

Wellesley West Gateway



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Town of Wellesley Planning Board
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Prepared by:

MetroWest

Growth Management Committee

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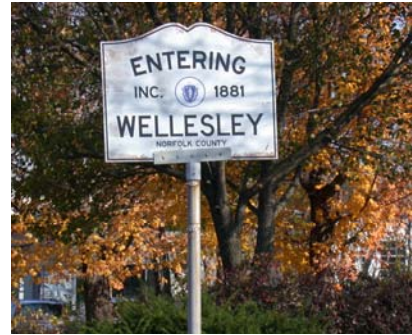
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I. Project Overview

The Town of Wellesley Planning Board is proactive in its efforts to plan for the future of Wellesley. In addition to the completion of a Comprehensive Plan, the Planning Board has successfully completed several specific area plans. During the process of developing the comprehensive plan, additional areas were identified for further study as small specific area plans. The Wellesley West Gateway Study Area was one of the areas identified.

Entering Wellesley at Natick Town Boundary – Photo P1



The Town of Wellesley contracted with the Metropolitan Area Planning Council, the regional planning agency, and the MetroWest Growth Management Committee to undertake and perform all appropriate tasks to produce a plan for the area along Route 9 generally from the Route 9 Weston Road intersection to the Route 9 Oak street intersection but with special attention to the land in Wellesley. The Town's "Statement of Work Request" dated October 24, 2006, is included as Appendix A.



Entering Natick at Natick/Wellesley Town Boundary – Photo P2

The MetroWest Growth Management Committee (MWGMC) is a unique collaborative partnership of municipalities created in 1984. MWGMC serves as a think tank and advocate for locally initiated regional solutions to policy and planning challenges shared by MetroWest communities. We regularly bring together elected officials and planning staff from neighboring communities to address regional growth management issues. MWGMC is the oldest of the eight subregions of MAPC.

“MetroWest” is a cluster of communities lying west of Newton and east of Westborough. While regional definitions of MetroWest may vary, the MetroWest Growth Management Committee, of which Wellesley is an active member, defines MetroWest as the communities of Ashland, Framingham, Holliston, Marlborough, Natick, Southborough, Wayland, Wellesley and Weston.

A gateway, is defined as an entrance or access point. The objective of the study is to develop a design for a welcoming town entrance from both the easterly and westerly directions along Route 9. The West Gateway Study Area is an ideal location to demonstrate many of the new and emerging zoning tools that can assist the community in preservation of open space, protection of key natural resources, and the creation of walkable neighborhoods that offer cultural and recreational opportunities, and a mixture of housing choices in addition to shops and offices that provide goods and services in close proximity to residential neighborhoods.

The suggestions developed as a result of the study attempt to synthesize the redevelopment opportunities within the study area and the major themes and desires expressed by stakeholders

during the planning process with the realities of the study area. It presents a specific blueprint to act as a guideline for future decision-making and private development and redevelopment.

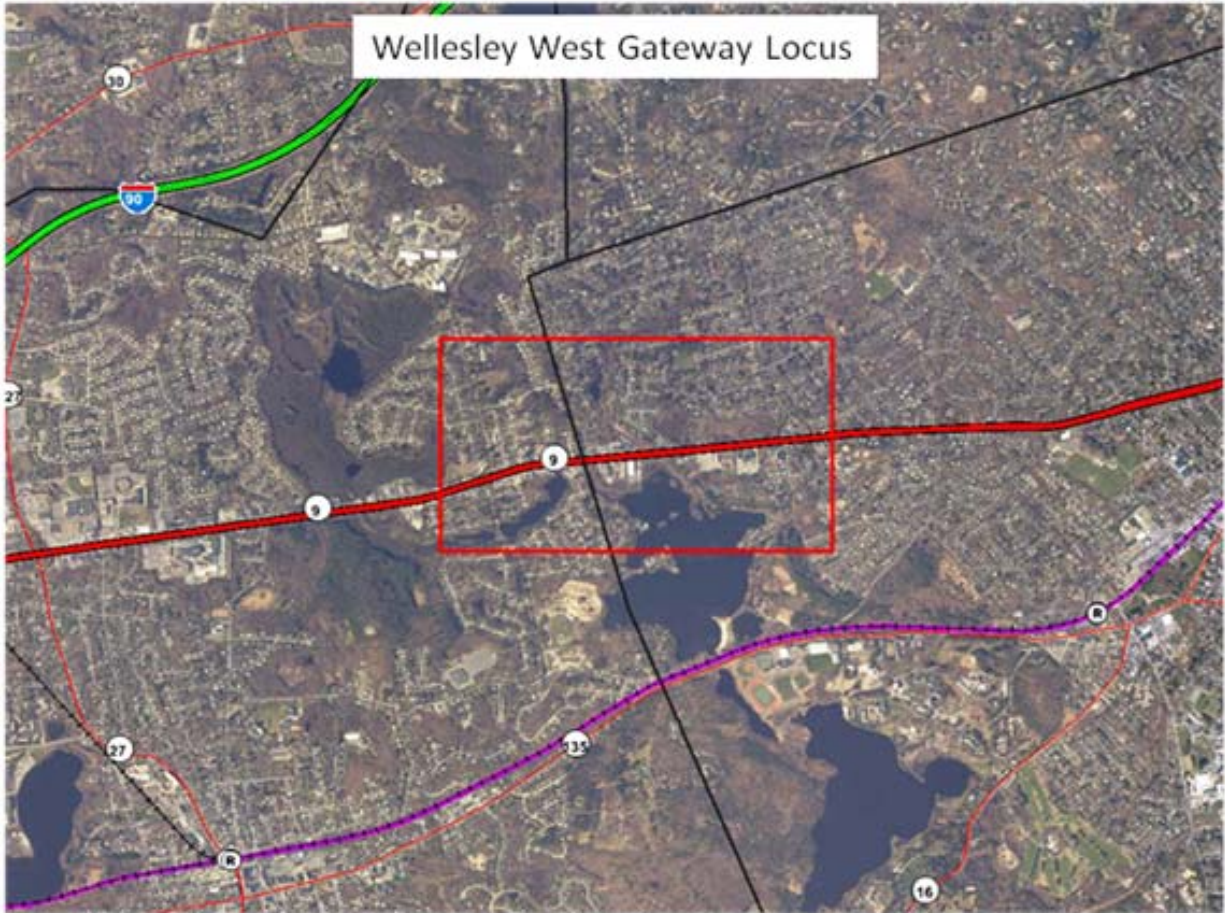
At project commencement, a steering committee was formed by the Planning Board. The first task was to define the study area. As defined for this study, the Wellesley West Gateway extends along Route 9 from just east of the Weston Road exit in Wellesley to Oak Street in Natick.

The Steering Committee organized a series of meetings with stakeholders. Included were two public forums held in December 2006 and June 2007. This report is based on the input received from the residents, business owners, developers, and town staff and officials.

Study Area - Figure P1



A larger version of the study area is included as Appendix B.



II. Public Participation

MetroWest Growth Management Committee (MWGMC) met several times with a committee made up of representatives from Wellesley Planning Board, Wellesley boards and committees, Natick Planning Board and municipal staff.

In addition, the planning process included two public forums for abutters, business owners, property owners and interested residents. The Wellesley Planning Department and the consultant made a concerted effort to include as many stakeholders as possible. The two public forums were held on December 14, 2006 and June 7, 2007. The agendas for these public forums are included in Appendix G. The public forums were advertised in the local newspapers, posted in Wellesley and Natick town halls and on town websites.



Rose Mary Donahue, Wellesley Planning Board - Photo P3

Throughout the planning process, there were several meetings with planning board members and relevant town staff to ensure that the Board's plans for the area were included, and the interests and concerns of town staff were also included.

Purpose of the first public forum

The purpose of the first public forum was twofold; to familiarize the residents of the two communities with the work being done under the contract and additional MWGMC technical assistance and to poll residents concerning areas to be protected, desirable land uses and impacts to be studied.

Analysis in preparation for the first public forum

In preparation for the public forum, the Wellesley GIS Department and MWGMC prepared a series of maps. These maps included the following:

- Natural resources
- Water resources
- Transportation
- Economic development and housing
- Topography
- Ortho-photograph of the site

These maps are included in Appendix I.

The Public Forum Agenda

The first public forum was held on June 7, 2007 at the Wellesley Town Hall. The full agenda for this forum is included in Appendix G. After presenting an overview of the project and previous studies that were done for the site, MWGMC and MAPC posed the following questions to the attendees:



Ken Soderholm, Natick Planning Board - Photo P4

Open Space/Natural Resources

1. *There are natural resources within the study area. Which natural resources should be*

protected?

- 2. The study area is adjacent to town-owned land where either playing fields or trails could be placed. Is this an important factor to consider when planning future development and/or redevelopment?*
- 3. The aqueduct is a regional historic asset. Should it also serve as a trail system?*

Housing

- 1. Is this study area a location where Wellesley can make some progress in ensuring that Wellesley is affordable for your children?*
- 2. What creative opportunities can we take to provide a range of housing types and densities?*
- 3. Would the study area be a good location for “empty-nester” housing?*

Economic Development

- 1. Are their improvements that can be made within the study area to keep the commercial life of Wellesley viable?*
- 2. Is additional commercial and/or industrial development needed or wanted in this study area to support the tax base? If so, how could that be accommodated?*
- 3. Should mixed use development be a major component?*
- 4. Should the study area become a business district that would serve nearby neighborhoods?*

Transportation

- 1. Are additional sidewalks necessary? Where and why?*
- 2. Other than sidewalks, what improvements should be made to make pedestrians safe?*
- 3. Where are the most dangerous sections of roadways or intersections?*
- 4. What steps can Wellesley take to encourage alternative modes of transportation and energy efficient transportation in the study area?*
- 5. Is parking in the study area insufficient at present? How can it be improved?*
- 6. Is it important to create off-road connections between lots/businesses in the study area?*

Rick Brown, Wellesley Planning Director - Photo P5



Public Forum - Photo P6



Aesthetics

1. *The study area is the gateway to Wellesley. What should be done to visually improve the study area?*
2. *Overhead utility wires are often viewed as a blight on an area. Is burying the overhead utilities important to the future success of the study area?*
3. *Is signage an issue within the study area?*
4. *Landscaping can be an important factor in creating an attractive setting. How important is landscaping in redevelopment within the study area?*

Meghan Jop, Wellesley Assistant Planning Director, presented a history of zoning and land uses within the study area. Mark Racicot of the Metropolitan Area Planning Council and Donna Jacobs, MWGMC Director asked for input on each subject area. Then MWGMC conducted a “show of hands” voting exercise to determine the number of

Public Forum - Photo P7



participants in support of each idea.

The following tables present the data that was gathered throughout the public process. The first table, P1, identifies the items that the attendees felt were assets that could be built upon as well as what they like about the area at the present time.

Table P1. Assets and Likes	
Open space – topography/aqueduct	Morse’s Pond watershed
Oldest family operations (history)	Major trail abuts area
Signature Place - Defines the town	Route 9 is regional access/egress
Offices provide jobs	Residential corridor

Retail area – need more	Automotive center – provides services / jobs
Diversity of uses	

Table P2 identifies the items that the participants believed to be real challenges to future development or redevelopment, and also identified their dislikes.

Table P2. Challenges and Dislikes	
Traffic	Flooding
Landscaping requirements	Major trail abuts area
Culvert on Route 9 at south end of Morse's Pond is inadequate	Health of Morse's Pond -surface runoff
Commercial encroachment of residential areas	Creating neighborhood retail – walkable
Morse's pond water levels	Need traffic & pedestrian lights
Town is not developer-friendly	Drinking Water
Parking requirements	Road Noise

Table P3 reports the participant's perceptions of Opportunities for Change, and they are reported in order of the highest number of votes.

Table P3. Opportunities for Change	
Less hostile, easier permitting process	12
Purchase remaining piece of aqueduct	12
Encourage investment in commercial properties as potential solutions to challenges	12
Address issue of flooding off of Route 9 and raise in level of Pond due to improper/inadequate maintenance of culvert that is outlet to pond.	11
Protect/maintain conservation land from infringement	9
Engagement & Commitment from state regarding Oak Street / Route 9	8
Need infrastructure improvements – water, power, drainage	5
Add Community/Neighborhood scale businesses and amenities – focus on community services	5
Quality of Development = rising tide	5
Diverse Housing – starter/smaller homes, empty nesters/seniors	5
Integrated development with surrounding park land	4
Opportunities to envision changes for larger tracts (St. James, Motor Inn)	4
Provide for pedestrian scale –crosswalks/lights	4
Community needs – encourage/explore open space and recreation	3
Beautification - Bury utilities, more landscaping	3
Possible green space at St. James	2
Use LID to make surface water improvements	2
Increase tax base – encourage expansion	1

As you can discern from the results reported in the tables above, the residents and business people who participated in the two public forums emphasized the dichotomy through their votes establishing their perception of the assets and likes as well as the

Table P4. Relationship to Sustainable Development Principles	
Principle	
Redevelop first	Yes
Concentrate development	Moderate
Be fair	Moderate
Restore and enhance the environment	High
Conserve natural resources	High
Expand housing opportunities	Moderate
Provide transportation choice	Moderate
Increase job opportunities	Moderate
Foster sustainable development	High
Plan regionally	High

challenges and dislikes. However, with respect to the opportunities for change, the results were surprisingly similar.



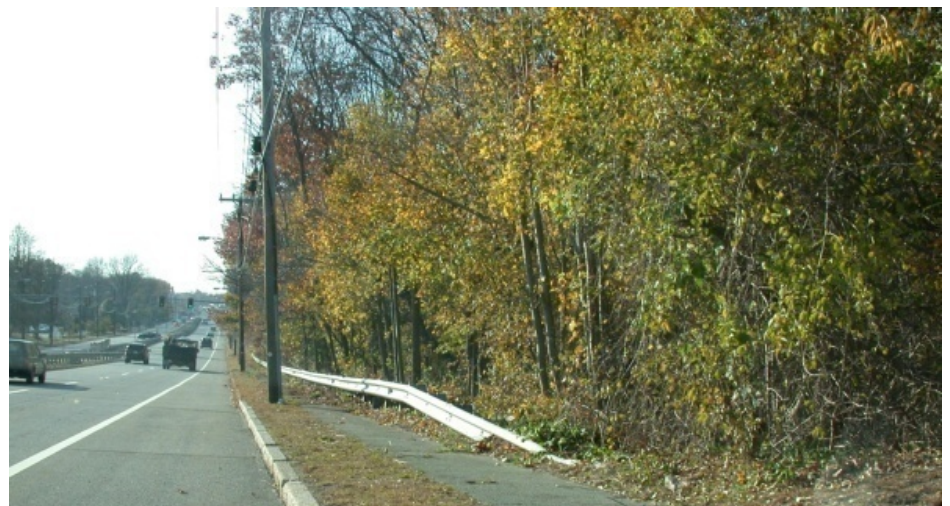
surprisingly similar.

Photos P8 and P9 provide visual proof of the dichotomy. The westbound gateway viewscape is dramatically different from the eastbound entry to the gateway. As you approach the Weston Road exit on Route 9 heading westbound, there isn't a noticeable difference from the viewscape further to the east, which consists primarily of homes nestled among the natural

Westbound Gateway - Photo P9

resource areas bordering the Route 9 corridor.

During the public forums, residents stated that the current Wellesley West Gateway is not consistent with the character of the Town of Wellesley, and that is an unattractive gateway to the community. Photo P10 below provides an aerial viewpoint that further proves the existence of a dichotomy.



Virtually all participants recognized the potential for change within the study area, and the opportunity to create a more attractive and cohesive gateway area. The closing of the St. James the Great Catholic Church and the likely redevelopment of the Wellesley Motor Inn both offer obvious opportunities for change. There are opportunities for redevelopment that are not as obvious, such as some potential for parcel assembly were also discussed at the two public forums.

Study Area, Aerial View of Area at Wellesley/Natick Town Boundary - Photo P10



Based on the input received at the two public forums and from the Planning Board, Planning Director, Town Planner and other department heads, the plan for Wellesley's West Gateway is carefully designed to ensure that the West Gateway will provide a high quality of life to residents, businesses, and visitors.

Study Area, Aerial View of Central Portion of Study Area - Photo P11



III. Geographic Context

To develop a blueprint for the future of the study area, it is necessary to understand both the geography and a certain amount of the area's demographics. Wellesley, on the eastern boundary of the MetroWest subregion, is bordered by Newton on the east, Weston on the north, Dover and Needham on the south, and Natick on the west. Wellesley is largely a residential bedroom community located in MetroWest. Located just 13 miles west of Boston, Wellesley provides easy access to all points via the MBTA commuter rail, nearby I-95 and I-90, and Route 9.

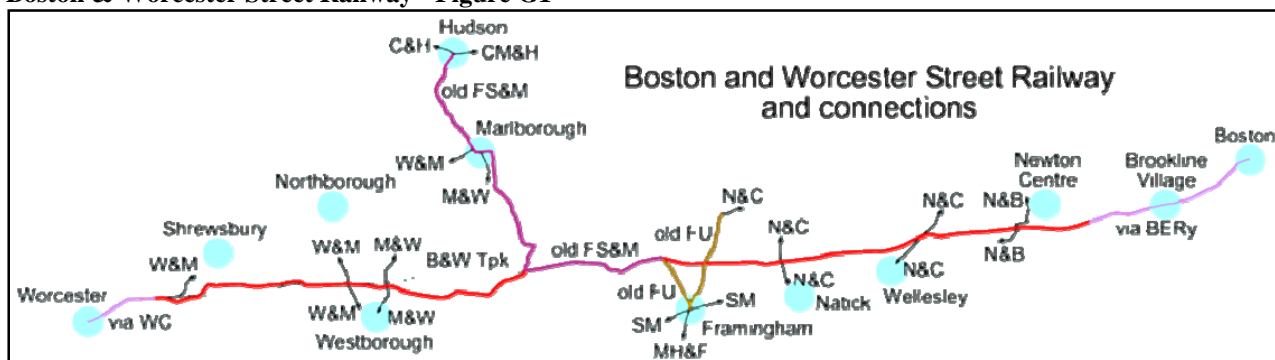
Wellesley and Surrounding Area - Figure G1



Route 9, a major east-west state highway, bisects the study area and divides the Town of Wellesley. Between Worcester and Boston, Route 9 follows the path of the 19th Century Worcester Turnpike, opened in 1810. From downtown Boston, Route 9 runs through Brookline, Newton, and into MetroWest (Wellesley, Natick, Framingham, Southborough) where it has been dubbed, “Main Street MetroWest”. It continues through Westborough, Northborough, Shrewsbury, and into Worcester. It follows Worcester's city streets and then heads west through Leicester, Spencer, East Brookfield, Brookfield, West Brookfield, Ware, Belchertown, Pelham, Amherst, Hadley, Northampton, Williamsburg, Goshen, Cummington, Windsor, and Dalton,

finally ending at Pittsfield. Along with US 20 to the south and Route 2 to the north, Route 9 is a main alternative to the Massachusetts Turnpike/I-90 toll road.

Boston & Worcester Street Railway - Figure G1



From 1903 to 1932, the Boston and Worcester Street Railway ran mostly via Route 9. The main line, built by the Boston and Worcester Street Railway, was an interurban streetcar line partly on the old Boston and Worcester Turnpike (now Route 9) and partly on private right-of-way. A predecessor to today's highways, the B&W Street Railway was chartered November 16, 1901, and the first section, from the Newton/Brookline line at Chestnut Hill to Framingham Junction, opened May 12, 1903. Streetcars last operated on June 10, 1932, after which buses took over as a result of a major reconstruction of Route 9, making it the heavily traveled highway it is today.

MetroWest is a dense, diverse, congested and highly successful hub of economic activity. This activity generates jobs, demands for housing, pressure to develop open space and lots of traffic.

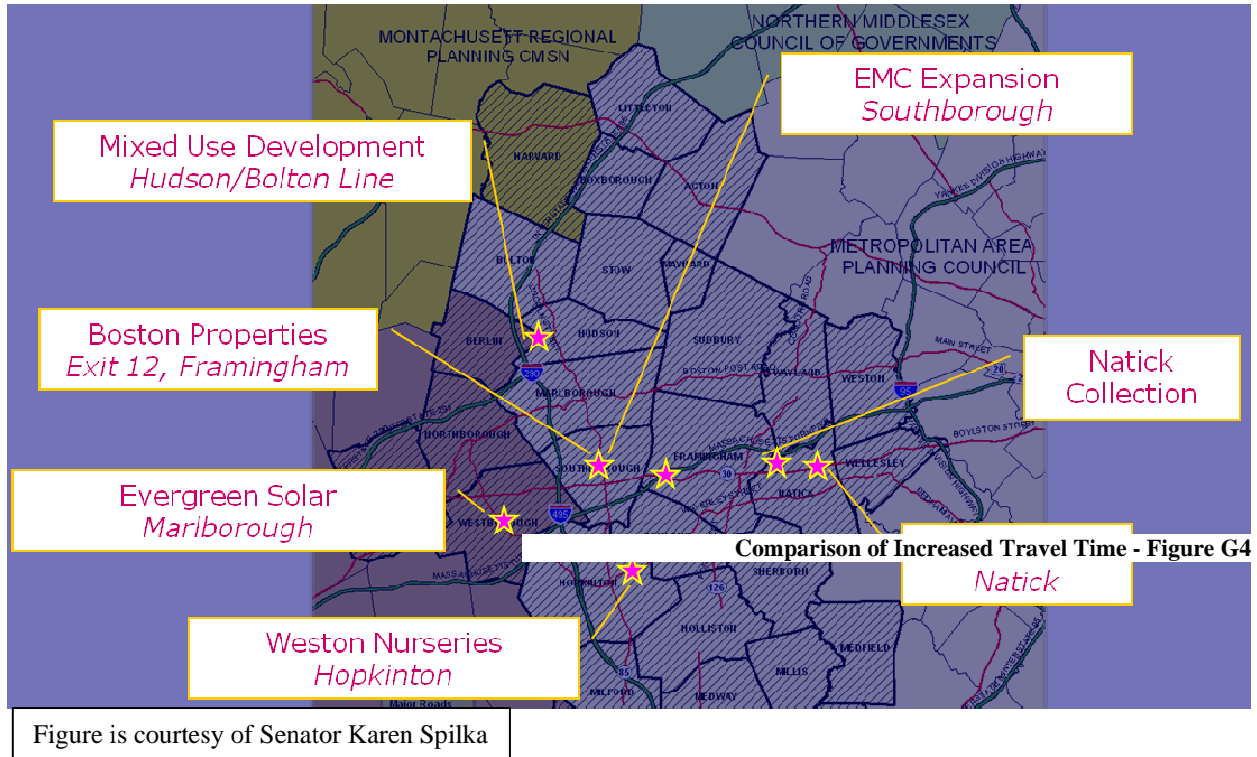
In 2001, the state predicted that there are 19,000 acres of developable land in the MWGMC subregion. If developed, that would add 239 miles of new roads, 50,000 more people, almost 50 Million additional square feet of commercial/industrial building space and 19,000 more units of housing. Roughly translated, that would be 320,000 additional vehicle trips.

Key Issues Facing Wellesley and the MetroWest Region – Figure G2



The MetroWest region has been growing despite the fact that many other locations in Massachusetts have been losing population and jobs. The MetroWest/495 area is home to six of the ten largest public employers in the Commonwealth. It has been and is predicted to continue to be one of the strongest economic engines in Massachusetts. Figure G3 below shows some of the new growth in the MetroWest region.

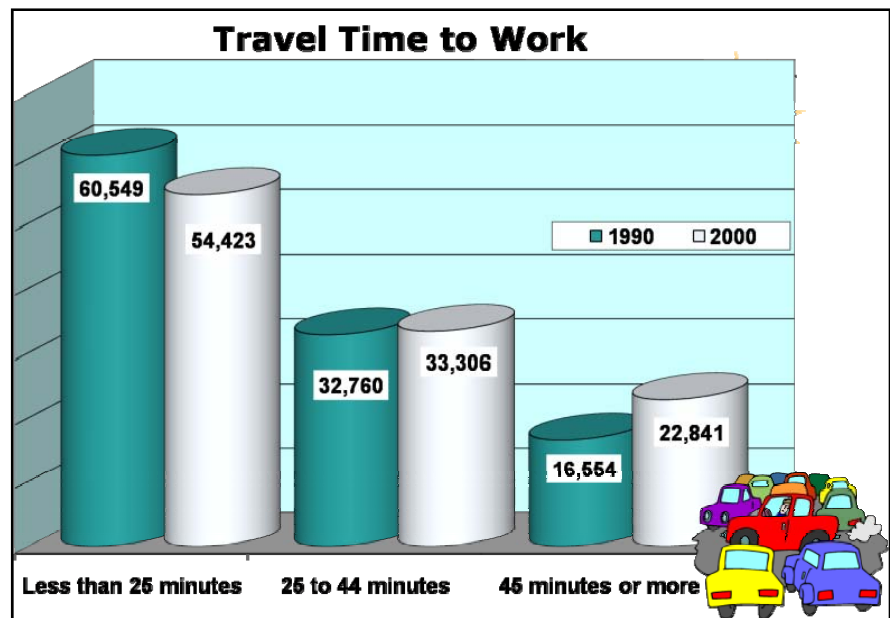
Proposed Development in MetroWest - Figure G3



In a 2005 traffic count performed by the Statewide Traffic Data Collection section of the Massachusetts Highway Department, there were 59,500 vehicles counted on Route 9 east of Route 27 in the Natick portion of the study area, and a count of 49,700 was reported in Wellesley west of Route 16.

MAPC Executive Director, Marc Draisen, was recently quoted by the Globe, “Certainly there's going to be more development on Route 9, and we'd like to see if we can figure out ways to mitigate it in advance”.

Because we're growing and we've carved out a place for ourselves in the Massachusetts economy, it is no wonder that we're spending much more time commuting to our



jobs. It is has been reported that vehicle miles and vehicle hours increase twice as fast as population and jobs.

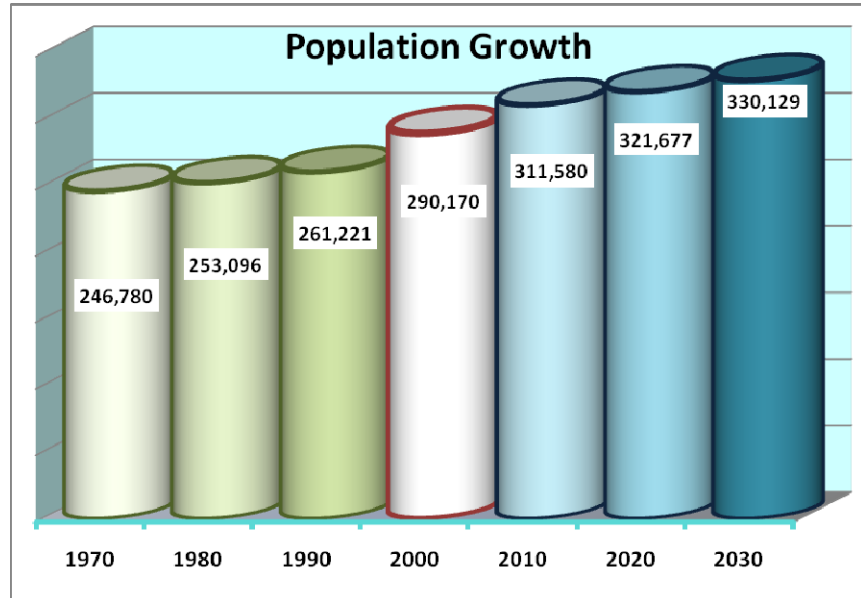
In addition to the Wellesley West Gateway Study effort covered in this report, the Metropolitan Area Planning Council (MAPC) and the MetroWest Growth Management Committee (MWGMC) are launching a \$50,000 study of Route 9 from the Route 128 interchange in Wellesley to the Shrewsbury-Worcester line. The analysis will focus on the traffic impact of current and projected construction development, and offer building and development scenarios. The MetroWest legislative delegation, led by Sen. Karen Spilka, is spearheading a complementary effort by lobbying the Executive Office of Transportation to put a comprehensive infrastructure improvement program for Route 9 in next year's capital budget. The overburdened Route 9 corridor is a main focus of MWGMC and MAPC, and a forum is being planned for early winter 2008.

IV. Demographics

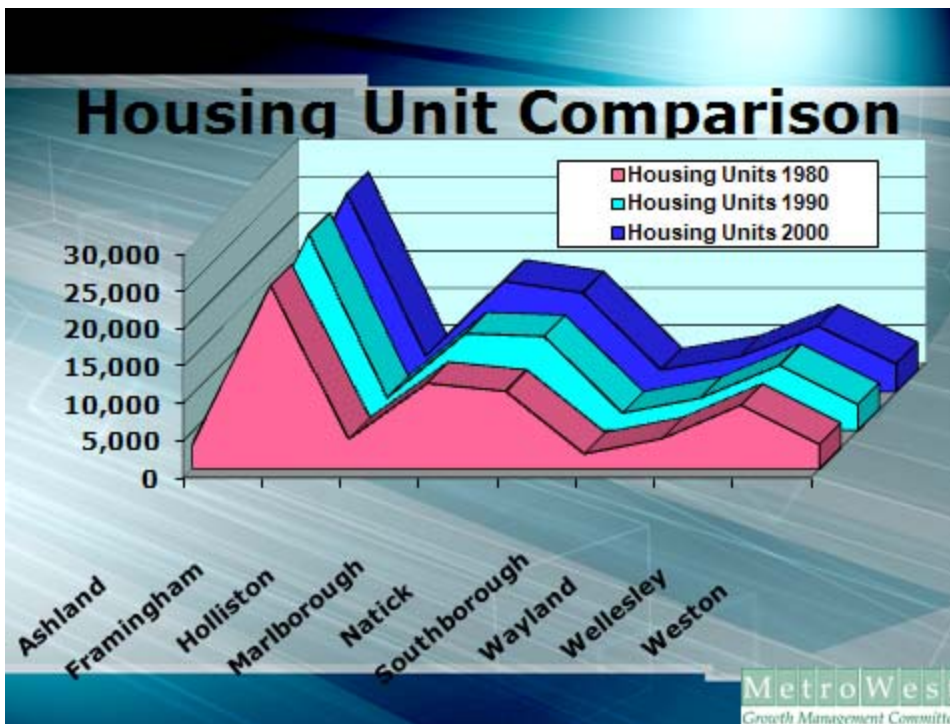
MetroWest has grown dramatically over the past four decades, as shown in the chart below which represents fourteen communities loosely defined as “MetroWest”. Wellesley’s population of 26,613¹ is slightly less than 10% of the total MetroWest population, and its workforce of 12,945² is also slightly less than 10%.

As you can see from just this handful of communities, we’ve been growing in numbers, and are predicted to continue to grow. Hopefully, not at the double-digit percentage increases we’ve seen in the past (Ashland grew 21.6% between 1990 and 2000, Southborough grew at 32.5% and Hopkinton grew at 45.2%). But area planners and public officials have some concerns. Many reported that they had attained the population projected for 2010 by 2005.

Population Past Present & Future – Figure D1



Housing Growth - Figure D2



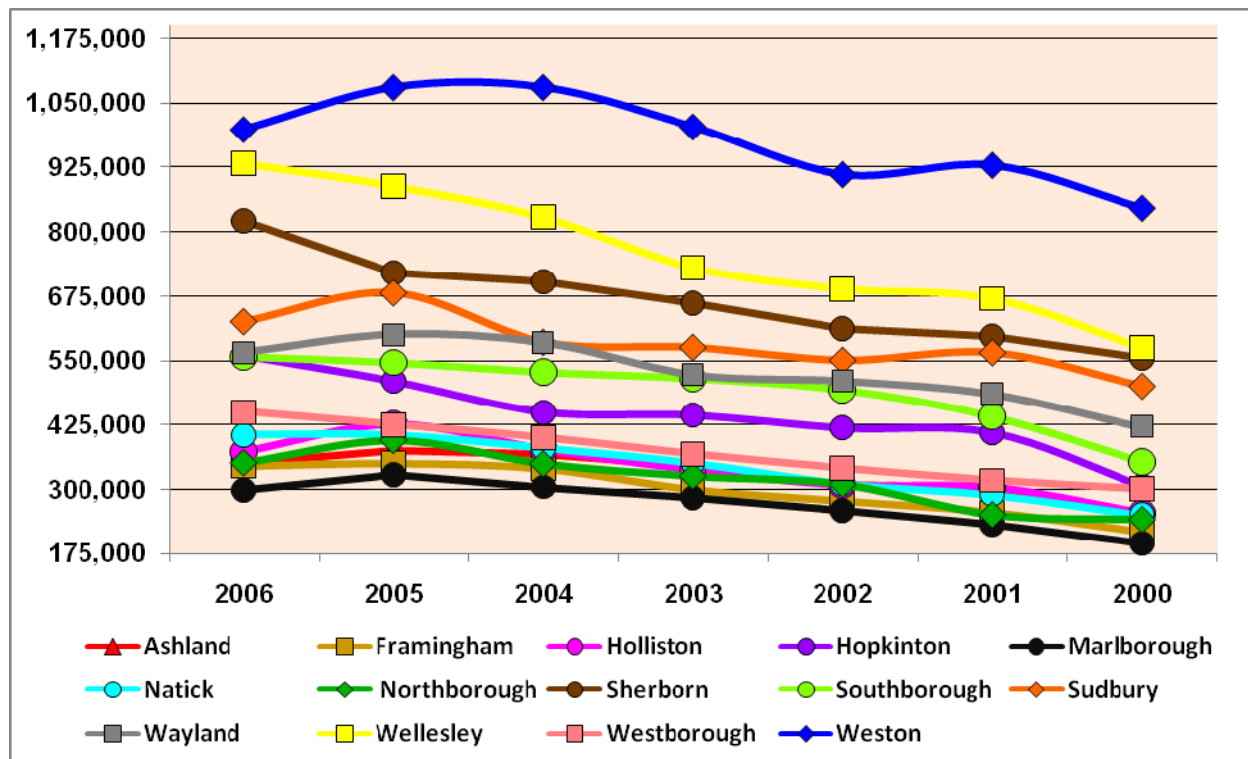
It is not surprising that we’ve been building housing to provide shelter for our increased population. In Natick alone, there are more than 1500 housing units in the pipeline. Framingham is adding another 700 units and Southborough may be facing 500 additional units of housing.

The ever increasing value of a housing unit has been a fact of life, and a great benefit to the fortunate property owners since the recession in the early 80’s. This is a quick look at home sale prices, both single

¹ 2000 U.S. Census

² Census 2000, Profile of Selected Economic Characteristics

family houses and condo units, for 14 MetroWest communities from 2000 to 2006. Although the housing market has softened considerably since 2006, housing in MetroWest is still in demand.



Median Home Sales Price - Figure D3

A major unintended consequence of increased housing value is the ever-widening housing affordability gap.

CEO's throughout MetroWest advise that our housing prices present serious problems for them. They report that they lose ideal job candidates to other locations due in part to our housing prices, but also due to our traffic congestion and lack of public transportation.

Over the past two decades, incomes for the highest income families in Massachusetts have grown almost five times as fast as those for low income families and nearly twice as fast as those for middle income families.³ While there have been similar trends across the country, the gap between upper- and lower-income families has grown more in Massachusetts than in forty seven of the fifty states.

Over the period from 1980 to 2001, families in the top 20 percent of the income distribution in Massachusetts saw their average annual income rise 77 percent. Low- and moderate-income families did not fare nearly as well during this span. The average annual income for families in the middle of the income distribution climbed 40 percent, and the families at the bottom of the income distribution experienced only a 16 percent increase.

Many of the new housing units proposed in MetroWest were created under the Chapter 40B statute. Enacted in 1969, Chapter 40B, "An Act Providing for the Construction of Low and Moderate Income Housing in Cities and Towns in Which Local Restrictions Hamper Such Construction" is a state statute

³ Massachusetts Budget and Policy Center, 2006

often called the Comprehensive Permit Law or “Anti-Snob Zoning” Law. The intent of Chapter 40B was to address the shortage of affordable housing statewide by reducing unnecessary barriers erected by local zoning and other local restrictions. Chapter 40B is highly controversial in most communities because it overrides local zoning regulations that make low-and moderate-income housing economically infeasible to build.

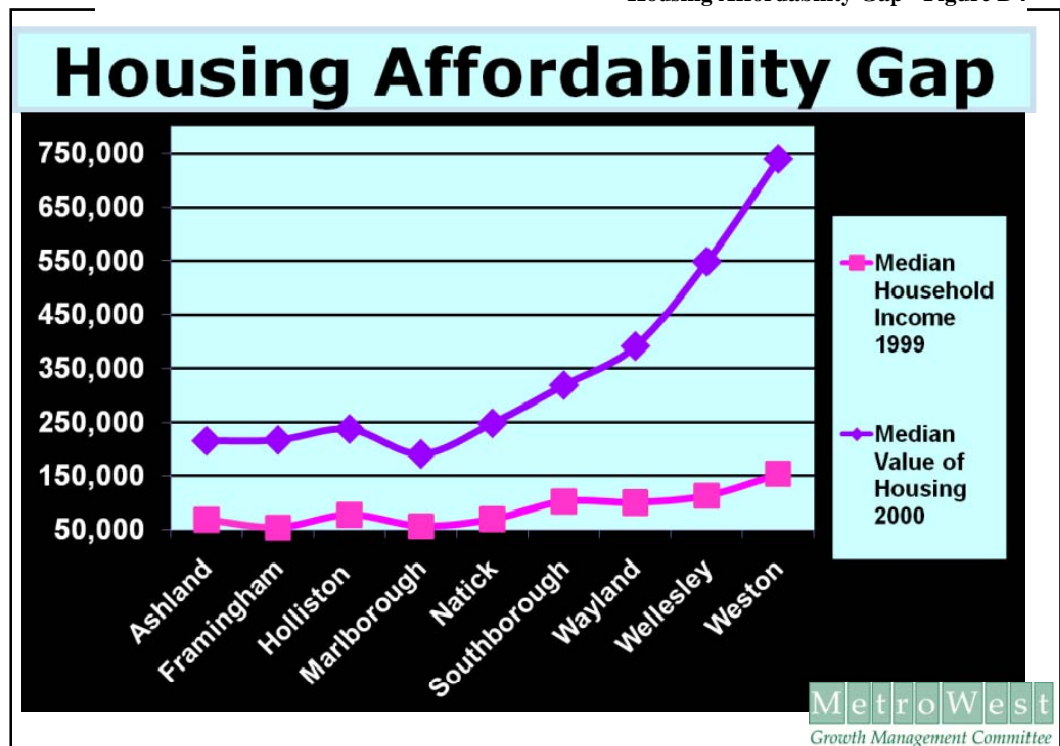
Chapter 40B, creates a wide variety of housing types that accommodate a diverse population, including growing families, senior citizens, persons and households with special needs, single householders, and families whose children are of adult age and have left the household, with special emphasis and high priority on the provision of housing for households with incomes that are not more than 110% of median income, as determined by the U.S. Department of Housing and Urban Development (HUD).

The sales or rental price is based on the Boston Primary Statistical Area median income and is defined by the Commonwealth. These dwelling units are made affordable to low-income and moderate-income households by a deed

restriction or covenant that restricts sale prices and rents as the units are sold, vacated or leased to new tenants.

As one would expect given a growing population, the workforce in our region is also growing. However, our job growth is growing even faster. It is important to note that the workforce of a community does not directly correlate to the number of jobs located in a community.

Housing Affordability Gap - Figure D4



The Massachusetts Executive Office of Labor and Workforce Development reports that 16,554 jobs were located in Wellesley during 2006. This contributes to the fact that MetroWest is an importer of jobs (there are more jobs located in the region than can be supported by the workforce of the region).

Going forward, MAPC expects a job growth of about 10% for the 101 cities and towns of the MAPC region, which is slower than national job growth over the same period. The largest number of jobs will likely be added in

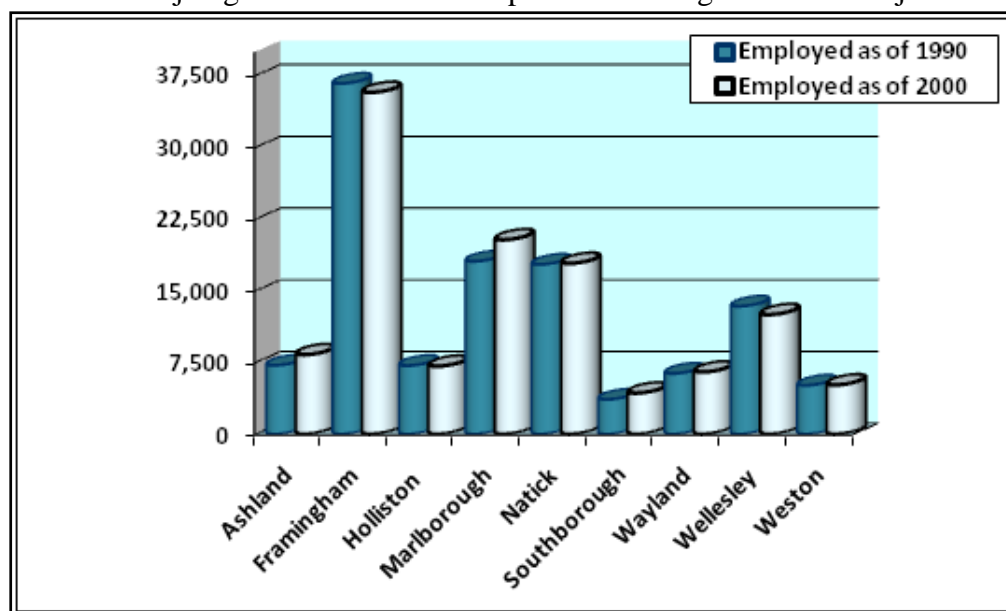
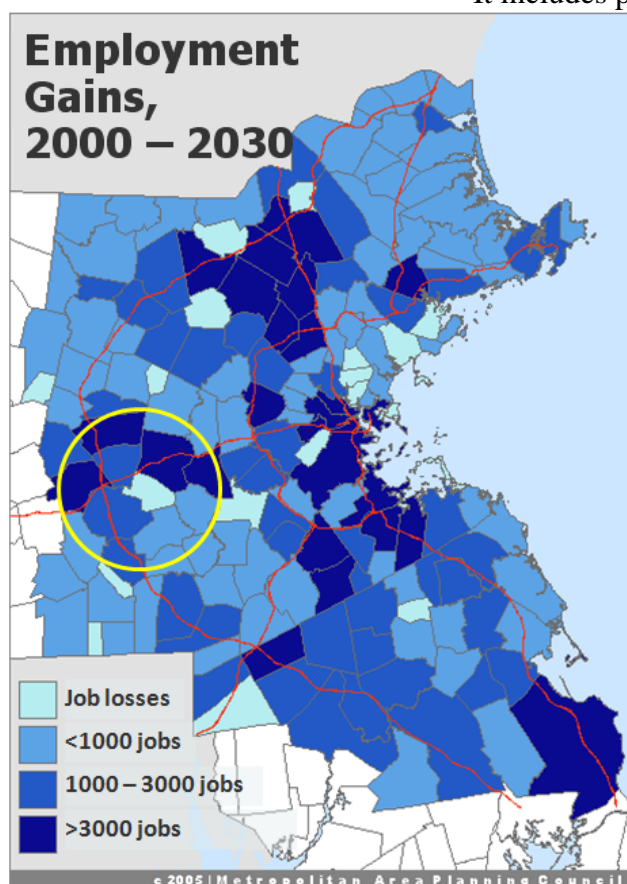
Professional and Business Services and Education and Health Services. These two sectors will account for half the new jobs in the MAPC region, while only moderate gains are expected in Trade Transportation and Utilities and Leisure and Hospitality.

Continuing the trend for the past decade, manufacturing is the

only major sector expected to lose

jobs. What about the high-tech jobs that MetroWest has become a magnet for high tech jobs and companies that provide goods and services to the high tech industry? High tech is not one particular

Gains in Employment - Figure D6



Workforce in MetroWest - Figure D5

sector but rather a set of activities that cut across different sectors.

It includes part of Education and Health Services, part of

Manufacturing, etc. Will our leadership in high tech industries continue? From predictions established by MAPC as part of the MetroFuture analysis, the answer is yes, but slowly.

MAPC expects that four major job centers, comprising 27 communities, will account for half of all new jobs over the next 25 years. MetroWest is identified by the yellow circle in Figure 7 to the right. It is predicted that 22,000 new jobs will be created in MetroWest between 2000 and 2030. This includes some concentration of employment, but current trends indicate that most office parks and industrial parks are put close to highway interchanges, but not necessarily close to commuter rail stops. Most new employees will have to commute by car, whether they live in the suburbs or in the inner core.

While the region's academic institutions and hospitals are very important assets in both Massachusetts and MetroWest, attracting new firms and new investment in the region's high tech environment is critical if MetroWest and the Greater

Boston region is to remain a competitive player in the nation's high tech economy.

Traditionally, this has been a region with an abundant supply of high skilled labor. However, with the movement of many professionals out of state, an influx of immigrants in need of education, and the retirement of many professional baby boomers, the profile of the labor supply is changing, in a way that high tech firms may not find very attractive.

MAPC compared projected labor force to expected occupational mix, and found an increasing mismatch between the jobs that may be available and the skills that workers may have. In comparison to the labor market dynamics we have today, our 2030 projections suggest that we may have a surplus of workers who lack a high school diploma, and a shortage of workers with graduate degrees, bachelors degrees, or even high school and vocational degrees. We may be facing a total shortage of about 170,000 workers, which will make it even harder to find good labor here. Some of the shortage may be met by people commuting in from New Hampshire, Central Massachusetts, or Rhode Island.

If efforts are successful to "import" enough workers to keep the economy going, this in-commuting can have serious impacts on the region's transportation system, which will be discussed in the Traffic and Circulation section.













V. Natural Resources

In virtually all conversations about the Wellesley West Gateway, protection and enhancement of natural resources was discussed. The study area is rich in natural resources that include brooks and streams, a significant pond, protected open space, and a trail system.

Environmental Constraints within the Study Area – Figure N 1



Morses Pond, a 103-acre, shallow eutrophic pond, is located within the study area and is one of Wellesley's most visible natural resources. Wellesley derives most of its public drinking water from seven municipal wells. Three of the seven wells are located on Morses Pond. For more than seventy-five years, Morses Pond has been available to Wellesley residents for aquatic activities. Today, Morses Pond serves as a recreational resource for swimming, boating, a park and picnic area. In recent years, recreational use of the pond has been limited due to excessive algal blooms.

-  Limited Access Highway
-  Multi-lane Hwy, not limited access
-  Other Numbered Highway
-  Major Road
-  Major Streams
- DEP Wetlands**
-  Reservoir
-  Marsh
-  Wooded Swamp
-  Cranberry Bog
-  Salt Marsh
-  Open Water
-  Tidal Flat/Rocky Shore

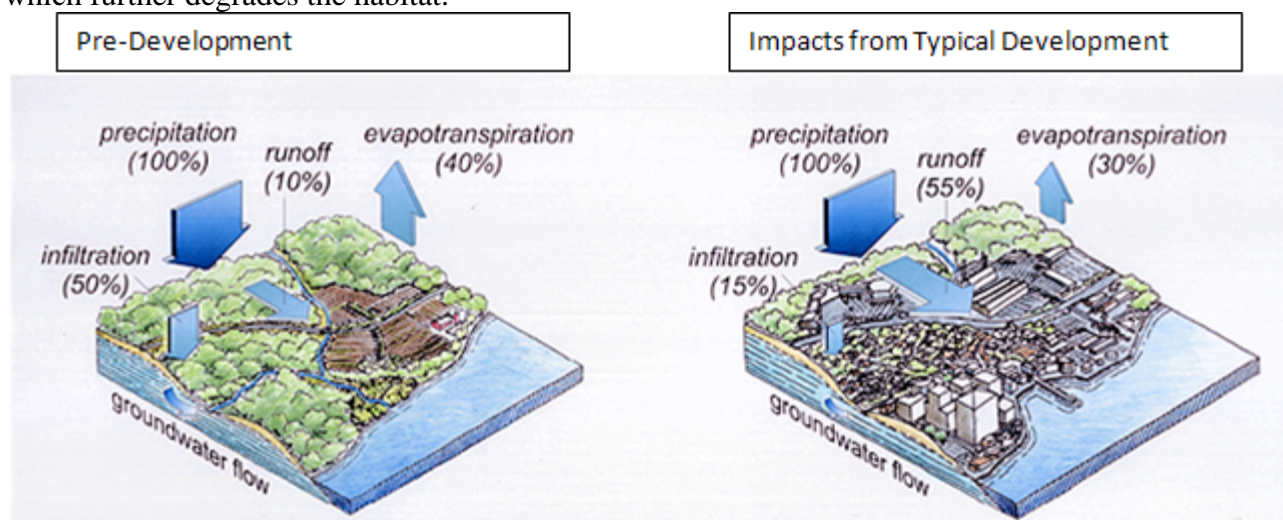
Morses Pond is currently under stress and is saturated by weeds that are so thick at times they cover a good portion of pond surface.

The dense urban environment along Route 9 and adjacent to Morses Pond poses a threat to the health of the pond, and is likely a major contributor to the eutrophication of the pond. Eutrophication is a process whereby water bodies, such as lakes, ponds, or slow-moving streams receive excess nutrients that stimulate excessive plant growth. This enhanced plant growth reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die.

Eutrophication decreases the resource value of rivers, lakes, and ponds such that recreation, and aesthetic enjoyment are hindered. Human activities can accelerate the rate at which nutrients enter ecosystems. Runoff from development, pollution from septic systems, and other human-related activities increase both inorganic nutrients and organic substances in aquatic ecosystems.

The predevelopment illustration below explains what happens to rainfall after it hits the ground, otherwise known as a depiction of the water budget. Under natural conditions in the Northeast, about 75% of the water from each rainfall event is either returned to the atmosphere by evaporation from vegetation or trapped on the forest floor, where it slowly soaks, or infiltrates, into the ground. There is very little surface runoff. The water that infiltrates is critical to maintaining the base flows of streams for fish and other aquatic life as well as ground water reserves for public & private water supplies.

When land is developed as illustrated in the “Impacts from Typical Development” figure shown below, the frequency, volume and rate of flow of surface runoff increases dramatically. This is because increased impervious areas, such as roads, driveways and buildings reduce evaporation and infiltration. The reduction of vegetation from development also decreases the amount of rainfall returning to the atmosphere through evapotranspiration and the amount that infiltrates to the ground. This increased volume of runoff and reduction in groundwater recharge destabilizes stream channels and in-stream habitat. The amount of sediments and pollutants also increases, which further degrades the habitat.



Typical Impacts from Development - Figure N2

Numerous studies throughout the United States have shown the adverse effects of urbanization on the health of streams and wildlife habitat. This study from the University of Washington shows the relationship between watershed urbanization and biological integrity of streams. The graph shows how streams and biological health, measured by a tool called “Benthic Index of Biotic Integrity”, generally declines as a watershed is covered by impervious surfaces. (See the University of Washington Center for Urban Water Resources Management’s web site for more information on this and other studies.) All studies regarding water quality and the amount of impervious area say the same thing: the higher percentage of impervious area, the lower the water quality.

Effects of Urbanization on a Watershed – Figure N3

A goal contained within the Town of Wellesley Comprehensive Plan Update, Section 7, is to, “Restore, preserve, and enhance open space and sensitive natural resources for protection of water resources, wildlife habitat, biodiversity, and enrichment of community character.” Wellesley has undertaken a concerted effort to restore Morses Pond.

Since the mid 1960's, the Town has performed various in-lake management efforts. Despite continued efforts over decades, the health of the pond and its environment has been in rapid decline. In FY05, the town used Community Preservation Act (CPA) funds to develop a Morses Pond Restoration Feasibility Study. In FY07, the DPW completed landscape renovations to the Morses Pond Beach pathway area, and five miles of trails were mapped near the pond. At the 2008 annual town meeting, the Wellesley Natural Resources Commission was successful in requesting and securing \$969,500 in funding from the Advisory Committee, the Community Preservation Committee, Town Meeting and Town Voters to implement the Morses Pond Comprehensive Management Plan. \$650,000 was approved in a debt exclusion vote for funding

the design, permitting, construction and monitoring for the dredging of the northern portion of Morses Pond.

In addition to Morses Pond, Boulder Brook and the Overbrook Reservation are located within the study area. At the public forums held during the planning process, neighbors expressed concern about the deterioration of the Overbrook Reservation. They reported that trash is being dumped in the Reservation, and that the trail system has become overgrown due to lack on on-going maintenance.

Overbrook Reservation and Boulder Brook - Figure N 4



In 2005, the Wellesley Trails Committee proposed a new woodland trail through the Overbrook Reservation. The trail would start at the Overbrook Reservation sign on Weston Road and loop around land on the north side of Boulder Brook. The only access to this open space is along a short section of Weston Road at the ramp up to Route 9 and along Route 9. The committee is considering whether it should try to obtain a trail easement from landowners on Shirley or Livingston Road to improve neighborhood access to the trail.

The project includes the construction of steps down from the Weston Road sidewalk, construction of a footbridge over Boulder Brook, construction of some bridges to cross over wet spots between Weston Road and the proposed footbridge, and development of a loop trail on the high ground north of brook.

VI. Traffic and Circulation

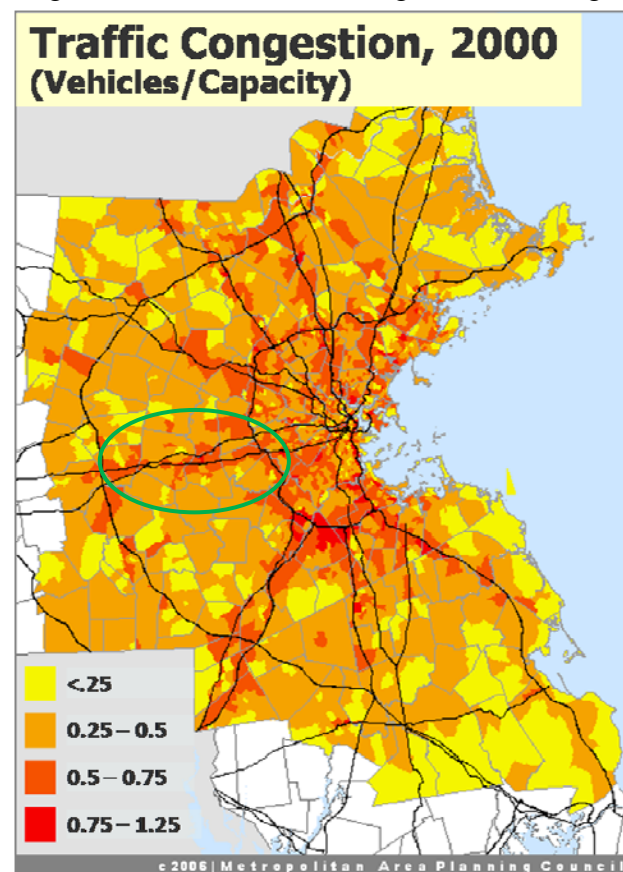
MetroWest is served by 4 east/west corridors, Routes #9, #20, #135, and the MassPike as well as 5 north/south corridors, Routes #495, #85, #126, #27, and #95. All experience extremely heavy traffic during peak commuting hours. This is exacerbated by extensive commercial/industrial development along Route 9 in Framingham/Natick and similar development adjacent to interchanges with the Turnpike and I-495, which continue to expand as foci of employment in the MetroWest. The core of MetroWest is centered on Route #9, sometimes referred to as “Main Street, MetroWest.” The density of commercial development on Route #9 throughout the region and particularly in the “golden triangle” has caused traffic congestion, which has also affected the north/south corridors running through the area.

MetroWest is a melting pot with a very diverse population that is not usually found in such concentrations in a suburban location. There are 67 languages spoken at Framingham High School, which substantiates the fact that MetroWest is a unique, diverse, suburban region. In addition to ethnicity, MetroWest’s population includes 19,555 low-income residents, an elderly population of 28,752 and 28,639 residents are persons with disabilities.

Although the MetroWest region will continue to advocate for expanded alternatives to single occupancy vehicle commuting, residents and local officials alike know that the suburbs are and will continue to be automobile dependent. Interstate 495, the Mass Turnpike and Route 128 carry the bulk of the traffic moving to and through the greater Boston metropolitan region. Interchange failure is a problem along the entire length of I-495. Route 9 is at grid-lock during the AM and PM peak periods. The Exit 12 and 13 Interchanges on the Mass. Turnpike are featured daily in the AM and PM traffic reports. Route 30 in the vicinity of the “Golden Triangle” is becoming built-out, and the recent redevelopment has resulted in more retail stores.

Traffic congestion on the major east/west routes through the region (Routes 9, 20, and 30) has significantly increased leading to longer commutes and deteriorating air quality. There is an increasing desire to reduce reliance on single occupancy vehicles and increase the use of alternative modes of transportation.

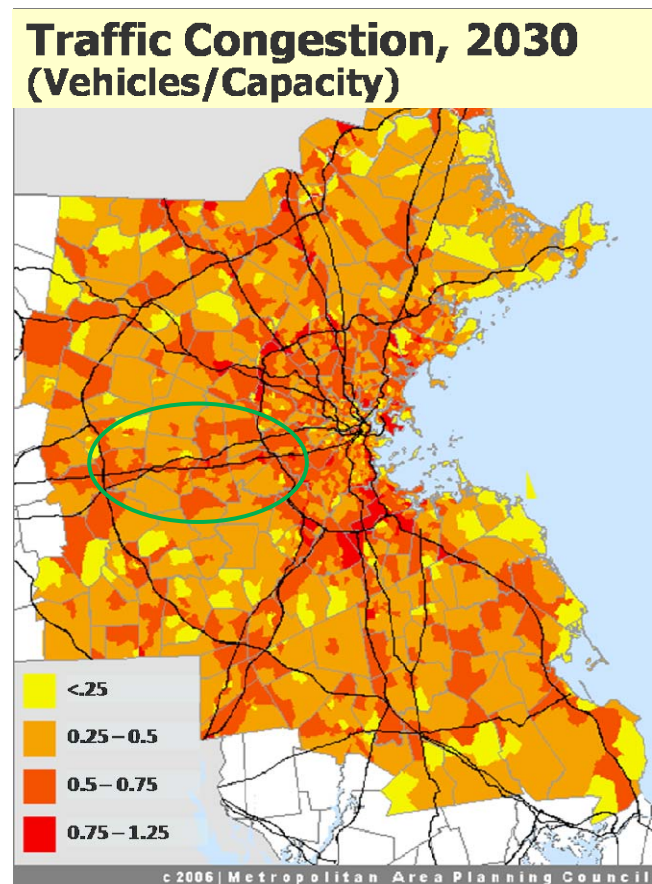
There is no question that Route 9 and the MetroWest region are at a point in time where major infrastructure decisions must be made, and solutions implemented. The economic health and quality of life of MetroWest are reliant on the functionality of Route 9, but we are perilously close to over-permitting the corridor without investing in its ability to



accommodate this growth. State agencies have reviewed many of the development projects permitted along Route 9 with a myopic eye toward transportation, and often assign mitigation requirements to individual projects without looking at the region or the corridor holistically. Any decision one community or one state agency makes with respects to development along Route 9 will inevitably affect another community, and not just the directly adjacent community.

In 2030, traffic congestion will be worse, and many cities and towns will experience moderate to high levels of congestion on their local roads.

There will be very few areas that have low levels of traffic congestion (notice that the yellow almost disappears). One the key findings of MAPC's MetroFuture regional plan is that "we can't pave our way out of congestion". If we only add capacity to the road network, without changing travel patterns or providing people with non-auto alternatives, the demand will simply expand to meet the new capacity of the roadways, and traffic will be just as bad as before."



Traffic and pedestrian and bicycle circulation was the second highest issue identified by the participants. Participants expressed concern about:

- the volume of traffic;
- the pedestrian/vehicle conflicts;
- a couple of key locations with high accident frequency;
- the lack of pedestrian safety measures;
- concerns about school children crossing Route 9 to get to school, and
- the disconnected trail system.

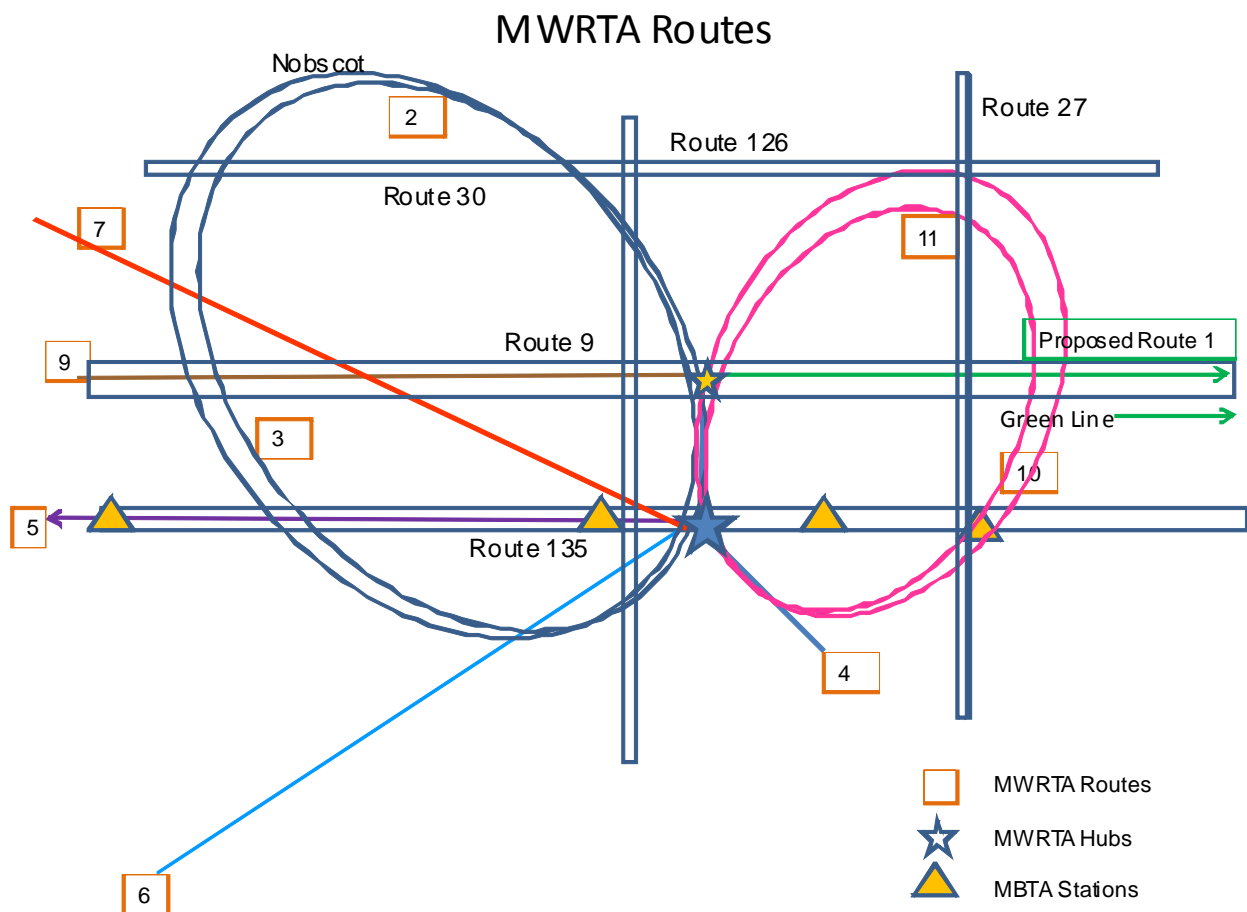
Public Transportation

In 2006, the MWRTA was formed. It is a new regional transit authority serving the MetroWest region. During the first year of its existence, the MetroWest RTA has provided a state-of -the-art fixed route bus service and para-transit services that feature real-time tracking of both fixed route buses and para-transit services, with a web-site specifically designed for individuals with visual impairments.

The MWRTA has developed a strong partnership with the MWGMC. In 2008, the MetroWest Growth Management Committee assisted the MWRTA with two applications to the Boston Metropolitan Planning Organization (MPO) for a Green Line project. The Green Line project is designed to expand existing fixed route and demand responsive services provided by the MetroWest Regional Transit Authority, specifically those that would serve the needs of individuals with disabilities attempting to access fixed route or para-transit services, and would improve access to employment related activities for people with low incomes. An added benefit provided by the expanded services would be improvement of access to reverse-commute employment.

The first application was for funding under the Boston MPO's Suburban Mobility Program for a new route, Route 1, to provide service from MetroWest to the Woodland Station of the MBTA's green line.

The second application that MWGMC wrote for the MWRTA was under the Jobs Access Reverse Commute (JARC) federal program for five new buses. The goal of the JARC program is to transport residents of urbanized areas and nonurbanized areas to suburban employment opportunities, and to improve access to transportation services that provide transportation to



employment and employment-related activities for welfare recipients and eligible low-income individuals.

The additional buses will provide a new connection to the MBTA Green Line. At present, the population of MetroWest has access to the MWRTA, the MBTA commuter rail service, and Logan Express. The addition of the new route can be realized in large part by the new buses, and will provide a heretofore unavailable connection to the Green Line. The two applications resulted in almost \$750,000 for the MWRTA, when they were awarded by the Boston Metropolitan Planning Organization in August 2008.

The Green Line project will improve access to reverse-commute employment from urban areas to MetroWest. Both MWGMC and the MWRTA regularly communicate with the CEO's of the largest public employers in the Commonwealth, and they express their frustration about the fact that they have a tough time attracting recent college graduates to work in MetroWest. The majority of the jobs that need to be filled in MetroWest are in engineering, computer and research & development. These employees work unusual hours, and need more public transit options than are currently offered to get from their homes in Worcester and Boston/Cambridge to the jobs available in MetroWest. In addition, the low income workers in both MetroWest and the urban areas east of MetroWest are needed to fill the multitude of retail and service jobs located in Golden Triangle of MetroWest.

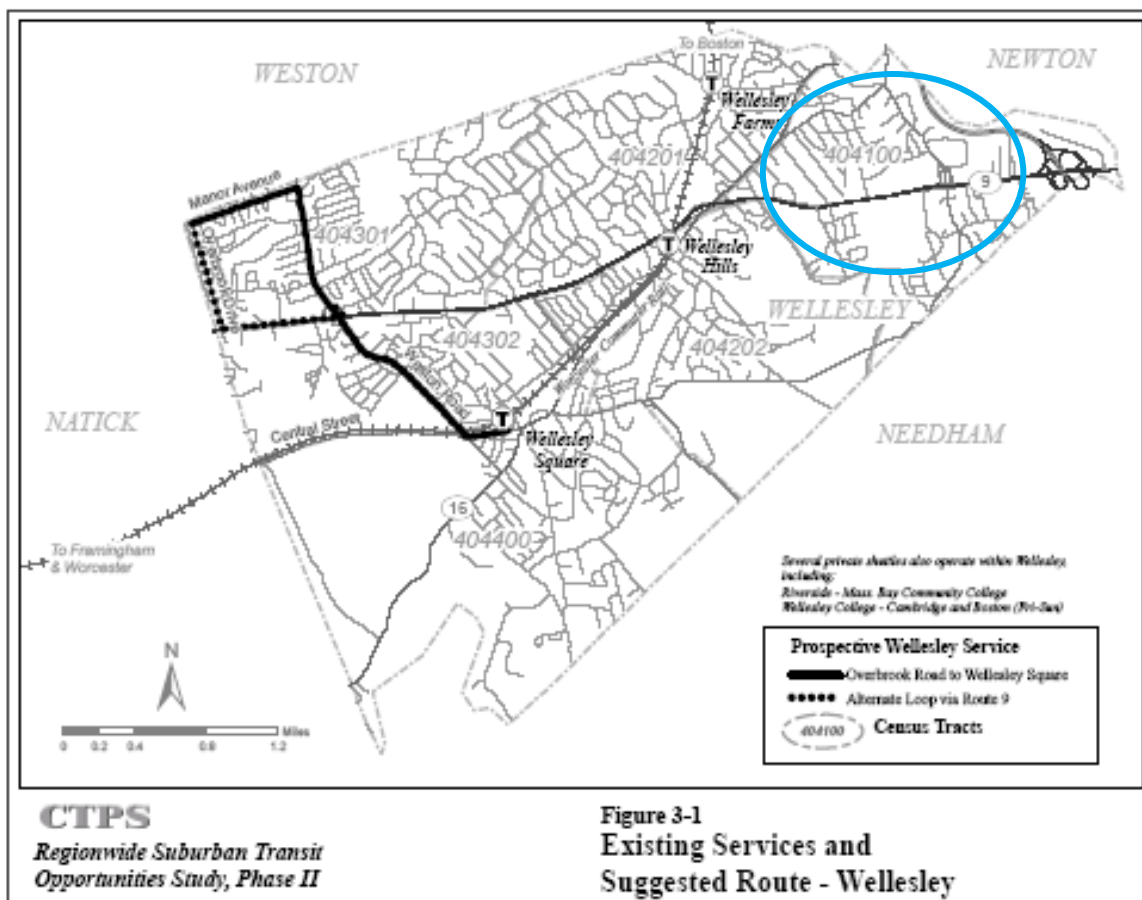
One of the over-arching goals of the MWRTA is to provide a seamless transportation network with connections to all other transportation modes. At present, Routes #2, #3, #4, #5 (Hopkinton & Ashland) #9, #10, #11 and the Natick Commuter shuttle serve the golden triangle area at Flutie Pass. Routes #6 (Ashland & Holliston) and #7 (Southborough & Marlborough) also provide connections to the Central Hub and other transportation services through our transfer system. The MWRTA uses its GPS and communication system to coordinate transfers. In the early stages of the Green Line project, which is expected to begin by January 2009, it will also provide an auxiliary shuttle to back-up late arrivals.

The Executive Office of Transportation includes the Central Transportation Planning Staff (CTPS), the planning support for the Boston MPO. The CTPS Regionwide Suburban Transit Opportunities Study, Phase II, completed in December 2005 includes a map of two suggested routes in Wellesley (see below). The Green Line project proposes a stop at the Natick/Wellesley town line in both eastbound and westbound directions to meet the Route 9 loop suggested in the study. According to the 2000 census Journey-to-Work figures, tract 404100 in Wellesley employed 693 reverse commuters from Boston to Wellesley. Another 114 workers came to this tract from Cambridge, and 432 from Newton. As the service grows, the MWRTA may consider a stop in this census tract.

The Green Line project will provide new service to the Newton-Wellesley Hospital, which is currently un-served by buses, and would provide bus service to the new apartment complex adjacent to the Woodland station. It intends to provide the opportunity for an additional stop in Wellesley in the vicinity of I-95 in the future.

The purchase of 5 new buses will enhance the existing hub-and-spoke system by providing mobility for the elderly, disabled and low income residents of the MetroWest region, while contributing to reverse commute options. In addition, the purchase of 5 new buses will allow the

MWRTA to serve the identified area with enough runs to reduce the length of the headways on such routes. The buses will allow the MWRTA to augment services provided by Council on Aging, Department of Transitional Assistance, Human-Services, Disability Commissions and Welfare Departments that are confined by political boundaries.



Furthermore, the buses will afford riders cost effective, timely and dependable service to the MBTA Green Line at Woodland Station from all communities served by the MWRTA, as well as Newton/Wellesley Hospital. These additional buses will improve quality of life by providing a broader menu of choices.

In the four years researched by MAPC, there was one pedestrian fatality in Wellesley, and an average of 23 injuries per 100 crashes community-wide.

There were 333 total crashes in 4 years within the study area (versus 3930 total in Wellesley). There were no collisions with bicyclists or

Wellesley Crash Analysis - Table T1				
	2002	2003	2004	2005
Total crashes – Wellesley	993	916	947	1074
Total Injuries - Wellesley	232	214	244	230
Total Fatalities	0	2	0	0
Collision with cyclist	2	5	9	3
Collision with pedestrian	18	13	17	5
Total crashes – study area	93	73	79	88
Total injuries – study area	33	13	19	24

pedestrians reported in the study area, and the injuries reported resulted in 27 injuries per 100 crashes within the study area, which is slightly higher than the town-wide average. Specific crash information is provided for each of the locations discussed below.

Considerations for compliance with the recommendations contained in the Mass Highway Route 9 Corridor Plan

Overbrook and Oak Street -

CTPS recommend interconnecting the Overbrook and Oak Street

signals. MAPC's transportation planner, Jim Gallagher, agrees with this recommendation, and finds that it is one of the opportunities to improve circulation in the corridor.



Weston Road Interchange - Photo T 1

There were 63 crashes at or near Overbrook Drive. There were 14 persons injured (22 per 100 crashes). Of the 63 crashes, 33 were rear-end collisions involving westbound vehicles only; another 14 rear-end collisions involved 2 or more eastbound vehicles. Not more than 5 appear to involve vehicles exiting Overlook. Seven of the 33 westbound crashes involved wet pavement, but only 4 of the 14 eastbound crashes involved wet pavement. Eleven westbound crashes took place in the AM, but only 10 of the eastbound ones took place at that time. All of this data seems to indicate that driver inattention during congestion is the cause of most of these accidents

Weston Road - CTPS also recommends a standard diamond interchange to replace the current substandard design at Weston Rd. There are safety problems on Route 9 caused by the insufficient length of the acceleration and deceleration lanes. The diamond design would likely remove this problem, but at a cost of land takings, including some of the town reservation. There would also be new signals on either end of the ramps on Weston Rd.

MAPC finds that this design is overbuilt and inappropriate for this location. Jim Gallagher's recommendation would be single ramps eastbound and westbound on Route 9, without any new signals on Weston Rd. The eastbound ramp on/off Route 9 would remain approximately where it

is. The westbound ramp would be the existing ramp on the east side of Weston Road, with the ramp on the west side closed. This would also simplify operations at that location on Weston Rd, which is the only place with any significant numbers of crashes in the area on Weston Rd.

The bridge on Route 9 over Weston Road would need to be widened to allow the acceleration and deceleration lanes to be lengthened. Some of the right-of-way from the closed ramp might need to be traded for some of the parking spaces of the commercial area on the west side to allow this to happen. There should also be warning signs (Slowed Traffic Ahead) on both sides of Route 9 approaching this interchange.

There should be similar warning signs approaching the Dunkin Donuts location for westbound traffic and for both directions on Route 9 at Overbrook. All this in total should improve traffic circulation.

Weston Road Crash Details

There were 57 crashes in 4 years reported on Weston Road within a ¼ mile of Route 9. Only 7 injuries were reported.

Seventeen of the crashes were angle collisions with one vehicle trying to exit a side street colliding with one on Weston.

Pilgrim Road was the most frequent site of these crashes, with 6 crashes in 4 years. No injuries were reported for any of these crashes.



**Dunkin Donuts entrance onto Route 9 –
Photo T1**

There were 25 rear collisions (resulting in all 7 injuries) as well, possibly reflecting congestion on Weston Rd. Ten of the 25 collisions took place during the peak driving hours of 7-9 AM and 4-6 PM. The pavement was listed as wet in 13 collisions; snow/ice was listed 8 times. Only 10 crashes occurred after dark.

Based on the crash information available, the intersection of the Route 9 ramps with Weston Road does not appear to have a severe safety problem. There were 18 collisions in the vicinity of the Weston Rd/Cleveland Rd intersection north of Route 9, none listed on the south side. Six of these were collisions with objects (fences, curbs, walls) or parked vehicles, a relatively high number that may reflect speeding or outdated geometrics.

Finally, there were 128 crashes on Route 9 in the area around the Weston Road interchange. Of these 128 crashes, there were 31 persons injured (24 per 100 crashes).

Crashes on Route 9

There were 273 crashes were associated with Route 9, with 81 injuries reported (30 injuries per 100 crashes). Of the 273 crashes, there were 19 single vehicle crashes, 10 westbound and 7

eastbound. Two hundred and one crashes were rear end collisions, 131 involve west bound vehicles, with 52 injuries. Fifty six involve eastbound vehicles with 8 injuries.

There were 44 crashes adjacent to and just east of Dunkin Donuts, including 969, 965, 951 Worcester Street and Ottaway Circle, all involving westbound vehicles on Route 9. This is a high number for an area without any cross streets or much entering traffic except for those using the business driveways. Almost all of these are rear-end collisions, 11 involved 3 or more vehicles, with 22 persons injured (50 injuries per 100 crashes, a high rate of injuries). Virtually all took place between 8 AM and 8 PM, almost all during daylight. There were 16 crashes with wet pavement conditions, a relatively high number indicating problems stopping suddenly. Queues from the Overlook Drive signal also may extend this far and factor into the number of crashes.

Saint James Church - There were 31 crashes in the area around Lexington Rd and across at St James Church. Almost all of these (24 of 31) were rear-end collisions involving 2 or more vehicles traveling westbound. All but 2 of the westbound crashes took place between 12 PM and 6:30 PM, and only 3

St. James the Great Church - Photo T 2

involved wet pavement, indicating most of the crashes were congestion-related. There were 14 persons injured (45 per 100 crashes). None of the descriptions suggest that vehicles leaving Lexington Street or St James were involved in the collisions.



VII. Land Uses

Wellesley's rich historic heritage helped to create the special community character that makes the town a desirable place to live. Evidence of this character exists throughout Wellesley, most notably in the traditional town center, and in the village centers with their historic architecture. The extent and variety of land uses are among the strongest determinants of the town's character. Wellesley's special community character, so highly valued by its citizens and by those who come to Wellesley as potential residents, visitors, tourists, workers, and shoppers, can be irretrievably altered by major growth and change.

Aerial View of Natick/Wellesley Town Boundary Photo L1

Zoning is the primary tool that allows a community to control the types, size and appearance of land uses. A zoning bylaw specifies how land is used, and the division of land areas into different zoning districts. Zoning changes over time, sometimes with little regard to building compatibility with the surrounding neighborhood. The Massachusetts Smart Growth Toolkit advises that "most zoning and subdivision regulations actually promote the sprawling development patterns that citizens generally oppose.



Wide streets, missing or small buffer strips, the absence of public shade trees, and building structures set back far from the street with parking areas within the front yard setback all detract from what citizens want from their neighborhoods. Developers often agree with the citizens, yet find that mixed uses, traditional design, and pedestrian-friendly streets are difficult, if not illegal, to build due to zoning constraints.”¹

Aerial View of Study Area - Photo L2



¹ Smart Growth / Smart Energy Toolkit - Form-Based Codes (FBCs), 2008

A key component of the Gateway study was a close look at the variety of the land uses within the study area. Residents expressed concerns about the adverse impact of some of the existing land uses within the study area, and stated their desires for new land uses that would be beneficial to the study area and the quality of life of Wellesley residents. In the first pages of this Section, the existing land uses are described and depicted. The later pages of this Section describe some of the themes that arose from the public participation throughout the planning process. Many of the themes and recommendations are directly related to land uses.

As you approach the Natick/Wellesley town boundary on Route 9 eastbound, you are aware of the diverse types of businesses on both sides of the highway. There is a heavy automotive land use presence ranging from gas stations to used car and new car sales and service. Mixed among the automotive uses, you'll discover a well-maintained office building surrounded by small retail uses, a furniture store and a bank.

As you can see from the aerial view, the single-

Collage of Businesses Adjacent to Westbound Lane of Route 9 near Natick Town Boundary– Photo L3



most obvious physical condition at the Natick/Wellesley town boundary is a substantially built environment. The majority of this western-most Gateway is covered with asphalt, bricks and mortar. To the south of Route 9 in the West Gateway, you can see Bogle Brook flowing under Route 9 through a wooded wetland and floodplain area that leads to Morses Pond. Morses Pond provides 40% of the town's drinking water for Wellesley residents. To the north, you can see an affordable housing development adjacent to a large residential neighborhood.

The photos above depict the businesses clustered on the west-bound lane with arrows to their location on the aerial view. The land uses in this area consist of small retail stores, gasoline

stations, automotive services, financial institutions and offices.

The photos provide evidence of the contrasts between older buildings and uses and uses and buildings that are two to three decades newer. In addition, it introduces the pervasive automotive uses which include gas stations, automotive repair shops, used car sales and new car sales. They also provide evidence of the urban environment that consists of asphalt, bricks and mortar with very little landscaping to soften the view.

Collage of Businesses Adjacent to Eastbound Lane of Route 9 near Natick Town Boundary– Photo L4

The study area ultimately drains into Morses



Pond. Morses Pond, a 103-acre, shallow eutrophic pond, is one of Wellesley's most visible natural resources. It serves as a recreational resource and its aquifer serves as a source for the town's public

water supply. The dense urban environment along Route 9 and adjacent to Morses Pond poses a threat to the health of the pond, and is likely a major contributor to the eutrophication of the pond. This topic is discussed in Section V. Natural Resources of the study report.

The photos labeled L4 show the land uses on the east-bound side of Route 9 at the Natick town line. As we saw with the westbound side of Route 9 in this location, the developable land is virtually paved and covered with dense commercial development, which is primarily automotive in nature.

The former Wellesley Travel Inn, a motor inn, restaurant and office building that has been vacant for a number of years, is one of the opportunities for redevelopment in the study area. However, it is important to note that much of the land area that appears to be open for redevelopment has limited or no development potential, this will be illustrated and discussed further in this section.



Traveling east along Route 9, you will notice another large auto dealership, Mazda.

Tucked very close to the



Mazda Dealership and Dunkin Donuts – Photo L 5

dealership is a Dunkin’ Donuts franchise with a very difficult entrance and limited parking. The site location of the Dunkin Donuts is particularly tight, and the entrance and exit are difficult. At peak business hours, the queuing extends onto Route 9, which is heavily traveled. This can create an unsafe vehicular conflict on a fairly regular basis.

Immediately after the Dunkin Donuts, you enter an area that consists of low- density residential



subdivision
development
s with
subdivision
roadways
directly off
Route 9,
Ottaway and
Lexington,
surrounded
by open



space, protected open space, and wetland resources – another brook connected
Center Portion of Study Area - Figure L1



to Morses Pond, which is on the south side of Route 9. This area contains widely differing land uses. It features auto-motive new car sales and service, a fast food drive-through restaurant,

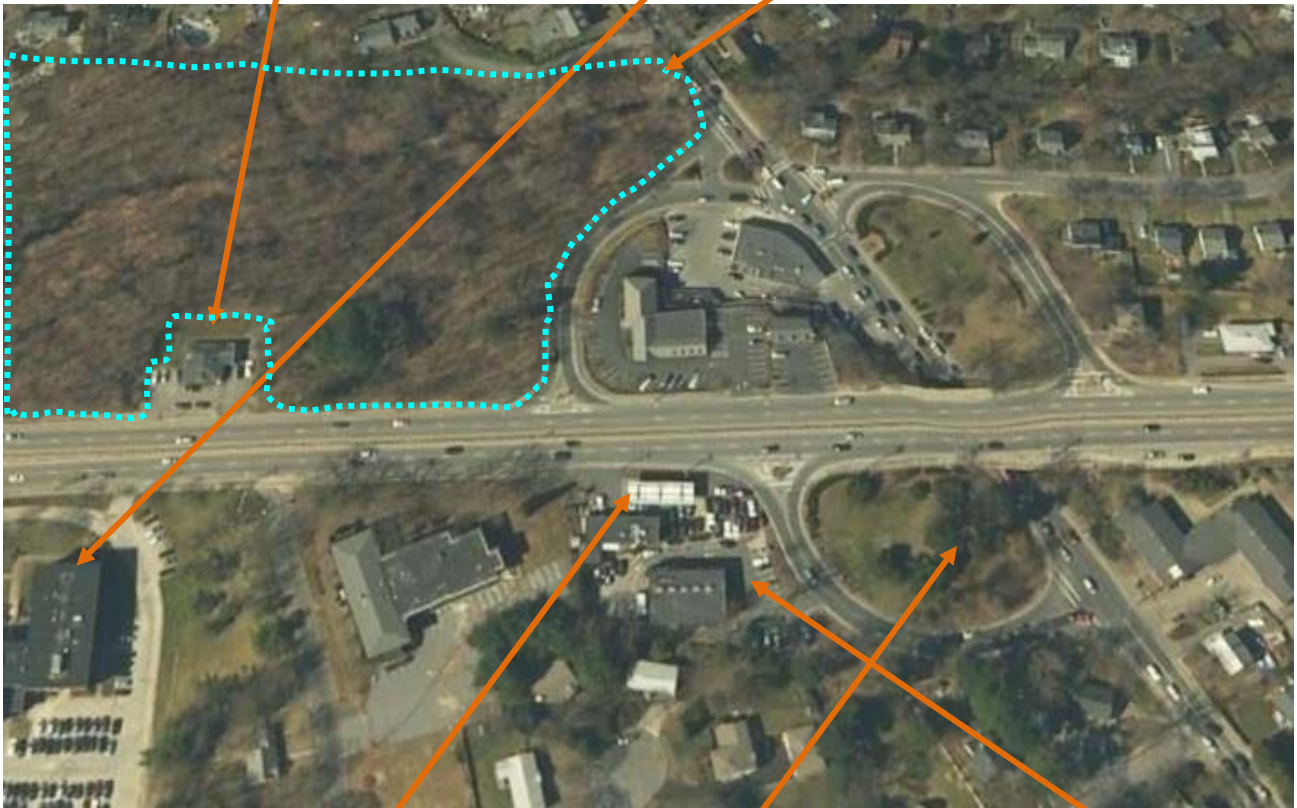
protected open space, wetland and wildlife resources, specialty retail and large lot residential land uses.

The large photo clearly shows the environmental constraints surrounding the eastbound side of the study area, and the protected open space adjacent to the westbound lanes of Route 9. We'll discuss these constraints in greater detail in subsequent paragraphs.



Some distance away, you'll notice California Closets, which is surrounded by the Overbrook Reservation. Adjacent to the eastbound travel lane you'll find a well-maintained office park, Wayne Office Park, nestled on a

Overbrook Reservation



Weston Road Area - Figure L2

The landscaping at California Closets and at the Wayne Office Park is a departure from all of the other businesses located in the Wellesley West Gateway Study Area (see photo L6 on the following page). As redevelopment occurs, the Town should encourage the project proponents to provide a certain minimum amount of landscaping. Over time, the hardscape will soften and the gateway will be more aesthetically appealing.





888 Worcester Street - Photo L 6



As you approach the Weston Road exit from an eastbound direction, you'll notice the new Fells Hollow residential development on the site of a former nursing home. Fells Hollow is a 28 unit, age restricted residential development which was granted a comprehensive

permit by the Wellesley Board of Appeals under Chapter 40B of

the General Laws of the Commonwealth. Seven of the 28 units are deed restricted for affordable households. The property manager appeared before the town in January 2008 to try to ease the age restriction to open the condominium development to a wider market citing the economy's toll on the real estate market as the reason for the request. This is becoming prevalent in MeroWest, so it is important to look at the fiscal impacts of development as a whole, and of particular types of land uses.

Fiscal Analysis of Proposed Development

While fiscal impact fees are still not allowed in Massachusetts, communities can make use of fiscal impact studies of proposed development and re-development proposals. However, these studies should be interpreted with caution. A study that lacks the benefit of the details available once the developer has made progress in the permitting process has to fall back on generic data obtained from comparable developments, yet project design changes that occur between a concept plan and a special permit or site plan submission can significantly alter the assumptions used in a fiscal impact study.

A fiscal impact analysis assesses the relationship between the amount of municipal revenue generated by a variety of land uses and their related community service costs. Most fiscal impact analyses are designed to evaluate the impacts of new development, such as the impacts of a proposed project or growth that may be triggered by a zoning change. A fiscal impact analysis will help a community determine whether a proposed land use is revenue positive (it generates more revenue than it costs in public services), revenue-neutral (land use is at the break-even point) or revenue negative (land use costs more in public services than the revenue it produces).

In general, a fiscal impact study sheds light on the costs and revenue associated with proposed development, but fiscal impact practice is not without hazards. Specifically, a common pitfall in fiscal impact studies is excessive focus on advertised sale prices as a market barometer. The

Typical Findings

- **Over 60 studies were summarized nationwide**
 - American Farmland Trust
 - Skagit County Washington
 - Alliance for Quality Growth, and others
- **All results tend to show nearly the same metrics**
- **For every dollar of revenue received:**
 - Residential development costs the Community \$1.11 to \$1.25 to provide services
 - Commercial / industrial development costs the Community \$0.25 to \$0.40 to provide services
 - Farm and Open Space land costs the Community **\$0.29 to \$0.50 to provide services**

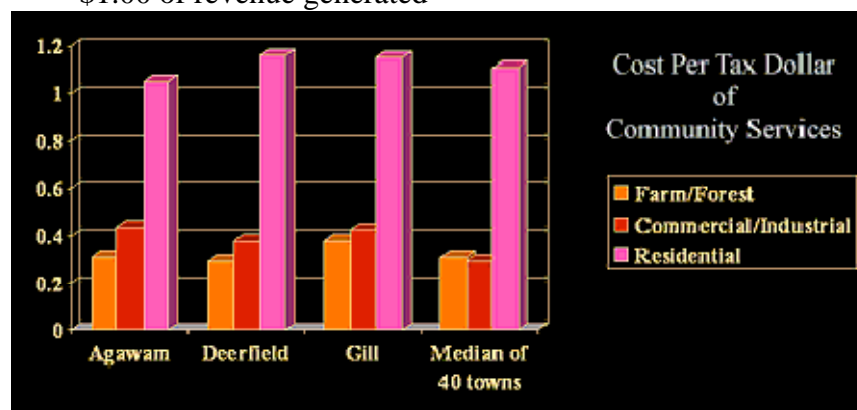
assessed value of recently built homes or commercial developments is more important to a fiscal impact study than what appears to be happening in the market.

Another way to consider the relationship between local government finance and land use is to examine costs and revenues under current development conditions, also known as a “Cost of Community Services” study. Such studies have been conducted around the US and many results are listed on the website of the American Farmland Trust (www.farmland.org). In general, residential development is an economic drain while commercial/industrial and farmland/forest/open space more than pay their own way.

A land use with a positive cost revenue ratio may seem advantageous, yet the amount of surplus revenue it generates may be remarkably small. Low-density commercial development tends to produce a positive revenue ratio and a very small surplus, for reasons ranging from inefficient land use to high public safety costs.

Cost of Community Services- Massachusetts

- Open Space Land costs \$0.33 in services for each \$1.00 of revenue generated
- Residential development costs between \$1.12 to \$1.30 for each \$1.00 of revenue generated



(source: American Farmland Trust data – Massachusetts)

Impact of Nonresidential Uses. Determining the fiscal impact of commercial development requires an assessment of similar business activity elsewhere in a community or market area. If a new business is likely to draw too many customers away from other stores, its net fiscal impact may be less advantageous than it appears. A carefully planned mix of shops, perhaps with a small restaurant could help to diversify the sources of property tax revenue generated by new development in the Wellesley West Gateway study area, and simultaneously respect downtown's role as the civic, social, cultural and business center of the town.

Housing Types and Household Population. Federal census data for Wellesley and other affluent suburbs in the Metro-West area shows that two-bedroom townhouses generate few school-age children. Since the average number of school-age children per household in owner-occupied townhouses and multi-family condominiums is smaller than the average number in owner-occupied, detached single-family homes, the inclusion of two-bedroom units in the Wellesley West Gateway study area would be advantageous to the Town from a fiscal perspective. It is important to note that if many of the two bedroom townhouses were occupied by renters rather than owners, there would likely be more school costs generated. MWGMC's research indicates that the average household size in renter-occupied townhouses is larger than in owner-occupied townhouses.

Mixed-Use Development. Mixed-use housing units (meaning units developed in conjunction with commercial space) were identified as a housing type that would fit well within the Wellesley West Gateway. Regrettably, Massachusetts has very little experience with new mixed-use development. Therefore, it is very difficult to predict the household population and school costs associated with this housing type. The uncertainty can be somewhat alleviated through design standards. For instance, if the housing units were all second story units over commercial uses, you could reduce the school cost impact because these units are typically occupied by smaller size households.

Municipal Services. Research indicates that the presence of multi-family rental and over 55 housing units can generate about 20% more incident response and emergency medical calls per unit than other residential uses. However, emergency medical calls often generate enough revenue from insurance companies to defray the cost of an ambulance response.

After looking at the various segments of the study area and the relationship or lack of relationship to adjacent or nearby segments within the study area, one can reach a basic finding. There are things that residents like, and others that residents don't like and want to change. The goals and recommendations set forth in the next two sections will help Wellesley to take what is liked and make sure to allow it, encourage it, require it, and protect it. They will also help Wellesley take what was identified as needing to be changed, and work to both discourage it and to prevent expansion of it.

It is important to recognize several key questions that served as a basis of the conceptual land use goals presented in the following section of the study report.

- What is the current pattern of land uses?
- What are the zoning designations? What uses are allowed in each zoning category?
- What environmental regulations limit development?
- Is the study area growing faster or more slowly than the region (or state) as a whole?

- Where do land uses conflict with the adjacent land uses, and where are they compatible?
- What types of businesses currently exist? Do they meet the needs to the nearby neighborhoods?
- What types of housing exist?
- What types of retail, office, and industrial land uses exist?
- How much capacity is available in water, sewer, and stormwater systems? Are there plans to expand and extend these systems?
- Are there unique local conditions, including individual businesses, developers, or landowners, that could have a substantial impact on future development?

VIII. Conceptual Land Use Goals

Four main players - **government, developers, businesses and residents** - determine the physical arrangements of land uses in communities in an interesting and sometimes complex set of interactions. Each depends upon or responds to the desires and actions of others. Residents, businesses and government demand new buildings in which to live or conduct their activities. Workers consider commuting times as a factor when selecting a new place to live. Businesses locate where they can attract needed workers for their needs and consumers for their products. Developers profit when they meet these demands. Government affects both the supply of developable land through their land use, infrastructure and economic development policies and plans.

The price of land can serve as a sorting mechanism for the type and location of development. Residents, business and developers are willing to pay for land, but only up to the amount they will receive in future benefits. At the same time, developers, business and residents may all benefit from certain locations more than others and will outbid all others for these sites. For example, retail business that needs high levels of visibility and/or accessibility, at the intersection of major streets and highways or on heavily traveled roadways, will outbid other businesses that may not require this.

The following major themes involve the four main players described above, and represent the strengths, weaknesses, opportunities and threats identified by participants of the study.



1) Enable new development, redevelopment and adaptive reuse through a cohesive plan for heterogeneous lots and land uses.

- a) Accommodate existing uses in large part.
- b) Transform the aging, auto-oriented uses into a series of integrated, livelier, development nodes.
- c) Encourage investment in commercial properties as potential solutions to challenges.
- d) Encourage neighborhood-oriented businesses.
- e) Develop and implement design guidelines for the West Gateway.

2) Create a built environment, streetscape and street design that will include a concentration of interrelated uses to provide a wide ranges of activities.

- a) Create a mix of uses, with taller, mixed-use buildings along Route 9, transitioning to less dense, more residential uses as development approaches the existing residential neighborhoods.
- b) Acknowledge the market for multi-generational living; provide high quality housing for a full range of incomes and ages.
- c) Provide the associated community and neighborhood services, open space, and public spaces important to making a great neighborhood.
- d) Any development must result in an improvement to the quality of life in Wellesley.

3) Respect and enhance the existing environment.

- a) Integrate development with surrounding conservation land and Morse's Pond
- b) Encourage integration of green building practices
- c) Protect/maintain conservation land from infringement
- d) Look for opportunities to integrate new and innovative ways to handle stormwater detention and provide water quality benefits.
- e) Improve connectivity - link to the trail system
- f) Encourage good connections to nearby neighborhoods.

4) Ensure a positive economic impact.

- a) Any development, whether commercial, conservation or residential, must be “revenue positive”.
- b) Provide new economic growth in Wellesley
 - Additional tax revenues
 - New jobs
 - More retail opportunities and services
- c) Ensure that the costs of development minimize:
 - any increase in traffic congestion
 - Conflicts between new and old residents
 - Government's cost of providing additional community services.



5) Create a framework for zoning changes and design standards that will guide future private development

- a) Careful review of the zoning bylaws indicates that zoning bylaw amendments and changes to existing rules and regulations would be required to allow the redevelopment.
- b) Craft zoning regulations with the understanding that market demand holds more sway than any other factor, including zoning, over the types of development proposed and constructed.
- c) Establish special parking requirements that encourage the consolidation and sharing of parking lots, the creation of interconnected parking lots between existing commercial development, and reduce the wide and numerous curb cuts;
- d) Consider Amending the Zoning Bylaw to include tools that will facilitate redevelopment and infill development through flexible dimensional and use standards, and by Transfer of Development Rights (TDR) within the overlay district.
 - Establish a Wellesley West Gateway Overlay District that combines a variety of housing types with commercial and civic functions in a cohesive and compatible context.
 - Utilize zero minimum lot requirements, maximum rather than minimum setbacks, and building separation requirements to enhance pedestrian access to buildings and between sites and promote site features and layouts conducive to walking and bicycling.
 - Use Form-Based Codes (FBCs) to replace or supplement standard text-based zoning, subdivision and other local regulations to achieve the desired outcomes.
 - Develop design standards to guide development of buildings and landscapes that are contextually compatible with the characteristics of the towns and promote the preservation of resources, i.e. xeriscape, green buildings (LEED).
 - Add best practice provisions for energy and environmental design for structures and orientation.

Opportunities

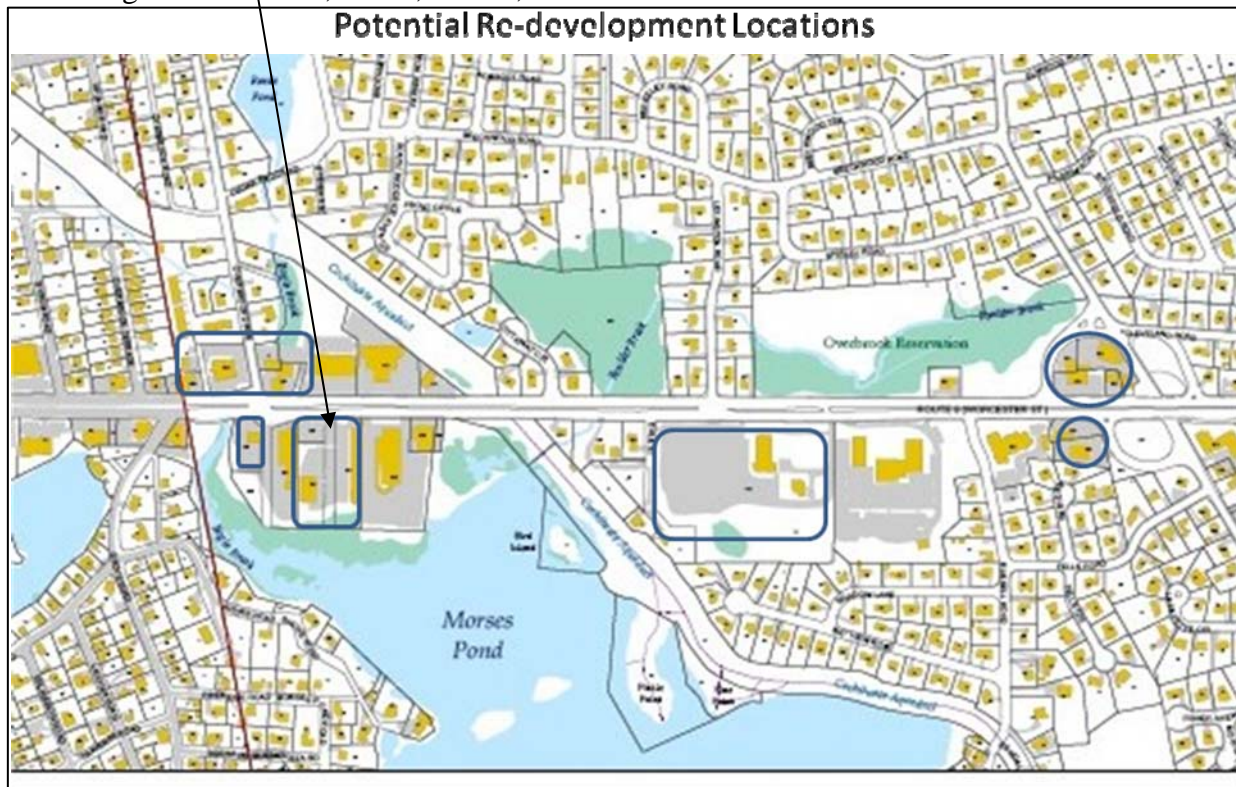
The following map shows six areas outlined in blue where there is obvious potential for redevelopment. The largest parcels are located on the east-bound side of Route 9. The area adjacent to the Natick town line is ripe for redevelopment due in large part to three abandoned buildings in close proximity to the town boundary. For this



reason, this portion of the Wellesley West Gateway is likely to be the first area that is redeveloped.



The property at 978 Worcester Street, the former Wellesley Travel Inn, is going through the development permitting process at this time. The project proponent has submitted a plan for a mixed-use development consisting of small retail, office, a bank, and residential condominiums.



The adjacent property to the east is vacant, and the property owner has made inquiries with the Planning Department about the potential for redevelopment of the property.





Three and one-half years ago, parishioners of St. James the Great Parish began a vigil to attempt to keep their Route 9 church open. During the past few years, the parishioners have filed appeals with the United States Supreme Court and the Vatican equivalent, the Apostolic Signatura.

Eleven months ago, the parishioners learned that the Supreme Judicial Court refused to interfere with the Archdiocese of Boston's decision to close the parish. The parish is still awaiting word from the Vatican on their decision regarding the parish.





Redevelopment of one or both of these properties would serve as a catalyst for the other redevelopment areas shown on the map above,



and other areas within the study area.

The area on the westbound side of Route 9 near the Natick town line may be ripe for redevelopment through parcel assembly, expansion of a non-conforming land use or building, or change of land uses. Although it is a fairly small area, any one of these changes could have a big impact, and could serve as a catalyst for other changes. Even this small area has a dominant automotive character, which is a concern as it drains into the brook which leads to Morses Pond.

A principal goal guiding the redevelopment of the study area should be to sustain and encourage a vital business center that provides needed goods, services, jobs and increased tax revenues in a manner that is compatible with Wellesley's historic development pattern, and establishes pedestrian accessibility and circulation throughout the study area.



Careful consideration of buffers between this business area and the adjacent neighborhoods, and improved pedestrian circulation should be a primary consideration in any redevelopment.

Pedestrian access and circulation are favored to limit vehicular congestion and air pollution. Adjacent



residential neighborhoods should be connected via safe pedestrian ways but should be separated with



landscape buffers. It is widely recognized that the mere

provision of sidewalks and crosswalks will not encourage pedestrian use of a commercial area unless the layout and design of the sites and buildings are also conducive to pedestrian use.

A leading design principle therefore is to provide convenient and efficient pedestrian access within the study area and to surrounding neighborhoods and facilities, to provide a safe and comfortable pedestrian environment with walkways, pedestrian conveniences and amenities, and to encourage buildings with a pedestrian oriented scale and design. These same precepts should apply



to the redevelopment areas identified in area adjacent to the Weston Road interchange and shown in the photos on this page.

To accomplish the redevelopment that would, over time, result in a showcase gateway, the town should strongly consider adoption and utilization of the zoning tools discussed in the following paragraphs.



IX. Recommendations

The Wellesley West Gateway is an ideal location to utilize many of the new and emerging zoning tools that can assist the community in preservation of open space, protection and enhancement of key natural resources, the addition of cultural and recreational opportunities, and a mixture of housing choices in addition to shops and offices that provide goods and services in close proximity to existing and new housing.


Tools for Consideration

1. Create a Wellesley West Gateway Overlay District

Because of the variety of land uses within the study area, and the importance of creating regulatory measures that do not affect the entire town, creation of an overlay district is worthy of serious consideration. An overlay district is an additional zoning requirement that is placed on a geographic area but does not change the underlying zoning. Overlay districts contain specific land use and development characteristics which warrant the need to encourage a creative and innovative approach to land use and design. Overlay districts are used to establish guidelines to permit creative


Overlay Districts

- **Adopt a transect-based overlay district with building form, streetscape, and architectural design standards.**
- **Examples:**
 - Amesbury's Smart Growth District
 - Lowell's Hamilton Canal District



Source: Amesbury, MA

Smart Growth / Smart Energy Toolkit



Source: Lowell, MA

Form Based Codes

mixtures of uses, flexibility in design standards and often aim at mixing residential and business activities in hopes of creating pedestrian oriented developments. Overlay districts have been used to impose development restrictions in specific locations in addition to standard zoning requirements.

The overlay district recommendation can work on its own, but can be strengthened when used in combination with recommendation #2, Form-Based Codes.

2. Form Based Zoning Codes (FBCs)

The first zoning tool that is recommended is development of Form Based Zoning Codes (FBCs). FBCs are

- One of the most effective land use tools for shaping pedestrian-scaled, mixed-use and active urban environments.
- Often used with “New Urbanism”, village-style development, or neo-traditional planning.
- More concerned with the arrangement and form of buildings than the use that goes on inside them.
- Represent an innovative response to undesirable urban sprawl.

FBC's are becoming increasingly popular in communities seeking practical ways to grow smarter, and provide certainty in a complex permitting process. FBCs are used to control physical form primarily through local land use regulations including zoning, subdivision and other regulations such as wetlands, drainage and shade trees, and historic preservation. The work well because:

- FBCs are prescriptive
 - ➔ Describe what you want rather than don't want.
- FBCs encourage public participation
 - ➔ Leads to better understanding of density.
- FBCs enable incremental growth
 - ➔ Less reliance on a developer.
- FBCs work well in established communities.
 - ➔ Codify the community's existing "DNA".

FBCs address the relationship between building facades and the public arena, the form and mass of buildings in relation to one another, and the scale and types of streets. The public arena includes streets, alleyways, sidewalks, lighting, landscaping and street furniture such as benches, bike racks, news racks and fountains, as well as squares, plazas, parks, public art, open space areas and pedestrian corridors.

The regulations in FBCs are usually presented in both diagrams and text. They are usually keyed to a specific area plan, a transect plan, that designates the appropriate form, scale and character of development rather than only distinctions in land-use types.

This approach is in direct contrast to conventional zoning's focus on the separation of land use types, allowed property uses, and the control of development intensity through setbacks, floor area ratios, height limits, and parking ratios. FBCs specify what type of development a community desires versus conventional zoning which has often resulted in the exact kind of development a community does not want.



FBCs should not be confused with design guidelines or general statements of policy. FBC's, are regulatory, not advisory, and they are not limited to the appearance of buildings. FBC's include building form standards to control the configuration, features and functions (such as height, massing, setback, parking and use) of buildings that define and shape an area. They depart from the conventional zoning "one-size-fits-all" approach. Each building type is principally defined by performance measures relating to pedestrian access and open space arrangement. Some FBCs also include frontage type performance measures which combine with the building type measures to establish a building's relationship to the street. This blends building scale and façade treatment to best accommodate the pedestrian.

FBC's can also include public space standards to set specifications for sidewalks, travel lanes, street trees, street furniture, bike lanes and utilities. They can be adopted in the form of performance standards under the Zoning Bylaw or as design standards under the Subdivision Rules and Regulations. These standards often include innovative techniques for mandating environmentally sensitive low impact development techniques for stormwater management on individual lots or for the roadway design. Provisions can also be added to promote energy efficient building designs such as Energy Star programs or LEED certification.

Municipalities have three main options to incorporate FBCs into their regulatory framework: Quick Fixes; Overlay Districts, and a Comprehensive Code (Zoning Bylaw/Ordinance) Update. For the Wellesley West Gateway Study Area, the town may want to use a blend of the "Quick Fix" option and the Overlay District. It would involve:

- Targeted districts/ zones.
- Revision of land use, building and parking regulations within the targeted district/s to effectively shape the public realm of the street.
- Inclusion of a transect-based zoning map, building form standards and some form of streetscape design standards.
- Examples:
 - ➔ Historic District regulations, which often regulate the form of new buildings in historic districts.
 - ➔ Building Design Standards, for instance regulating proposed "Main Street" buildings, or taming big boxes.
 - ➔ New generation of dimensional standards, replacing setback lines with "Build-to" lines.

First, they can modify existing regulations to include criteria for building forms. This approach can be time consuming because most regulations provide for the segregating of use, limited densities, and the accommodation of traffic and parking. Next, a community can opt to replace existing zoning regulations with FBCs. This solution is best for communities with a strong history of adherence to "smart growth" initiatives. However, eliminating the entire existing regulatory framework can be very controversial and difficult to pass at Town Meeting. Finally, a community can adopt new FBCs expressly for special districts or "overlays" planned for revitalization. With this approach the existing framework remains and FBCs simply augment the underlying zoning.

Useful link:

http://www.mass.gov/envir/smart_growth_toolkit/bylaws/FBC-Bylaw.pdf

3. Low Impact Development

To reduce the amount of stormwater runoff from developed areas, the town should require implementation of **Low Impact Development** measures in the design of all development proposals within the West Gateway Study Area, and it would be beneficial to implement LID regulations town-wide. The LID approach provides opportunities to build the homes and businesses that are needed, while conserving natural areas and drainage patterns.

LID is accomplished as a two-step process; **FIRST**--thoughtful site planning and, **SECOND**--incorporation of "natural" stormwater best management practices (BMPs).¹

From the local authority's perspective, the better site design in Low Impact Development helps:

- to identify and preserve natural features;
- to maintain natural hydrology;
- to help respect abutter's properties;
- to retain property values;
- to augment groundwater supplies, and
- to maintain high water quality.

Low Impact Development (LID) uses a holistic approach to mimic the natural hydrological characteristics of undeveloped land. LID recognizes that uncontrolled storm water discharges will damage the water quality and biological resources.

LID STRATEGIES: Low Impact Site Design

Stormwater Management

- Minimize directly connected impervious area
- Create multiple sub-watersheds
- Increase time of concentration
- Use a "treatment train" of LID techniques to deal with frequent, low-intensity storms.



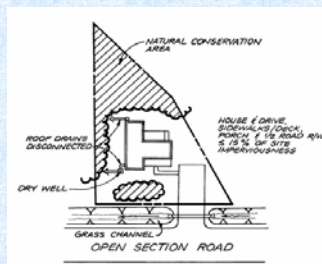
1. Use existing natural systems as the integrating framework for site planning



- Land use planning and watershed planning
- Identify environmentally sensitive areas: wetlands, mature trees, slopes, drainageways, permeable soils.
- Minimize alteration (clearing and grading)

2. Focus on prevention

- Minimize grading and clearing
- Delineate development envelope and work area
- Cluster buildings and reduce building footprints
- Reduce road widths, use shared driveways, reduce parking area
- Use green rooftops
- Use permeable paving



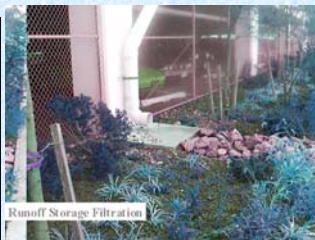
¹ Smart Growth / Smart Energy Toolkit - Low Impact Development, 2008

Low Impact Development measures will reduce runoff and increase recharge of the aquifers, and benefits both water quantity & water quality in the watershed. The goal of LID design is to maintain the integrity of each watershed by maintaining the natural, pre-developed hydrology on each development site. (Site hydrology is the relationship between rainfall, runoff, plant uptake, evaporation and infiltration.)

A LID design creates a functional hydrologic landscape by maintaining natural drainages, like streams, and by using small-scale stormwater controls distributed evenly throughout the site. By doing this on individual sites, the overall watershed can be better protected.

4. Emphasize simple, nonstructural, low-tech, low-cost, methods

- Open drainage systems and filter strips
- Disconnection of roof runoff
- Rain barrels
- Street sweeping
- Public Education



3. Treat stormwater close to the source

- Maintain natural flow paths
- Create subwatersheds and "micromanage" runoff in a treatment train of small structures
- Use open drainage
- Flatten slopes
- Lengthen flow paths
- Maximize sheet flow



Adoption of a **Low Impact Development Bylaw** applicable town-wide would encourage better site design and more efficient form of development that consumes less open land and protects existing topography, wildlife habitats, and natural features. Better site design is a land planning process that follows a logical resource protection approach and employs site design strategies to minimize impervious cover and create opportunities

for micro-scale stormwater management.

Low Impact Site Design provides for:

- Conservation of natural hydrology, trees, vegetation;
- Minimized impervious surfaces;
- Dispersal of stormwater runoff;
- Conservation of stream & wetland buffers; and
- Ecological landscaping.

5. Create a multifunctional landscape

- Use stormwater management components that provide filtration, treatment, and infiltration.
- Provide open space and wildlife habitat.
- Store water for landscape use
- Reduce heat island effect
- Enhance site aesthetics



MetroWest Growth Management Committee developed a Lower Impact Development Bylaw and implementing regulations for the Town of Southborough, which are available on our website: www.metrowestgrowth.org. The Massachusetts Low Impact Development Toolkit (see links below) is a set of materials designed to help citizens, public officials and developers implement LID.

Links:

<http://www.mapc.org/LID.html>

<http://www.epa.gov/hiri/strategies/vegetation.html>

http://www.mass.gov/envir/smart_growth_toolkit

http://www.mass.gov/envir/smart_growth_toolkit/bylaws/LID-Bylaw-reg.pdf

<http://www.sierraclub.org/healthycommunities/buildingbetter/>

Builder's Guide to Low Impact Development:

http://www.toolbase.org/PDF/DesignGuides/Builder_LID.pdf

4. Chapter 43D

Chapter 43D provides a transparent and efficient process for municipal permitting. It guarantees local permitting decisions on priority development sites within 180 days, and increases visibility of your community and target development site(s). The town should consider utilization of Chapter 43D as a tool to develop specific area plans for the Wellesley Travel Inn site and the St. James the Great church parcel.

Chapter 43D is a site-specific opt-in program in which the municipality identifies the Priority Development Site(s). The site eligibility requirements are:

- zoned for commercial, industrial or mixed-use development;
- eligible for the development or redevelopment of at least 50,000 square feet of gross floor area, and
- Must have permission of property owners and town meeting.

What are the benefits of opting-in? Chapter 43D grants up to \$150,000 for such things as professional staffing assistance, local government reorganization, and consulting services. It provides priority consideration for PWED, CDAG, brownfields remediation assistance, MORE infrastructure funds, and other financing through quasi-public organizations. It provides an aggressive online marketing of the site and promotion of your pro-business regulatory climate.

6. Educate property owners and public about maintenance

- Reduce the use of pesticides and fertilizers.
- Use drought-resistant, native, non-invasive plants.
- Maintain rain gardens, stormwater planters, grass swales and bioretention areas.



Chapter 43D Overview

- ❖ Site-specific opt-in program
- ❖ Municipality identifies Priority Development Site(s)
- ❖ Site eligibility requirements:
 - zoned for commercial, industrial or mixed-use development
 - eligible for the development or redevelopment of at least 50,000 square feet of gross floor area
- ❖ Must have permission of property owners and local governing body

MetroWest
Growth Management Committee

Additional information about Chapter 43D can be found at
<http://www.mass.gov/Eoed/docs/43DFactSheet.pdf>

5. Mixed Use Development

Adoption of a Mixed Use Development bylaw provision would be beneficial for the Wellesley Travel Inn parcel. Mixed Use Development generally refers to a deliberate mix of housing, civic uses, and commercial uses, including retail, restaurants, and offices. Mixed use development is not a new idea. Housing above stores was common

Mixed-use is Smart Growth

What is so “smart” about Mixed-Use Projects?

- Civic identification
- Walkability and connectivity
- Public and civic spaces
- Variety of uses
- Diverse housing types
- Improved quality of urban design
- Increased density
- Environmental sensitivity
- Access to Public Transportation (where possible)

in village centers before the advent of zoning. Traditional zoning was developed during a time when factories and many commercial uses were noisy, smelly, and/or hazardous to the public. To protect public health and residential property values, early zoning focused on separating different uses, and buffering them from each other to minimize nuisances. Today, most commercial development is environmentally benign, and there are often advantages to locating different uses in close proximity.

There are a number of Mixed-Use Overlay bylaw models that can be used as a starting point. The mixed use bylaw for the Wellesley West Gateway should allow some housing, including multi-family, retail, restaurants, offices, and civic uses. Other uses may include housing for the elderly, personal services shops, child care facilities, recreation, and municipal uses. Several communities have found it useful to cap the percentage of housing in a mixed use development bylaw.

Depending on how much housing is desired by a community, the cap on housing ranges from 10% to 40%. You can and should exclude those land uses that are not conducive to your vision of the Wellesley West Gateway of the future.

As a tool, Mixed Use:

- Spurs revitalization;
- Encourages high quality design by providing both greater flexibility and more control;
- Promotes a village-style mix of retail, restaurants, offices, civic uses, and multi-family housing;
- Provides more housing opportunities and choices;
- May increase affordable housing opportunities;
- Enhances an area's unique identity and development potential (e.g., village centers, locations near bike paths, or "gateway" areas that announce a community's strengths);
- Promotes pedestrian & bicycle travel;
- Reduces auto dependency, roadway congestion, and air pollution by co-locating multiple destinations;
- Promotes a sense of community;
- Encourages economic investment, and
- Promotes efficient use of land and infrastructure.

Mixed use development is seen as a key "smart growth" tool to reduce auto dependence and preserve and enhance green space and natural resources. However, Massachusetts has so little experience with new mixed-use development that it is difficult to forecast the household population and school enrollment impacts of this type of housing.

It would address the following Opportunities for Change identified at the public forums held on December 14, 2006 and June 7, 2007:

- Add Community/Neighborhood scale businesses and amenities – focus on community services;
- Diverse Housing – starter/smaller homes, empty nesters/seniors;
- Increase tax base – encourage expansion;
- Creating neighborhood retail – walkable;
- Encourage investment in commercial properties as potential solutions to challenges, and
- Integrated development with surrounding park land.

6. Develop a Traditional Neighborhood Development Bylaw Provision

Traditional Neighborhood Development (TND) is a zoning tool that is compatible with the eastern edge of the Wellesley West Gateway, specifically for the St. James the Great church property. Although similar to Mixed Use Development, Traditional Neighborhood Development is usually more residential in nature, and includes a strong public presence such as an arts and cultural center envisioned by a Wellesley resident as a potential re-use of the church building now known as the St. James the Great Church.

TND seeks to remedy the most pressing problems associated with recent suburban expansion - low-density, auto-oriented development, single-use developments lacking in context and distinction as a unique community. TND is usually utilized for infill in an existing

developed area or as a district scale project. It is characterized by developments that provide a variety of uses, diverse housing types, and often a transit option within a compact neighborhood scale anchored by a central public space area.



Both Mixed Use Development and Traditional Neighborhood Development:

- Spur revitalization;
- Encourage high quality design by providing both greater flexibility and more control;
- Promote a village-style mix of retail, restaurants, offices, civic uses, and multi-family housing;
- Provide more housing opportunities and choices and may increase affordable housing opportunities;
- Enhance an area's unique identity and development potential (e.g., village centers, locations near bike paths, or "gateway" areas that announce a community's strengths);
- Promote pedestrian & bicycle travel;
- Reduce auto dependency, roadway congestion, and air pollution by co-locating multiple destinations;
- Promote a sense of community;
- Encourage economic investment, and
- Promote efficient use of land and infrastructure.

The higher standard of living we enjoy today hasn't necessarily resulted in a higher quality of life. By implementing TND, the Wellesley West Gateway Study Area can fulfill this potential.

As you can see from the Churchill Homes illustration, the mixed use development that is part of TND usually differs significantly from standard mixed use development. In contrast, TND is cost-effective. The TND model makes the most of existing public infrastructure before expanding it, and households with fewer cars can invest more resources in home purchases.

TND is time-saving. Mixed use development reduces the need for vehicle trips, increasing time available for recreation and civic participation. TND promotes health, safety and well-being. More walkable communities decrease the rate of obesity by encouraging frequent exercise, and building relationships with neighbors leads to an increased sense of security. For each of these reasons, TND is a superior option to development as usual.

Churchill Homes, Holyoke MA

With the help of the TND principles listed below, the patterns of growth can be smarter, and our future generations will be healthier and healthier. The eight principles of Traditional Neighborhood Development are:

- 1: Town Center and Edges
- 2: Connectivity
- 3: Walkability
- 4: Mixed Uses
- 5: Mixed Housing
- 6: Compatible Architecture
- 7: Community-Oriented Design
- 8: Vibrant Neighborhood Districts.



No one person or group invented sprawl. Few residents would consciously choose a faceless urban strip over an accessible main street in a intimate village center. But prevailing development have become accepted, and many people don't know that alternatives exist. Through the use of the TND principles stated above, the Wellesley West Gateway Study Area can become a prime example of development and redevelopment that includes a return to the vibrant walkable communities of 50 years ago.

Links:

- Mashpee Commons
 - www.mashpeecommons.com
- Churchill Homes
 - www.dietzarch.com/projects_churchill.html
- Harbor Point
 - www.gcassoc.com

- Congress for the New Urbanism
 - www.cnu.org/
- Other TND projects
 - www.tndtownpaper.com/neighborhoods.htm

7. Opportunities for Pedestrian and Bicycle Circulation and Links to and Between Existing Uses in the Area and to Other Destinations

The bike path using the aqueduct is part of the Regional Bike Plan, and will also improve access to the commuter rail stations along Route 16. It is recommended that the bike path be a multi-use trail system that can adequately accommodate pedestrians, hikers and bicycles. The purchase of the portion of the aqueduct north of route 9 was recommended by many of the participants at the public forums. The vision is to provide a boardwalk around the edge of Morses Pond along the rear portion of the Wellesley Travel Inn parcel that would be an integral component of a multi-use trail extending from Wellesley Square to the Cochituate State Park and the new Natick Collection regional shopping center. The bike path is eligible for an Enhancement Grant through MAPC.

The other design change consistent with the new Guidebook would be to move the guardrails on Route 9 adjacent to the roadway to protect pedestrians, rather than their present location behind the sidewalks, protecting the trees. Where there is room in the Right of Way trees should be planted between the sidewalk and the roadway. At present, the crosswalk and pedestrian buttons at Overbrook seem ok, but they need to be maintained.

When the church property is redeveloped a pedestrian crossing of Route 9 should be part of any design.

8. Opportunities to Promote Transportation Demand Management and Public Transportation And/Or Links to Public Transportation

Any large new development along Route 9 should be designed with room for a bus pullover and a shelter, but Wellesley by itself cannot support transit along Route 9. The newly formed MetroWest Regional Transit Authority (MWRTA) could be beneficial to Wellesley, and it is recommended that the Town vote to join the MWRTA at its earliest convenience. There are now 8 members of the MWRTA (Ashland, Framingham, Holliston, Hopkinton, Natick, Wayland, Weston and Sherborn) that will formulate plans for improvements to and enhancement of public transportation in MetroWest. Wellesley should be at the table as these plans are formulated. In addition, the MWRTA can assist Wellesley with a public transportation needs analysis.

9. Chapter 40R, 40S

Although Chapter 40R, 40S is a tool that could be implemented to offset the cost of development, the density needed to qualify for approval under Chapter 40R is likely more than appropriate for Wellesley. If the town wanted to pursue this type of option and the state approved the proposed zoning – an overlay district with variable densities of up to 20 multi-family units per acre by right –

Wellesley would qualify for a one-time, non-recurring “zoning incentive payment” and a one-time payment per building permit of \$3,000 for each unit built in the Chapter 40R district over and above what could be developed under existing zoning. Chapter 40S authorizes supplemental Chapter 70 aids to offset a community’s educational costs for children living in a Chapter 40R district.

10. Access Management Regulation

An initial recommendation is that the Town considers adopting an **Access Management Regulation** to minimize the number of driveways, consolidate existing driveways, encourage shared driveways, control the geometric design of driveways, and to locate driveways as far away from roadway intersections as possible on those roads that are under the Town’s control. As you can see from MAPC’s crash analysis reported in the table below, an access management bylaw may alleviate some of the vehicle/vehicle conflicts that result in crashes.

APPENDICES

A. Study Area



B. Scope of Work

PLANNING STUDY
DRAFT SCOPE OF WORK
ROUTE 9 @ NATICK LINE
ST. JAMES CHURCH SITE

Study Area – The land consists of the lots having frontage on the north and south sides of Route 9 (Worcester Street) from the Natick Town Line to and including the intersection of Route 9 and Weston Road. The specific lots involved are numbered #859-1005 (odd), 854-990 (even) and #315 Weston Road (public housing).

The Project shall include:

Preparation of an Outline for an Interactive Public Process.

Meeting with Town Staff to review plan documents and obtain additional details from Town in advance of first public forum. Town will assemble all relevant planning materials and provide synopsis of the materials and a history of planning efforts.

Present proposed process to Planning Board for review/discussion on October 24, 2006.

Identification of stake-holders. Recommendations for a Steering Committee.

Conducting a Public Forum

Notification/s to be the responsibility of Town of Wellesley

Overview of the Planning process:

Break out into small groups, dot votes

Re-assemble for reports of break-out groups, summation of issues and priorities.

Town of Wellesley GIS:

Need Maps – land use, development constraints, environmental resources, zoning & transportation networks

Determine:

Assets & likes

Challenges & dislikes

Things that are missing

Opportunities for change

MAPC: 1 day

MWPMC: 2.5 days

Preparation of a Vision Statement for the study area created out of discussion at the Forum.

THE STUDY SHALL IDENTIFY:

Past planning efforts;

Land Use:

Physical conditions and constraints, land characteristics, including environmental considerations;

Legal status, zoning and regulatory considerations;

Conceptual land use goals for the area and for each major parcel including St. James and the Wellesley Motor Inn;

Desirable future uses considering improving the tax base as well as degree of compatibility with surrounding areas;

Uses or classes of uses which should be encouraged and discouraged;

MAPC: .5 days

MWGMC: 3 days

Transportation:

Opportunities for pedestrian and bicycle circulation, trails, sidewalks and amenities with attention to safety and links to and between existing uses in the area and to other destinations;

Opportunities to improve traffic circulation;

Opportunities to promote transportation demand management and public transportation and/or links to public transportation;

Application of New Highway Design Manual/Guidebook/Regional Bike Plan to above areas of planning

Town will provide assistance from traffic consultant as needed.

MAPC Transportation Planner: 3 days

Economic Vitality:

Recommendations to promote the economic vitality of the area considering current and future land uses.

Housing:

Opportunities for additional 40B housing as well as opportunities for assisted living with medical support.

Environmental Considerations:

Measures to improve the watershed ecology and the health of Morse's Pond.

Recommendations to include land uses and engineering measures (stormwater

systems) that would not degrade Morse's Pond but may improve water quality and the environment.

Route 9 Corridor

Considerations for compliance with the recommendations contained in the Mass Highway Route 9 Corridor Plan.

MAPC: 2 days

MWGMC: 6 days

Chapter 40 Considerations:

Opportunities to advance community housing needs;

Opportunities for building preservation and reuse;

Next steps and recommendations for further or more detailed study.

MAPC: 1 day

MWGMC: 4 days

Meetings with town staff and Planning Board subcommittee

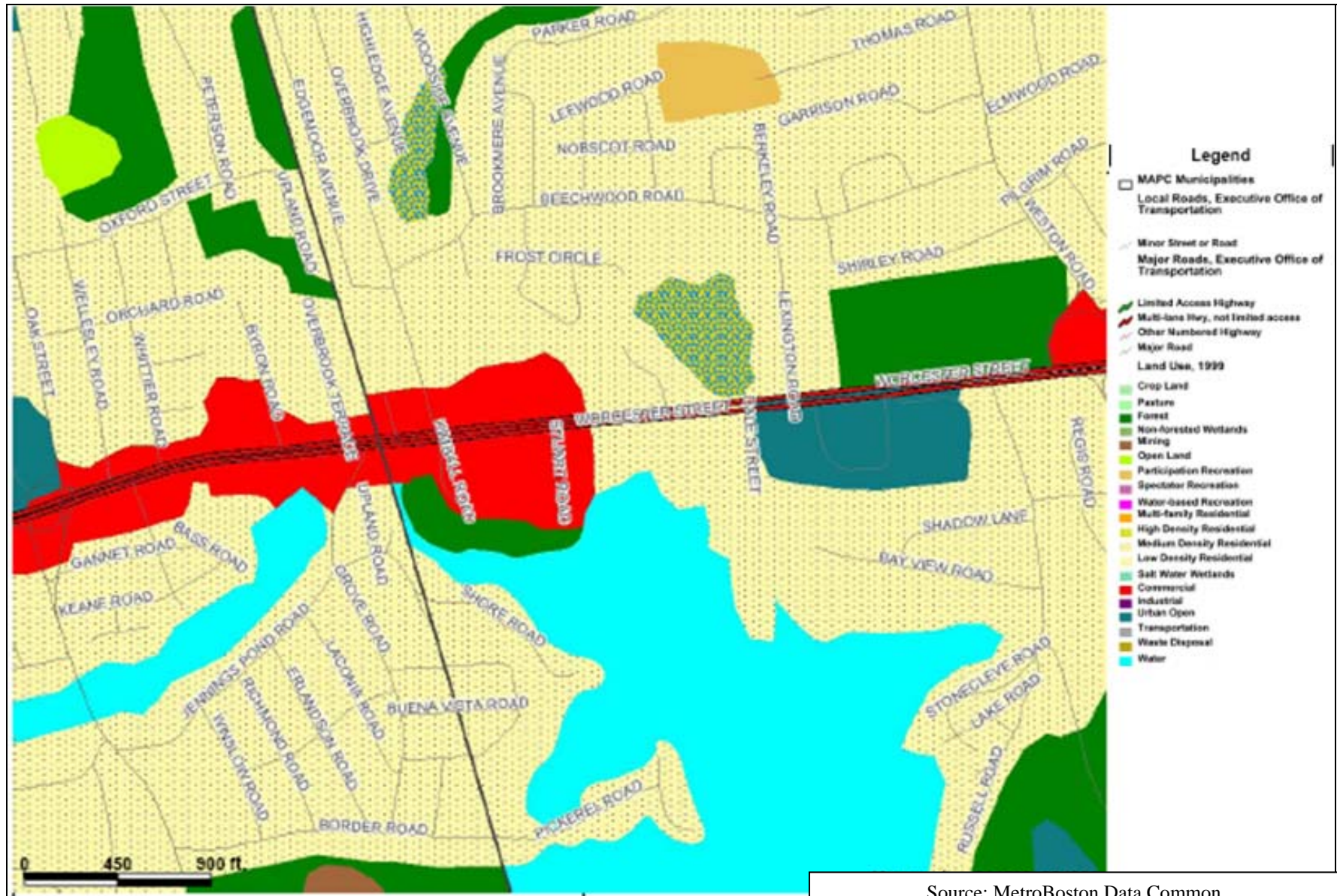
3 meetings with Planning Board

2 public forums

Total Cost to Town of Wellesley = \$10,000

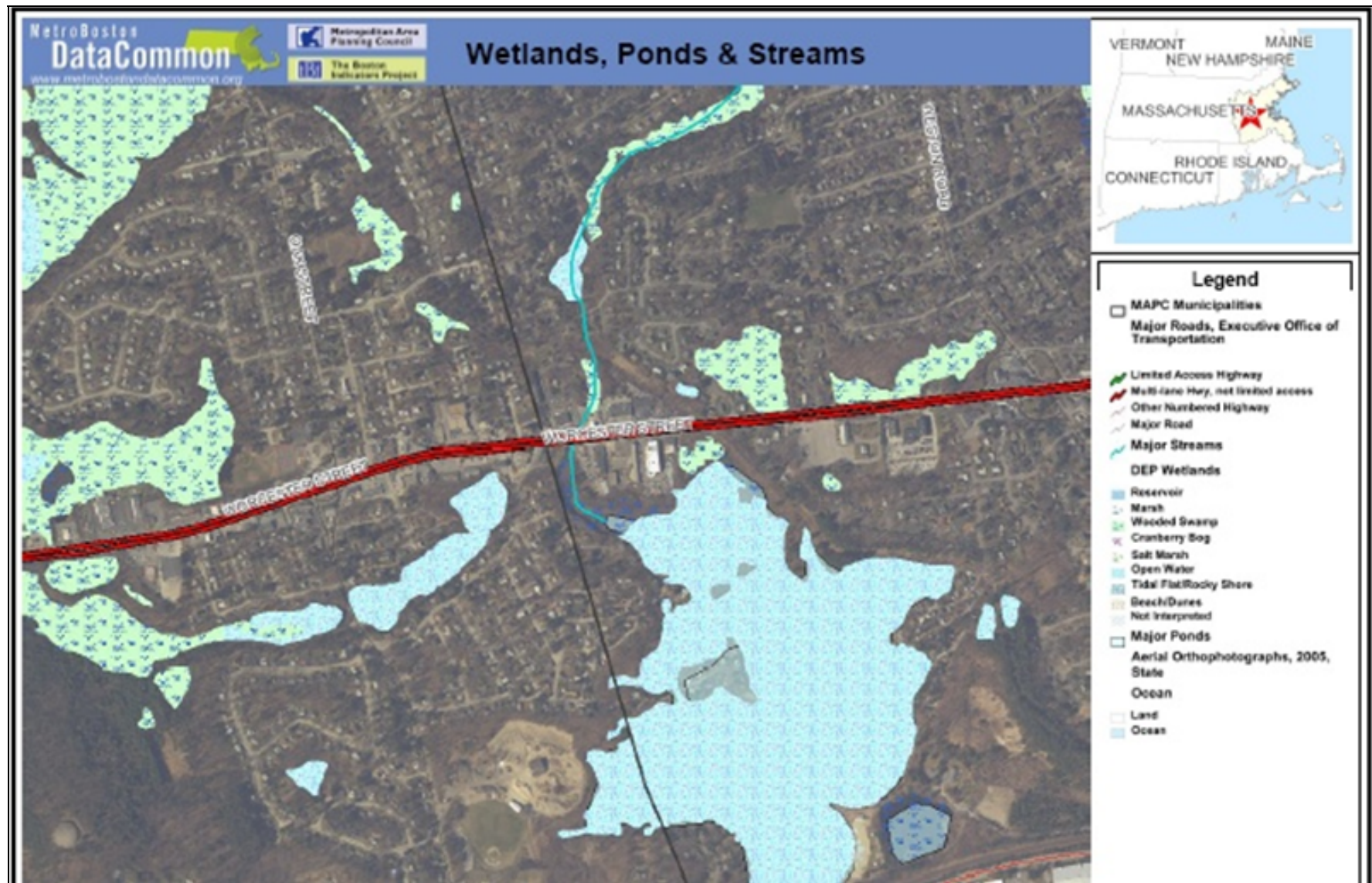
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Land Uses as of 1999

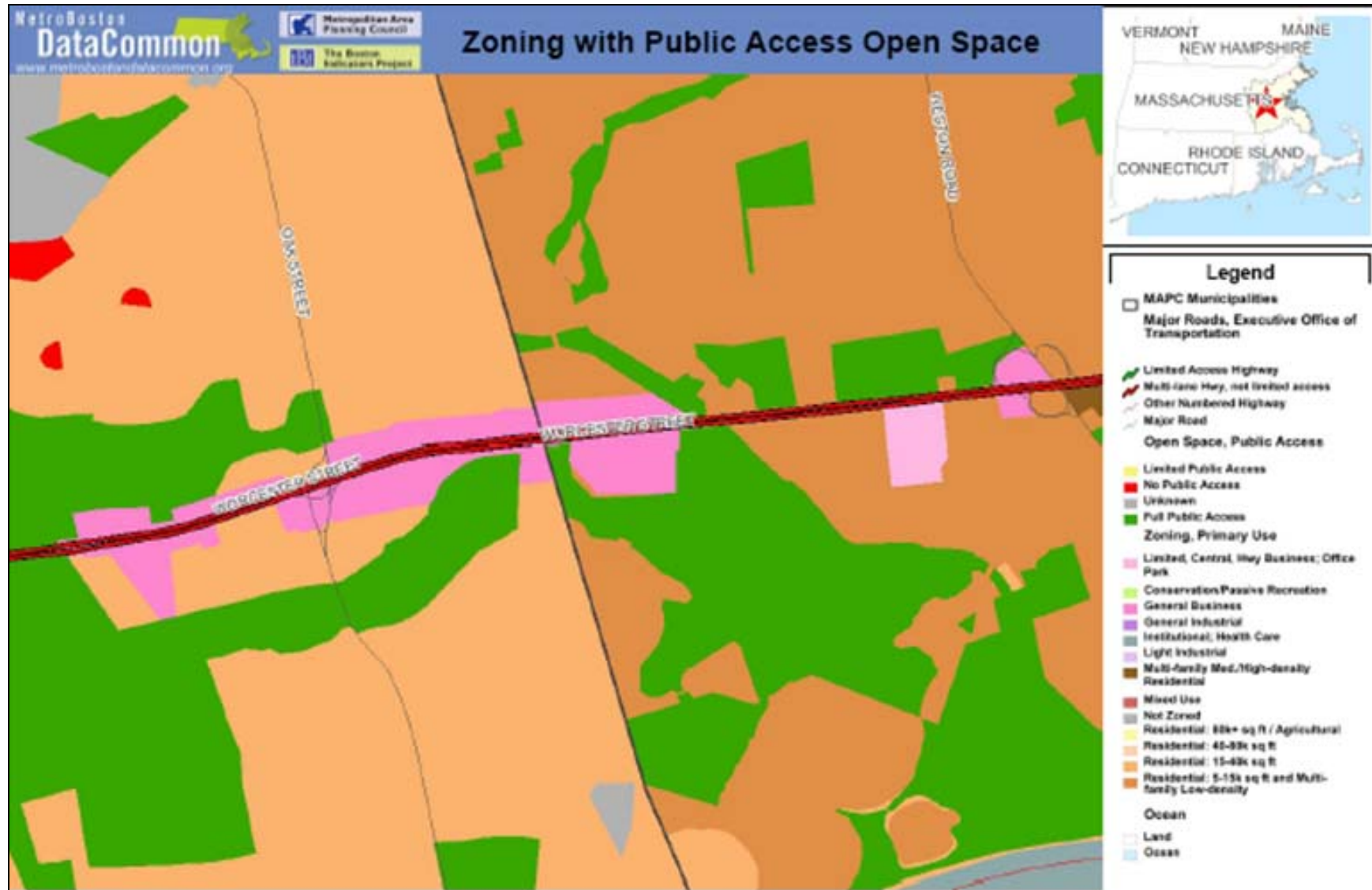


Source: MetroBoston Data Common

D. Wetlands, Ponds and Streams





E. Zoning with Public Access Open Space



F. Public Participation

December 14, 2006

Wellesley West Gateway Forum

7:30	Welcome – Rosemary Donahue, Planning Board Vice-Chair <i>The Town of Wellesley, in collaboration with MetroWest Growth Management Committee(MWGMC) and the Metropolitan Area Planning Council (MAPC), is seeking your thoughts and advice about the Route 9 Corridor from the Natick town line to Weston Road.</i>
7:35	Introductions – Marc Draisen, MAPC Executive Director
7:45	Overview – Brief history of planning efforts Rick Brown, Town of Wellesley Planning Director
7:55	Existing Zoning - Meghan Conlon, Town Planner
8:00	Process Explanation and Ground Rules Donna Jacobs, MWGMC Director Mark Racicot, MAPC Manager, Government Services
8:05	Group Discussion Determine:  Assets & likes  Challenges & dislikes  Opportunities for change
8:50	Prioritizing Opportunities To Move Ahead <i>Participants will rank priority issues using the Dot Voting Method</i>
9:10	Wrap Up – What We’ve Learned, Next Steps, Thank You Rick Brown, Town of Wellesley Planning Director

June 7, 2007

Wellesley West Gateway Forum

7:30	Welcome – Don McCauley <i>The Town of Wellesley, in collaboration with MetroWest Growth Management Committee (MWGMC) and the Metropolitan Area Planning Council (MAPC), is seeking your thoughts and advice about the Route 9 Corridor from the Natick town line to Weston Road.</i>
7:35	Overview – Brief history of planning efforts, Existing Zoning Meghan Conlon, Town Planner
7:50	Recap of December Forum Donna Jacobs, MWGMC Director
8:00	What's Happened Since December?  Rick Brown  Morse's Pond Neal Seaborn, Chairman of the Wellesley Natural Resources Commission
8:30	Tools for Your Consideration  Low Impact Development  Mixed Use Development  Traditional Neighborhood Development  Expedited Permitting
9:00	Wrap Up – Next Steps  What we heard tonight  What happens over the summer? ➤ Jim Gallagher's work on transportation/traffic issues ➤ Martin Pillsbury's work on environmental issues  Next Event – September 20th

Wellesley West Gateway Forum

Open Space/Natural Resources

1. *There are natural resources within the study area. Which natural resources should be protected?*
2. *The study area is adjacent to town-owned land where either playing fields or trails could be placed. Is this an important factor to consider when planning future development and/or redevelopment?*
3. *The aqueduct is a regional historic asset. Should it also serve as a trail system?*

Housing

1. *Is this study area a location where Wellesley can make some progress in ensuring that Wellesley is affordable for your children?*
2. *What creative opportunities can we take to provide a range of housing types and densities?*
3. *Would the study area be a good location for “empty-nester” housing?*

Economic Development

1. *Are their improvements that can be made within the study area to keep the commercial life of Wellesley viable?*
2. *Is additional commercial and/or industrial development needed or wanted in this study area to support the tax base? If so, how could that be accommodated?*
3. *Should mixed use development be a major component?*
4. *Should the study area become a business district that would serve nearby neighborhoods?*

Transportation

1. *Are additional sidewalks necessary? Where and why?*
2. *Other than sidewalks, what improvements should be made to make pedestrians safe?*
3. *Where are the most dangerous sections of roadways or intersections?*
4. *What steps can Wellesley take to encourage alternative modes of transportation and energy efficient transportation in the study area?*
5. *Is parking in the study area insufficient at present? How can it be improved?*
6. *Is it important to create off-road connections between lots/businesses in the study area?*

Aesthetics

1. *The study area is the gateway to Wellesley. What should be done to visually improve the study area?*
2. *Overhead utility wires are often viewed as a blight on an area. Is burying the overhead utilities important to the future success of the study area?*
3. *Is signage an issue within the study area?*
4. *Landscaping can be an important factor in creating an attractive setting. How important is landscaping in redevelopment within the study area?*

G. Sample Design Standards

High density mixed use neighborhood district

(D) *Land Use Standards.*

(1) *Density.* Residential developments in the High Density Mixed-Use Neighborhood District shall have an overall minimum average density of twenty (20) dwelling units per net acre of residential land.

(a) The minimum residential density of any phase in a multiple-phase development plan shall be at least sixteen (16) dwelling units per acre of residential land.

(2) *Dimensional Standards.*

(a) Minimum building height for new structures, or for additions to existing structures when such additions exceed twenty-five (25) percent of the gross floor area of such existing structures, shall be one and one-half (1½) stories.

(b) Maximum building height shall be five (5) stories.

(c) Minimum front yard setback from an arterial street shall be forty-five (45) feet and from all other streets shall be thirty (30) feet. For all setback standards, building walls over thirty-five (35) feet in height shall be set back an additional one (1) foot beyond the minimum required, for each two (2) feet or fraction thereof of wall or building that exceeds thirty-five (35) feet in height. Terracing or stepping back the mass of large buildings is encouraged.

(E) *Development Standards.*

(1) *Buildings.*

(a) *Doorways Facing Streets.* New buildings shall provide doorways facing the street, at grade level or slightly elevated.

(b) *Relationship of Doorways to Streets.* If the street is a nonarterial street, then such doorways required under subsection (a) above shall be principal entrances with sidewalk access to the street. If the street is an arterial street, then such doorways may be secondary (e.g. for patio or deck access only).

(c) *Front Yards.* Building design, in conjunction with site design, shall include structured elements to mark the transition from the public street to doorways. Examples of such elements are porches, pediments, pergolas, low walls or fencing, railings, pedestrian light fixtures and hedges.

(d) *Roof Form.* Buildings shall have either: 1) sloped roofs, or 2) combined flat and sloped roofs, provided that the sloped portion(s) forms a substantial part of the building and is related to the street facade, the integral structure and building entries.

(e) Facade Variations. Buildings shall be articulated with projections, recesses, covered doorways, balconies, covered box or bay windows and/or other similar features, dividing large facades into human-scaled proportions that reflect single-family dwellings nearby and avoiding repetitive monotonous, undifferentiated wall planes.

(f) Outdoor Activity. Buildings and extensions of buildings shall be designed to form outdoor spaces such as balconies, terraces, patios, decks or courtyards.

(2) *Site Design.*

(a) Street Sidewalks. Developments with new construction or with additions which exceed twenty-five (25) percent of the gross floor area of the existing structure shall include replacement of all existing substandard sidewalks with sidewalks which comply with the current regulations of the city.

(b) Parking Lots. Development plans shall be arranged so that any new parking lots or other vehicle use areas are located in side or rear yards, not in front yards

Corridor District:

(a) Maximum building height for all nonresidential uses shall be six (6) stories. Maximum building height for residential uses shall be three (3) stories.

(b) All new structures greater than eighty thousand (80,000) square feet in gross leasable area shall be subject to Planning and Zoning Board review.

(c) Any building addition that exceeds eighty thousand (80,000) square feet in gross leasable area and exceeds twenty-five (25) percent of the gross leasable area of the existing building shall be subject to Planning and Zoning Board review.

(4) *Density/Intensity.* All residential development in the Corridor District shall have an overall minimum average density of seven (7) dwelling units per net acre of residential land.

(5) *Mix of Housing Types.* A mix of permitted housing types shall be included in any development plan proposing residential uses as secondary uses. The following standards are intended to promote a variety of housing within such a development plan:

(a) A minimum of two (2) housing types shall be required on any residential portion of a development plan greater than ten (10) acres but less than thirty (30) acres in size, including parcels which are part of a phased development. A minimum of three (3) housing types shall be required on any residential portion of a development plan greater than thirty (30) acres in size, including parcels which are part of a phased development.

(b) If single-family detached housing is proposed, at least an equivalent number of single-family attached housing, two-family dwellings or multi-family dwelling units (or combination thereof) must also be provided.

(c) Lot sizes and dimensions shall be varied for different housing types to avoid monotonous streetscapes.

(d) Lot pattern. The lot size and layout pattern shall be designed to allow buildings to face toward a street.

(6) *Access to a park, central feature or gathering place.* Within any development proposal that contains a residential component larger than ten (10) acres in size, at least ninety (90) percent of the dwellings shall be located within one thousand three hundred twenty (1,320) feet (one-quarter [¹/₄] mile) of either a neighborhood park, a privately owned park or a central feature or gathering place that is located either within the project or within adjacent development, which distance shall be measured along street frontage without crossing an arterial street. Such parks, central features or gathering places shall contain one (1) or more of the following uses:

(a) Public parks, recreation areas or other open lands.

(b) Privately owned parks meeting the following criteria:

1. Size. Such private parks must be a minimum of ten thousand (10,000) square feet.

2. Location. Such parks must be highly visible, secure settings formed by the street layout and pattern of lots and easily observed from streets. Rear facades and rear yards of dwellings shall not abut more than two (2) sides or more than fifty (50) percent of the perimeter frontage of the park.

3. Accessibility. All parts of such parks shall be safely and easily accessible by pedestrians, and open to the public.

4. Facilities. Such parks shall consist of multiple-use turf areas, walking paths, plazas, pavilions, picnic tables, benches or other features for various age groups to utilize.

5. Ownership and Maintenance. Such parks may, in the discretion of the city, be acquired by the city (through dedication or purchase), or be privately owned and maintained by the developer or property owners' association.

6. Storm Drainage. When integrating storm drainage and detention functions to satisfy this requirement, the design of such facilities shall not result in slopes or gradients that conflict with other recreational and civic purposes of the park.

(c) Community facilities or neighborhood support/recreation facilities (which are permitted as an accessory use to housing). If one (1) of these buildings or structures is used to meet the requirements of this subsection, then it must also include a year-round, publicly accessible, outdoor space of at least ten thousand (10,000) square feet in a usable configuration. Such a space may be a park-like lawn, garden, plaza, pavilion or courtyard to

accommodate such activities or outdoor gatherings, neighborhood events, picnicking, sitting or active and/or passive recreation.

(7) *Access to Neighborhood Center.* At least ninety (90) percent of the dwellings of a residential development proposal shall be located within three thousand nine hundred sixty (3,960) feet (three-quarter [$\frac{3}{4}$] mile) of either a neighborhood center pursuant to the requirements of Division 4.4(D)(3)(c) that is located within the project or within adjacent development, or an existing or planned Neighborhood Commercial District commercial project, which distance shall be measured along street frontage without crossing an arterial street.

(E) ***Development Standards.***

(1) *Corridor Development Standards.* All development in the Corridor District shall also comply with the Corridor design standards as adopted by the city and the following specific standards to the extent that such standards apply to the property proposed for development.

(2) *Site Design.*

(a) In the case of multiple parcel ownership, to the extent reasonably feasible, an applicant shall enter into cooperative agreements with adjacent property owners to create a comprehensive development plan that establishes an integrated pattern of streets, outdoor spaces, building styles and land uses.

(b) Where an employment or industrial use abuts a residential area, there shall be no drastic and abrupt change in the scale and height of buildings.

(c) All commercial/retail and industrial uses, except for off-street parking and loading, shall be conducted or carried out entirely within completely enclosed buildings or structures.

(3) *Building Design.* To the extent reasonably feasible, industrial buildings shall provide a primary entrance that faces and opens directly onto the adjacent street sidewalk or a walkway, plaza or courtyard that has direct linkage to the street sidewalk without requiring pedestrians to cross any intervening driveways or parking lots. The following exceptions shall be permitted to this standard and to the requirements contained in Section 3.5.3(B):

(a) Buildings may orient away from the street if the development provides a campus or park-like development block with a unifying, formative internal framework of outdoor spaces and connecting walkways that functions as an alternative to street sidewalks by organizing and connecting buildings within the site and directly connecting to common destinations in the district (such as transit stops, restaurants, child care facilities and convenience shopping centers). Such an internal network shall provide direct pedestrian access to the street sidewalk(s).

(b) The streetfront orientation requirement may be met by facing only a portion of the front facade to the adjacent street with no intervening front yard parking, provided that the streetfront facade adjoins a landscaped yard with a connecting walkway. Such building face shall not consist of a blank wall. In no case shall the streetfront facade be less than thirty (30) percent of the building frontage.

H. Sample Fiscal Impact Assessment

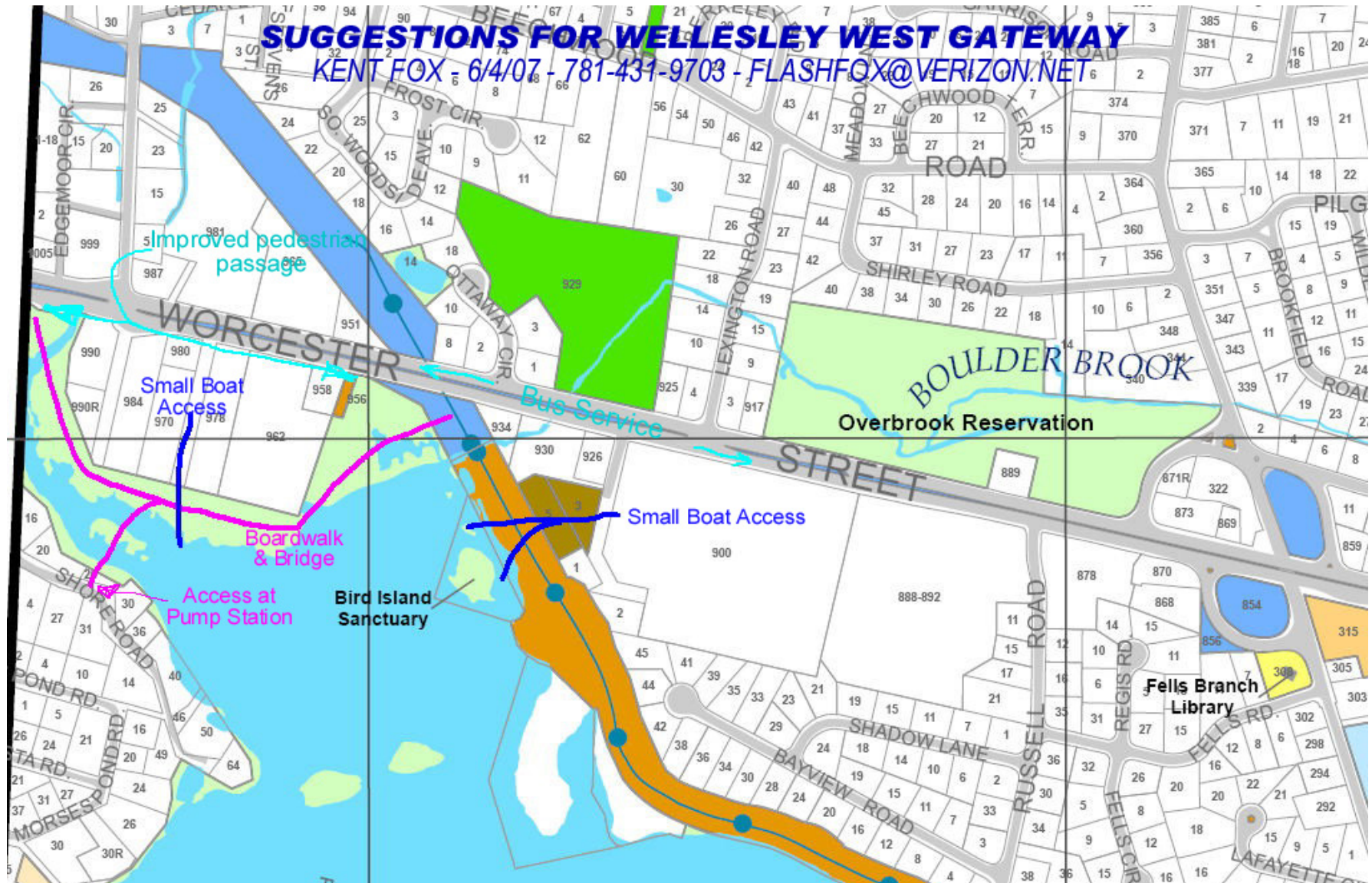
DRAFT FISCAL IMPACT ASSESSMENT *				
	* figures should be updated annually			
	For Impacts due to Commercial Development fill in the following information			
1	Market Value of Proposed Commercial Development			
2	Commercial Assessment Ratio for Tax Purposes (source: MASSDOR)	100.00%		
3	Commercial Tax Rate per \$1,000 (source: Assessors)	\$30.00		
4	Total Tax Levy (source: Town Treasurer)			
5	Appropriated Expenditures excluding schools (Source: Treasurer)			
6	Equalized Value of Commercial/Industrial Property			
7	Commercial Proportion of real property (Source: Treasurer)			
8	Average Value of Dwelling Unit (Source: Assessors)			
9	Residential Tax Rate per \$1,000 (Source: Assessors)	\$15.00		
10	Capital Improvements Costs			
	(As a result of this project, will expanded or new capital improvements be required?)			
	If Yes, Amount. in Dollars for: School Buildings			
	Roads			
	Sewer System			
	Water System			
	Fire Company			
	Police Department			
	Electric System			
	Other			
11a	The # of years over which costs will be spread	30		
11b	Finance Rate per Year (as a percent)			
11c	What is the percentage of capital costs attributed to new development			

	COMPUTER GENERATED CALCULATIONS			
	FISCAL IMPACT OF COMMERCIAL DEVELOPMENT			
I	REVENUE FROM NEW COMMERCIAL DEVELOPMENT			
A.	Revenue from Property Tax on Development			
A-1.	Market Value of Development	\$0.00		
	multiplied by			
A-2.	Assessment Ratio	100.00%		
A-3.	Actual Assessed Value	\$0.00		
	multiplied by			
A-4.	Commercial Tax Rate /\$1000	\$30.00		
A-5.	Estimated Property Tax Revenue	\$0.00		
II	COSTS DUE TO NEW COMMERCIAL DEVELOPMENT			
A.	Service Costs Due to Development			
	(Costs associated with Library, Health, Recreation, Police, Fire & Road Maintenance)			
A-1.	Town expenditures excluding Schools	\$0.00		
	multiplied by			
A-2.	Commercial portion of Equalized Value	0.00%		
A-3.	Service Costs due to Commercial use	\$0.00		
	divided by			
A-4.	Equalized Value of all Commercial Property	\$0.00		
A-5.	Service Cost per \$1 in value	#DIV/0!		
	multiplied by			
A-6.	Value of new development	#REF!		
A-7.	Town Service Costs for Commercial Development	#REF!		
B	Capital Improvements Cost due to Development			
B-1.	Total Costs due to Capital Improvements	0		
B-2.	The # of years that costs will be spread over	30		
B-3.	Finance Rate per Year (as a percent)	0		

B-4.	Debt Service (principal+interest) per year	0		
B-5.	What is the %age attributed to new development	0		
B-6.	Capital Improvement Costs due to Development	0		
C	Total Costs due to Development	#REF!		
III	Net Fiscal Impact Resulting from Development			
A	Total Revenue from Commercial Development	#REF!		
B	Total Costs due to Commercial Development	#REF!		
C	Net Fiscal Impact per Year	#REF!		
IV	Change in Tax Rates due to New Development			
	(negative #s indicate a decrease in tax payments, thus a gain to homeowners)			
A	Change in Town Tax Rate			
A-1.	Total Tax Levy	\$0.00		
	divided by			
A-2.	Tax Rate/thousand	\$15.00		
A-3.	Amount affecting Tax Rate			
	by one dollar	\$0.00		
A-4.	Net Fiscal Gain	#REF!		
	divided by			
A-5.	Amount affecting Tax Rate			
	by one dollar	\$0.00		
A-6.	Decrease (Increase) in Tax Rate	#REF!		
B.	Impact on Average Home Owner			
B-1.	Value of Home	\$0.00		
B-2.	Tax Rate per 1000 <i>at Present</i>	\$15.00		

B-3.	Annual Tax Payment without Further Growth	\$0.00		
B-4.	Value of Home	\$0.00		
B-5.	Tax Rate per 1000 after New Development	#REF!		
B-6.	Annual Tax Payment after New Development	#REF!		
B-7.	Total Yearly Savings (Loss) after New Development	#REF!		
	IN SUMMARY			
A.	NET BENEFIT (LOSS) TO THE TOWN	#REF!		
B.	DECREASE (INCREASE) IN TAX RATE	#REF!		
C.	TOTAL YEARLY SAVINGS (LOSS) TO AVE. HOMEOWNER	#REF!		

I. Potential Vision



J. Glossary

A

Accessory Dwelling Unit (ADU): A self-contained housing unit incorporated within a single-family dwelling (not within accessory structures, except with a Special Permit) that is clearly a subordinate part of the single-family dwelling.

Adequate Public Facilities: Adequate public facilities ordinances prevent new construction until municipal services, including water, sewer, roads, and schools, are available to serve that development.

Agricultural Districts/Preservation Areas: Areas designed to keep land in agriculture that are legally recognized. Landowners may voluntarily enroll in programs and may receive special benefits and protection from regulation.

Agricultural Preservation Restriction Program (APR): A voluntary program which is intended to offer a non-development alternative to farmers and other owners or "prime" and "state important" agricultural land who are faced with a decision regarding future use and disposition of their farms. Towards this end, the program offers to pay farmers the difference between the "fair market value" and the "agricultural value" of their farmland in exchange for a permanent deed restriction which precludes any use of the property that will have a negative impact on its agricultural viability.

Agricultural Zoning: Agricultural zoning, including forestry zoning, restricts land uses to farming and livestock, other kinds of open-space activities and limited home building. It is sometimes used in tandem with urban growth restrictions.

Annexation: A change in existing community boundaries resulting from the incorporation of additional land.

Aquifer: A water-bearing geologic formation, sometimes confined between clay layers and sometimes on the surface. The source of ground water for drinking and irrigation.

B

Biodiversity: The variety and essential interdependence of all living things; it includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning.

Bioretention System: The bioretention system (also referred to as a "rain garden" or a "biofilter") is a stormwater management practice to manage and treat stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. The method combines physical filtering and adsorption with bio-geochemical processes to remove pollutants. The system consists of an inflow component, a pretreatment element, an overflow structure, a shallow ponding area (less than 9" deep), a surface organic layer of mulch, a planting soil bed, plant materials, and an underdrain system to convey treated runoff to a downstream

facility.

Blight: Physical and economic conditions within an area that cause a reduction of or lack of proper utilization of that area. A blighted area is one that has deteriorated or has been arrested in its development by physical, economic, or social forces.

BMP: Best Management Practice; refers to the practice considered most effective to achieve a specific desired result for protection of water, air and land and to control the release of toxins.

Brownfields: Sites that are underutilized or not in active use, on land that is either contaminated or perceived as contaminated.

Buffer Zone: A strip of land created to separate and protect one type of land use from another; for example, as a screen of planting or fencing to insulate the surroundings from the noise, smoke, or visual aspects of an industrial zone or junkyard.

Built Environment: The urban environment consisting of buildings, roads, fixtures, parks, and all other improvements that form the physical character of a city.

C

Carrying Capacity: The level of land use or human activity that can be permanently accommodated without an irreversible change in the quality of air, water, land, or plant and animal habitats. In human settlements, this term also refers to the upper limits beyond which the quality of life, community character, or human health, welfare, and safety, will be impaired, such as the estimated maximum number of persons that can be served by existing and planned infrastructure systems, or the maximum number of vehicles that can be accommodated on a roadway.

Catch Basin: A conventional structure for the capture of stormwater utilized in streets and parking areas. It includes an inlet, sump, and outlet and provides minimal removal of suspended solids. In most cases a hood also is included to separate oil and grease from stormwater. Catch basins are differentiated from drainage "inlets", which do not contain sumps or hoods.

Charrette: A Charrette is a planning session in which participants brainstorm and visualize solutions to a design issue. Charrettes provide a forum for ideas and offer the unique advantage of giving immediate feedback to designers while giving mutual authorship to the plan by all those who participate. The term "charrette" comes from the French term for "little cart" and refers to the final intense work effort expended by architects to meet a project deadline. At the Ecole de Beaux Arts in Paris during the 19th century, proctors circulated with little carts to collect final drawings, and students would jump on the charrette to put finishing touches on their presentations minutes before their deadlines.

Cluster Development: A pattern of development in which industrial and commercial facilities, and homes are grouped together on parcels of land in order to leave parts of the land undeveloped. Cluster development is often used in areas that require large lot sizes, and typically involves density transfer. Zoning ordinances permit cluster development by allowing smaller lot sizes when part of the land is left as open space.

Compact Building Design: Refers to the act of constructing buildings vertically rather than horizontally, and configuring them on a block or neighborhood scale that makes efficient use of land and resources, and is consistent with neighborhood character and scale. Compact building design reduces the footprint of new construction, thus preserving greenspace to absorb and filter rain water, reduce flooding and stormwater drainage needs, and lower the amount of pollution washing into our streams, rivers and lakes. Compact building design is necessary to sustain transit ridership at levels necessary to make public transit a viable transportation option.

Comprehensive Plan: Regional, state, or local documents that describe community visions for future growth. Comprehensive plans describe general plans and policies for how communities will grow and the tools that are used to guide land use decisions, and give general, long-range recommendations for community growth. Typical elements include, land use, housing, transportation, environment, economic development, and community facilities.

Conservation Areas: Environmentally sensitive and valuable lands protected from any activity that would significantly alter their ecological integrity, balance, or character, except in cases of overriding public interest.

Conservation Easements: Conservation easements are voluntary, legally binding agreements for landowners that limit parcels of land or pieces of property to certain uses. Land under conservation easements remains privately owned, and most easements are permanent.

Context Sensitive Design (CSD): A collaborative, interdisciplinary approach that involves all stakeholders to develop a facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources. CSD is an approach that considers the total context within which a project will exist.

D

Deed Restriction: A legally binding restriction on the use, activity, and/or limitation of property rights, recorded at the registry of deeds.

Density: The average number of people, families, or housing units on one unit of land. Density is also expressed as dwelling units per acre.

Density bonus: Allows developers to build in specified areas densities that are higher than normally allowed.

Design Standards: Design standards or guidelines can serve as a community's desire to control its appearance, from within and without, through a series of standards that govern site planning policies, densities, building heights, traffic and lighting.

Detention Ponds: (Extended Detention Basins) An area surrounded by an embankment, or an excavated pit, designed to temporarily hold stormwater long enough to allow settling of solids and reduce local and downstream flooding.

Development Rights: Development rights give property owners the right to develop land in ways that comply with local land use regulation.

District Improvement Financing (DIF): Economic tool that promotes redevelopment by channeling dollars into targeted redevelopment districts.

Downzoning: A change in zoning classification to less intensive use and/or development.

E

Ecological Footprint: The impact of humans on ecosystems created by their use of land, water, and other natural resources. Ecological footprint used as a complex sustainability indicator that answers the question: How much of the Earth's resources does your lifestyle require?

Economic Opportunity Area (EOA): An area or several areas within a designated Massachusetts Environmental Target Area of particular need and priority for economic development.

Ecosystem: The species and natural communities of a specific location interacting with one another and with the physical environment.

Energy Efficiency: Using less energy to achieve the same outcome. For example, better insulation would enable a home to stay warm utilizing less energy.

Energy Service Company (ESCO): A company that offers to reduce a client's energy costs by capitalizing the upfront expenditures and sharing the resulting future cost savings with the client. This is typically accomplished through the use of an energy-performance contract (EPC) or a shared-savings agreement.

EPA (Environmental Protection Agency): The federal body charged with responsibility for natural resource protection and oversight of the release of toxins and other threats to the environment.

Eminent Domain: The legal right of government to take private property for public use, provided the owner is offered just compensation for the taking of property.

Environmental Impact Statement (EIS): A comprehensive study of likely environmental impacts resulting from major federally-assisted projects; statements are required by the National Environmental Policy Act (NEPA).

Endangered: Species that are in danger of extinction. It also is a category that denotes protection under federal law (Endangered Species Act).

Estuary: A water body where salt and fresh water meet resulting in brackish water. These areas usually have associated marshlands and are critical nursery and feeding habitat for a variety of marine species.

Eutrophication: The natural aging process of water bodies, by siltation and organic decomposition, which reduces both water volume and oxygen levels. Surface run-off or airborne deposition of nitrogen and phosphorus accelerate this.

F

Fair Market Value: The price an owner willing, but not under compulsion, to sell, ought to receive from a buyer willing but not under compulsion to buy.

Federal Tax Incentives: The federal government offers financial and tax incentives to individuals and business that install renewable energy systems at their homes or offices. This section provides a summary of these incentives and who to contact for more information.

Fiscal Impact Analysis: The analysis of the estimated taxes that a development project would generate in comparison to the cost of providing municipal services demanded by that project.

Flood Hazard Area: Total stream and adjacent area periodically covered by overflow from the stream channel containing 1) the floodway which is the channel itself and portions of the immediately adjacent overbank that carry the major portion of flood flow, and 2) the flood fringe beyond it which is inundated to a lesser degree.

Flood Plain: The land adjacent to a water body ? stream, river, lake or ocean - that experiences occasional flooding.

Floor Area Ratio (FAR): A measure of development intensity. FAR is the ratio of the amount of floor area of a building to the amount of area of its site. For instance, a one-story building that covers an entire lot has an FAR of 1. Similarly, a one-story building that covers 1/2 of a lot has an FAR of 0.5.

Frontage: The continuous linear distance along any approved way, measured on the street line, between the side lot lines.

G

GIS (Graphic Information Systems): GIS technology is used to develop maps that depict resources or features such as soil types, population densities, land uses, transportation corridors, waterways, etc. GIS computer programs link features commonly seen on maps (such as roads, town boundaries, water bodies) with related information not usually presented on maps, such as type of road surface, population, type of agriculture, type of vegetation, or water quality information. A GIS is a unique information system in which individual observations can be spatially referenced to each other.

Green Building or Green Design: Building design that yields environmental benefits, such as savings in energy, building materials, and water consumption, or reduced waste generation.

Greenfields: Newly developed commercial real estate on what was previously undeveloped open space.

Greenway: A linear open space; a corridor composed of natural vegetation. Greenways can be used to create connected networks of open space that include traditional parks and natural areas.

Groundwater: All water below the surface of the land. It is water found in the pore spaces of bedrock or soil, and it reaches the land surface through springs or it can be pumped using wells.

Growth Management: A term that encompasses a whole range of policies designed to control, guide, or mitigate the effects of growth.

H

Habitat: Living environment of a species, that provides whatever that species needs for its survival, such as nutrients, water and living space.

Housing Element: A comprehensive assessment of current and projected housing needs for all economic segments of the community. It sets forth local housing policies and programs to implement those policies.

Historic Area: An area or building in which historic events occurred, or one which has special value due to architectural or cultural features relating to the heritage of the community. Elements in historic areas have significance that necessitates preservation or conservation.

HVAC: Heating, ventilation, and air conditioning.

I

Impact Fees: Costs imposed on new development to fund public facility improvements required by new development and ease fiscal burdens on localities.

Imperviousness Overlay Zoning: One form of the overlay zoning process. Environmental aspects of future imperviousness are estimated based on the future zoning build-out conditions. Estimated impacts are compared with environmental protection goals to determine the limit for total impervious surfaces in the watershed. Imperviousness overlay zoning areas are then used to define subdivision layout options that conform to the total imperviousness limit.

Impervious Surface: Any surface through which rainfall cannot pass or be effectively absorbed. (Roads, buildings, paved parking lots, sidewalks etc.)

Incentive Zoning: Provides for give and take compromise on zoning restrictions, allowing for more flexibility to provide environmental protection. Incentive zoning allows a developer to exceed a zoning ordinance's limitations if the developer agrees to fulfill conditions specified in the ordinance. The developer may be allowed to exceed height limits by a specified amount in exchange for providing open spaces or plazas adjacent to the building.

Inclusionary zoning: A system that requires a minimum percentage of lower and moderate income housing to be provided in new developments. Inclusionary programs are based on mandatory requirements or development incentives, such as density bonuses.

Infill Development: Infill projects use vacant or underutilized land in previously developed areas for buildings, parking, and other uses.

Infrastructure: Water and sewer lines, roads, urban transit lines, schools and other public facilities needed to support developed areas.

Intermodal: Those issues or activities which involve or affect more than one mode of transportation, including transportation connections, choices, cooperation and coordination of various modes. Also known as "multimodal."

K

L

Land Trusts: Nonprofit organizations interested in the protection of natural resources and historic areas. Activities include public education, purchase and coordination of conservation easements, and planning services.

Land Use: The manner in which a parcel of land is used or occupied.

LEED: Leadership in Energy and Environmental Design Green Building Rating System is a nationally accepted benchmark for the design, construction, and operation of high performance green buildings. Administered by the U.S. Green Building Council LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

LEED "Plus": Created by the Massachusetts Sustainable Design Roundtable to address shortcomings with standard LEED certification these standards apply to construction of state facilities. This standard specifically mandates certain LEED points for energy performance, building commissioning, achievement of smart growth objectives, and water conservation.

Level of Service (LOS): A qualitative measure describing operational conditions within a traffic stream in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Level A denotes the best traffic conditions while Level F indicates gridlock. An Environmental Impact Report (EIR) for a development proposal evaluates the impact the development will have on the LOS standards for police, fire, utilities, parks, schools and traffic in the effected area.

Lot Area: area is the total square footage of horizontal area included within the property lines. Zoning ordinances typically set a minimum required lot area for building in a particular zoning district.

Low Impact Development (LID): An approach to environmentally friendly land use planning. It includes a suite of landscaping and design techniques that attempt to maintain the natural, pre-developed ability of a site to manage rainfall. LID techniques capture water on site, filter it through vegetation, and let it soak into the ground where it can recharge the local water table rather than being lost as surface runoff. An important LID principle includes the idea that stormwater is not merely a waste product to be disposed of, but rather that rainwater is a resource.

M

MassGIS: The Commonwealth's Office of Geographic and Environmental Information, within the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA). Through MassGIS, the Commonwealth has created a comprehensive, statewide database of spatial information for environmental planning and management.

Master Plan: A statement, through text, maps, illustrations or other forms of communication, that is designed to provide a basis for decision making regarding the long term physical development of the municipality.

Mitigation: Process or projects replacing lost or degraded resources, such as wetlands or habitat, at another location.

Mixed Use Development: Development that is created in response to patterns of separate uses that are typical in suburban areas necessitating reliance on cars. Mixed use developments include residential, commercial, and business accommodations in one area.

Modal Split: A term that describes how many people use alternative forms of transportation. Frequently used to describe the percentage of people using private automobiles as opposed to the percentage using public transportation.

N

National Environmental Policy Act (NEPA): A comprehensive federal law requiring analysis of the environmental impacts of federal actions such as the approval of grants; also requiring preparation of an Environmental Impact Statement (EIS) for every major federal action significantly affecting the quality of the human environment.

Neo-Traditional Development: A traditional neighborhood, where a mix of different types of residential and commercial developments form a tightly knit unit. Residents can walk or bike to more of the places they need to go and municipal services costs are lower due to the close proximity of residences. A more compact development also reduces the amount of rural land that must be converted to serve urban needs.

New Urbanism: Neighborhood design trend used to promote community and livability. Characteristics include narrow streets, wide sidewalks, porches, and homes located closer together than typical suburban designs.

NIMBY ("Not In My Backyard"): NIMBY is an acronym for the "Not in my backyard" sentiment that exists among some people who do not want any type of change in their neighborhood.

Non-Point Source Pollution (NPS): Pollution that cannot be identified as coming from a specific source and thus cannot be controlled through the issuing of permits. Storm water runoff and some deposits from the air fall into this category.

O

Open Space: Used to describe undeveloped land or land that is used for recreation. Farmland as well as all natural habitats (forests, fields, wetlands etc.) is lumped in this category.

Open Space Residential Design (OSRD): A form of residential subdivision that maximizes resource protection and conservation of natural areas through the use of design strategies that result in permanent open space preservation.

Overlay Districts: Zoning districts in which additional regulatory standards are superimposed on existing zoning. Overlay districts provide a method of placing special restrictions in addition to those required by basic zoning ordinances.

P

Performance Zoning: Establishes minimum criteria to be used when assessing whether a particular project is appropriate for a certain area; ensures that the end result adheres to an acceptable level of performance or compatibility. This type of zoning provides flexibility with the well-defined goals and rules found in conventional zoning.

Plan: A statement of policies, including text and diagrams, setting forth objectives, principles, standards, and plan proposals for the future physical development of the city or county.

Planning: The process of setting development goals and policy, gathering and evaluating information, and developing alternatives for future actions based on the evaluation of the information.

Planned Unit Development (PUD): PUDs are areas that are planned and developed as one entity, by a single group. Planned unit developments usually include a variety of uses, including different housing types of varying densities, open space, and commercial uses. Project planning and density is calculated for the entire development rather than individual lots.

Purchase of Development Rights: Programs through which local governments may purchase development rights and dedicate the land for conservation easements, protecting it as open space or agricultural areas.

Q

Quality of Life: Those aspects of the economic, social and physical environment that make a community a desirable place in which to live or do business. Quality of life factors include those such as climate and natural features, access to schools, housing, employment opportunities, medical facilities, cultural and recreational amenities, and public services.

R

Receiving District: An overlay zoning district established by the Town Meeting/ Town Council upon recommendation from the Planning Board as an area suitable to receive transferred development rights.

Recharge: Water that infiltrates into the ground, usually from above, that replenishes groundwater reserves, provides soil moisture, and affords evapotranspiration.

Rehabilitation: In communities with a large stock of older housing or other structures that could lend themselves more easily to conversion into residential units, rehabilitation can be a very affordable and environmentally-friendly way to provide more housing, commercial areas, and offices.

Residential Site Improvement Standards (RSIS): Development rules (disseminated by DCA) that delineate infrastructure requirements for new residential areas. (Road widths, sidewalks, type of materials used, etc.)

Riparian Area: Vegetated ecosystems along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding.

Runoff: The water that flows off the surface of the land, ultimately into our streams and water bodies, without being absorbed into the soil.

S

Sending District: An overlay zoning district established by the Town Meeting/Town Council upon recommendation from the Planning Board as an area in which use or development rights should be restricted and from which development rights may be transferred to a Receiving District.

Siltation: Process by which loose soil is transferred and builds up in streams, rivers, and lakes, causing changes in stream channels and in depth. It may result in filling in an area and/or causing flooding.

Site Plan: A scaled plan showing proposed uses and structures for a parcel of land. A site plan could also show the location of lot lines, the layout of buildings, open space, parking areas, landscape features, and utility lines.

Smart Energy: Is the use of renewable resources to create electricity and to heat and cool buildings, as well as more efficient use of energy through conservation and high efficiency technologies.

Smart Growth: Well-planned development that protects open space and farmland, revitalizes communities, keeps housing affordable and provides more transportation choices.

Special Districts: Geographic areas in which fees or taxes are collected to fund investments or services benefiting properties within the district.

Special Permit: A use that would not be appropriate generally, or without restriction through the zoning district but which, if controlled as to number, area, location, or relation to the neighborhood, would promote the public health, safety, welfare, order, comfort, convenience, appearance, prosperity or general welfare. Such uses may be permitted in such zoning districts as special permits, where specific provision for such special permits is made in a Town zoning bylaw or City

zoning ordinance.

Sprawl: Development patterns where rural land is converted to urban/suburban uses more quickly than needed to house new residents and support new businesses, and people become more dependent on automobiles. Sprawl defines patterns of urban growth that includes large acreage of low-density residential development, rigid separation between residential and commercial uses, residential and commercial development in rural areas away from urban centers, minimal support for non-motorized transportation methods, and a lack of integrated transportation and land use planning.

State Tax Incentives: Massachusetts offers tax incentives to individuals and business that install renewable energy systems at their homes or offices. This section provides a summary of these incentives and who to contact for more information.

Stream Corridor: The area (containing wetlands, flood plains, woodlands, unique habitats, and steep slopes) which lies between relatively level uplands and stream banks and through which water, draining from the uplands, flows and is naturally cleansed and stored. Base flow for streams comes from ground water as springs and seeps.

Streetscape: The space between the buildings on either side of a street that defines its character. The elements of a streetscape include: building frontage/façade; landscaping (trees, yards, bushes, plantings, etc.); sidewalks; street paving; street furniture (benches, kiosks, trash receptacles, fountains, etc.); signs; awnings; and street lighting.

Sustainable Development: Development with the goal of preserving environmental quality, natural resources and livability for present and future generations. Sustainable initiatives work to ensure efficient use of resources.

Subdivision: A subdivision occurs as the result of dividing land into lots for sale or development.

Subdivision Rules and Regulations: Procedures, requirements, and provisions governing the subdivision of land that is specified in formal Rules and Regulations promulgated by a city or town under the authority vested in the Planning Board by section 81-Q of Chapter 41 of the General Laws of Massachusetts.

T

Taking: A taking occurs when a government action violates the 5th Amendment property rights of a landowner by taking a piece of property without offering fair compensation. "Takings" include physical acquisitions of land, and may include regulations that unduly deprive landowners of certain uses of their property or have the effect of diminishing the value of property.

Tax Increment Financing: A program designed to leverage private investment for economic development projects in a manner that enhances the benefits accrued to the public interest.

TEA-21 (Transportation Efficiency Act for the 21st Century): Federal legislation that encompasses all transportation regulation and funding (Inter-modal Surface Transportation Efficiency Act was the original title).

Traditional Neighborhoods: Traditional neighborhood development emphasizes two broad goals: to reduce the destruction of habitat and natural resources, and to reduce dependency on automobiles and their associated impacts; and to reduce polluting emissions, excessive use of energy and fragmentation of the landscape. Traditional neighborhood design is a development approach that reflects historic settlement patterns and town planning concepts such as gridded, narrow streets, reduced front and side setbacks, and an orientation of streets and neighborhoods around a pedestrian oriented "town center." Such an approach usually requires modifications to zoning and subdivision regulations.

Transfer of Development Rights (TDR): A system that assigns development rights to parcels of land and gives landowners the option of using those rights to develop or to sell their land. TDRs are used to promote conservation and protection of land by giving landowners the right to transfer the development rights of one parcel to another parcel. By selling development rights, a landowner gives up the right to develop his/her property, but the buyer could use the rights to develop another piece of land at a greater intensity than would otherwise be permitted.

Transit-Oriented Development (TOD): The development of housing, commercial space, services, and job opportunities in close proximity to public transportation. Reduces dependency on cars and time spent in traffic, which protects the environment and can ease traffic congestion, as well as increasing opportunity by linking residents to jobs and services.

Transit Nodes: Stops along a public transportation route where people board and disembark, often where one or more routes intersect with each other. These sites can provide ideal locations for mixed-use development as well as transit-oriented development.

Transportation demand management strategies (TDM): TDM is a general term for strategies that result in more efficient use of transportation resources, including incentives to reduce driving, use alternative options, and improve transit.

U

Upzone: To change the zoning of a tract or parcel of land from a lesser to greater intensity of usage. An example would be a change in zoning from single family to multi-family or mixed use.

USGS (United States Geological Survey): A federal agency which provides mapping of topography, aquifer levels, and areas where aquifers are recharged.

Use Value Taxation: Land assessments according to the value of the present use rather than the speculative value.

V

Variance: The relaxation of requirements of a zoning district for a specific parcel or tract of land. Variances are often issued to avoid unnecessary hardships to a landowner.

W

Watershed: The geographic area which drains into a specific body of water. A watershed may contain several sub-watersheds.

Wetlands: Area having specific hydric soil and water table characteristics supporting or capable of supporting wetlands vegetation.

X

Y

Z

Zero-lot-line Development: A development option where side yard restrictions are reduced and the building abuts a side lot line. Overall unit-lot densities are therefore increased. Zero-lot-line development can result in increased protection of natural resources.

Zoning: Classification of land in a community into different areas and districts. Zoning is a legislative process that regulates building dimensions, density, design, placement and use within each district.

K. Cape Cod Commission Model Access Management Regulation

Background

Roads are classified by the Metropolitan Planning Organization (a regional committee defined in Section 02.4, below) in coordination with the Commonwealth of Massachusetts and the Federal Highway Commission according to their role in the regional roadway system. The higher the classification of the road, the more the road is intended for through travel instead of access. At the highest level are limited access highways. At the lowest level, are roads considered as "local," providing access to limited commercial and residential districts. In order to allow the roadway system to function as intended, driveways and new access points should be minimized on higher class roads. If these access points are deemed necessary, they must nevertheless be spaced sufficiently apart.

This regulation is intended to strengthen Cape town's general bylaws and subdivision rules and regulations with respect to access from new land divisions onto public, and in some cases, private ways. As a general bylaw or ordinance, this model must be adopted by Town Meeting or Town Council in accordance with G.L. c. 43B §13. As a subdivision regulation, this model must be adopted by a planning board in accordance with G.L. c. 41 §81-Q.

01.0 Purpose: The purpose of this access management regulation is to provide reasonable access to development which is consistent with the intended function of the adjacent roadway system. This reasonable access is achieved through location and spacing criteria for driveways and subdivision road access points along town roadways, minimizing the number of driveways, consolidating existing driveways, encouraging driveways on collectors versus arterials for corner lots, encouraging shared driveways, controlling the geometric design of driveways, and locating driveways as far away from roadway intersections as possible.

02.0 Definitions: As used in this bylaw, the following words and terms shall have the meanings specified herein:

02.1 Driveway/Curb Cut: Any access point onto a roadway. This may include, but is not limited to, an entrance to a parcel, or an intersection with another roadway.

02.2 Driveway Interconnection: A private driveway connection between two lots that does not require traveling on the roadway system.

02.3 Functional Classification: The category of a road according to its intended purpose. At the highest end are roads designed to provide mobility, and at the lowest end are roads designed to provide access to land development. The Metropolitan Planning Organization (MPO) classifies roads as one of nine different classifications or as "unaccepted." For the purposes of this bylaw, these classifications have been consolidated into four types:

02.3.1 Arterial: Provides the greatest mobility at the greatest vehicle speed for the longest uninterrupted distance. Includes functional road classifications of "rural principal arterial," "urban extension of rural principal arterial," "rural minor arterial," "urban extension of rural minor arterial," and "urban minor arterial," with the exception of limited access roads.

02.3.2 Collector: Provides balance of mobility and land access, collects and distributes traffic between local and arterial roadways. Includes functional road classifications of "rural major collector," "urban collector" and "rural minor collector."

02.3.3 Local: Provides greatest land access and little or no through movement. Includes functional road classification of "local."

02.3.4 Unclassified: Private or unmaintained public roads that function like local roads. Includes functional road classifications of "unaccepted" and "unclassified."

When references are made in this bylaw to "higher" or "lower" functional class, the ranking of these classifications from high to low is arterial, highest, followed by collector and then local, lowest.

Commentary: The MPO/state method of classifying roads is useful for some purposes but too detailed for the needs of this bylaw. That is why they are grouped into three basic types (which are the types commonly used by transportation engineers). Limited access roads such as Route 6 before the Orleans/Eastham Rotary and Route 28 south of the Otis Rotary cannot have additional driveways or access points without extensive state review and approval and are thus not considered under this bylaw.

02.4 Metropolitan Planning Organization (MPO): A regional planning committee that consists of representatives of the Massachusetts Highway Department (MHD), Executive Office of Transportation and Construction (EOTC), the Cape Cod Regional Transit Authority (CCRTA) and the Cape Cod Commission (CCC). In consultation with its advisory group, the Cape Cod Joint Transportation Committee, the MPO is responsible for making decisions regarding transportation planning and development in Barnstable County, including classifying roads by their functional types.

02.5 Regional Roadways in Regional Policy Plan: All roads on Cape Cod that are not classified "local" or "unclassified."

03.0 Authorization: Pursuant to G.L. c. 43B §13 and G.L. c. 41 §81-Q, the Town of adopts a roadway classification program to protect the public health, safety and welfare. The roadway classification system is based on the roadway classification system adopted by the Metropolitan Planning Organization (MPO). The functional classification of town roads is shown in Figure 1.

Commentary: Each town should include in its bylaw a Figure listing the functional classification of town roads. The Cape Cod Commission can provide this information.

04.0 Classification of Future Roads: It shall be the responsibility of the planning board, at the time of the subdivision of land, to issue a determination as to the recommended classification of all roads to be created by said subdivision. Failure to designate a road classification shall mean that the roads are to be designated as local roads. These decisions will be passed on by the Town Planner to the MPO for approval in their functional classification.

05.0 Changes to Roadway Classification: The planning board, with the approval of the Town governing body, may recommend changes to town road classifications with the intent to enhance the protection of the general health, safety and welfare. These decisions will be passed on by the Town Planner to the MPO for approval in their functional classification.

Commentary: The above section is designed to provide the town with a method for choosing the functional classification they want for any new roads, or to decide to change them for existing roads. These changes are subject to MPO approval before becoming part of the state's functional classification but may be used by the town regardless. Towns may wish to include a provision for a public hearing as part of this process.

06.0 Curb Cuts: All driveways and changes to driveways shall:

06.1 be approved by the Town Department of Public Works and be issued an Access Permit by the Superintendent/Director of Public Works.

06.2 be located according to Figures 2a-2f. These distances are measured from the nearest side of the driveway to the nearest side of any other driveways. In cases where a specific distance cannot be determined from these Figures, the Superintendent/Director of Public Works shall make a determination as to the applicable distance based on extrapolation from the values in these Figures.

Commentary: While Figures 2a-2f are likely to apply all Cape towns, each municipality should review the guidelines established by these Figures to ensure reflection of local ingress/egress and road spacing criteria.

06.3 be consolidated into a single driveway where possible. All development and redevelopment shall provide the minimum number of driveways for the size and type of land use proposed and provide a maximum of one driveway for up to 50 feet of frontage, two driveways for 51 to 150 feet of frontage and three driveways for 151 to 500 feet of frontage.

06.4 be located and designed to provide safe sight distances at the driveway in accordance with American Association of State Highway Transportation Officials (AASHTO) guidelines for stopping sight distances under wet pavement conditions.

06.5 be in compliance with standard Massachusetts Highway Department design criteria.

06.6 operate at Level of Service C or better (Level of Service D or better in certified growth/activity centers) during the PM peak hour for a minimum of five years into the future from issuance of an Access Permit, as assessed by the project applicant and reviewed and approved by the town DPW Superintendent/Director.

06.7 provide appropriate traffic control devices in accordance with the Manual on Uniform Traffic Control Devices. Where traffic signals are proposed and warranted, traffic signals must be placed at uniform intervals as allowed by the road system, and must not be located less than 1/4 mile (1,320 feet) away from an existing or planned traffic signal. Proposed signals must also be consistent with all other town policies and regulations governing traffic signals.

06.8 prohibit turn movements that cause safety concerns through driveway geometry and signage, or for consistency with future roadway plans described in the Local Comprehensive Plan.

06.9 not intersect the storage, deceleration and transition taper areas of a proposed right-turn lane. Existing driveways shall be relocated outside this area consistent with the appropriate spacing requirements above as approved by the Superintendent/Director of Public Works. The relocation of existing driveways needing to be moved shall be provided by the proponent of the turning lane.

06.10 not intersect the storage, deceleration, and transition taper areas of a proposed left-turn lane. Existing driveways on either side of the road shall prohibit left-turn movements through geometric changes in the driveway design or be relocated outside this area consistent with the appropriate space requirements above as approved by the Superintendent/Director of Public Works. The relocation of existing driveways needing to be moved shall be provided by the proponent of the turning lane.

06.11 for corner lots where collector and arterial roads meet, be located on the collector road if possible.

Commentary: This requirement is designed to keep driveways off arterial roads if possible. Additional driveways on local roads within residential neighborhoods are not always encouraged, so this requirement only gives preference to collector over arterial roads. Note also that this portion of the

bylaw grants review authority over new curb cuts to the Director of Public Works or his/her designee. Towns may wish to have another town agency responsible for issuing these permits such as the Planning Board.

07.0 Additional Requirements: All applicants for the division of land subject to the Subdivision Control Law and/or the Town of ____'s subdivision rules and regulations shall:

07.1 be responsible for the cost to provide access. Project applicant(s) may be required by the Town to install and pay for standard traffic control devices, pavement markings, channelization, or other access related improvements to facilitate safe and efficient traffic flow, or such improvements may be installed by the Town and up to one hundred per cent of the cost of such improvements may be assessed upon the applicant.

07.2 not consolidate traffic from existing development to justify signaling a driveway, unless the location is at least 1/4 mile (1,320 feet) from any other existing or planned traffic signal.

Commentary: Although combining driveways is often to be encouraged, if such combination requires that a traffic signal be installed at the resulting access point, that signal can cause more problems than the original driveway arrangement unless sufficient space is provided between signals.

07.3 consult the town Director/Superintendent of Public Works regarding access on State Highway roadways prior to seeking a curb-cut permit from the Massachusetts Highway Department, and work with the Town and other authorizing agencies such as the MHD to agree on an overall access plan for the site prior to site approval.

07.4 provide shared access with adjacent development where feasible. Providing shared access can be used to satisfy a portion of trip reduction requirements in cases where a project is a Development of Regional Impact or requires trip reduction under the Local Comprehensive Plan.

07.5 provide a driveway interconnection between adjacent parcels to avoid short trips and conflicts on the main road. Providing a driveway interconnection can be used to satisfy a portion of trip reduction requirements in the case where a project is a Development of Regional Impact or requires trip reduction under the Local Comprehensive Plan.

07.6 consolidate existing driveways located adjacent to the desired driveway location where driveways cannot meet the spacing and location criteria.

07.7 be in conformance with the driveway spacing and location criteria as soon as practicable after a road is reclassified to a higher functional classification.

In any case where the requirements of this section cannot all be met due to space limitations, the Superintendent/Director of Public Works shall consult with the Planning Board and determine the most appropriate location(s) and number of driveways permitted for the site.

08.0 Subdivision Street Continuity

08.1 Proposed roads shall be in accordance with existing and proposed arterial, collector and local roads, based on the town's functional class map shown in Figure 1 and shall be designed to afford safe access to abutting lots.

08.2 Road alignment shall give due consideration to land contours and natural features.

08.3 Where required by the Planning Board provision shall be made for the extension of the road to abutting property. The plan of any proposed subdivision shall show all work required to connect and

complete the improvements between the proposed road pattern and any connecting road in an existing subdivision.

08.4 Location of any proposed subdivision road shall require an Access Permit as required in the town bylaws; and shall conform to all other town bylaws regarding access management.

08.5 In order to provide safe access and egress for all subdivisions, no temporary or permanent gate, fence or other obstruction may be erected on any portion of the traveling surface of the road unless permitted by the Director/Superintendent of Public Works in consultation with the Planning Board.

Commentary: The above-noted provisions should help strengthen the town's subdivision regulations with respect to road layouts and new road access. Towns should note that some of these provisions may be included within existing subdivision rules and regulations. In addition, note that if the text of this model regulation is adopted as a general town bylaw, the provisions of Section 08.0 above may nevertheless need to be adopted by the Planning Board as revisions to the Town subdivision rules and regulations.

09.0 Severability:

09.1 If any provision of this bylaw/regulation is held invalid by a court of competent jurisdiction, the remainder of the bylaw shall not be affected thereby. The invalidity of any section or sections or parts of any section or sections of this bylaw/regulation shall not affect the validity of the remainder of the [town]'s general bylaws/regulations.

Commentary: This Section is a generic severability clause. Severability clauses are intended to allow a court to strike or delete portions of a regulation that it determines to violate state or federal law. In addition, the severability clause provides limited insurance that a court will not strike down the entire bylaw should it find one or two offending sections.

Go to the Cape Cod Commission's
[Model Bylaws and Regulations](#) Page

L. LID Fact Sheets

What is Low Impact Development?

- Comprehensive, landscape-based approach to sustainable development
- Set of strategies to maintain existing natural systems, hydrology, ecology
- Cost-effective, flexible approach based on a toolkit of simple techniques
- Collection of practices that have been implemented nationwide
- **NOT** rocket science
- **NOT** formulaic
- **NOT** the answer to every challenge

The Traditional Landscape

- Mostly impervious lawn, building and driveway
- High water use non-native ornamentals
- High inputs of chemicals and fertilizers
- High maintenance, little ecological value, high impact to water resources, little site specification



The Environmental Design Approach

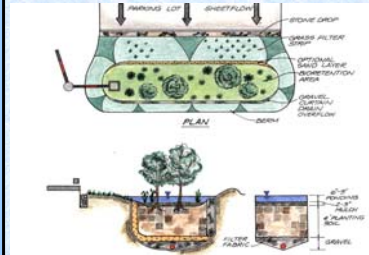
- Minimizes runoff & maximizes infiltration
- Minimizes chemical & fertilizer applications to prevent water quality impacts
- Minimizes water use & captures impervious surface runoff for on site water supplies for watering purposes



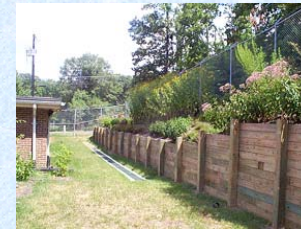
LID STRATEGIES: Bioretention

Treatment, retention, infiltration, landscaping

- Excavation filled with engineered soil mix
- Herbaceous perennials, shrubs, trees
- Pounded water infiltrates within 72 hours
- Overflow outlet and optional underdrain



Bioretention: Practical Applications



LID STRATEGIES: Rain Barrels & Cisterns

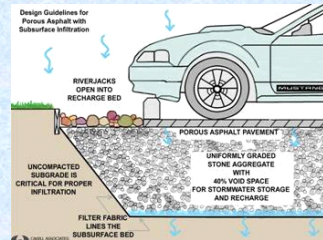


LID STRATEGIES: Permeable Paving

- Grass pavers
- Paving stones
- Porous asphalt
- Pervious concrete

Applications:

- Parking stalls
- Overflow parking
- Driveways
- Walkways, patios and plazas



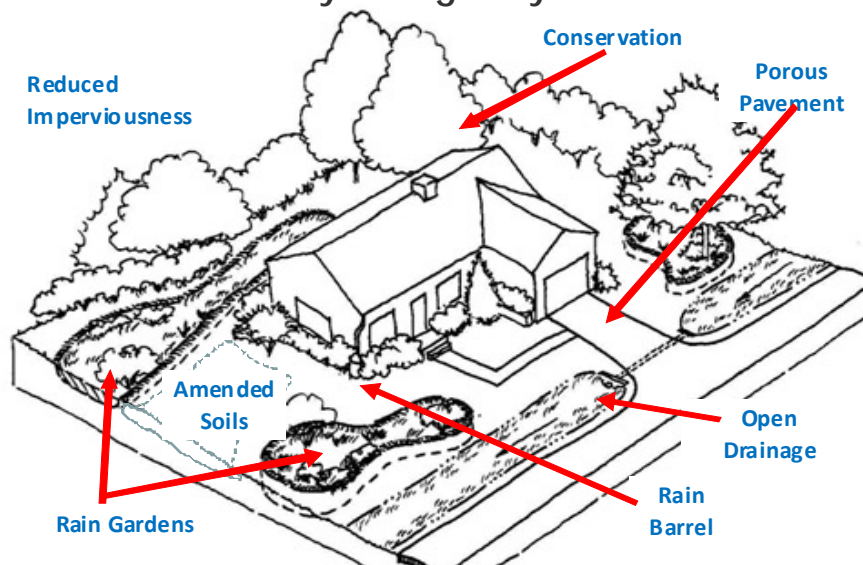
LID STRATEGIES: Green Roofs

Using light-weight media and geo-synthetic fibers and membranes, contemporary green roofs can be readily engineered to conform to the load requirements of most roofs.

Beautiful vegetated roof covers weighing only 15 pounds per square foot have been installed. This weight is comparable to the weight of gravel ballast placed on many conventional roofs.



The Result: A Hydrologically Functional Lot



Low Impact Development strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth. This approach improves water quality, minimizes the need for expensive pipe-and-pond stormwater systems, and creates more attractive developments.

MASSACHUSETTS LOW IMPACT DEVELOPMENT TOOLKIT

FACT SHEET #1

LOW IMPACT SITE DESIGN



Overview

Conventional development strategies treat stormwater as a secondary component of site design, usually managed with “pipe-and-pond” systems that collect rainwater and discharge it off site. In contrast, Low Impact Development embraces hydrology as an integrating framework for site design, not a secondary consideration. Existing conditions influence the location of roadways, buildings, and parking areas, as well as the nature of the stormwater management system.

LID site design is a multi-step process that involves identifying important natural features, placing buildings and roadways in areas less sensitive to disturbance, and designing a stormwater management system that creates a relationship between development and natural hydrology. The attention to natural hydrology, stormwater “micromanagement,” nonstructural approaches, and landscaping results in a more attractive, multifunctional landscape with development and maintenance costs comparable to or less than conventional strategies that rely on a pipe-and-pond approach.

Sensitive site landscaping is an important component of Low Impact Development. Ecological landscaping strategies seek to minimize the amount of lawn area and enhance the property with native, drought-resistant species; as a result, property owners use less water, pesticides, and fertilizers. The maintenance of vegetated buffers along waterways can also enhance the site and help protect water quality.

Applications and Design Principles

LID site planning is similar to Conservation Subdivision Design (CSD) process, though LID site planning can be applied to both residential and nonresidential development as well as redevelopment projects. The four step process of CSD (identify conservation areas; locate home sites; align streets and trails; draw in lot lines) provides a serviceable framework for the LID site design process, which involves designing a stormwater management system in conjunction with the second and third steps of the CSD process.

Management Objectives

- Develop a site plan that reflects natural hydrology.
- Minimize impervious surfaces.
- Treat stormwater in numerous small, decentralized structures.
- Use natural topography for drainageways and storage areas.
- Preserve portions of the site in undisturbed, natural conditions.
- Lengthen travel paths to increase time of concentration and attenuate peak rates.
- Use “end of pipe” treatment structures only for quantity/rate controls of large storms.



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Site Analysis

An LID site planning strategy will begin with an assessment of environmental and hydrologic conditions on a site and identification of important natural features such as streams and drainageways, floodplains, wetlands, recharge groundwater protection areas, high-permeability soils, steep slopes and erosion-prone soils, woodland conservation areas, farmland, and meadows. This investigation will help to determine what “conservation areas” should be protected from development and construction impacts, and what site features (such as natural swales) might be incorporated into the LID stormwater system.

The site analysis will also identify a “development envelope” where development can occur with minimal impact to hydrology and other ecologic, scenic, or historic features. In general, this will include upland areas, ridge lines and gently sloping hillsides, and slowly permeable soils outside of wetlands. The remainder of the site should be left in a natural undisturbed condition. It is important to protect mature trees and to limit clearing and grading to the minimum amount needed for buildings, access, and fire protection; lawn areas increase runoff that must be managed, whereas preservation of wooded areas reduces the volume of stormwater that must be treated. Construction activity, including stockpiles and storage areas, should be confined to those areas that will be permanently altered, and the construction fingerprint should be clearly delineated.

Locate Development and Roadways

Based on the development envelope from the site analysis, developers and their consultants should prepare potential site development layouts. These layouts should minimize total impervious area; reflect the existing topography; and utilize existing drainageways, swales, depressions, and storage areas in their natural state. The goal is to minimize the amount of runoff that must be treated in a stormwater management system.

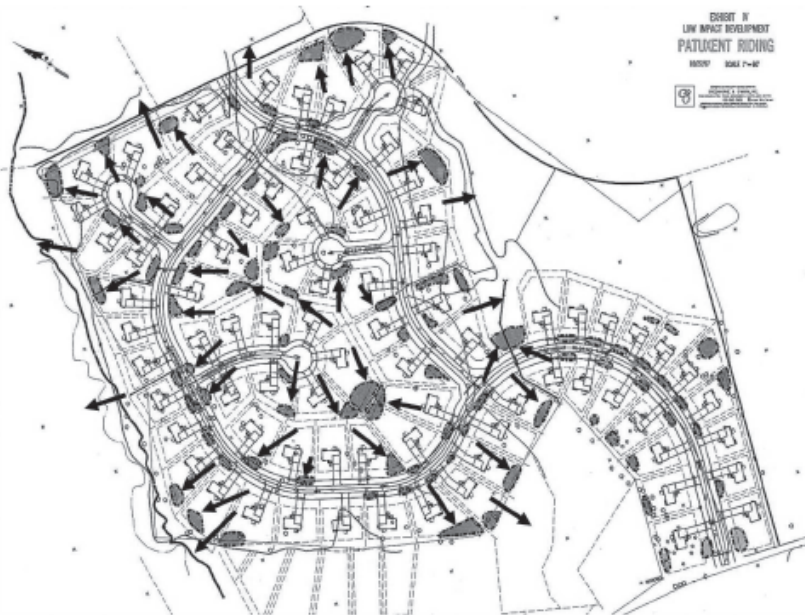
In order to reduce site coverage but not square footage, site development layouts may include buildings clustered together, parking structures (instead of lots), or taller buildings with a smaller footprint relative to floor area. However, these strategies may conflict with local land use regulations that address density, height, frontages, and lot coverage, so consultation with local officials is critical to help them

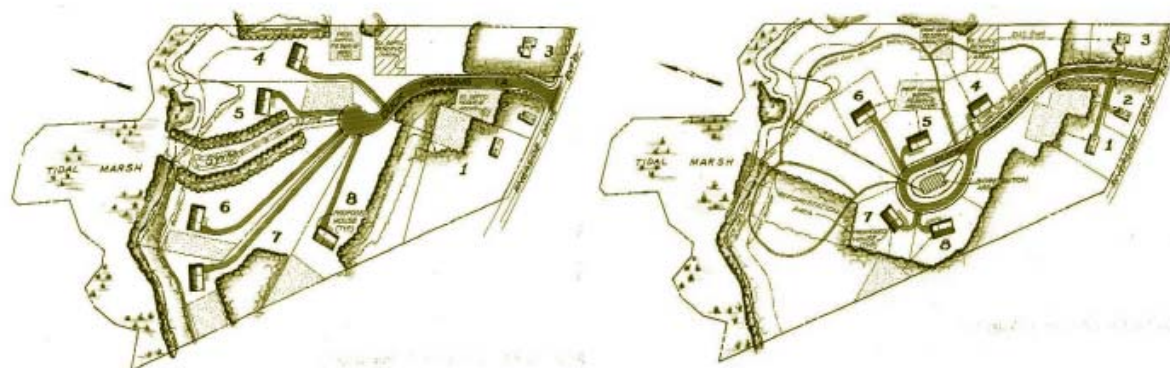


Conventional development strategies (above) concentrate stormwater runoff in storm sewers and deliver it to a few large ponds for treatment at the end of the pipe. Low Impact Development (right) seeks to create multiple small “sub-watersheds” on a site and treats runoff close to the source in smaller structures.

Cover, top: A clustered subdivision with smaller setbacks and preserved natural areas (left) contrasts with a conventional subdivision where all the trees have been removed.

Cover, bottom: A schematic diagram of a conservation subdivision design plan.





Above: Two alternative designs for an eight-lot subdivision. The low-impact on the right uses shared driveways and a one-way loop road to minimize impervious surfaces. The preservation of natural areas and the creation of trails adds value to the properties. Images: Center for Watershed Protection



Above: A commercial site design that uses clustering and multiple parking areas to protect water resources and provide opportunities for low impact stormwater management techniques. This design provides the same square footage and parking spaces as a conventional design that encroaches on a nearby marsh (at top). Image: Center for Watershed Protection

understand the rationale for the proposed development plan. Other strategies for minimizing impervious surfaces include reduced road widths, smaller parking areas, permeable paving, and green roofs, all of which are described in greater detail in other LID fact sheets.

Once approximate building locations are known, general roads alignments can be identified. Roads should not cross steep slopes, where cutting and filling will unnecessarily disturb drainage patterns; instead, roadways should follow existing grades and run along existing ridge lines or high points. As a rule of thumb, roadways should run parallel to contours on gentle slopes, and perpendicular to the contours on steeper slopes. Large expanses of parking should be broken up into multiple smaller parking lots; this will help to reduce grading on hilly sites, since separate parking areas can be placed at different elevations.

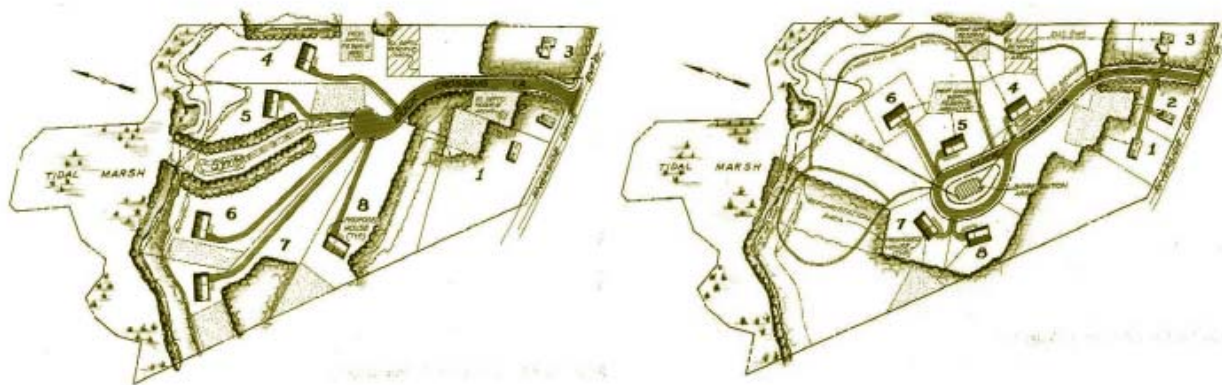
Create a Decentralized Stormwater System

The actual location of buildings and the alignment of roadways should be determined in conjunction with the design of the stormwater management system. The goal of this process is to minimize “directly connected impervious area”—those impervious areas that drain directly into a pipe-and-pond stormwater system. Designers should seek to maintain or create small sub-watersheds on the site and “micromanage” the runoff from these sub-watersheds in small decentralized structures, such as swales, bioretention areas, infiltration structures, and filter strips. Paved surfaces should be graded and crowned so that they form multiple “mini-watersheds;” the runoff from each small drainage area should to a different bioretention area, swale, or filter strip. Roof runoff should be sent to rain barrels, cisterns, dry wells, and vegetated areas via level spreaders.

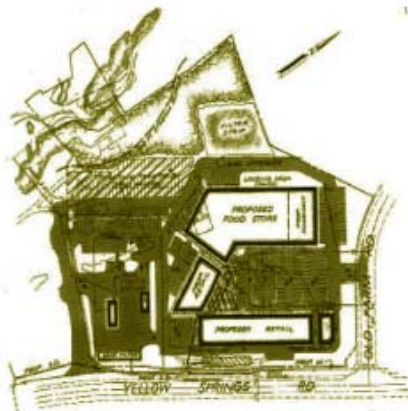
LID site design should also seek to maximize the travel time for stormwater runoff. Conventional pipe systems increase the speed of stormwater runoff, resulting in bigger peak discharge rates (and therefore bigger ponds) at the end of the pipe. In contrast, LID seeks to increase the time of concentration (the average travel time for rainfall) through a variety of techniques: retain stormwater in small structures close to the source (described above), provide as much overland or sheet flow as possible, use open drainage systems, provide long travel paths, and use vegetation to increase surface roughness.

Wherever possible, site design should use multifunctional open drainage systems such as vegetated swales or filter strips which also help to fulfill landscaping or green space requirements. Swales and conveyances can be designed to increase travel length (and time of concentration) with long flow paths that loop around parking lots or other features, rather than more direct routes. The result is increased infiltration and more attenuated peak discharge at the downstream end of the site—the peak comes later and is smaller.

LID stormwater structures (such as bioretention areas and infiltration trenches) should be sized to treat the stormwater from frequent, low intensity storms for



Above: Two alternative designs for an eight-lot subdivision. The low-impact on the right uses shared driveways and a one-way loop road to minimize impervious surfaces. The preservation of natural areas and the creation of trails adds value to the properties. Images: Center for Watershed Protection



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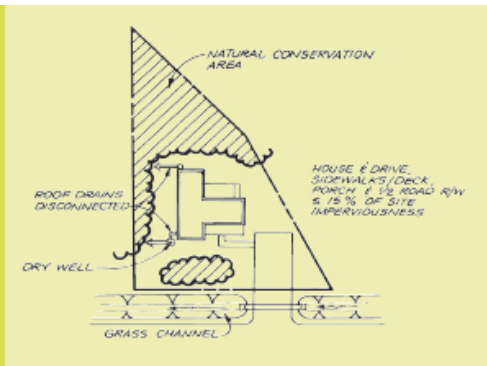
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Above: A lot layout that uses infiltration, disconnection of rooftop runoff, conservation and vegetated swales to treat runoff.

water quality and infiltrate it into the ground or slowly release it; they should not be expected to completely manage the peak discharge rate or volume from large storms. Volume and rate controls at the downstream end of the site may still be necessary, but much smaller as a result of LID site design, decentralized stormwater management, and long travel paths.

Benefits and Effectiveness

- A comprehensive approach to site design is the most effective, cost-efficient means of minimizing stormwater runoff. A small investment in design at the outset of the project can reduce the expense associated with conventional stormwater systems.
- An LID site design approach based on natural hydrology will integrate the built space into the natural environment, giving the development integrity and an aesthetically pleasing relationship with the natural features of the site. Many LID stormwater management structures also serve as site landscaping.
- Developers who take a careful, comprehensive approach to site design—one that accommodates local development goals and protects important resources—run into less resistance from neighbors and local boards concerned about the aesthetic and environmental impacts of development.
- Site designs that involve a minimal amount of clearing, grading, and road/parking lot construction have lower overall site development costs.
- Small, distributed stormwater “micromanagement” techniques offer an advantage over centralized systems because one or more of the individual structures can fail without compromising the overall integrity of the stormwater management strategy for the site.
- Smaller decentralized facilities feature shallow basing

depths and gentle side slopes, which reduce safety concerns as compared to deep ponds that must be fenced off.

Limitations

- The comprehensive LID site analysis and design process can rarely be conducted “in house” by developers; it requires the assistance of knowledgeable and qualified engineers and landscape architects.
- Some LID site designs that seek to cluster development and reduce lot coverage may conflict with local land use regulations or public perceptions about what type of development is desirable (a compact multistory building may be more visible than a single story building with a larger footprint.) Consequently, public education is necessary as well as cooperation among developers, advocates, and regulators who recognize the values of the LID site design approach.

Maintenance

There are no particular maintenance requirements associated with an LID site design, but by reducing the amount of stormwater runoff and associated stormwater management structures, LID can reduce the amount of maintenance required on a site.

Cost

The cost of an LID site design will vary depending on the site. The expertise necessary to create a comprehensive site plan may cost more than a simple engineering plan that ignores natural conditions and treats stormwater using a “pipe and pond” system; however, the resulting plans are commonly less expensive to construct and maintain, and the additional landscaping and aesthetic value of an LID development will add a premium to the sales price.

Additional References

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- Better Site Design: A Handbook for Changing Development Rules in Your Community*; Center for Watershed Protection; 1998
- Site Planning for Urban Stream Protection*; Thomas Schueler; Center for Watershed Protection; 1995.
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- An Introduction to Better Site Design*; Article 45 from *Watershed Protection Techniques*; Center for Watershed Protection; 2000

This publication is one component of the Massachusetts Low Impact Development Toolkit, a production of the Metropolitan Area Planning Council, in coordination with the I-495 MetroWest Corridor Partnership, with financial support from US EPA. The Massachusetts Low Impact Development Interagency Working Group also provided valuable input and feedback on the LID Toolkit.

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FACT SHEET #2

ROADWAY AND PARKING LOT DESIGN



Overview

One of the simplest ways to cut down on stormwater runoff is to reduce the amount of impervious cover associated with roadways and parking lots. Careful design is the key to reducing pavement while still providing good site access and adequate parking. Good road and parking lot design can also create opportunities for decentralized stormwater management in bioretention areas, roadside swales, and infiltration structures. Basic strategies for roadway design include low-impact roadway layouts, narrow road widths, shared driveways, and open-section roadways. Parking lots designers should look at strategies to break up large parking lots, maximize shared parking, rethink parking requirements, and use permeable paving where appropriate.

Alternative road and parking designs may offer cost savings for developers, because there is less pavement to construct and less stormwater runoff to treat. In some cases, more compact parking may allow higher site densities. The primary impediment to these strategies may be resistance at the permitting stage. Many communities stringently enforce elaborate and often excessive roadway and parking standards in an effort to prevent development. Developers, advocates, and regulators who understand the benefits of Low Impact Development need to work together to point out that alternative designs can provide safe access and sufficient parking, as well as environmental and aesthetic benefits.

Applications and Design Principles

Roadway Width

Excessively wide streets are the greatest source of impervious cover (and stormwater runoff) in most residential developments. Some local codes require streets up to 40 feet wide in subdivisions with only a dozen houses. These inappropriate standards result from blanket application of high volume/high speed road design criteria, overestimates of on-street parking demand, and the perception that wide streets result in faster emergency response times.

Narrower road sections and alternative road profiles can reduce stormwater runoff and mitigate its impacts, while still allowing safe travel, emergency

Design Objectives

- Reduce total impervious surface.
- Reduce road/parking construction costs.
- Provide safe access and adequate parking.
- Minimize disturbance to natural site hydrology.
- Create opportunities for stormwater treatment and infiltration.
- Improve site appearance.



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Above: Excessively wide streets (top) with conventional curb-and-gutter profiles create large volumes of runoff and concentrate it in storm sewers. Low-impact roadways (bottom) use a narrower, more traditional design that enhances neighborhood character. Less runoff is created and it is directed to roadside swales for treatment and conveyance.

Cover, top: A narrow roadway design can allow for on-street parking as well as plenty of room for safe travel and emergency vehicle access.

Cover, bottom: This photo shows a perforated curb that directs runoff into a roadside bioretention area with a drop overflow inlet into the storm drain system. This approach treats the "first flush" of runoff using a low-impact technique and directs the remaining stormwater to conventional practices.

Photo: Lower Columbia River Estuary Partnership

Right: A schematic diagram of an open-section roadway, with permeable paving parking lanes and roadside swales. Swales should be located between the roadway and a sidewalk, where present. Image: Valley Branch (MN) Watershed District

vehicle access, and adequate parking. For most low-traffic roads, a 24' road width is sufficient to accommodate two way traffic, and even narrower widths should be used in very low traffic conditions (e.g., a six-lot subdivision.) The National Fire Protection Administration Uniform Fire Code (2003) recommends a minimum unobstructed width of just 20 feet, with the recognition that local authorities can set lower standards if turnouts or alternate exits are available.

Recommended Minimum Street Widths

Source	Width (feet)
National Fire Protection Administration	20
Massachusetts State Fire Marshall	18 (minimum)
AASHTO	22
Institute of Transportation Engineers	22
Prince George's County, Maryland	20
Portland, Oregon	18 (on-street parking on one side) 26 (parking both sides)

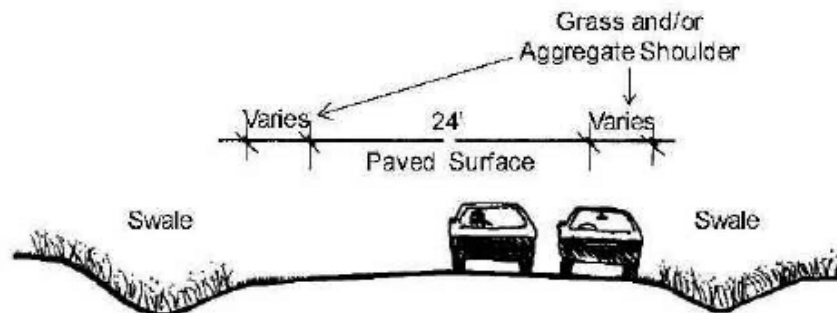
Source: Center for Watershed Protection

In order to achieve the environmental benefits of narrower street widths, regulators must make clear that they are willing to adjust site design standards to provide developers with the opportunity to try alternative designs. One preliminary step is to require parking on one side of the street only. This is appropriate where most houses have off-street parking. Design standards can also allow parking lanes or road shoulders made of permeable paving, such as grass pavers or paving blocks.

Some communities are moving to roadways that use a single travel lane and one or two "queuing lanes," which can be used for either parking or travel. This strategy can reduce street width by a third, and it does not affect travel except when two cars need to pass each other at the spot where a third car is parked, in which case one car pulls into the queuing lane until the oncoming car has passed. Research indicates that "tight streets" actually improve traffic safety by encouraging vehicles to slow down in residential neighborhoods. Throughout Massachusetts, many older neighborhoods built before current standards were enacted have narrow streets that function well, calm traffic, and lend character to the community.

Roadway Profile

Curbs and gutters concentrate stormwater runoff and increase its velocity, impeding decentralized treatment and infiltration. LID strategies recommend open-section roadways flanked by filter strips and swales instead of curbs and gutters. These LID techniques, built on the model of "country drainage," help to filter roadway runoff, promote infiltration, and reduce runoff velocity, resulting in lower peak discharge rates. If properly designed, open section roadways will be no more prone



to flooding than conventional roadway profiles. If curbs are deemed necessary to stabilize the roadway edge, the design can use invisible curbs (same level as the road surface), periodic curb cuts, or perforated curbs to allow stormwater to run off the roadway edge.

Roadway layout

The location and layout of roadways can also be modified to improve post-development hydrology. Roadways should be placed to avoid crossing steep slopes where significant cut and fill will be required. They should run parallel to contours on gentle slopes and perpendicular to contours on steeper slopes. Design of a roadway network may involve some give and take between reducing total roadway length and road layouts compatible with existing topography. On low-speed streets, clearing and grading should be limited to a small strip of land (5') on either side of the roadway and sidewalk.

In residential subdivisions, shared driveways can reduce site development costs as well as impervious surface coverage. Property owners will also realize some savings through shared snow plowing costs. Driveways can be limited to 9 feet in width. They should be sloped or crowned so that they drain evenly onto adjacent vegetated areas (not onto the street) where the runoff will infiltrate or travel via sheetflow.

Turnarounds and Cul-de-Sacs

Many residential streets end in large cul-de-sacs up to 80 feet across, which generate large amounts of runoff during storms. Alternative designs can reduce runoff and improve neighborhood character, while still providing sufficient room for fire trucks and school buses to maneuver. One simple approach (applicable to both new construction and retrofits) is to create a landscaped island in the middle of a standard-size cul-de-sac. A 30-foot island in an 80-foot diameter cul-de-sac will reduce the impervious surface by 15%; if the island is designed and built as a bioretention area, and the roadway graded appropriately, this strategy can also treat roadway runoff.

Other design changes can produce even greater benefits. Reducing the radius of a cul-de-sac from 40 feet to 30 feet yields a 45% reduction in paved surface (5,000 sq. ft versus 2,800 sq. ft.) A T-shaped hammerhead occupies even less space but still provides sufficient room for turning vehicles and fire trucks (though it may require a 3-point turn.) Depending on the length of the street, designers should consider a one-way loop road with parking on one side. Cul-de-sac design is definitely one area where regulatory standards prevent creative designs; regulators should consider re-wording their regulations to replace geometric standards with performance standards.

Parking Lots

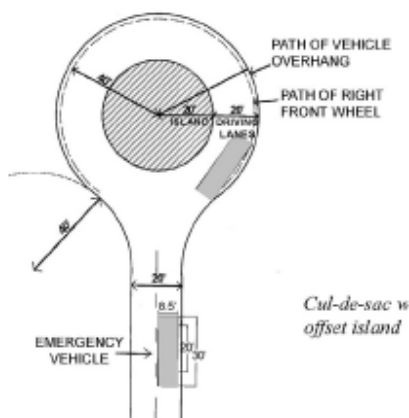
Expansive parking lots that drain to just a few catch basins create large volumes and high velocities that require the use of pipe-and-pond stormwater techniques. The LID approach encourages designers to create multiple smaller parking lots separated by natural vegetation and bioretention areas. On hilly sites, the creation of multiple parking areas at different elevations can reduce the amount of grading necessary and preserve natural hydrology.

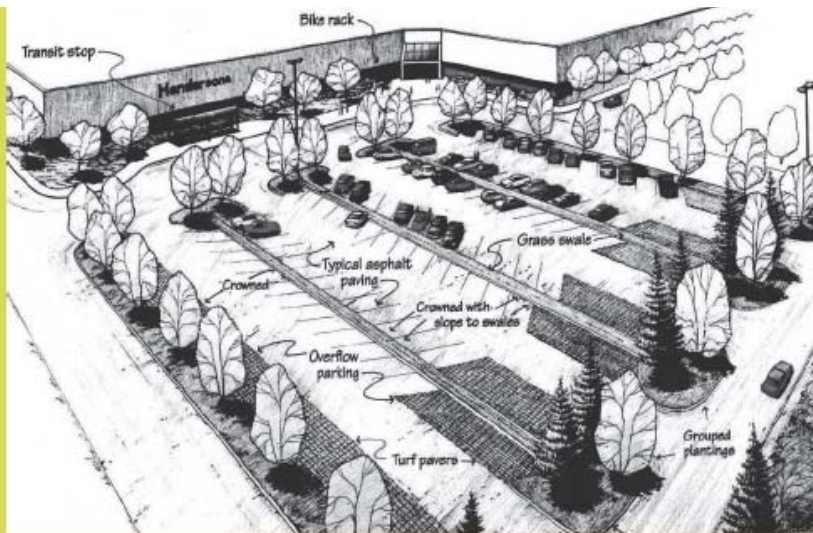
Permeable paving is rarely appropriate for use in high traffic parking lots, but some success has been found with hybrid parking lots, which use conventional paving for driveways and aisles, and permeable paving for stalls. Permeable paving may also be appropriate for overflow parking areas, which are generally used only a few weeks out of the year.



Above: Periodic curb cuts in an urban setting allow for streetside infiltration. Photo: Lower Columbia River Estuary Partnership

Below: A 20-foot diameter landscaped island in a cul-de-sac can reduce impervious surface by 25%. Cul-de-sac islands can also be designed to treat and infiltrate runoff through bioretention. Image: Valley Branch (MN) Watershed District





Above: A schematic drawing of a parking lot that uses a variety of low impact techniques. Parking areas are separated by vegetated swales that convey runoff to bioretention areas, and permeable paving is used for overflow parking at the periphery of the lot. A bike rack and transit stop help to reduce the number of auto trips to the site.
Image: Robert W. Droll, ASLA

Other strategies include reducing the total number of parking spaces and reducing the size of some parking spaces. Many communities have provisions for shared parking, so that mixed use developments, or single-use developments near other uses, can share parking according to a formula based on the peak demand periods; residents use the parking spaces at night and customers or employees use the same spaces during the day. Parking spaces designed for compact cars can also help to limit impervious coverage.

Considering the aesthetic and environmental impacts of large parking areas, community boards might consider parking maximums, as well as parking minimums, in order to prevent oversized parking lots and ensure that supply is in line with demand.

Benefits and Effectiveness

- Narrower roadways, smaller parking areas, and smaller stormwater management systems result in lower site development costs.
- A hierarchy of streets sized according to daily needs yields a wide variety of benefits: lower average speeds, more room for trees and landscaping, improved aesthetics, and reduced heat island effect.
- Designs that reduce the amount of parking and break it up into multiple smaller lots separated by vegetation create more attractive developments.

Limitations

- Alternative roadway and parking designs may conflict with local codes, which often have strict requirements for road widths and drainage systems. However, many boards may be willing to adjust their standards if developers, advocates, and neighbors support the alternative design.
- Emergency service access is a common concern with reduced street widths. Where possible, these concerns can be addressed through education or multiple points of access to a site.

Cost

Narrower streets and smaller parking lots cost less than conventional streets because less grading, base material, and pavement is required. Open section roadways cost considerably less than standard designs due to the elimination of curbs and gutters.

Additional References

A Policy on Geometric Design of Highways and Streets, 5th Edition; American Association of State Highway and Transportation Officials, 2004

Shared Parking Guidelines; Institute of Transportation Engineers, Washington DC; 1995.

The American Planning Association (www.planning.org) has published a variety of reports on parking standards, as part of its Planners Advisory Service.

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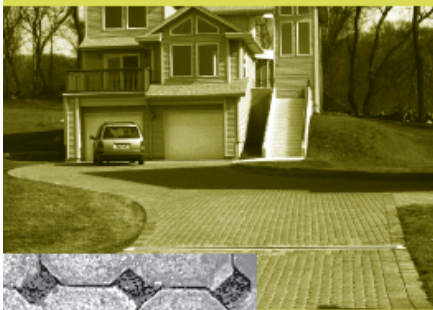
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FACT SHEET #3

PERMEABLE PAVING



Overview

Since impervious pavement is the primary source of stormwater runoff, Low Impact Development strategies recommend permeable paving for parking areas and other hard surfaces. Permeable paving allows rainwater to percolate through the paving and into the ground before it runs off. This approach reduces stormwater runoff volumes and minimizes the pollutants introduced into stormwater runoff from parking areas.

All permeable paving systems consist of a durable, load bearing, pervious surface overlying a crushed stone base that stores rainwater before it infiltrates into the underlying soil. Permeable paving techniques include porous asphalt, pervious concrete, paving stones, and manufactured “grass pavers” made of concrete or plastic. Permeable paving may be used for walkways, patios, plazas, driveways, parking stalls, and overflow parking areas.

Applications and Design Principles

Permeable paving is appropriate for pedestrian-only areas and for low- to medium-volume, low-speed areas such as overflow parking areas, residential driveways, alleys, and parking stalls. Underlying soils should have a permeability of at least 0.3” per hour; less permeable soils will require an underdrain.

Permeable paving is an excellent technique for dense urban areas because it does not require any additional land. With proper design, cold climates are not a major limitation; porous pavement has been used successfully in Norway, incorporating design features to reduce frost heave.

Permeable paving is not ideal for high traffic/high speed areas because it generally has lower load-bearing capacity than conventional pavement. Nor should it be used on stormwater “hotspots” with high pollutant loads because stormwater cannot be pretreated prior to infiltration. Heavy winter sanding may clog joints and void spaces.

Management Objectives

- Reduce stormwater runoff volume from paved surfaces
- Reduce peak discharge rates.
- Increase recharge through infiltration.
- Reduce pollutant transport through direct infiltration.
- Improve site landscaping benefits (grass pavers only.)



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Cover: A driveway in Connecticut built with manufactured paving stones. Lower photo shows paving stone detail. Photo: University of Connecticut, Jordan Cove Urban Monitoring Project

Above: A parking lot with concrete grass paver parking stalls. Lower photo shows grass paver detail. Photos: Lower Columbia River Estuary Partnership

Right: A schematic cross section of permeable paving. In some applications, the crushed stone reservoir below the paving is designed to store and infiltrate rooftop runoff as well. Image: Cahill Associates, Inc. 2004

Three Major Types of Permeable Paving

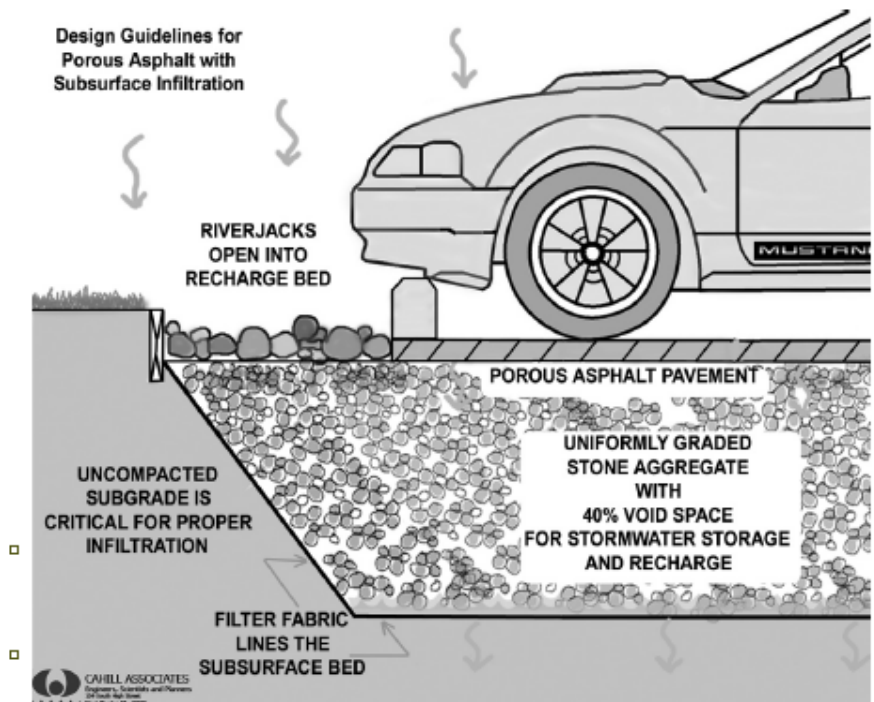
- Porous asphalt and pervious concrete appear to be the same as traditional asphalt or concrete pavement. However, they are mixed with a very low content of fine sand, so that they have 10%-25% void space and very low runoff coefficients.
- Paving stones (aka unit pavers) are impermeable blocks made of brick, stone, or concrete, set on a sand or crushed stone base. Joints are filled with stone or sand to allow water to percolate downward. Runoff coefficients range from 0.1 – 0.7, depending on rainfall intensity, joint width, materials, and base layer permeability. Open cell designs and coarse bed material can yield runoff coefficients less than 0.3.
- Grass pavers (aka turf blocks or grid pavers) are a type of open-cell unit paver in which the cells are filled with soil and planted with turf. The pavers, made of concrete or synthetic, distribute the weight of traffic and prevent compression of the underlying soil. Runoff coefficients are similar to grass, 0.15 to 0.6.

Each of these techniques is constructed over a base course that doubles as a reservoir for the stormwater before it infiltrates into the subsoil. The reservoir should consist of uniformly-sized crushed stone, with a depth sufficient to store all of the rainfall from the design storm. The bottom of the stone reservoir should be completely flat so that infiltrated runoff will be able to infiltrate through the entire surface. Some designs incorporate an “overflow edge,” which is a trench surrounding the edge of the pavement. The trench connects to the stone reservoir below the surface of the pavement and acts as a backup in case the surface clogs.

Benefits and Effectiveness

Porous pavement provides groundwater recharge and reduces stormwater runoff volume. Depending on design, paving material, soil type, and rainfall, permeable paving can infiltrate as much as 70% to 80% of annual rainfall.

Porous pavement can reduce peak discharge rates significantly by diverting stormwater into the ground and away from the pipe-and-pond stormwater management system.





Above: A parking lot with conventional asphalt aisles and paving stone parking stalls. Paving stones are most appropriate for low-speed, low-traffic areas. Photo: Lower Columbia River Estuary Partnership

- Grass pavers can improve site appearance by providing vegetation where there would otherwise be only pavement.
- Porous paving increases effective developable area on a site because portions of the stormwater management system are located underneath the paved areas, and the infiltration provided by permeable paving can significantly reduce the need for large stormwater management structures on a site.

Limitations

- Permeable paving can be prone to clogging from sand and fine sediments that fill void spaces and the joints between pavers. As a result, it should be used carefully where frequent winter sanding is necessary because the sand may clog the surface of the material. Periodic maintenance is critical, and surfaces should be cleaned with a vacuum sweeper at least three times per year.
- In cold climates, the potential for frost is minimized with 24-hour design times for the reservoir. Some design manuals recommend excavating the base course to below the frost line, but this may not be necessary in rapidly permeable soils. In addition, the dead air and void spaces in the base course provide insulation so that the frost line is closer to the surface.
- Permeable paving should not receive stormwater from other drainage areas, especially any areas that are not fully stabilized.
- Permeable paving can only be used on gentle slopes (<5%). It should be used judiciously in high-traffic areas or where it will be subject to heavy axle loads.
- Snow plows can catch the edge of grass pavers and some paving stones. Rollers can be attached to the bottom edge of a snowplow to prevent this problem.



Above: A handicap-accessible park pathway made of permeable paving stones.
Photo: GeoSyntec Consultants, Inc.

Maintenance

- Post signs identifying porous pavement areas.
- Minimize use of salt or sand during winter months
- Keep landscaped areas well-maintained and prevent soil from being transported onto the pavement.
- Clean the surface using vacuum sweeping machines. Paving stones may require periodic addition of joint material to replace material that has been transported.
- Monitor regularly to ensure that the paving surface drains properly after storms.
- Do not reseal or repave with impermeable materials.
- Inspect the surface annually for deterioration.
- Grass pavers may require periodic reseeded to fill in bare spots.

Design Details

- For all permeable paving, base course is a reservoir layer of 1"-2" crushed stone; depth to be determined by storage required and frost penetration.
- Permeable paving require a single-size grading of base material in order to provide voids for rainwater storage; choice of materials is a compromise between stiffness, permeability, and storage capacity. Use angular crushed rock material with a high surface friction to prevent traffic compaction and rutting.
- The design may also include a 2" thick filter course of 0.5" crushed stone, applied over the base course. A geotextile fabric may be laid at the top of the filter layer to trap sediment and pollutants.
- For grass pavers, use deep-rooted grass species whose roots can penetrate the reservoir base course. Irrigation may be required but should be infrequent soakings so that the turf develops deep root systems. Grass pavers are not suitable for every day, all day parking because

the grass will get insufficient sunlight. Better for use as occasional overflow parking.

- The introduction of dirt or sand onto the paving surface, whether transported by runoff from elsewhere or carried by vehicles, will contribute to premature clogging and failure of the paving. Consequently, permeable paving should be one of the last items to be built on a development site, after most heavy construction vehicles are finished and after the majority of the landscaping work is completed.

Cost

On most sites, permeable paving costs more than conventional asphalt or concrete paving techniques. In the case of porous asphalt and pervious concrete, construction costs may be 50% more than conventional asphalt and concrete. Construction costs of paving stones and grass pavers varies considerably and will depend on the application. As with any site improvement or stormwater management structure, property owners should provide a budget for maintenance of permeable paving, at an annual rate of 1%-2% of construction costs.

Permeable paving reduces the need for stormwater conveyances and treatment structures, resulting in cost savings elsewhere. Permeable paving also reduces the amount of land needed for stormwater management and may satisfy requirements for greenspace, allowing more development on a site.

Local Case Study

West Farms Mall – West Hartford, CT

Grass pavers were installed at the West Farms Mall off of I-84 at exit 40, to handle peak-season overflow parking associated with a mall expansion. Over four acres of reinforced turf was designed to accommodate 700 spaces of overflow parking for the peak shopping seasons. There are a few drains installed in the reinforced turf but are only used during very heavy storms. Because the reinforced turf works so well the existing storm drainage system did not have to be enlarged for the additional parking. The overflow parking area needs to be mowed on a regular basis and treated like a regular lawn. The area also needs to be plowed as any parking would be. Rollers were fit to the bottom of the snow plow so the reinforced turf would not be damaged. The manager of the Westfarms facility is satisfied with the turf.

Websites

www.unh.edu/erg/cstev/index.htm (University of NH)
www.invisiblestructures.com/GP2/whole_lotof_turf.htm
www.uni-groupusa.org/case.htm
www.nemo.uconn.edu/ (University of CT)
www.lowimpactdevelopment.org/epa03/pavespec.htm
www.epa.gov/ednnrmrl/repository/abstrac2/abstra2.htm
www.forester.net/sw_0503_advances.html
www.icpi.org (Interlocking Concrete Pavement Institute)

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FOR MORE INFORMATION, VISIT: WWW.MAPC.ORG/LID AND WWW.ARC-OF-INNOVATION.ORG.

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MASSACHUSETTS LOW IMPACT DEVELOPMENT TOOLKIT

FACT SHEET #4

BIORETENTION AREAS



Overview

Bioretention is an important technique that uses soil, plants and microbes to treat stormwater before it is infiltrated or discharged. Bioretention “cells” are shallow depressions filled with sandy soil, topped with a thick layer of mulch, and planted with dense vegetation. Stormwater runoff flows into the cell and slowly percolates through the soil (which acts as a filter) and into the groundwater; some of the water is also taken up by the plants. Bioretention areas are usually designed to allow ponded water 6-8 inches deep, with an overflow outlet to prevent flooding during heavy storms. Where soils are tight or fast drainage is desired, designers may use a perforated underdrain, connected to the storm drain system.



Bioretention areas can provide excellent pollutant removal and recharge for the “first flush” of stormwater runoff. Properly designed cells remove suspended solids, metals, and nutrients, and can infiltrate an inch or more of rainfall. Distributed around a property, vegetated bioretention areas can enhance site aesthetics. In residential developments they are often described as “rain gardens” and marketed as property amenities. Routine maintenance is simple and can be handled by homeowners or conventional landscaping companies, with proper direction.

Applications and Design Principles

Bioretention systems can be applied to a wide range of development in many climatic and geologic situations; they work well on small sites and on large sites divided into multiple small drainages. Common applications for bioretention areas include parking lot islands, median strips, and traffic islands. Bioretention is a feasible “retrofit” that can be accomplished by replacing existing parking lot islands or by re-configuring a parking lot during resurfacing. On residential sites they are commonly used for rooftop and driveway runoff.

Management Objectives

- ▢ Provide water quality treatment.
- ▢ Remove suspended solids, metals, nutrients.
- ▢ Increase groundwater recharge through infiltration.
- ▢ Reduce peak discharge rates.
- ▢ Reduce total runoff volume.
- ▢ Improve site landscaping.



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Above: This bioretention cell at a office park also helps to fulfill site landscaping requirements. Photo: Low Impact Development Center

Right: This schematic diagram shows parking lot runoff directed to a bioretention cell, with pretreatment by a grassed filter strip. Image: Prince George's County (MD) Bioretention Manual

Cover, top: A rain garden in a Connecticut Subdivision infiltrates rooftop and driveway runoff, and can be marketed as an extra amenity. Photo: University of Connecticut, Jordan Cove Urban Monitoring Project

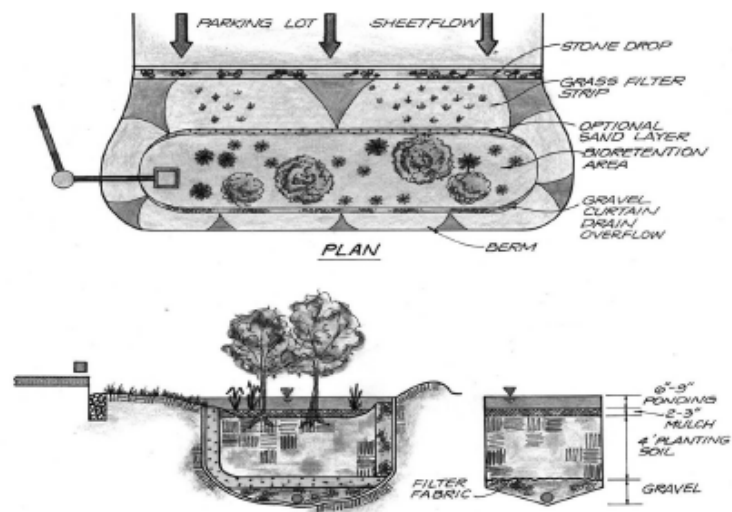
Cover, bottom: A narrow bioretention cell in a parking lot, planted with small trees to reduce the urban heat island effect. Photo: Low Impact Development Center

Bioretention cells are usually excavated to a depth of 4 feet, depending on local conditions. Generally, cells should be sized (based on void space and ponding area) to capture and treat the water quality volume (the first 0.5" or 1" of runoff, depending on local requirements.) Some manuals suggest a minimum width of 15', though much narrower bioretention cells have been installed in parking lot islands and are functioning well. Regardless of size, some type of filter should cover the bottom of the excavation. Filter fabric is commonly used but can be prone to clogging; consequently some engineers recommend a filter of coarse gravel, over pea gravel, over sand.

The cell should be filled with a soil mix of sandy loam or loamy sand. The area should be graded to allow a ponding depth of 6-8 inches; depending on site conditions, more or less ponding may be appropriate. The planting plan should include a mix of herbaceous perennials, shrubs, and (if conditions permit) understory trees that can tolerate intermittent ponding, occasionally saline conditions (due to road salt), and extended dry periods. The soil should be covered with 2-3" of fine-shredded hardwood mulch.

In very permeable soils, some bioretention areas can be designed as "off-line" treatment structures (no overflow necessary), but in most situations they will be an "on-line" component of the stormwater management system, connected to downstream treatment structures through an overflow outlet or an overflow drop inlet installed at the ponding depth and routed to the site's stormwater management system. Ideally, overflow outlets should be located as far as possible from runoff inlets to maximize residence time and treatment. In general, bioretention area should be designed to drain within 72 hours. In slowly permeable soils (less than 0.3 inches/hour) a perforated underdrain can be installed at the bottom of the excavation to prevent ponding.

Bioretention areas work best if designed with some pretreatment, either in the form of swales or a narrow filter strip. A stone or pea gravel diaphragm (or, better yet, a concrete level spreader) upstream of a filter strip will enhance sheet flow and better pre-treatment.



Benefits and Effectiveness

- Bioretention areas remove pollutants through filtration, microbes, and uptake by plants; contact with soil and roots provides water quality treatment better than conventional infiltration structures. Studies indicate that bioretention areas can remove 75% of phosphorus and nitrogen; 95% of metals; and 90% of organics,



Above, top: Bioretention cells are designed to allow ponded water six inches deep, which should infiltrate into the ground within 72 hours after a storm.

Above, middle: A large bioretention cell adjacent to a parking lot can reduce or eliminate expenses on storm sewers and detention basins. Photo: Low Impact Development Center

Above, bottom: Maintenance of rain gardens can generally be handled by homeowners. Photo: Low Impact Development Center

bacteria, and total suspended solids. Bioretention areas qualify as an organic filter according to the Massachusetts Stormwater Policy.

- In most applications, bioretention areas increase groundwater recharge as compared to a conventional “pipe and pond” approach. They can help to reduce stress in watersheds that experience severe low flows due to impervious coverage.
- Low-tech, decentralized bioretention areas are also less costly to design, install, and maintain than conventional stormwater technologies that treat runoff at the end of the pipe. The use of decentralized bioretention cells can also reduce the size of storm drain pipes, a major driver of stormwater treatment costs.
- Bioretention areas enhance the landscape in a variety of ways: they improve the appearance of developed sites, provide wind breaks, absorb noise, provide wildlife habitat, and reduce the urban heat island effect.

Limitations

- Because bioretention areas infiltrate runoff to groundwater, they may be inappropriate for use at stormwater “hotspots” (such as gas stations) with higher potential pollutant loads. On these sites, the design should include adequate pretreatment so that runoff can be infiltrated, or else the filter bed should be built with an impermeable liner, so that all water is carried away by the underdrain to another location for additional treatment prior to discharge.
- Premature failure of bioretention areas is a significant issue that results from lack of regular maintenance. Ensuring long-term maintenance involves sustained public education and deed restrictions or covenants for privately-owned cells.
- Bioretention areas must be used carefully on slopes; terraces may be required for slopes >20%.
- The design should ensure vertical separation of at least 2' from the seasonal high water table.



This parking lot bioretention cell is being constructed with an impermeable liner and a perforated underdrain, to provide retention and treatment of runoff (but not infiltration).

Maintenance

- Bioretention requires careful attention while plants are being established and seasonal landscaping maintenance thereafter.
- In many cases, maintenance tasks can be completed by a landscaping contractor working elsewhere on the site.
- Inspect pretreatment devices and bioretention cells regularly for sediment build-up, structural damage, and standing water.
- Inspect soil and repair eroded areas monthly. Re-mulch void areas as needed. Remove litter and debris monthly.
- Treat diseased vegetation as needed. Remove and replace dead vegetation twice per year (spring and fall.)
- Proper selection of plant species and support during establishment of vegetation should minimize—if not eliminate—the need for fertilizers and pesticides.
- Remove invasive species as needed to prevent these species from spreading into the bioretention area.
- Replace mulch every two years, in the early spring.
- Upon failure, excavate bioretention area, scarify bottom and sides, replace filter fabric and soil, replant, and mulch.

Cost

Bioretention areas require careful design and construction, the price of which will depend on site conditions and design objective. Generally, the cost of bioretention areas is less than or equal to that of a catch basin and underground chambers intended to treat the same area. Additionally, bioretention areas treat and recharge stormwater thereby reducing the amount/size of piping needed and the size of downstream basins and treatment structures.

Design Details

- Where bioretention areas are adjacent to parking areas, allow 3" of freeboard above ponding depth to prevent flooding.
- Determine the infiltrative capacity of the underlying native soil through an infiltration test using a double-ring infiltrometer. Do not use a standard septic system percolation test to determine soil permeability.
- Soil mix should be sandy loam or loamy sand with clay content less than 15%. Soil pH should generally be between 5.5-6.5, which is optimal for microbial activity and adsorption of nitrogen, phosphorus, and other pollutants. Planting soils should be 1.5-3% organic content and maximum 500ppm soluble salts.
- Planting soils should be placed in 1'-2' lifts, compacted with minimal pressure, until desired elevation is achieved. Some engineers suggest flooding the cell between each lift placement in lieu of compaction.
- Planting plan should generally include one tree or shrub per 50 s.f. of bioretention area, and at least 3 species each of herbaceous perennials, shrubs, and (if applicable) trees to avoid a monoculture.
- The bioretention landscaping plan should meet the requirements of any applicable local landscaping requirements.
- During construction, avoid excessive compaction of soils around the bioretention areas and accumulation of silt around the drainfield.
- In order to minimize sediment loading in the treatment area, only runoff from stabilized drainage areas should be directed to bioretention areas; construction runoff should be diverted elsewhere.

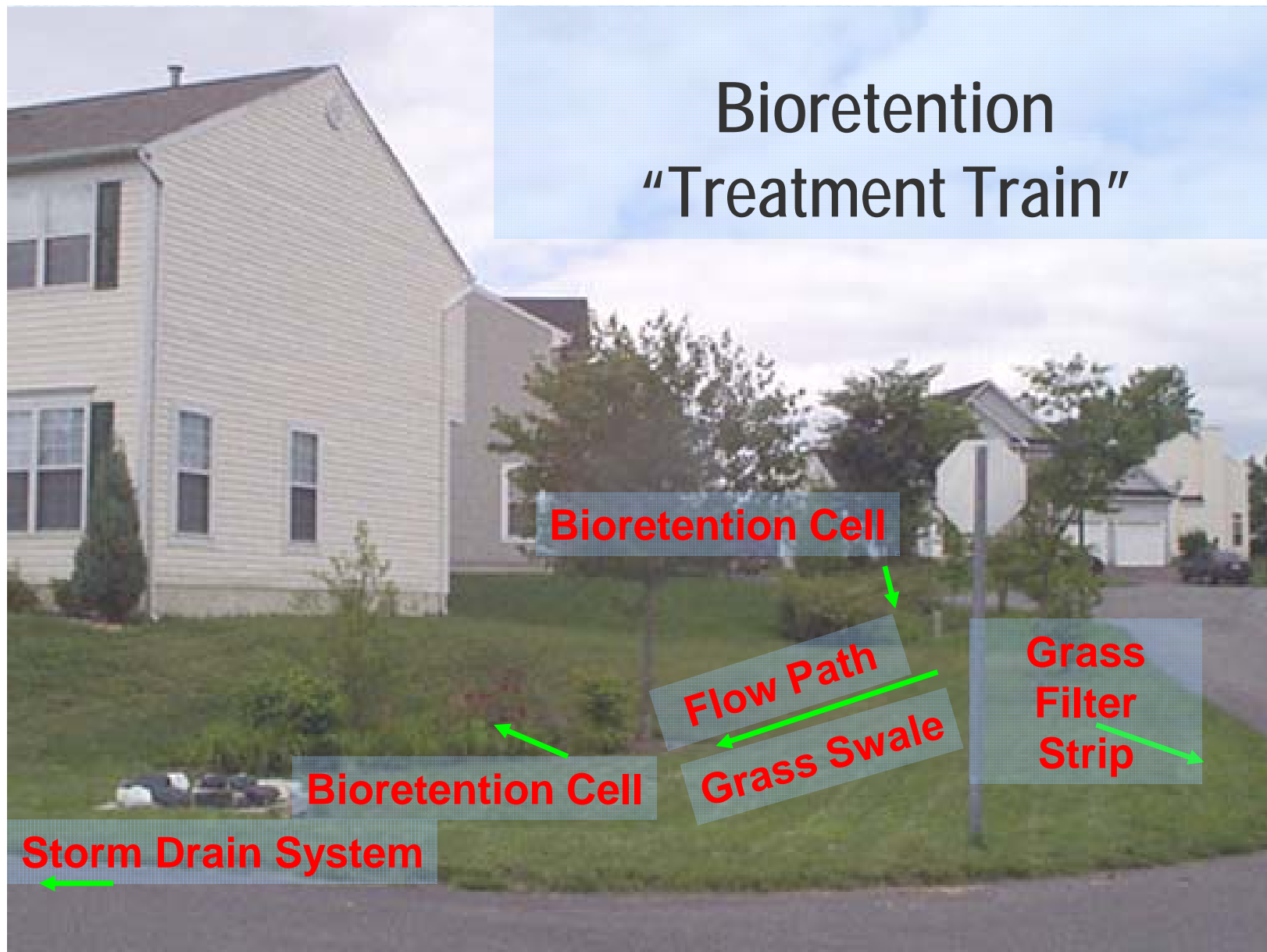
Additional References

- Design Manual for Use of Bioretention in Stormwater Management*; Department of Environmental Resources, Prince George's County, MD; 1993.
- Bioretention as a Water Quality Best Management Practice, Article 110 from Watershed Protection Techniques*; Center for Watershed Protection; 2000
http://www.cwp.org/Downloads/ELC_PWP110.pdf
- Storm Water Technology Fact Sheet, Bioretention*, United States Environmental Protection Agency, Office of Water; 1999 <http://www.lowimpactdevelopment.org/epa03/biospec.htm>
- Bioretention Fact Sheet*, Federal Highway Administration www.fhwa.dot.gov/environment/ultraurb/3fs3.html

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Bioretention "Treatment Train"



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FACT SHEET #5

VEGETATED SWALES



Overview

Vegetated swales are an important Low Impact Development technique used to convey stormwater runoff. These open, shallow channels slow runoff, filter it, and promote infiltration into the ground; as a result, runoff volumes are smaller, peak discharge rates are lower, and runoff is cleaner. This approach contrasts with conventional stormwater strategies that rely on gutters and pipes that increase the velocity of runoff and do nothing for water quality.

Swales are not just ditches under another name—they must be carefully designed and maintained to function properly. The vegetation in swales, usually thick grass, helps to trap pollutants (suspended solids and trace metals), and reduce the velocity of stormwater runoff; stormwater also percolates through the natural substrate.

Vegetated swales can replace curb and gutter systems as well as storm sewers that convey runoff. Swales require more room than curb and gutter systems but they require less expensive hardscaping; furthermore, the reduction in discharge rate and volume means that downstream treatment facilities can be smaller. Swales also double as landscaping features, increasing the value and attractiveness of the site, as well as its appeal to neighbors and regulatory boards.

Applications and Design Principles

Water quality swales are widely applicable on residential, commercial, industrial, and institutional sites. The amount of impervious cover in the contributing area to each swale

should be no more than a few acres, and swales should not be used in areas where pollutant spills are likely. Grassed swales can be used in parking lots to break up areas of impervious cover. Roadside swales can be used in place of curb and gutter systems, except where there are numerous driveways requiring culverts. Where sidewalk and road are parallel, swale should be between the sidewalk and the road.

Management Objectives

- Provide water quality treatment; remove suspended solids, heavy metals, trash.
- Reduce peak discharge rate.
- Reduce total runoff volume.
- Infiltrate water into the ground.
- Provide a location for snow storage.
- Improve site landscaping.



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Cover, top: Stone check dams in this roadside swale serve to slow runoff, promote settling, and increase infiltration. Photo: Virginia Stormwater Management Handbook

Cover, bottom: This swale in a residential neighborhood fits in with the landscaping. Photo: University of Connecticut, Jordan Cove Urban Monitoring Project

Below: A meandering grassed swale filters runoff and helps to improve site landscaping. Photo: Low Impact Development Center.

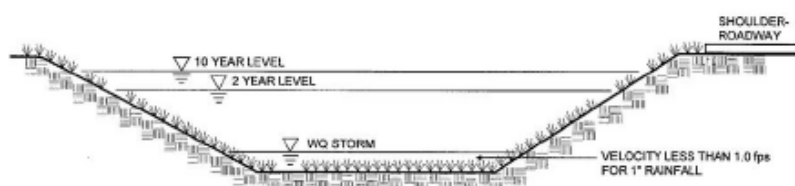


Vegetated swales may be parabolic or trapezoidal in cross section. Longitudinal slopes should be as low as possible, and never more than 4%; swales should follow natural topography and drainage patterns to the extent possible. Swales work best in sandy loams that facilitate infiltration; very sandy soils may be prone to erosion under high runoff velocities. Check dams placed along the length of the swale can help to slow the runoff even more and promote greater infiltration and pollutant removal. Careful hydrologic design is necessary to ensure adequate pretreatment of the water quality volume and nonerosive conveyance of large storms.

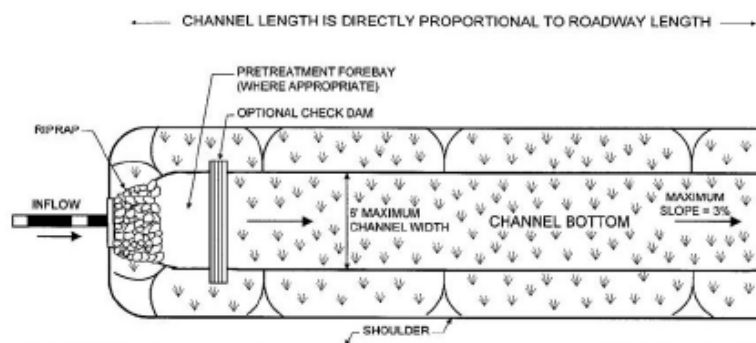
In some applications, swales are designed with a 2- to 3-foot deep soil bed of loamy sand to promote greater infiltration; on denser sites, this bed may include a perforated underdrain to ensure rapid drainage of the swale if groundwater infiltration is slow. In such applications, the runoff would end up (via the underdrain or swale termination) in the conventional stormwater system, but the swale would still provide considerable quality, quantity, and rate benefits.

Benefits and Effectiveness

- Swales help to control peak discharges by reducing runoff velocity, lengthening flow paths, and increasing time of concentration.
- Infiltration through the natural substrate helps to reduce total stormwater runoff volume.
- Swales provide effective pretreatment for downstream BMPs by trapping, filtering and infiltrating particulates and associated pollutants. The design rate for TSS removal is 70%.
- Swales accent the landscape and may help to satisfy landscaping and greenspace requirements.
- Swales can provide a location for snow storage during winter months.
- Roadside swales effectively keep stormwater flows away from street surfaces.
- Construction may cost less than conventional curb and gutter systems.



SECTION



PLAN VIEW



Above: This roadside swale can provide a convenient location for snow storage. As the snow melts, sand is filtered by the vegetation and some of the runoff will infiltrate. Photo: University of Connecticut, Jordan Cove Urban Monitoring Project.

Limitations

- Each grassed swale can treat a relatively small drainage area of a few acres, depending on land use and soil type. Large areas should be divided and treated using multiple swales.
- Swales are impractical in areas with steep topography.
- A thick vegetative cover is needed for these practices to function properly. Grass must not be mowed too short.
- Swales should be used carefully on industrial sites or areas of higher pollutant concentrations. If used, they should be part of a “treatment train” that includes other treatment BMPs.
- Swales can be subject to channelization, if erosive velocity is exceeded.
- Soil compaction can reduce infiltration capacity.
- Swales are not effective at reducing soluble nutrients such as phosphorous.
- In some places, the use of swales is restricted by law; many local municipalities may require curb and gutter systems in residential areas.

Maintenance

- Permits for water quality swales should specify schedules and responsibility for inspection and maintenance. Since swales may be located on private residential property, it is important for developers to clearly outline the maintenance requirements to property purchasers.
- Inspect on a semi-annual basis; additional inspections should be scheduled during the first few months to make sure that the vegetation in the swales becomes adequately established. Inspections should assess slope integrity, soil moisture, vegetative health, soil stability, compaction, erosion, ponding, and sedimentation.
- Mow at least once per year, but do not cut grass shorter than the design flow



Above: Swales can be used on commercial sites to convey runoff around the site and to help slow peak discharge rates.
Photo: Lower Columbia River Estuary Partnership

depth because the effectiveness of the vegetation in reducing flow velocity and pollutant removal may be reduced. Grass cuttings should be removed from the swale and composted.

- Remove accumulated sediment when it is 3" deep or higher than the turf, to minimize potential concentrated flows and sediment resuspension.
- Irrigate only as necessary to prevent vegetation from dying.
- The application of fertilizers and pesticides should be minimal.
- Reseed periodically to maintain dense turf.
- Remove trash or obstructions that cause standing water.
- Prevent off-street parking or other activities that can cause rutting or soil compaction.

Cost

Vegetated swales typically cost less to construct than curbs and gutters or underground stormwater conveyance pipes. The cost of construction will depend on local conditions and management objectives. As with any stormwater management structure, property owners should provide a budget for ongoing maintenance, such as regular mowing and repairs as necessary.

Design Details

- The topography of the site should generally allow for a longitudinal slope of no more than 4% and no less than 0.5%. Flatter slopes can result in ponding, while steeper slopes may result in erosion (depending on soil type, vegetation, and velocity.) Use natural topographic low points and drainageways to minimize excavation.
- Underlying soils should be a sandy loam or a similar soil type with no more than 20% clay. Soil augmentation may be necessary.
- Side slopes should be 3:1 or flatter for maintenance and to prevent side slope erosion. Swale bottoms should generally be between 2 and 8 feet in width.
- Use pea gravel diaphragms for lateral inflows.
- Check dams can be utilized to establish multiple cells. Check dams at 50-foot intervals (<2' drop) help to maximize retention time, increase infiltration, promote particulate settling, and decrease flow velocities. Check dams are not necessary with very low longitudinal slopes. Provide for scour protection below check dam.
- Outlet protection must be used at any discharge point from swales to prevent scour.
- Select grass species that produce fine, uniform, and dense cover and that can withstand prevailing moisture conditions.
- Temporary erosion and sediment controls should be utilized during construction.
- Keep heavy equipment out of the channel during construction to minimize compaction. Even a bobcat grader can compact soils and reduce potential infiltration. Use excavator with a swing arm and work from the side of the swale.
- Mulch anchoring should be done immediately after seeding.

Additional References

- *Massachusetts Stormwater Management Policy: Volume Two: Stormwater Technical Handbook*; Massachusetts Department of Environmental Protection and Massachusetts Coastal Zone Management; 1997
- *Grassed Swales*; from The Wisconsin Stormwater Manual, University of Wisconsin-Extension Service; 2000

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LID STRATEGIES: Rain Gardens



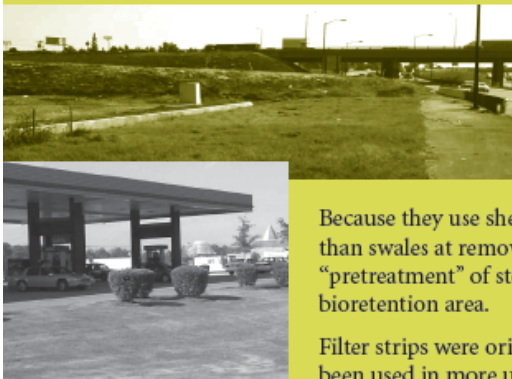
- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids
- Groundwater recharge
- Aesthetically Pleasing
- Reduction of peak discharge rate

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FACT SHEET #6

GRASS FILTER STRIPS



Overview

Grass filter strips are low-angle vegetated slopes designed to treat sheet flow runoff from adjacent impervious areas. Filter strips (also known as vegetated filter strips and grassed filters) function by slowing runoff velocities, filtering out sediment and other pollutants, and providing some infiltration into underlying soils.

Because they use sheet flow and not channelized flow, filter strips are often more effective than swales at removing suspended solids and trash from runoff. They provide good “pretreatment” of stormwater that will then be routed to another technique such as a bioretention area.

Filter strips were originally used as an agricultural treatment practice, but have recently been used in more urban and suburban locations. They differ slightly from buffer strips, which are natural vegetated areas alongside streams and lakes; buffer strips are

left undisturbed for habitat protection and visual screening, while filter strips are altered areas designed primarily for stormwater management. Like many other LID techniques, vegetated filter strips can add aesthetic value to development. They cost significantly less than “hardscaped” stormwater infrastructure and also provide a convenient and effective area for snow storage and treatment.

Applications and Design Principles

Filter strips are appropriate for roadside applications and along the edge of small- to medium-sized parking lots, so long as the tributary area extends no more than 60 feet uphill from the buffer strip. They can also be used to treat roof runoff that is discharged over a level spreader. Filter strips are ideal components of the outer zone of a stream buffer, or as pretreatment to another stormwater treatment practice. They generally require too much land area for applications in urban areas. The contributing drainage area should generally be less than five acres.

Management Objectives

- Remove suspended solids, heavy metals, trash, oil and grease.
- Reduce peak discharge rate and total runoff volume.
- Provide modest infiltration and recharge.
- Provide snow storage areas.
- Improve site landscaping.



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Filter strips work best when they are at least 20 feet long (downhill axis), though shorter strips will still provide some treatment. They should have slopes between 1% and 15%, preferably in the lower end of that range. It is critical for filter strips to be planar or convex, since any undulation in the surface or obstructions can cause concentrated flow that leads to erosion, channelization, and loss of water quality benefits.

The design should seek to keep runoff velocity in the low to moderate range (less than 2 feet per second) in order to maximize water quality benefits. This can be done by limiting the size of the contributing impervious surface. Both the top and toe of the slope should be as flat as possible to encourage sheet flow. A pea gravel or cement level spreader (with a lip) at the top of the filter strip will improve sheet flow and will capture some sediment.

Some filter strips are designed with a pervious berm at the downhill end of the filter strip, to detain water temporarily, increasing infiltration and reducing peak discharge rates. This berm can significantly enhance water quality benefits if it is designed to impound the water quality volume.

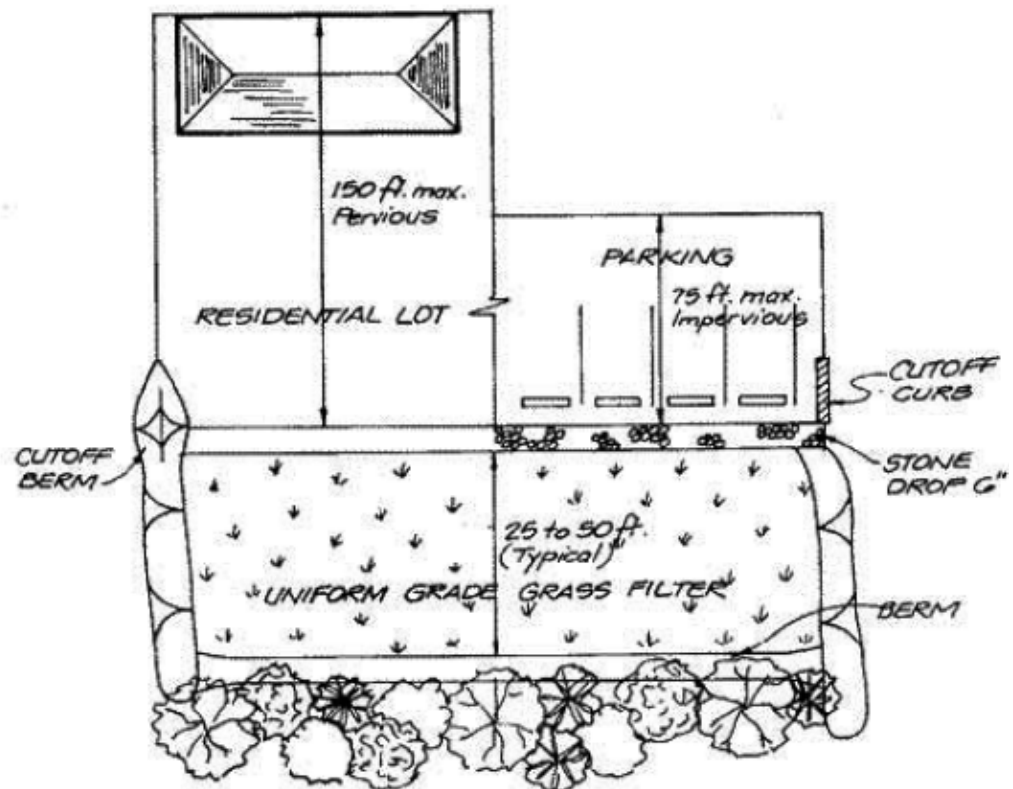
Benefits and Effectiveness

- Filter strips provide runoff pretreatment by trapping, filtering and infiltrating particulates and associated pollutants. TSS removal rates range from 40%-90%. Effectiveness depends largely on the quantity of water treated, the slope and length of the filter strip, the type of vegetation, and the soil infiltration rate.
- Vegetated filter strips also reduce runoff velocities and increase the time of concentration as compared to channelized flow, resulting in a reduction of peak discharge rates.
- Filter strips may provide groundwater recharge as runoff infiltrates into soil; recharge may be considerable if design incorporates a ponding area at the toe of the slope.

Cover, top: This 40-foot wide filter strip provides water quality pretreatment of runoff from the adjacent highway. Photo: California Stormwater Quality Association.

Cover, bottom: A filter strip adjacent to this filling station provides room for snow storage and can remove sediment and organics from runoff. Photo: Steve Haubner, Atlanta Regional Commission

Below right: A plan view of filter strips in residential and commercial settings. Image: Center for Watershed Protection





Above: Here a filter strip is being used as pretreatment for parking lot runoff directed to an infiltration basin. Note concrete level spreader (at right) to facilitate sheetflow across filter strip. Photo: California Stormwater Quality Association

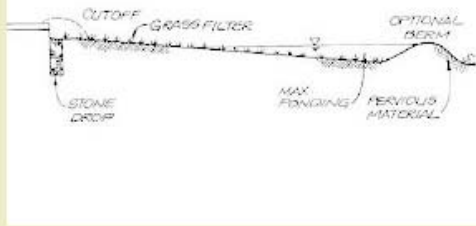
- Filter strips can serve as a location for snow storage during winter months and will also help to trap and treat the salt and sand in snow when it melts.
- Filter strips are inexpensive to construct, especially when compared to conventional curb-and-gutter systems.
- Vegetated filter strips help to accent the natural landscape by providing green space adjacent to parking lots and roadways.

Limitations

- Because filter strips infiltrate runoff to groundwater, they could be inappropriate at stormwater “hotspots” (such as gas stations) with higher potential pollutant loads. They should be combined with other BMPs to ensure adequate treatment of polluted runoff prior to discharge.
- Channelization and premature failure may result from poor design, imprecise construction, or lack of maintenance. Proper design requires a great deal of finesse, and slight problems in the construction, such as improper grading, can render the practice less effective in terms of pollutant removal.
- Filter strips have low removal rates for nutrients, so they must be used in conjunction with other best management practices.
- Filter strips often require lots of space, making them often infeasible in urban environments where land prices are high.

Maintenance

- Inspect level spreader monthly and remove built-up sediment.
- Inspect vegetation monthly for rills and gullies and correct. Fill any depressions or channels. Seed or sod bare areas.
- In the year following construction, inspect the filter strip regularly to ensure that grass has established. If not, replace with an alternative species. Allow natural succession by native grasses and shrubs if it occurs.



This diagram shows a filter strip designed with a berm to impound water, resulting in improved water quality treatment and increased infiltration. Image: Center for Watershed Protection

- Mow grass, as rarely as 2-3 times per year, to maintain 4" to 6" of dense grass cover. Grass clippings should be collected and composted elsewhere. Provide a minimum of fertilizer only when necessary. Mow when the soil is dry and firm to prevent rutting.
- Semi-annually, remove sediment that has accumulated to prevent berms or channels.

Cost

Filter strips cost considerably less to construct than many hardscaped stormwater management structures such as curbs, storm sewers, and ponds. The primary direct expenses are clearing, grading, and seed or sod. Additional expenses may include construction of a level spreader at the top of the strip or a berm at the toe of the slope.

The most significant cost of filter strips may be an indirect expense, which is the cost of the land, which may be very valuable in dense urban settings. In many cases, however, open spaces and buffers are required by municipal landscaping or zoning regulations, and filter strips may be used to satisfy these requirements. Established vegetated buffers may also add value a property.

Design Details

- The limiting design factor for filter strips is not total drainage area but rather the length of flow contributing to it. Because sheetflow runoff becomes concentrated flow as distance increases, the contributing area to a vegetated buffer should be no more than 60 feet for impervious surfaces, and 100 feet for pervious surfaces.
- Slopes should be between 1% and 15%, though slopes less than 5% are preferred. The top and toe of the slope should be as flat as possible.
- The filter strip should be at least 20' long (downhill length) to provide water quality treatment. Minimum

width is 8' or 0.2 X length of flow over the impervious surface upstream of the filter strip.

- Depth of sheetflow should be less than 0.5" for the design storm. Depending on the pollutant removal required, residence time should be at least 5 minutes, preferably 9 minutes or more.
- Use Manning's equation to calculate velocity, assuming hydraulic radius equals depth, with *n* values of 0.20 for mowed grass slope and 0.24 for infrequently mowed grass slope. Normal velocity should be <1.0 feet/second for design flow, with maximum permissible velocity of 3.0 feet/second for peak discharge during 10-year storm.
- Use a cement level spreader or pea gravel diaphragm at the top of the slope.
- Filter strips can be designed with a pervious berm of sand and gravel at the toe of the slope. This feature provides an area for shallow ponding at the bottom of the filter strip. Runoff ponds behind the berm and gradually flows through outlet pipes in the berm. The volume ponded behind the berm should be equal to the water quality volume.
- Designers should choose a grass that can withstand calculated flow velocities, and both wet and dry periods. Also consider depth to groundwater and choose facultative wetland species if appropriate.
- If filter strip will be used for snow storage, use salt tolerant vegetation (e.g., creeping bentgrass.)
- During construction, divert runoff from unstabilized areas away from filter strips.
- Protect the underlying soil from compaction to the extent possible: work from outside the boundaries of the filter strip or use oversized tires and lightweight equipment.

Additional Resources

Mass Highway Department Stormwater Handbook
(www.mhd.state.ma.us/mhd/enviro/publications.htm)
www.stormwatercenter.net

This publication is one component of the Massachusetts Low Impact Development Toolkit, a production of the Metropolitan Area Planning Council, in coordination with the I-495 MetroWest Corridor Partnership, with financial support from US EPA. The Massachusetts Low Impact Development Interagency Working Group also provided valuable input and feedback on the LID Toolkit.

FOR MORE INFORMATION, VISIT: WWW.MAPC.ORG/LID AND WWW.ARC-OF-INNOVATION.ORG.



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