Using an Integrated Approach to Developing Sustainability Guidelines and Performance Targets for a New College Campus

Bruce F. Douglas, PE, Stone Environmental, Inc.
Brent N. Toth, REHS, Stone Environmental, Inc.
Cori L. Barraclough, RP Bio, Aqua-Tex Scientific Consulting Ltd
W. Patrick Lucey, RP Bio, [2]Aqua-Tex Scientific Consulting Ltd.
Barbara Bradley, PE, Stone Environmental, Inc.
Stone Environmental, Inc.
535 Stone Cutters Way
Montpelier, Vermont, USA 05602
802-229-2193

ABSTRACT

In 2010, the College of the Desert focused the development of a new community college campus on the goal of creating a practical example of sustainable design. The West Valley Campus, located in Palm Springs, California, is currently being designed using an integrated approach, through which independent planners, designers, and contractors will work using a common framework to create a uniquely integrated sustainable facility that will become a living laboratory for teaching and learning. The integrated campus design process was developed to enable the campus to mitigate, and adapt to, climate change by potentially having a lower water and energy demand when compared to a series of parallel green design elements.

Two documents are central to the framework of the Integrated Design Campus Plan. The Sustainability Guidelines were completed in January, 2010, followed by the Performance Targets in July, 2010. These two documents were created by a diverse team of professionals representing the fields of planning, design, engineering, ecology, scientific research, and architecture. This team shared a singular vision of creating a framework to provide guidance for current and future phases of campus development that move beyond the current sustainability paradigm of living within available resources. The strategy adopted here was for designing a holistic campus to mimic desert ecology, emphasize resource conservation and efficiency, the recovery of wastes, and adaptation to climate change.

The overarching goals of the Sustainability Guidelines were zero waste, sustainable hydrology, net zero energy, carbon-neutral campus, and ecological restoration. Principles of sustainability were identified and arranged by thirteen themes over the Community, Campus, and Building scales: Education, Policy & Governance, Social, Economics, Ecology, Water, Energy, Waste, Transportation, Greenhouse Gases, Health & Wellness, Agriculture & Food and Materials. A fundamental aspect of integrated and sustainable design was recognition of the need to open boundaries -- such as property boundaries, boundaries between scales (building, site and community) and boundaries between design disciplines -- to find synergies that would enhance

the triple bottom line of ecological, social, and economic values. The performance guidelines will enable the campus to become a core part of the local and regional green economy and community. Water and waste recovery, energy generation, ecological regeneration, energy recovery from waste, and shared infrastructure will drive sustainability as the campus is developed.

The Performance Targets were a refinement of the Sustainability Guidelines. In this context, concepts of integrated sustainability were transformed through explicit analysis of campus themes and systems to achieve optimal efficiencies and maximum environmental, social, and economic value in the final campus. The Performance Targets are providing the campus and building design team with a practical resource of performance targets, technologies, strategies, applicability, and relevant case studies for each theme and system. The document illustrates how, when the themes were interrelated, the broader context of each theme becomes readily apparent. The Performance Targets compendium became a guide to the creative design professionals who are bringing to life the sustainable vision of the College of the Desert.

The ultimate goal of this process was creating a new approach to the design of institutions that integrates sustainability into the design process at three physical and social scales: building, campus, and community. The project team believes that concepts introduced in the project documents apply, not only to college campuses, but to new and renovation project opportunities for institutional, industrial, and municipal projects in a broad range of geographic, ecological, and economic settings.

KEY WORDS

Integrated Sustainability, Performance Targets, Campus Planning, Sustainable Hydrology, Ecological Regeneration, Net-Zero Energy, Desert, Infrastructure Planning, Metrics, Integrated Design.

INTRODUCTION

The sustainability merits of many projects have been documented and disseminated. This paper will focus not on the achievable degree of sustainability, but rather on the process for defining guidelines and targets for sustainability at the planning stage using an integrated and interdisciplinary approach. The approach was based on a premise that optimal solutions can be attained by deliberate integration – crossing disciplines, scales and boundaries – to solve multiple problems at the same time. Through the integration of the project elements, optimal sustainability can be achieved.

The College of the Desert is a community college, located in the Coachella Valley in central Riverside County, California. The Coachella Valley is part of the Colorado Desert which in turn is part of the larger Sonoran Desert, extending east to the vicinity of Tucson, Arizona and south into the state of Sonora, Mexico. The population of the Sonoran Desert has been estimated at

approximately 8 million people in the year 2000 (University of Arizona, 2002). The College of the Desert's main campus is located in the City of Palm Desert, one of a string of nine cities running east-west in the Coachella Valley. The Coachella Valley's 2010 population was estimated at 419,000 with an overall growth rate of 31 percent between 2000 and 2010(Claremont McKenna College, 2011).

The College of the Desert passed a bond in 2004 which included development of two new college campuses at either end of the Coachella Valley – the East Valley Campus in Thermal and the West Valley Campus (WVC or the Campus) in Palm Springs. WVC is the subject of this paper, although most of the sustainability framework developed for the WVC is usable for planning the East Valley Campus. In 2009 the College of the Desert approved a clear and articulate Policy on Sustainable Stewardship to guide the direction and actions of the College with respect to environmental and societal decisions concerning the existing and proposed campuses. It was apparent that specific integrated guidelines and performance targets were needed for the WVC. Thus, a pre-design planning process including sustainability guidelines and performance targets was conducted as described below (Stone Environmental, Inc., et al, 2010a and 2010b).

The integrated sustainability project team consisted of an interdisciplinary consulting team (Stone Environmental, Aqua-Tex Scientific Consulting, Farallon Consultants, and Cobalt Engineering); led by key College of the Desert managers: Edwin Deas, Vice President- Business Affairs; Steve Renew, Facilities Manager; and Mac McGinnis, Bond Program Manager; with Terence Williams, AIA, campus planning consultant.

The College had three main reasons for developing sustainable buildings and infrastructure:

- Reduce the ecological footprint of the College (e.g., water consumption, energy consumption, and greenhouse gas emissions) in a way that also demonstrates that sustainable buildings and infrastructure are economically viable.
- Show generations of students, faculty, staff, and community members the ecological, social, and economic value of designing campus buildings and infrastructure in an integrated fashion, in concert with our urban and natural environments.
- Reclaim resources and, if possible, to generate energy to support California's growing energy demand, in a sustainable fashion.

METHODOLOGY

The project team's first task was to clearly develop the project boundaries, goals and themes, and to design the framework for useful outcomes.

Defining Boundaries

The 119-acre WVC site, donated by the City of Palm Springs, is located on the northern edge of the City of Palm Spring, California. The College intends to develop the site in phases over several years. The initial site concept consists of three main areas, the Academic, Expansion and Joint Use, and Solar Energy Park zones.

The boundaries of the integrated sustainability approach were defined at multiple scales – buildings, site (campus), and community – with the objective of optimizing the transfer of resources across the boundaries defined by these scales through integration of the buildings into the site and the campus into the community. The community boundary was chosen as the Coachella Valley, the area within which the College of the Desert draws most of its students.

The project team conducted extensive research into the local ecology, hydrology, soils, geology, climate, culture, infrastructure, and governance. The team evaluated the conceptual plan for the campus and the City of Palm Springs' area plan, while characterizing applicable county, state, and federal regulatory and incentive programs.

An important lesson on defining boundaries was not to limit the project to a specific obvious limit such as the campus border, but to identify the boundaries of all relevant scales.

Defining Sustainability Goals and Themes

It is challenging to identify a single brief definition of sustainability applicable for multiple projects. In this context, the rationale for sustainability came from a desire to reduce the ecological (including energy, water and materials) footprint of the college; to use the buildings, campus, and connections to the community as a classroom for sustainability; and to mimic nature by reclaiming resources to the greatest extent possible.

Overarching sustainability goals for the campus were focused on the following categories:

- Zero waste
- Sustainable hydrology
- Net-zero energy utilization
- Carbon neutral
- Ecological regeneration

The project team held a charrette early on the process and identified thirteen major themes within which sustainability would need to be addressed and integrated between and amongst each other:

1. Education
2. Policy & Governance
3. Social
4. Economics

5. Ecology
6. Water
7. Energy
8. Waste
9. Greenhouse Gases
10. Health & Wellness
11. Transportation
12. Agriculture & Food
13. Materials

These themes can be addressed at each scale, building, site (campus) and community, as schematically illustrated in Figure 1.

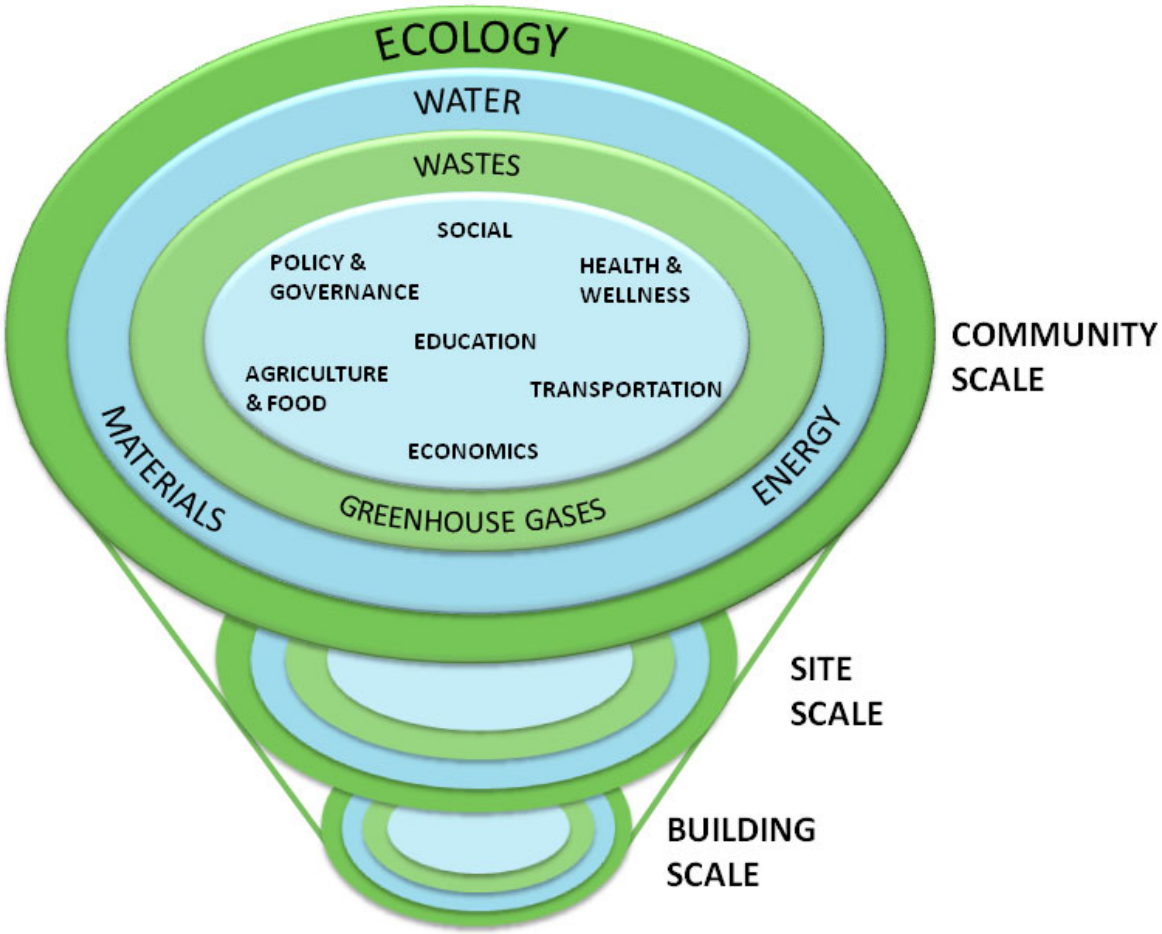

Figure 1 – Schematic of Sustainability Themes and Scales

Each theme has project-specific performance guidelines. Each performance guideline included three parts: the intent of the theme, a narrative describing the local context, and project-specific performance and evaluation criteria. These performance guidelines were intended to provide guidance to enable the design team to proceed, but not to provide pre-selected solutions which could constrain the design team.

Integrated Sustainability Guidelines

From the outset of the project, an off-the-shelf framework for addressing social, environmental, and economic aspects of sustainability at multiple scales simply did not exist. The College decided to use existing sustainability metrics, but to also go beyond that by defining how sustainability would merge with academics and the local ecological and cultural settings. Three main resources t required for any project are water, energy, and materials. In this case the resources would be conservatively used and reused as close to the sources as possible. The team also focused on ensuring that the various sustainability elements would be financially sound, confirming the economic viability of the project.

Performance Targets and Matrices

Quantitative and qualitative performance targets were organized by theme and scale. For each theme, matrices were developed to address the applicability and practically of key strategies and technologies to the WVC project.

RESULTS

The outcome of the analysis was a set of clear performance guidelines and targets, and matrices of their practicality and applicability.

Performance Guidelines

Resultant performance guidelines specific to WVC are shown in Table 1 for each theme and each scale.

Table 1. West Valley Campus Performance Target Summary

Scale		Buildings	Site/Campus	Community
Theme				
1	**Education**	enhance the learning environment; educate through experiencing a regenerative building;	model regenerative, adaptive design, educate by example through a living, regenerative campus community;	provide experiential and applied learning; seek industry input to the curriculum; provide green skill development;
2	**Policy/ Governance**	meet or exceed federal, state, county & municipal sustainability policies	meet or exceed federal, state, county & municipal sustainability policies;	lead the community in implementing the sustainability policies of federal, state, county & municipal governments
3	**Social**	have gathering and contemplative spaces that enhance feelings of wellbeing	be a safe, welcoming, respectful, gathering place for all;	belong to and inspire the community; be designed to reflect community needs, goals and aspirations
4	**Economics**	cost less to own and operate;	be revenue positive in the areas of water, energy and ecology;	reduce taxes and create local green jobs
5	**Ecology**	work with natural processes (sun, wind, land and water)	adapt to the climatic and ecological conditions of the site	regenerate ecological function
6	**Water**	maximize efficiency and water reuse, minimize consumption of potable water	consume net zero water; reclaim and reuse water; maintain site hydrology	enhance the community hydrological cycle
7	**Energy**	be energy efficient	consume net zero energy	reduce fossil energy dependency; increase energy autonomy
8	**Waste**	support the net zero waste goal	generate net zero waste	contribute to zero waste
9	**Transportation**	be pedestrian and bicycle-oriented	be integrated into public transit infrastructure	reduce environmental impact of transportation
10	**Greenhouse Gas (GHG)**	minimize GHG emissions	generate net zero GHGs	reduce community GHGs
11	**Health & Wellness**	create a healthy environment for learning	provide a healthy landscape for people and creatures	improve overall community health and wellness; reduce air pollution
12	**Agriculture and Food**	enable healthy eating	support local, sustainable agriculture	generate demand for local, sustainable agricultural products
13	**Materials**	be locally–sourced	be locally–sourced and sustainable	create local demand

Performance Targets

The performance targets were a refinement of the Sustainability Guidelines, and included both qualitative and quantitative metrics. In this context, concepts of integrated sustainability were transformed through explicit analysis of campus themes and systems to achieve optimal efficiencies and maximum environmental, social and economic value in the proposed campus. The Performance Targets provided the campus and building design team with a practical resource of performance targets, technologies, strategies, applicability, and relevant case studies for each theme and system. The following list provides an example of how performance targets were summarized for the ecology theme:

1. Target a medium density floor area ratio (FAR) (m2/ developed ha) for campus buildings to ensure efficient use of developable land
2. Minimize and monitor emissions of common air pollutants
3. Use passive design to reduce energy use and ensure efficiency within the desert environment (Design with Nature)
4. Maintain the ecosystem functions and services of the surrounding desert environment
5. Regenerate ecological function in neighboring areas within the community to offset the losses incurred through the construction of the new campus (no-net-loss)

The performance targets, strategies, and technologies (referred to collectively as performance targets) were organized according to the three scales of building, campus, and community. Each scale provides a different lens for evaluating sustainability and for optimizing benefits from the interrelationship of the scales. Optimization may occur through combinations of strategies and technologies to meet various objectives. For example, graywater reuse is useful at the building scale, but would not be needed if comprehensive onsite wastewater recycling were implemented. Similarly, composting food waste may be less optimal from a resource recovery perspective than creating biogas from wet organics, although it could serve as an interim measure until a biogas facility becomes feasible. The targets provide specific quantitative and qualitative objectives for the design team although quantitative targets are not intended to represent the ultimate attainment of sustainability. Exceeding the quantitative targets is encouraged. Each of the performance targets were cross-referenced with other themes to ensure the context of integration was clear.

The rationale for the performance targets were documented for the benefit of the design team. For each theme, specific potential strategies or technologies were described and discussed in terms of the benefit and relative costs.

Practicality and Applicability Matrices

The college administration, facilities department, and bond office provided review and feedback on the performance target. One of their priorities is that proposed solutions be practical and applicable to the college's needs. Since this is a pre-design planning project, it is not appropriate to rule out specific potential systems or technologies, but constraints were identified using matrices to rank solutions.

A sustainable design rating system was developed to compare the relative merits of various design strategies and technologies. They were created with a flexible format to will allow designers and builders to use the matrices with new technologies as they become available.

Eleven matrices cover each of the thirteen themes. Because the Greenhouse gasses theme is an outcome of several design themes and is not an explicit design theme in this context, Greenhouse gasses could not be separated in this way. The Wastes and Materials themes were combined into a single theme. The matrices compare and contrast performance targets providing an adjunct for the design team's decision making. A portion of the applicability and practicality matrix for indoor water conservation under the water theme (Table 2) illustrates this point. The right hand column in Table 2 has a numerical rating as follows:

1. Provides baseline objectives for practicality and applicability
2. Exceeds baseline objectives for practicality and applicability
3. Maximizes objectives for practicality and applicability

Table 4. Excerpt from Practicality and Applicability Matrix

Criteria		Rationale	Rating
Environmental Aspects	Environmental Sustainability	Well balanced benefits with significant water savings	3
	Interoperability with Like Systems	Independent operation	3
	Greenhouse Gas Reductions	Reduced use of water requires less energy for treatment and transport	2
	Water Supply Impacts	Reduced use of community's water resource	3
	Landscape Impacts	NA	
	Permanent Dedication of Land or Space	None	1
Social Aspects	Agency Approvals Required	Some are required for code compliance	1
	Degree of User Control	High	3
	Architectural Impacts	Fixture selection	2
	Operator Certifications Required	None	3
	Flexibility of Implementation	High	3
	Ease of Operation	Easy	3
	Prestige/Public Opinion	high	3
Economic Aspects	Installation Cost	Low	3
	Annual Operating Costs	Low	3
	Life Cycle Costs	Low	3
	Life Cycle Revenues/Savings	Low	3
	Probable Annual Costs Versus Baseline Standards	Similar to Plumbing Code with modest cost increase	1
Sum of Ratings			43
Maximum Possible Rating			51
Category's Percentage of Maximum Rating			84%

DISCUSSION AND CONCLUSION

Integrated sustainability is the core of 21st century design at a campus scale. A project-specific roadmap for integration at the pre-design phase enables the design team to take a holistic

approach from day one. Beginning with the College of the Desert's sustainability principles, a project site, and a conceptual design of the college campus, a framework was laid out for the design team to incorporate and integrate the sustainability themes into the campus design and operation.

The specific performance targets, strategies, and technologies are meant to prompt interaction and innovative practices within the design team while concurrently serving as a checklist to ensure that key elements are considered at each step of the design process. The matrices illustrate how the themes are interrelated and are guides to the creative professionals who will bring to life the sustainable vision of the College of the Desert.

Well planned integrated green infrastructure can solve several problems at once, such as the needs of the College and the community need for sustainable water and waste management, inexpensive energy, and connection to the local ecology. In this case, the benefits of sustainability go further as the college buildings, site and connection to the community all become part of the classroom, teaching students, staff, and visitors the value and values of integrated sustainability.

The outcome of this project is a new approach to the design of institutions that integrates sustainability into the planning of the design process at the building, campus, and community levels. Designing with nature, including practical application of biomimicry and ecological regeneration concepts are essential to cost-effective development. The concepts used in this project apply, not only to college campuses, but to new and renovation project opportunities in a broad range of geographic, ecological, and economic settings, including institutional, industrial and municipal projects.

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