PERFORMANCE DESIGN ASSIST: INTEGRATING SUSTAINABILITY, RESILIENCE AND WELLNESS

Presented by SEQUIL Systems Inc.

2019 FEFPA Summer Session
Boca Raton Resort & Club

SEQUIL

PERFORMANCE DESIGN-ASSIST

COURSE FOCUS *PDA, an Integrative Design Approach*

1. Provide guidance, experience and creativity towards incorporating sustainable, resilient and wellness features into the building's DNA.

2. Respond to emerging code changes due to energy, sea-level rise and healthy building desires.

3. Integrate best practices on these elements at a high level, allowing the design team to follow their instincts while delivering a performance-enhanced structure.

4. This course is approved for AIA 1 LU|HSW. Course Number 202.2019

5. GBCI/USGBC approval pending.

AIA Continuing Education Provider

SEQUIL SYSTEMS INC.

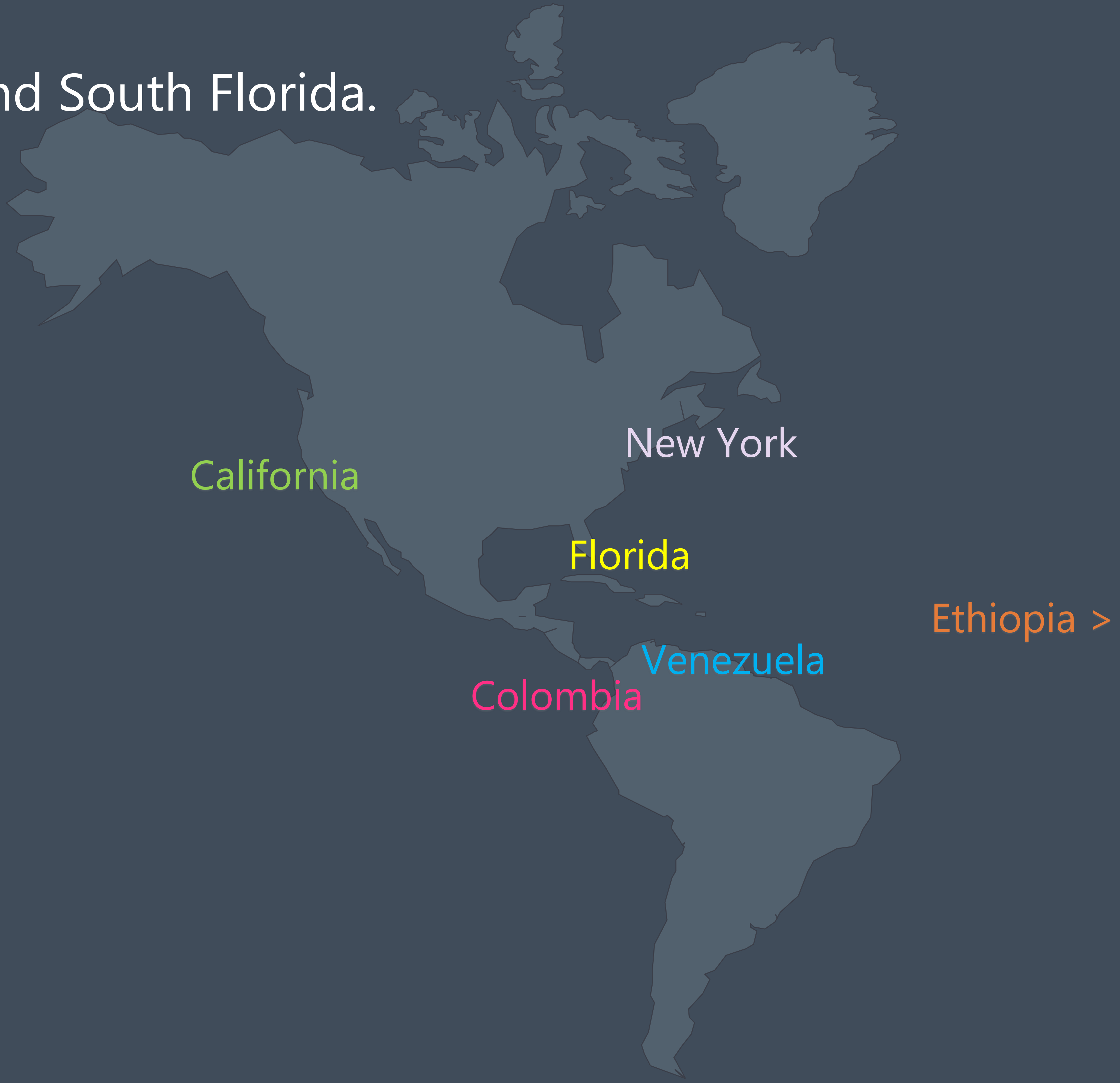
ABOUT US *Performance Consultants to the Built Environment*

SEQUIL Systems is a consulting firm created to provide support for building **owners, architects, developers**, and building design and construction **project teams** world-wide.

SEQUIL is located in Delray Beach, but our projects reach far beyond South Florida.

Establish **efficiency** + **sustainability** + **wellness** + **adaptation** guidelines that create high-performance sustainable and resilient structures that provide healthy environments for their occupants.

We ensure that design philosophies, strategies and decisions are made with absolute consideration of energy, internal, and external environments.



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SET GOALS AND EXPECTATIONS *Designing for Performance*

SURE THERE'S THE PROGRAM. BUT WHAT ABOUT PERFORMANCE?

- The architect and engineers may try to design efficient systems…but to code.
- In a performance-based design approach, performance goals are developed during the initial stages of the design.
- The design team should buy into the goals, and it is most effective when the design team is involved in establishing the goals.
- The Integrated Design Process Guideline provides examples of how goals can be integrated into the design process

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SET GOALS AND EXPECTATIONS *In Design Phase*

TALK IS CHEAP!

So communicate. A lot.

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<u>SET</u> GOALS AND EXPECTATIONS *In Design Phase*

INSTRUCTION MANUALS

How to DESIGN the building – IDP, OPR, BOD

How to BUILD the building – Const. Docs, Submittals

How to OPERATE the building – O&Ms, Cx Manuals, Training

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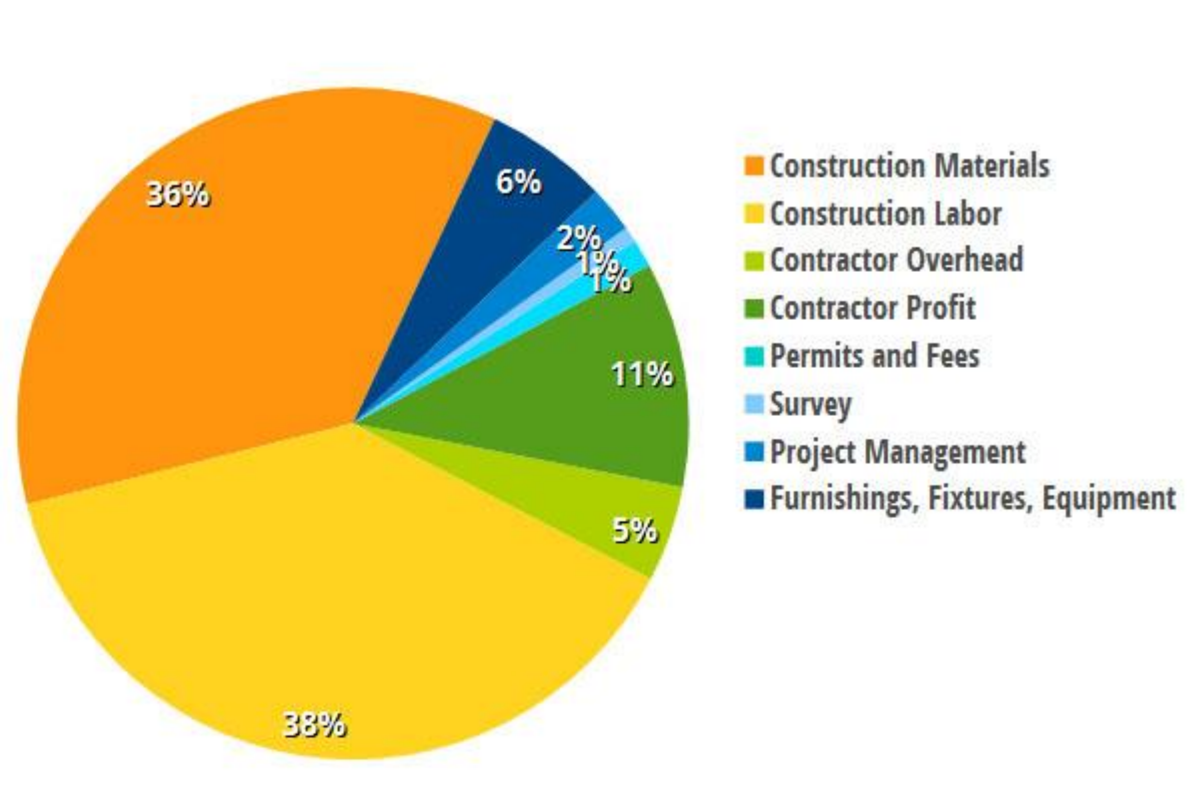
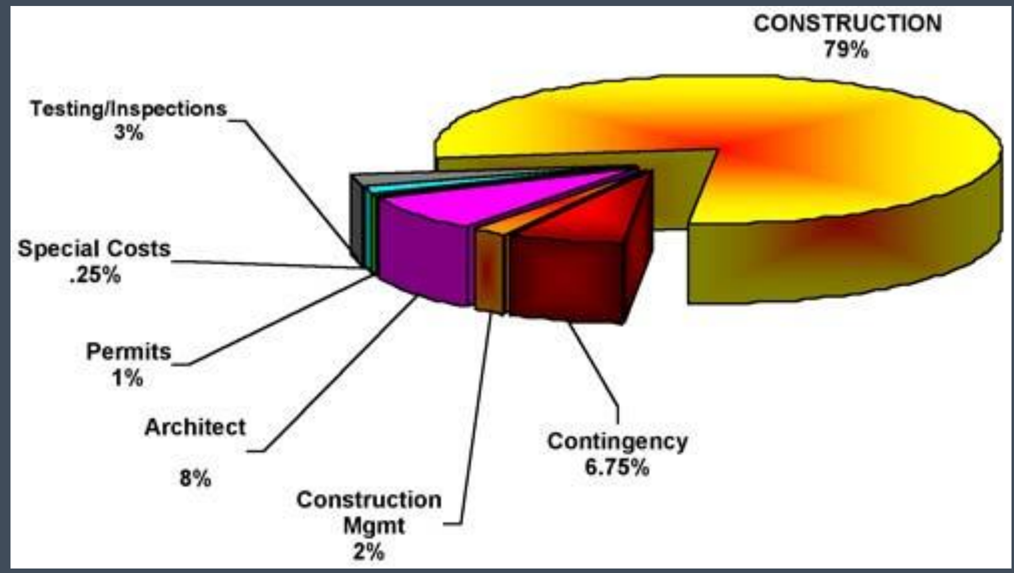
SET GOALS AND EXPECTATIONS *In Design Phase*

TRUE COST ASSESSMENT

High-performance buildings are only more expensive when you bolt on efficiencies to a conventionally-designed project.





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SET GOALS AND EXPECTATIONS *In Design Phase*

TOP-DOWN APPROACH

Design down from a DREAM building, rather than up from a DRAB building.

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SET GOALS AND EXPECTATIONS *Integrative design from the beginning*

INTEGRATED DESIGN TEAM

Taking a DEEP DIVE into performance by design

Performance Based Design ≠ Performance

Clearly define ownership goals

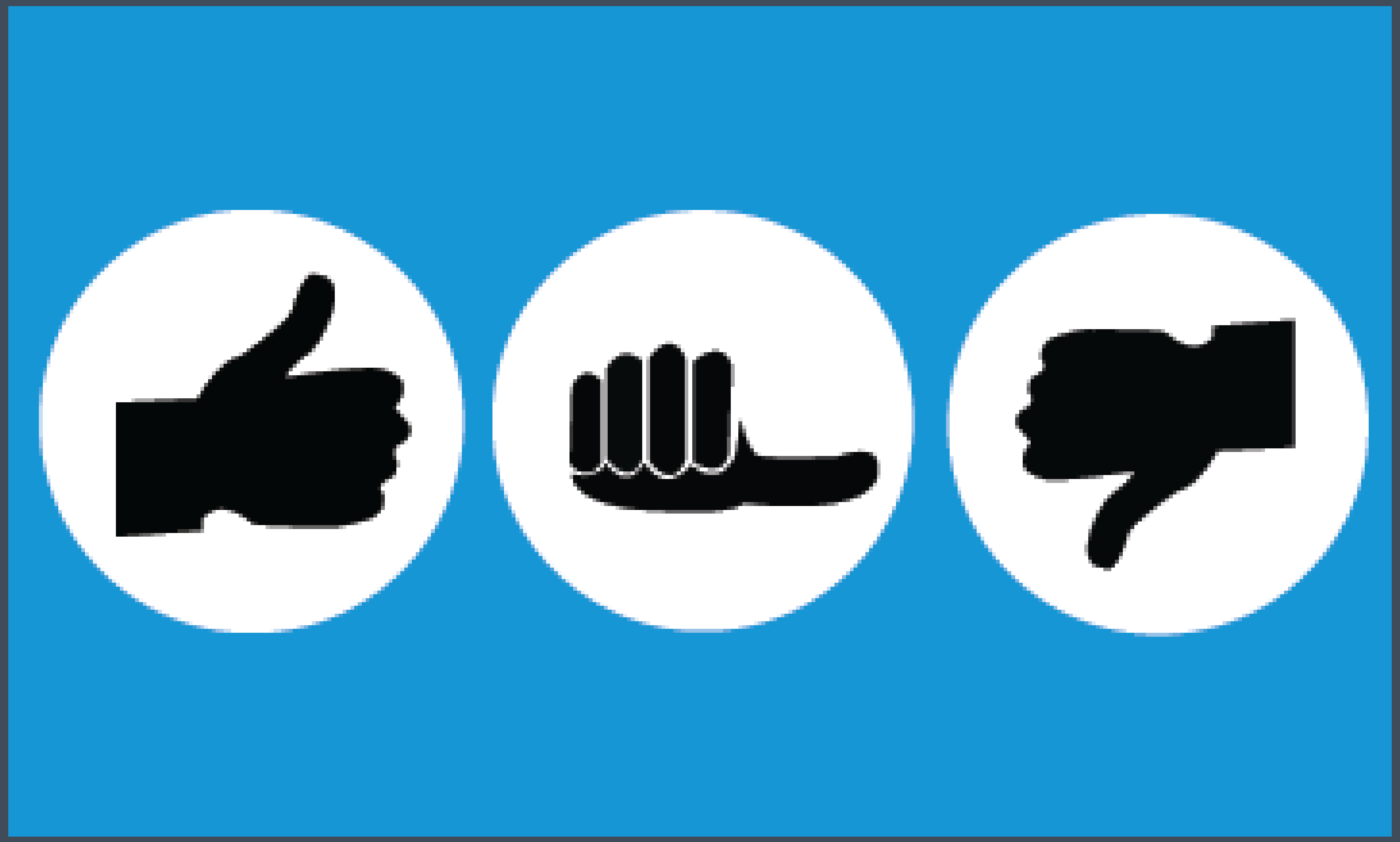
Team communication

PERFORMANCE DESIGN-ASSIST

SET GOALS AND EXPECTATIONS *Integrative design from the beginning*

INTEGRATED DESIGN TEAM

- *New set of skills and priorities*
- *DIVERGENCE IN DESIGN SOLUTIONS can be common when team members are working in too much isolation*
- *Life Cycle Analysis*
- *TRACKING AND ASSURANCE*



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MEET GOALS AND EXPECTATIONS *In Design Phase*

QUANTITATIVE ANALYSIS

Use ENERGY MODELING to document building performance and inform the design.

Reveal BIG BOLD TARGETS for improvements

Use MEASURABLE GOALS to VERIFY and REASSESS

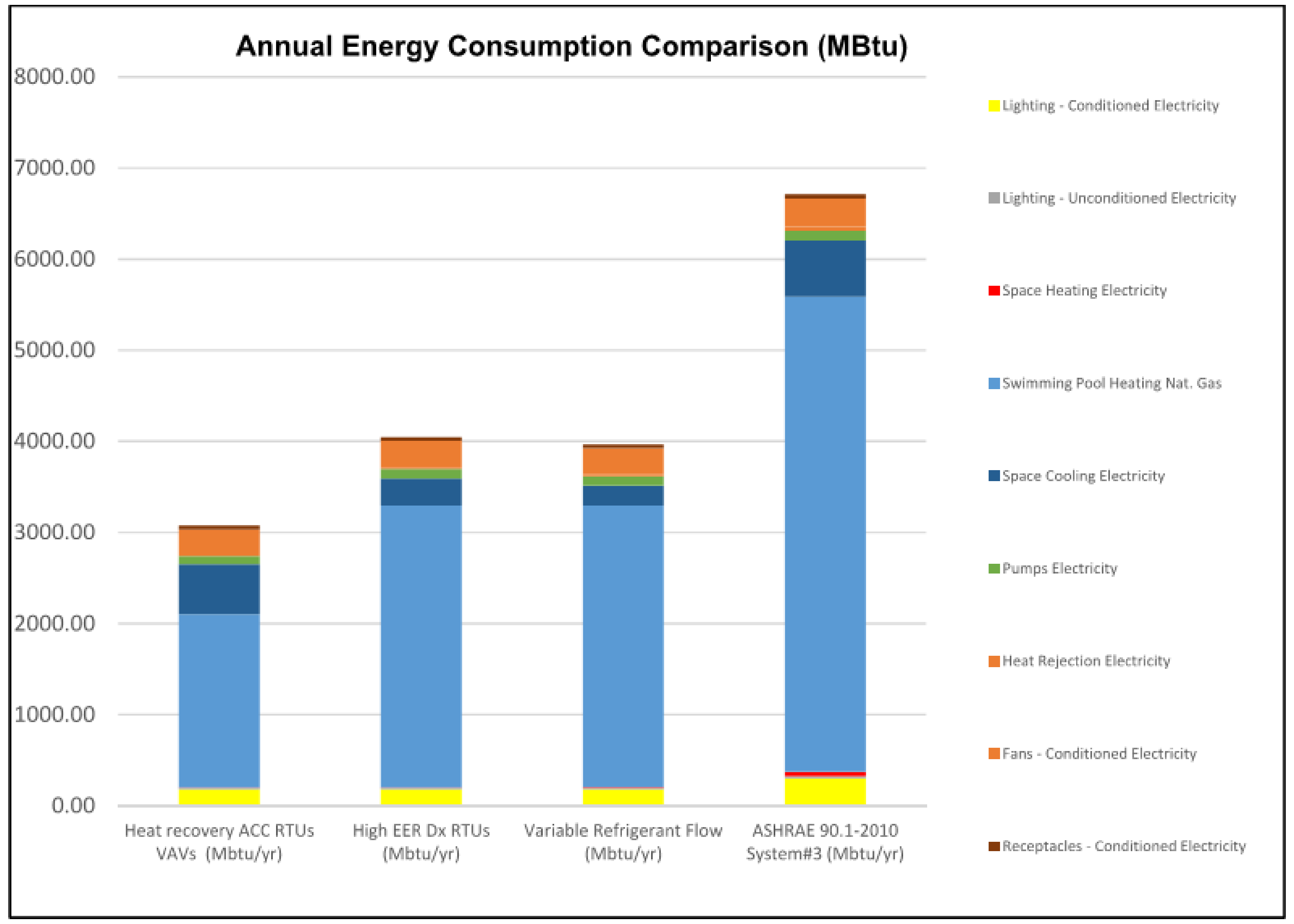

Figure 1: Comparison of annual energy cost for the baseline (1) and current design (2), broken down by end use, and the high-efficiency Package 1 (3) and Package 2 (4) as outlined in the table below.

Run	Strategy	Annual Energy Cost	Annual Savings Relative to Baseline	% Cost Savings (LEED)	LEED Points	Nat. Gas Consumption (therms)	Electric Consumption (kWh)	Electric Demand (kW)
LEED Baseline	LEED Baseline - ASHRAE 90.1-2010	$61,603				52,117	545,845	134
Proposed	Heat Recovery ACC	$45,535	$16,068	26.1%	11	19,311	426,214	98
1	High Performance RTUs	$40,334	$21,269	34.5%	13	31,147	360,914	89
2	Variable Refrigerant Flow	$37,933	$23,670	38.4%	15	30,917	337,507	72

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MEET GOALS AND EXPECTATIONS *In Design Phase*

QUANTITATIVE ANALYSIS

DEFINE energy-saving goals

ESTABLISH ROI timeline

CREATE ECMs

Energy Math

Reduced consumption = Reduced cost

Energy Cost Budget / PRM Summary

	Date: May 06, 2018
City: Miami Florida	Weather Data: MIA FY, FLorida

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the ECB study.

		* Alt-1 Water Cooled Chillers wi			Alt-2 ASHRAE 9012010 System8			Alt-3 Air Cooled Chillers		
		Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	1,455.7	10	342	2,493.8	171	598	1,455.7	100	342
Lighting - Unconditioned	Electricity	816.0	6	206	1,002.6	123	245	816.0	100	206
Space Heating	Electricity	59.2	0	1,168	332.9	563	3,584	70.2	119	1,178
Space Cooling	Electricity	4,575.1	31	1,867	5,900.6	129	2,497	8,232.8	180	3,668
Pumps	Electricity	2,061.4	14	360	3,542.1	172	495	951.1	46	289
Heat Rejection	Electricity	1,349.9	9	226	2,589.7	192	353	1,907.5	141	760
Fans - Conditioned	Electricity	1,970.2	13	619	2,781.2	141	1,236	1,970.2	100	619
Receptacles - Conditioned	Electricity	480.6	3	103	480.6	100	103	480.6	100	103
Stand-alone Base Utilities	Electricity	1,595.2	11	623	1,805.2	113	674	1,595.2	100	623
	Gas	401.2	3	150	802.4	200	300	401.2	100	150
Total Building Consumption		14,764.4			21,731.1			17,880.5		

		* Alt-1 Water Cooled Chillers w	Alt-2 ASHRAE 9012010 System8	Alt-3 Air Cooled Chillers
Total	Number of hours heating load not met	8	4	8
	Number of hours cooling load not met	27	0	27

	* Alt-1 Water Cooled Chillers w		Alt-2 ASHRAE 9012010 System8		Alt-3 Air Cooled Chillers	
	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr
Electricity	14,363.3	426,731	20,928.8	621,792	17,479.3	519,308
Gas	401.2	481	802.4	963	401.2	481
Total	14,764	427,213	21,731	622,755	17,880	519,790

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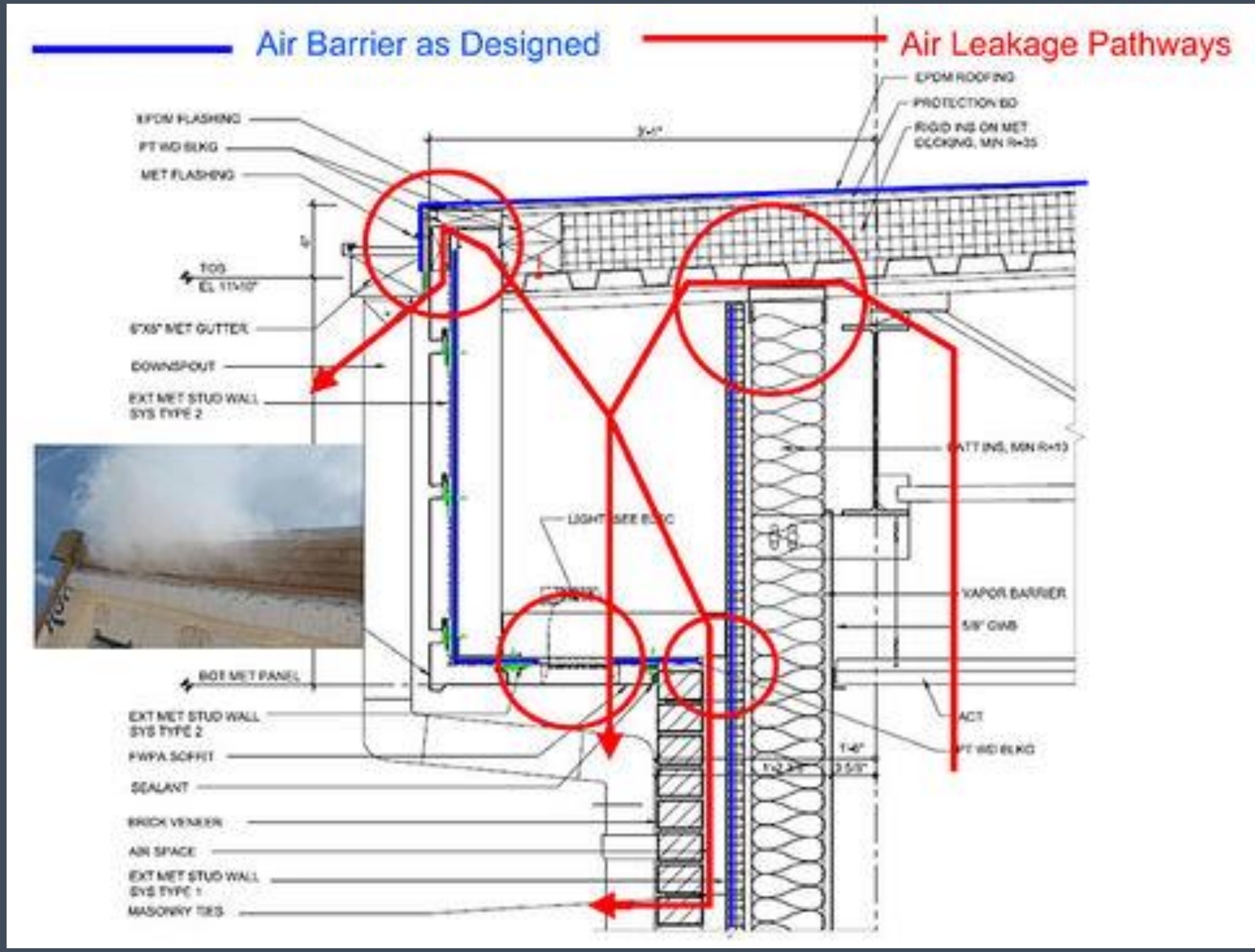
MEET GOALS AND EXPECTATIONS *In Design Phase*

BUILDING ENVELOPE

Modern Design (REVIT) + Construction (Prefab) technologies

Increasing precision and building tightness

Envelope Commissioning



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MEET GOALS AND EXPECTATIONS *In Design Phase*

BUILDING ENVELOPE

Consider Window-to-Wall Ratios

Better Envelope = Better building performance

Couple Envelope with:

- *System Improvements*
- *Automation*
- *Expectations*

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *In Design Phase*

ACCOUNTABILITY

Assign responsibilities for TRACKING and ASSURING building performance

INTEGRATED PROJECT DELIVERY…FOR SCHOOLS

An approach that involves people, systems, and business structures (contractual and legal agreements) and practices. The process harnesses the talents and insights of all participants to improve results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction. (Adapted from American Institute of Architects).

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SET GOALS AND EXPECTATIONS *Integrative Design Process*

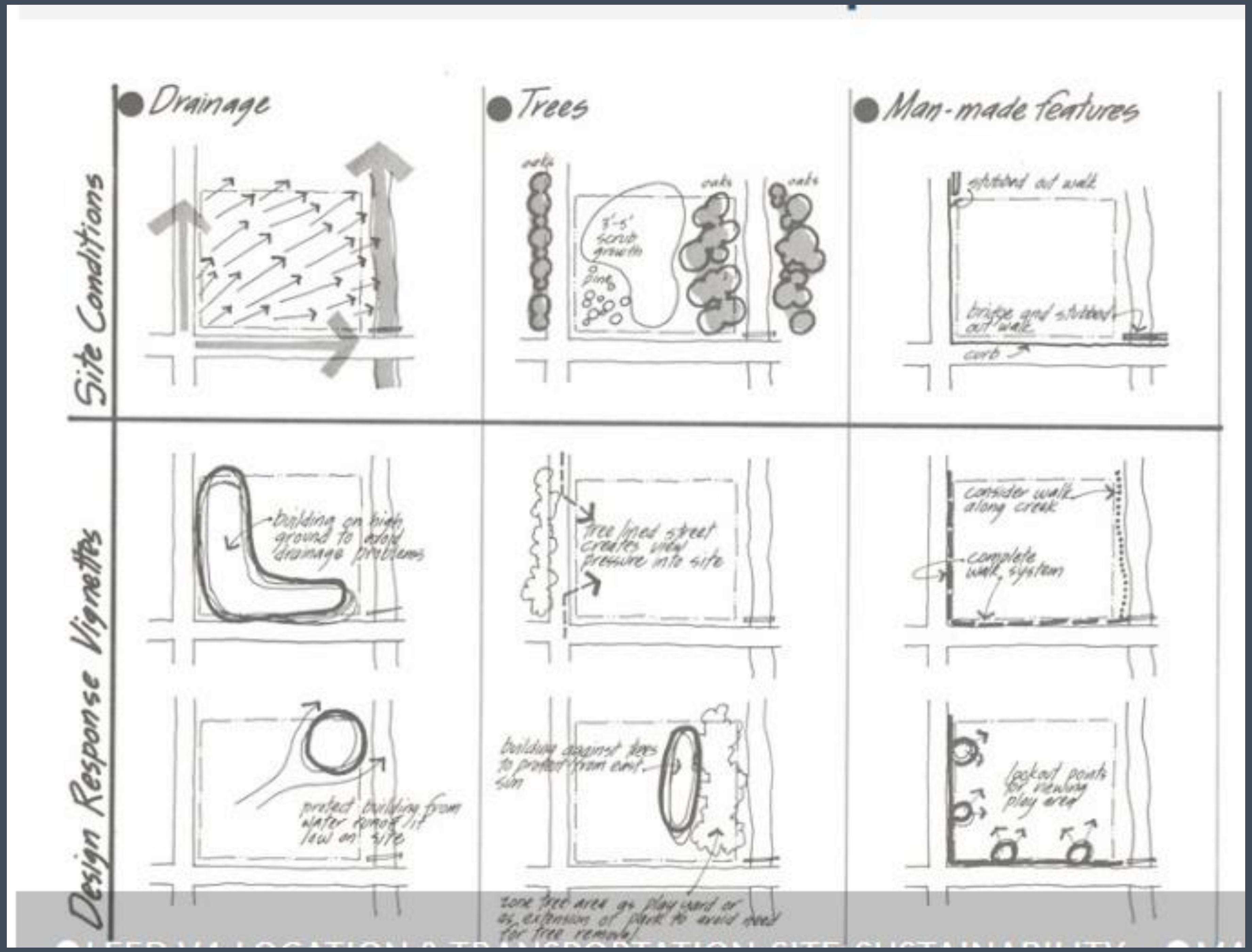
PRE-DESIGN PRACTICE

Early definition of performance goals

Identify synergies across disciplines

Bake these into the design

>> Early and lasting impact on building performance



(Source: http://www.archecology.com/category/leed-v4/)

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SET GOALS AND EXPECTATIONS *Designing for Performance*

ENERGY

- Site conditions
- Massing and Orientation
- Basic envelope attributes
- Lighting levels
- Thermal comfort ranges
- Plug and Process load analysis
- Program and operations
- Energy consumption, reduction

WATER

- Indoor water demand
- Outdoor water demand
- Process water demand
- Supply sources – potable, non-potable

PERFORMANCE DESIGN-ASSIST

SET GOALS AND EXPECTATIONS *Designing for Performance*

SITE SELECTION

- ❑Building site attributes
- ❑Transportation to/from
- ❑Occupant and community well-being

RESILIENCE

- ❑Hazard assessment
- ❑Climate assessment
- ❑Service life of facility
- ❑Duration disruption

WELLNESS

- ❑Establish health goals, targets
- ❑Prioritize design strategies
- ❑Anticipate outcomes
- ❑Analyze impact on population health behaviors

PERFORMANCE DESIGN-ASSIST

SET GOALS AND EXPECTATIONS *Designing for Performance*

- ❑ Efficiency
- ❑ Life-cycle analysis
- ❑ Operations
- ❑ Resource conservation

- ❑ LEED
- ❑ FGBC
- ❑ NGBS

- ❑ Sea Level Rise
- ❑ Flooding and Climate
- ❑ Education
- ❑ Adaptation

- ❑ Fundamental Energy Modeling
- ❑ Enhanced Energy Modeling
- ❑ Performance Design Assistance
- ❑ Energy Conservation Consulting

- ❑ Air/Light/Water
- ❑ Comfort
- ❑ Mind
- ❑ Safety

- ❑ Fitwel
- ❑ WELL Building

- ❑ Fundamental Commissioning
- ❑ Enhanced Commissioning
- ❑ Envelope Commissioning

- ❑ Occupancy Commissioning
- ❑ Continuous Commissioning
- ❑ Enterprise Commissioning

WHAT ABOUT ZERO ENERGY?

- Energy consumption represents the second highest operational expense to schools, second only to salaries.
- Each year, a significant portion of taxpayer dollars are spent on school utility expenses, thereby cutting into funding that could be allocated to resources for students.
- On average, zero energy schools can use between **65%–80% less energy** than conventionally constructed schools, and the remaining energy required is supplied by renewable energy.
- In addition, zero energy schools can become prominent community landmarks that educate a new generation of students with science, technology, engineering, and mathematics (STEM) skills critical to our nation's future.

(source: U.S. Department of Energy Better Building Initiative)

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Designing for Performance*

SUSTAINABLE DESIGN INTEREST QUESTIONNARE

SUSTAINABLE DESIGN INTEREST QUESTIONNARE

			YES	NO
1	School as a Teaching Tool	Provide school staff with the knowledge to identify what supports or impedes healthy, resource-efficient and environmentally sustainable learning spaces; and the foundation for imparting that knowledge to their students. Additionally, educate students on the connections between the built and natural environment; and the knowledge, skills, and behaviors to recognize and apply that learning in their own school facility.	✓	
2	Bike racks and showers	Provide covered bicycle storage for at least 5% of regular building occupants, but no fewer than four storage spaces per building. AND Provide at least one on-site shower with changing facility for the first 100 regular building occupants (excluding all students).	✓	
3	Carpool parking spaces	Provide reserved parking for those who carpool to school	✓	
4	Electric Vehicle Charging Stations	Provide at least 1 station serving 2 electric vehicles for those who drive electric vehicles to school	✓	
5	Green buses	Develop and implement a plan for every bus serving the school to meet certain emissions standards within **seven years** of the building certificate of occupancy.		✓
6	4th Level Courtyard: native landscape	To conserve and restore areas to provide habitat and promote biodiversity. To use as a teaching tool for students showing plants that are native to South Florida.	✓	
7	4th Level Couryard: restorative garden space	Providing a therapeutic landscape amenity, such as a restorative garden, improves employee mental health, reduces stress levels, and improves productivity.	✓	
8	4th Level Couryard: fruit and vegetable garden space	Providing on-site gardening opportunities contributes to increased physical activity levels and social capital benefits from working in the gardens. In addition, convenient access to healthy food helps improve diets for everyone.	✓	
9	Stairwell active design	Active design strategies in stairwell design include, but are not limited to, posting motivational signs, installing a music system or creative lighting, moderating stairwell temperature, adding rubber treading to stairs, painting walls a bright color, and hanging framed artwork.	✓	
10	Ventilation	Provide mechanical ventilation in all rooms and provide separate ventilation in all areas with chemical use or storage	✓	
11	Daylight	To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylight into the space. Provide manual or automatic (with manual override) glare-control devices for all regularly occupied spaces.		✓
12	Permanent educational signs promoting hand-washing in bathrooms	To help reduce the transmission of diarrheal and respiratory infections, potentially reducing absenteeism.	✓	

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Designing for Performance*

SUSTAINABLE DESIGN INTEREST QUESTIONNARE

13	Water Bottle Refilling Station at every floor	The ability for students and faculty to refill water bottles with potable water can lead to improved hydration and decreases in consumption of sugar-sweetened beverages, potentially leading to decreased obesity and related health problems.	✓	
14	Healthy Vending	Adopting healthy food and beverage standards can increase student and faculty access to healthy food and beverages, and decrease access to competing food and beverages, leadign to increased well-being.	✓	
16	Green (Vegetative) Roof	To be used as a teaching tool, to help deflect heat from the building, and to provide a habitat for animals		✓
17	Reflective Roof	To help deflect heat away from the building	✓	
18	Photovoltaic panels (Solar Panels) and/or Wind Turbines and/or Solar hot water	To be used to provide a certain amount of power for the school's use and use as a teaching tool. There are tax incentives and other benefits out there.	✓	
19	Water Cistern	To be used to collect raintwater for irrigation use such as for the courtyard landscaping	✓	
20	Low flow plumbing fixtures	Reducing the amount of water used for plumbing such as 1.1 gpf toilets, 0.125 gpf urinals, 0.5 gpm lavatories, 1.5 gpm showers, and 1.5 gpm kitchen faucets.	✓	
21	Advanced Energy Metering	Installing a Building Automation System that monitors all electrical consuming systems including mechanical systems, lighting systems, plug-loads, etc. A good tool to be studied by students and helpful for building operators	✓	
22	Recycling	Provide recycling waste bins thorughout the building and provide descriptions of waste that can be recycled	✓	
23	Enhanced Indoor Air Quality Strategies	Providing 10 feet long walkoff mats in all interior spaces entrered from the outside and/or carbon dioxide monitors		
24	Lighting controllability	To promote occupants' productivity, comfort, and well-being by providing high-quality lighting. For at least 90% of individual occupant spaces, provide individual lighting controls that enable occupants to adjust the lighting to suit their individual tasks and preferences, with at least three lighting levels or scenes (on, off, midlevel). Midlevel is 30% to 70% of the maximum illumination level (not including daylight contributions).	**TBD**	**TBD**
25	Visibility to systems	Providing transparency for students and teachers to study/see the Chiller Room on the ground floor by having vision glazing along the cooridor	✓	
26	Quality Views	Providing vision glazing for 75% of all regularly occupied floor area to give building occupants a connectino to the natural outdoor environment by providing quality views.	✓	
27	Acoustic performance	Design classrooms and other core learning spaces to meet the sound transmission class (STC) requirements of ANSI S12.60–2010 Part 1, or a local equivalent. Exterior windows would have an STC rating of at least 35, unless outdoor and indoor noise levels can be verified to justify a lower rating.	✓	
28	Chiller System	Consider using a water-cooled chiller vs an air-cooled chiller to capture more energy efficiency/savings.	✓	

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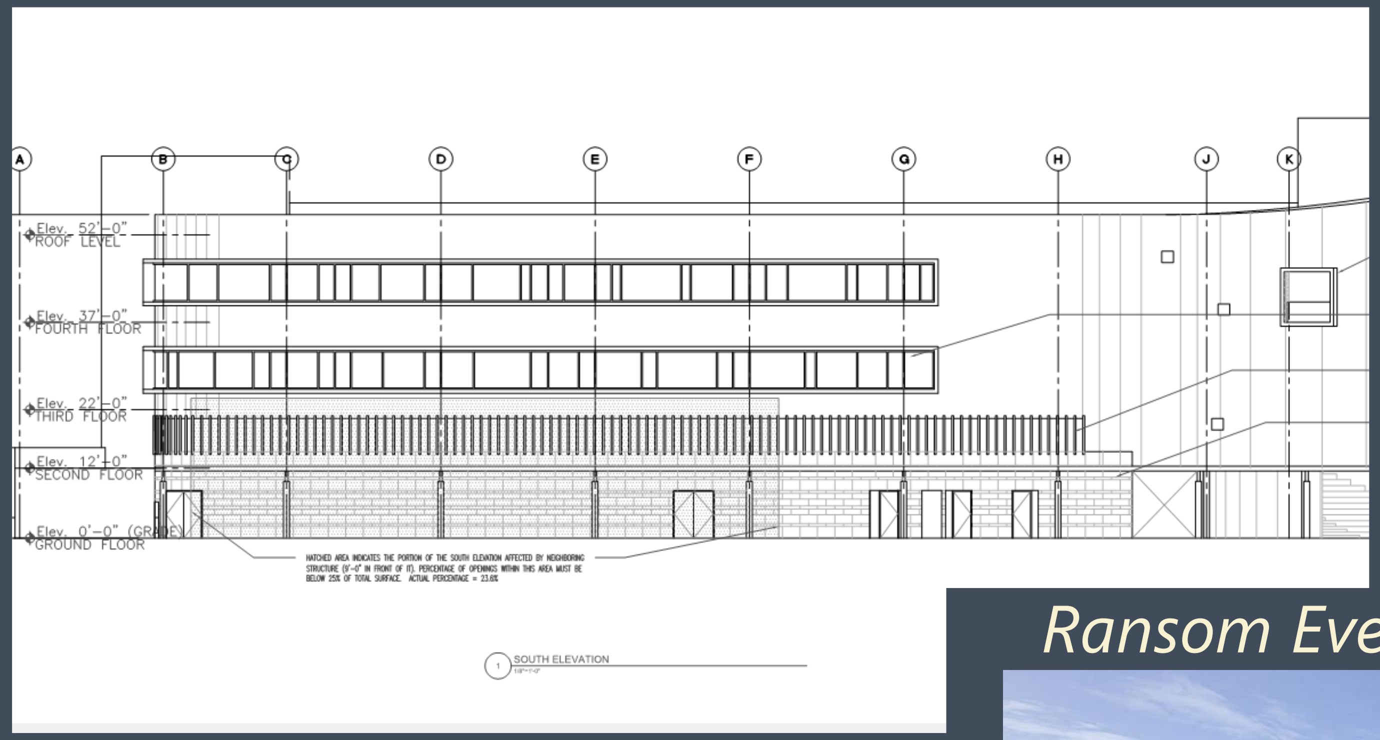
<u>MEET</u> GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

SITE IMPROVEMENTS

- *Reduce Parking*
- *Furnishings and Finishes*
- *On-site water reuse*
- *Select components and furnishings for dual-purpose*

  e.g. Swimming pool coupled into fully integrated water resource system

Christopher Columbus High School



Ransom Everglades High School

Photo: Perkins + Will

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

ENERGY REDUCTION

- *Integrate PV materials into building envelope materials, shading*
- *Capture all waste heat into other heating uses*
- *Utilize chilled beam and other proven technologies*
- *Centralize OAUs to deliver 100% dehumidified and filtered air*
- *Manage wellness objectives by redefining "normal" air temps*

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

BASELINE STRATEGIES, GOALS, TACTICS

IDENTIFY what promotes or impedes healthy, resource-efficient + environmentally sustainable learning

ESTABLISH a foundation for imparting that knowledge to their students

EDUCATE students on the connections between the built and natural environment

PROVIDE knowledge, skills, and behaviors to recognize and apply that learning in their own school facility

PERFORMANCE DESIGN-ASSIST

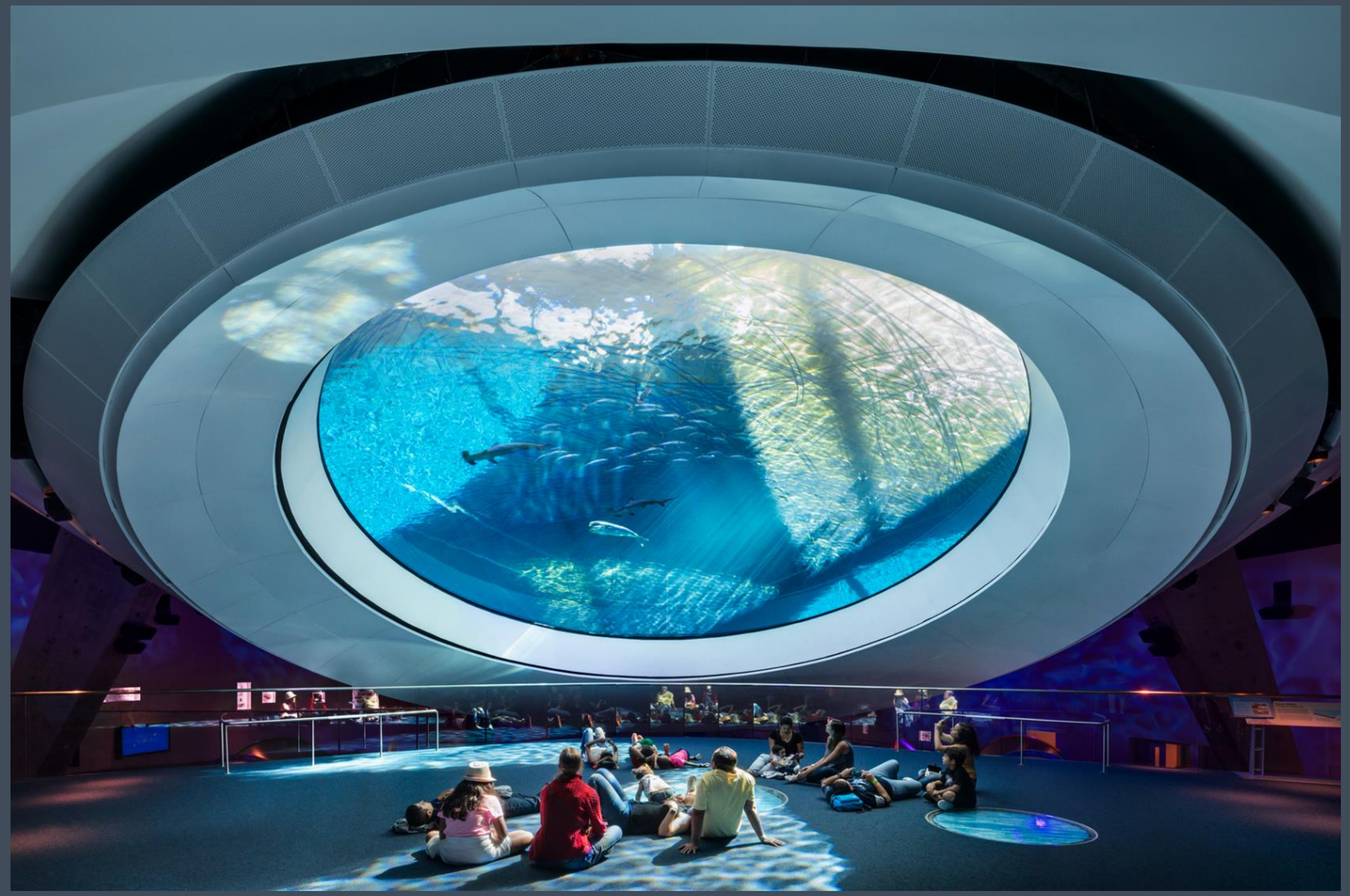
MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

RENEWABLE ENERGY SYSTEMS

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

INTEGRATED SYSTEMS INTERACTING



Courtesy of: Frost Museum of Science

Courtesy of: Perkins + Will, Ransom Everglades

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MEET GOALS AND EXPECTATIONS *Sustainability and Wellness as Teaching Tools*

LANDSCAPE, WATER AND WELLNESS

Courtesy of: Arquitectonica, UM Student Housing

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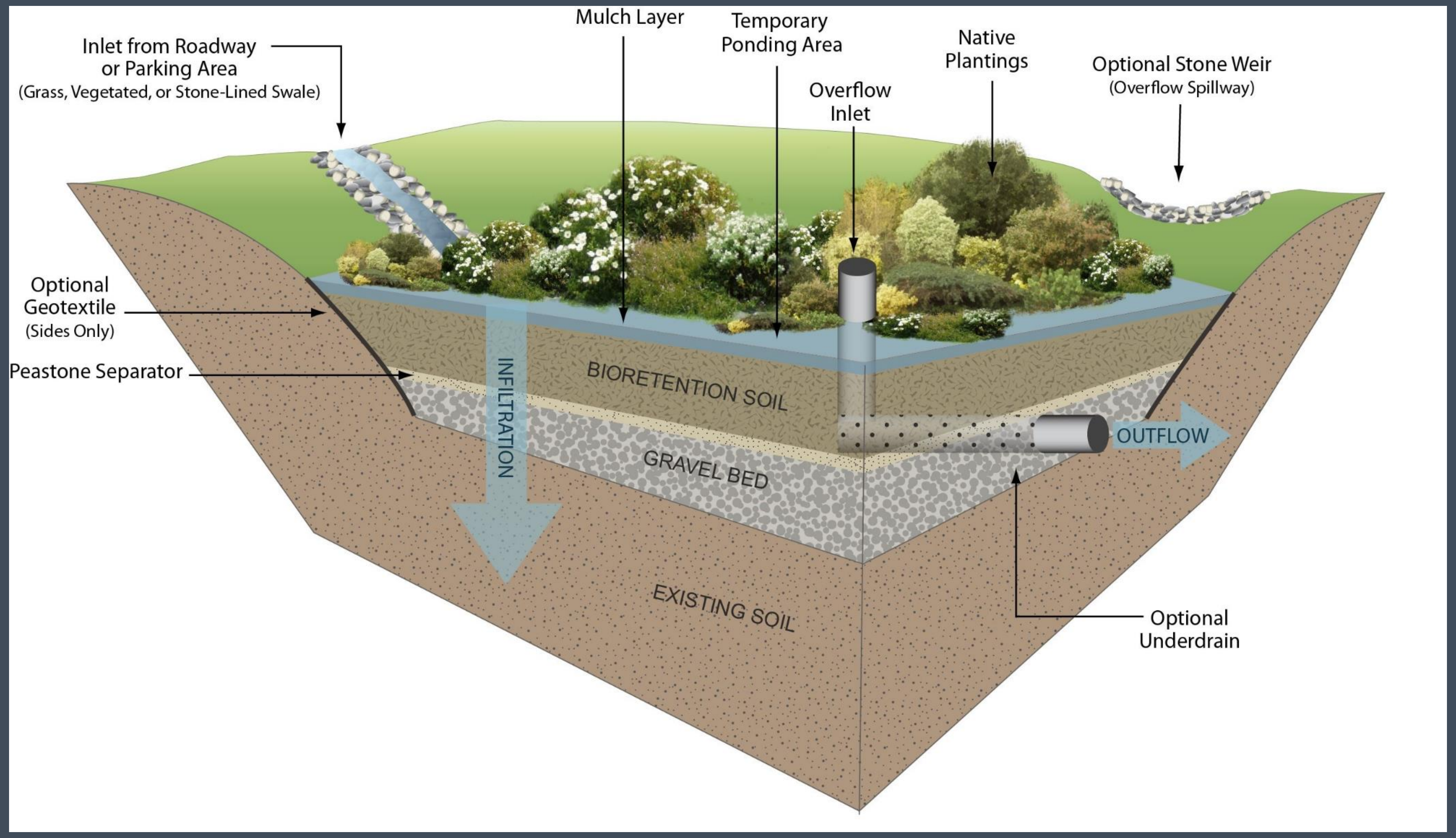
LANDSCAPE, WATER ND WELLNESS

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

WATER SYSTEMS



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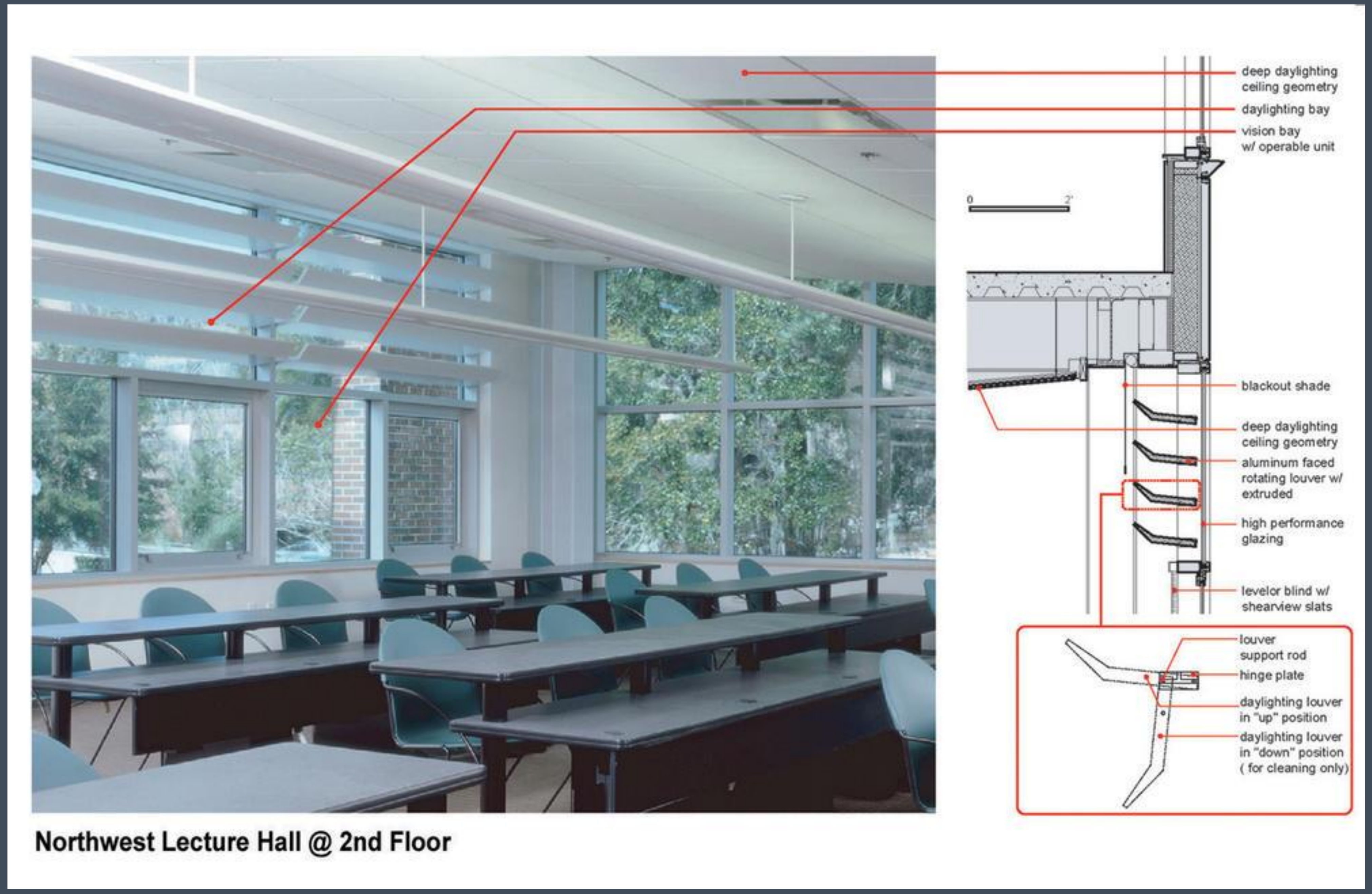
MEET GOALS AND EXPECTATIONS *Building Performance as Teaching Tools*

LIGHTING AND DAYLIGHTING

Courtesy of: Spodak Dental



Courtesy of: UF Rinker Hall

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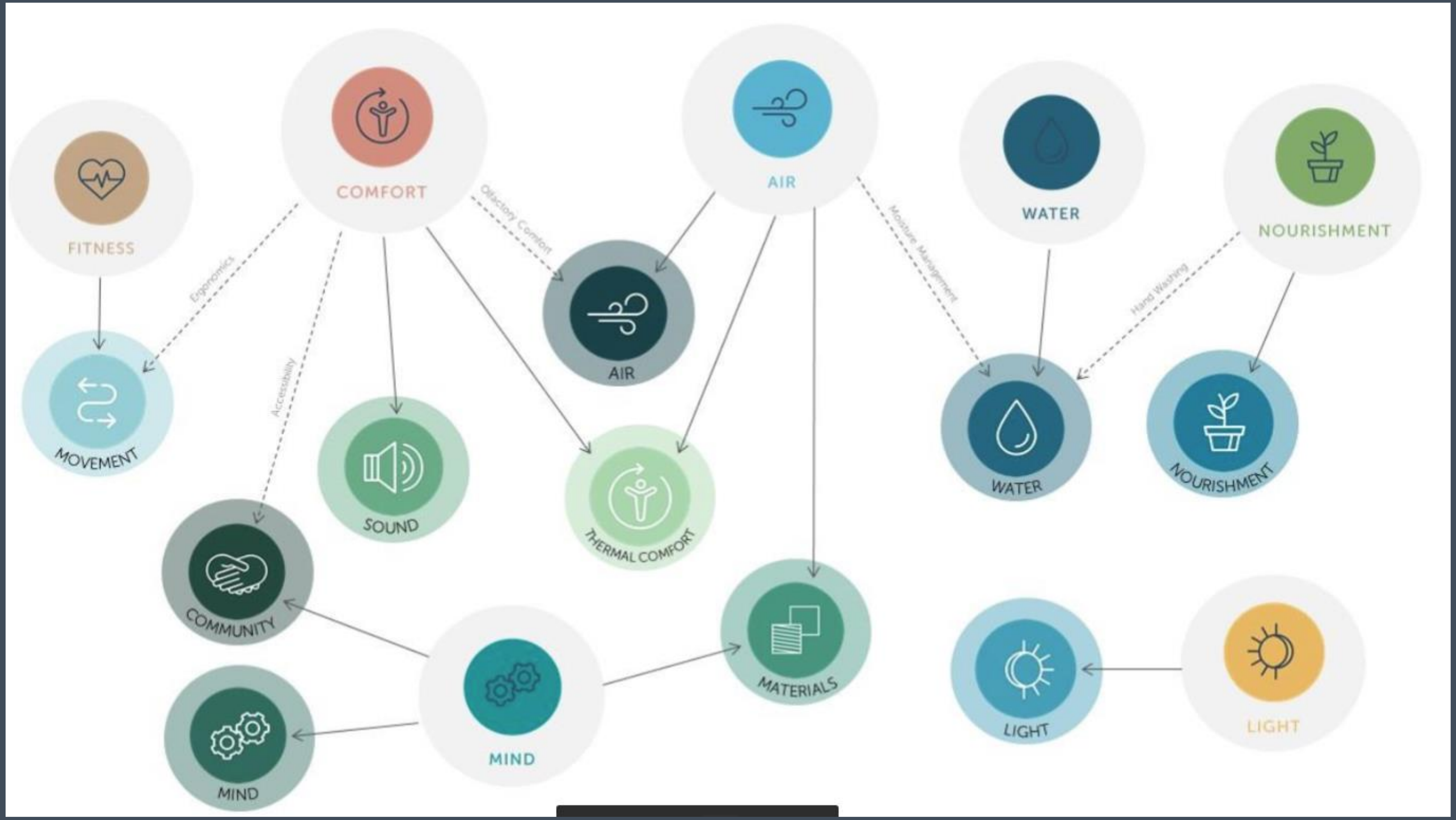
MEET GOALS AND EXPECTATIONS *Sustainability, Resilience and Wellness*

SYNERGIES AMONGST THE STRATEGIES



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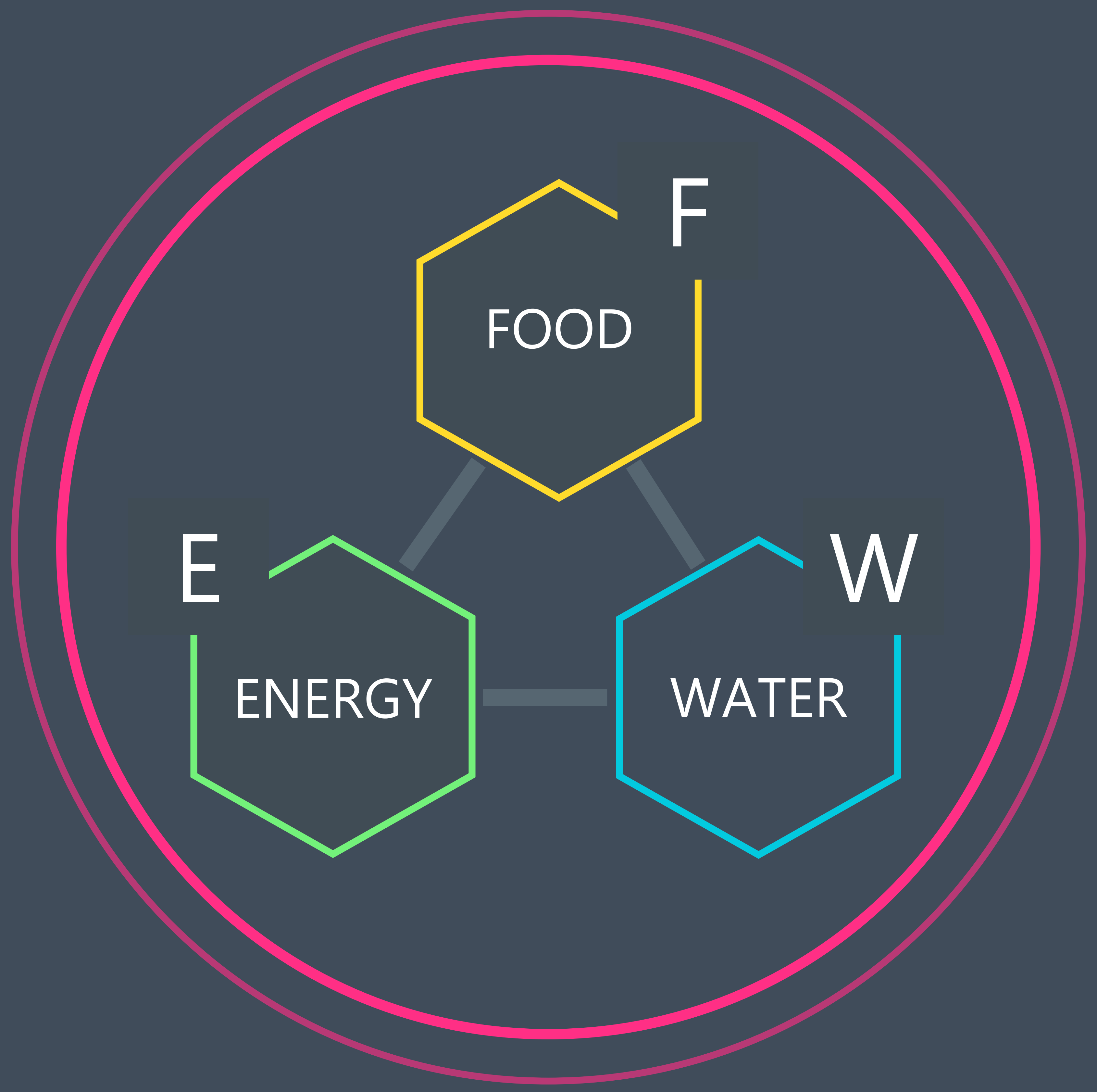
TALK ABOUT RESILIENCE *In Design Phase*

Think BEYOND THE STRUCTURE

*Address **F.E.W.S.***

FOOD + ENERGY + WATER Systems



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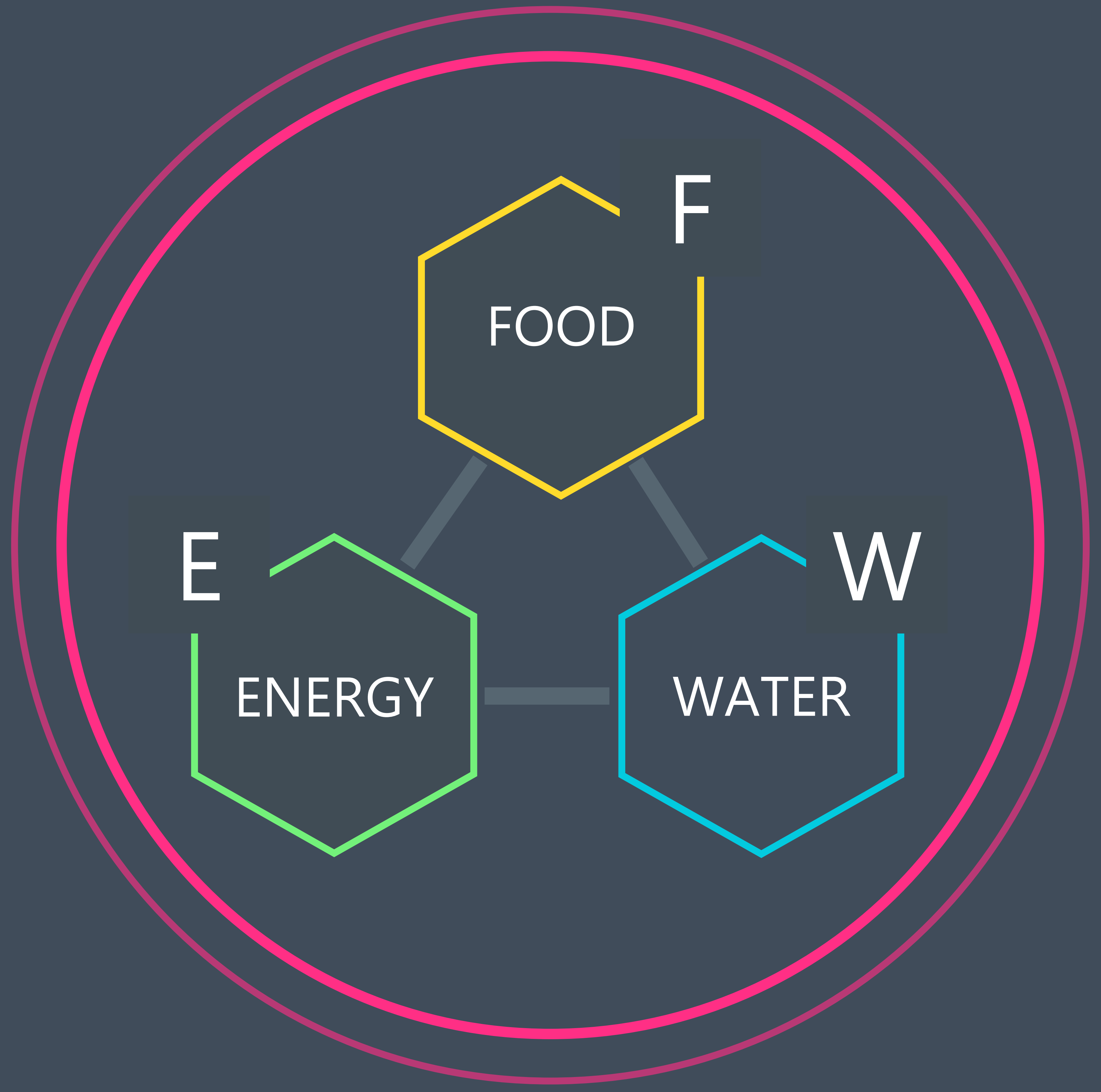
TALK ABOUT RESILIENCE *In Design Phase*

IMPACTS AND RISKS

Reasons for Concern:

1. ***Protection***
2. ***Safety***
3. ***Comfort***

FOOD + *ENERGY* + *WATER* *Systems*



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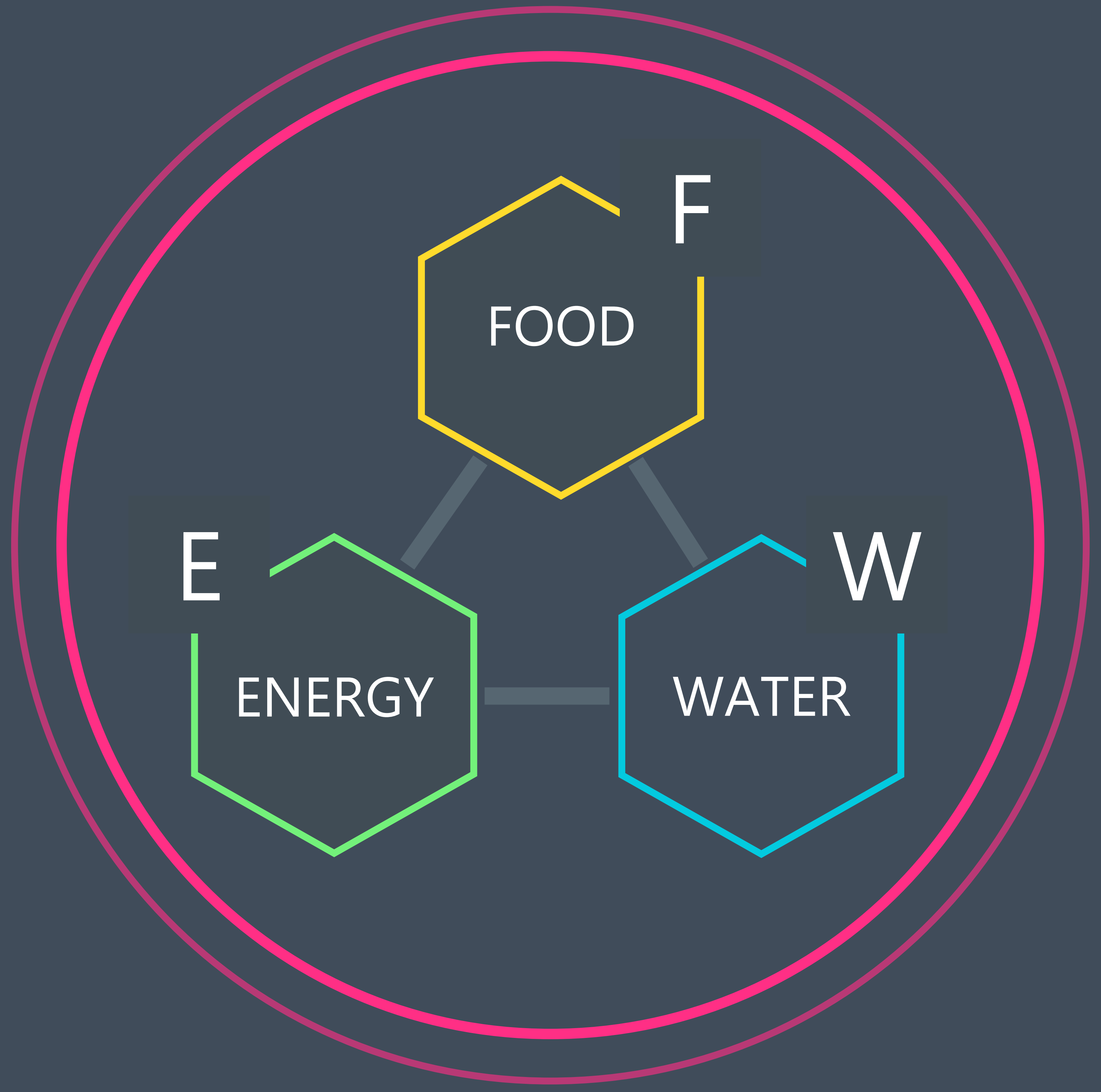
TALK ABOUT RESILIENCE *In Design Phase*

INTEGRATIVE DESIGN

Buildings are a system reliant on the interaction of other systematic parts.

The life and operation of a building depends on its collaboration with the surrounding environment and availability of resources.

A wholesome building design incorporates minimization of resources and maximization of efficiencies that improve the quality of the surrounding environment and community.



PERFORMANCE DESIGN-ASSIST

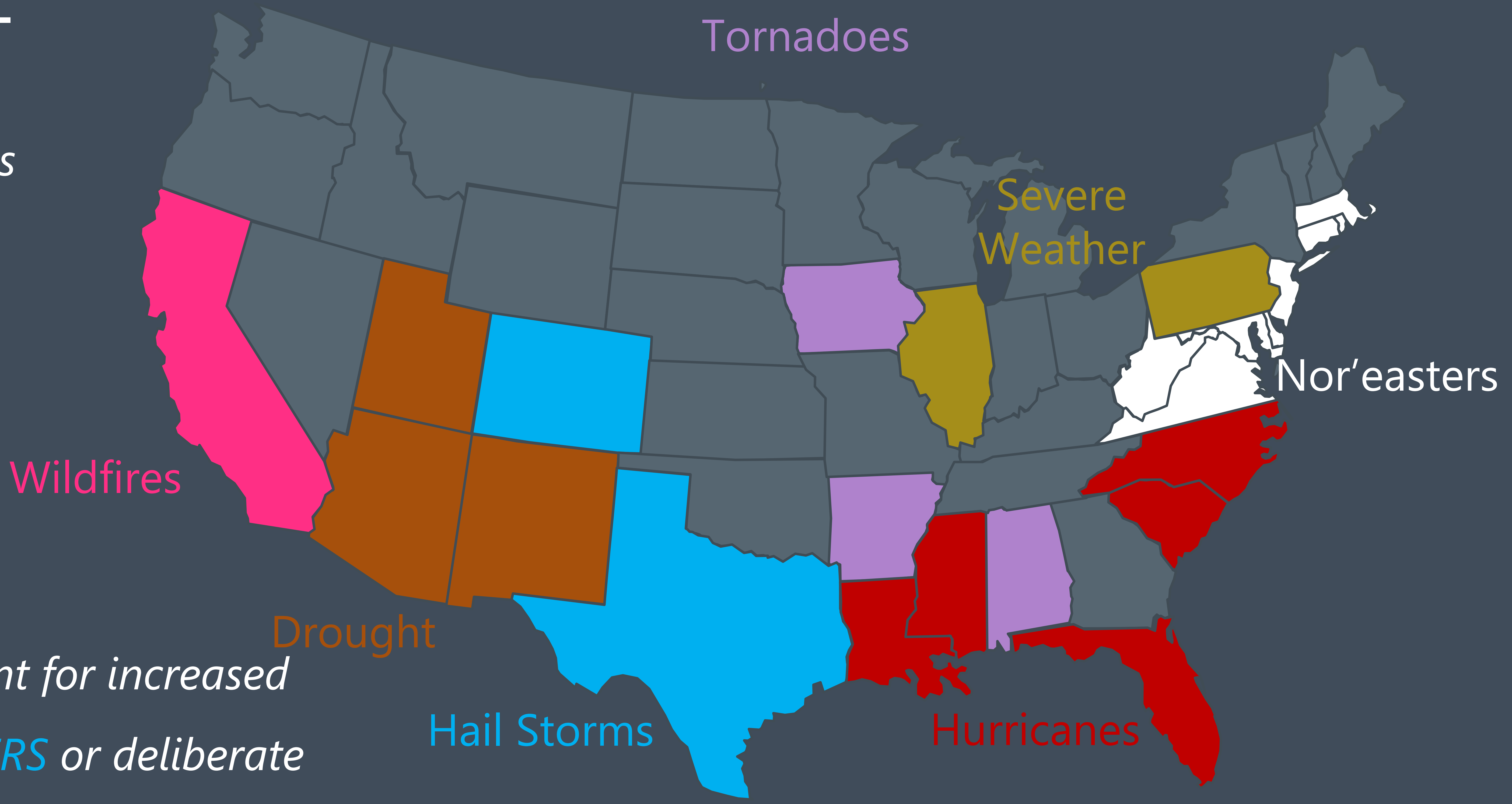
TALK ABOUT RESILIENCE *In Design Phase*

LOCAL ENVIRONMENT

$BILLION Impacts from natural hazards

IMPERATIVE OF RESILIENCE

DESIGN critical infrastructure to account for increased vulnerabilities such as natural DISASTERS or deliberate ATTACKS

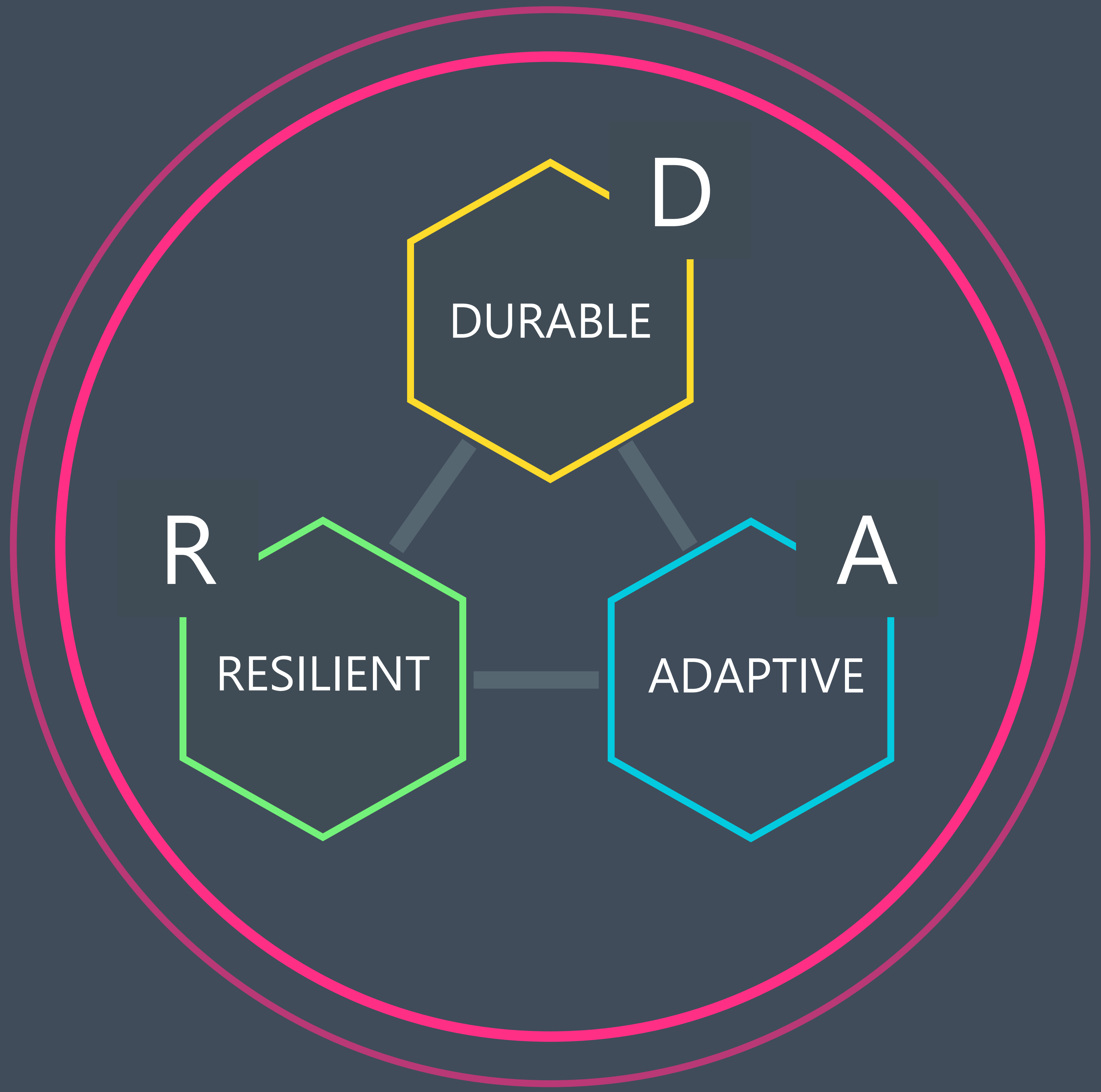


RESILIENCE AND ADAPTATION

Natural and manmade hazardous events can impose a devastating cost upon society.

Stakeholders of civil infrastructure have a vested interest in reducing these costs by improving and maintaining operational and physical performance.

When planning and designing buildings, it is appropriate to try to mitigate the potential of the spiraling cost of operational failures by opting for more resilient performance through well-thought-out investments in better planning and designs.



https://www.wbdg.org/resources/building-resiliency

PERFORMANCE DESIGN-ASSIST

<u>SET</u> GOALS AND EXPECTATIONS *Building Resilience*

RESILIENCE AND ADAPTATION

Robustness

Resourcefulness

Rapid recovery

Redundancy

EVOLVE away from <u>Code-Compliant</u> and <u>First Cost</u> <u>minimums</u> to release INNOVATION + PROTECTION

Image courtesy of Perkins + Will

PERFORMANCE DESIGN-ASSIST

SET GOALS AND EXPECTATIONS *Building Resilience*

RESILIENCE DESIGN CONCEPTS

ADAPTATION in the face of challenges or threats is MONITORING and MEASURING to learn and decrease vulnerabilities to future disasters

PERSISTENCE of Systems, which can absorb change and disturbance

ABILITY of infrastructure systems to prevent and avoid hazards

ABILITY of infrastructure to lessen immediate damage caused by hazardous event, UTILIZING system redundancies

Image Courtesy of Arquitectonica

PERFORMANCE DESIGN-ASSIST

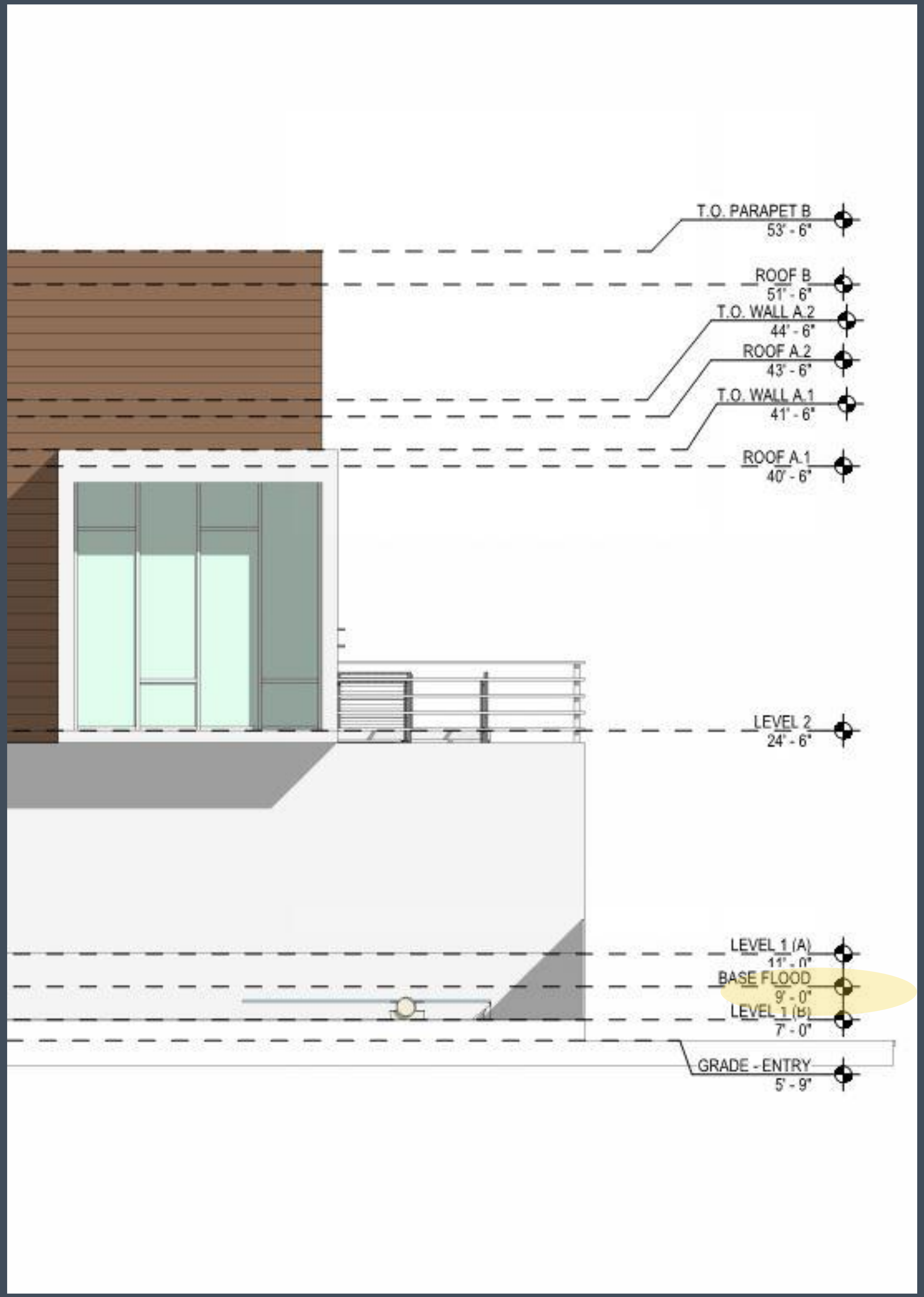
SET GOALS AND EXPECTATIONS *Building Resilience*

RESILIENCE DESIGN EXAMPLE

Located most of the Recreational building program on the second floor.

The ground floor FFE is 24” above base flood elevation except for the pool systems which will be protected by dry floodproofing methods.

The proposed lower pool deck elevation maintains the new pool deck.



PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Resilience*

MANDATED CODE CHANGES

May increase resilience requirements to force ADOPTION and reduce LIFE-CYCLE Costs over time

Still not rigorous enough

Resilience and Sustainability Strategies	Miami Beach	County/City of Miami 21	Broward County	Palm Beach County
LEED Certification	x	x		
Vulnerability Assessment	x	x		x
Sea Level Rise	x	x	x	
Carbon Emissions Reduction	x	x		
Stormwater Management	x	x	x	
Flood Modeling improvements	x	x		
Habitat protection and restoration	x	x		
Infrastructure improvements - roadways, drainage	x	x	x	
Hazard ID and Mitigation Planning	x	x		x
Zoning and Regulations amendments	x	x	x	x

Image Courtesy of Zyscovich Architects

PERFORMANCE DESIGN-ASSIST

MEET GOALS AND EXPECTATIONS *Building Resilience*

PERFORMANCE DESIGN-ASSIST

THANK YOU *For Participating*

Please be sure to use the sign-in sheet and provide AIA Number and email.

We will provide a Certificate of Completion to you via email.

Participant attendance will be reported to AIA by SEQUIL Systems Inc.

Jeffrey Conley – Managing Principal
jconley@sequil.com

Heather Appell – Director, Sustainability
happell@sequil.com

www.sequil.com
561-921-0900