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Integrative Design Workshop/Charrette Report

Germantown Academy
Fort Washington, PA

08 January 2008

WRT

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Project Summary

Germantown Academy New Upper School & Middle School

The Germantown Academy is engaged in the process of developing plans for significantly expanding their educational facilities on their campus in Fort Washington, PA. They have hired Wallace Roberts & Todd (WRT) to provide architectural design services. Currently, the project is in the Schematic Design phase. 7group was contracted to facilitate an all-day workshop that combined the activities of a Goal-Setting Workshop with a Design Charrette for the project team. On 08 January 2009, members of the project team gathered to discuss and evaluate sustainable design practices, integrative design strategies, and the status of the project's LEED for Schools Green Building Rating System pursuits. This report records key points from this integrative design workshop/charrette.

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 technologies 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 benefit from the connections and interdependencies of an integrated, or “whole systems”, design approach. This is the fundamental challenge of high performance building design and LEED® Certification.

High performance buildings are most effectively developed through a design process that invites the client, building 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 encourage the exchange of ideas and information, thereby allowing truly integrated solutions to take form. A forum and methodology is provided where every team member is encouraged to cross fertilize with all others in order to identify solutions to problems that may relate to, but are not typically addressed by any one team member’s 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 can result.

The charrette method is very important when the Owner is not one person but consists of a number of interested people. This is a successful way to educate all the participants: architects, engineers, the client team and the broad range of stakeholders that comprise a private school community, including members of the Board, faculty, administrators, alumni, parents, and students.

There are many advantages to this approach: The client’s staff members are invited to participate throughout the process. Participants are educated about the issues and participate in the team’s investigations in order to "buy in" to the solutions. The educational process is accelerated, decisions are verified, adversity is diminished, the nuances of organizational issues are learned, and the design process is expedited. Final resolutions are not necessarily produced in the charrette, but most of the issues are explored with all the involved parties present.

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

Workshop/Charrette Agenda & Participants

Charrette Objectives:

1. Gain an understanding of the integrative process required to realize high performance goals.
2. Familiarize participants with the importance of this approach.
3. Identify integrative design strategies to be pursued and analyzed by the project team.
4. Review preliminary LEED performance goals and verify potential achievement.
5. Establish next steps.

Charrette Agenda:

Thursday 08 January 2009: 8:30am – 5:00pm

Welcome
- Introduction of participants
- Overview of the day

Project Overview: Owner and AE Design Team
- Owner's presentation of purpose, opportunities and constraints, program concerns
- Overview of current design status

Integrative Design: The Key to Producing High Performance LEED Buildings within Budget
- What it is and case study examples of its effects
- How to do it: Changes to the standard design process
- Overview of purpose and content of LEED

Touchstones Exercise: Identify and prioritize Values and Aspirations

BREAK

Review of Project's LEED Status: Credit-by-credit review of selected germane LEED credits

LUNCH: 12:30 – 1:15 pm

Breakout Sessions:

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

1. Energy
2. Building & Site Design

Report results from the small group sessions: What to Keep & What to Avoid

Identify Performance Targets and design strategies for analysis in next Research & Analysis stage:

Four key sub-systems:

1. Habitat – human and other biotic systems
2. Water
3. Energy
4. Materials

Cost bundling templates

Next Steps

Charrette Participants:

Name	Affiliation	Role in Project
Audrey Shnur (partial)	Germantown Academy	Client / Development
Richard House (partial)	Germantown Academy	Client / Head of Middle School
Joe Cotillo	Germantown Academy	Client / Facilities Director
Charlie _____	Germantown Academy	Client / Maintenance
Mike Rufo	Rufo Contracting	Project Manager
Ansley Cox	Rufo Contracting	Project Management
Maarten Pesch	WRT	Architect / Principal-in-Charge
Joe Salerno	WRT	Architect / Project Manager
Karen Blanchard	WRT	Architect / Project Designer
Sam Robinson	WRT	Architect / Project Architect
My Ly	WRT	Architectural Designer
Jamie Ober	WRT	Architectural Designer
Donna Carney	WRT	Architectural Designer
Eric Tamulonis	WRT	Landscape Architecture
Lauren Mandel	WRT and GA Alumnus	Landscape Architecture
Max Zahniser	WRT	Sustainability Director
Bob Stano	HF Lenz	MEP Eng / Principal-in-Charge
John Stewart	HF Lenz	MEP Eng / Project Manager
Scott Mack	HF Lenz	MEP Eng / Sustainability
Hugh _____	Devine Brothers	Mechanical Contractor
Rick Stoneback (partial)	C. E. Shoemaker	Civil Engineer
Chad Bressinger (partial)	C. E. Shoemaker	Civil Engineer
Matt Johnson	SGH	Structural Eng / Project Manager
Mike Barber	Lighting Practice	Lighting Design / Principal-in-Charge
Lindsey Paquette	Lighting Practice	Lighting Designer
Marcus Sheffer	7group	Integrative Design Consultant
John Boecker	7group	Integrative Design Consultant

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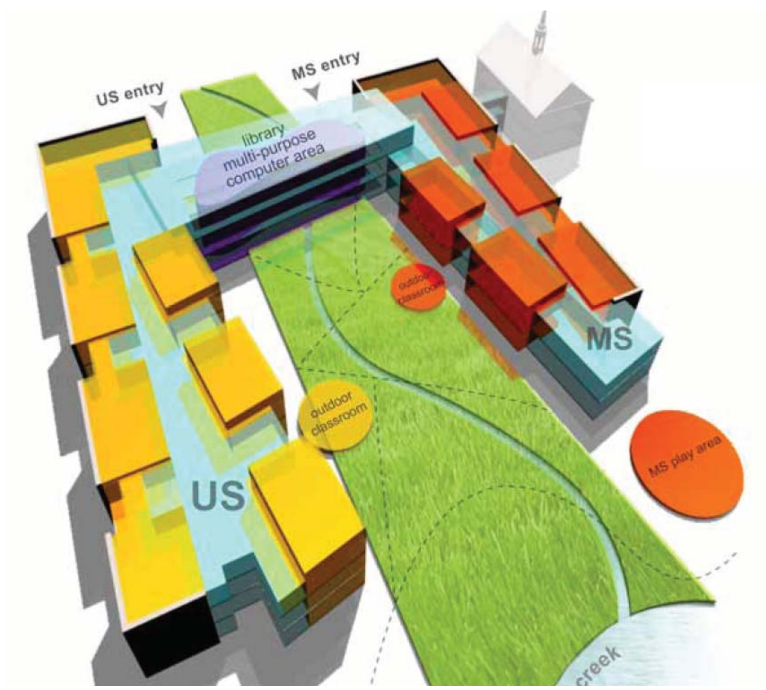
Design Team Presentation

After an overview of the Germantown Academy's mission by Audrey Shnur, Marteen Pesch from WRT presented the history of the project's master planning and deign efforts to date, including a review of the phasing, the status of the current design scheme, and the following programmatic objectives:

- Connect to the Creek and take advantage of our natural asset
- Improve location, quality of athletic fields
- Increase meeting spaces: including new auditorium / lecture spaces, department spaces, informal spaces and individual meeting spaces
- Establish community areas with display opportunities for school history, student art, etc.
- Relocate Middle School closer to common areas such as dining and athletics
- Design flexible interior space that will serve changing academic needs for the next 70 years
- Implement sustainable technologies and systems that will help the campus run more efficiently

This presentation focused on the expansion of Upper and Middle School educational spaces, since this will be the focus of the day's design efforts, including drawings of the current design such as those below.



Integrative Design Presentation

A presentation was made by 7group to illustrate that a successful sustainable, or green, project is a solution that is greater than the sum of its parts. By intentionally building connections and cross-linked support between the engineered, cultural and natural systems present in all building projects, significant efficiencies, as well as natural system regeneration, can be achieved. Project and operating costs can also be reduced. Simply adding or overlaying individual “environmental” systems in isolation will not allow buildings and communities to benefit from the available connections and interdependencies that can be identified in an integrated, or whole system, design approach. This is the fundamental challenge of sustainable design and building cost-effective LEED® projects.

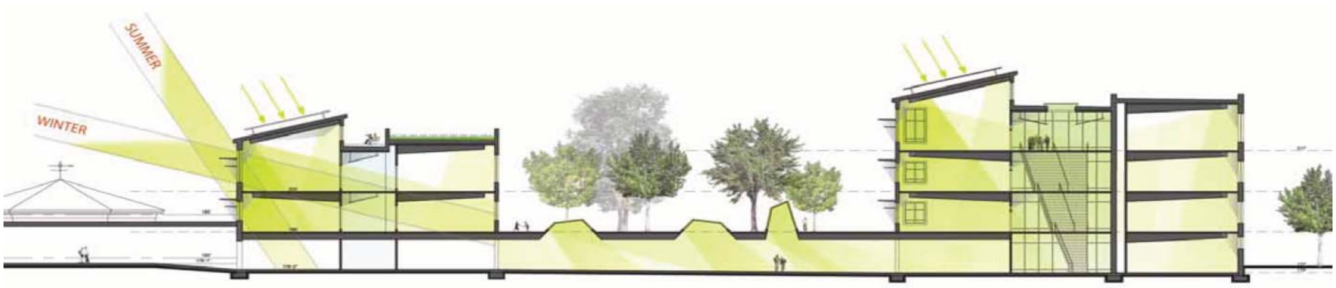
The core concept of integrative design is simple - most everything in a building project affects everything else. Consequently, we will examine how to integrate site parameters, solar orientation, water, stormwater systems, thermal envelope, lighting, window performance, heating and cooling supply systems, ventilation, and air distribution in a way that all of these systems are working together, much like those within an organism. For example: by enhancing insulation levels, improving lighting, increasing air-distribution efficiency, and installing high-performance glazing, we can downsize a building’s mechanical systems (equipment such as furnaces, air conditioners, heat pumps, fans, etc.). In many climates, entire perimeter heating systems can be eliminated. The cost savings achieved through such mechanical equipment reductions pay for the provisions that allowed for such downsizing in the first place (the better insulation, lighting, air distribution, and windows listed above). The resulting building will cost the same, but energy consumption and utility bills will be reduced dramatically.

Dozens more examples could be described here, but the point being made is that when all design decisions are based on similar notions of integrating the building’s systems, certain conventional components can be reduced in size or even eliminated altogether. The result can be dramatic in terms of energy efficiency, performance, cost savings, and environmental impacts. Via such integration, the size and cost of HVAC systems often can be reduced by 40-50% with proper solar orientation - or even more depending upon project parameters and goals. Consequently, over the life of the building, operational cost savings will easily exceed the building’s initial construction cost.

In short, this design methodology constantly examines the tradeoffs between up-front costs for pursuing these goals and the benefits that are derived from achieving them. Design decisions are based upon analyzing, quantifying, and evaluating the synergistic interactions between building systems in a series of research and analysis stages followed by “all hands” team workshops. Unlike conventional design, then, integrative design mandates closer interaction among the owner’s representatives, architects, engineers, and operations staff while they work together from the earliest pre-design phase to evaluate measures that can produce overall project savings, higher performance, and environmental benefits.

In conclusion, a mantra for pursuing integrative design can be expressed by the four *E*s:
Everyone **E**ngaging **E**verything **E**arly

> *“Optimizing components in isolation tends to pessimize the whole system – and hence the bottom line. You can actually make a system less efficient, simply by not properly linking up those components. . . If they’re not designed to work with one another, they’ll tend to work against one another.”*
>
> \- Hawken, A. Lovins, H. Lovins, from Natural Capitalism



Touchstones Exercise

A brain-storming session was initiated during the charrette to list the values and aspirations of the project team and to prioritize important issues. The "Touchstones" listed below were determined to be important design considerations. Once this list was generated, each project team member was given 10 votes (20 votes for the owners' representatives) and asked to distribute them among the values listed. The results of the exercise are listed in the table below.

Touchstones	# of votes
Building/site to serve as Educational tools for environmental sustainability/community	32
Daylighting – quantity *and* quality	27
Within budget and schedule	25
Energy efficiency	24
Connection to the outdoors/environment	20
Regenerative for habitat health	15
Indoor Air Quality	13
Durable – 70 to 100 year service life	13
Ease of maintenance	13
Aesthetics	12
Diversity of spatial experience – joyful	12
Increased human interaction	11
Safety and security	11
Water balance for buite	10
Thermal comfort	5
Flexible and adaptable	5
Improve occupant performance for growing leaders	4
Campus future growth with community interaction	2
Increased access to technology	0

LEED Review

Prior to the January 8th workshop, the project team reviewed the LEED for Schools Green Building Rating System on a credit-by-credit basis for the project's educational facility. Each credit was determined to be a "Yes" - it likely will be implemented on this project; a "Maybe" - these credits will require further investigation and/or consideration; and a "No" – these credits are not feasible for this project. In this comprehensive review of the LEED Rating System, each credit was discussed to determine how it fit (or not) within the scope of the project.

In addition, the project team recorded an assessment of potential cost implications in the project's LEED for Schools checklist. Additional comments also were added into the "comments" column of this LEED checklist. A complete version of this checklist with is contained in the Appendix.

The results of this LEED review indicate a total of 51 points targeted as feasible with 20 additional points listed as maybe. Accordingly, it appears that LEED Gold level certification would be a realistic target, which would require achievement of at least 44 points (Platinum requires 58 points)..

During the workshop, the project team discussed the LEED site boundary that will be used for calculating credit compliance with several credits. During this discussion, it was determined that the project likely consists of two separate LEED submissions as follows:

- Upper & Middle School Expansion – LEED for Schools
- Athletic Fields and support buildings – LEED-NC

It was also agreed that the LEED site area boundaries should match the Phase 1 Land Development submission's site disturbance area for the Upper & Middle School Expansion LEED submission.

LEED® Targeted Credits Summary by Credit Category	Yes	?	Total
Sustainable Sites (SS)	10	4	14
Water Efficiency (WE)	5	2	7
Energy & Atmosphere (EA)	9	6	15
Materials & resources (MR)	6	3	9
Indoor Environmental Quality (EQ)	17	3	30
Innovation & Design Process (ID)	4	2	6
Total	**51**	**20**	**81**

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Additional project-specific issues pertaining to the pursuit of various LEEE credits were discussed, and the project team agreed to pursue the following strategies with regard to the four key subsystems:.

- Habitat (human and other biotic systems)
  - Stormwater: currently GA has to sandbag the basement of the arts center during heavy rains
  - Reduce post-development run-off relative to current conditions
  - Investigate approval issues (Township, DEP, etc.) related to constructed treatment wetlands
  - Explore maintenance issues associated with constructed treatment wetlands
  - Investigate cistern sizing for rainwater harvesting
  - Consider courtyard as location for wetlands and educational functions
  - Explore alternatives for more effective solar orientation
  - Consider underfloor supply air plenum distribution with 12”-24” raised floor system
  - Analyze acoustics & lighting issues related to eliminating ceilings
  - Flexible wireless internet, access to be provided (with additional hard wire data system?)

- Energy
  - Target 28% annual energy cost reduction
  - Investigate impacts of the Central Plant on achieving this target
  - Consider ground source heat pumps
  - Energy modeling occupancy schedule: Science, arts, performance arts have no summer use

- Water
  - Dual flush water closets are acceptable
  - Use pint flush urinals
  - Determine supply and demand for analyzing water balance
  - Potentially collect condensation water from cooling equipment
  - Explore reduced sewer tap fees due to reduced water consumption

- Materials
  - Pursue Construction Waste Management for diversion of demolition waste from landfill disposal
  - Grind and reuse asphalt from existing parking for clean fill and/or sub-base material
  - Use concrete from existing US & MS building for back-fill, etc.
  - Reuse existing stone on the new US & MS building and landscape paving/seating

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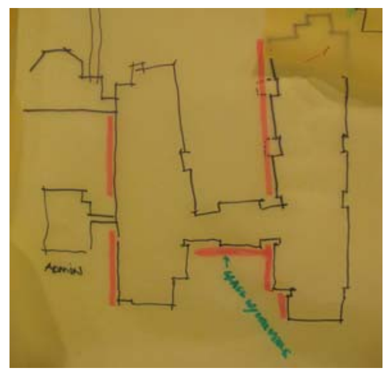
Results from Small Group Sessions – Round 1

The project team was split into two groups to participate in focused small group sessions to explore and identify performance parameters and specific design solutions. One group focused on building and site design, while the other group focused primarily on energy issues. The issues and ideas resulting from this breakout session are indicated below.



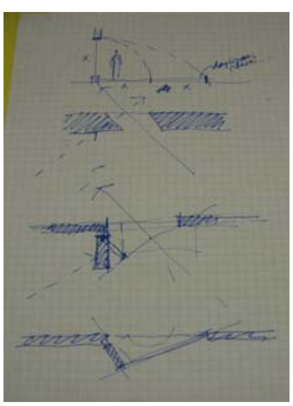
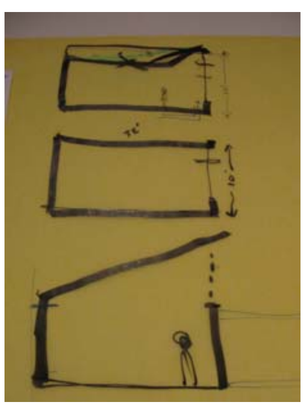
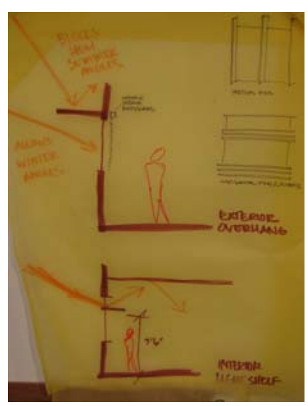
Both breakout groups identified the highlighted facades above as problematic with regard to solar exposure.

Energy group breakout:

- Overall energy goals:
    - Benchmarks for energy comparisons:
        - Current building
        - 2030 Challenge
        - EPA Target Finder
    - Baseline (prelim): assume 65K Btu/sf/yr
    - Target 40-45K Btu/sf/yr
    - ~ 25% to 30% energy cost savings
- Performance Parameters:
    - LPD: classrooms = 1.05 W/sf
- Summer programs (6 weeks) generate $150K revenue
    - classes done by noon; schedule might change with AC
- Perhaps expand thermal comfort range for summer peak
- Design targets will need to be established by zones
- Daylighting:
    - Controls – investigate:
        - Continuous dimming
        - Stepped dimming
        - On/off
        - Controls cost – approx. $130 per dimming ballast, or $1,000 per room
    - Identify targeted spaces for different types of above controls
    - Orientation: SW exposure is a problem
        - SW classrooms: exterior shading devices/glare control/Mechoshades
        - Explore configurations for light shelves, overhangs, louvers, etc.
        - Operable Windows for natural ventilation with open-back chairs
        - Top floor clerestories
    - Glazing parameters:
        - Target Tvis min. ~ 55+
        - Daylight Autonomy Ratio (DAR): an optional criteria – target 40% DAR?

Building/Site group breakout:

- Orientation:
  - Keep current overall building footprint
  - Explore SW façade treatments and shading devices instead of rotating building
  - SW exterior shading w/lightshelves
  - Investigate reorientation of windows - perhaps smaller punched windows to SW
  - Reduce glass area in commons – explore adding solid panels
  - Explore articulating windows in problem elevations
- Site and Building water:
  - Constructed treatment wetland (CTW) or rain garden wetland in courtyard
  - CTW to serve as an eduvcational tool; focal point with access
  - Must calculate supply capacity for CTW and calculate required size (area x depth)
  - Building as *permeable membrane* in relationship with wetlands
  - Examine shading and maintenance issues related to CTW
  - Perhaps include water/wetland element on parking lot side
- Raised floor:
  - Could gain window head height for daylighting - 13'-4" floor to floor height currently
  - Delete acoustical panels for flat ceilings – exposed structure (avoid spray fireproofing)
  - Sloped ceilings will need acoustical panels
  - Floor finish could be 12x12, 18x18, or 36x36 cork vs. VCT


Both breakout groups in round one produced conceptual sketches of potential daylighting configurations to explore

Results from Small Group Sessions – Round 2

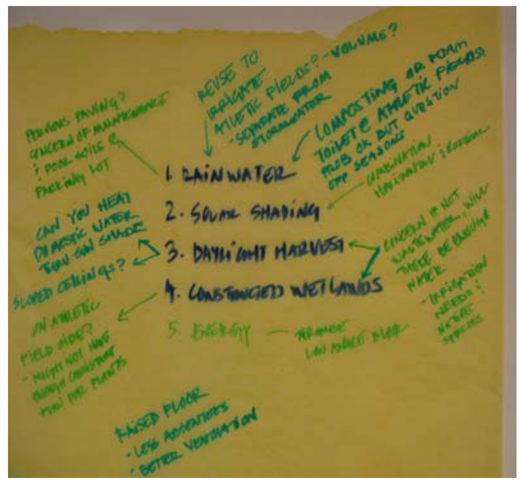
The project team again split into two breakout groups to participate in focused small group sessions to explore holistic design solutions for the site and building. The issues and ideas resulting from this second round of breakout sessions are indicated below.

Group 1 breakout:

- Orientation revisited:
  - Look at schemes produced earlier by the design team
  - Likely will remain as currently designed
  - SW elevations potential options:
    - Window configuration (inset)
    - Different at quad from new courtyard
    - Shading Upper School building with façade/plan shifts
- Floor to floor height and ceiling issues:
  - Raise window head height
  - Underfloor air to be investigated
  - Ceiling configurations to be analyzed – sloped ceilings for daylighting?
  - Top floor clerestories
- Rainwater / water:
  - Explore rainwater harvesting US & MS building for irrigation
  - Analyze rainwater harvesting to irrigate athletic fields – calculate required volume
  - Consider composting or foam toilet at athletic fields – explore off-season implications
  - Courtyard wetlands on athletic field side? Analyze if consistent enough supply for plants
  - Explore irrigation demand and supply, along with native species
- Solar shading and daylight harvesting:
  - Investigate combinations of horizontal and vertical shading devices
  - Explore integration of solar thermal system with solar shade
- Energy:
  - Consider trombe walls at appropriate exposures (south and SW)

Group 2 breakout:

- Rainwater/water:
  - Irrigation via rainwater harvesting?
  - Athletic field: composting toilets
  - One small green roof are should be included
- Daylighting:
  - Horizontal/vertical shading
  - Sloped ceilings?
- Constructed wetlands
  - Must calculate supply and demand
- Raised floor: improved ventilation/less absenteeism
- Rain gardens
  - Include in CDs not for township submission
  - D.E.P. concerns
  - Local NPDS - Whitemarsh township
  - Permeable infiltration shold be incorporated
  - Less to the south of site
- Site/civil:
  - Currently conservative approaches for Land Development Application
  - Will develop rain gardens
  - Rainwater collection at:
    - Athletic site discharged into on-site wetlands for quality issues
    - No increase in post-development quantity at Athletic site for 2/5 year storms
    - School side w/bioretention and rain gardens for smaller storms (2/5 year)



Whole group assessment of *Things to Keep*:

1. Rainwater harvesting
2. Solar shading
3. Daylight harvesting
4. Courtyard wetlands

Whole group assessment of *Things to Avoid*:

1. Waterless urinals
2. Porous pavement in general (concern of maintenance w/poor soils at parking lot)

Four Key Subsystems Research & Analysis

The group discussed what issues and/or strategies needs to be explored by the project team during the next research & analysis stage to integrate and make decisions about the four key subsystems.

Habitat:

- Other biotic systems:
    - Species list for landscaping
    - Green roof options

- Human
    - Daylighting: preliminary fenestration analysis:
        - Configuration
        - Size
        - Orientation
        - Shading elements
        - Glazing characteristics
        - Analyze controls for sample classroom(s)
    - Underfloor air:
        - Acoustical analysis related to no ceilings
        - Architectural impacts and feasibility analysis, including pricing
    - Operable windows relative to natural ventilation capacity and controls

Water:

- Water balance analysis to include (for both the Athletic site and the US/MS building site)
    - Supply and demand calculations for all water flows
    - Irrigation strategies (rainwater vs. well?)
    - Explore constructed treatment wetlands (CTW):
        - Visit examples
        - Investigate approval aspects
        - Seasonal functionality and variable loads
        - Wetlands design (required size and appropriate planting species)
    - Explore alternatives to CTW:
        - Rain gardensand infiltration strategies (required size and appropriate species)
        - Rainwater harvesting for sewage conveyance
        - HVAC-related water (captured condensate)
        - Gray water supply calculations (for irrigation and/or building reuse)

Energy:

- Energy modeling parameters:
    - Glazing characteristics performance options
    - Thermal envelope R-value options
    - Lighting scenario options for LPD and controls options
    - Exterior shading options
    - Orientation (?)
- Need occupancy schedule/patterns for modeling
- Central plant with modular phased boiler/chiller capacity
- Initial sizing of HVAC systems
    - Baseline case
    - Design Case with load reductions
    - Perhaps analyze initial sizing of systems by using a "pod", then extrapolate
    - Engage parallel costing exercise
- Performance Targets:
    - 7group will send list of issues
    - Determine energy benchmark (baseline case)

Materials:

- Investigate:
    - Flooring options
    - Ceiling options

Cost Bundling and Next Steps

The group discussed what major strategies should be investigated as bundles of costs for all of the systems and components affected by implementing that strategy. It is important to first establish a cot benchmark line item for the currently budgeted cost for each of these affected systems and components so that baseline (budget) cost bundles can be compared against potential design case cost bundles. The team also discussed what next steps should be taken..

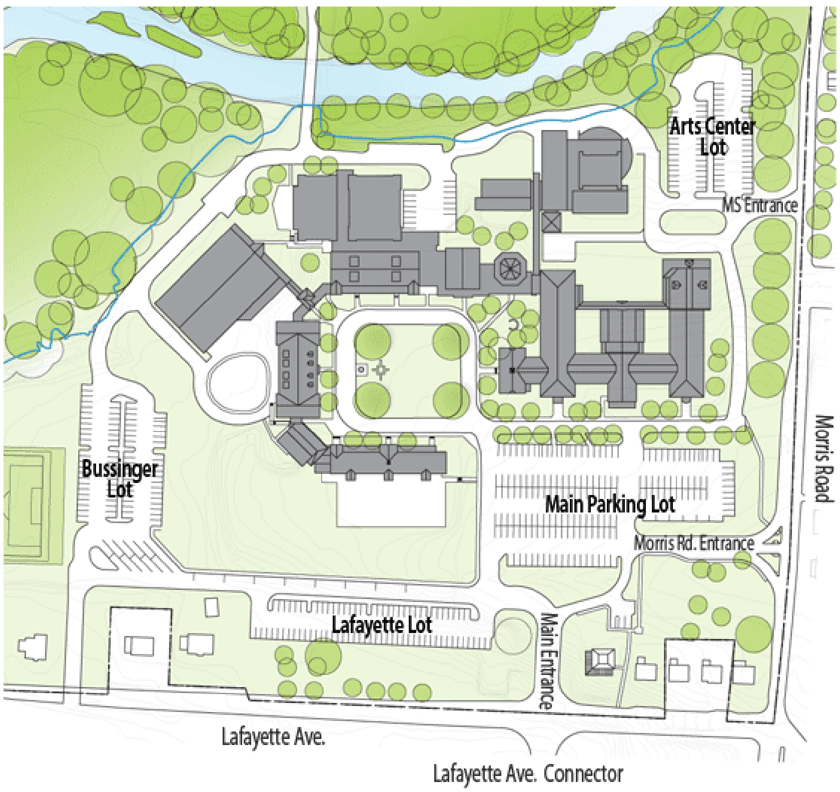
Cost bundles:

- Underfloor air system
- Daylighting strategies
- Constructed treatment wetlands
- Building envelope/MEP impacts

Next steps:

- Itemize research tasks and responsibilities for each team member
- Visit CTW installations to evaluate (Haverford, Sidwell Friends, Willow School)
- Visit underfloor air installations to evaluate (DEP Norristown, Clearview)
- Determine date for next team meeting to share results
- Identify and convene sub-group meetings
- LEED registration for both projects
- Develop LEED scorecard for both projects

Appendix


Arts Center Lot
MS Entrance
Bussinger Lot
Main Parking Lot
Morris Rd. Entrance
Morris Road
Lafayette Lot
Main Entrance
Lafayette Ave.
Lafayette Ave. Connector