HIGH PERFORMANCE GREEN BUILDING DESIGN CHARRETTE REPORT

U.S. EPA Gulf Breeze Ecology Division Research Support Center

August 9 and 10, 2005

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SUMMARY

U.S. EPA Gulf Breeze Ecology Division - Research Support Center

The U.S. EPA Gulf Breeze Ecology Division has undertaken the design of a Research Support Center project. The EPA had begun the process by hiring Bullock Tice Associates to provide design services in accordance with the Program of Requirements. The Requirements include achievement of LEED® Gold Certification. The focus of LEED is to produce high performance, green building projects which reduce operating costs, provide building amenities which have a positive effect on the performance of the occupants, and are constructed with little or no additional first cost.

7group was contacted to discuss the best methodology for beginning the green building process and recommended a two day education, goal setting and design charrette.

On August 9 and 10, 2005 members of the design team, the building managers and occupants gathered to discuss and evaluate sustainable design elements. This report provides the highlights of this two day charrette.

The charrette result concluded that LEED Gold Certification was possible within the project's construction budget.

U.S. EPA Gulf Breeze Ecology Division - Research Support Center
High Performance Green Building Design Meeting
August 9 & 10, 2005

A Summary of the Charrette Process

A successful high performance building is a solution that is greater than the sum of its parts. It is a system of integrated processes and products that increases the efficiency of the building systems and helps to reduce overall costs. A building that conserves energy alone does not constitute a high performance building. In the same respect, adding or overlaying environmental systems will not truly help the building to benefit from the connections and interdependencies of an integrated, or whole systems, design approach. This is the fundamental challenge of high performance building design.

High performance buildings are most effectively developed through a design process that invites the client, appropriate designers and consultants, a consulting general contractor/cost estimator and other appropriate stakeholders to participate from the very beginning of the project. This is done in a focused and collaborative design effort, or brainstorming session(s), known collectively as a design charrette process. The purpose of this composite design team and design process is to provide for an exchange of ideas and information that allows for truly integrated solutions to take form. A forum and methodology is provided where every team member is encouraged to cross fertilize one another with solutions to problems that may relate to, but are not typically addressed by, their specialty. The objective is to have every member of this composite design team understand the issues that the other members need to address. Thus more thorough and integrated solutions are the result.

The charrette method is very important when the client is not one person but consists of a number of interested people. This is a successful way to educate all the participants: architects, engineers, and the client team. There are many advantages in this. The client's staff members are invited to participate throughout the process. Participants are educated about the issues and "buy in" to the solutions. The education process is accelerated, decisions are verified, adversity is diminished, the nuances of organizational issues are learned and the design process is expedited. A final solution isn't necessarily produced in the charrette but most of the issues are explored with all the involved parties being present.

Most buildings have great potential for incorporating the most advanced green building design techniques and systems. Part of the job is to help find an acceptable balance between the economic, cultural, ecological areas of sustainability that will meet the Client's objectives and yet allow for future adaptation of new technologies and interactions with the community.

7group's approach is one of common sense application of thoughtful and integrated solutions. Market transformation in this area can only occur if environmentally responsible buildings can be built at conventional construction cost. The integrated design process is the key to producing high performance green buildings within budget.

Objectives for this charrette:

1. Gain an understanding of high performance green buildings.
2. Gain an understanding of the process required to realize high performance green goals.
3. Establish preliminary performance goals.
4. Familiarize participants with the importance of this approach.
5. Develop design concepts.
6. Establish next steps.

Description - Day 1: 9:00 am - 5:00pm

Welcome

- Introduction of participants
- Overview of the day
- What is a high performance green building?
- Why are we concerned?

Project Overview - Bullock Tice Associates

- Program and site
- Opportunities and constraints, infrastructure issues, program concerns
- Overview of current design

Core Values Exercise

Integrated Design: The Key to Producing High Performance Green Buildings within Budget

- What it is
- Examples of its effects
- How to do it
- Changes to the standard design process

LUNCH: Noon to 1:00 pm

High Performance Green Buildings: Credit-by-Credit Review of LEED

Using the LEED rating system as a framework for discussion, we will review the many items that can compromise a high performance green building. Special emphasis will focus on the design process and the methodologies needed to achieve certain LEED credits. Specific project examples will demonstrate many of the concepts, techniques and technologies.

Sustainable Site Credits
Water Efficiency Credits
Energy & Atmosphere Credits
Materials & Resources Credits
Indoor Environmental Credits
Innovation & Design Credits

Day 2

9:00 am - 5:00 pm

Site Issues
- Climactic Issues
- Regenerative/Restorative Design
- Integration of building on campus
- Sustainable site opportunities created by this project

Building Design
- Explore potential conceptual design solutions:
- Primary site components (storm water, utilities, circulation, parking, etc.)
- Orientation
- Functional relationships
- Massing
- Daylighting design

LUNCH: Noon to 1:00 pm

Breakout Sessions

Focused small group sessions to explore and identify performance parameters and specific design solutions:

1. Site/Water
2. Energy (EQ 1, 2, 3, 5, 6, 7, 8)
3. Materials (EQ 3, 4, 5, 6, 8)

Report results from the small group sessions.

Integration of Performance Parameters
- Review and integrate various performance metrics and design ideas from the breakout groups, targeting holistic solutions. Consider budget, environmental efficacy, achievability, core values and project mission.
- Establish specific performance goals for the project.

Next Steps
- Application of integrated, whole-system design process
- Specific services required
- Schedule & Milestones

Adjourn

U.S. EPA Design Charrette
August 9-10, 2005
Administration Building 65, Conference Room

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CORE VALUES EXERCISE

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A brain-storming session was initiated to list the core values of the group. The values listed are to be important design considerations for the project team. Once the list was generated each project team member was allowed to vote for their ten most important values. The results of the exercise are listed in the table below.

	Value	Votes
1	Thermal Comfort	17
2	Energy Efficiency	10
3	Low Maintenance	7
4	HVAC/Lighting Zoning	7
5	Durability	7
6	Functionality	7
7	Daylighting	6
8	Individual Controls	6
9	Indoor Air Quality	6
10	Flexibility/Adaptability	6
11	Reduced Materials Consumption/Use of Recycled Materials	5
12	Aesthetics	5
13	Lighting Quality	5
14	Acoustics	4
15	Reduce Ecological Footprint	2
16	Reduce Water Consumption	1
17	Spatial/Volumetric Efficiency	1
18	Complete Program within Budget	1

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The project team reviewed the LEED Green Building Rating System on a credit-by-credit basis in the context of the project. Each credit was determined to be a “Yes” - it will be implemented on this project; a “Maybe” - these credits will require further investigation; and a “No” - these credits are not feasible for this project. A summary preliminary scorecard for the project is included on the following page. A complete score card with comments and tasks is contained in the Appendix.

In addition, each credit was assigned a cost implication value of “No”, “Low, “Medium” or “High” cost. The figures assigned to these values are summarized below along with a list of the quantity of credits by feasibility and cost implications.

Total construction cost = $4 million
Low - $0 - $2,000 Medium - $2,000 to $20,000 High - over $20,000

LEED™ Targeted Credits by Cost Implications

	Yes	Maybe	Totals
No Cost	32	3	35
Low Cost	6	3	9
Mid Cost	6	2	8
High Cost		3	3
Totals	44	11	55

The results of the LEED review indicate a total of 44 points targeted as feasible with 11 additional points listed as maybe. The project team has determined that LEED Gold level certification should be targeted.

Summary LEED Scorecard

Y	?	N	Total Project Score	Possible Points 69
44	11	14	Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points	

Sustainable Sites — Possible Points 14

Y	?	N			
9	0	5		Sustainable Sites	14
Y			Prereq 1	Erosion & Sedimentation Control	0
		1	Credit 1	Site Selection	1
		1	Credit 2	Dewnsity Development	1
		1	Credit 3	Brownfield Redevelopment	1
		1	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1			Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	Alternative Transportation, Alternative Fuel Refueling Stations	1
1			Credit 4.4	Alternative Transportation, Parking Capacity	1
1			Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
1			Credit 5.2	Reduced Site Disturbance, Development Footprint	1
1			Credit 6.1	Stormwater Management, Rate and Quantity	1
1			Credit 6.2	Stormwater Management, Treatment	1
1			Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
1			Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
1			Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points 5

Y	?	N			
5	0	0		Water Efficiency	5
1			Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1			Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
1			Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction, 20% Reduction	1
1			Credit 3.2	Water Use Reduction, 30% Reduction	1

Energy & Atmosphere — Possible Points 17

Y	?	N			
8	5	4		Energy & Atmosphere	17
Y			Prereq 1	Fundamental Building Systems Commissioning	0
Y			Prereq 2	Minimum Energy Performance	0
Y			Prereq 3	CFC Reduction in HVAC&R Equipment	0
2			Credit 1.1	Optimize Energy Performance, 20% New / 10% Existing	2
2			Credit 1.2	Optimize Energy Performance, 30% New / 20% Existing	2
2			Credit 1.3	Optimize Energy Performance, 40% New / 30% Existing	2
	2		Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2
		2	Credit 1.5	Optimize Energy Performance, 60% New / 50% Existing	2
	1		Credit 2.1	Renewable Energy, 5%	1
		1	Credit 2.2	Renewable Energy, 10%	1
		1	Credit 2.3	Renewable Energy, 20%	1
1			Credit 3	Additional Commissioning	1
1			Credit 4	Ozone Depletion	1
	1		Credit 5	Measurement & Verification	1
	1		Credit 6	Green Power	1

Materials & Resources — Possible Points 13

Y	?	N			
4	4	5		Materials & Resources	13
Y			Prereq 1	Storage & Collection of Recyclables	0
		1	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
		1	Credit 1.2	Building Reuse, Maintain 100% of Existing Shell	1
		1	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1			Credit 2.1	Construction Waste Management, Divert 50%	1
	1		Credit 2.2	Construction Waste Management, Divert 75%	1
		1	Credit 3.1	Resource Reuse, Specify 5%	1
		1	Credit 3.2	Resource Reuse, Specify 10%	1
1			Credit 4.1	Recycled Content, Specify 5%	1
	1		Credit 4.2	Recycled Content, Specify 10%	1
1			Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1			Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	1		Credit 6	Rapidly Renewable Materials	1
	1		Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points 15

Y	?	N			
14	1	0		Indoor Environmental Quality	15
Y			Prereq 1	Minimum IAQ Performance	0
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	0
1			Credit 1	Carbon Dioxide (CO_2) Monitoring	1
1			Credit 2	Increase Ventilation Effectiveness	1
1			Credit 3.1	Construction IAQ Management Plan, During Construction	1
1			Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1			Credit 4.2	Low-Emitting Materials, Paints	1
1			Credit 4.3	Low-Emitting Materials, Carpet	1
1			Credit 4.4	Low-Emitting Materials, Composite Wood	1
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems, Perimeter	1
1			Credit 6.2	Controllability of Systems, Non-Perimeter	1
1			Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
1			Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
	1		Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
1			Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

Innovation & Design Process — Possible Points 5

Y	?	N			
4	1	0		Innovation & Design Process	5
1			Credit 1.1	Innovation in Design: Exemplary Performance WEc2	1
1			Credit 1.2	Innovation in Design: Exemplary Performance WEc3	1
1			Credit 1.3	Innovation in Design: Exemplary Performance MRc5.1	1
	1		Credit 1.4	Innovation in Design: Blended Cement or other exemplary	1
1			Credit 2	LEED™ Accredited Professional	1

SITE ISSUES AND BUILDING DESIGN

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Building design ideas were discussed to modify the existing building design to accommodate the LEED and green building parameters discussed during day one. Alternative design concepts were discussed in general to incorporate sustainable design elements into the project.

Climactic issues were reviewed and discussed. These issues are summarized in the charts in the Appendix. The site of the new facility is in the current location of Buildings 63, 64 and 27.

The building site with the current buildings is shown in the images below.

South/Southwest View

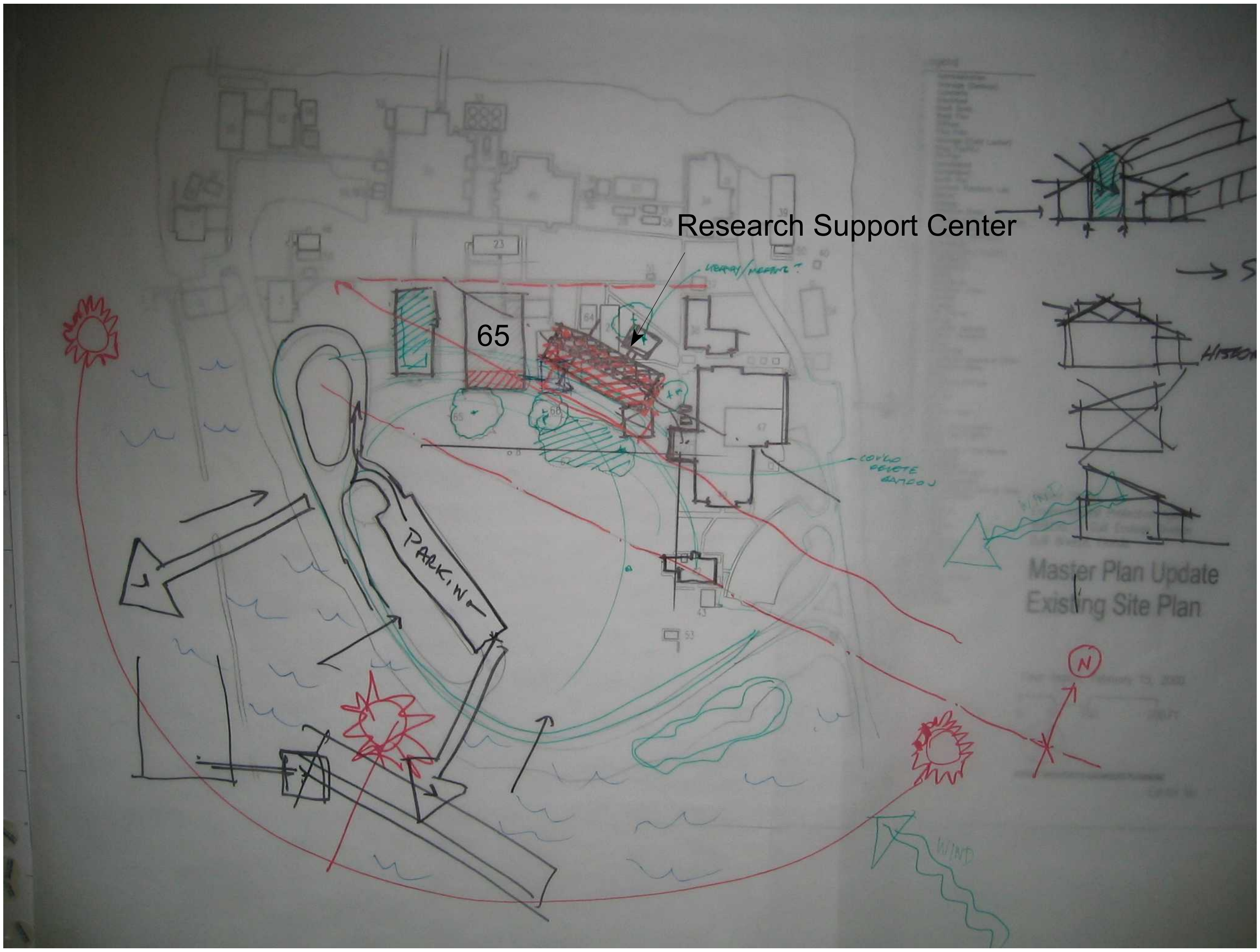
Northwest View

The site is constrained by two large trees, a pecan tree to the southwest and a sizable live oak to the east. The Pecan tree is on the edge of a large non-native bamboo grove.

Pecan Tree

Live Oak Tree

A site diagram was used to illustrate the potential site forces and relationships. These included solar orientation for daylighting and energy efficiency, access to high quality views, orientation to prevailing winds, and the building's relationship on campus.



A north-south oriented building with properly shaded windows, will typically use 10% to 30% less energy than a building oriented east-west. In addition, daylighting goals will be significantly easier and less costly to attain.

The highest quality view from the project site is in a southerly direction. This view is mostly blocked from the project site by the large grove of bamboo. It is recommended that this bamboo is removed as a part of the construction project.

The view of the building from the primary access road and the creation of a defined arrival space was one of the benefits of orienting the building off of the campus defined grid.

South View

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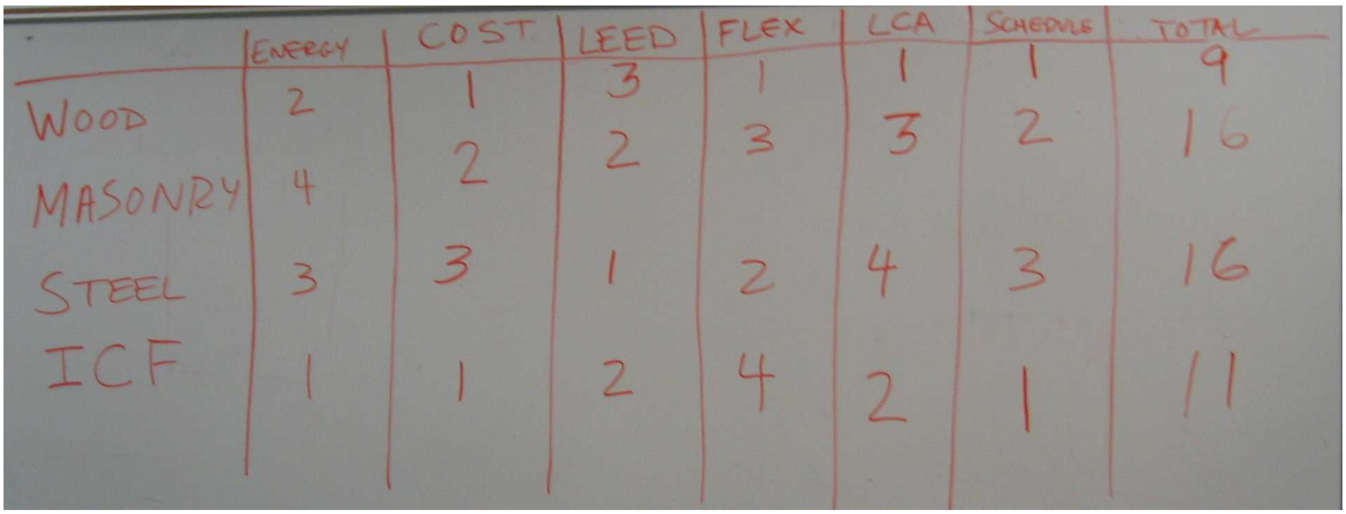
Breakout sessions were convened to focus discussion on issues related to the building's structural system and potential HVAC systems.

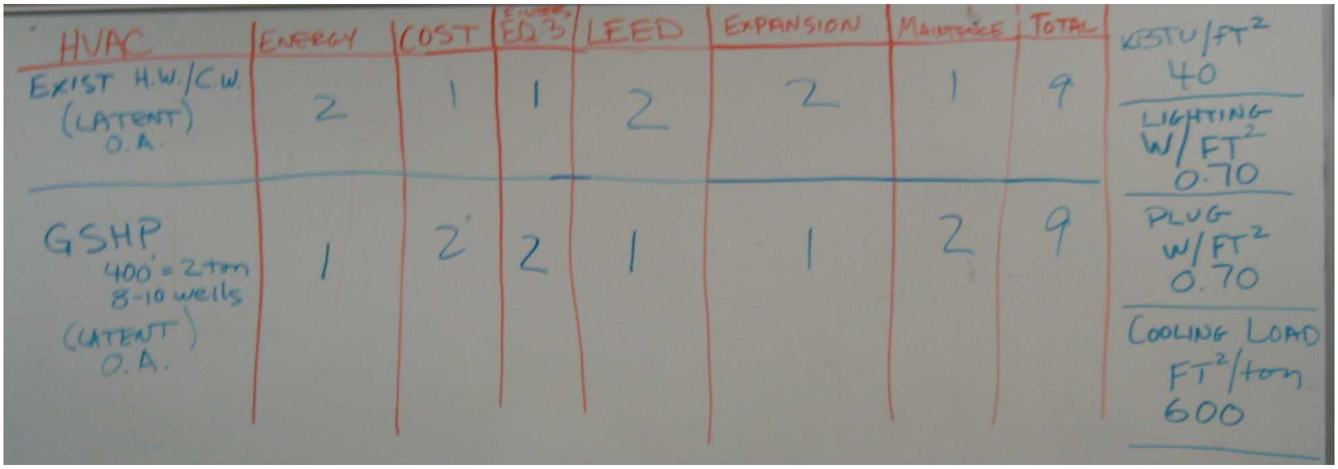
The advantages and disadvantages of four different structural systems were evaluated by the team. The results of this evaluation are summarized in the image below. Each system was ranked by criteria which included energy efficiency, first cost, LEED impact, future flexibility, life cycle assessment (LCA), and schedule impacts. The rankings were listed from one to four with one being the best choice in that category. The lower the total the better the system. It was determined that wood frame and ICFs would be considered for further evaluation.



While John Boecker and Linda Sawyer began to sketch some conceptual design ideas, the remainder of the group discussed potential HVAC issues and design goals related to energy efficiency.

A variety of potential HVAC systems were discussed. The options were quickly narrowed to two choices - tap into an existing boiler/chiller plant or ground source heat pumps. In either case the team decided to investigate separate treatment of outdoor air with some type of latent heat recovery or desiccant system. Solar regenerated liquid desiccant systems were discussed (see Appendix for more information).

The advantages and disadvantages of the two systems were discussed. The systems were ranked by criteria including energy efficiency, first cost, LEED impacts (including use of MERV 13 filters), future expansion, and maintenance. The systems came out even with these criteria. The existing system will be evaluated to determine the extent of the available capacity and the feasibility of using this capacity for the sensible portion of the cooling load.

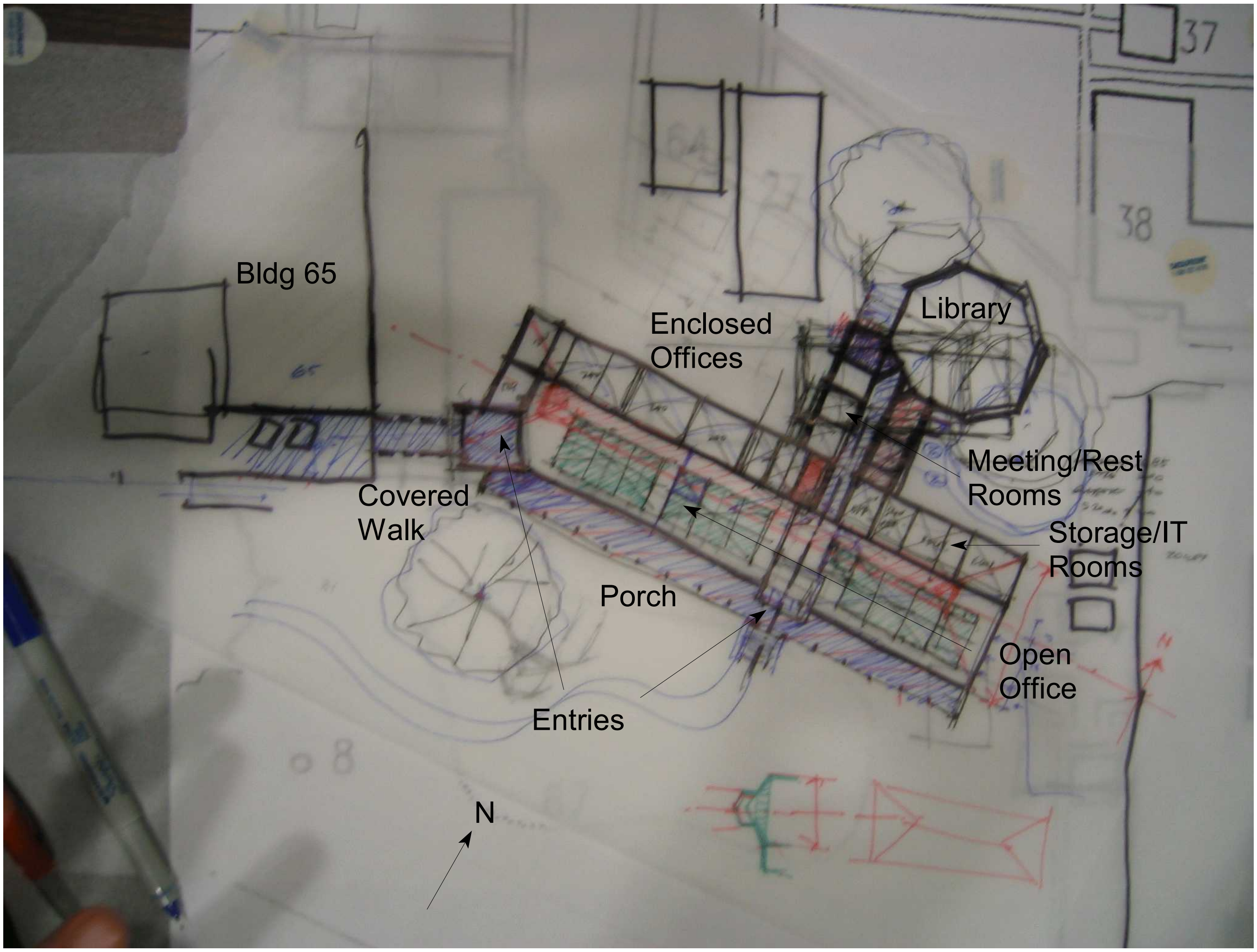


Goals related to energy efficiency and HVAC system sizing were discussed. Results from EPA's Target Finder were presented to the team. A score of 75 (top 25 percentile of actual building performance) in Target Finder equated to an energy usage of 50.9 kBTU/ft^2/year. A score of 90 in Target Finder equated to 39.5 kBTU/ft^2/year. See Appendix for complete Target Finder results.

The team established the following design goals:

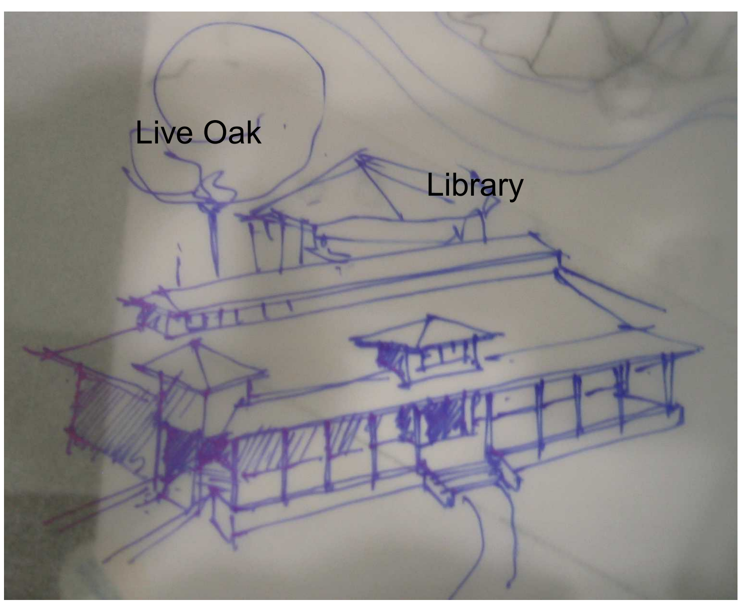
Overall energy usage - not to exceed 40.0 kBTU/ft^2/year
Lighting Power Density - 0.70 Watts/ft^2
Equipment Loads - 0.70 Watts/ft^2
Cooling Loads - 600 ft^2/ton

The group then reconvened to review the conceptual floor plan developed by the design group.



Conceptual Floor Plan

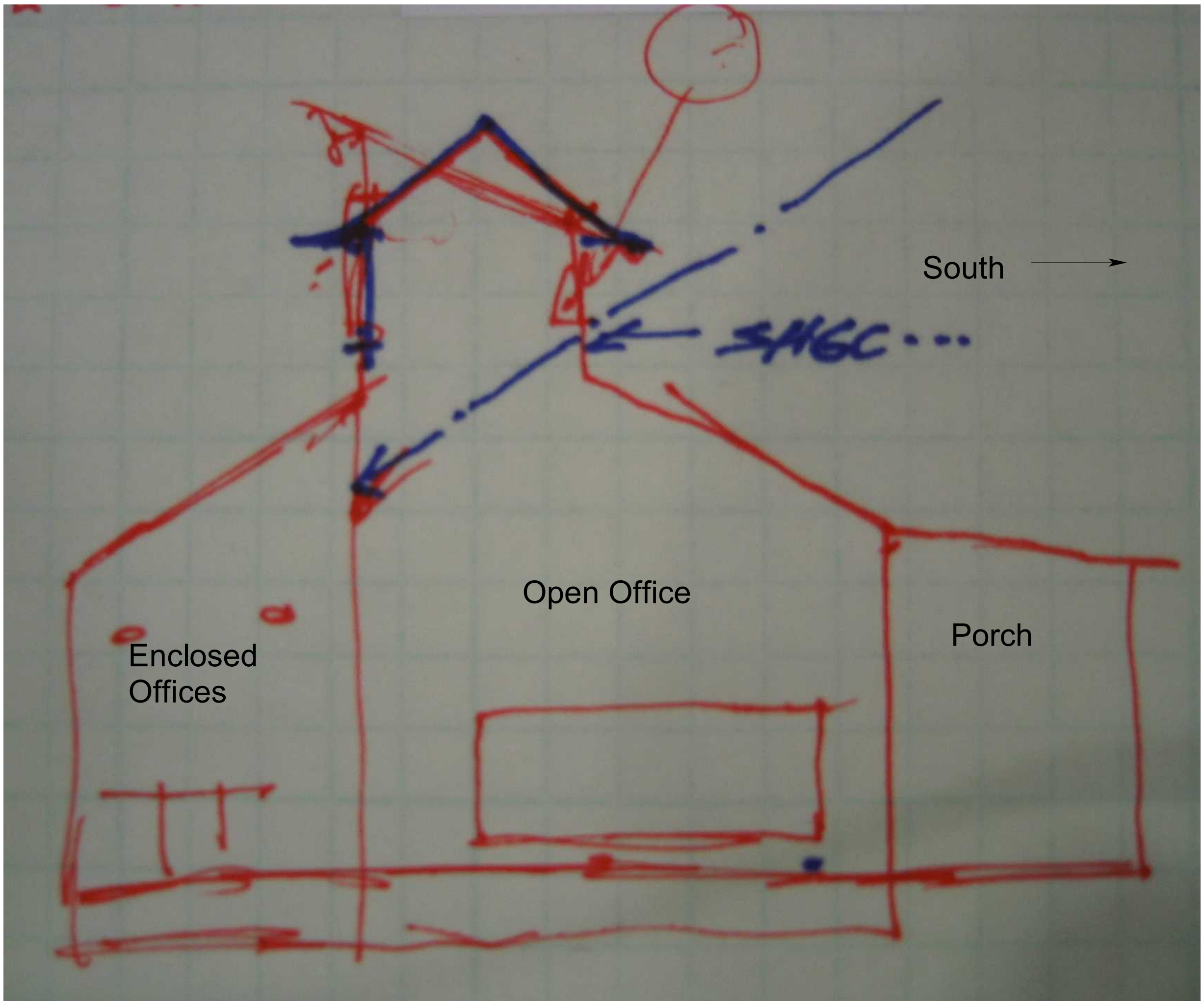
Massing and daylighting strategies were discussed in keeping with the vernacular architecture of the area and as a compliment to the adjoining Building 65. A conceptual elevation was drawn.



Conceptual Elevation

The south facade includes a deep porch to shade the high summer sun and take advantage of the easterly prevailing winds. Small clerestory windows with a deep overhang are included in the roof monitor. The north side of the monitor contains an almost continuous row of windows to admit the more indirect north light. Architectural elements at the building entrances complement the design of the adjoining Building 65. The library is shown as a separate space which can be bid separately and provides good access to the rest of the campus.

A section of the building shows the daylighting potential.



RESULTS AND NEXT STEPS

U.S. EPA Gulf Breeze Ecology Division - Research Support Center

The charrette resulted in the education of the design and owner team as well as the creation of a preliminary LEED scorecard, a list of actions and responsibilities, recommendations for site placement, a preliminary floor plan and elevation.

A discussion was facilitated to incorporate the possible performance criteria and sustainability concepts into the design.

Next Steps

1. Presentation of concept to and feedback from EPA
2. Determine scope of work needed to complete the design
3. Analysis - structural systems, energy modeling, daylighting analysis, rainwater harvesting
4. Investigation - local zoning, roofing materials, finish materials, underfloor air systems

Appendix