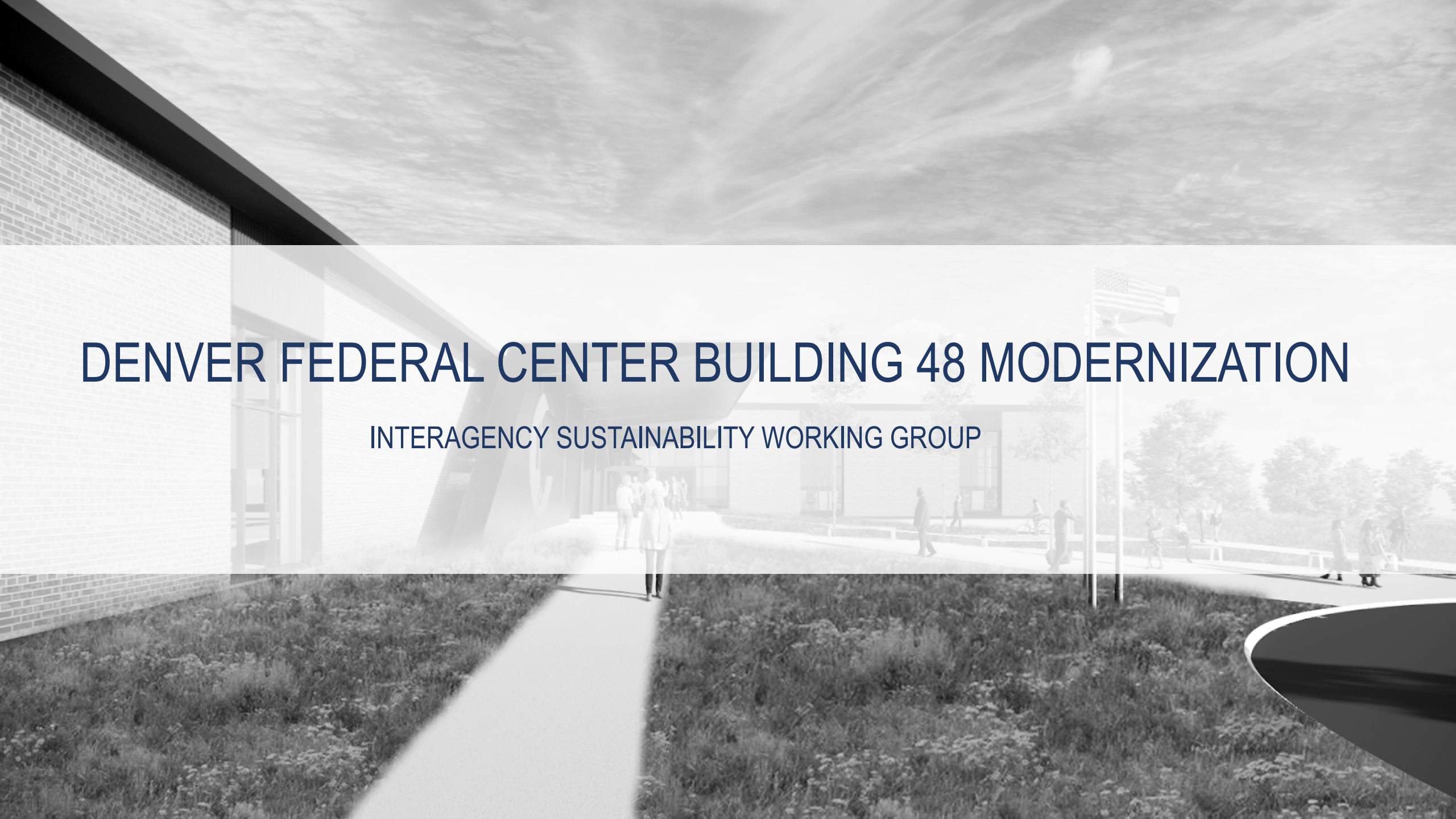


DENVER FEDERAL CENTER BUILDING 48 MODERNIZATION

INTERAGENCY SUSTAINABILITY WORKING GROUP

BUILDING 48

B48 MODERNIZATION PROJECT

Full Building Modernization of a 1940's Ammunition Manufacturing Plant & Warehouse

- Complete adaptive reuse to office
- New mechanical, electrical, plumbing, life safety systems, etc.
- Site upgrades – paving, landscaping, parking
- New envelope

B48 MODERNIZATION GOALS:

High Performance Green Building

- Meet or exceed federal energy and water conservation goals and incorporate exceptional integration of architectural form and optimized building systems which provide excellent indoor environmental quality

High Performance Workplace

- Enhance all human factors including health, functional efficiency, productivity, space flexibility, air quality, and comfort in thermal, acoustical, and visual perspectives utilizing natural daylight.

Design, Construction, & Operational Excellence

- Utilize best practices to design and construct an office of outstanding quality and value. Extending the service life of the building.

Space & Experience

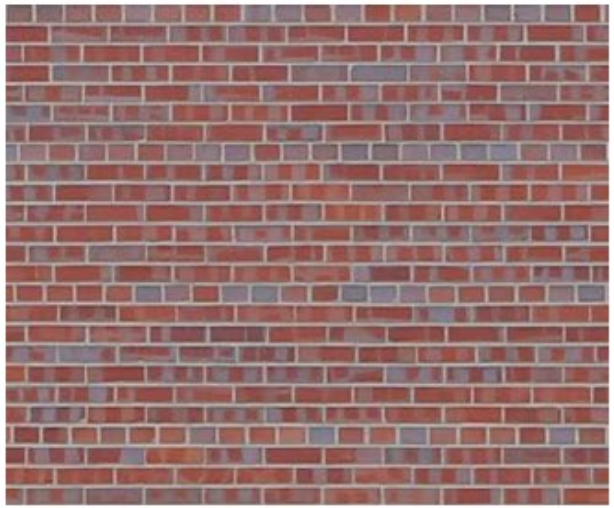
- Provide spatial experiences for those working and visiting Building 48 connecting the outdoors and the indoors both spatially and visually.

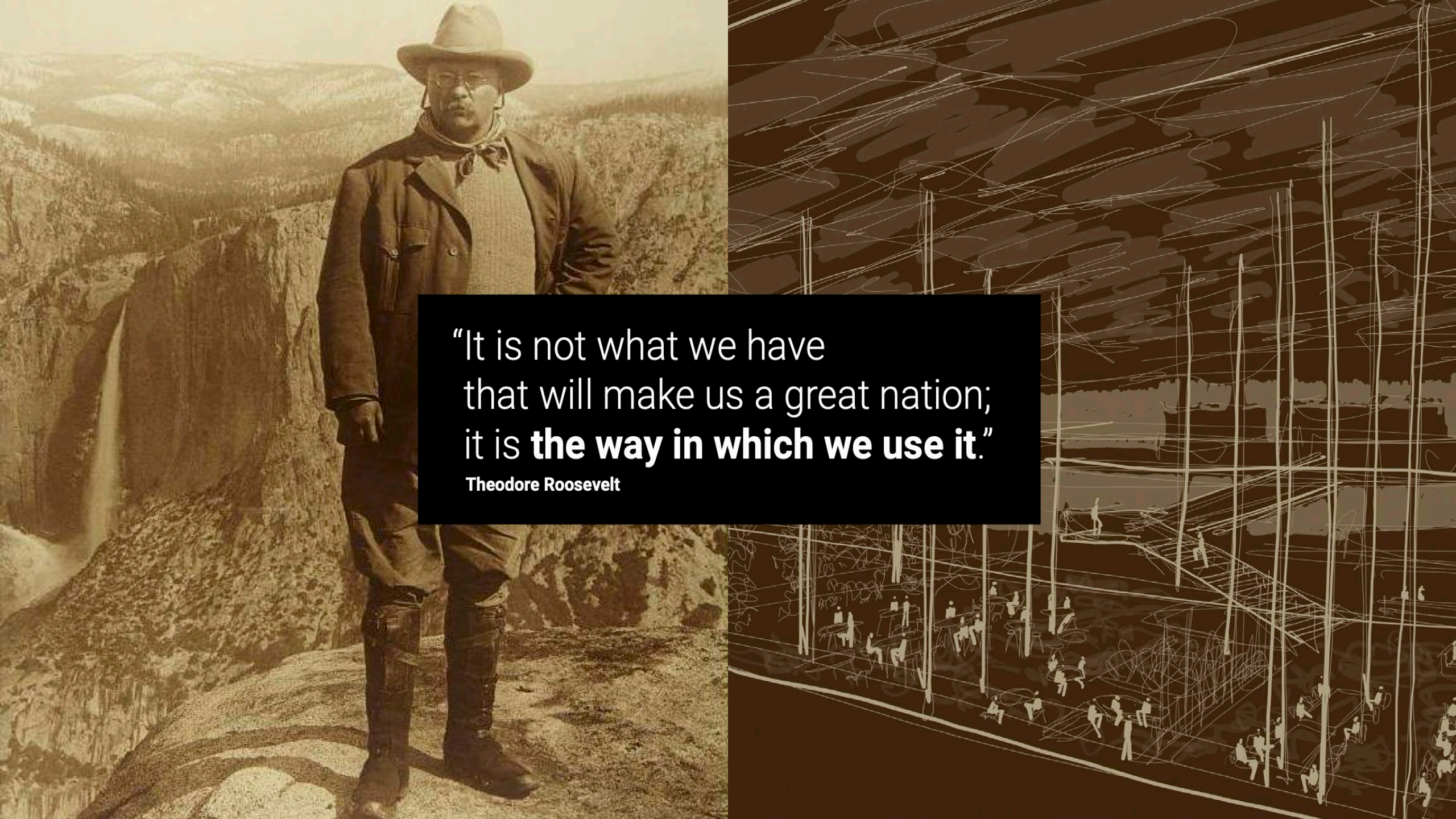
Modern Office Environment

- Modernize and transform the building from its current state, meeting IBC's programmatic needs while creating a lasting impression.



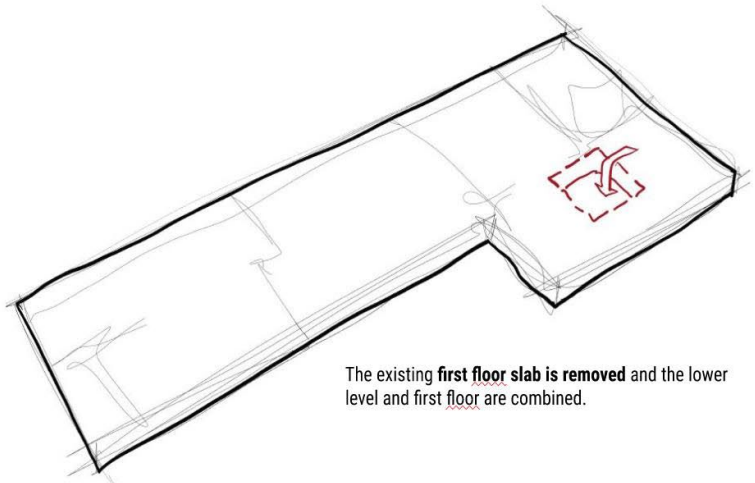




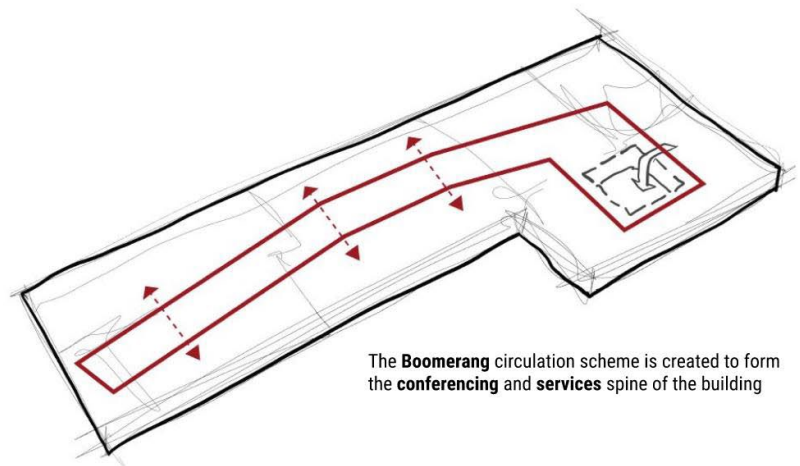



"It is not what we have
that will make us a great nation;
it is **the way in which we use it**."

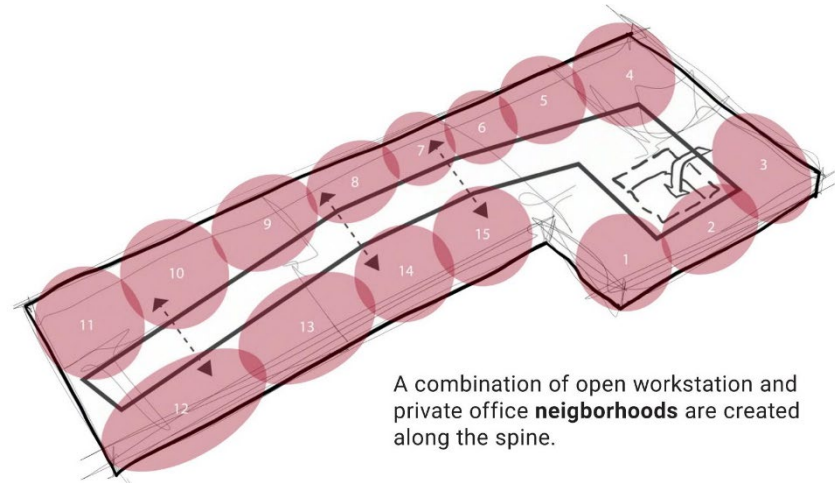
Theodore Roosevelt



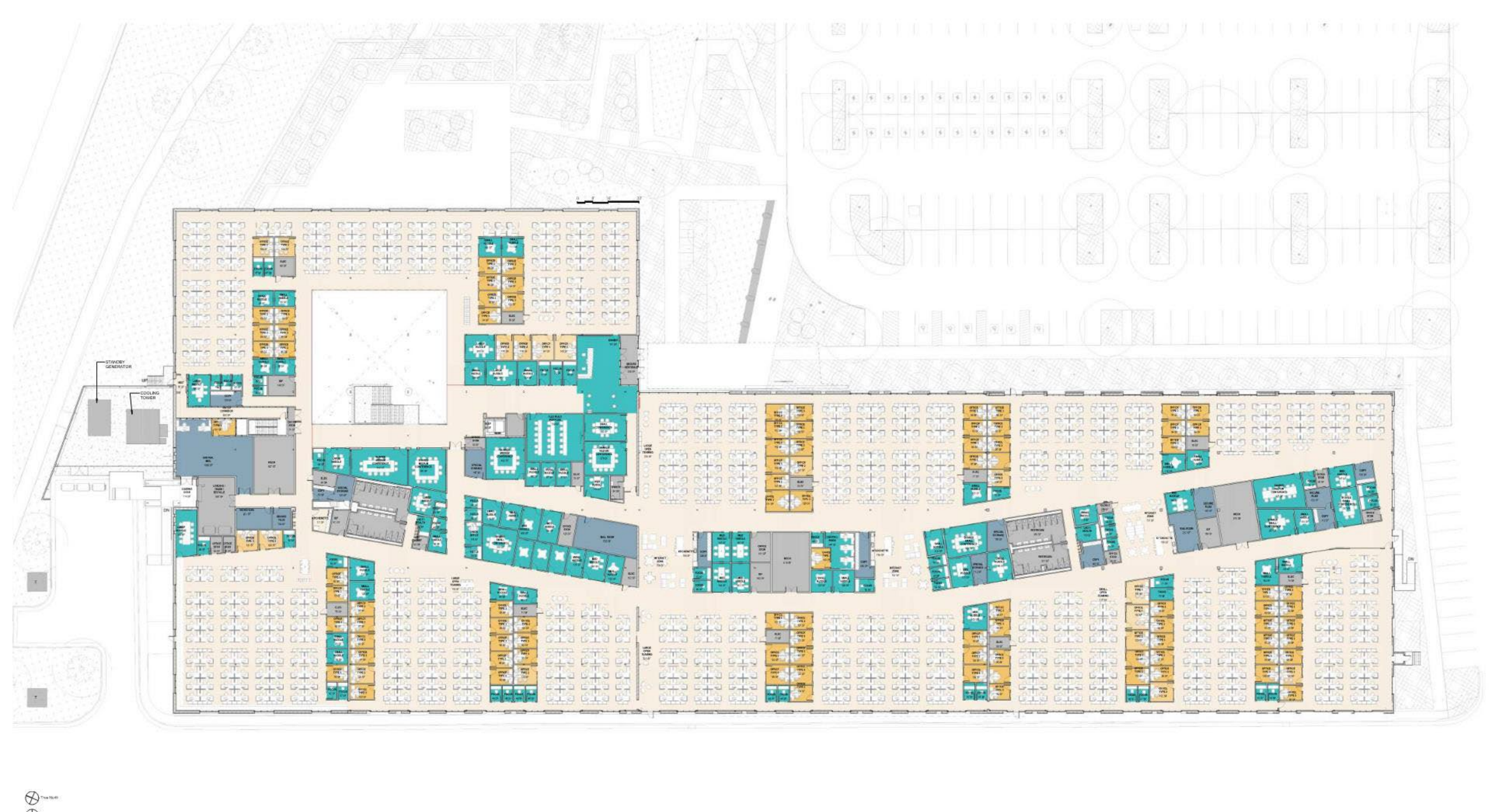
The existing **first floor slab is removed** and the lower level and first floor are combined.



The **Boomerang** circulation scheme is created to form the **conferencing** and **services** spine of the building



A combination of open workstation and private office **neigborhoods** are created along the spine.


STANDBY GENERATOR
COOLING TOWER
UP
DN
True North
Plan North

EXISTING CONDITION

EXISTING CONDITION

EXISTING CONDITION


INTERIOR
BUSINESS
CENTER


BLACK CANYON OF THE GUNNISON

ACHIEVEMENTS:

Lease Cost Avoidance

- Nearly $6M in Annual Taxpayer Savings
- Taxpayer ROI < 9 Years | ROI w/ Rent Revenue < 5 Years

Addressing Climate Change + Human Health

- LEED Gold
- SITES Silver
- Net Zero Energy
- USGBC Net Zero Energy Certification
- All-Electric Building
- Net Zero Operational Carbon
- UL Design Guideline DG24480
  Design Guideline for Promoting Circadian Entrainment with Light for Day-Active People
- 87% Embodied Carbon Avoidance
- Embodied Carbon Emissions Tracking for Future Baselines

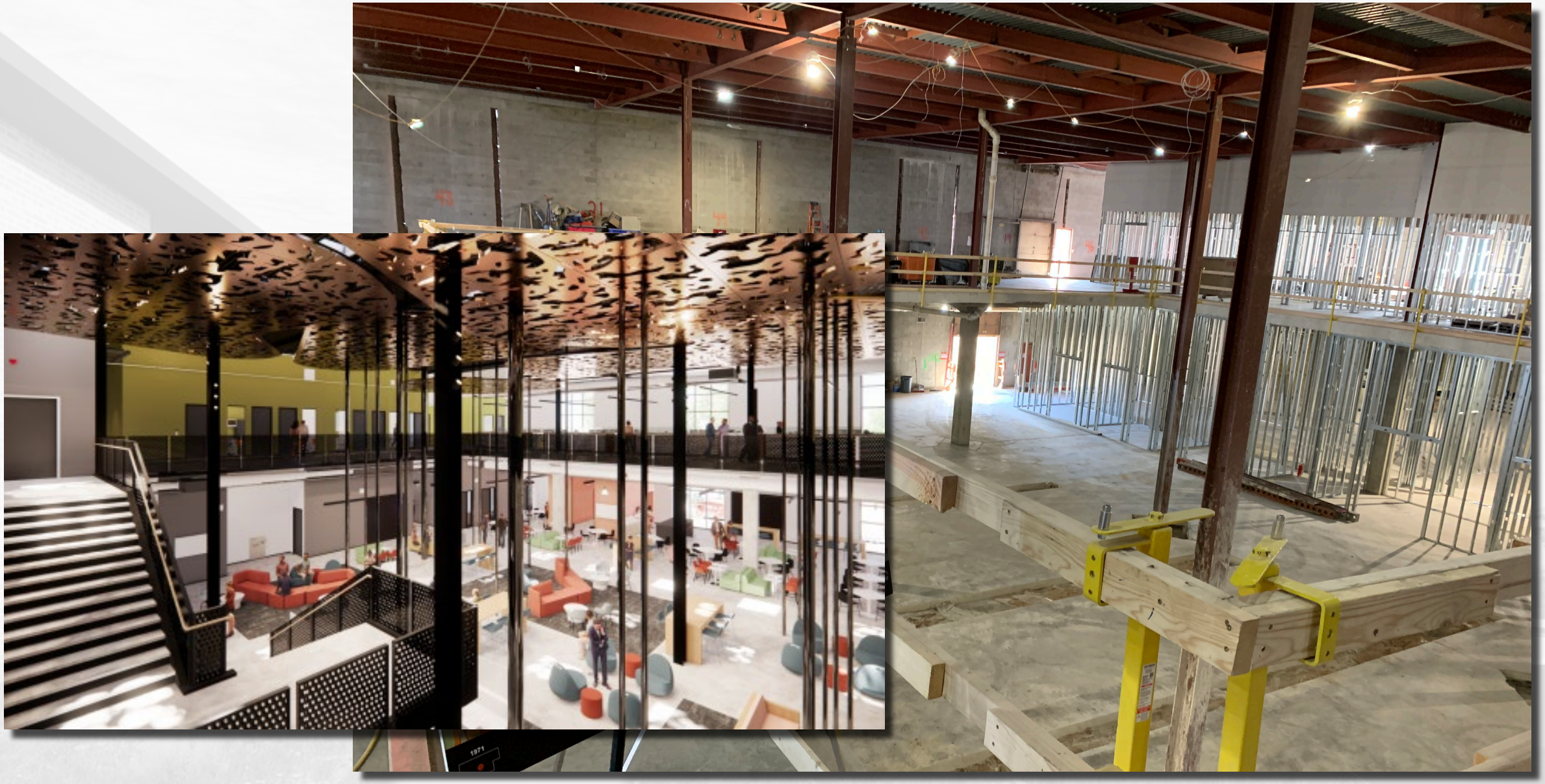
Customer Business Improvement

- Co-Location
- Improved Workplace
- Innovative Technology
- Modern Work Environment

Asset Performance

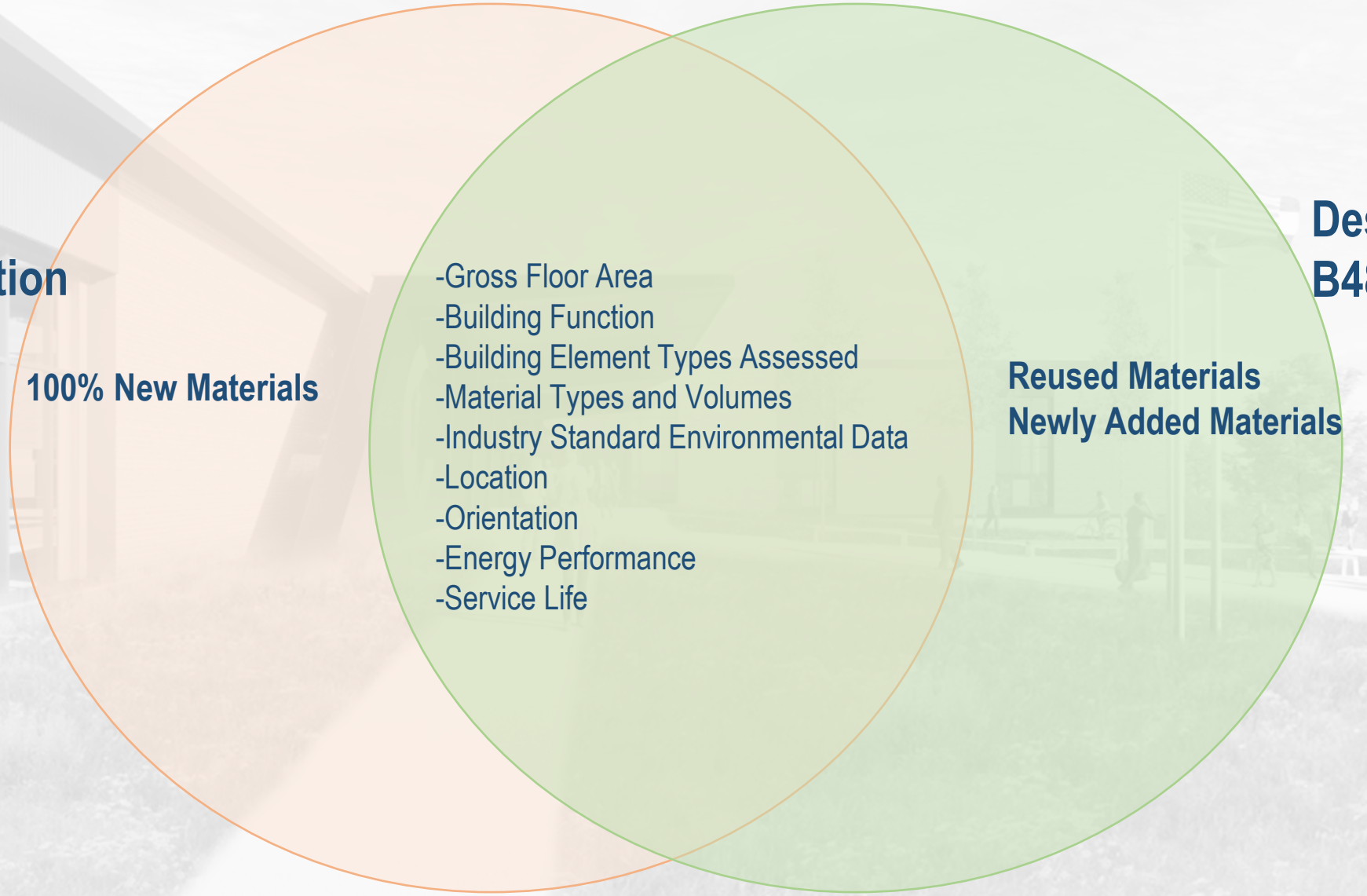
- Adaptive Reuse of an Underperforming Asset.

ADAPTIVE REUSE & EMBODIED CARBON AVOIDED



The most sustainable material is the material that already exists.

B48 COMPARED TO SIMILAR NEW CONSTRUCTION | WBLCA



WBLCA | INCLUDED BUILDING ELEMENTS

Building Structure & Envelope

Foundation & Substructure

-Foundation & foundation walls
-Sub-surface structure
-Drilled piers & footings
-Basement & retaining walls

Horizontal Elements

-Roof materials
-Roofing decks / assemblies
-Horizontal beams
-Floor slabs
-Insulation

Vertical Elements

-External walls & façade
-Insulation
-Gypsum board & drywall of structural walls
-Columns & load-bearing structures
-Interior structural walls

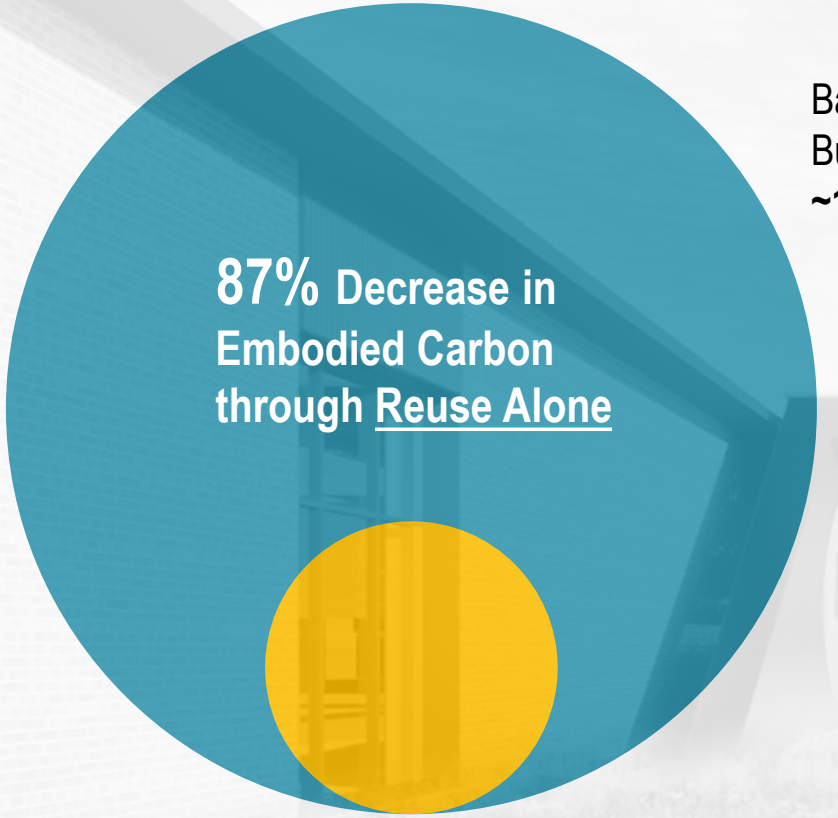
Other Elements

-Doors
-Windows
-Stairs
-Ramps
-Other misc. structure and envelope items

Excluded Elements:

MEP and life safety systems
Site work, parking lots, and landscaping
Interior finishes (flooring, paint, tiling, acoustical panels, etc)
Interior non-structural walls

B48 COMPARED TO SIMILAR NEW CONSTRUCTION | WBLCA



Baseline Brand New Building
~19.7 million kg CO2e

Adaptive Reuse Design
~2.6 million kg CO2e

The carbon savings from Building 48's adaptive reuse are equivalent to approximately:

43 million miles driven by an average gasoline powered passenger vehicle

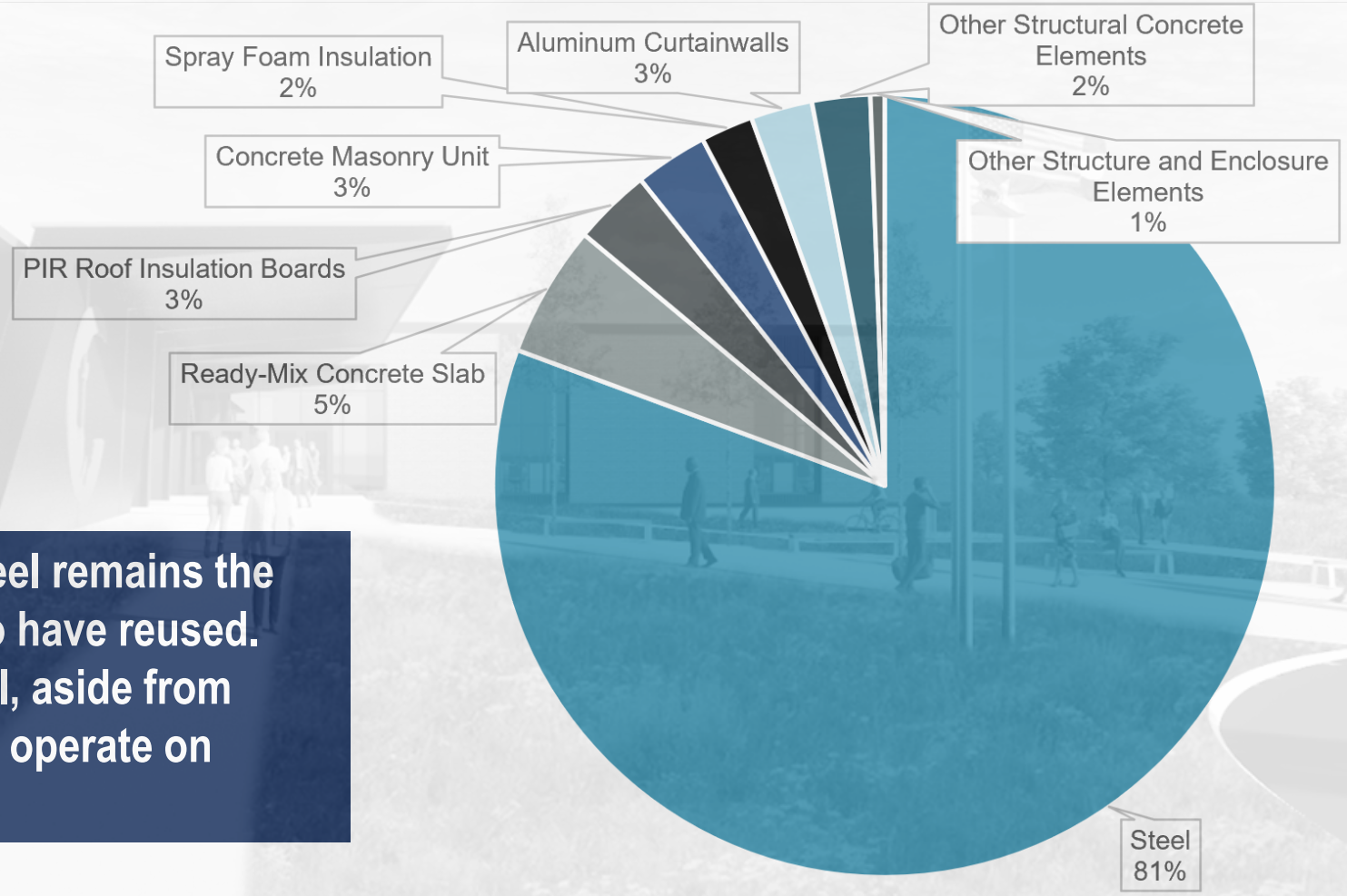
3,300 homes' electricity use for 1 year

116 acres of U.S. forests saved from conversion to cropland

Source: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

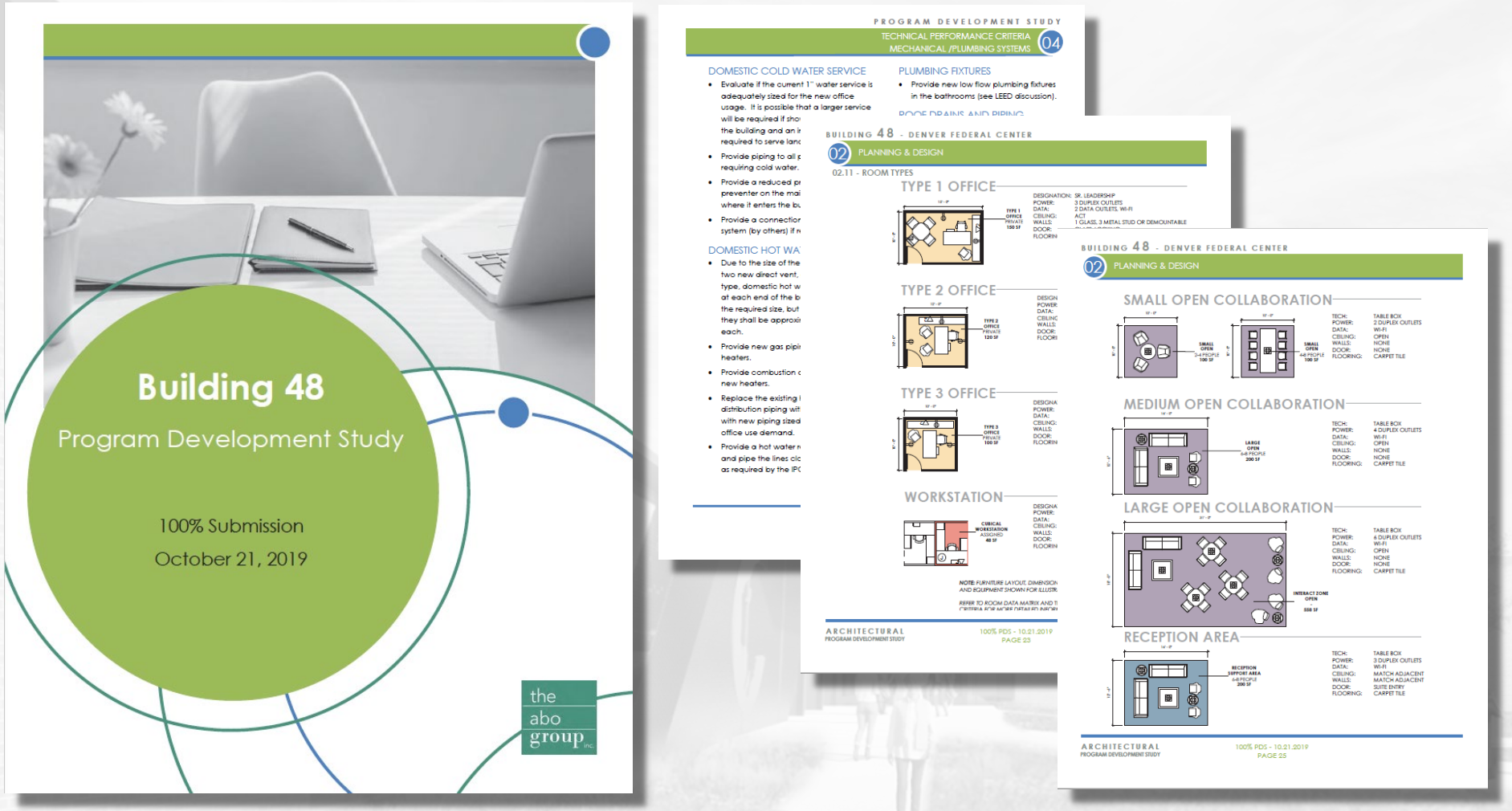
This does not account for any improvements from material selection – both design and baseline used industry standard materials. This is the savings simply from using materials that were already there!

B48 WBLCA | MATERIAL IMPACT



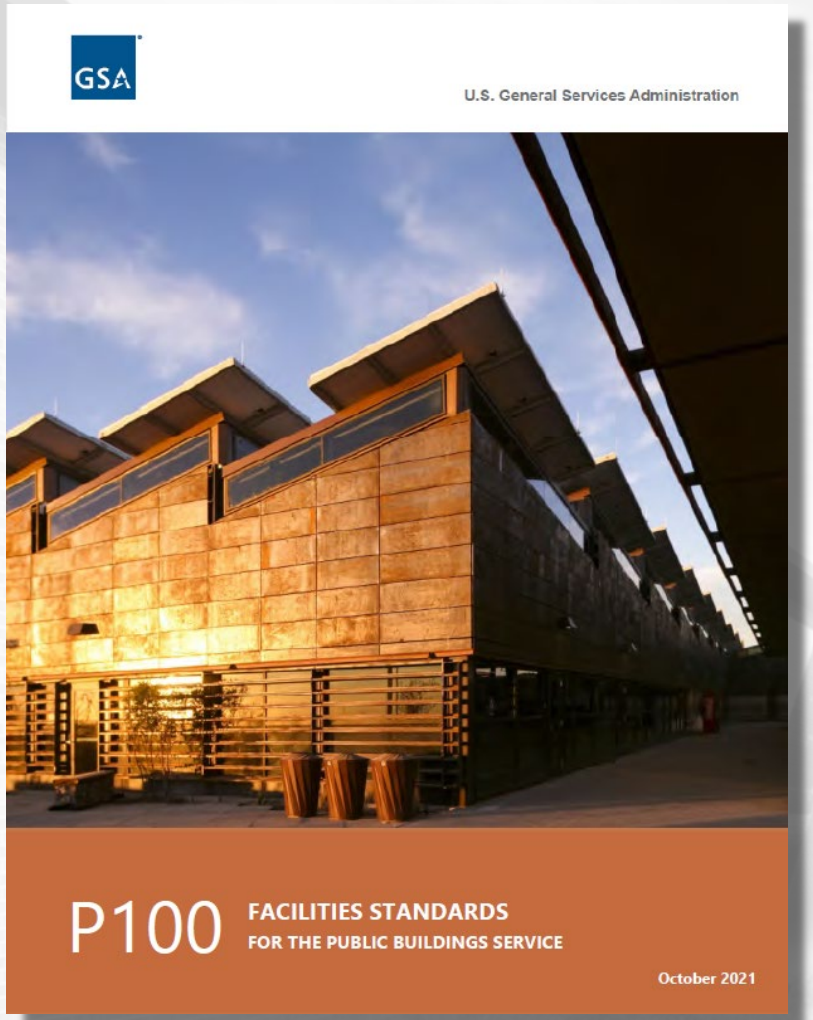
Despite high recycled content, steel remains the most impactful material for B48 to have reused. The biggest opportunity with steel, aside from reuse, is to source from mills that operate on renewable energy sources.

ELECTRIFICATION & DESIGN-BUILD PROCUREMENT



PRESCRIPTIVE REQUIREMENTS

- Statement of Work & Owner's Project Requirements
- Functional requirements of the building and tenant space
- Deliverable requirements of the DB during each phase of the project



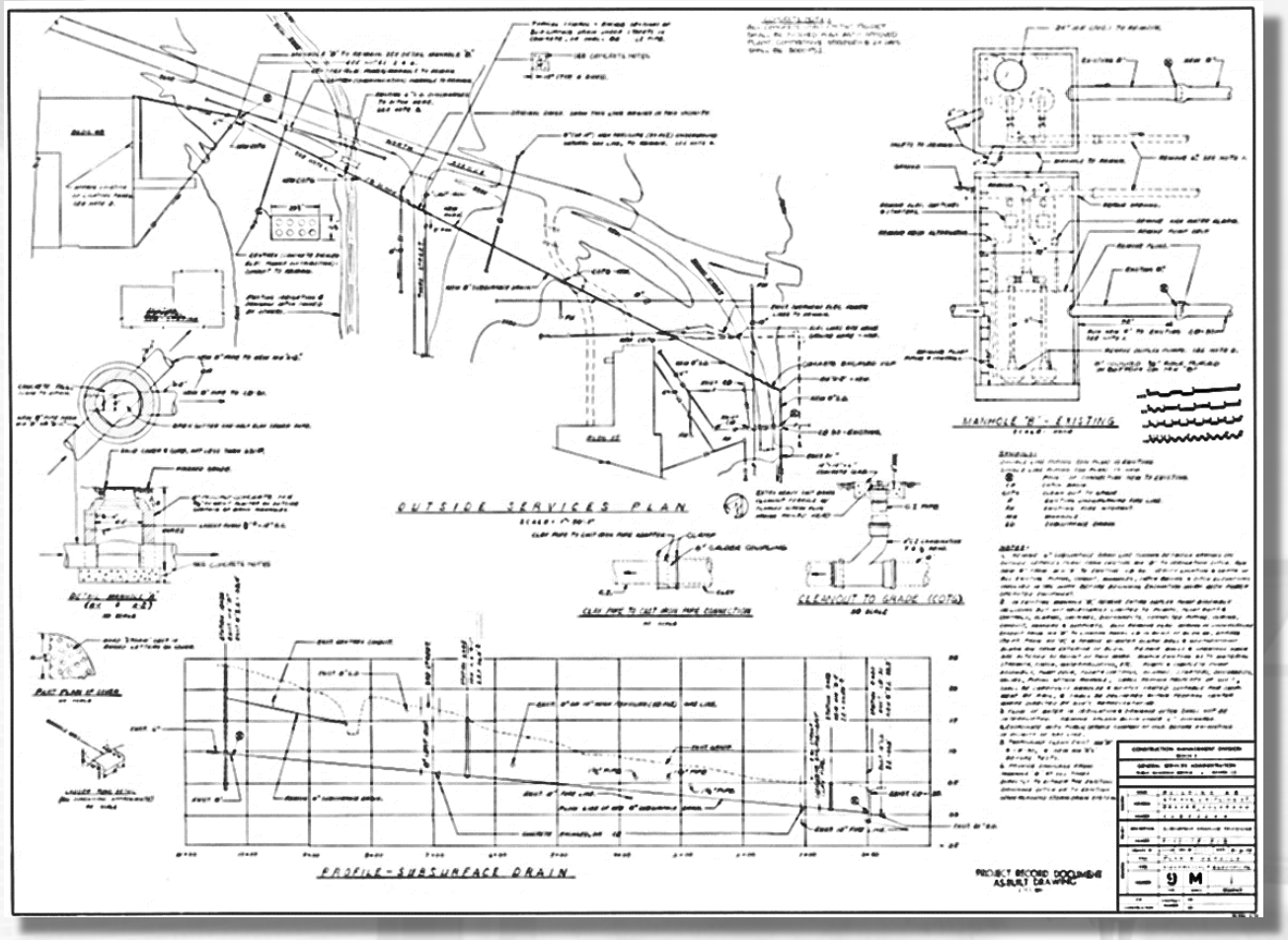
Energy	
Energy Net-Zero	
Baseline	Designs must be Energy Net-Zero ready on a source energy basis with onsite renewables that are designated on the plan for future installation including pathways, conduits, or other means of getting the power in the building.
Tier 1	Designs must be Energy Net-Zero ready with 25% onsite renewables installed and the remainder designated on the plan for future installation. At a minimum, comply with IgCC-2018 Section 701.4.1.1 (7.4.1.1) On-Site Renewable Energy Systems, however Exception 2 shall not apply.
Tier 2	Tier 1 + 50% onsite renewables installed.
Tier 3	Tier 1 + 100% renewables installed.
M & V	Report the projects ongoing energy performance in a sustainability benchmarking platform
Plans & Specs	Y
Calculations & Analysis	Provide 90.1 Appendix G energy model and calculations for proposed and installed renewable energy.
References	
Basis of Design	Show project is energy net-zero ready, on a source energy basis, and achieves actual annual delivered energy less than or equal to the on-site and/or proposed renewable exported energy.
Construction Verification	CX agent to confirm installed renewables supply the required power to meet the high-performance tiers.

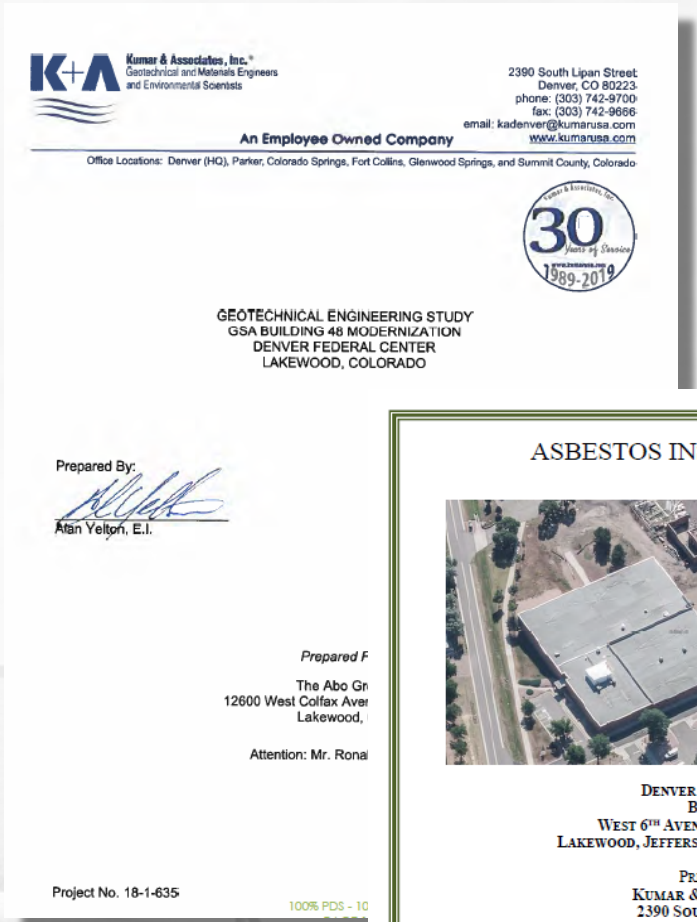
Water	
Water Net-Zero	
Baseline	Meet current policy including EISA sec. 438.
Tier 1	Designs must be Water Net-Zero ready with 50% potable water returned to the original water source on site.
Tier 2	Designs must be Water Net-Zero ready with 75% potable water returned to the original water source on site.
Tier 3	Comply with IgCC-2018 Chapter 6, W (5.3.4.1) Projects on Greenfields.
M & V	Report the project's ongoing water p
Plans & Specs	Y
Calculations & Analysis	Provide calculations for water-use ba water returned to the original water

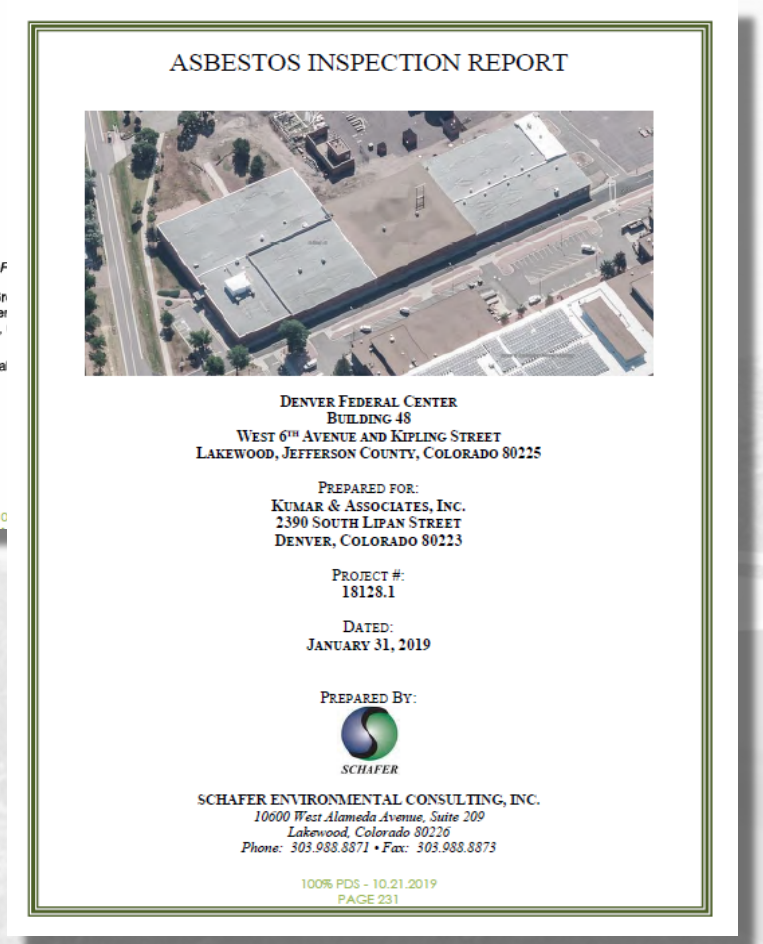
2018 P100 Performance Matrix	Place an X for each requirement					
Attribute	Baseline	Tier 1	Tier2	Tier 3	N/A	Notes (Describe how design meets performance or any waivers from a requirement)
1.7.2 Sustainable Performance Requirements						
Energy						
Energy Net Zero	X	X	X	X		GSA allocated 1,067,817 kWh/yr of PV to the site. Design is net-zero ready based on source energy. Preliminary energy simulations show an additional 200 kW of PV is needed to achieve net zero energy.
Water						
Water Net Zero	x					EISA section 438 Stormwater Management goals are met in the baseline design by retaining rainfall from 95th percentile event on site and infiltrating the rainwater through raingardens and porous pavers to soils below the parking lot.
High Performance Building Technologies						
GSA Proving Ground	X	X				Base design incorporates condensing boilers and LED fixtures.
Construction Personnel						
Green Credentialed	X					Tier 1-3 for Subcontractor credentials not feasible.

PERFORMANCE REQUIREMENTS

- Performance based goals focusing on the end result
- Baseline is the standard
  - Owner can specify a higher tier if desired
  - Proposals can be evaluated and higher scores can be provided for teams which exceed the baseline







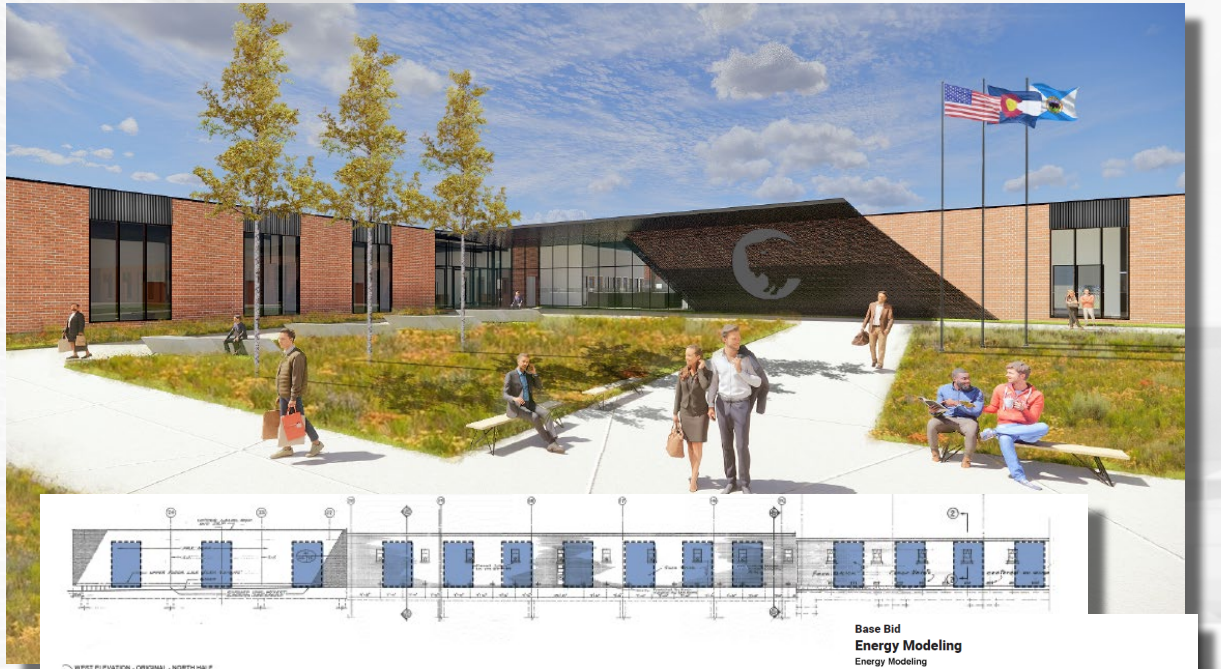
SUPPORTING DOCUMENTATION

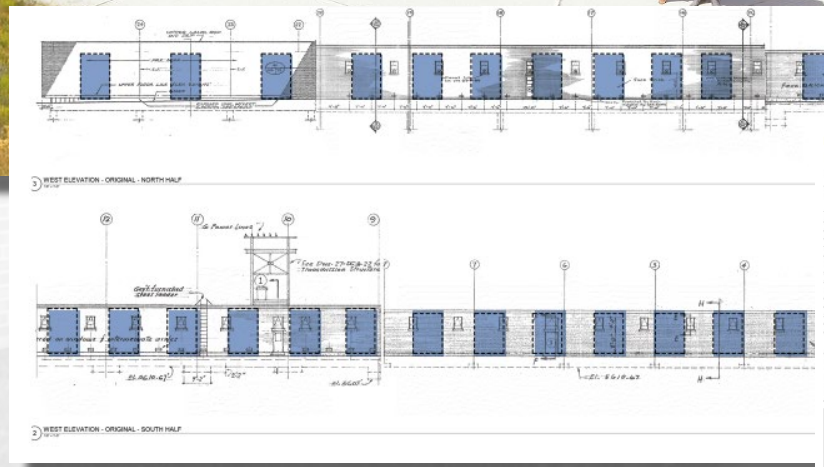
- Studies
- Hazardous materials reports
- As-Built Conditions

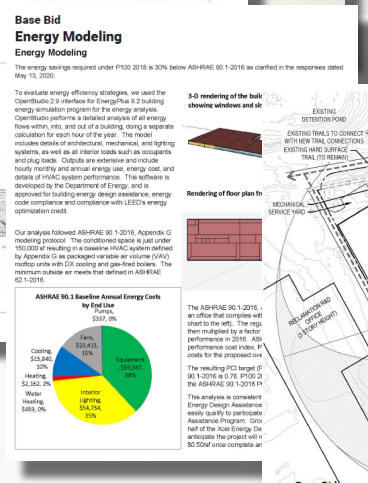
ELECTRIFICATION & DESIGN BUILD PROPOSAL

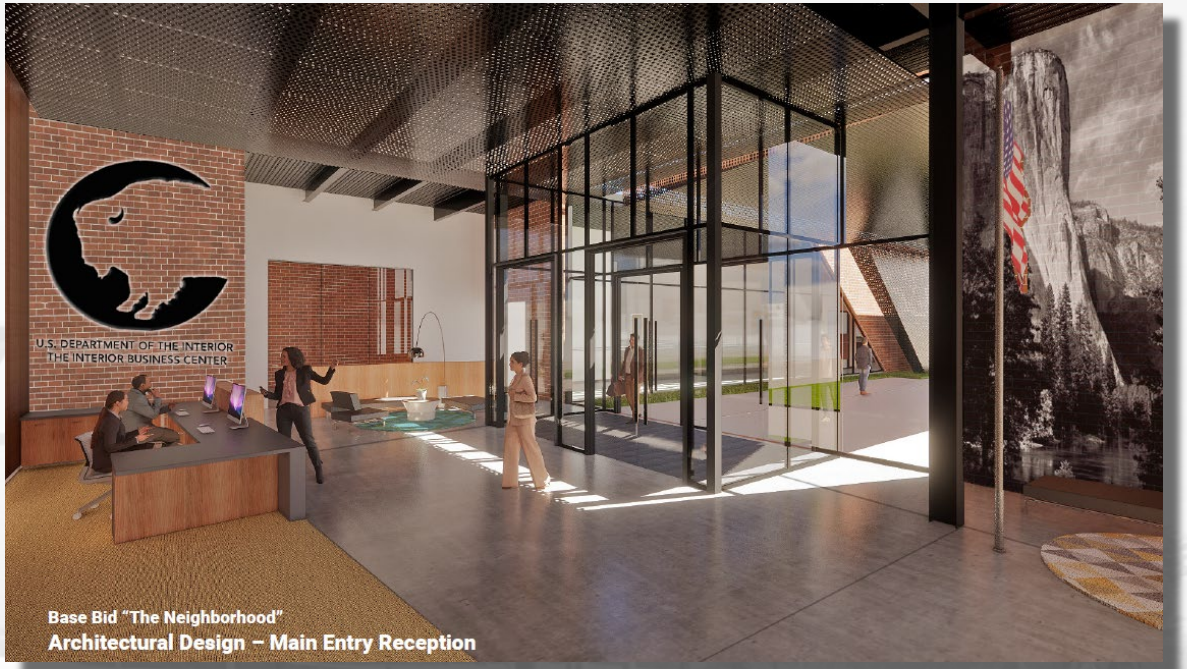
BASE PROPOSAL:

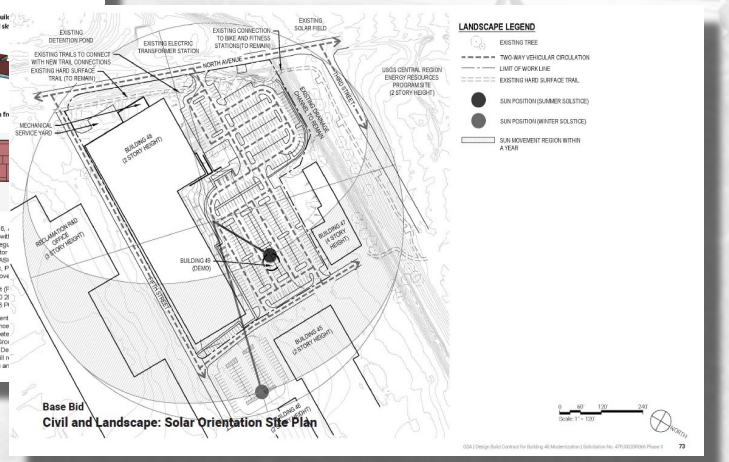
- Meets Performance and Prescriptive Requirements of the Proposal
- Combination of Narrative, Drawings, Cut Sheets, and Renderings





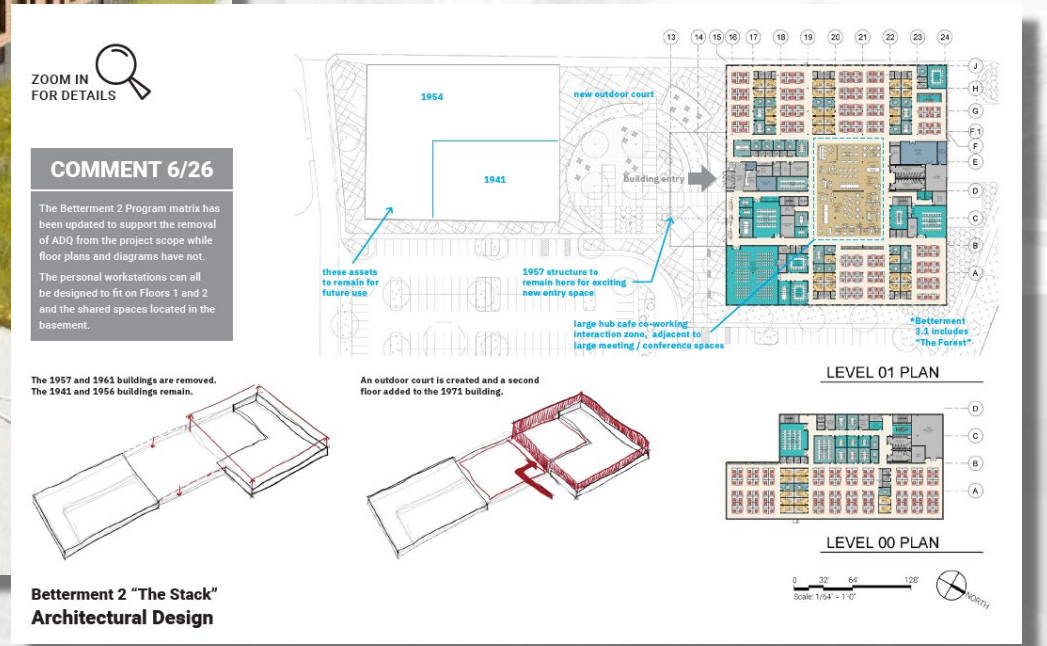






BETTERMENTS:

- Empower the Design Build Team explore self proposed alternatives
- Design Builder breaks out cost information for each betterment



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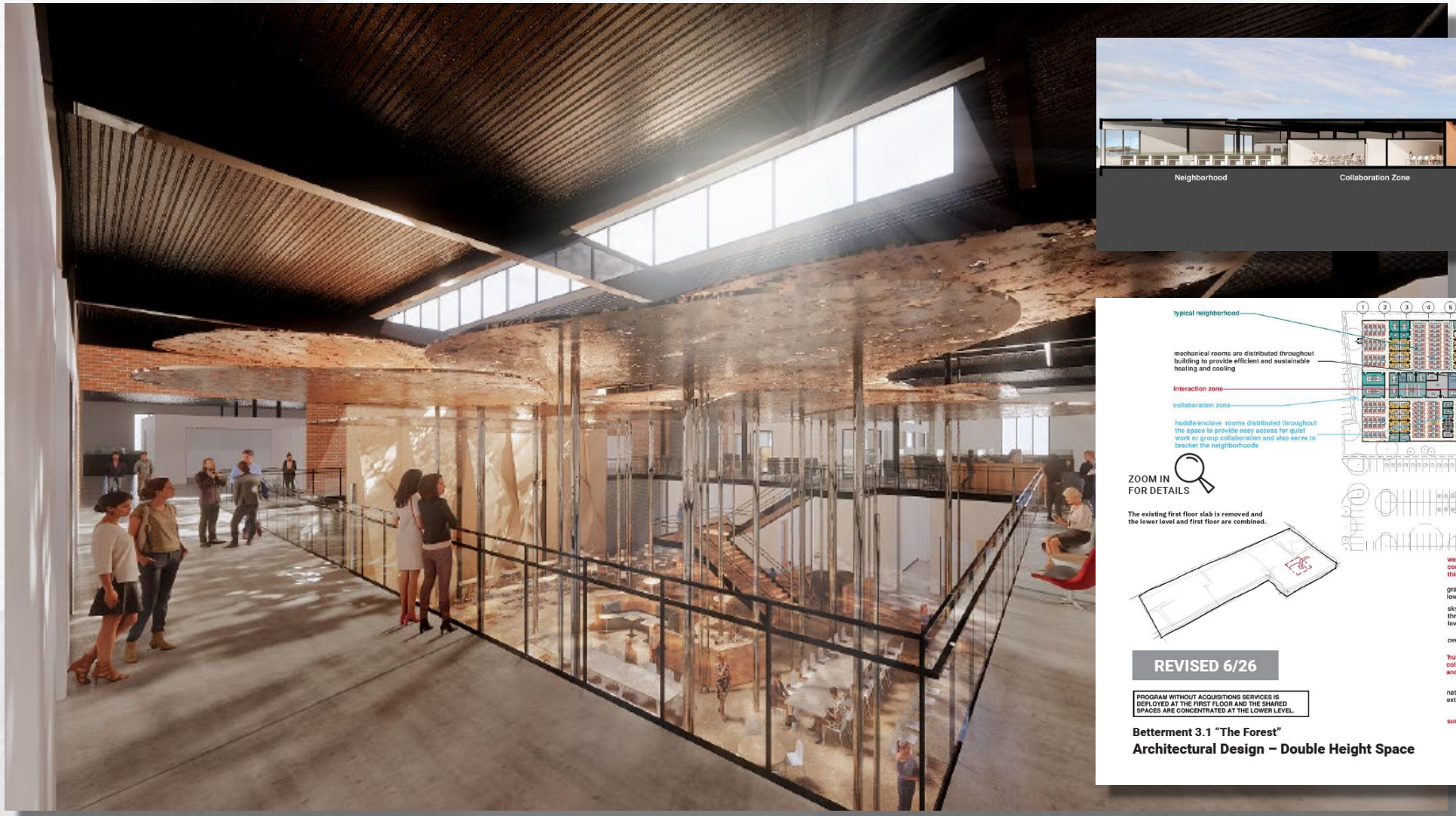
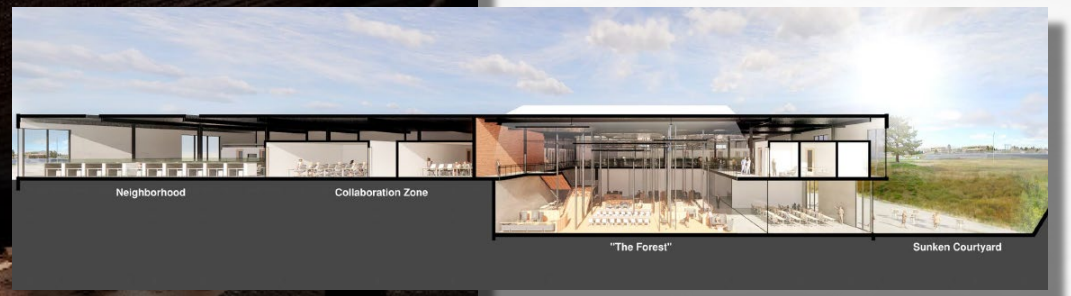
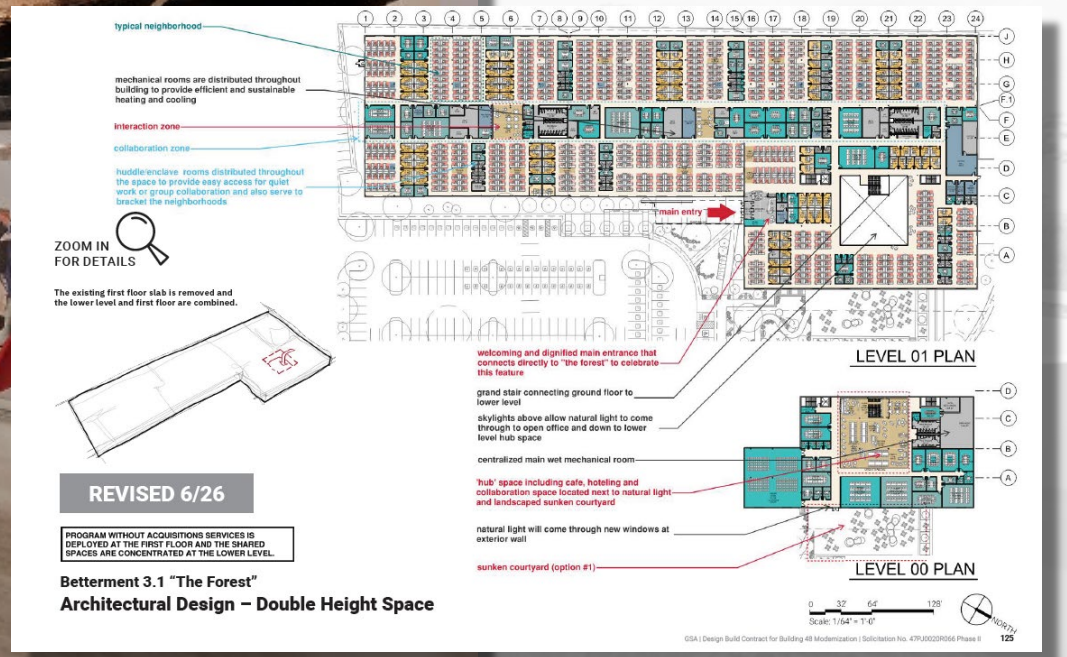






BETTERMENTS:

- Empower the Design Build Team explore self proposed alternatives
- Design Build Team breaks out cost & technical information for each betterment

Miscellaneous Betterments
3.2 to 3.7

Betterment 3.2: Covid Response Mechanical system
The design build team offers a betterment air handling system which is the same WSHP based system with a Displacement Ventilation distribution and dedicated outside air systems (DOAS). Displacement Ventilation delivers air at the floor, which pools and seeks out heat sources like people and equipment. This air is drawn to the heat source and rises in a plume, taking the heat from the source. This air naturally rises to the upper areas of the space, drawing further new air to the occupant, constantly flushing the breathing zone of contaminates with a generally unidirectional flow of air.
(see following pages)

Betterment 3.3: Carbon net-zero on-site production mechanical system
The team has a betterment to provide three electric boilers in lieu of the modulating condensing natural gas boilers which would remove the need for natural gas to the building and reducing the building's site carbon footprint with no fossil fuels consumed on site. All other components and design points of the heating water system remain the same as the base bid.
(see following pages)

Betterment 3.4: Demountable partitions
Betterment is for the Betterment-1 or Betterment-2 only and replaces the office fronts (Door/frame/hardware, Glass and Drywall) with DIRTT sliding doors, and office fronts.

Betterment 3.5: 200kw PV array on Roof
200kw Photovoltaic system on roof of buildings 1957 and 1961. Minor structural upgrades are included to the roof of the 1956, 1961, and 1971 buildings to accomodate the 200kw and future PV array expansion.

Betterment 3.6: Work Place Strategy - Change Implementation
Provide consulting services during construction to help IBC stakeholders make a successful transition into new ways of working. Supports the roll-out of the change strategy leading up to the occupancy of the new workplace. Key areas of focus include content creation and coordination of change network engagement. Anticipated duration is six months and will commence at least four months prior to move-in / occupancy, with at least two months post-occupancy change management support.

Betterment 3.7: Ultra Violet light system and HEPA
This system is to add HEPA filters and a UV light filtration system into the 4 main indoor AHUs providing all of the ventilation air to the space. Though this is not guarantee that contaminants such as viruses do not enter and/or get filtered in the air stream it assists in the removal of contaminants.

Common considerations for HVAC systems design and operation related to operating buildings during the COVID-19 pandemic include the following:

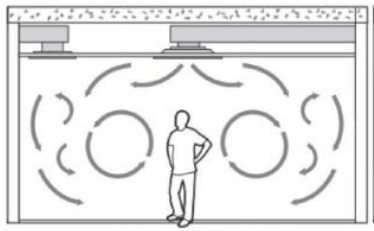
Passive filtration: ASHRAE has indicated that the use of MERV-13 filter media is effective in capturing the SARS-CoV-2 virus that causes the COVID-19 disease. This particular virus is large enough that it can be captured with conventional media. Upgrading to MERV-14 filter media would improve overall filter performance and capture rate.

The more efficient the filter media is, the higher will be the pressure drop associated with its use. It is possible to incorporate sufficient supply fan horsepower to account for the filters in new equipment and systems. The addition of improved filter media in existing systems will require evaluation of the impact on the existing supply fan and motor. Increasing the filter efficiency will increase energy usage for those fan systems. As part of the UVGI system (UV lights with filtration) betterment we have provided HEPA filters which have a higher filter efficiency than MERV-14.

Electronic filtration: ASHRAE documentation to date has indicated that UVGI (ultraviolet germicidal irradiation) systems can be used as an effective means of controlling the spread of the coronavirus. This type of electronic filter system using UV-C radiation can be installed in new equipment and retro-fitted to existing systems. It has been in use for many years for purification of both water and air systems. This has been provided as part of our UVGI system (UV lights with filtration) betterment.

Outdoor air control: Documentation from ASHRAE favors increasing the percentage of outdoor air that is delivered by an HVAC system into the occupied zone, in order to improve dilution. Central air handling systems with outdoor air economizer provisions already have this capability; however, the quantity of outdoor air that can be delivered will be limited by the heating and cooling capacity of the equipment and systems. The air handling units provided as part of our base bid have this capability. 100 percent outside air will be used only in cases where the outside conditions would not put excessive load on the system. This will help to mitigate excessive energy usage.

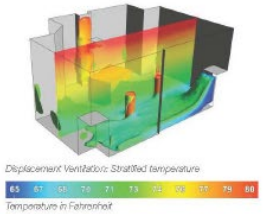
ASHRAE further has suggested disabling demand controlled ventilation, and running systems on a 24/7 basis, in order to increase the outdoor air circulation on a continuous basis. We have chosen not to provide this as it would more greatly affect our LEED criteria.



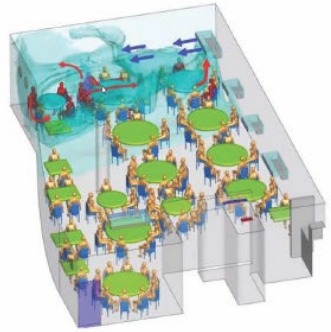
OVERHEAD MIXING VENTILATION

DISPLACMENT VENTILATION

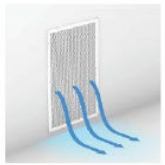
DISPLACEMENT VENTILATION WORKS BY LAYING A LOW VELOCITY BLANKET OF COOL AIR ON THE FLOOR. THIS COOL AIR STAYS LOW DUE TO NEGATIVE BUOYANCY, UNTIL IT FINDS A HEAT SOURCE, THEN CREATES A PLUME TO THE CEILING. THIS PLUME SWEEPS AWAY CONTAMINATES SUCH AS CO2, DUST, AND PATHOGENS



TYPICAL CFD MODEL OF TEMPERATURES IN A DV SUPPLIED ROOM. THE COOL AIR FLOWS AROUND FLOOR PLAN OBJECTS TO FIND A HEAT SOURCE.



CFD MODEL OF THE SUSPECTED PATHOGEN VECTORS OF A COVID OUTBREAK IN GUANGZHOU CHINA. THE HVAC UNITS ARE SHOWN TO BE RECIRCULATING FAN-COILS (VRF OR SIMILAR).



BASIC DV WALL DIFFUSER

CORNER DV DIFFUSER

EXPOSED DV DIFFUSER

CEILING DIFFUSER IS POSSIBLE, NEED TO LOCATE WHERE PEOPLE ARE NOT FIXED IN PLACE TO AVOID DRAFTS

ELECTRIFICATION

Considerations

- What is right for the building ‘Beneficial electrification’
- Maintenance personal
- Scope of planned renovations
- Electrical rates and possible renewables
- Equipment layout

Hurdles

- Service size
- Electrical room space
- Spare capacity requirements

QUESTIONS