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## A Three Infrastructures Approach to Land Use Planning in New Hampshire

PHOTOS BY BILL SMITH

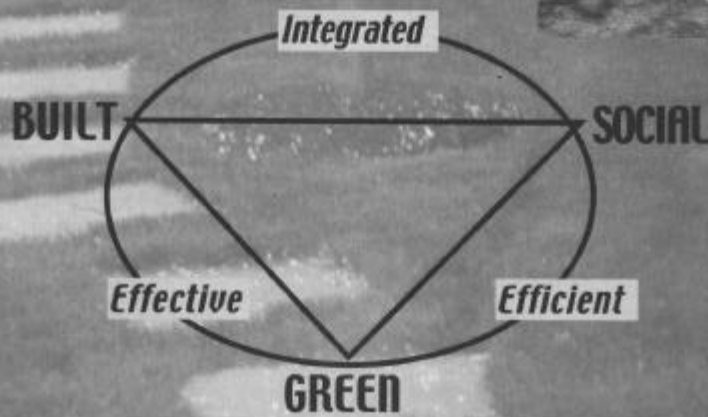


PHOTO BY STEPHEN SCHWABER

# A Three Infrastructures Approach to Land Use Planning in New Hampshire

**BUILT INFRASTRUCTURE:** the many constructed elements that transport and shelter people, goods, and information.

**GREEN INFRASTRUCTURE:** the natural life support system of interconnected lands and waters upon which human life and economic activity, as well as all other forms of life, depend.

**SOCIAL INFRASTRUCTURE:** the opportunities within a community for organized and informal social interaction.

PONEAH BOG, BY STEPHEN G. WALKER. OTHER PHOTOS BY BILL SMITH

by Carol Foss, Audubon Society of New Hampshire; Kate Hartnett, Jordan Institute; Meredith Cooper, Minimum Impact Development Partnership

It's easy to complain about development patterns that we don't like, but not so easy to really identify the characteristics of patterns we might like better. One vision of a process that might help to move us in the right direction involves thinking of a community as the intersection of three kinds of infrastructure: built, green, and social (see box on page 6).

At least in theory, the more effective, efficient, and integrated these three kinds of infrastructure are in a community, the higher the quality of life for its residents. Effective infrastructure is very successful in accomplishing its purpose. Efficient infrastructure accomplishes its purpose with a minimum of wasted effort and resources. Efficiency and effectiveness are common goals for infrastructure systems and have many widely recognized benefits. Integrating these infrastructures greatly enhances the benefits of each independent system by reducing potential conflicts and minimizing competition for resources.

How can a community apply these concepts to land use planning? One good starting place is the municipal master plan, the underlying document that guides growth and development in the community. By state law, the master plan includes an introductory section of objectives, principles, assumptions, policies, and standards for development, as well as sections addressing land use, housing, transportation, utilities and public services, community facilities, recreation, conservation and preservation, and construction materials.

The introductory section provides an opportunity to include the effectiveness, efficiency, and integration of the three infrastructures as community goals. The community facilities and recreation sections relate most directly to social infrastructure, and the conservation and preservation section relates most directly to green. These sections reflect a town's public investment in green and social infrastructures and their contribution to local quality of life. The greatest impact, however, may come from carefully considering effects on green and social infrastructures in the built infrastructure sections that address housing, transportation, utilities, and construction materials. Built infrastructure goals can include efforts to promote social infrastructure, for example, through the layout of transportation networks and the design of new neighborhoods. They also can address efforts to minimize negative impacts on green infrastructure, such as by minimizing the fragmentation of undeveloped lands when siting new facilities. The land use section provides the opportunity to express a community vision that truly integrates the many ways in which citizens use land.

In the coming months, we will be working with several pilot communities to explore the application of three infrastructure ideas in their master planning processes. Every community's master plan is unique, and participating local citizens will determine if or how the three infrastructure concept can be useful to them. We urge our readers, whether planning board or conservation commission members or citizens interested in the future of their towns, to consider these ideas, discuss them with neighbors and colleagues, and be actively involved in your town's planning process.

**Challenge:** How do we encourage development where it makes sense and minimize it where it doesn't?

## Challenge: How do we create an approach that fits development into the landscape and the site?

### Introduction to the Minimum Impact Development Partnership

The Minimum Impact Development (MID) Partnership is a group of professionals with diverse backgrounds, interests in New Hampshire's growth and development, and a shared commitment to development strategies that benefit the state's economy, environment, and quality of life. Partners include architects, bankers, biologists, builders, developers, engineers, landscape architects, municipal officials, planners, realtors, state regulators, and soils and wetlands scientists.

The Partners are working toward a vision of "good development" by integrating ecological design, public health concerns, and economic vitality in a multi-disciplinary and multi-scale approach. What are the characteristics of "good development," New Hampshire style? They include:

- Site design that incorporates available ecological services such as sunlight and prevailing winds, minimizes pollution, recharges groundwater, and includes landscaping that provides shade and winter storm protection and minimizes mowing, watering, and pesticide use.
- Buildings that are energy efficient and comfortable, with

excellent indoor environmental quality (temperature, humidity, ventilation, lighting, and acoustics).

- Neighborhood and community design that provides mobility for people and wildlife.
- Site design and function that enhances community character.

The MID team is working at the site scale, with buildings and grounds; the community scale, with neighborhoods and municipalities; and at the landscape scale, with regions and the state, to promote good development as New Hampshire grows. This issue of *New Hampshire Audubon* focuses on concepts and activities primarily at the community and landscape scales.



SITE DESIGN THAT MAXIMIZES SUNLIGHT

	GREEN	BUILT	SOCIAL
DEFINITION	<i>A network of interconnected lands and waters that provide basic goods and ecological services such as clean air and water, climate moderation, food and fiber, and waste decomposition.</i>	<i>The human-constructed elements that shelter and transport people, goods, and information.</i>	<i>The opportunities within a community for organized (event-based) and informal (place-based) social interaction.</i>
COMPONENTS	<ul style="list-style-type: none"> <li>• Working Lands</li> <li>• Conservation Lands</li> <li>• Recreation Lands</li> <li>• Riparian Buffers</li> <li>• Urban Woodlots</li> <li>• Streetside and Yard Vegetation</li> </ul> <p>In a network of:</p> <ul style="list-style-type: none"> <li>n Superhubs (35,000+ acres in northern N.H.; 15,000+ acres in southern N.H.)</li> <li>n Hubs (minimum 5,000 acres)</li> <li>n Nubs 500-5,000 acres</li> <li>n Subnubs (50-500 acres)</li> <li>n Interspersion Areas (fine scale business and green mix)</li> <li>n Links (broad, permeable travelways)</li> <li>n Corridors (narrow, linear travelways)</li> </ul>	<ul style="list-style-type: none"> <li>• Buildings</li> <li>• Roads, Bridges, Rails, Trails</li> <li>• Wires, Satellites</li> <li>• Pipelines</li> <li>• Fuel Supply</li> <li>• Sewage Treatment Facilities</li> <li>• Landfills/Incineration</li> </ul>	<p><b>Organized:</b></p> <ul style="list-style-type: none"> <li>• Meetings of Organizations</li> <li>• Education Classes</li> <li>• Cultural Events</li> <li>• Religious Services</li> <li>• Government Functions</li> <li>• School Events</li> <li>• Sports Events</li> </ul> <p><b>Informal:</b></p> <ul style="list-style-type: none"> <li>• Stores, Post Offices</li> <li>• Trails and Sidewalks</li> <li>• Parks and Playgrounds</li> <li>• Community Centers</li> <li>• Health Clubs</li> <li>• Pools and Beaches</li> <li>• Libraries</li> <li>• Transfer Stations</li> <li>• Waiting Rooms</li> </ul>
FUNCTIONS	<ul style="list-style-type: none"> <li>• Air quality, purification</li> <li>• Climate moderation: shade and sunlight (cool in summer, warm in winter)</li> <li>• Water: flood prevention, storm water retention, groundwater recharge</li> <li>• Surface water quality, purification</li> <li>• Pollination and seed dispersal</li> <li>• Food and fiber supply</li> <li>• Waste decomposition</li> <li>• Carbon sequestration</li> <li>• Insect population control</li> <li>• Noise reduction</li> <li>• Recreation</li> <li>• Spiritual connection</li> <li>• Aesthetics and visual screening</li> </ul>	<ul style="list-style-type: none"> <li>• Shelter, comfort</li> <li>• Mobility</li> <li>• Transportation</li> <li>• Water supply</li> <li>• Power generation and distribution</li> <li>• Communication</li> <li>• Waste handling &amp; treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Support</li> <li>• Safety</li> <li>• Bonding</li> <li>• Connection</li> <li>• Information</li> <li>• Governance</li> <li>• Education</li> <li>• Service</li> <li>• Commerce</li> </ul>

## Green Infrastructure: A Tool for Maintaining Rural Character

Green infrastructure, as defined previously, constitutes the natural life support system upon which wildlife, human life, and economic activity ultimately depend. This system is a network of interconnected lands and waters that supports native plants and animals, maintains natural ecological processes, sustains air and water resources, and contributes to human health and quality of life. Green infrastructure, with the native biodiversity it supports, provides many essential ecological services (see Box 1), and contributes to human quality of life in additional ways (see Box 2).

### Box 1: Essential Ecological Services

- Groundwater recharge
- Surface water purification
- Storm water retention
- Microclimate moderation
- Air purification
- Food and fiber production
- Insect population control
- Carbon sequestration

Waste decomposition

### Box 2: Quality of Life Contributions

- Shade
- Visual screening
- Noise reduction
- Recreational opportunities
- Aesthetic appreciation
- Intellectual stimulation
- Spiritual connection

We can think of green infrastructure as a set of building blocks, sort of like tinker toys, that can fit together in various ways on the landscape. These building blocks can be separated into two broad categories—patches and connections. We have defined five different kinds of patches, based on New Hampshire's landscape and wildlife:

*Superhubs* are large contiguous blocks of undeveloped land, at least 35,000 acres in northern New Hampshire and at least 15,000 acres in southern New Hampshire. These areas, based on Nature Conservancy research, are believed to be large enough to sustain the full range of forest ages and the animals that depend on them at any given time, based on the natural disturbances (e.g., wind, ice, insects, fire, disease) typical of the region.

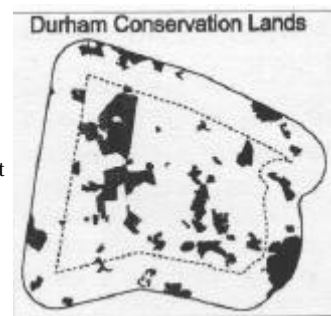
*Hubs* are contiguous blocks of at least 5,000 acres and preferably more than 10,000 acres. These blocks should be large enough to support medium-sized predatory mammals, such as fishers and bobcats.

*Nubs* are blocks of 500 to 5,000 acres, preferably at least 1,000 acres, and should be large enough to support somewhat smaller predators, such as Barred Owls and long-tailed weasels.

*Subnubs* are blocks of less than 500 acres that are large enough to support forest interior birds, such as Ovenbirds and Scarlet Tanagers. Research is underway in southern New Hampshire this

summer to help determine the lower size limit of these blocks.

*Interspersion areas* are areas in which green and built infrastructures are interwoven at a fine scale. They range from downtown areas with very few trees to large lot subdivisions with patches of natural vegetation. Their common charac-



teristic is a lack of ground-nesting and other interior forest birds.

Connections come in two broad categories: links and corridors. *Links* are broad connections between patches that include some scattered development but enough undeveloped land for wildlife to move safely from one patch to another over a variety of routes. You can picture them as a braided river, where a canoe could take any number of routes down interconnecting channels, but numerous islands require some careful navigation. *Corridors* are narrow connections between patches, similar to canals, though which wildlife can move from one patch to another over a single, well-defined route, with impassable terrain on either side. A riparian corridor through a developed area is one example of a corridor.

New Hampshire's rural character has long enabled communities to take green infrastructure for granted. However, an increasing proportion of land is being converted from natural systems to developed landscapes. Municipalities now need to plan for green infrastructure as an integrated system, rather than as isolated patches of protected land.



## Minimum Impact Development at the Landscape Scale: Maintaining Choices in Community Character

The interaction of built, green, and social infrastructures helps to define community character. The mix of land uses over New Hampshire's landscape creates a diversity of human densities, with open spaces between developed places. Our state offers residents a wide range of choices in community character along a gradient from rural to urban. This diversity of community character helps to make New Hampshire a special place to live.

Each of New Hampshire's 259 municipalities and unincorporated places can be categorized as one of ten community types (see sidebar).

The *Wild Land* category encompasses unincorporated places with no housing units and no active forest management and includes nine unincorporated places located at high elevations within the White Mountain National Forest. Built infrastructure is limited to trails and other recreational facilities, and these places are within the state's largest green infrastructure superhubs. Social infrastructure is associated with recreational activities.

The *Working Forest* category encompasses unincorporated places with no housing units (but usually some seasonal camps) and active management for forest products. Nearly all Working Forest unincorporated places are in Coos County; one is in Grafton County. Built infrastructure includes roads as well as trails, and social infrastructure is associated with work activities as well as recreation. These places also are important components of green infrastructure superhubs.

*Rural Communities* are municipalities or unincorporated places with fewer than 2,000 housing units and no municipal water supply. Their undeveloped lands may be either "wild" or "working" and contribute to hubs and superhubs. Built infrastructure is limited and includes roads, buildings, and utility lines. Social infrastructure is largely informal and may or may not include local government, schools, and religious institutions.

*Villages* are municipalities with fewer than 2,000 housing units and a municipal water supply. The availability of a public water system enables compact development in a village center. Villages are distributed throughout New Hampshire, but only two remain in Strafford County. Built infrastructure is somewhat more extensive than in Rural Communities, including a water system and, in some cases, a sewer system. Social infrastructure is limited, but it is likely to include local government, schools, stores, and at least one religious institution. Green infrastructure includes a small interspersed area and contributions to hubs or superhubs.

*Recreational Communities* have 2,000 to 9,999 housing units, many of which are second homes, and no municipal water supply. These communities occur in the White Mountain and Lakes Regions. Built infrastructure is moderately extensive and may be focused around a particular recreational activity (e.g., downhill skiing or golf). Social infrastructure may exist as two largely separate systems, one involving seasonal residents and the other year-round residents, with local commerce serving as the primary link between the two. Green infrastructure may include portions of hubs and superhubs, as well as smaller components.

*Suburbs* have 2,000 to 9,999 housing units, most of which are primary residences, and no municipal water supply. Suburbs are

## Challenge: Can we maintain New Hampshire's rural character as the state grows? How can we help our communities grow without losing their essential character?

Located in Rockingham, Strafford, Hillsborough, and Merrimack counties. Built infrastructure is widely dispersed and includes an extensive road system. Commercial centers, if any, are small and scattered. Social infrastructure is limited, as residents spend considerable time in associated urban centers. Green infrastructure exists primarily as subhubs and interspersed areas.

*Small Towns* are municipalities with 2,000 to 3,999 housing units and a municipal water supply. They occur throughout the state except in Coos County. Built infrastructure is fairly concentrated, and social infrastructure is moderately extensive and complex and usually includes a shopping district and several civic organizations. Green infrastructure includes interspersed areas, hubs, subhubs, and portions of hubs.

*Large Towns* have 4,000 to 9,999 housing units and a municipal water supply. Large Towns are located in all ten New Hampshire counties. Built infrastructure is typically extensive and concentrated, with numerous commercial and government buildings. Social infrastructure may include multiple religious, social, recreational, and cultural organizations.

*Small Cities* have 10,000 to 19,999 housing units and a municipal water supply. New Hampshire's Small Cities are located in Merrimack, Rockingham, and Strafford counties. Small Cities have extensive built infrastructures, with dense urban centers and various densities of residential neighborhoods. Social infrastructure is complex and includes numerous religious, social, recreational, and cultural organizations. Green infrastructure may include at least portions of hubs but is largely composed of subhubs and interspersed areas.

*Large Cities* have 20,000 or more housing units and a municipal water supply. Both of New Hampshire's Large Cities are located in Hillsborough County. Large cities have extensive built infrastructure, with large downtown business areas, commercial and industrial areas, and large residential areas in a variety of densities. Social infrastructure includes a wide array of both formal and informal options. Green infrastructure is limited and exists largely as subhubs and interspersed areas.

Towns and cities can accommodate carefully managed growth without dramatic changes to their character. Existing infrastructure makes it easier to focus new development in areas where services are already available or can be extended at reasonable cost. New Hampshire's villages and rural communities, which comprise well over half of the state's municipalities, face tough questions as they experience growth. Would they prefer to grow into a town or a suburb? What are the costs and benefits of each alternative? What are the long-term economic implications of investing in water and sewer infrastructures that enable compact growth versus the dispersed growth alternative that will ultimately require large budgets for road maintenance, student transportation, and emergency services? What actions are needed now to guide future growth in the desired direction?

The answers to these questions are neither easy nor obvious and are likely to differ from one community to another. Asking the questions is an important first step. We hope that communities facing growth will actively seek answers and make informed choices rather than allow inaction to lead them in directions they would rather not go.

## NEW HAMPSHIRE COMMUNITIES SORTED BY CATEGORY TYPE

WILD		VILLAGE	
Bean's Grant	Ettingham	Londonery	
Bean's Purchase	Ellsworth	Arslover	
Chandler's Purchase	Fremont	Antrim	Plaistow
Cut's Grant	Gilmanston	Ashland	Stratham
Hadley's Purchase	Gilsum	Bath	Weare
Law & Burbank's Grant	Goshen	Bennington	Windham
Pinkham's Grant	Greifon	Bethlehem	
Sargent's Purchase	Greenfield	Boscawen	<b>SMALL TOWN</b>
Thompson's & Meserve Purchase	Greenland	Campton	Alton
	Groton	Canaan	Amherst
	Hampton Falls	Carroll	Bumstead
	Harrisville	Colebrook	Burdett
	Harris Location	Epsom	Belmont
	Hebron	Errol	Bristol
	Holderness	Fitzwilliam	Charlestown
	Jefferson	Francetown	Durham
	Kensington	Francis	Enfield
<b>WORKING</b>	Larsdell	Freedom	Essex
Atkinson & Gilmanston	Langdon	Gorham	Essex
Academy Grant	Lee	Grantham	Franklin
Cambridge	Lempster	Greenville	Hampstead
Crawford's Purchase	Loudon	Hancock	Hanover
Dix's Grant	Lyme	Henniker	Hillsborough
Dixville	Lyndeborough	Hill	Hopkinton
Erving's Location	Madison	Hinsdale	Jaffrey
Green's Grant	Marlow	Jackson	Lincoln
Kilkenny	Mason	Lancaster	Littleton
Livermore	Middleton	Libon	Newmarket
Martin's Location	Milford	Marbleborough	Newport
	Mont Vernon	Milton	Pembroke
	Nelson	Monroe	Peterborough
Odell	New Boston	New Castle	Plymouth
Second College Grant	New Durham	New Hampton	Raymond
Success	New Ipswich	New London	Rye
Livermore	Nashua	Northfield	Seabrook
	Newington	Northumberland	Sunapee
	Newton	Northwood	Swaney
	North Hampton	Oxford	Wakefield
	Nottingham	Pittsburg	
	Orange	Pensfield	<b>LARGE TOWN</b>
	Piermont	Plainfield	Berlin
	Randolph	Rollinsford	Claremont
	Richmond	Sandown	Conway
	Rindge	Stewartstown	Essex
	Roxbury	Stratford	Gilford
	Rumsey	Sury	Goffstown
	Salisbury	Tamworth	Hampton
	Sambornon	Tilton	Hooksett
	Sandwich	Troy	Hudson
	Sharon	Walpole	Keene
	Shelburne	Warner	Laconia
	South Hampton	Waren	Lebanon
	Springfield	Whitefield	Meredith
	Stark	Wilton	Merrimack
	Stoddard	Winchester	Milford
	Stratford	Woodstock	Somersworth
	Sugar Hill		Wolfeboro
	Sullivan	<b>RECREATIONAL</b>	
	Sutton	Hale's Location	
	Temple	Moultonborough	
	Thompson	Cutpea	<b>SMALL CITY</b>
	Unity	Tuftonboro	Concord
	Washington	Wareville	Derry
	Webster	Valley	Dover
	Wentworth		Portsmouth
	Wentworth's	<b>SUBURB</b>	Rochester
	Locazion	Allensworth	Salem
	Westmoreland	Atkinson	
	Wilton	Barrington	<b>LARGE CITY</b>
	Windsoe	Bedford	Manchester
		Bow	Nashua
		Hollis	
		Kington	
		Litchfield	

## What is Social Infrastructure?

Until recently, social infrastructure has received relatively little attention as an important contributor to quality of life. Defined as the opportunities within a community for organized and informal social interaction, social infrastructure can be considered at multiple scales. *Organized* social infrastructure tends to be event-based, with people coming together for a specific, planned activity. *Informal* social infrastructure tends to be more place-based, involving chance encounters at locations where many people come independently to conduct various activities.

Social infrastructure exists at the site scale both in buildings (primarily work places) and on their grounds. Organized opportunities may include meetings, work sessions, and presentations; informal opportunities exist in break rooms and cafeterias, lobbies and waiting rooms, at mailboxes, bulletin boards, and water coolers. On the grounds, organized opportunities include group picnics and organized recreation, such as softball games, while informal opportunities exist on trails and sidewalks and at benches and picnic tables.

Organized opportunities are relatively uncommon at the neighborhood scale, but may include neighborhood meetings, block parties, cookie swaps, trick-or-treating, and Christmas caroling. Informal opportunities, including sidewalks and trails, playgrounds and parks, backyards, and sledding hills and skating rinks, are more typical of the neighborhood scale.

Organized opportunities abound at the community scale at government functions, such as town meeting and various public hearings, school events, educational classes, religious services, organization meetings, cultural events, and celebrations, such as Old Home Day, Memorial Day parades, and July Fourth fireworks. Informal opportunities at this scale can be grouped roughly into two broad categories: recreational and business-related. The recreational category includes community centers, sidewalks and trails, restaurants, athletic facilities, bandstands, parks, pools, and beaches. The business-related category includes libraries, town halls, transfer stations, stores, post offices, and waiting rooms.

Incorporating social infrastructure considerations into site and neighborhood design is a worthwhile investment that promotes public health, safety, and general quality of life. As communities grow and lives become busier, diverse opportunities to interact with neighbors and fellow citizens become more valuable for social capital (see [www.bettertogethernh.org](http://www.bettertogethernh.org)).



CATEGORY	NUMBER	PERCENT	AREA	PERCENT
WILD	9	3	170	2
WORKING	13	5	393	4
RURAL	106	41	3576	39
VILLAGE	56	22	2302	25
SMALL TOWN	31	12	1236	13
LARGE TOWN	17	7	656	7
RECREATIONAL	5	2	267	3
SUBURB	14	5	394	4
SMALL CITY	6	2	221	2
LARGE CITY	2	<1	67	<1