically sealed
- HM door frame with 6' wide x 7' high side lite

Daylight:

- Manually operated roller window shades at exterior windows
-

Writing Surfaces:

- (1) 16'-0 w x 4'-0" h porcelain enamel marker boards at teaching wall
- (2) 8'-0 w x 4'-0" h porcelain enamel marker boards at teaching wall

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (3) Projection screens and projectors (CFCI)

Seating and Furnishings:

- Movable tables at different heights (OFOI)
- Loose seating on casters (OFOI)

Alternate: 80-seat Case Study Classroom

Overview:
As an alternate, the 80-seat classroom would have tiered seating at fixed tables. The horse-shoe shape of the seating provides close proximity between instructors and students and fosters in-class discussion and debate between students as part of the course format. The teaching wall provides large format information display and traditional writing surfaces. The instructor uses a digital writing surface and electronic display on up to 3 projection screens to present information to the class.

Footprint: Approx. 60'-0" x 41'-0"

Floor:

- Tiered – 12" high tiers
- Carpet Tile

Ceilings:

- Ceiling Height: 10 feet
- Front 1/3 of ceiling over lecture area to be angled hard ceiling for sound reflection.
- Flat absorptive tile ceiling covering remaining ceiling area (ACT -3: Armstrong Optima Tegular 24x60 (3265PB) or equal)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Wood wainscot (4' high) paneling with wood base on west and east walls
- Perforated wood paneling with 1" thick acoustical insulation on east and west wall from 4' to ceiling.
- Painted gyp board with painted MDF base recessed to be co-planar w/gyp board above north and south walls.
- Perforated Acoustical Gypsum Board on south wall from 5' to ceiling.
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Doors:

- Pair of 36" wide by 7'-0" high solid wood doors, acoustically sealed
- Wood door frame with 3' wide x 7' high side lite

Daylight:

- Manually operated roller window shades at exterior windows

Writing Surfaces:

- (1) 6'-0 w x 4'-0" h porcelain enamel marker boards at main teaching wall
- (2) 8'-0 w x 4'-0" h porcelain enamel marker boards at angled side teaching walls

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (3) Projection screens and projectors (CFCI)

Seating and Furnishings:

- Fixed Tables (CFCI)
- Loose seating on casters (OFOI)

Handrails:

- Wood handrail anchored to side wall
- Wood handrail with painted steel stanchions at steps

72-seat Learning Studio (1)

Overview:
Learning Studios are modeled after the existing OSU classroom in Corvallis (Weninger 212) and SCALE-UP classrooms at other universities. They are set up for highly interactive student directed

learning. Three teams of three students are seated at round tables for 9, each team having a laptop, and each table having a Smartboard-type device. The instructor's podium has controls to all the Smartboard-type devices in the room.

Footprint: Approx. 43'-0" x 41'-6"

Floor:
- Flat floor with carpet tile

Ceilings:
- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -2: Armstrong Optima Tegular 24x24 (3251PB) or equal)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:
- Painted gyp board with rubber base
- 1" thick sound absorptive acoustical wall panels approx. total area of 150sf
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:
- 2' high butt glazed clerestory windows along corridor wall
- Manually operated roller window shades at exterior windows

Doors:
- 36" wide by 7'-0" high wood door, acoustically sealed
- Painted HM door frame with 2' wide x 7' high side lite

Writing Surfaces:
- (2) 8'-0 w x 4'-0" h porcelain enamel marker boards

Audio-Visual Systems: (See Audio-Visual System Narrative)
- Interactive Whiteboard by each table (OFCI)

Seating and Furnishings:
- Large round tables with power (OFOI)
- Loose seating on casters (OFOI)

72-seat Flat Floor Classroom (1)

Overview:
This flexible flat floor classroom provides an interactive learning environment. Seating options include loose stacking chairs at moveable tables on casters, or the "Node" chair on casters. The teaching wall provides large format information displays. Marker board writing surfaces are located

on 2 walls. Students use the marker boards for working in small group break-out sessions during class.

Footprint: Approx. 43'-0" x 36'-6"

Floor:

- Flat floor with carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -2: Armstrong Optima Tegular 24x24 (3251PB) or equal)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- 1" thick sound absorptive acoustical wall panels approx. total area of 150sf
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:

- 2' high butt glazed clerestory windows along corridor wall
- Manually operated roller window shades at exterior windows

Doors:

- 36" wide by 7'-0" high wood door, acoustically sealed
- Painted HM door frame with 2' wide x 7' high side lite

Writing Surfaces:

- (2) 16'-0 w x 4'-0" h porcelain enamel marker boards
- (4) 8'-0 w x 4'-0" h porcelain enamel marker boards

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (2) Projection screens and projectors (CFCI)

Seating and Furnishings:

- Mobile rectangular tables with loose seating on casters

40-seat Flat Floor Classrooms (4) and 26-seat Flat Floor Classrooms (1)

Overview:
Flexible flat floor classrooms provide an interactive learning environment. Seating options include loose stacking chairs at moveable tables on wheels, or the "Node" chair on casters. The teaching wall provides large format information display. Marker board writing surfaces are located on 2 walls. Students use the marker boards for working in small group break-out sessions during class.

Footprint: 40-seat: Approx. 32'-0" x 31'-0"
25-seat: Approx. 24'-0" x 31'-0"

Floor:
- Flat floor with carpet tile

Ceilings:
- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -2: Armstrong Optima Tegular 24x24 (3251PB) or equal)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:
- Painted gyp board with rubber base
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:
- Manually operated roller window shades at exterior windows

Doors:
- Level 1:
  - 36" wide by 7'-0" high wood door, acoustically sealed.
  - Painted HM door frame with 2' wide x 7' high side lite
- Level 2:
  - 36" wide by 7'-0" high wood door, acoustically sealed with painted HM door frame
  - Butt glazed relite with translucent window film, between doors.

Writing Surfaces:
- (2) 16'-0 w x 4'-0" h porcelain enamel marker boards
- (4) 8'-0 w x 4'-0" h porcelain enamel marker boards

Audio-Visual Systems: (See Audio-Visual System Narrative)
- (1) Projection screen and projector (CFCI)

Seating and Furnishings:
- Mobile rectangular tables with loose seating on casters

Science Labs (3) and Support Spaces *(also refer to Room Data Sheets for Labs)*

Overview: Labs include one Chemistry Teaching Lab, one Biology Teaching Lab, and one Flexible Teaching Lab which will be used to teach subjects ranging from Intro Bio to Physics to Geology. Lab support spaces include chemistry and biology prep labs, instrumentation lab and chemical storage.

Room Data Sheets: See Appendix for Room Data Sheets.

Footprint: Labs: Approx. 43'-0" x 32'-0"

Floor: Rubber Tile Flooring

Ceilings:

- Ceiling Height: 10 feet
  Flat absorptive tile ceiling – clean room (cleanable and anti-microbial protection)
  (ACT -4: Armstrong Ultima Health Zone 24x24 (1936) or equal)
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base , with water based epoxy paint
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:

- Manually operated roller window shades at exterior windows

Doors:

- One entry door to lab to be: 42" wide by 7'-0" high, half glazed wood door , acoustically sealed, remaining doors to be similar but 36" wide.
- Pairs of doors for equipment: 36" wide by 7'-0" high, half glazed wood door, acoustically sealed, with 12" inactive leaf
- Painted HM door frame with 5' wide x 7' high side lite

Casework

- Built in wood laboratory casework with epoxy resin countertops
- Laboratory tables with epoxy countertops

Writing Surfaces:

- (1) 16'-0 w x 4'-0" h porcelain enamel marker boards
  (Some labs have sliding marking boards with storage behind, see plans)

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (2) Projection screens and pole mounted projectors (CFCI)

Seating and Furnishings:

- Counter height seating (OFOI)

Main Lobby

The main lobby will be a welcoming social hub for the building and campus. Adjacent to a covered porch area on the west, it is a gathering space with direct connections to outdoor campus amenities. Lined with exterior windows, it will be filled with daylight. The space will provide direct access to the enrollment center and the Associated Students of Cascades Campus (ASCC). A variety of furniture and casework will provide options for students, staff, and faculty.

Floor:

- Polished concrete Floor
- 20% area of carpet tile as area rug to designate seating areas

Ceilings:

- Ceiling Height: 10 feet
- Panelized linear wood ceiling ((9 -Wood 2100 or similar)
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Slat-wall above cabinets at Retail.
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Casework

- 22' long built-in concrete study bar/ bench with power along west window wall
- Retail display wall with glass and wood cabinets
- Wood bench along east wall of Vestibule

Doors:

- Exterior doors: see Exterior description below

Seating and Furnishings:

- Lounge furniture (OFOI)

Enclosed Stairs

Floor:

- Polished concrete floor on Level 1
-

Ceilings:

- Ceiling Height: 38 feet
- Acoustical absorptive linear metal ceiling (Armstrong MetalWorks Linear or equal)
- See Electrical Narrative for light fixtures

- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Wallcovering (Designtex Digital Walls with Digital Duraprene, custom graphic)
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Doors:

- Exterior doors: see Exterior description below
- Rated fire glass frame with doors on magnetic hold open

Stairs:

- Design-build steel stair system
  - Folded steel plate with precast concrete treads
  - Solid wood panel guardrail and wall mounted wood handrail at perimeter

Public Circulation Spaces

Circulation throughout the building will be designed to encourage and accommodate spontaneous interaction between students, faculty and staff, through the use of programmed niches along the corridors. Transparency between circulation corridors and adjacent uses will enhance visual connections and engagement of students throughout the building.

The niches may consist of built in benches, counters, and study nooks (facing banquette seats with a table between). They are provided to support students waiting between classes, to foster student group work, and to allow faculty or teaching assistants to consult with one or more students before or after scheduled class times. Cork tack board and marker board paint may also be provided along the corridor and/or within the niches.

Floor:

- Polished concrete on Level 1
- Rubber Floor Tile on Level 2 and 3

Ceilings:

- Ceiling Height: 10 feet
- Acoustical absorptive linear metal ceiling (Armstrong MetalWorks Linear or equal)
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- 50% whiteboard paint and cork tack board at alcoves and niches
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Casework

- Built-in wood counters, upholstered bench, and study nooks (upholstered banquettes and wood table) with power

Learning Commons

Overview:
Its location at the west end and top floor of the building will set up the learning commons as a quiet place to study on campus while having great views to the mountains. It is also immediately adjacent to a covered deck area that will provide additional seating when weather permits.

The learning commons will consist of a quiet open study lounge for 24 students, a tutoring center for 24 students, and 3 medium study rooms for 6 to 8 students each. There will be a variety of furniture and built-in casework to facilitate different study needs.

Floor:

- Flat floor with carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Panelized linear wood ceiling (9 -Wood 2100 or similar)
- See Electrical Narrative for light fixtures
- Mechanical noise: Background noise criteria of NC-30 to 35
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Wood paneling at exterior of central Study Room's, see drawings.
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:

- Manually operated roller window shades at exterior windows

Doors:

- Butt glazed entry wall with pivoting glass door(s).
- Pivoting glass doors between Tutoring and the Study Lounge
- Butt glazed glass wall and door at study rooms
- Exterior doors to deck: see Exterior description below

Writing Surfaces:

- Whiteboard paint on gyp board walls in study rooms

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (1) Projection screen and projector in tutoring lab (CFCI)

Casework

- Built-in wood counters, upholstered bench, and study nooks with power

Seating and Furnishings:

- Mobile whiteboards on casters (OFOI)
- Lounge seating (OFOI)
- Rectangular tables with power (OFOI) in tutoring lab
- Tables and Loose seating on casters (OFOI)

Associated Students of Cascades Campus (ASCC)

Overview:
The location adjacent to the main lobby will give OSU Cascades students great access to the ASCC. The ASCC suite will include an open work area with counter workstations, a meeting/work room, storage room, and counter for coffee/bagels for students.

Floor:

- Carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -1: Armstrong Ultima Tegular 24x24 (1912HRC) or equal) in office, conference room, storage.
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Cork tack surface on east wall in open workstation area
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:

- Manually operated roller window shades at exterior windows

Doors:

- 3'-6" x 8' sliding glass doors and butt glazed side-lite at entry.
- Painted HM door frame with 6' wide x 7' high side lite at conference room
- 36" wide by 7'-0" high wood doors in painted HM door frames at storage room

Writing Surfaces:

- Whiteboard paint on gyp board walls in conference room

Audio-Visual Systems: (See Audio-Visual System Narrative)

- (1) Flat Panel LED Display in conference room (OFCI)

Casework

- Built-in wood counter along west wall

Seating and Furnishings:

- Task seating (OFOI)

- Conference tables with caster chairs (OFOI)
- Side chairs (OFOI)
- Storage shelving (OFOI)

Open Computer Lab

Overview:
Located on level 1, the open computer lab will have 16 computer stations and a print station for student use.

Floor:

- Carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -1: Armstrong Ultima Tegular 24x24 (1912HRC) or equal)
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Doors:

- Solid wood, sliding doors, track hung.

Casework

- Built-in plastic laminate work counter with power
- Plastic laminate storage cabinets at printer station

Seating and Furnishings:

- Task seating (OFOI)

IT, Administrative and Faculty Office Suites

Overview:

The administrative office suite for Enrollment Services and Student Success will be housed on the first floor immediately adjacent to the main lobby. The enrollment counter will be visibly accessible from the Main Lobby. The office suite is located along the main corridor and its frontage will be comprised mainly of glass, allowing for visual connection between staff and students.

The Enrollment Services office suite will be a combination of open workstations and enclosed offices. The Student Success suite will provide all enclosed offices for its occupants. Enrollment Services and Student success will share a Print/Mail Room and Storage room.

The IT work room is located on the east end of level 1 . This space will include a help counter, work area behind a screen wall, and full height shelving on the west wall.

The Faculty Office suites are distributed evenly between level 2 and 3. In total, there are 54 enclosed offices, Print/Mail rooms, 12 workstations for research assistants, a small break-room, and a conference room.

Floor:

- Carpet tile

Ceilings:

- Ceiling Height: 10 feet
- Flat absorptive tile ceiling (ACT -1: Armstrong Ultima Tegular 24x24 (1912HRC) or equal)
- See Electrical Narrative for light fixtures
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Wall Finishes:

- Painted gyp board with rubber base
- Acoustic Requirements: (See Acoustical Narrative for Horizontal and Vertical Room Separation and Wall Types)

Daylight:

- Manually operated roller window shades at exterior windows

Doors:

- 36” wide by 7’-0” high full lite wood doors in painted HM door frame with 2’ wide x 7’ high side lite at suite entries and enclosed offices.
- 36” wide by 7’-0” high wood doors in painted HM door frames at workroom and storage rooms
- Coiling security screen at enrollment center and IT Work Room counters.

Casework

- IT Work Room:
  - Plastic Laminate counters, cabinets and full-height shelving.
- Print/Mail:
  - Built-in plastic laminate counter, lower and upper cabinets in Print/Mail Rooms.
- Offices:
  - Shelving standards with shop painted MDF; 3 rows of 9LF per office (total of 27LF)
- RA Workstations:
  - Built-in plastic laminate work counter with power for (12) stations.
- Break Room:
  - Solid surface counter with under-mount sink with garbage disposal.
  - Plastic laminate lower and upper cabinets.
- Enrollment Counter:
  - Quartz at front panel and counters.

- Plastic laminate cabinets under west counter.

Seating and Furnishings:

- Office Systems Furniture (OFOI)
- Task seating (OFOI)
- Conference tables with caster chairs (OFOI)
- Side chairs (OFOI)
- Storage shelving (OFOI)

Equipment:

- Break Room:
  - Top Freezer Refrigerator (CFCI)
  - Microwave (OFOI)
  - Dishwasher (CFCI)

Restrooms/Shower

Flooring:

- Polished concrete on Level 1
- Porcelain floor tile on Level 2,3

Ceilings:

- Ceiling height: 9 feet
- Painted gyp board ceiling
- See Electrical Narrative for light fixtures

Wall Finishes:

- Full height ceramic wall tile on wet walls
- Coved tile base
- Painted gyp board
- Full width mirror at lavatory wall.

Doors:

- HM frame and wood door 36" wide by 7'-0" high with power assist, at all single occupant toilet rooms and at multi-stall restroom

Toilet Partitions, Lavatories and Countertops:

- Stainless steel toilet partitions
- Quartz surface countertops with under mount sinks at Restrooms
- Wall hung, accessible sink at Shower.
- Fiberglass unit shower.
- Recessed toilet accessories (OFCI)

Lockers:

- Formed sheet metal locker, powder coated, 2 tier.

Furnishings:

- Bench (OFOI)

Mother's Room

Flooring:

- Rubber Tile

Ceilings:

- Ceiling height: 9 feet
- Flat absorptive tile ceiling (ACT -1: Armstrong Ultima Tegular 24x24 (1912HRC) or equal)
- See Electrical Narrative for light fixtures
- Privacy curtains hung from drapery track.

Wall Finishes:

- Painted gyp board

Doors:

- HM frame with wood door, 36" wide by 7'-0" high.

Casework/Sink:

- Quartz surface counter with under-mount sink.
- 54" wide plastic laminate lower cabinets

Equipment:

- Under counter refrigerator (CFCI)
- Wall hung, unit mirror (OFOI)

Building Storage/Janitor Rooms/Back of House Support Space

Ceiling Height: Open to Structure

Doors:

- HM doors 36" wide by 8'-0" high
- Painted HM frames

Wall Finishes:

- Painted gyp board
- Protective wall covering wainscot to 3'-0" A.F.F.
- Rubber base

Flooring:

- Clear-sealed concrete

Ceilings:

- Painted exposed structure
- See Electrical Narrative for light fixtures

Exterior Building Envelope

Overview:
The envelope will prioritize the project's energy performance goals but will also be responsive to architectural and programmatic requirements. The architectural expression of the building will be respectful of its context while providing a unique identity. It will employ cementitious panels, metal panels, wood and glass. Transparency will be concentrated around public areas but all occupied spaces will have access to natural light and views. The envelope will be well insulated and tightly constructed.

Airtight Envelope: Provide a fluid-applied air barrier with flexible flashing at transitions per manufacturer's recommendation. Use spray-foam insulation at envelope transitions and penetrations to maintain continuity of air, thermal and moisture barriers.

Exterior Enclosure:

- Exterior Wall Assembly
  - Interior Gypsum Board, painted
  - Smart vapor retarder – MemBrain by CertainTeed or equal
  - 2x8 wood studs w/ batt insulation filling cavity
  - 5/8" water resistant gypsum sheathing
  - Continuous vapor permeable weather resistive air barrier
  - 3 ½" fiberglass cladding support w/ 1" metal furring (vented air cavity): Cascadia Clip or equal
  - 3 ½" mineral wool board insulation
  - Finish Material (per below)
- Main Exterior Finish Material – Cementitious Panel
  - Option 1: Textured Cementitious Siding - CERACLAD Rain Screen System. Cast Stripe Style.
  - Option 2: Cement Composite Panel System – SWISSPEARL Façade System, Caret 8mm thick
  - Option 3: Cementitious Plank Siding – OkoSkin Slat Wall Panels, ½" thick
- Infill Exterior Finish Material (Siding, Soffits & Screens) – Wood
  - Siding/soffits: 1x4 T&G Juniper, clear finish
  - Screens: Painted steel frame w/ 4x8 Juniper infill, clear finish;
- Exterior Windows
  - Fiberglass Window System: Cascadia Series 400 or equal
  - Operable Vents: Cascadia Series 325 outswinging awning, (1) per office
  - Glazing: 7/8" Double Pane IGU, Cardinal LoE-366 (#2), argon filled, warm edge spacer
  - Spandrel Glazing at opaque locations, including continuous rigid insulation
  - Sun shades: 30" Deep Fixed Aluminum Bar Grille Sunshades With Channel Frame. Provide allowance for 200lf.
- Exterior Doors
  - Heavy-Duty Aluminum Doors: Kawneer Tuffline or equal, finish to match window system
  - Sliding Door System: Kawneer Thermal Aluminum Commercial Sliding Glass Doors
- Exterior Louvers
  - 6" extruded aluminum louvers; drainable blade; finish to match window system; size and location per Mechanical

- Roof
    - 60 mil, mechanically attached, gray TPO roofing system
    - Air/vapor barrier on roof sheathing per Structural
    - 10-inches minimum rigid insulation with staggered joints
    - Air/vapor barrier on 1/2" glass-mat, water resistant gypsum cover board
    - Internal roof drains and overflow drains with tapered insulation crickets (sloped structure – ½"/ft)
    - Roof hatch with integral curb
    - Skylights: 4'x8' unit skylights as indicated on roof plan.
    - Walking pads, davits, flashing, and typical roof accessories
- Mechanical Roof Screen
    - Steel HSS posts and rails, painted.
    - Corrugate-profile metal siding: AEP Span, Nu-Wave or equal; exposed fastener.

OSU Cascades Classroom: MEP Basis of Design

April 11, 2014

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Project Directory

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1.0 Project Description

The OSU Cascades Academic Building is a new 45,000 square foot building with offices, classrooms, and labs to be located on the new Oregon State Cascades campus. The building, along with residential halls and other buildings, is part of a new site development in Bend. The academic building is part of the first 10 acres of development for the new campus.

2.0 Codes and Standards

The following codes and standards will be used for the project.

[1]2010 Oregon Structural Specialty Code

[1]2011 Oregon Plumbing Specialty Code

[1]2010 Oregon Mechanical Specialty Code

[1]2010 Oregon Fire Code

[1]2010 Oregon Energy Efficiency Specialty Code

NEC 2014

NFPA 13 – Fire Sprinklers

ASHRAE Standard 62 – Ventilation

ASHRAE Standard 55 – Thermal Comfort

Labs21 Design Guidelines

FM Global (OSU Insurance Underwriter)

[2]Oregon State University – Facilities Services Construction Standards June 2012

[1]If the project permit date moves beyond September 30, 2014 the project may be subject to 2014 code.

[2]Oregon State University Construction Standards will be used for the Cascades Campus as a baseline pending other direction from the Cascades planning and facilities staff.

3.0 Sustainability

The path towards sustainable design is illustrated below. Local climate analysis is one of the first steps; this highlights natural resources and driving factors in the heating and cooling systems. Design then becomes focused on the reduction of energy consumption. This is a primary design goal and is pursued before selecting mechanical and renewable energy systems. It is much less costly to reduce energy consumption than it is to buy expensive mechanical or renewable energy systems.

3.1 Goals

A preliminary goal for the project is to be energy and water net zero ready. The pursuit of this goal will be largely dependent on budget. However, if the higher first costs can be met, a net zero building will cost less to operate and maintain over the course of its lifetime. Below is an example analysis for another project used to illustrate impact of a net zero building on costs over time.

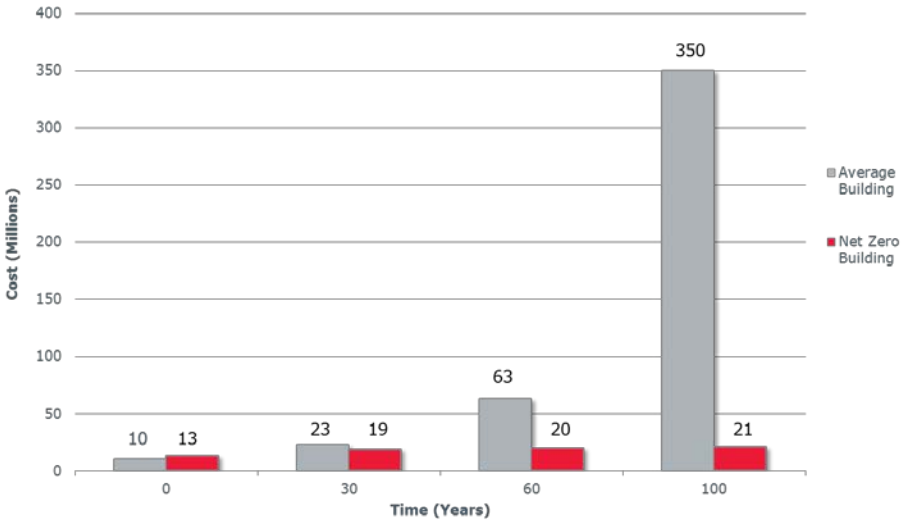


Figure 1: Cost Over Time of an Average Building Versus Net Zero Building

Additionally, it is proposed that the building be benchmarked utilizing elements of the following standards:

- PassivHaus
- Living Building Challenge
- Eco-Districts
- Architecture 2030
- LEED Platinum “equivalent”
- Labs for the 21st Century

3.2 Climate Analysis

3.2.1 Temperature

Sitting at 44°N and 3660 feet above sea level in central Oregon, Bend has a high desert climate with cold winters and warm summers. This is a heating dominated climate with an average January temperature of 29°F and almost 7000 heating degree days (at 65°F) per year.

Climate Data	
Summer Design Temperature (DB/MCWB)	92.8°F/61.9°F
Winter Design Temperature (DB)	5.4°F
Cooling Degree Days (65°F)	151
Heating Degree Days (65°F)	6926
50 Year Extreme Low	-26°F
50 Year Extreme High	108°F
August Mean Daily Range	36.5°F

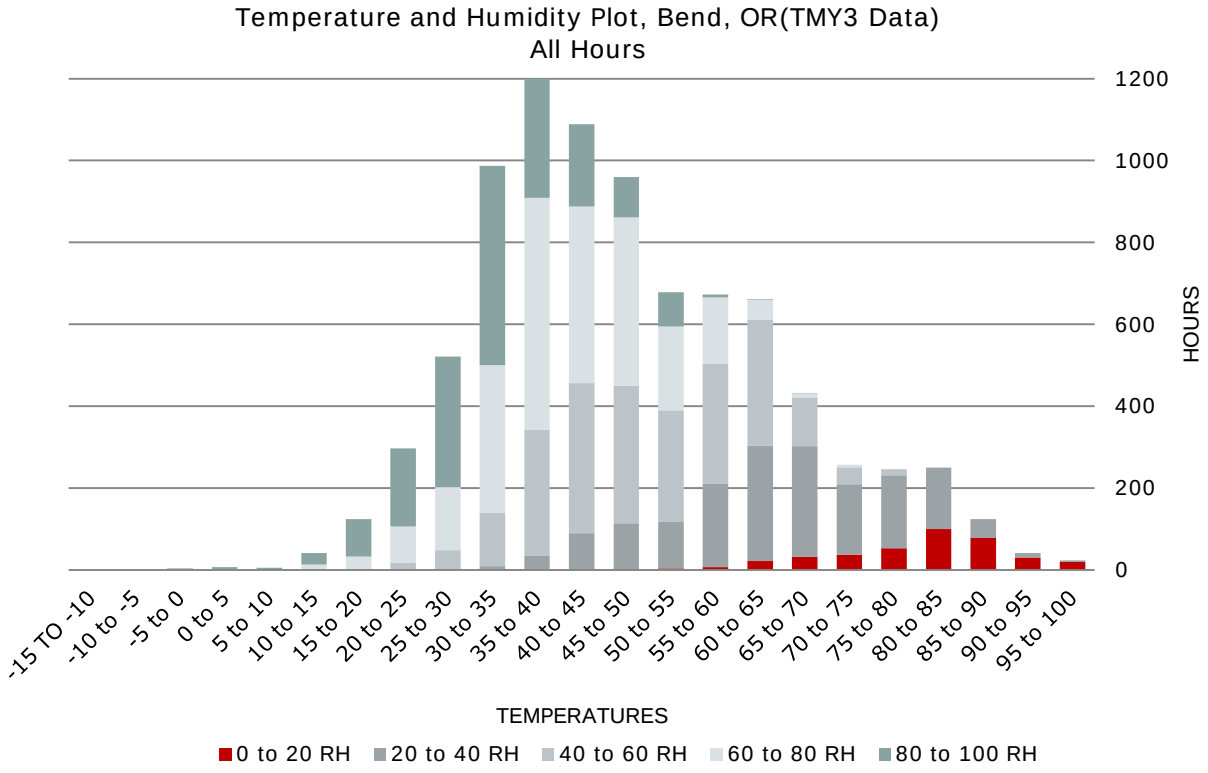


Figure 2: Typical Annual Temperature and Humidity Profile for Bend

Average high temperatures in July and August are in the low 80s and evening temperatures typically drop significantly. The mean daily range between daytime highs and nighttime lows in August is 36.5°F. This high temperature range is ideal for utilizing natural ventilation and night cooling of the building mass for thermal comfort.

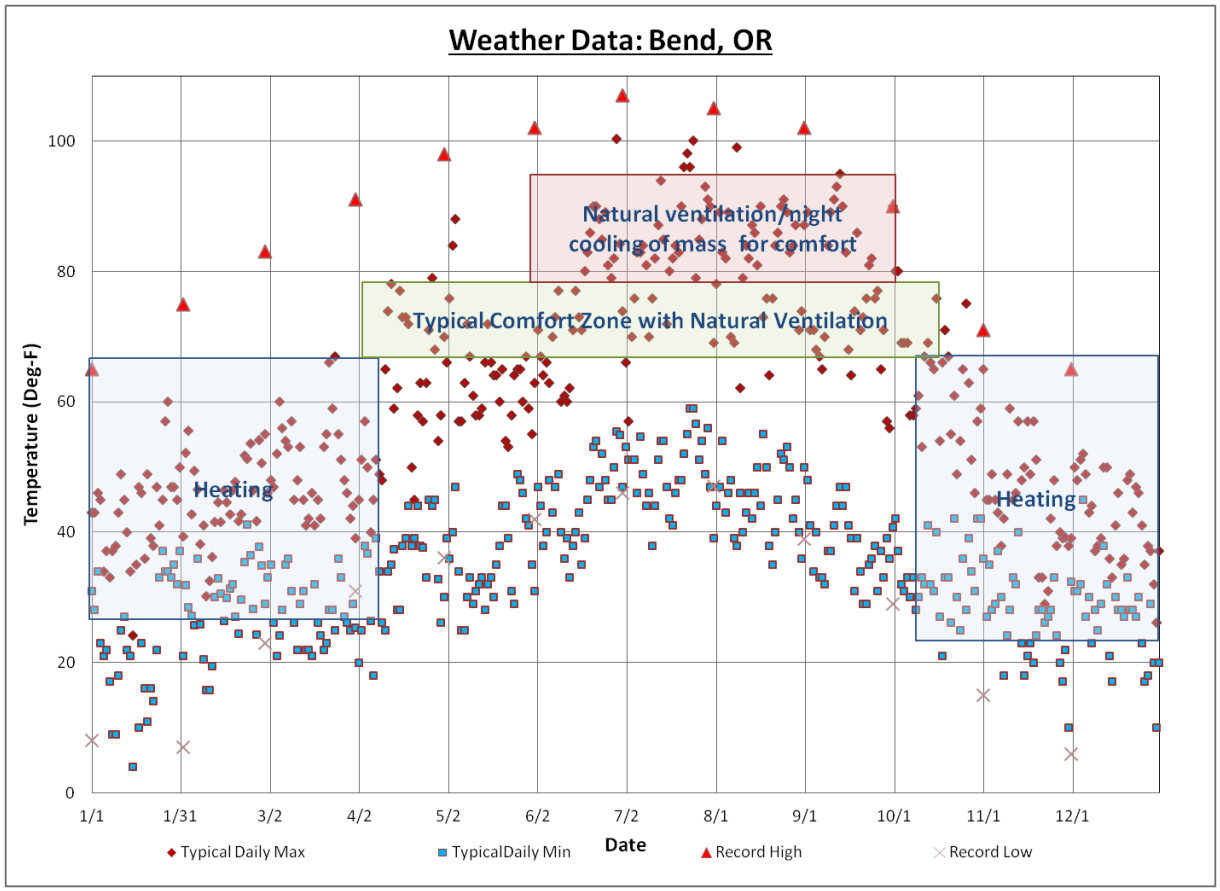


Figure 3: Typical Daily Maximum and Minimum Temperatures

3.2.2 Precipitation

Bend has an arid climate, receiving on average 11.6" of precipitation per year. This is largely due to the Cascade mountain range which acts as a rain shadow for Central Oregon; the majority of precipitation falls west of the Cascades. Much of the precipitation that does occur falls as snow during the winter months. Average snowfall is 32.4" per year. This rarely accumulates above several inches due to frequent sunny days.

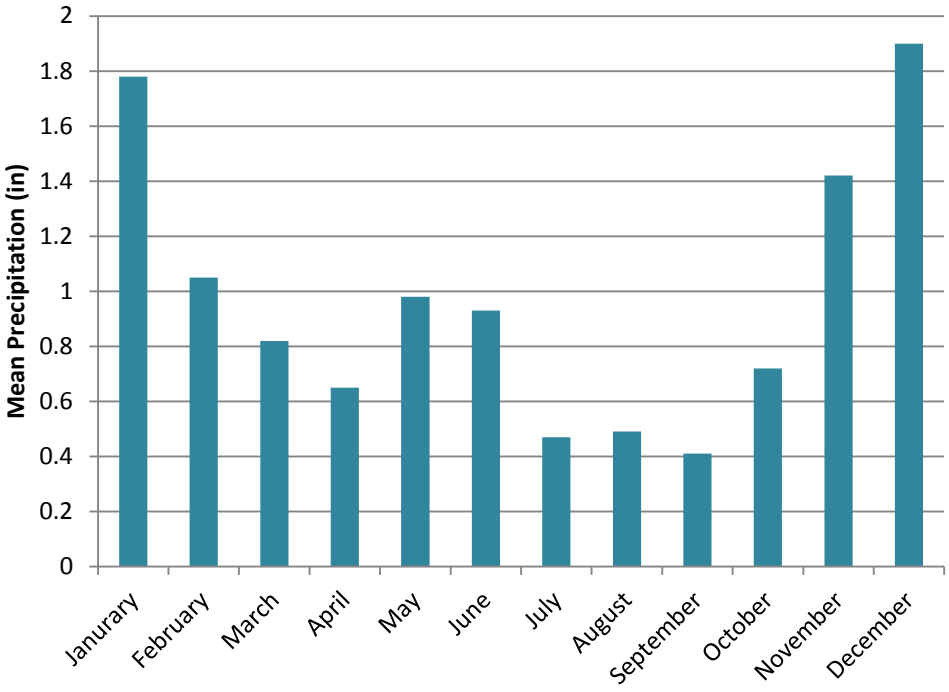


Figure 4: Average Monthly Precipitation

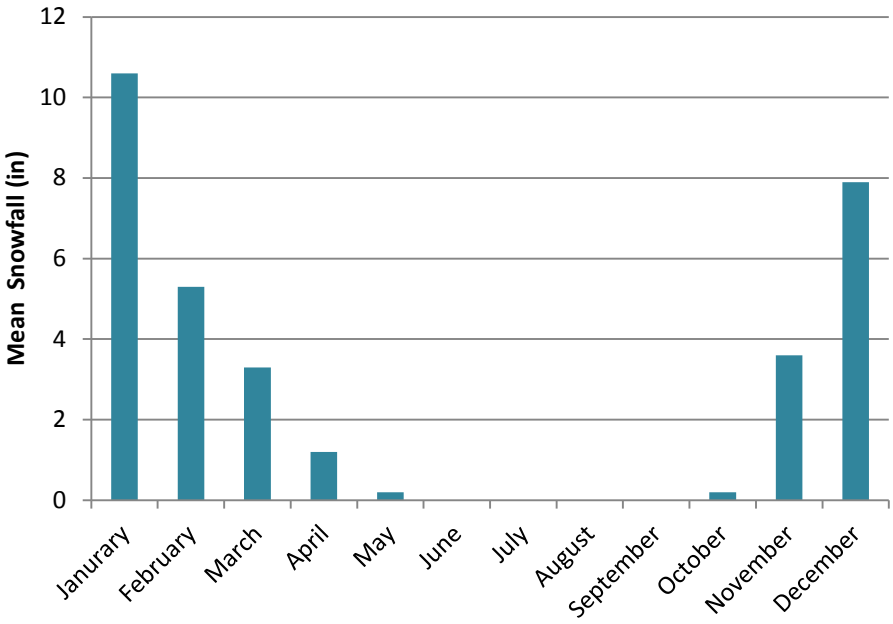


Figure 5: Average Monthly Snowfall

3.2.3 Solar Resources

Bend has good solar resources. 40% of days have less than 20% cloud cover and over half of the time cloud cover is less than 50%. On an annual basis, Bend receives 149 kWh/sqft of horizontal radiation.

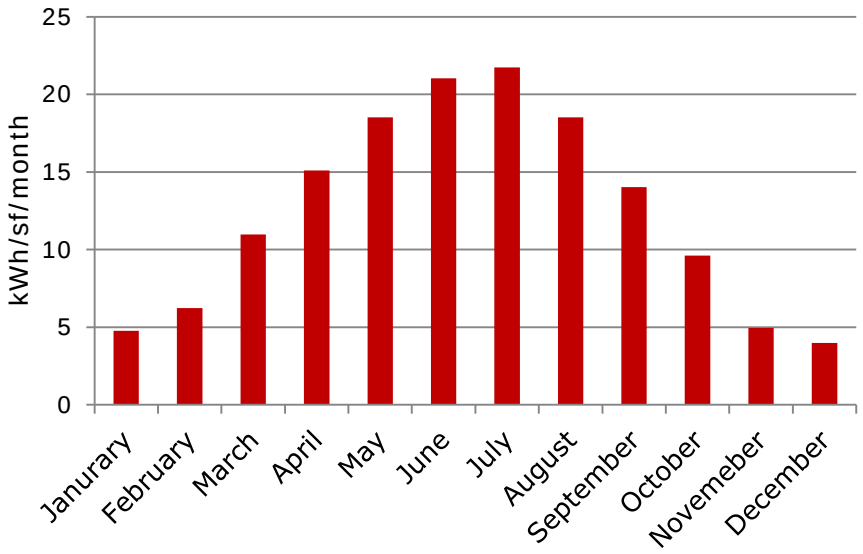


Figure 6: Average Monthly Solar Radiation

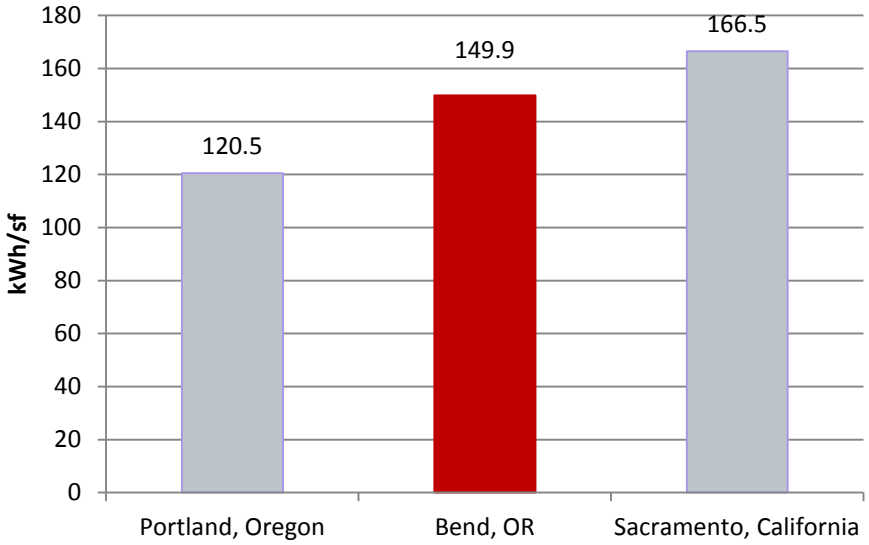


Figure 7: Annual Solar Radiation Comparison

3.2.4 Wind Resources

Bend is not a particularly windy city with average wind speeds of 7 miles per hour. In winter months winds are predominately from the south southeast; during the summer months winds are normally from the west northwest direction. As a general trend, winds are calmer in the evening and pick up in the afternoon.

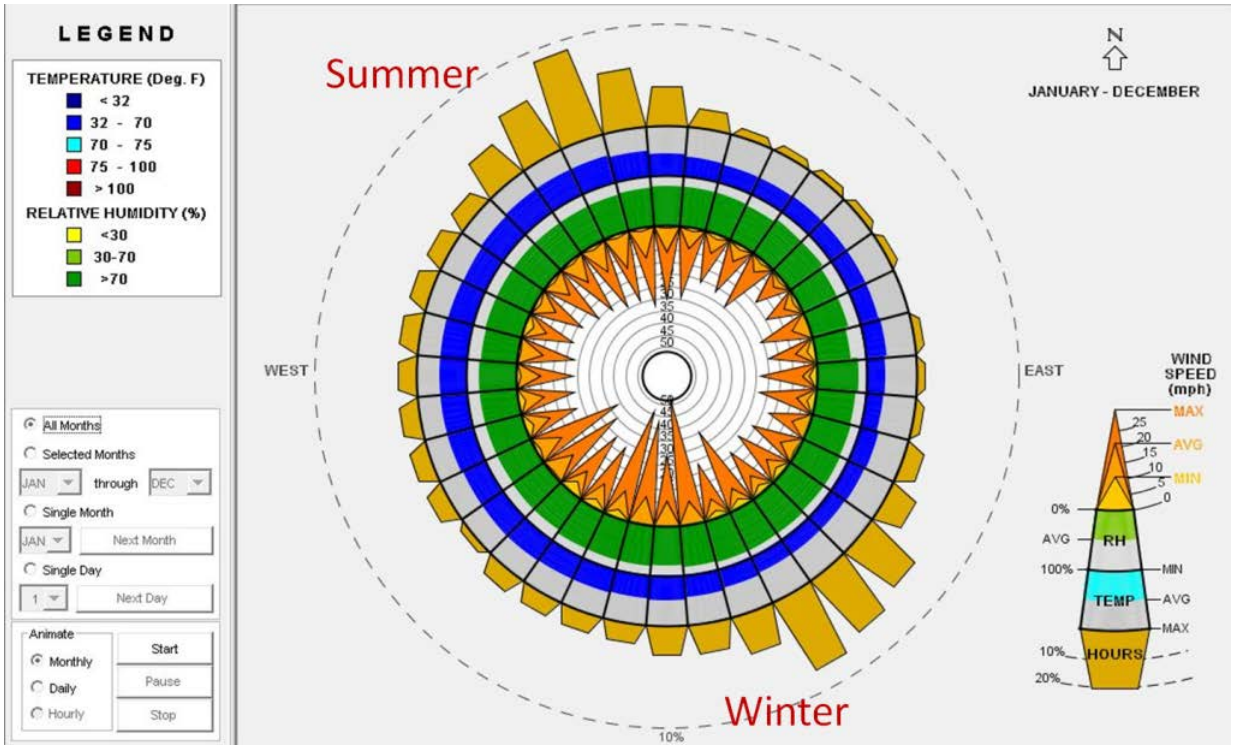


Figure 8: Wind Rose Showing Annual Wind Data for Bend

3.3 Reduce Consumption & Choose Efficient Systems

3.3.1 Net Zero Energy

A net zero energy ready project typically entails the design of a highly efficient building. Energy consumption is minimized to the point that renewable energy systems capable of generating 100% of annual consumption can be installed at a later date. Delaying the purchase of energy generation systems helps lower the first cost of the project. However, the size, type, and production ability of potential renewable systems are considered to help inform target energy use and ensure that all other systems are designed to be compatible with the renewable energy systems. A good target EUI for a net zero ready academic building is 30 kBtu/sqft/yr.

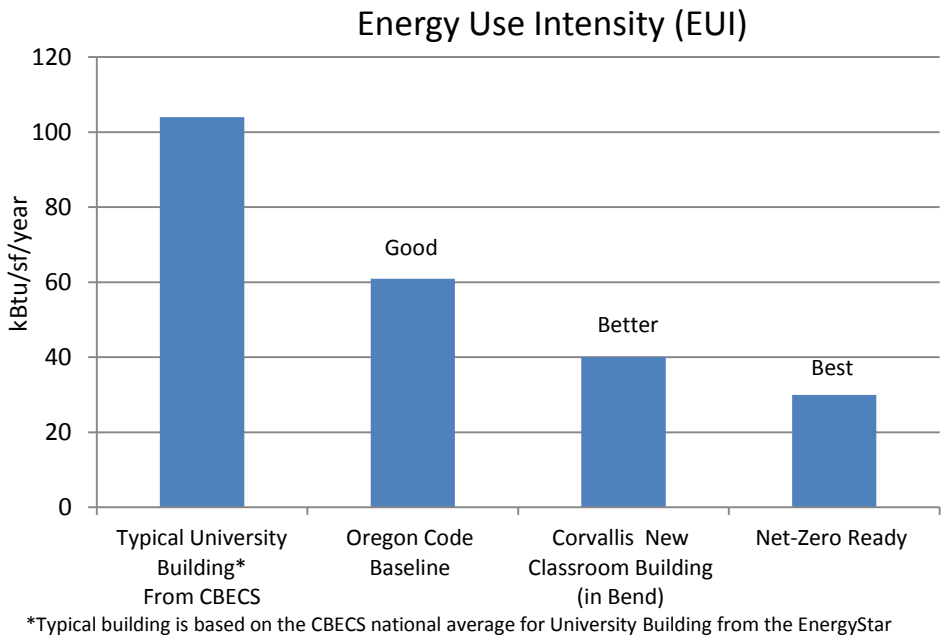


Figure 9: Energy Use Comparison of Buildings Based on Design Goals

A comparison of energy consumption by end use for a minimum code compliant "Good" classroom building, to a high performance "Better" classroom building, in Bend Oregon can be seen in the figures below. Note that energy was reduced by 30% in the "Better" design.

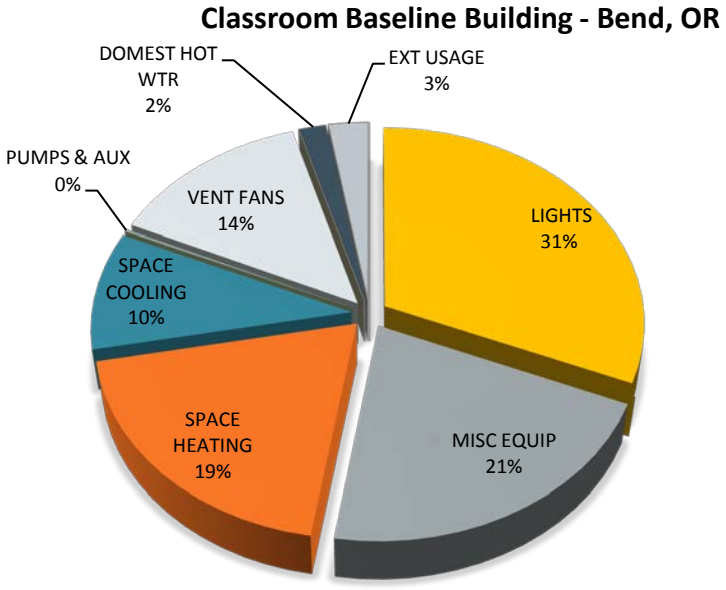


Figure 10: Baseline Classroom Building Energy Use by Type

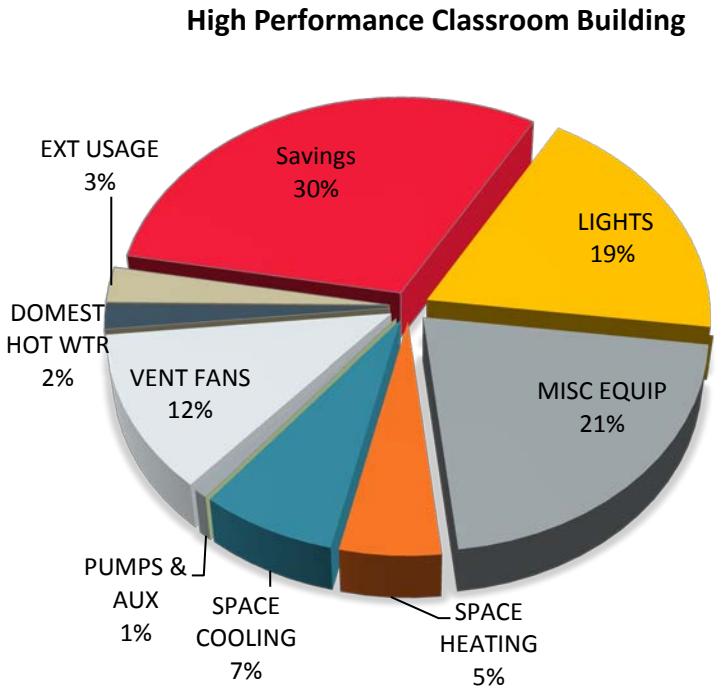


Figure 11: "Better" Classroom Energy Use by Type

Envelope

A high performance envelope is recommended for a net zero ready building. An airtight well-insulated envelope helps to reduce heating and cooling requirements and thereby reduce overall energy consumption. This should be part of the initial design as it is difficult and expensive to retrofit a building's skin. As can be seen below, losses due to infiltration and windows account for the majority of a building's skin losses. Other problem areas occur in transitions such as a wall to wall or wall to roof corners.

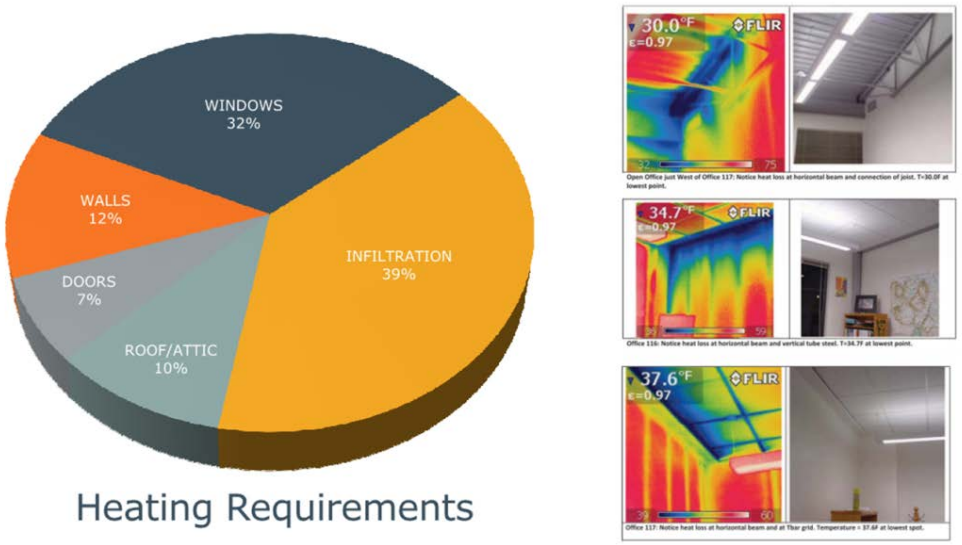


Figure 12: Heating Load by Type

The proposed envelope for a net zero ready OSU Academic building can be seen below alongside code requirements and PassiveHaus recommendations.

Component	Category	Estimated PassiveHaus	2011 ASHRAE Advanced Design Guide 50% (Climate Zone 5b)[2]	2010 Oregon Energy Efficiency Specialty Code	OSU Cascades Preliminary Recommendation
			Non-Residential	Non-Residential	
Roofs	Insulation Above Deck	R-60	R-30ci (R-49 if attic)	R-20ci (R-38 if Attic)	R-50ci (R-49 if attic)
Wall, Above Grade	Metal Framed		R-13+R-15.6ci	R-13+R-7.5ci	R-13+R-20ci
	Wood Framed and Other		R-13+R-10ci	R-13+R-3.8ci	-
Walls, Below Grade	Below Grade Wall		R-7.5ci	R-7.5ci	R-7.5ci
Slab on Grade Floors	Unheated Slabs		R-15 for 24in	NR	R-15 for 24in
	Heated Slabs		R-20 for 24in	R-15 for 24in	R-20 for 24in+R-10 under slab
Opaque Doors	Swinging		U-0.5	U-0.7	U-0.5
Vertical Fenestration	Maximum Percent of Wall	30% (of floor)	40%	30%	30%
	Metal Frame Entrance	U-0.14 (R-7.14)	U-0.39 (R-2.6)	U-0.80 (R-1.25)	U-0.2
	Metal Frame (Other)		U-0.39 (R-2.6)	U-0.46 (R-2.2)	U-0.2
	SHGC (All Frames)		0.26-0.38	0.40	0.40
Skylights	Maximum Percent of Roof		NA	3%	3.0%
	All		NA	U-0.6	U-0.45
	SHGC (All Frames)		NA	0.40	0.40
Infiltration		0.6 ACH@50Pa ~0.26 CFM/SF@75Pa	NA	NA	0.20CFM/SF@75Pa

Table 1: Comparison of Envelope Options

Lighting / Daylighting

Lighting would be expected to comprise about 30% of building energy use for a typical classroom/lab building in Bend. Lighting also contributes to the cooling load. Significant strides can be made in reducing this energy consumption by selecting efficient lighting fixtures and utilizing controls based on building schedules and occupancy sensors. In addition, photocells can be installed to turn off lights when sufficient light is available from natural light. Through intentional design of a building's shape, placement of glazing, and the use of light shelves and other daylighting devices, a building may require almost no electric lighting during daytime hours.

Space Type	Light Level (fc)	Light Power Code (W/sf)	Light Power Reduced (W/sf)
Classrooms	35-45	1.23	0.8
Offices	35	0.97	0.75
Labs	30, 80 (task)	1.4	1.1
Lobbies	30	1.28	0.9
Circulation	15-25	0.41	0.41
Utility Spaces	25	0.8-1.24	0.5
Site	--	Varies	50% of Code

Table 2: Lighting Comparison by Space Type

Equipment / Plug Loads

Plug loads are another target for energy use reduction. Selection of efficient computers, office equipment, and lab equipment is recommended. In lab areas, options exist for reducing fume hood energy. These include the installation of high performance hoods and variable air volume fume hood controls as well as conducting occupant sash management training. Figure 14 shows a significant decrease in average exhaust flow rate for a laboratory after sash management training.

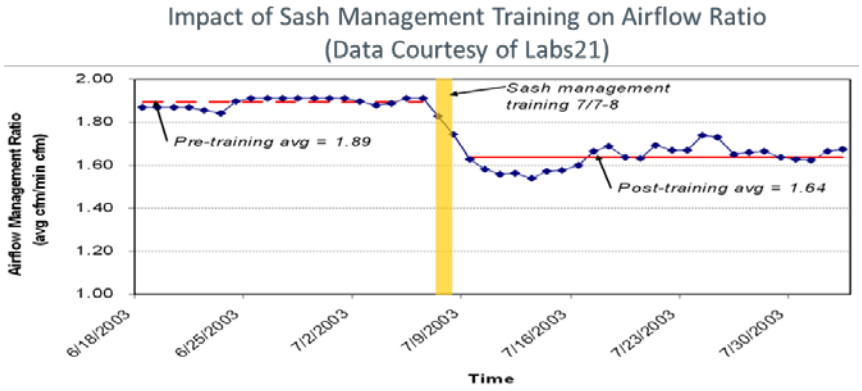


Figure 13: Hood Airflow Before and After Occupant Sash Management Training

Passive Cooling

As discussed above, Bend has a good climate for utilizing passive cooling strategies. Through operable windows – either manually or automatically operated – and stacks opening on the roof, cross and stack ventilation can bring cool outside air into the space without the use of mechanical systems. This can occur during operating hours when outside air is cooler than indoor air. The space can also be flushed with cool night air. This is especially effective if the building has a significant amount of exposed mass such as concrete. If the mass is cooled at night, it can then absorb excess heat in the space during the day and minimize the rise in temperature.

Figure 14: Schematic of a Naturally Ventilated Building

In naturally ventilated spaces where occupants have the ability to open and close nearby windows, ASHRAE has determined that there is an extended occupant comfort range which is dependent on mean outdoor temperatures. Based on average monthly temperatures of 64°F and 63°F during the months of July and August in Bend, an upper operative temperature of 78°F is comfortable for 90% of occupants and 80°F is comfortable for 80% of occupants during these months. Operative temperature is the average of the air and surrounding surface temperatures. If air speed is increased, possibly through the use of ceiling fans, perceived temperatures experienced by occupants drops by 1-2°F.

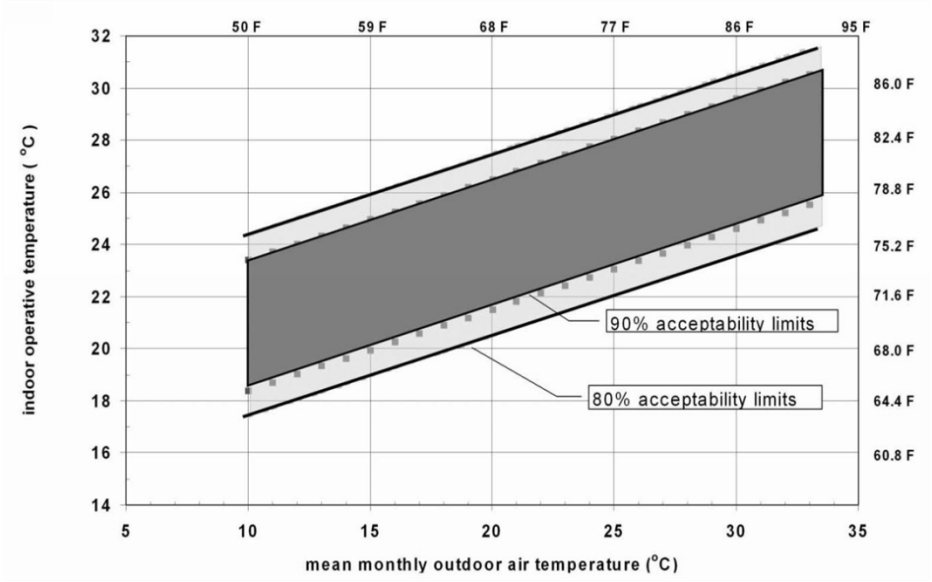


Figure 15: Acceptable Operative Temperature Ranges for Naturally Conditioned Spaces

Efficient Mechanical Systems

The overall size of the mechanical systems is decreased by building a high performance envelope and reducing lighting and plug loads. High efficiency mechanical systems are then selected. The figures below compare central plant and distribution possibilities considered for the Academic Building. Option D highlights the most efficient option. Refer to the Mechanical Section for current selections.

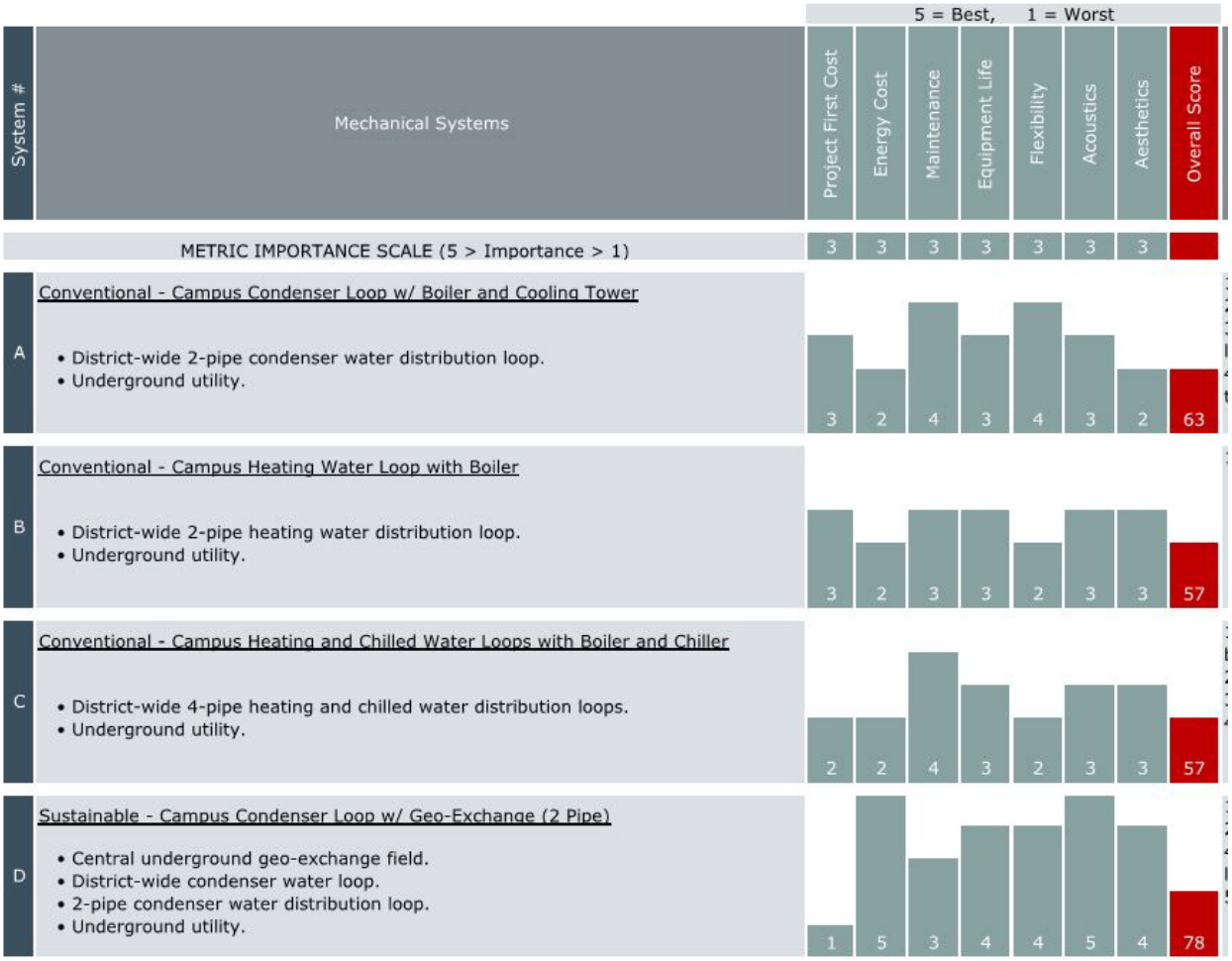


Figure 16: Central Plant Options Considered for the Academic Building

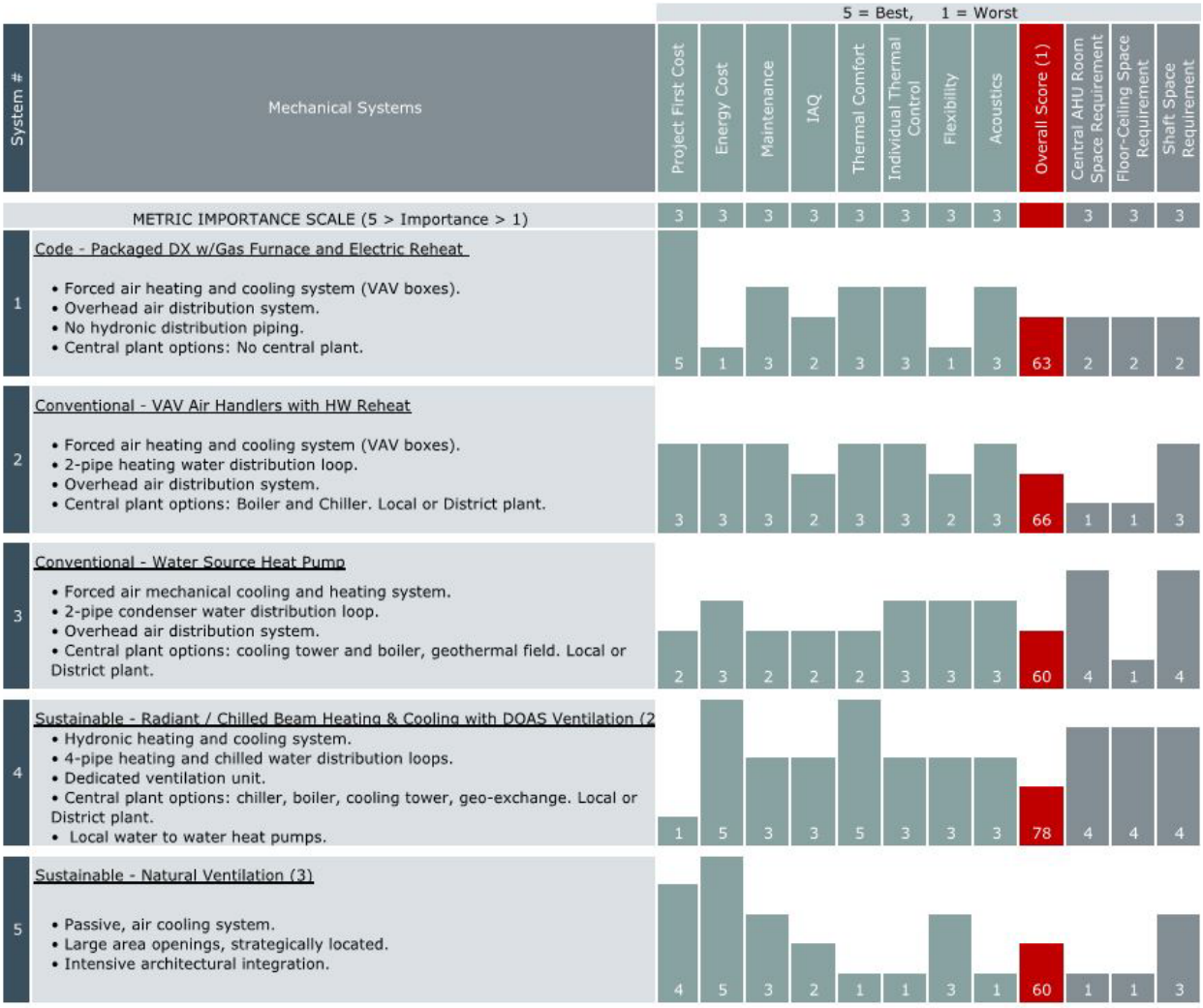


Figure 17: Distribution Options Considered for the Academic Building

3.3.2 Net Zero Water

Accessible, clean water is a shrinking resource that is vital to not only human health and survival but also the planet's. As communities strive to become more sustainable and eventually reach a net zero footprint, water becomes an important factor. A net zero water building addresses the complete hydro cycle of the site. All water needs are met through onsite harvesting, use and reuse at various stages, and treatment and eventual on site infiltration.

A net zero ready project will have significantly reduced water consumption. In addition, if the systems for water capture, reuse, and treatment are not installed initially, then they will have been planned, allocated space, and possibly partially plumbed.

Water Supply

Rather than becoming part of the stormwater flow, rainwater can be collected from the rooftop. It can be stored for non potable and potable uses depending on the system and level of treatment. Irrigation and toilet flushing usually only requires filtration to prevent clogging of piping and pumps. Potable use requires a treatment system. Additionally, the roof surface, downspouts, and equipment must also be rated for potable water. Stormwater may also be collected but has higher potential for particulates and other contaminants.

Water Use Reduction

Similar to the energy side, reduction in overall use plays a key role in achieving net zero water. A detailed water budget is first completed to compare resources to demand as well as identify and target areas for potential savings. The figure below is an analysis of water use by type for both the Academic Building and INTO Residential Building.

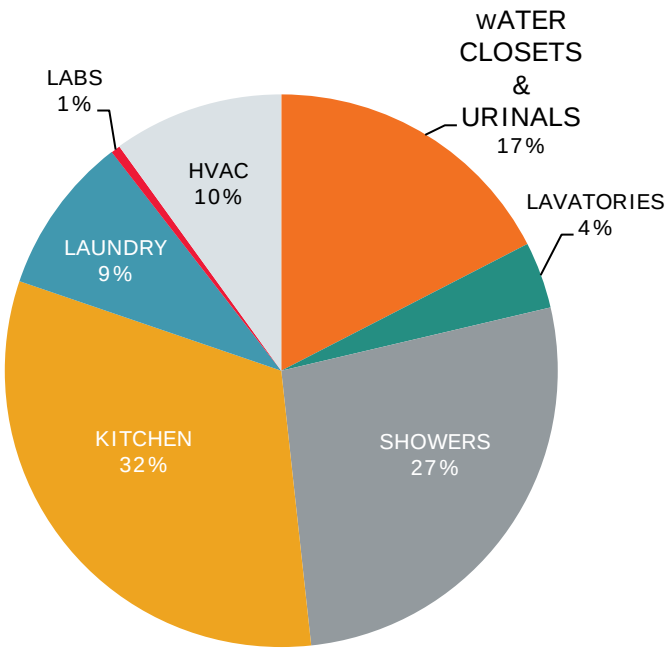


Figure 18: Predicted Water Use by type for Phase 1 of the Campus

Low flow, ultra low flow, and even no flow fixtures are good ways of lowering water demands without adding much to the first cost of the project. Water efficient appliances should also be considered. Figure 19 shows a combined savings for the academic building and residence halls (300 residents and 400 daytime occupants) of almost two million gallons by switching to low flow fixtures and efficient appliances. Other targeted consumption includes mechanical systems and irrigation. A smaller

mechanical cooling load reduces the need for makeup cooling tower water. Irrigation demand can be lowered through efficient systems such as subsurface or drip irrigation rather than sprinklers and through the selection of native plants which do not require additional water.

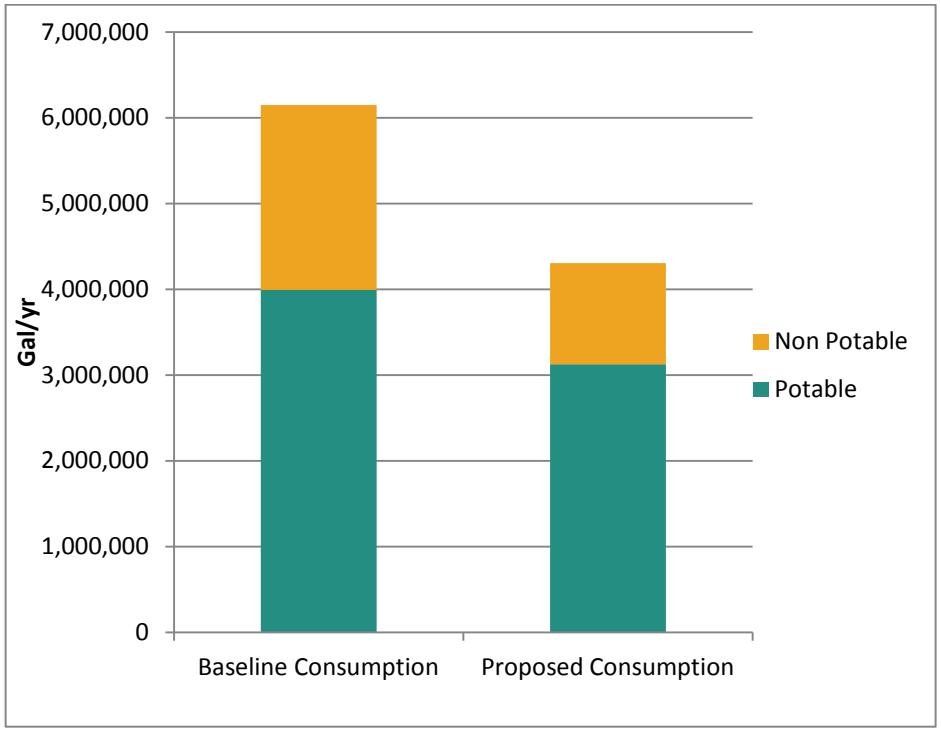


Figure 19: Baseline Versus Proposed Site Water Consumption

Water Reuse

Much of the water used onsite can be captured for reuse before full treatment and infiltration. This involves separating wastewater streams into greywater and blackwater. Greywater is water from bathroom sinks, showers, laundry, and mechanical equipment condensate. Blackwater is water from toilets and kitchen sinks. Greywater systems can collect water from certain fixtures and then reuse this water for non potable uses such as flushing toilets and irrigation.

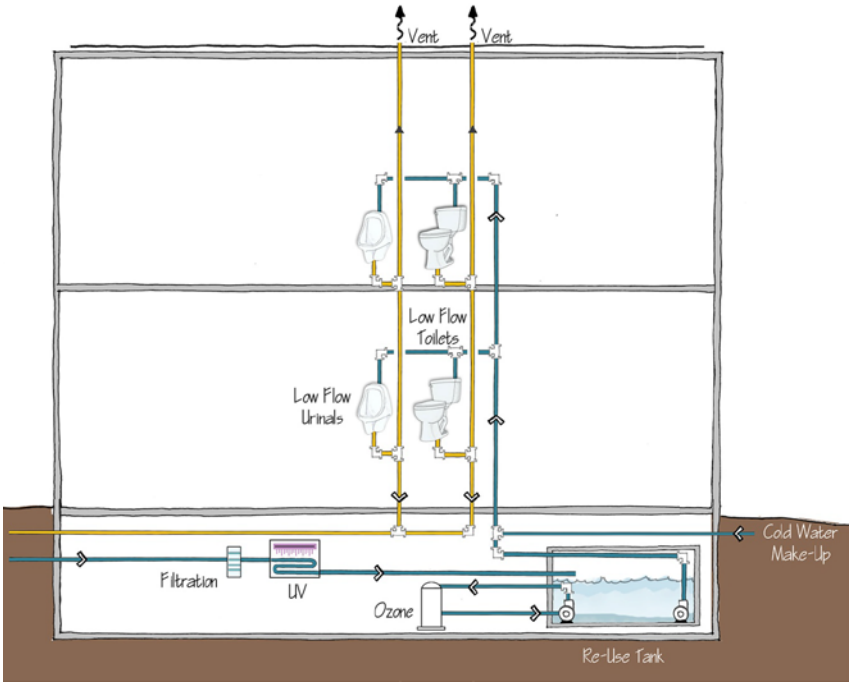


Figure 20: Schematic of a Possible Greywater System Used to Flush Water Closets

Wastewater Treatment

One of the goals of a net zero water project is to treat all water on site. Many cities have difficulties keeping up with the growing volume of wastewater produced. They have centralized wastewater treatment plants which after treatment often discharge into a local waterway. Though the water has been treated to safe standards, it also has high levels of phosphates and nitrates which is damaging to river ecosystems. This eutrophication of waterways can be prevented by localized treatment and infiltration.

A range of options exist for onsite wastewater treatment including constructed wetlands (shown below), membrane bioreactors, and recirculating biofilters.

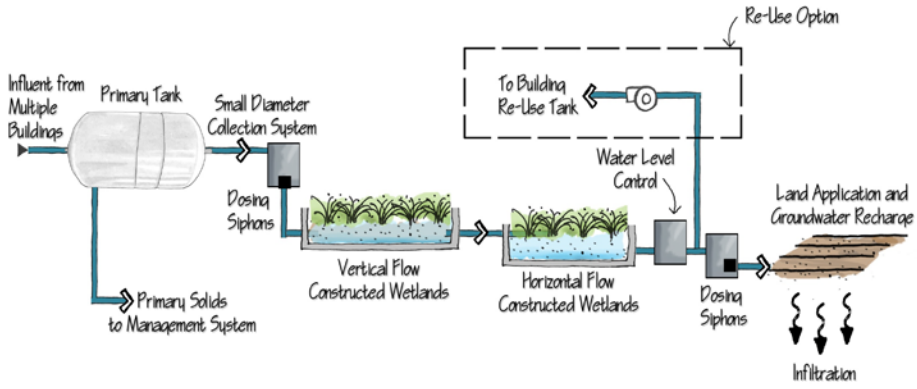


Figure 21: Schematic of a Constructed Wetland Used for Wastewater Treatment

3.4 Opt for Renewables

With Bend's great solar resource, solar energy can eventually be harvested by installing a photovoltaic array to generate electricity and solar thermal panels to generate hot water. Other renewable options include wind and biomass. Wind turbines can generate electricity for the site and biomass can provide either heat or combined heat and electricity.

Figure 22: PV arrays and wind turbines are examples of renewable energy generation systems.

3.5 Verify Performance

Commissioning to ensure that building systems function as designed is one of the first steps in performance verification. This includes testing the building envelope during and after construction and testing all mechanical systems and controls after installation. Commissioning helps to ensure that the building provides a high level of efficiency, thermal comfort, and occupant control.

Ongoing measurement and verification of building performance should also be conducted. The Building Automation System can give feedback to owners, occupants, and maintenance staff. The maintenance staff should be alerted to problems in the system and have a well designed interface with historical and current data that allows for quick identification of any problems within the system. The BAS can also be used to create a "green screen" type interface for the occupants. The screen can be designed based on owner preference but typically includes high level feedback such as weather data, energy and water consumption, and renewable energy generation. This provides continuing education as well as a greater level of interaction between the building systems and the people inside.

Figure 23: An Example of a "Green Screen"

4.0 Mechanical

4.1 HVAC Systems

4.1.1 Design Criteria

Outdoor Conditions	Summer	Winter
ASHRAE 99.4% Redmond, OR	93°F DB/ 62°F WB	2°F

Table 3: Outdoor Conditions

Indoor Conditions	Summer	Winter
Office	76°F±2°F No Humidification	68°F±2°F No Humidification
Classroom	76°F±2°F No Humidification	68°F±2°F No Humidification
Lab	73°F±2°F No Humidification	68°F±2°F No Humidification

Table 4: Indoor Conditions

Outside Air Requirements:	
General Office:	5 CFM/person + 0.06 CFM/sf
Lecture Classroom:	7.5 CFM/person + 0.06 CFM/sf
Lobby:	5 CFM/person + 0.06 CFM/sf
Exhaust Air Requirements:	
Janitor:	1.0 CFM/sf
Restroom:	2.0 CFM/sf
Copy/Print Rooms	0.5 CFM/sf
Acoustical Criteria:	
Open Offices	RC 30-40
Private Offices	RC 25-35
Classrooms	RC 35
Halls, Corridors, Lobbies	RC 40
Toilet and Storage	RC 45

Table 5: Indoor Conditions

Low-Pressure Ductwork:	
Static Pressure Loss:	Maximum 0.1 inches WC per 100 feet
Shaft Velocity:	Maximum 1,500 feet per minute
Main Velocity:	Maximum 1,200 feet per minute
Run-out Velocity:	Maximum 600 fpm
Flexible Ducts:	Maximum length 7 feet
Medium-Pressure Ductwork:	
Static Pressure Loss:	Maximum 0.28 inches WC per 100 feet
Shaft Velocity:	Maximum 2,400 feet per minute
Main Velocity:	Maximum 2,000 feet per minute
Branch Velocity:	Maximum 1,750 fpm

Lab Exhaust:	
Static Pressure Loss:	Maximum 0.28 inches WC per 100 feet
Fan Discharge Velocity:	Minimum 2,800 fpm
Hydronic Piping:	
Static Pressure Loss:	Maximum 4 feet WC per 100 feet
Velocity (in public spaces):	Maximum 5 feet per second
Velocity (in mech rooms):	Maximum 10 feet per second

Table 6: Duct and Pipe Sizing Criteria

4.1.2 Baseline Office and Classroom HVAC Systems

The offices and classrooms will be served by a single roof top air handling unit. The unit will consist of a natural gas fired heating coil and direct expansion (DX) cooling coil. The coiling condenser will be integral to the air handling unit (packaged). The unit will have variable volume supply and return fans. The unit will deliver a combination of ventilation and return air at a temperature between 55-65°F depending on the demand for cooling in the building. When the outside air is colder than the return air, increased outside air will be introduced to maintain the supply air temperature set-point (air side economizer); this will prevent the cooling compressors from needing to run at temperatures below about 60-65°F. This functionality is required by the 2010 Oregon Energy Efficiency Specialty Code.

Zone heating control will be provided by variable air volume terminal units with electric re-heat. The terminal units will control the quantity and temperature of air delivered to each zone based on zone demand. All terminal units will include an airflow measuring device with damper to control the volume of air delivered to the zone and an electric heating coil to control the temperature of air delivered to the zone. Some zone terminal units will include integral fans to provide re-circulated room air. This will increase the ability of the terminal unit to heat the space without requiring more air from the air handling unit. This functionality will be required by the 2010 Oregon Energy Efficiency Specialty Code for spaces with high heating demands (perimeter spaces with significant amounts of glazing).

Terminal units will be controlled by room thermostats. Each high occupancy room (classrooms, labs, conference rooms) will have a dedicated thermostat; offices will be grouped together by exterior exposure.

There is no heating water or chilled water associated with this system; thus there is no heating or chilled water piping and accessories.

Because there is no cooling source at the individual zones, the single “warmest” zone will drive the supply temperature from the rooftop unit to all zones (accomplished either by operating the heating coil, cooling coil, or introducing increased outside air). During cold outside air temperatures, the warmest zone would likely be an interior space with

internal loads. Perimeter zones which may require heating at that time will have to re-heat the supply air at the zone terminal units. This zone re-heat is an energy penalty associated with an “All-Air” style HVAC system.

There is no redundancy provided in this system.

The expected annually energy cost for the non-lab portion of the building is $1.20-$1.60 per sqft.

The following equipment is included in this design:

1. 50,000 CFM VAV Air Handler
   120 Ton Packaged DX Cooling
   1000 MBH (Output) Gas Furnace Heating
   Based on JCI Series 100

2. 10x Passive Terminal Units with Electric Reheat
   25x Parallel Fan Power Terminal Units with Electric Reheat
   Based on Price SDV and FDV with EC Motor

3. (1x) 5000 CFM Roof Top General Exhaust Fan
   Based on Greenheck Down-blast Direct Drive with EC Motor

4.1.3 Baseline Lab HVAC Systems

Two of the laboratory classrooms are assumed to contain a total of seven (7) 6-foot fume hoods, one (1) 4-foot fume hood and two (2) bio-safety cabinets. The fume hoods and bio-safety cabinets will need to be exhausted whenever experiments are conducted or when chemicals are

stored in the hoods. The hoods will be served by a single rooftop lab exhaust fan. The exhaust flow from the hoods will vary depending on the open area of the sash at any given time. Exhaust flow from each hood will be controlled by pressure independent airflow control valves for each hood. The exhaust fan will include an integral stack with discharge cone and bypass. The bypass and discharge cone ensure that the quantity and velocity of lab exhaust leaving the fan are propelled safely away from the building.

Lab make-up air will be provided by a packaged gas fired variable air volume roof top air handling unit. The lab make up air supply temperature will be controlled based on the demand for heating or cooling in the zone. Each lab will contain 1-2 zone terminal units to control the volume of air to the lab.

Controlling the volume of exhaust air from each hood (variable lab exhaust) will provide a significant energy savings both in fan power and in heating, since the amount of make-up air to be heated is reduced.

The exhaust air will be routed via medium pressure exhaust ductwork (welded 304 stainless steel ductwork) to the central exhaust fan.

There is no redundancy provided in this system.

The following equipment is included in the design:

1. 5,700 CFM Lab Exhaust Fan
   Based on Greenheck Vektor H

2. 10x Exhaust Terminal boxes with pressure independent control valves.
   Associated controls.
   Based on Phoenix Accel II
3. 5,700 CFM Make-Up Air Unit
   15 Ton Packaged DX Cooling
   725 MBH (Output) Gas Furnace Heating
   Based on JCI

4. 4x Supply Passive Terminal Units with Electric Reheat
   Based on Price SDV

4.1.4 HVAC Controls

A direct digital control (DDC) system will be provided to control and monitor HVAC equipment and systems. An additional dedicated laboratory control system will be evaluated as design proceeds. This system would control airflow and temperature in all laboratory spaces and it would be integrated into building's DDC system. Valve and damper actuation will be electric type.

DDC system will be web accessible to allow full control and monitoring from an operator's terminal. The control system will perform all required control functions, including optimization of equipment and system performance, reliability, equipment life and energy consumption.

4.1.5 Measurement & Verification

The Base Design does not include any metering beyond the utility provided gas and electric meters.

4.1.6 Balancing and Commissioning

Balancing

Testing and balancing will be conducted for all HVAC systems.

Commissioning

The building systems will be commissioned. OSU will hire a Commissioning Agent to manage the process.

4.2 Mechanical Alternates

4.2.1 HVAC Alternate 1 - Hydronic Heating in lieu of Gas Furnace with Electric Re-Heat

This alternate adds hydronic heating to the building. Condensing boilers would heat water to 140°F for distribution throughout the building. The heating water would be used in lieu of the gas furnace heating coil in the air handlers and in lieu of the electric reheat coils in the terminal units. The condensing boilers will generate heating water at about 90% efficiency - more efficient than the gas furnaces in the base design (about 80%). Also, by replacing the electric re-heat in the base design with a natural gas heat source in this alternate, substantial energy cost savings and a reduction in green house gas emissions can be achieved. Electricity costs about 2.5x more than natural gas per unit of energy and accounts for about 3x more green house gas emissions per unit of energy (based on the greenhouse gas emissions factors reported for the North West Power Pool http://cfpub.epa.gov/egridweb/ghg.cfm). Heating water would also provide improved air temperature control compared to gas furnace heating.

Heating water would be distributed from the mechanical room to the roof top air handlers and to each zone terminal unit. Mechanical room piping will be 3". Distribution piping will be primarily 2" and smaller.

The boilers would each be sized at approximately 65% of peak load and heating water pumps would each be sized at full load, providing some redundancy. The air distribution and cooling would not consist of any redundancy.

The expected annually energy cost for the non-lab portion of the building is $1.00-$1.40 per sqft.

The following equipment changes from the base design are made in this alternate:

Add to Base Design

1. (2x) 1000 MBH Condensing Gas Boilers (each sized at 65% of load)
   Based on Hydrotherm KN 10

2. (2x) 5hp Inline Heating Water Pumps (100% redundant)
   Based on B&G Series 90

3. Hot water heating coils at all terminal units
4. Hydronic accessories

Remove from Base Design

1. 1000 MBH Gas furnace from AHU
2. 725 MBH Furnace from Make-up Air Unit
3. Electric heating coils at all terminal units

Benefits Summary

1. Decreased energy cost and greenhouse gas emissions.
2. Improved temperature control.
3. Improved equipment life.

4.2.2 HVAC Alternate 2 – Dedicated Outside Air (DOAS) with Chilled Beams

This alternate replaces the all air distribution system with a dedicated outside air system and chilled beams for zone heating and cooling. The dedicated outside air system would have sensible heat recovery – wheel or plate. Heat recovery wheels provide more effective heat transfer than plate type, but consist of a moving wheel in lieu of a static flat plate heat exchanger. The unit would include variable speed drives for supply and relief fans for demand controlled ventilation, balancing, and flexibility. Air distribution would be via medium pressure ductwork to zone terminal units (without heating coils) and low pressure ductwork downstream of terminal units.

The primary heating water loop would be 140°F and would serve the air handler coils – the extent of this distribution loop would be from the mechanical room to the rooftop air handling units. The secondary heating water loop would be 110°F and would serve the chilled beams – this loop would be distributed throughout the building.

The primary chilled water loop would be 44°F and would serve the air handler coils. The secondary chilled water loop would be 58°F and would serve the chilled beams.

The chilled beams would be four pipe (Heating Water Supply/Return and Chilled Water Supply/Return) active beams. Active beams receive the ventilation air through a ducted connection on the beam. Active beams have much greater heating and cooling capacity than passive beams - beams which do not have a ducted ventilation air connection.

This system provides a zone cooling source (chilled beams), eliminating the need for all cooling to be done at the central air handling unit and the energy penalty associated with zone reheat. Heat recovery for the ventilation air also provides an energy savings. The size of ductwork is greatly reduced compared to the base design system by reducing the quantity of air delivered to the zones by 65-75%. Because less air is delivered than in an “all air” system (the base design), this alternate can save fan energy, except in cases where the distribution system for the all air system has been sized for a peak airflow which is much greater than typical operating flow. In which case the all air system fan power usage can be comparable to the DOAS system, but it comes at the cost and space requirement of having sized the ductwork 3x larger than for the DOAS system.

The boilers would each be sized at approximately 65% of load and heating water pumps would each be sized at full load, providing some redundancy. The air distribution and cooling would not consist of any redundancy.

The expected annually energy cost for the non-lab portion of the building is $0.90-$1.30 per sqft.

The following equipment changes from the base design are made in this alternate:

Add to Base Design

1. 15,000 cfm dedicated outside air unit
   Sensible Heat Recovery
   Heating Water Coil
   Chilled Water Coil

2. 25x Passive Terminal Units without Heating Coil
   Based on Price SDV

3. (2x) 1000 MBH Condensing Gas Boilers (each sized at 65% of load)
   Based on Hydrotherm KN 10

4. (2x) 5hp Inline Primary Heating Water Pumps (fully redundant)
   Based on B&G Series 90

5. (2x) 5hp Inline Secondary Heating Water Pumps (fully redundant)
   Based on B&G Series 90

6. (1x) 120 Ton Air Cooled Chiller
   Based on JCI

7. (1x) 15hp Base Mounted Primary Chilled Water Pump
   Based on B&G Series 1510

8. (1x) 10hp Base Mounted Secondary Chilled Water Pump
   Based on B&G Series 1510

9. Hydronic piping and accessories

10. (250x) 2' (wide) x 4' (long) Four Pipe Active Chilled Beams
    Based on Dadanco ACB40

Remove from Base Design

1. 50,000 CFM VAV Air Handler
   120 Ton Packaged DX Cooling
   1000 MBH (Output) Gas Furnace Heating
   Based on JCI Series 100

2. 10x Passive Terminal Units with Electric Reheat
   25x Parallel Fan Power Terminal Units with Electric Reheat
   Based on Price SDV and FDV with EC Motor

Benefits Summary

1. Decreased energy cost and greenhouse gas emissions.

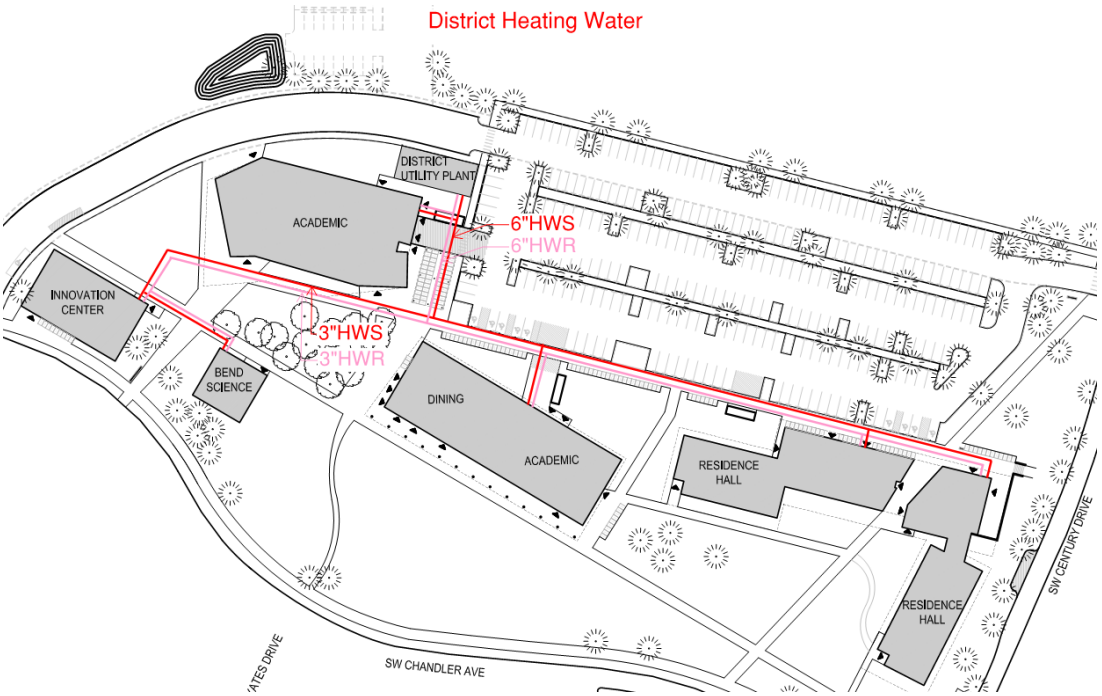
2. Improved thermal comfort.

3. Reduced ceiling space requirement for ductwork.

4.2.3 HVAC Alternate 3 – Central Heating Water Plant

In this alternate a campus heating water plant is constructed concurrently with the Academic Building. The campus plant would provide heating water for the Academic Building, the housing Building and all future development on the 10 acres which encompass Phase 1 of the campus construction.

The plant would consist of heating water boilers which could be condensing natural gas (HVAC Alternate 3a) or biomass (HVAC Alternate 3b) boilers. The plant would also house central heating water pumps and hydronic accessories (expansion tank, chemical treatment, etc…). Heating water would be distributed to each connected building via direct buried pre-insulated steel pipe.



This alternate requires that the Academic Building system is compatible with hot water heating; this alternate can only be taken in conjunction with HVAC Alternate 1 or HVAC Alternate 2; it cannot be used with the Base system design.

This Alternate will not substantially affect energy consumption compared to HVAC Alternates 1 or 2 (in which the heating water plant is local to the building).

Three boilers will each be sized at approximately 45% of the combined heating load for the Academic and Housing buildings. Heating water pumps will each be sized at the full combined load of the Academic and Housing buildings, providing some redundancy. Space will be allocated in the central plant for the addition of future boilers and pumps when it becomes necessary.

The following equipment changes from HVAC Alternates 1 or 2 are made in this alternate:

The expected annually energy use and cost for the building with this HVAC system is similar to that of HVAC Alternate 1 or 2 depending on building distribution; however the heating energy consumption is moved from the building to the central plant.

Add to Alternate 1 or 2

1. (3x) 2600 MBH Condensing Gas Boilers (each sized at 45% of load)
   Based on Hydrotherm KN-26 (Alternate 3a)

OR

(1x) 7300 MBH (Output) Biomass Boiler (Alternate 3b)

2. (2x) 15hp Base Mounted Heating Water Pumps (100% redundant)
   Based on B&G Series 1510

3. Central Plant Hydronic accessories sized for 300 GPM.

4. 1000-ft of 6-inch direct buried pre-insulted steel pipe (allows for 2x future capacity).

5. 500-ft of 4-inch direct buried pre-insulated steel pipe.

6. 1000-ft of 3-inch direct buried pre-insulated steel pipe.

Remove from Alternate 1 or 2

1. (2x) 1000 MBH Condensing Gas Boilers
   Based on Hydrotherm KN 10

2. (2x) 5hp Inline Primary Heating Water Pumps (fully redundant)
   Based on B&G Series 90

3. Local Building Hydronic accessories sized for 110 GPM.

Benefits Summary

1. More practical to install central biomass boiler(s) than biomass boilers at each building

2. Centralized equipment is easier to maintain

3. Centralized equipment decreases mechanical space requirements for the individual buildings

4. More practical to provide redundancy with centralized equipment

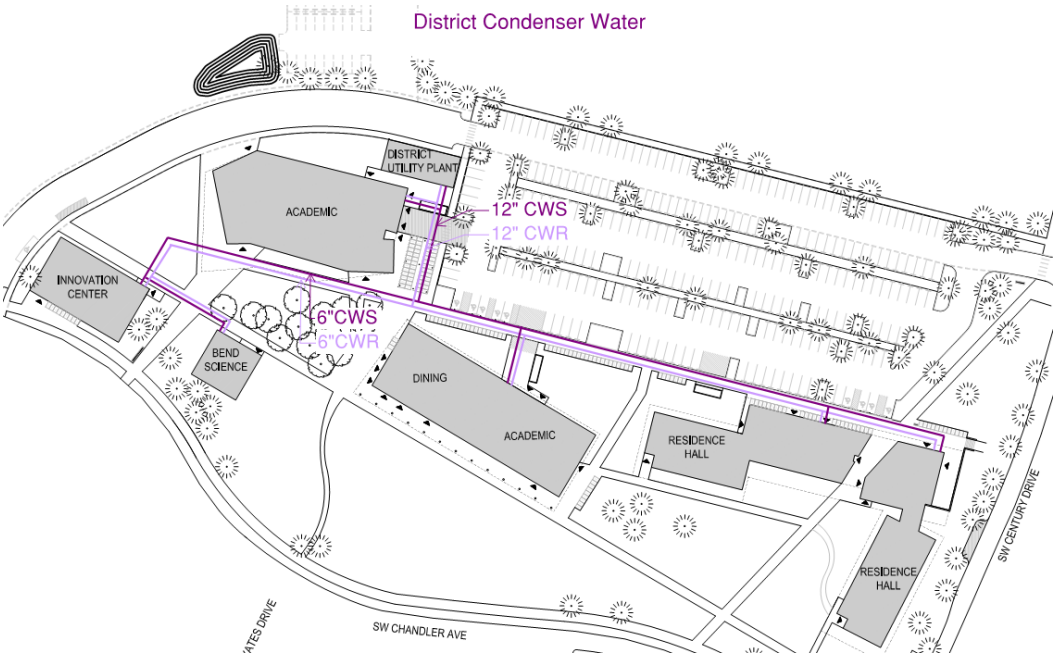
5. Economy of purchasing larger central equipment in lieu of smaller equipment at each building (economy will be realized by future buildings)

4.2.4 HVAC Alternate 4 – Central Condenser Water Plant

In this alternate a campus condenser water plant is constructed concurrently with the Academic Building. The campus plant would provide condenser water for the Academic Building, the Housing Building and all future development on the 10 acres which encompass Phase 1 of the campus construction.

A central “condenser water” loop would act as a heat source and sink for each building connected to it. When a building requires heating, heat pumps within the building would extract heat from the condenser loop and transfer it to the building – either into forced air heating or into the building heating water loop. When a building requires cooling, heat pumps within the building would extract heat from the building - either from forced air cooling or the building chilled water loop, and transfer it into the condenser water loop. This alternate requires that all connected buildings have heat pump based HVAC systems.

The central plant adds heat to or extracts heat from the condenser loop to balance out (offset) the heat added or removed from the loop at the other buildings. The plant adds heat to the loop via natural gas boilers, and removes heat from the condenser loop via cooling towers. Condenser water would be distributed to each connected building via direct buried un-insulated HDPE pipe.



This alternate assumes HVAC Alternate 2, which includes heating and chilled water distribution, is selected for the Academic Building. However, the boilers and chiller are replaced with water to water heat pumps. The heat pumps generate heating or chilled water depending on the building demand.

Compared to HVAC Alternate 2, this Alternate reduces the natural gas consumption for heating and moves it from the building to the central plant. This alternate adds electric consumption for heating (via heat pumps) at the building. This alternate reduces gas energy consumption but increases electric energy consumption. Overall, the absolute energy consumption would be less than Alternate 2, but the energy cost would be similar, since electricity is more expensive than gas. The associated greenhouse gas emissions would also be similar to Alternate 2.

Two boilers would be sized at approximately 65% of the combined heating load on the condenser loop from the Academic and Housing buildings. One cooling tower would be sized at approximately 100% of the combined cooling load on the condenser loop from the Academic and Housing buildings. Each of three condenser water pumps would be sized at 50% of the combined load of the Academic and Housing buildings, providing some redundancy. Space will be allocated in the central plant for the addition of future boilers, cooling towers, and pumps when it becomes necessary.

The expected annually energy cost for the non-lab portion of the building is $0.80-$1.30 per sqft.

The following equipment changes from HVAC Alternate 2 are made in this alternate:

Add to Alternate 2 (District Plant)

1. (2x) 2600 MBH Condensing Gas Boilers (each sized at 65% of load)
   Based on Hydrotherm KN-26.

2. (3x) 30hp Base Mounted Condenser Water Pumps (n+1 redundant)
   Based on B&G Series 1510

3. (1x) 400 Ton Open Cooling Tower
   Based on Evapco AT

4. Central Plant Hydronic accessories sized for 1400 GPM.

5. 1000-ft of 12-inch direct buried un-insulted HDPE pipe (allows for 2x future expansion).

6. 1500-ft of 6-inch direct buried un-insulted HDPE pipe.

Add to Alternate 2 (Academic Building)

1. (4x) 45-Ton Water to Water Heat Pumps (n+1 redundant)
   Based on Water Furnace Envision 540.

Remove from Alternate 2 (Academic Building)

1. (2x) 1000 MBH Condensing Gas Boilers
   Based on Hydrotherm KN 10

2. (1x) 120 Ton Air Cooled Chiller
   Based on JCI

Benefits Summary

1. This system is compatible with ground source heating and cooling, allowing for future connection to geo-exchange wells. There is potential for cost effective geo-exchange capacity to be installed in the existing quarry.

2. The alternate replaces the Academic Building boiler and chiller with water to water heat pumps. This requires less mechanical room space in the Academic Building and eliminates the roof top chiller at the Academic Building.

3. Centralized equipment is easier to maintain.

4. More practical to provide redundancy with centralized equipment.

5. Economy of purchasing larger central equipment in lieu of smaller equipment at each building (economy will be realized by future buildings).

4.2.5 HVAC Alternate 5 – Measurement and Verification

This alternate adds sub-metering for the following energy uses:

1. HVAC Equipment – electric
2. Lighting - electric
3. Plug Loads – electric
4. Other - electric
5. HVAC Equipment – gas
6. Domestic Hot Water - gas

Additionally all metered data (should be integrated into and trended by the building DDC system. The DDC system should include a “green screen" interface for occupants to view building performance on a public display in the building. An energy analyst should be contracted to create a calibrated energy model after one year of operation to evaluate building performance and identify any discrepancies between design and operation.

Benefits Summary

1. Measurement and verification provides a valuable tool to make sure the building is operating as intended. If the building is not operating as intended, performance problems can be identified and corrected, saving energy cost and potentially increasing the life of equipment.

4.2.6 HVAC Alternate 6 (Deductive) – Individual Lab Exhaust Fans

This alternate replaces the centralized lab exhaust system with individual utility fans for each hood. The fans would be constant volume. Exhaust air flow control valves ("Phoenix Valves") and the associated control system would not be included. Occupants would turn on and off hood exhaust fans based on use. If chemicals are stored in hoods the associated exhaust fans would need to run continuously, requiring continuous make-up air. Each hood would be individually ducted to the associated fan. Because the air volume does not turn down based on sash height, more energy would be used in this design than in the base design. The following equipment changes from the base design are made in this alternate:

Add to Base Design

1. (10x) 500 cfm roof top exhaust fans with EC Motor and sheet metal stack.
   Based on Greenheck SWD-VG

Remove from Base Design

1. 5,700 CFM Lab Exhaust Fan
   Based on Greenheck Vektor H

2. 10x Terminal boxes with pressure independent control valves. Associated controls.
   Based on Phoenix Accel II

Benefits Summary

1. This alternate is expected to provide a first cost savings; however, it is expected to increase the annual energy cost and decrease the reliability of the fume exhaust system.

4.3 Plumbing Systems

4.3.1 Design Criteria

Domestic Water Piping:	
Minimum Pressure:	35 PSI at most remote outlet
Maximum Pressure:	80 PSI
Static Pressure Loss:	Maximum 6 psi per 100 feet
Velocity:	Maximum 8 feet per second (Cold Water) Maximum 5 feet per second (Hot Water)
Storm Drainage:	
Rainfall Rate:	Maximum 1.1 Inch/hr
Piping Slope:	Minimum 1/8” per foot
Waster and Vent Piping:	
Sizing:	Sized per OPSC
Piping Slope:	Minimum 1/4” per foot

Table 7: Plumbing Design Criteria

4.3.2 Plumbing Fixtures

Description

Commercial grade low flow fixtures will be provided where indicated on the architectural drawings.

Plumbing Fixture Types and locations:						
Fixture	**Location**	**Type**	**Control**	**Flow**	**Basis of Design**	**Notes**
WC-1 Water Closet	Restrooms	Wall hung, vitreous china	Sensor Operated flush valve	1.28 GPF	Kohler water closets with Sloan flush valve	
WC-2 Water Closet	Restrooms (ADA wheel chair and ambulatory stalls)	Wall hung, vitreous china	Sensor Operated flush valve	1.28 GPF	Kohler water closets with Sloan flush valve	Seat at 18-inches above floor, centerline at 17-inches from wall
L-1 Lavatory	Restrooms	Counter mounted, vitreous china	Sensor Operated	0.5 GPM	Kohler sink basin with Delta faucet	All locations are ADA accessible

U-1 Urinal	Restrooms	Wall Hung, vitreous china	Sensor Operated flush valve	0.5 GPF	Kohler Urinal with Sloan flush valve	
U-2 Urinal	Restrooms (ADA)	Wall Hung, vitreous china	Senor Operated flush valve	0.5 GPF	Kohler Urinal with Sloan flush valve	Rim mounted at 17-inches above floor
SH-1 Shower	Shower Rooms			1.5 GPM		ADA faucet
S-1 Sink	Labs	Epoxy Resin, undermount sink.	Dual handle faucet, goose neck spout	1.5 GPM	Durcon dink basin with delta faucet	
S-2 Sink	Labs (ADA)	Epoxy Resin, undermount sink.	Dual handle faucet, goose neck spout	1.5 GPM	Durcon dink basin with delta faucet	ADA Handle
S-3 Sink	Lactation room	Self rimming, counter mounted, Stainless steel	Dual handle faucet, goose neck spout	1.5 GPM	Elkay sink basin with Delta faucet	ADA Handle
DF-1 Drinking fountain with bottle filler	Varies	Dual height with bottle filling station, stainless steel	Front push pad operation for drinking fountains and sensor operation at bottle filler	1.5 GPM at bottle filler	Elkay	Non-refrigerated
ES-1 Emergency Shower	Labs	Recessed, ADA Compliant	Stay open Valve, thermostatic mixing valve		Guardian	
EEW-1 Emergency Eye Wash	Labs	Deck mounted	Stay open valve, thermostatic mixing valve.		Guardian	

Table 8: Plumbing Fixture Types and Locations

4.3.3 Domestic Cold Water System

A new water main located as indicated on the Civil drawings will serve the domestic water system. The potable domestic water system shall be provided with positive means to control backflow. The backflow devices serving the incoming domestic water supply will be located within the mechanical room. Two (2) 3-inch double check type backflow preventers will be provided.. Appropriate backflow preventers will be provided at sources of possible contamination within the building, such as mechanical equipment make-up or non potable water systems.

Cold water will be distributed to the plumbing fixtures and other areas requiring water. Distribution piping will be copper. Refer to Architectural Drawings for plumbing fixture locations. Freeze-proof hose bibs to be distributed around perimeter of building at every 100 feet maximum. Refer to mechanical site plan for locations.

Current flow tests indicate that street water pressure will not be adequate to serve the building water pressure needs. A duplex domestic booster pump package with VFD drive and remote hydro-pneumatic tank will be provided. Each pump will be approximately 5 hp.

Reclaim Water Alternate:

Non-potable water will be distributed to flush plumbing fixtures. Distribution piping will be copper with code compliant labeling. Refer to Architectural Drawings for plumbing fixture locations. Provisions will be made to supply non-potable to the irrigation system.

4.3.4 Domestic Hot Water System

Domestic hot water will be provided from a gas fired water heater. The water heater will produce 140°F water. A master thermostatic mixing valve will temper the hot water to 120°F for use. A recirculating hot water loop and hot water circulation pump will be provided. The hot water will be distributed in the same manner as the cold water. Distribution piping will be copper. An expansion tank will be provided for the hot water system. The expansion tank will be located near the water heater. The water heating system will be located within the first floor mechanical room. The domestic hot water system components shall be controlled by the building management system.

Electric Heater Alternate:

Domestic hot water will be provided from an electric water heater. The water heater will produce 140°F water. The electric water heater will be provided with hot water storage tank and shall have a recovery rate of 123 gallons per hour at 100°F rise. A master thermostatic mixing valve will temper the hot water to 120°F for use. A recirculating hot water loop and hot water circulation pump will be provided. The hot water will be distributed in the same manner as the cold water. Distribution piping will be copper. An expansion tank will be provided for the hot water system.

The expansion tank will be located near the water heater. The water heating system will be located within the first floor mechanical room. The domestic hot water system components shall be controlled by the building management system.

4.3.5 Industrial Cold and Hot Water System

Industrial cold and hot water piping will be routed to laboratories as required. Copper piping will be used. Industrial water systems will be isolated from the domestic water system by means of a reduced pressure backflow preventer. A dedicated electric water heater will be provided for the industrial hot water system. The water temperature will be controlled by using a master mixing valve. A recirculating hot water loop and hot water circulation pump will be provided. As an alternative to recirculation loop, the applicability and cost effectiveness of the heat trace cables will be evaluated. Industrial water heating equipment will be located in the second floor plumbing room.

Equipment:

(2) Reduced Pressure Backflow Assembly
(1) Electric Water Heater
(1) Mixing Valve Recirculating Hot Water Pump
(1) Domestic Water Expansion Tank

4.3.6 Laboratory Services

Laboratory spaces will be provided with natural gas, vacuum, compressed air and DI water. The vacuum, compressed air and DI water will be provided by central systems. DI piping will be looped into each lab with a continuous recirculation loop and point of use polishing stations where needed (system diversification will be further coordinated with lab designers and the owner during subsequent design phases). Distribution piping will be schedule 80 CPVC for DI water. The central DI system will be located in the second floor plumbing room.

Equipment:

(1) DI/RO/Pre-Treatment Skid
(1) Distribution Skid –duplex distribution pumps.
(1) storage tank.

In addition to or as an alternate to central DI system, point of use deionized water system(s) will be evaluated. The capacity and the required quality of DI water will be determined in the next phase of project.

Compressed air will be produced by a packaged system, which includes duplex (or multiplex) air compressors, receiver tank, and air dryer. Copper piping will be used. Compressed air will be delivered at 100 PSI to all required laboratories. Pressure will be reduced by means of a pressure regulator for those spaces requiring 15 PSI compressed air. Distribution

piping will be copper. The central compressed air system will be located in the second floor plumbing room.

Equipment:

(1) Air Compressor – Oil-less rotary scroll air compressor.
(1) Refrigerated Air Dryer
(1) ASME receiver.
(1) Accessories.

Vacuum pump and receiver tank will be located in the second floor plumbing room. Vacuum will be routed through lab corridors to the designated laboratory units. Copper pipes will be used.

Equipment:

(1) Duplex Vacuum Pump - rotary vane or hook and claw type with ASME Tank.
(1) Accessories.

Vacuum, Compressed Air, DI, cold/hot ICW, emergency water supply, natural gas, and potable cold/hot water will be routed down the equipment corridors and stubbed out above each door for connection to lab distribution system (lab distribution systems will be designed by lab consultant). Isolation valves will be provided in each system at these locations. All lateral Lab waste/vent lines will be distributed within labs.

4.3.7 Sanitary Sewer System

Description:

Sanitary waste and vent piping will be provided toilet rooms and other spaces as required. Coordination with the Architect will be done to provide adequate furring or chase space to conceal all interior waste/vent risers. Waste and vent piping shall be cast iron. Floor drains/sinks will be provided.

Sanitary waste piping leaving the site will connect to the sanitary system as indicated on the Civil drawings. Sump pumps will be provided for elevator shafts, and connected to the gravity sanitary system within the building.

Campus Blackwater Alternate:

Sanitary waste piping leaving the site will connect to a campus-wide blackwater treatment system as indicated on the Civil drawings. A connection to the city sanitary system will be stubbed out of the building as a back-up to the primary sanitary system described above.

4.3.8 Storm Drain System

A roof and overflow drain system will be provided as required by code. Coordination with the Architect will be done to provide adequate furring

or chase space to conceal any interior storm water risers. Storm and overflow drain piping will be cast iron. 4-inch storm drain piping will stub out of the building in three (3) locations, one on the north, west and south sides of the building. Overflow storm drain system will daylight utilizing downspout nozzles at the first floor level above grade. The storm water will be routed to the site storm water system designed by the civil engineer.

Rainwater Reclamation Alternate:

The Rainwater reclamation system will collect 100% of the rainwater from the roof and store it in an underground storage tank (approximately 15,000 gallons). The stored water will be used for water closet flushing. The collected rainwater will be routed through a “leaf filter” that separates the initial rain water collected to ensure that sediment collected on the roof is washed off prior to storage. The water from the tank will be pumped to a “day tank” inside the building with the reclaim water related equipment. Chlorine injection into the day tank will eliminate any bacteria or odor. Reclaimed water from the day tank will then be pumped through particulate filters before being pumped to serve the water closets. Make-up water from the municipal water system will provide water into the tank when the water level reaches a “low level”, or be used to serve the flush valve system if the equipment is down for service. The plumbing code requires the rainwater system to be identified and separated from the potable water system. The plumbing code requires fixtures served from the rainwater system to be on opposite walls from those served with potable water (lavatories & drinking fountains). Design and installation of the rainwater reclamation system shall be in accordance with all applicable codes and guidelines.

4.3.9 Natural Gas System

A new natural gas service and separate low pressure gas meter will be provided for laboratory use and domestic water heating. Black steel piping will be used.

4.4 Fire Protection Systems

4.4.1 Wet Pipe Sprinkler System

Fire protection service will be connected with a double check detector assembly to the existing city water main that runs through the site. The backflow preventer will be located either in the mechanical room on the first floor or on the site in the vault. The building will be protected by a wet sprinkler system meeting FM Global requirements and in accordance with NFPA 13 and local AHJ. Dry sprinkler heads will be used where sprinklers are subject to freezing(3rd floor patio area). Supplemental fire protection systems will be provided if required in hazardous materials area.

The wet standpipe with standpipe outlets at each level will be located in stairwell. A combination standpipe complete with standpipe outlets and

fire sprinkler zone control valves will be located in stairwell. All required system isolation valves will be provided with tamper switches. Each floor will be provided with a zone isolation valve with a tamper switch, flow switch, and standpipe outlet. The exact location of standpipe outlets within the stairwells will be coordinated with Fire Marshall. The fire department test drain will terminate outside of the building. All fire protection system materials will be of a domestic manufacture.

Black steel pipe will be used; schedule 10 for pipes 4-inch and larger, and schedule 40 for pipes 3-inch and smaller.

4.4.2 Gaseous Fire Extinguishing System

If required, gaseous fire protection systems will be utilized in limited building areas (chemical storage areas). The requirements for gaseous fire protection system will be evaluated in the next phase of the project.

5.0 Electrical

5.1 Service and Distribution

5.1.1 Design Criteria

Load Densities: Lighting and Power Systems

The following load allowances will be provided for the project:

Area	Power Systems (VA/sf)
Offices	5.0
Classrooms	3.0
Lab	25
Circulation/Transition	1.0
Lobby	1.5
Service Areas	0.5
Stairs	0.5
Restrooms	1.0
Storage	0.5
Mechanical/Electrical Areas	0.5

Table 9: Lighting and Power Load Densities

5.1.2 Service

Underground utility primary power will be extended from the PP&L service point to a 12.4KV-480Y/277V pad mounted transformer to provide building service power at 480Y/277V. Primary conduit, secondary conduit and transformer pad provided by the owner, transformer andconductors provided by the utility.

5.1.3 Distribution

The main service will be approximately 1600 amps at a voltage of 480Y/277V. The 480/277V distribution will be used to serve lighting and large mechanical loads. A secondary voltage of 208Y/120V will be derived using energy efficient dry type transformer(s) providing a level of isolation from other loads and deriving a new grounded neutral point. The 208/120V distribution will used to serve receptacle and other miscellaneous loads. Distribution will be designed to incorporate a roof mounted PV array.

Flexibility: The power distribution system will be developed to provide flexibility for reconfiguring lab spaces. Lab spaces will be provided with individual branch circuit panels as required to minimize impact to adjacent spaces. Separate panels will permit a shut down on the panel for safe work on the panel when a modification is being performed in/on an adjacent space. Spare raceways and or chases will be provided for future distribution and to accommodate flexibility.

Power Quality: Quality of power supply is affected by noise sources within a facility as well as outside (utility transferred). Transient Voltage Surge Suppressors (TVSS) are provided at the service entrance and at lab branch circuit panel busses. A third level TVSS is available using the portable plug strips at equipment. Iso-shield transformers will be used for the dry type transformers. Loads types will be separated on panels, to prevent general purpose power needs to share panels with critical operation loads.

Branch Circuit Wiring: Copper conductors in conduit will be used for all feeders to panels and branch circuit homeruns. Metal Clad cable will be used for branch circuit wiring downstream of homerun locations. Dedicated neutrals will be provided for all 277V/120V circuits. Lab spaces will use surface metal raceway to route power and data cables adjacent to the tasks in the lab. The surface raceway permits ease of reconfiguration of power and data cabling within a space without disturbing building walls and finishes. Ground fault circuit interrupter receptacles will be provided in toilet rooms at sinks, roof, outdoor and wet areas and any other locations required by the NEC.

Equipment Connections: Electrical power connections will be made to all mechanical equipment, to include providing all electrically associated devices such as disconnect switches, contactors, magnetic or manual starters, lock-out switches, etc., not furnished under Division 23. VFD's furnished under Division 23 and installed under Division 26. Reference mechanical sections above for connection requirements for Good, Better, Best system options.

Electrical power connections will be made to support miscellaneous equipment. Connections include disconnect safety switches and wiring to support interlocks to remote devices.

Electromechanical Interference (EMI): Provisions in layout of the electrical power system will be made to minimize the impact of electric fields on sensitive lab spaces. Equipment producing fields (transformers and motors) are to be located remote from sensitive labs. Large ampere feeds will be routed around labs or contained within rigid steel conduits.

Smart Grid Metering Alternate: Metering provisions will be integrated into the distribution system to accommodate a future "smart grid" management system with PP&L.

5.2 On-Site Power Systems

5.2.1 Emergency Generator

Basis of Design: Emergency and Optional Standby power will be provided by a 60 KW natural gas fired generator, generator will be sized for the classroom/lab building only. Separate transfer switches are provided for emergency loads and standby loads. Natural gas connection will be separately metered by the utility. Emergency loads will be those designated as life safety meeting the criteria of NEC 700. Optional

Standby loads will include the UPS, selected cooling and designated lab loads.

Centralized Generator Alternate: Emergency and Optional Standby power will be provided by a centralized diesel generator. Generator capacity will be sized for full build out of the phase 1 development. Potential joint partnership with the serving utility PP&L will be evaluated. Provide cost for a 500KW generator.

5.2.2 Grounding System

Two grounding criteria will be addressed, safety and performance. A safe grounded power system will be provided in compliance with the 2014 NEC. This ground system consists of the building service ground (multiple ground rods, UFER ground and bonding to the water service and structure steel. The safe grounding system conductor will be extended thru out all electrical systems in facility. All metallic systems will be bonded to the building ground system. Isolated grounding systems will be provided for AV applications.

Performance grounding includes a system of insulated grounding conductors and busses to be used for the Building Distribution Frame (BDF) and Intermediate Distribution Frame (IDF)s.The performance ground system will tie into the code required safety grounding system at the main distribution panel ground bus.

5.2.3 PV System

Ground mounted PV array alternate: Provide costs for a 350KW PV array to meet required production for a net zero building.

6.0 Technology

6.1 Telecom

Oregon State University has standard specifications and requirements which detail how communications and security systems are designed throughout their campus system. These standards requirements will be the basis of design for all Division 27 systems throughout the Bend campus.

Local Exchange Carriers' (LEC) (Bend Broadband and Century Link) services will originate from a demarcation point on SW Century Drive. Underground pathways and supports will be installed from the Carriers service locations to one of the new campus buildings BDF/MDF space. This new BDF/MDF will act as the main campus connection point for all systems on the new construction campus. From the new BDF underground pathways and supports will be installed to facilitate a campus wide communications network for telephony, data and signaling systems. The requirement for redundant networks and communications spaces will be explored in future versions of this document.

The main telecommunication room (BDF/MDF) will be located on the lowest level of the new campus building. This room will be the entrance point for voice, data and any CATV signals which originate on the site will also serve as the main distribution point for voice and data cabling for the building.

The intermediate telecom rooms (IDF) are located on the upper floors and will provide a distribution point for each. In each of the telecommunication rooms will feature similar fittings and pathway systems. Each of these systems will be installed as per OSU standards.

Plywood: A 4'x8' plywood backboard will be installed in each of the Telecommunications spaces. The backboard will be kiln-dried, A/C grade (with the A side out) and shall be painted with highly reflective flame retardant paint. At least two walls of each room will be covered with the plywood.

Connecting the TMGB and subsequent TGB's will be a Telecommunications Bonding Backbone (TBB) which will ensure the reference impedance stays at the proper level.

Cable Supports: Each of the rooms shall feature 84" high 2-post racks and per OSU standard basket type cable tray.

Floor Distribution: The telecommunications pathway system is an essential part of the building. In order to allow OSU IS personnel to manage administer and troubleshoot the cabling system the system must be flexible and accessible at all times. In areas with accessible ceilings and those open to structure basket-type cable tray will be used to protect, provide access to, conceal and support cabling. In non-accessible areas premise electrical conduits with spare capacity will be used throughout and be provided with pull strings.

Each Work area outlet will be provided with three (3) Category 6 cables. Each wireless access point (WAP) location will be provided with (2) Category 6 cables. Work area outlets will be installed with a minimum 1" conduit to the accessible ceiling. All work area outlets will be fitted with Stainless Steel faceplates as required by OSU standards.

Approved Manufacturers for the Telecommunications systems are:

- Superior Essex
- Corning
- Legrand
- Ortronics

Owner provided equipment will include: Wireless Access Points, Active network components, UPS and building phones, all other fittings and equipment will be Contractor furnished and installed.

6.2 Security

Site Security provisions consist of pole mounted Video Surveillance cameras and code blue pedestal stations. The code blue stations are equipped with a blue strobe light and speaker-phone. Each system will integrate into the campus wide

monitoring system. The basis of design for the blue phone is a RAMTEL PLC series.

Video surveillance requirements vary from OSU building to building and will be further developed in future versions of this document. The constant requirement throughout all OSU campuses is the Video management system which is based on a Milestone server based system.

Electronic Access Control at Oregon State University is based off several different configurations. In classroom and non-dining or housing buildings HID ProxPoint and Hirsch ScramblePad card readers are deployed throughout.. A smoked gray polycarbonate lens in added at all MaxiProx locations. OSU's standard for electronic access control management is Hirsch-Identive.

The portions of Division 28 not covered by Division 8 are:

- Card Readers
- Door Contacts
- ADA Buttons
- Access Control systems
- Gender Inclusive Restroom Controls
- Request for Exits

6.3 Fire Alarm

The Fire Alarm system will consist of a supervised addressable supervised, Class B hard wired system.

Device	Coverage
Manual pull stations	Located at the fire alarm control panel.
Smoke Detectors	Air handlers (>2,000CFM), Elevators lobbies, Elevator machine rooms, Elevator hoistways, Fire Alarm control panels.
Fire Sprinkler	Tamper and Flow
Annunciation	Remote Annunciation at entry
Building Annunciation	Horn and Strobe annunciation thru out the facility.
System output	Relay interface for mechanical system shut down and elevator recall.
Monitoring	Central Station Monitoring

Table 10: Fire Alarm Device Coverage

6.4 Audio / Visual

OSU standards also dictate how audiovisual systems are to be integrated into the rooms they will work within. These systems vary greatly and will be further detailed in future versions of this document.

6.5 Clock System

A hard wired clock system is not programmed for the building.

L OSU Cascades Classroom: Lighting Basis of Design

April 11, 2014

Luma Lighting Design
Portland | San Francisco | Seattle
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1.0 LIGHTING DESIGN:

General: The schematic lighting design is to comply with or exceed applicable standards and codes. Applicable codes, guidelines, and standards referenced are:

- Oregon Energy Code
- International Building Code
- Oregon Structural Specialty Code
- Oregon State University Construction Standards – Cascade Campus

A complete electrical lighting system will be provided, meeting all codes and ordinances. The lighting systems will be independent and stand-alone for the building with connections to the main campus for signal systems. The facility, when constructed, will be complete with electrical lighting provisions for a future expansion to the northwest.

This is a schematic design lighting systems narrative. The design of the lighting systems is still in development, and, as such, are as complete as possible for this level of design. Spaces not directly identified in this narrative shall use similar space types for their basis of design. Light fixtures and specific controls have not been selected at this time. The quality of the lighting on this project will, at a minimum, be a medium specification grade. Higher specification grade products will be used in appropriate spaces such as lobbies, common corridors, entries, lounges and other public spaces. Fixtures in hazardous storage areas shall be rated for use in those areas.

AREA	SOURCE	LIGHT LEVEL AMBIENT (ave FC)	LIGHT LEVEL TASK / ACCENT (ave FC)	LIGHT LEVEL EMERGENCY (ave) FC*	TARGET LPD W/SF
Exterior Entries	LED	3	N/A	1	.3
Outdoor Circulation	LED	.5 to 1.5	N/A	1	.13
Outdoor Seating	LED	.25 to 1	N/A	N/A	.10
Parking	LED	.5 to 1	N/A	N/A	.10
Vestibules	Fluorescent / LED	10 to 20	N/A	1.0	.5
Student Lounge/Lobby	LED	5 to 35	N/A	1	1.0
70 - 80 Seat Classroom	Fluorescent, LED	30 - 45	N/A	1	.9
40 - 60 Seat	Fluorescent,	1 to 40	N/A	1	.9

AREA	SOURCE	LIGHT LEVEL AMBIENT (ave FC)	LIGHT LEVEL TASK / ACCENT (ave FC)	LIGHT LEVEL EMERGENCY (ave) FC*	TARGET LPD W/SF
Classrooms	LED				
Retail	Fluorescent, LED	5 to 20	50-60	1	1.2
Corridors	LED	15	NA	1	.6
Open Stairs	LED	10 to 20	N/A	1.0	.45
Enclosed Stairs	Fluorescent	10 to 15	N/A	1.0	.35
Lab Spaces	Fluorescent, LED	30	60 to 80	N/A	1.3
Lab Support Spaces	Fluorescent, LED	40	N/A	N/A	.75
Support Spaces /Storage	Fluorescent	20	N/A	N/A	.5
Elec/IT/Mech	Fluorescent	30	N/A	1	.5
Restrooms	Fluorescent, LED	20	35 (vertical at mirror)	1N/A	.75
Offices / small conf. rooms	Fluorescent, LED	30	45**	N/A	.75
Mother's Room	LED	30 to 45	N/A	1	1.0
Open Meeting	Fluorescent, LED	15 to 25	N/A	N/A	.50
Open workstations	Fluorescent, LED	25	40**	1	.80

* Emergency Lighting: Emergency lighting system and panel capacity will be designed on the basis of 0.25 volt-amperes/sq. ft. of gross space. Exits sign assumption is an LED edge-lit type.

** energy efficient task lights provided by the owner are assumed

Table 1: Lighting Design Criteria

Site Lighting: It is assumed that the site is a Zone 1 as defined in the 2010 Oregon Energy Efficiency Specialty Code with a site base allowance per code.

Luminaires (pole, ground-mount, bollards, and wall-mount) will be selected based upon their ability to provide higher amounts of vertical footcandles for facial recognition and student safety. Exterior luminaires will be shielded and full cut-off/cut-off whenever possible to minimize amounts of stray light and disability glare. Shielding will aid in keeping site lighting from exiting the property boundaries. Exterior lighting levels will comply or be below ASHRAE/IESNA Standard 90.1-2007, Exterior Lighting Section. While the

exterior lighting design strategy will strive to exceed minimum energy codes and cut-off requirements for Dark Sky compliance, lighting for student safety will be paramount. In some cases, elevated lighting levels and non-cut off luminaires may be utilized to provide a basic level of site security lighting.

Exterior building lighting will be integrated with the building exterior features to glow the entrances for safety and way-finding. Appropriate illumination will be provided for passage and perception of security/safety, and to feature exterior elements.

Site, Pathway and Parking lighting per the drawings.

Lamps and ballasts: The lighting system shall use Linear LED or T8 lamps wherever possible. All linear fluorescent lamps are to be super T8 lamps (4 ft long, 32 watts, 3100 lumens, 85+ CRI) compliant with Energy Trust specifications for high performance systems. T5HO will also be considered in applicable spaces. All ballasts shall be high efficiency program start electronic ballasts or high efficiency dimming ballasts, where indicated. Linear LED lamps will be over 70 delivered lumens per watt in efficacy, 80+ CRI and CCT to match the rest of the lamps on the project

Non-linear T8 lamp sources shall comply with university lamp requirements.

Elevator lighting to be provided by elevator manufacturer.

Recessed Downlights will be LED with over 70 delivered lumens per watt in efficacy, 80+ CRI and CCT to match the rest of the lamps on the project

Controls: All controls are to comply with the Oregon Energy Code, except where indicated in system description below, if more stringent than required by code.

Interior lighting: In general, the interior public space lighting will focus illumination on the vertical surfaces. Indirect wall wash approaches, wall grazing and accent lighting will be used to vary the luminance of the walls to guide people through the building. Lighting will be accessible from an 6-foot ladder whenever possible. Exceptions to this will be approved by OSU prior to final design sign-off.

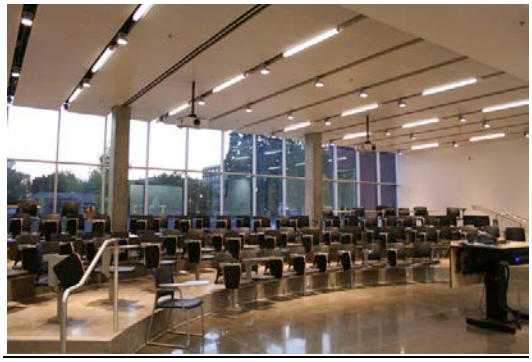
AREA	LIGHTING TYPE
Exterior Entries	Per Drawings
Outdoor Circulation	Per Drawings
Outdoor Seating	LED bollards, in-grade and mast lighting will be used in conjunction with canopy integrated LED lighting to subtly accent seating areas.
Parking (alternate)	Per Drawings
Vestibules	LED recessed luminaires or recessed linear fluorescent will be considered. Typical cost average is $7/sf installed.
Student	Recessed LED luminaires in conjunction with linear T8 wall wash

AREA	LIGHTING TYPE
Lounge/Lobby	luminaires and decorative LED pendants will be used to provide appropriate ambient light and more subdued lighting when needed. Typical cost average is $10/sf installed
70 - 80 Seat Classroom	Linear LED or fluorescent T8 high lumen output luminaires with direct/indirect distribution and Osram power-sense dimming ballasts suspended from structure. Dimmable LED accent lights will be integrated for more direct and task based illumination. Linear fluorescent T8 wall wash luminaires with Osram power-sense dimming ballasts at site walls and whiteboard. Aimable and dimmable LED adjustable recessed lighting for podium illumination. Typical cost average is $15/sf installed.
40 - 60 Seat Classrooms	Linear LED or fluorescent T8 high lumen output luminaires with direct/indirect distribution and 0-10 dimming ballasts suspended from structure. Dimmable LED accent lights will be integrated for more direct and task based illumination. Linear fluorescent T8 wall wash luminaires with Osram power-sense dimming ballasts at side walls and whiteboard. Typical installed cost should be based on the typical space layout in the drawings. Typical cost average is $12/sf installed.
Retail	Linear fluorescent recessed luminaires for ambient lighting with decorative LED accent lighting and LED or fluorescent sign-board lighting. Typical cost average is $8/sf installed cost.
Corridors	Linear fluorescent recessed or suspended luminaires with daylight dimming or switching where appropriate, recessed LED downlights and accent lighting where required. Typical installed cost average is $6.50/sf
Open Stairs	Multiple approaches will be evaluated to allow a harmonious integration with the stair structure. Linear fluorescent vertical step lights integrated into the pickets, LED integrated handrail lighting (by intense lighting, not IO lighting) will be evaluated. Alternate approaches with LED or linear fluorescent sources integrated into the adjacent walls and landings will also be considered. Typical cost average is $100/lf installed along the stair run length.
Enclosed Stairs	Occupancy sensor integrated surface mount linear T8 luminaires with hi/low switching ballasts will be used at each landing (8 foot of fixture per primary landing and 4 foot per intermediate landing). Assume $400 per 4 foot fixture installed cost.
Lab Spaces	Linear LED fluorescent T8 direct/indirect luminaires. LED task lights under lab bench shelving. Typical cost average is $8/sf installed.
Lab Support Spaces	Fluorescent or LED lensed troffers or strip lights with guards (depending on ceiling configuration). Typical cost average is $5/sf installed.
Support Spaces /Storage	Fluorescent lensed troffers or strip lights with guards (depending on ceiling configuration). Typical cost average is $5/sf installed.
Elec/IT/Mech	Fluorescent lensed troffers or strip lights (depending on ceiling

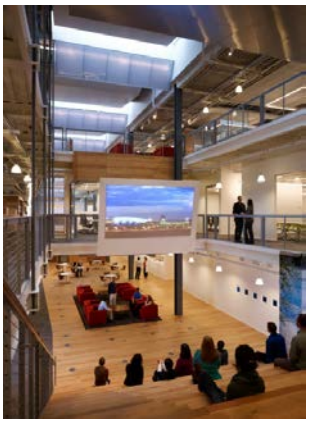
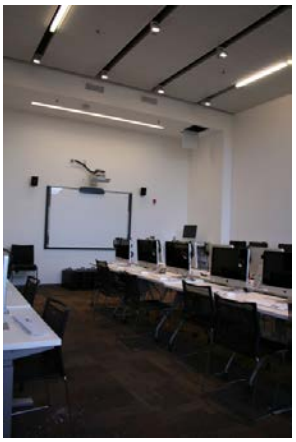
AREA	LIGHTING TYPE
	configuration). Typical cost average is $5/sf installed.
Restrooms	Linear fluorescent or LED lighting along wet wall with LED recessed downlights in walking area and linear fluorescent sconces at mirror. Typical cost average is $6/sf installed.
Offices / small conf. rooms	Linear LED fluorescent dimmable T8 direct/indirect luminaires. LED accent downlights if required, one LED task light per office (owner provided). Typical cost average is $10/sf installed.
Mother's Room	Simple dimmable LED downlight and a decorative pendant. Assume $600 per room
Open Meeting	Recessed or suspended linear LED or T8 luminaires and recessed LED luminaires will be considered. Typical cost average is $8/sf installed.
Open workstations	Linear LED or fluorescent T8 direct/indirect luminaires. Typical cost average is $8/sf installed.
2) See controls narrative below for control descriptions	

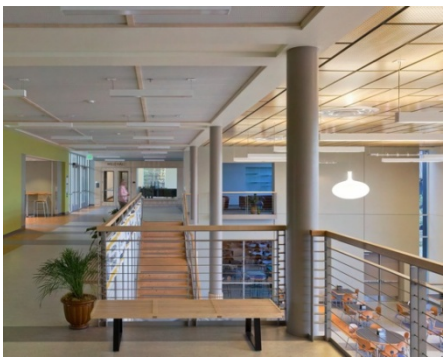
Table 2: Lighting System by Area

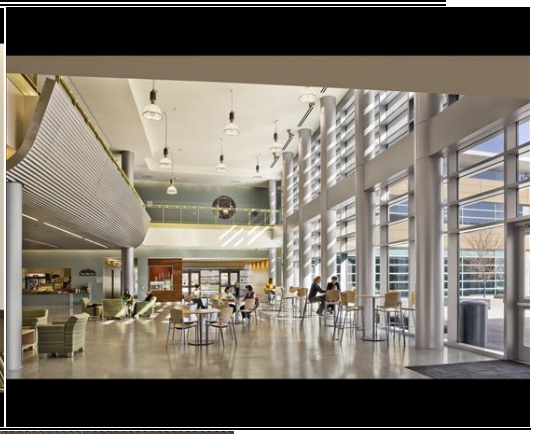
Prescedent Images

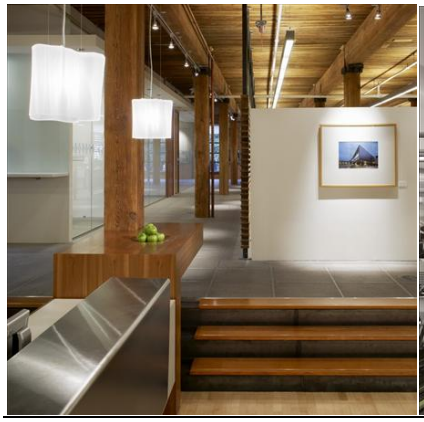
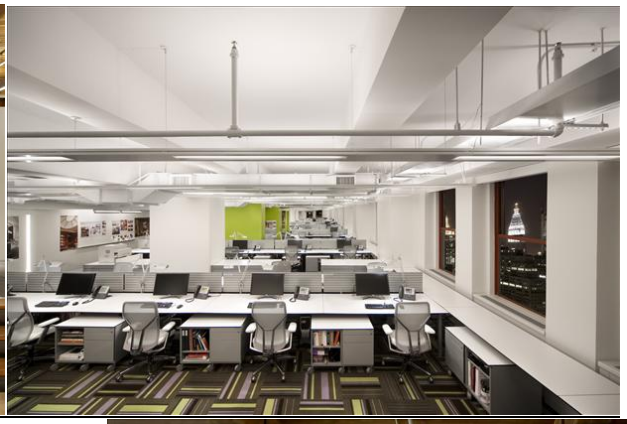


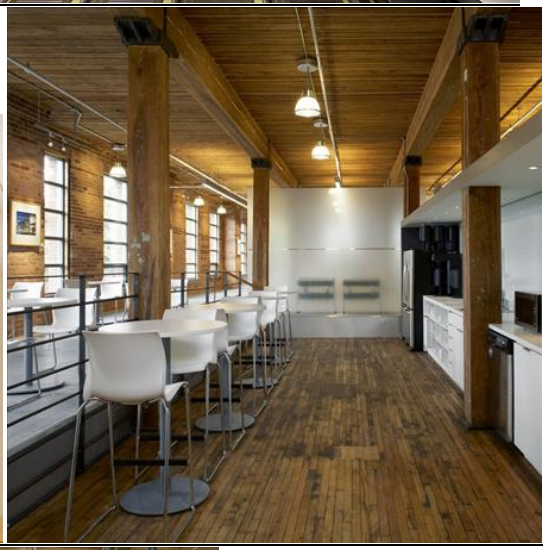


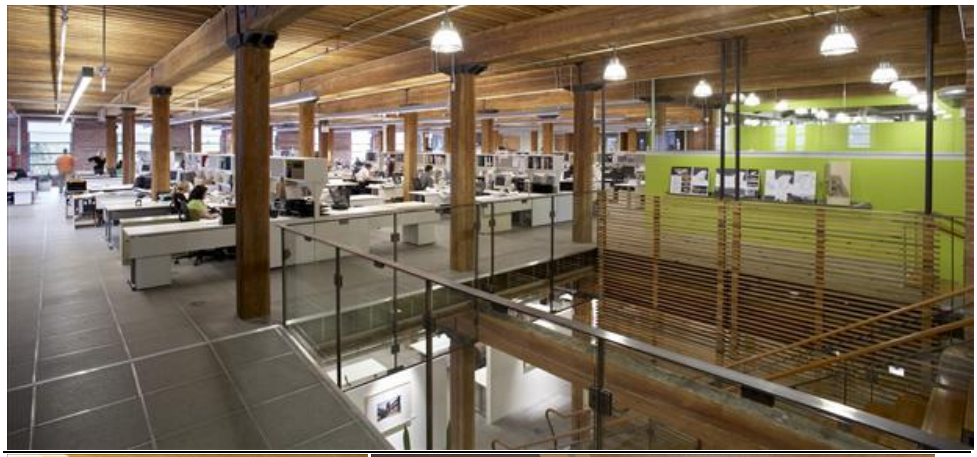




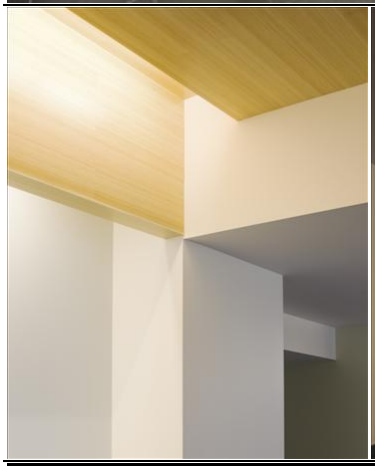










Exterior ballasted luminaries shall be provided with the lowest operating temperature ballast available for the application. In no case shall this rating be higher than zero degrees Fahrenheit

Fluorescent dimming ballasts shall be 0-10v ballasts.

Fluorescent ballasts for T5 and T5HO lamps shall be programmed start. Ballasts for T8 lamps and compact fluorescent shall be program start with low ballast factor ballasts. In spaces not controlled by occupancy sensors and occupied more than eight hours a day, parallel wired instant start ballasts may be used.

All switching ballasts shall be as manufactured by Universal, Advance, GE, Lutron, Osram/Sylvania, Vossloh Schwabe (for metal halide only), Or Hatch (for metal halide only).

All lamps used on this project shall be high quality specification grade models with a Correlated Color Temperature of 4100K in public spaces, offices, exam rooms, etc. and a minimum Color Rendering Index of 80. Where possible, lamp types have been standardized to ensure that a minimal number of individual lamp types, including variants on each type, shall be required for this project.

Lamps shall be as manufactured by Philips, Osram Sylvania, and General Electric. Specific type designations shall be noted within the Lighting Fixture Schedule.

Compact fluorescent lamps shall be of the 4-pin PLT triple tube type using amalgam technology only, unless otherwise noted in the Lighting Fixture Schedule.

Linear fluorescent lamps shall be of the nominal 4', tri-phosphor T8 or T5 types unless otherwise noted in the Lighting Fixture Schedule. Linear T8 lamps shall have an initial lumen value of 3100 lumens and a lamp life of 36,000 hours at 3 hours per start. T5HO lamps shall be 51W energy saving lamps.

All HID lamps shall be of the ceramic metal halide type by Philips, Osram Sylvania, and General Electric or Ushio.

LED lamps shall conform to IES LM-80-08 and LM-79-08 test procedures for lumen output and lamp life. All LED fixtures shall carry a minimum 5 year, full replacement warranty.

Standard OSU stocked lamping will be implemented into this project for ease of facility maintenance and stocking , such as:

F32T8 linear fluorescent, 3100 lumen output lamps

Provide a 10% additional stocking supply of all lamps and ballast types, lenses, louvers and diffusers to owner.

Automatic lighting control will be provided to switch common areas and corridor lighting off during non-essential hours. The University will have input as to the level of control students will be given in the common and corridor areas. Smaller service areas such as janitorial rooms, ADA restrooms, and closets will

utilize a standalone occupancy sensor to automatically shut off overhead luminaires during unoccupied hours.

The same automatic lighting control system that controls interior lighting will control outdoor and exterior lighting to provide shut-off of during daylight hours. Public space lighting control and exterior lighting control system BOD: Wattstopper DLM, Sensorswitch nlight or approved

All occupancy sensors shall be by Wattstopper.

Table L3: Lighting Control Methods by Area

AREA	CONTROL METHOD
Exterior Entries	LCP, TC : Dusk to Dawn operation
Outdoor Circulation	Campus lighting control : Dusk to dawn operation
Outdoor Seating	LCP, TC: Dusk to close (10pm)
Parking (alternate)	LCP, TC: Dusk to close (10pm)
Vestibules	LCP, PC, OS, TC: time clock turns lights on in morning (6am), photocell turns all lights off if daylight is available (20 fc), time clock turns normal power lights off after 10pm, occupancy sensor turns emergency lighting off after hours when unoccupied
Student Lounge/Lobby	DRC, OS, PC, PWS: manual on, auto off operation. Wall station turns lights on to preset level and allows raise/lower function. 3 zone dimming control. Photocell dims designated daylight zones, occupancy (vacancy) turns lights off when unoccupied. UL 924 emergency lighting control integration.
70 - 80 Seat Classroom	DLCP, OC, LCD, AMX, I/O-SH, I/O-SC: Manual 4 button preset station turns lights on to a pre-set scene. LCD screen allows full range control for all fixtures. AMX, Shade and Screen interface allow simple preset scenes to interface with A/V system, Occupancy Sensor acts as vacancy sensor and turns lights off when space is unoccupied, Photocell operation is possible and will depend on glazing percentage. UL 1008 emergency lighting integration.
40 - 60 Seat Classrooms	DRC, OS, PC, PWS: manual on, auto off operation. Wall station turns lights on to preset level and allows raise/lower function. 3 zone dimming control. Photocell dims designated daylight zones, occupancy (vacancy) turns lights off when unoccupied. UL 924 emergency lighting control

AREA	CONTROL METHOD
	integration.
Retail	LCP, TC, WS: manual on, manual off, time clock off
Corridors	LCP, OS, TC, WS (keyed), PC: time clock turns normal and emergency lighting on at 6am, photocell turns off areas with available daylight (20 fc), time clock turns normal power lights off after 10pm and engages occupancy sensors, OS turn emergency lighting off after hours when space is unoccupied. When one OS senses movement, the entire corridor for that level turns on including the open stairs.
Open Stairs	LCP, TC, PC: time clock turns lights on at 6am, photocell turns lights off if daylight is available (20fc), time clock turns lights off after 10pm.
Enclosed Stairs	OS (integral to fixture): occupancy sensors keep lights at 50% output when space is unoccupied and turn lights on to 100% when occupied.
Lab Spaces	DRC, OS, PC, PWS: manual on, auto off operation. Wall station turns lights on to preset level and allows raise/lower function. 3 zone dimming control. Photocell dims designated daylight zones, occupancy (vacancy) turns lights off when unoccupied. UL 924 emergency lighting control integration.
Lab Support Spaces	WS, OS: manual on, auto off, bi-level switching. Perimeter SSC offices will be controlled similar to project rooms.
Support Spaces /Storage	WS, OS: manual on, auto off
Elec/IT/Mech	WS: manual on, manual off, no automatic controls allowed by code.
Restrooms	WS: manual on, manual off, no automatic controls allowed by code. Keyed override switch.
Offices / small conf. rooms	OS: auto on, auto off
Mother's Room	MD, OS: manual on, auto off
Open Meeting	D WS, OS: manual on, auto off RC, OS, PC, PWS: manual on, auto off operation. Wall station turns lights on to preset level and allows raise/lower function. 3 zone dimming control. Photocell dims designated daylight zones, occupancy (vacancy) turns

AREA	CONTROL METHOD
	lights off when unoccupied. UL 924 emergency lighting control integration.
Open workstations	DRC, OS, PC, PWS: manual on, auto off operation. Wall station turns lights on to preset level and allows raise/lower function. 3 zone dimming control. Photocell dims designated daylight zones, occupancy (vacancy) turns lights off when unoccupied.
TC = Time Clock LCP = Lighting control panel PC = Photocell OC = Occupancy Sensor DLCP = Dimming Lighting Control Panel LCD = LCD touch screen controller I/O-AMX = A/V RS-232 interface I/O-SH = Shades interface I/O-SC = Screen Interface DRC = Digital Room Controller PWS = Preset wall Station MD = Manual Dimmer (0-10v) MS = Manual switch (low or line voltage)	
The lighting control systems outlined in this table are equivalent with a lighting control system that should price out at approximately $2.50/sf to $2.75 installed cost. No allowance is being carried for interconnecting the lighting control system with the Building Management System (BMS) or DDC system. Add $.25/sf for interconnectivity if required by the owner.	

SPARLING

WORK TOGETHER | STAND APART

Oregon State University
Cascades Campus – Phase 1
Schematic Design - Acoustic Narrative

INTRODUCTION

This schematic design narrative addresses architectural acoustics and mechanical systems noise and vibration control consideration for Oregon State University Cascade Campus Phase 1 Building in Bend, Oregon. Architectural acoustics involves both the creation of appropriate acoustic environments (interior acoustics) and the control of sound between spaces (acoustical separation). Whereas mechanical system noise and vibration control is focused on the reducing noise and vibration associated with the mechanical and electrical equipment serving the building.

ARCHITECTURAL ACOUSTICS

Architectural acoustics involves both the creation of appropriate acoustic environments (interior acoustics) and the control of sound between spaces (acoustical separation).

Interior Acoustics

Student Lounge/Lobby

Located on level 1, the Student Lounge/Lobby is connected to levels 2 and 3 via open stairs. Without sound absorptive material in this space, voices from groups and raised conversations by individuals will seem louder and are expected to propagate down level 1 corridor and to level 2 through the open stairs. In this case and due to the liveliness of the space, conversations that are distant would appear to be closer than they actually are.

Sound absorptive material is recommended to reduce the overall loudness in the lounge/lobby area and to reduce the propagation of the voices to the level 1 corridor and level two through the open stairs. The most effective location of this material is at the ceiling or to the underside of the structure if ceilings are not planned for this area. The sound absorptive material should have a noise reduction coefficient of NRC-0.7 or better and should cover approximately 80% of the ceiling area.

Classrooms

The interior acoustics goal for the classrooms is the achievement of good speech intelligibility. To achieve this goal, classrooms should have appropriate background noise level and sound absorptive ceiling and acoustical panels of the two perpendicular walls.

- The ceiling sound absorptive material should have a noise reduction coefficient rating of NRC-0.7 or better. Mineral board acoustical tile ceiling meets this criterion so does a host of other material.
- Wall panels should be rated at NRC-0.80 or better; usually covering 75% of an area between 36” and 84” on two perpendicular walls.

Offices and Study Rooms

Overhead sound absorptive material is sufficient for these rooms. The sound absorptive material should have a noise reduction coefficient of NRC-0.65 or better.

Labs

Overhead sound absorptive material is sufficient for these rooms. The sound absorptive material should have a noise reduction coefficient of NRC-0.65 or better.

Acoustical Separation

The design of architectural separation between spaces is a function of the partitions' ability to reduce sound traveling through it and the available background noise in the receiving space. We perceive intruding sounds relative to the noise environment (or background noise) in which we listen. If we are listening in a room with quiet background noise, intruding voices will standout more than if we were to listen to the same intruding voices in the same room with noisier background noise. Background noise, if designed properly, is beneficial in masking out intruding voices. In the absence of background noise or if background noise is too low, the partition construction (or ability to reduce noise) would have to increase to make up the difference depending on the system used.

Background noise is typically generated by the HVAC system serving the building. Overhead HVAC systems traditionally generate sufficient background noise since they provide the most volume of air for cooling and heating. Systems that use less air volume can be significantly quieter. Since the base design for the project is to use a traditional overhead HVAC system with an alternate to replace the system with hydronic system that is quieter (or provide less background noise), two wall types are provided below since.

Table 1 provides recommended wall types for the base HVAC system design and for the Alternate HVAC system design.

Table 1: Recommended Wall Types

Source Room	Receiving Room	Wall Type w/ Base HVAC System Design*	Wall Type w/ Alternate HVAC System Design*
Lab Office Office Study Room Lab	Hallway Hallway Office Hallway Instrument/Storage	Type 1	Type 3
Classroom Study Room	Hallway Study Room	Type 4	Type 5
Classroom Classroom Classroom	Classroom Offices Electrical Room	Type 5	Type 5
Office	Restroom	Type 6	Type 6
*see end of document for wall types			

MECHANICAL SYSTEM NOISE AND VIBRATION CONTROL

Criteria

The acoustical design goal for the HVAC system is the achievement of a level of background noise that is unobtrusive in quality (frequency content) and low enough in level (amplitude) that it does not interfere with the function of the space being used. To be unobtrusive, the background noise should exhibit the following characteristics:

- A balanced distribution of sound energy over a broad frequency range to create a sound that is bland in character.
- No audible tonal characteristics such as a whine, hum, or rumble.
- No noticeable time-varying levels from system induced aerodynamic instability or air turbulence.

We use the Noise Criteria (NC) curves in our design work to ensure that the mechanical system meets the noise levels suggested in the design goals. The suggested system noise criteria for this project are shown in Table 2 below.

Table 2: Recommended Background Noise Criteria

Area	Criteria
Classrooms	NC 30 to 35
Study Rooms	NC 38 to 42
Labs	NC 38 to 42
Lounge/Lobby/Corridors	NC 38 to 42
Open Offices	NC 38 to 42
Offices	NC 35 to 40

Mechanical Equipment

The following are early consideration for the HVAC system noise and vibration control. They are based on our experience with similar buildings and should be used for budgeting and space allocation purposes. These recommendations will be refined as the mechanical system design develops.

Air Handling Units

- The interior liner of the air handling units walls should be perforated expect for the coil section.
- A 5 foot long silencer should be budgeted for the supply side of the unit /ductwork
- A 3 feet long silencer should be budgeted for the return side of the unit/ductwork
- Budget for 15' of 1" thick ductliner upstream and downstream each air handling unit

Exhaust System

- A 5 foot long silencer should be planned for the ductwork upstream of the fan
- A silencer might also be needed on the discharge of the fan to control noise to the campus

VAV Boxes

Passive boxes are scheduled to be used for this project. The following are our early recommendations

- Nailor boxes are quieter than Titus boxes and should be considered for this project.
- Avoid placing VAV boxes over Classrooms.
- The first 3 feet of rectangular ductwork downstream of VAV boxes should be lined with 1" thick duct liner. The first duct branch should be downstream the lined three feet of ductwork.

Supply and Return Air Grilles Selection

The acoustical rating of the selected diffusers and grilles should be 5 points less than the NC rating of the room that they serve. The exception is the auditorium, where the rating of diffusers and grilles should be equal to the NC rating.

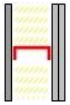
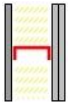
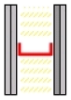
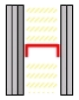
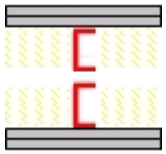
Vibration Isolation

The following vibration isolation schemes should be considered:

- All fans should be isolated on springs isolators
- All duct connections to fans and air handling units should be via flex duct
- Pumps should be isolated on concrete inertia bas and springs isolators
- Vacuum pumps and compressors should be isolated on concrete inertia basis and spring isolators
- Allow for at least 50 feet of isolated ductwork and pipework from vibration isolated equipment. We will revisit this requirement as we see the ductwork and pipework routing plans

Please feel free to contact us with any comments or questions.

Wall Types

	Rating	25 gauge Stud Construction	20 or 16 gauge Construction	Notes
Type 1	STC-35	 • 1 layer 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 1 layer 5/8" GWB		• This wall stops 6″ above the ceiling. • Mineral board acoustical tile ceiling should be used on both sides of the wall. • The tile should be rated at min NRC-0.70 and min CAC-35.
Type 2	STC-40	 • 1 layer 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 1 layer 5/8" GWB		**Option 1:** This wall stops 6″ above the ceiling. Mineral board acoustical tile should be used on both sides of the wall. The tile should be rated at min NRC-0.70 and min CAC-**40**. **Option 2:** Extend 1 layer of GWB to underside of structure and use Mineral board acoustical tile ceiling on both sides of the wall. The tile should be rated at min NRC-0.70 and min CAC-**35**
Type 3	STC-45	 • 1 layer 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 1 layer 5/8" GWB	 • 2 layers 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 1 layer 5/8" GWB	• One layer of gwb should extend to underside of structure. • The other layer can stop at 6″ above the ceiling. • R-11 batts to extend as high as the shortest of the two layers
Type 4	STC-50	 • 2 layers 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 1 layer 5/8" GWB	 • 2 layers 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 2 layer 5/8" GWB	• One layer of gwb should extend to underside of structure. • The other layer can stop at 6″ above the ceiling. • R-11 batts to extend as high as the shortest of the two layers
Type 5	STC-55	 • 2 layers 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 2 layer 5/8" GWB	 • 2 layers 5/8" GWB • 3 5/8" metal stud • R-11 insulation • 3 layer 5/8" GWB	• Two inner layers of gwb should extend to underside of structure. • R-11 batts to extend full height
Type 6	STC-63 	• 2 layers 5/8" GWB • 3 5/8" metal studs • R-11 insulation in cavity • minimum 1" air space • R-11 insulation in cavity • 3 5/8" metal studs • 2 layers 5/8" GWB.		• All four layers layers of gwb should extend to underside of structure. • R-11 batts to extend full height • STC rating degrades significantly when blocking is added in a wall bridging the two sides of the double-studs. Such blocking is added to support plumbing or other objects and should not be allowed to bridge the two sides of the wall.

The Shalleck Collaborative Inc.
Planning and Design of Theatres and Production Systems

TRANSMITTAL / MEMO

Project:	OSU Cascades		
Date:	April 11, 2014	*Via:*	e-mail
		Fax:	
To:	Thomas Bauer AIA, LEED AP Associate Principal Boora Architects	*Tel:*	503 226 1575
From:	Ian Hunter, CTS-D		
Re:	AV Systems Budget – 100% SD	*# of pgs. including cover:*	

Tom,

Below are listed the budget recommendations for auditorium systems within the OSU Cascades Classroom Building 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 presentation systems infrastructure and installation (in the case of electrical) that normally falls under Structural and Electrical. Those major needs are described below.

The recommendations below are listed in 2014 dollars and do not include General Contractors mark-up and general conditions, escalation or overall contingencies.

1. 80-Person Lecture

AV Systems – Section 274116 **$125,000**

Audio: (1) wireless mic, automixer, ceiling and front wall speakers, and assistive listening.
Video: Three-projectors on three screens, HDMI & VGA inputs, portable device wireless interface, matrix switcher.
Control: (1) 7.5" touchpanel, processor and programming.
Also includes wire, pull and complete system integration and installation.
Related Exclusions: Electrical work including all line voltage connections (complete), and providing and installing all low-voltage conduit and backboxes required by the AV system.

2. 72-Person Lecture

AV Systems – Section 274116 **$140,000**

Audio: (1) wireless mic, automixer, ceiling speakers, and assistive listening.
Video: (1) projectors with motorized screen, (8) flat panel displays, (8) wireless "huddle" systems, HDMI & VGA inputs, portable device wireless interface, matrix switcher.
Control: (1) 7.5" touchpanel, processor and programming.
Also includes wire, pull and complete system integration and installation.
Related Exclusions: Electrical work including all line voltage connections (complete), and providing and installing all low-voltage conduit and backboxes required by the AV system.

3. 40/60-Person Lecture

AV Systems – Section 274116 **$45,000/ea x 4**

Audio: (1) wireless mic, automixer, ceiling speakers, and assistive listening.
Video: (2) projectors with motorized screens, HDMI & VGA inputs, portable device wireless interface, matrix switcher.
Control: (1) 7.5" touchpanel, processor and programming.
Also includes wire, pull and complete system integration and installation.
Related Exclusions: Electrical work including all line voltage connections (complete), and providing and installing all low-voltage conduit and backboxes required by the AV system.

4. Lab/24-Person Lecture

AV Systems – Section 274116 **$20,000/ea x 4**

Audio: Ceiling speakers.
Video: (1) projectors with motorized screen, HDMI & VGA inputs, portable device wireless interface.
Control: (1) 7.5" touchpanel, processor and programming.
Also includes wire, pull and complete system integration and installation.
Related Exclusions: Electrical work including all line voltage connections (complete), and providing and installing all low-voltage conduit and backboxes required by the AV system.

5. Loose Equipment (FF&E)

Allowance **$10,000**

Includes mics, stands, portable equipment, cables, etc.

6. Miscellaneous Aspects To Be Included By Cost Estimator In Other Sections

Electrical & Mechanical: *(See engineering drawings)*

Miscellaneous:

- Blackout shades on all exterior windows in rooms with video projection.
- Casework for AV equipment racks with thermal management scheme.
- Data connections to all AV equipment racks.

END OF REPORT

Appendix

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Flex Lab	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Flex Teaching Lab

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Geology Storage

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
24-26			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ◯ Open ◯ Swing Doors
- ◯ Sliding Doors ◯ Adjustable

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Fume Hood	CF	C	1	6'				C	Provide base cabinets

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Flex Lab

Space Type:

(●) Teaching Lab ( ) Laboratory ( ) Lab Support (Shared) ( ) Biosafety Level: _____ ( ) Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

(●) Summer Temp: 72°F +/- 2°F or other: _____
(●) Summer RH: 50% +/- 10% or other: _____
(●) Winter Temp: 72°F +/- 2°F or other: _____
(●) Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

( ) Not Critical ( ) Monitored
( ) Double Positive ( ) Positive
( ) Double Negative (●) Negative
(●) 8~10 AC per Hour or 6 Unoccup'd per hour

Air Quality / Exhaust Requirements:

( ) Filtered Supply ( ) Filtered Exhaust
( ) Special Filter Types: _____
( ) Biosafety Cabinets (●) Fume Hoods
( ) Ventilated Work Stations ( ) Point Exhausts

Plumbing Issues

Services:

(●) Potable Water . . . . . (●) Hot (●) Cold
(●) Non-Potable Water. . . . . (●) Hot (●) Cold
( ) High Purity Water . . . . . ( ) DI ( ) RO
( ) Water for Injection (WFI) : ( ) Hot ( ) Cold

( ) Compressed Air (Bldg.)
( ) Compressed Air (Clean)
( ) Plant Steam
( ) Clean Steam

( ) Nitrogen (●) Natural Gas ( )
( ) Helium ( ) Hydrogen ( )
( ) Argon ( ) Acetylene ( ) Other _____
( ) Carbon Dioxide ( ) ( ) Other _____
(●) Vacuum

Fixtures / Features:

(●) Lab Sink(s) . . . . . ( ) S/S (●) Epoxy
( ) Hand Washing Sink . . . . . ( ) Foot-Operated

( ) Dishwashing Sink
( ) Cupsink(s)

(●) Floor Drain(s) (●) Eye Wash(s)..... (●) Tempered (●) ADA
(●) Lab Waste Piping (●) Safety Shower(s)... (●) Tempered (●) ADA

Electrical Issues

Power Requirements:

(●) 120V
( ) 208V ~ 1 Phase
( ) 240V ~ 3 Phase
( ) 480V ~ 1 Phase
( ) 480V ~ 3 Phase

Power Supply Features:

( ) Filtering . . . . . ( ) Panel ( ) Local
( ) Explosion Proof Fixtures
(●) GFCI Outlets . . . . . ( ) Panel ( ) Local
( ) Dedicated Circuits for : _____
( ) Other : _____

Monitors/Alarm:

( ) Emergency Power Required for : _____
( ) UPS System . . . . . ( ) Building ( ) Local
( ) UPS Required for : _____

Lighting Requirements:

(●) Primary Fluorescent
( ) Task Lighting
( ) Multi-Level Control
( ) Sensor Activated
( ) Other : _____

Communication Issues

( ) Telephone Connections (●) Data Connections ( ) Network Type(s) _____ ( ) Intercom System ( ) Public Address System (●) Clocks

Safety Issues

Security / Access Control:

(●) Key Lock ( ) Alarmed Door ( ) Closed Circuit Television
( ) Card Access ( ) Motion Sensors ( ) Other _____

( ) Humidity / Temperature
( ) Power Interruption / Failure

( ) Equipment Failure ( ) Cylinder Pressure
( ) Waste Flow ( ) Other _____

Fire Protection Issues

Potential Fire Hazards:

(●) Flammable Materials : _____
( ) Explosive Materials : _____

Sprinkler System Types:

(●) Wet Pipe System ( ) Pre-Action System
( ) Dry Pipe System ( ) Halon Equivalent System

Detection Methods:

(●) Smoke Detectors (●) Air Flow Monitoring
( ) Heat Detectors ( ) Other _____

Structural Issues

( ) Vibration Sensitivity ( ) Special Floor Loading Requirements _____ PSF ( ) Recessed Floor Area Req. ( ) Ceiling Mounted Equipment

Acoustical Issues

( ) Noise Generator
( ) Noise Sensitivity

Environmental Issues

( ) Visual Privacy Required (●) Natural Light is desirable ( ) Odor Producing Operations
( ) Views Desirable ( ) Avoid Natural Light ( ) Waste Production: ( ) Low ( ) High

General Comments / Remarks: _____

OSU Cascades Campus Phase I | 04/08/14 | OR1404

Project Name | **Date last revised** | **TEG Project No.**

	Biology Lab	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Biology Teaching Laboratory

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Stockroom, Chem. Storage, Instrument room & Biology Prep

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
24-26			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ◯ Open ● Swing Doors w/Glass
- ◯ Sliding Doors ◯ Adjustable

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Bio-Safety Cabinet	CF	B/B	1	6'		2'-10"	8'	F	Class II A2

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Biology Lab

Space Type:

(●) Teaching Lab ( ) Laboratory ( ) Lab Support (Shared) ( ) Biosafety Level: _____ ( ) Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

(●) Summer Temp: 72°F +/- 2°F or other: _____
(●) Summer RH: 50% +/- 10% or other: _____
(●) Winter Temp: 72°F +/- 2°F or other: _____
(●) Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

( ) Not Critical ( ) Monitored
( ) Double Positive ( ) Positive
( ) Double Negative (●) Negative
(●) 8~10 AC per Hour or 6 Unoccup'd per hour

Air Quality / Exhaust Requirements:

( ) Filtered Supply ( ) Filtered Exhaust
( ) Special Filter Types: _____
(●) Biosafety Cabinets ( ) Fume Hoods
( ) Ventilated Work Stations ( ) Point Exhausts

Plumbing Issues

Services:

(●) Potable Water . . . . . (●) Hot (●) Cold
(●) Non-Potable Water. . . . . (●) Hot (●) Cold
( ) High Purity Water . . . . . ( ) DI ( ) RO
( ) Water for Injection (WFI) : ( ) Hot ( ) Cold

( ) Compressed Air (Bldg.)
( ) Compressed Air (Clean)
( ) Plant Steam
( ) Clean Steam

( ) Nitrogen (●) Natural Gas ( )
( ) Helium ( ) Hydrogen ( )
( ) Argon ( ) Acetylene ( ) Other _____
( ) Carbon Dioxide ( ) ( ) Other _____
(●) Vacuum

Fixtures / Features:

(●) Lab Sink(s) . . . . . ( ) S/S (●) Epoxy
( ) Hand Washing Sink . . . . . ( ) Foot-Operated

( ) Dishwashing Sink
(●) Cupsink(s)

(●) Floor Drain(s) (●) Eye Wash(s)..... (●) Tempered (●) ADA
(●) Lab Waste Piping (●) Safety Shower(s)... (●) Tempered (●) ADA

Electrical Issues

Power Requirements:

(●) 120V
( ) 208V ~ 1 Phase
( ) 240V ~ 3 Phase
( ) 480V ~ 1 Phase
( ) 480V ~ 3 Phase

Power Supply Features:

( ) Filtering . . . . . ( ) Panel ( ) Local
( ) Explosion Proof Fixtures
(●) GFCI Outlets . . . . . ( ) Panel ( ) Local
( ) Dedicated Circuits for : _____
( ) Other : _____

Monitors/Alarm:

( ) Emergency Power Required for : _____
( ) UPS System . . . . . ( ) Building ( ) Local
( ) UPS Required for : _____

Lighting Requirements:

(●) Primary Fluorescent
( ) Task Lighting
( ) Multi-Level Control
( ) Sensor Activated
( ) Other : _____

Communication Issues

( ) Telephone Connections (●) Data Connections ( ) Network Type(s) _____ ( ) Intercom System ( ) Public Address System (●) Clocks

Safety Issues

Security / Access Control:

(●) Key Lock ( ) Alarmed Door ( ) Closed Circuit Television
( ) Card Access ( ) Motion Sensors ( ) Other _____

( ) Humidity / Temperature ( ) Equipment Failure ( ) Cylinder Pressure
( ) Power Interruption / Failure ( ) Waste Flow ( ) Other _____

Fire Protection Issues

Potential Fire Hazards:

(●) Flammable Materials : _____
( ) Explosive Materials : _____

Sprinkler System Types:

(●) Wet Pipe System ( ) Pre-Action System
( ) Dry Pipe System ( ) Halon Equivalent System

Detection Methods:

(●) Smoke Detectors (●) Air Flow Monitoring
( ) Heat Detectors ( ) Other _____

Structural Issues

( ) Vibration Sensitivity ( ) Special Floor Loading Requirements _____ PSF ( ) Recessed Floor Area Req. ( ) Ceiling Mounted Equipment

Acoustical Issues

( ) Noise Generator
( ) Noise Sensitivity

Environmental Issues

( ) Visual Privacy Required (●) Natural Light is desirable ( ) Odor Producing Operations
( ) Views Desirable ( ) Avoid Natural Light ( ) Waste Production: ( ) Low ( ) High

General Comments / Remarks:

_____

_____

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Chemistry Lab	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Chemistry Teaching Laboratory

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Stockroom, Chem. Storage, & Instrument room.

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
24-26			

Finishes and Materials

Floor / Base

- ○ Vinyl Composition Tile / 4" Vinyl Base
- ○ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ○ Epoxy / Integral Coved Epoxy Base
- ○ Carpet / 4" Vinyl Base
- ○ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ○ Standard Lay-In Tile
- ● Mylar Faced Tile
- ○ Gypsum Wall Board / Painted
- ○ Exposed / Painted
- ○ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ○ Cementitous Wall Board
- ○ Concrete Masonry Units
- ○ Other :

Wall Finishes

- ○ Latex Enamel Paint
- ● Epoxy Paint
- ○ Vinyl Wallcovering
- ○ Seamless Sheet Vinyl
- ○ Other :

Lab Casework

- ● Wood ○ Fixed
- ○ Metal ○ Portable
- ○ Other :

Lab Benchtop

- ○ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ○ Stainless Steel
- ○ Other :

Wall Cabinets/Shelving

- ○ Open ○ Swing Doors
- ○ Sliding Doors ○ Adjustable

Doors

○ Hollow Metal ● Wood ● Vision Panel ○ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Fume hood	CF	C	6	6'		3'		C	Flammable / Acid base cabinets

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Chemistry Lab

Space Type:

(●) Teaching Lab ( ) Laboratory ( ) Lab Support (Shared) ( ) Biosafety Level: _____ ( ) Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

(●) Summer Temp: 72°F +/- 2°F or other: _____
(●) Summer RH: 50% +/- 10% or other: _____
(●) Winter Temp: 72°F +/- 2°F or other: _____
(●) Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

( ) Not Critical ( ) Monitored
( ) Double Positive ( ) Positive
( ) Double Negative (●) Negative
(●) 8~10 AC per Hour or 6 Unoccup'd per hour

Air Quality / Exhaust Requirements:

( ) Filtered Supply ( ) Filtered Exhaust
( ) Special Filter Types: _____
( ) Biosafety Cabinets (●) Fume Hoods
( ) Ventilated Work Stations ( ) Point Exhausts

Plumbing Issues

Services:

(●) Potable Water . . . . . (●) Hot (●) Cold
(●) Non-Potable Water. . . . . (●) Hot (●) Cold
( ) High Purity Water . . . . . ( ) DI ( ) RO
( ) Water for Injection (WFI) : ( ) Hot ( ) Cold

( ) Compressed Air (Bldg.)
( ) Compressed Air (Clean)
( ) Plant Steam
( ) Clean Steam

( ) Nitrogen ( ) Natural Gas ( )
( ) Helium ( ) Hydrogen ( )
( ) Argon ( ) Acetylene ( ) Other _____
( ) Carbon Dioxide ( ) ( ) Other _____
(●) Vacuum

Fixtures / Features:

(●) Lab Sink(s) . . . . . ( ) S/S (●) Epoxy
( ) Hand Washing Sink . . . . . ( ) Foot-Operated

( ) Dishwashing Sink
(●) Cupsink(s)

(●) Floor Drain(s) (●) Eye Wash(s)..... (●) Tempered (●) ADA
(●) Lab Waste Piping (●) Safety Shower(s)... (●) Tempered (●) ADA

Electrical Issues

Power Requirements:

(●) 120V
( ) 208V ~ 1 Phase
( ) 240V ~ 3 Phase
( ) 480V ~ 1 Phase
( ) 480V ~ 3 Phase

Power Supply Features:

( ) Filtering . . . . . ( ) Panel ( ) Local
( ) Explosion Proof Fixtures
(●) GFCI Outlets . . . . . ( ) Panel ( ) Local
( ) Dedicated Circuits for : _____
( ) Other : _____

Monitors/Alarm:

( ) Emergency Power Required for : _____
( ) UPS System . . . . . ( ) Building ( ) Local
( ) UPS Required for : _____

Lighting Requirements:

(●) Primary Fluorescent
( ) Task Lighting
( ) Multi-Level Control
( ) Sensor Activated
( ) Other : _____

Communication Issues

( ) Telephone Connections (●) Data Connections ( ) Network Type(s) _____ ( ) Intercom System ( ) Public Address System (●) Clocks

Safety Issues

Security / Access Control:

(●) Key Lock ( ) Alarmed Door ( ) Closed Circuit Television
( ) Card Access ( ) Motion Sensors ( ) Other _____

( ) Humidity / Temperature
( ) Power Interruption / Failure

( ) Equipment Failure ( ) Cylinder Pressure
( ) Waste Flow ( ) Other _____

Fire Protection Issues

Potential Fire Hazards:

(●) Flammable Materials : _____
( ) Explosive Materials : _____

Sprinkler System Types:

(●) Wet Pipe System ( ) Pre-Action System
( ) Dry Pipe System ( ) Halon Equivalent System

Detection Methods:

(●) Smoke Detectors (●) Air Flow Monitoring
( ) Heat Detectors ( ) Other _____

Structural Issues

( ) Vibration Sensitivity ( ) Special Floor Loading Requirements _____ PSF ( ) Recessed Floor Area Req. ( ) Ceiling Mounted Equipment

Acoustical Issues

( ) Noise Generator
( ) Noise Sensitivity

Environmental Issues

( ) Visual Privacy Required (●) Natural Light is desirable ( ) Odor Producing Operations
( ) Views Desirable ( ) Avoid Natural Light ( ) Waste Production: ( ) Low ( ) High

General Comments / Remarks:

_____

_____

The Estime Group

Laboratory/Lab Support Room Data Sheets

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Stock Room / Prep	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Stock Room

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Biology & Chemistry Lab

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
1-2			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ● Open ● Swing Doors w/Glass
- ◯ Other: Full ht. H.D. adjust. Shelv'g

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ◯ Other:

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Stock Room / Prep

Space Type:

○ Teaching Lab ○ Laboratory ● Lab Support (Shared) ○ Biosafety Level: _____ ○ Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

- ● Summer Temp: 72°F +/- 2°F or other: _____
- ● Summer RH: 50% +/- 10% or other: _____
- ● Winter Temp: 72°F +/- 2°F or other: _____
- ● Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

- ○ Not Critical ○ Monitored
- ○ Double Positive ○ Positive
- ○ Double Negative ● Negative
- ● 8~10 AC per Hour or _____ per hour

Air Quality / Exhaust Requirements:

- ○ Filtered Supply ○ Filtered Exhaust
- ○ Special Filter Types: _____
- ○ Biosafety Cabinets ○ Fume Hoods
- ○ Ventilated Work Stations ○ Point Exhausts

Plumbing Issues

Services:

● Potable Water	● Hot	● Cold	○ Compressed Air (Bldg.)	○ Nitrogen	○ Natural Gas	○		
● Non-Potable Water.	● Hot	● Cold	○ Compressed Air (Clean)	○ Helium	○ Hydrogen	○		
○ High Purity Water	○ DI	○ RO	○ Plant Steam	○ Argon	○ Acetylene	○ Other	_____	
○ Water for Injection (WFI) :	○ Hot	○ Cold	○ Clean Steam	○ Carbon Dioxide	○ Tanked Gas	○ Other	_____	
				○ Vacuum				

Fixtures / Features:

● Lab Sink(s)	○ S/S	● Epoxy	○ Dishwashing Sink	● Floor Drain(s)	● Eye Wash(s).....	● Tempered	● ADA
○ Hand Washing Sink	○ Foot-Operated		○ Cupsink(s)	○ Lab Waste Piping	○ Safety Shower(s)...	○ Tempered	○ ADA

Electrical Issues

Power Requirements:

- ● 120V
- ○ 208V ~ 1 Phase
- ○ 240V ~ 3 Phase
- ○ 480V ~ 1 Phase
- ○ 480V ~ 3 Phase

Power Supply Features:

- ○ Filtering . . . . . ○ Panel ○ Local
- ○ Explosion Proof Fixtures
- ○ GFCI Outlets . . . . . ○ Panel ○ Local
- ○ Dedicated Circuits for : _____
- ○ Other : _____

Monitors/Alarm:

- ○ Emergency Power Required for : _____
- ○ UPS System . . . . . ○ Building ○ Local
- ○ UPS Required for : _____

Lighting Requirements:

- ● Primary Fluorescent
- ○ Task Lighting
- ○ Multi-Level Control
- ○ Sensor Activated
- ○ Other : _____

Communication Issues

○ Telephone Connections ● Data Connections ○ Network Type(s) _____ ○ Intercom System ○ Public Address System ● Clocks

Safety Issues

Security / Access Control:

● Key Lock	○ Alarmed Door	○ Closed Circuit Television	○ Humidity / Temperature	○ Equipment Failure	○ Cylinder Pressure
○ Card Access	○ Motion Sensors	○ Other _____	○ Power Interruption / Failure	○ Waste Flow	○ Other _____

Fire Protection Issues

Potential Fire Hazards:

- ● Flammable Materials : _____
- ○ Explosive Materials : _____

Sprinkler System Types:

- ● Wet Pipe System ○ Pre-Action System
- ○ Dry Pipe System ○ Halon Equivalent System

Detection Methods:

- ● Smoke Detectors ● Air Flow Monitoring
- ○ Heat Detectors ○ Other _____

Structural Issues

○ Vibration Sensitivity ○ Special Floor Loading Requirements _____ PSF ○ Recessed Floor Area Req. ○ Ceiling Mounted Equipment

Acoustical Issues

- ○ Noise Generator
- ○ Noise Sensitivity

Environmental Issues

- ○ Visual Privacy Required ● Natural Light is desirable ○ Odor Producing Operations
- ○ Views Desirable ○ Avoid Natural Light ○ Waste Production: ○ Low ○ High

General Comments / Remarks: _____

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Instrument Room	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Instrument Room

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Biology & Chemistry Lab

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
1-2			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood
- ◯ Fixed
- ◯ Metal
- ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin
- ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ◯ Open
- ● Swing Doors w/Glass
- ◯ Sliding Doors
- ◯ Adjustable

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Analytical Instrumentation	OF		2					C	Power, Point Exhaust

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Instrument Room

Space Type:

○ Teaching Lab ○ Laboratory ● Lab Support (Shared) ○ Biosafety Level: _____ ○ Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

- ● Summer Temp: 72°F +/- 2°F or other: _____
- ● Summer RH: 50% +/- 10% or other: _____
- ● Winter Temp: 72°F +/- 2°F or other: _____
- ● Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

- ○ Not Critical ○ Monitored
- ○ Double Positive ○ Positive
- ○ Double Negative ● Negative
- ● 8~10 AC per Hour or _____ per hour

Air Quality / Exhaust Requirements:

- ○ Filtered Supply ○ Filtered Exhaust
- ○ Special Filter Types: _____
- ○ Biosafety Cabinets ○ Fume Hoods
- ○ Ventilated Work Stations ● Point Exhausts

Plumbing Issues

Services:

○ Potable Water	○ Hot	○ Cold	○ Compressed Air (Bldg.)	● Nitrogen	○ Natural Gas	○	
○ Non-Potable Water.	○ Hot	○ Cold	○ Compressed Air (Clean)	● Helium	○ Hydrogen	○	
○ High Purity Water	○ DI	○ RO	○ Plant Steam	● Argon	○ Acetylene	○ Other	_____
○ Water for Injection (WFI) :	○ Hot	○ Cold	○ Clean Steam	○ Carbon Dioxide	● Tanked Gas	○ Other	_____
				○ Vacuum			

Fixtures / Features:

○ Lab Sink(s)	○ S/S	○ Epoxy	○ Dishwashing Sink	○ Floor Drain(s)	○ Eye Wash(s).....	○ Tempered	○ ADA
○ Hand Washing Sink	○ Foot-Operated		○ Cupsink(s)	○ Lab Waste Piping	○ Safety Shower(s)...	○ Tempered	○ ADA

Electrical Issues

Power Requirements:

- ● 120V
- ○ 208V ~ 1 Phase
- ○ 240V ~ 3 Phase
- ○ 480V ~ 1 Phase
- ○ 480V ~ 3 Phase

Power Supply Features:

- ○ Filtering . . . . . ○ Panel ○ Local
- ○ Explosion Proof Fixtures
- ○ GFCI Outlets . . . . . ○ Panel ○ Local
- ● Dedicated Circuits for : _____
- ○ Other : _____

Monitors/Alarm:

- ○ Emergency Power Required for : _____
- ○ UPS System . . . . . ○ Building ○ Local
- ○ UPS Required for : _____

Lighting Requirements:

- ● Primary Fluorescent
- ○ Task Lighting
- ○ Multi-Level Control
- ○ Sensor Activated
- ○ Other : _____

Communication Issues

○ Telephone Connections ● Data Connections ○ Network Type(s) _____ ○ Intercom System ○ Public Address System ● Clocks

Safety Issues

Security / Access Control:

● Key Lock	○ Alarmed Door	○ Closed Circuit Television	○ Humidity / Temperature	○ Equipment Failure	○ Cylinder Pressure
○ Card Access	○ Motion Sensors	○ Other _____	○ Power Interruption / Failure	○ Waste Flow	○ Other _____

Fire Protection Issues

Potential Fire Hazards:

- ● Flammable Materials : _____
- ○ Explosive Materials : _____

Sprinkler System Types:

- ● Wet Pipe System ○ Pre-Action System
- ○ Dry Pipe System ○ Halon Equivalent System

Detection Methods:

- ● Smoke Detectors ● Air Flow Monitoring
- ○ Heat Detectors ○ Other _____

Structural Issues

○ Vibration Sensitivity ○ Special Floor Loading Requirements _____ PSF ○ Recessed Floor Area Req. ○ Ceiling Mounted Equipment

Acoustical Issues

- ○ Noise Generator
- ○ Noise Sensitivity

Environmental Issues

- ○ Visual Privacy Required ● Natural Light is desirable ○ Odor Producing Operations
- ○ Views Desirable ○ Avoid Natural Light ○ Waste Production: ○ Low ○ High

General Comments / Remarks: _____

OSU Cascades Campus Phase I | 04/08/14 | OR1404

Project Name | **Date last revised** | **TEG Project No.**

Geology Storage

Department / Group Name | **Room Name** | **Contact, Title**

Room Function: Rock Collection Storage

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Geology Storage

No. of Occupants:	Special Ceiling Height (if any):	Fire Rating (if known):	Special / Hazardous Room Conditions (if any):
1-2			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ◯ Open ● Swing Doors w/ Glass
- ◯ Sliding Doors ◯ Adjustable

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Geology Storage

Space Type:

○ Teaching Lab ○ Laboratory ● Lab Support ○ Biosafety Level: _____ ○ Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

- ● Summer Temp: 72°F +/- 2°F or other: _____
- ● Summer RH: 50% +/- 10% or other: _____
- ● Winter Temp: 72°F +/- 2°F or other: _____
- ● Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

- ○ Not Critical ○ Monitored
- ○ Double Positive ○ Positive
- ○ Double Negative ● Negative
- ○ 8~10 AC per Hour or 6 per hour

Air Quality / Exhaust Requirements:

- ○ Filtered Supply ○ Filtered Exhaust
- ○ Special Filter Types: _____
- ○ Biosafety Cabinets ○ Fume Hoods
- ○ Ventilated Work Stations ○ Point Exhausts

Plumbing Issues

Services:

○ Potable Water	○ Hot	○ Cold	○ Compressed Air (Bldg.)	○ Nitrogen	○ Natural Gas	○
○ Non-Potable Water.	○ Hot	○ Cold	○ Compressed Air (Clean)	○ Helium	○ Hydrogen	○
○ High Purity Water	○ DI	○ RO	○ Plant Steam	○ Argon	○ Acetylene	○ Other _____
○ Water for Injection (WFI) :	○ Hot	○ Cold	○ Clean Steam	○ Carbon Dioxide	○	○ Other _____
				○ Vacuum		

Fixtures / Features:

○ Lab Sink(s)	○ S/S	● Epoxy	○ Dishwashing Sink	○ Floor Drain(s)	○ Eye Wash(s).....	○ Tempered ○ ADA
○ Hand Washing Sink	○ Foot-Operated		○ Cupsink(s)	○ Lab Waste Piping	○ Safety Shower(s)...	○ Tempered ○ ADA

Electrical Issues

Power Requirements:

- ● 120V
- ○ 208V ~ 1 Phase
- ○ 240V ~ 3 Phase
- ○ 480V ~ 1 Phase
- ○ 480V ~ 3 Phase

Power Supply Features:

- ○ Filtering . . . . . ○ Panel ○ Local
- ○ Explosion Proof Fixtures
- ○ GFCI Outlets . . . . . ○ Panel ○ Local
- ○ Dedicated Circuits for : _____
- ○ Other : _____

Monitors/Alarm:

- ○ Emergency Power Required for : _____
- ○ UPS System . . . . . ○ Building ○ Local
- ○ UPS Required for : _____

Lighting Requirements:

- ● Primary Fluorescent
- ○ Task Lighting
- ○ Multi-Level Control
- ○ Sensor Activated
- ○ Other : _____

Communication Issues

○ Telephone Connections ● Data Connections ○ Network Type(s) _____ ○ Intercom System ○ Public Address System ○ Clocks

Safety Issues

Security / Access Control:

- ● Key Lock ○ Alarmed Door ○ Closed Circuit Television
- ○ Card Access ○ Motion Sensors ○ Other _____

- ○ Humidity / Temperature ○ Equipment Failure ○ Cylinder Pressure
- ○ Power Interruption / Failure ○ Waste Flow ○ Other _____

Fire Protection Issues

Potential Fire Hazards:

- ● Flammable Materials : _____
- ○ Explosive Materials : _____

Sprinkler System Types:

- ● Wet Pipe System ○ Pre-Action System
- ○ Dry Pipe System ○ Halon Equivalent System

Detection Methods:

- ● Smoke Detectors ● Air Flow Monitoring
- ○ Heat Detectors ○ Other _____

Structural Issues

○ Vibration Sensitivity ○ Special Floor Loading Requirements _____ PSF ○ Recessed Floor Area Req. ○ Ceiling Mounted Equipment

Acoustical Issues

- ○ Noise Generator
- ○ Noise Sensitivity

Environmental Issues

- ○ Visual Privacy Required ● Natural Light is desirable ○ Odor Producing Operations
- ○ Views Desirable ○ Avoid Natural Light ○ Waste Production: ○ Low ○ High

General Comments / Remarks:

_____

_____

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Biology Prep	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Biology Prep

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Biology Lab

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
1-2			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile
- ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted
- ◯ Exposed / Non-Painted

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ◯ Open ● Swing Doors w/Glass
- ◯ Sliding Doors ◯ Adjustable

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ● Acoustical Seals ● Other: 3'x 1' unequal leaf doors

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Bio-Safety Cabinet	CF	B/B	1	4'		2'-10"	8'	F	Class II A2
Autoclave	CF		1					F	Power, Vacume, ICW
-80 Freezer	OF		1	41		40	78	F	Emergency Power
Deli Case Frig	OF		1	54		32	75	F	Power
-20 Freezer	OF		1	30		30	68	F	Power
Undercounter Glassware Wash.	CF		1	24		24	34	F	Power, Drain, DI water source

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
B - 30% Recirculated Air
C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Biology Prep

Space Type:

○ Teaching Lab ○ Laboratory ● Lab Support (Shared) ○ Biosafety Level: _____ ○ Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

- ● Summer Temp: 72°F +/- 2°F or other: _____
- ● Summer RH: 50% +/- 10% or other: _____
- ● Winter Temp: 72°F +/- 2°F or other: _____
- ● Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

- ○ Not Critical ○ Monitored
- ○ Double Positive ○ Positive
- ○ Double Negative ● Negative
- ● 8~10 AC per Hour or _____ per hour

Air Quality / Exhaust Requirements:

- ○ Filtered Supply ○ Filtered Exhaust
- ○ Special Filter Types: _____
- ● Biosafety Cabinets ○ Fume Hoods
- ○ Ventilated Work Stations ○ Point Exhausts

Plumbing Issues

Services:

● Potable Water	● Hot	● Cold	○ Compressed Air (Bldg.)	○ Nitrogen	○ Natural Gas	○		
● Non-Potable Water.	● Hot	● Cold	○ Compressed Air (Clean)	○ Helium	○ Hydrogen	○		
○ High Purity Water	○ DI	○ RO	○ Plant Steam	○ Argon	○ Acetylene	○ Other		
○ Water for Injection (WFI) :	○ Hot	○ Cold	○ Clean Steam	○ Carbon Dioxide	○	○ Other		
Fixtures / Features:				○ Vacuum				
● Lab Sink(s)	○ S/S	● Epoxy	○ Dishwashing Sink	● Floor Drain(s)	● Eye Wash(s).....	● Tempered	● ADA	
○ Hand Washing Sink	○ Foot-Operated		● Cupsink(s)	● Lab Waste Piping	○ Safety Shower(s)...	○ Tempered	○ ADA	

Electrical Issues

Power Requirements:

- ● 120V
- ● 208V ~ 1 Phase
- ○ 240V ~ 3 Phase
- ● 480V ~ 1 Phase
- ○ 480V ~ 3 Phase

Power Supply Features:

- ○ Filtering . . . . . ○ Panel ○ Local
- ○ Explosion Proof Fixtures
- ● GFCI Outlets . . . . . ○ Panel ○ Local
- ● Dedicated Circuits for : -80 Freezer
- ○ Other : _____

Monitors/Alarm:

- ● Emergency Power Required for : -80 Freezer
- ○ UPS System . . . . . ○ Building ○ Local
- ○ UPS Required for : _____

Lighting Requirements:

- ● Primary Fluorescent
- ○ Task Lighting
- ○ Multi-Level Control
- ○ Sensor Activated
- ○ Other : _____

Communication Issues

○ Telephone Connections ● Data Connections ○ Network Type(s) _____ ○ Intercom System ○ Public Address System ● Clocks

Safety Issues

Security / Access Control:

- ● Key Lock ○ Alarmed Door ○ Closed Circuit Television
- ○ Card Access ○ Motion Sensors ○ Other _____

- ○ Humidity / Temperature ○ Equipment Failure ○ Cylinder Pressure
- ○ Power Interruption / Failure ○ Waste Flow ○ Other _____

Fire Protection Issues

Potential Fire Hazards:

- ● Flammable Materials : _____
- ○ Explosive Materials : _____

Sprinkler System Types:

- ● Wet Pipe System ○ Pre-Action System
- ○ Dry Pipe System ○ Halon Equivalent System

Detection Methods:

- ● Smoke Detectors ● Air Flow Monitoring
- ○ Heat Detectors ○ Other _____

Structural Issues

○ Vibration Sensitivity ○ Special Floor Loading Requirements _____ PSF ○ Recessed Floor Area Req. ○ Ceiling Mounted Equipment

Acoustical Issues

- ○ Noise Generator
- ○ Noise Sensitivity

Environmental Issues

- ○ Visual Privacy Required ● Natural Light is desirable ○ Odor Producing Operations
- ○ Views Desirable ○ Avoid Natural Light ○ Waste Production: ○ Low ○ High

General Comments / Remarks:

_____

_____

The Estime Group

Laboratory/Lab Support Room Data Sheets

OSU Cascades Campus Phase I	04/08/14	OR1404
Project Name	**Date last revised**	**TEG Project No.**

	Chem. Storage	
Department / Group Name	**Room Name**	**Contact, Title**

Room Function: Chemical Storage

Room Adjacencies - *What other rooms / functions should this room be directly adjacent to, if any? Why?* Biology & Chemistry Lab

No. of Occupants:	**Special Ceiling Height (if any):**	**Fire Rating (if known):**	**Special / Hazardous Room Conditions (if any):**
N/A			

Finishes and Materials

Floor / Base

- ◯ Vinyl Composition Tile / 4" Vinyl Base
- ◯ Seamless Sheet Vinyl / Integral Coved Vinyl Base
- ◯ Epoxy / Integral Coved Epoxy Base
- ◯ Carpet / 4" Vinyl Base
- ◯ Sealed Concrete
- ● Other : Ruber Tile

Ceiling

- ◯ Standard Lay-In Tile ● Mylar Faced Tile
- ◯ Gypsum Wall Board / Painted
- ◯ Exposed / Painted ◯ Exposed / Non-Painted

Doors

◯ Hollow Metal ● Wood ● Vision Panel ◯ Light Seals ◯ Acoustical Seals ◯ Other:

Walls

- ● Gypsum Wall Board
- ◯ Cementitous Wall Board
- ◯ Concrete Masonry Units
- ◯ Other :

Wall Finishes

- ◯ Latex Enamel Paint
- ● Epoxy Paint
- ◯ Vinyl Wallcovering
- ◯ Seamless Sheet Vinyl
- ◯ Other :

Lab Casework

- ● Wood ◯ Fixed
- ◯ Metal ◯ Portable
- ◯ Other :

Lab Benchtop

- ◯ Chemical-resistant Plastic Laminate
- ● Epoxy Resin ◯ Stainless Steel
- ◯ Other :

Wall Cabinets/Shelving

- ● Open ● Swing Doors w/Glass
- ◯ Other:

Equipment Schedule

Equipment Description	OF/CF***	Type*	Quantity	Width	Total Width	Depth	Height	F/C/W***	Utilities / Comments
Fume Hood	CF	C	1	4'				C	Provide Base Cabinets
Tall Flammable Stor. Cabinets	CF	VE	3	3'-7"		18"		F	Mechanically Ventilated

* Hood Types:
C - Chemical
R - Radioisotope
P - Perchloric
W- Walk-in
B - Biosafety**
L - Laminar / Clean bench
PE - Point Exhaust
VE - Ventilated Enclosure

** Biosafety Cabinet Types:
RC - 100% Recirculated Air
A - 70% Recirculated Air
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C - 0% Recirculated Air

(Note: Add 7" to nominal length of all biosafety cabinets for the actual installed unit length)

*** OF/CF - Owner Furnished / Contractor Furnished Equipment
F/C/W - Floor / Counter / Wall Mounted

Laboratory / Lab Support Room Data Sheets

Room Name: Chem. Storage

Space Type:

○ Teaching Lab ○ Laboratory ● Lab Support (Shared) ○ Biosafety Level: _____ ○ Clean Room Classification _____

HVAC Issues

Temperature / Relative Humidity:

- ● Summer Temp: 72°F +/- 2°F or other: _____
- ● Summer RH: 50% +/- 10% or other: _____
- ● Winter Temp: 72°F +/- 2°F or other: _____
- ● Winter RH: 30% +/- 10% or other: _____

Air Flow / Changes:

- ○ Not Critical ○ Monitored
- ○ Double Positive ○ Positive
- ○ Double Negative ● Negative
- ● 8~10 AC per Hour or _____ per hour

Air Quality / Exhaust Requirements:

- ○ Filtered Supply ○ Filtered Exhaust
- ○ Special Filter Types: _____
- ○ Biosafety Cabinets ● Fume Hoods
- ● Tall Flamm. Cabinet ○ Point Exhausts

Plumbing Issues

Services:

● Potable Water	● Hot	● Cold	● Compressed Air (Bldg.)	○ Nitrogen	● Natural Gas	○			
● Non-Potable Water.	● Hot	● Cold	○ Compressed Air (Clean)	○ Helium	○ Hydrogen	○			
○ High Purity Water	○ DI	○ RO	○ Plant Steam	○ Argon	○ Acetylene	○ Other	_____		
○ Water for Injection (WFI) :	○ Hot	○ Cold	○ Clean Steam	○ Carbon Dioxide	○ Tanked Gas	○ Other	_____		

Fixtures / Features:

				● Vacuum				
● Lab Sink(s)	○ S/S	● Epoxy	○ Dishwashing Sink	○ Floor Drain(s)	● Eye Wash(s).....	● Tempered	● ADA	
○ Hand Washing Sink	○ Foot-Operated		○ Cupsink(s)	○ Lab Waste Piping	○ Safety Shower(s)...	○ Tempered	○ ADA	

Electrical Issues

Power Requirements:

- ● 120V
- ○ 208V ~ 1 Phase
- ○ 240V ~ 3 Phase
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Power Supply Features:

- ○ Filtering . . . . . ○ Panel ○ Local
- ○ Explosion Proof Fixtures
- ○ GFCI Outlets . . . . . ○ Panel ○ Local
- ○ Dedicated Circuits for : _____
- ○ Other : _____

Monitors/Alarm:

- ○ Emergency Power Required for : _____
- ○ UPS System . . . . . ○ Building ○ Local
- ○ UPS Required for : _____

Lighting Requirements:

- ● Primary Fluorescent
- ○ Task Lighting
- ○ Multi-Level Control
- ○ Sensor Activated
- ○ Other : _____

Communication Issues

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Safety Issues

Security / Access Control:

● Key Lock	○ Alarmed Door	○ Closed Circuit Television	○ Humidity / Temperature	○ Equipment Failure	○ Cylinder Pressure
○ Card Access	○ Motion Sensors	○ Other _____	○ Power Interruption / Failure	○ Waste Flow	○ Other _____

Fire Protection Issues

Potential Fire Hazards:

- ● Flammable Materials : _____
- ○ Explosive Materials : _____

Sprinkler System Types:

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Environmental Issues

- ○ Visual Privacy Required ● Natural Light is desirable ○ Odor Producing Operations
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General Comments / Remarks: _____