2.1 LAND USE AND THE ENVIRONMENT

The Cape Cod Commission has always supported a strong relationship between land use, environmental issues, and transportation planning. This relationship is most evident when consulting the transportation section of the Regional Policy Plan (RPP) as it relates to the goals of the Regional Transportation Plan (RTP). The RPP relies heavily on land use planning and environmental protection in tandem with developing transportation solutions consistent with the Cape Cod Commission Act.

This section addresses the Cape’s land use and environmental issues and includes discussion of a growing concern – climate change – and its potential for impact to the transportation network.

2.1.1 LAND USE VISION MAP

The Regional Land Use Vision Map (RLUVM - adopted with the 2009 RPP) expresses a vision for the future of Cape Cod. The Cape Cod Commission is working collaboratively with all 15 towns in Barnstable County to develop this vision. The land uses are categorized as Economic Centers, Villages, Industrial and Service Trade Areas, Resource Protection Areas, and Other Areas. Towns where the planning board has endorsed the vision map for their community are included on the Regional Land Use Vision Map after adoption by the Barnstable County Assembly of Delegates. The RLUVM is used to tailor minimum performance standards applied to Developments of Regional Impact (DRIs) according to planning areas. Adoption of each town’s Land Use Vision Map also allows a town to seek revisions to DRI thresholds based on the land use categories listed in Commission regulations. The intent is to encourage growth and redevelopment in appropriate areas that contain existing or proposed infrastructure – and – to discourage sprawl in more environmentally sensitive areas.

Land Use Categories include:

- **Economic Centers** – Areas designated as appropriate for growth and redevelopment. These areas serve the region or sub-region and could include characteristics such as civic and institutional uses, retail, and mixed use. Economic Centers are defined by parcel data and/or zoning district boundaries, shown in detail on individual town maps. Developments of Regional Impact (DRI) proposed within Economic Centers benefit from some reduced minimum performance standards during DRI review under the RPP.

- **Industrial and Service Trade Areas** – Areas designated for industrial uses, construction trades, and/or public works facilities. Areas are intended for uses that are incompatible with residential and village settings, with a high square-footage-to-employee ratio.

- **Resource Protection Areas** – Areas designated that warrant protection and where additional growth is not desired due to the presence of one or more sensitive resources. These resources shall include at a minimum Wellhead...
Protection Areas, Land Subject to Coastal Storm Flowage or Sea, Lake, and Overland Surges by Hurricanes (SLOSH) zones, historic districts, and the Cape Cod National Seashore. Resource Protection Areas may also include but not be limited to wetlands, vernal pools, protected open space, and designated Districts of Critical Planning Concern (DCPCs).

- **Villages** – Areas designated to preserve historic and/or community character. Consist of small, compact areas with development at a local scale. Characteristics could include civic uses, mixed use, and/or home occupations.

- **Other** – Areas remaining after the other areas have been identified. The land use category boundaries are based on digital data obtained from MassGIS, Army Corps of Engineers, NHESP, and Town GIS Departments, including town-based zoning and parcel information.

The Land Use Vision Map is presented in the following figure. Please consult the Cape Cod Commission website for full explanations of assumptions and to see the latest update (June 18, 2010):


Link for Cape Cod Commission regional maps

[http://www.capecodcommission.org/GIS/regionalmaps.htm](http://www.capecodcommission.org/GIS/regionalmaps.htm)
FIGURE 1 - LAND USE VISION MAP
2.1.2 LAND USES ALONG MAJOR ROADWAYS

Of the major roadway corridors of Barnstable County, existing land use varies by the characteristics of the town or sub-region as well as along each corridor. The following includes a summary of these characteristics.

**Route 6:**

Adjacent land uses vary by location. In the limited access sections of the road there is some residential development and some industrial development along the corridor. In the sections with curb cuts there is more commercial development, including retail activity.

In addition to being the main thoroughfare for the Cape as a whole, it also is the “Main Street” of several Cape towns. Buzzards Bay, Eastham, and to a lesser degree, Truro and Wellfleet, all use Route 6 as a downtown thoroughfare. This dual purpose for the road has created some conflicts for this corridor.

**Route 28:**

Land use along Route 28 may vary to a greater extent than any other roadway on Cape Cod. Sections between Chatham and Orleans for example are lightly settled with scenic vistas of Pleasant Bay. In the Upper Cape, Route 28’s MacArthur Boulevard is nearly a freeway with the undeveloped Massachusetts Military Reservation to the east and sprawling commercial enterprises along the west. Route 28 serves as a Main Street to numerous villages such as Falmouth, Dennisport, Harwichport or Chatham, where close-to-the-street business and residences are complemented by the lower travel speed of the road. In the Mid-Cape towns of Barnstable and Yarmouth, much of Route 28 is congested due to high traffic demands and frequent curb-cuts for the many businesses taking advantage of the proximity to drive-by customers.

**Route 6A:**

Typical commercial uses include inns, motels, and cottages, restaurants, antique shops, galleries, gift shops, services such as gas stations, banks, small markets, and small professional offices. Residential uses, including home occupations, mixed with churches, municipal buildings, and open land, continue to dominate the rest of the roadway. Over 3,350 acres of vacant developable land is located within the Route 6A corridor, most of it zoned for residential use. Development of vacant parcels that abut the roadway or are located within or adjacent to historic resource areas and scenic viewsheds could diminish the distinctive character. Several village centers exist along the corridor, such as Barnstable Village, Yarmouthport, and Brewster. Several “new villages” have also sprung up as strip development in the last 20 years, such as the development in Orleans. In addition, Sandwich Center lies just off 6A to the south.
Much of the corridor remains residential, or is undeveloped due to the proximity of wetlands with Sandwich and Orleans the notable exceptions. Bike travel along the corridor is common despite the fact that it is best suited for experienced bicyclists. This is due to the narrow lane widths and lack of shoulders, scenic nature of the corridor, and residential and commercial development.

2.1.3 CONTEXT SENSITIVE DESIGN

To address transportation problems with infrastructure solutions, the Federal Highway Administration recommends that we “…develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility.” The concept of Context-Sensitive Design has a strong influence on design criteria for transportation projects as will be evident in the Alternatives Analysis Chapter of this RTP.

2.1.4 CAPE COD ENVIRONMENTAL RESOURCES

Cape Cod is rich in environmental features that both deserve and are required by statute to be protected. Land use planning, transportation planning, and many other related efforts are influenced by, and have an influence on the environmental resources of Cape Cod. The following figure shows a number of these features including:

- Wellhead Protection Areas
- Vernal Pool Buffers
- Water Bodies
- Pond Shore Buffers
• Potential Public Water Supply Area
• Habitats
• Wetlands

For reference, major roads and town boundaries are displayed as well.

![Map of Cape Cod Significant Natural Resource Areas](image)

**FIGURE 3 - CAPE COD SIGNIFICANT NATURAL RESOURCE AREAS**

Source from the Cape Cod Commission:
http://www.capecodcommission.org/RPP/CCSNR_o8RPP0609amend0610.pdf

Link for Cape Cod Commission regional maps:
http://www.capecodcommission.org/GIS/regionalmaps.htm
The Cape Cod Commission’s Geographic Information System department and Natural Resources’ staff have developed an interactive mapping technique that can be used in assessing the proximity of planned infrastructure (e.g., road improvements) and the various geographic layers of natural resource information. This tool will be of increasing usefulness in minimizing impacts to natural resources in the advanced planning stage of transportation projects. This effort will result in an interactive online application that will allow the public to review transportation projects in the context of any natural resource of interest.

2.1.5 STORMWATER MANAGEMENT

Cape Cod hosts nearly 1,000 ponds and lakes. Of the 57 watersheds draining into the Cape’s coastal embayments, 46 have been identified by the U.S. Environmental Protection Agency as being “nitrogen-sensitive,” of which half are currently subject to Total Maximum daily Loads.

The issue of stormwater runoff was first addressed at the national level in Phase I of the EPA’s stormwater program in 1990. Phase I required permit coverage under the National Pollutant Discharge Elimination System (NPDES). Those required to apply for permits included municipal separate sewer systems that serve populations of approximately 100,000 people or more, and construction activity disturbing 5 or more acres of land.

“Storm Water Phase II Final Rule” is the EPA’s next step in addressing stormwater runoff pollution. Phase II expands upon those required to hold permits under Phase I to include all of the towns on Cape Cod except Provincetown, Wellfleet and Truro because they are considered to be "operators of MS4s (municipal separate storm sewer systems) in urbanized areas.” Phase II also applies to operators of small construction sites that disturb between 1 and 5 acres of land, and ten categories of industrial activity.

Phase II is anticipated to further reduce adverse impacts to water quality and aquatic habitat by controlling the unregulated sources of storm water discharges that hold the greatest likelihood of significantly contributing to stormwater pollution.

2.1.6 CLIMATE CHANGE

Climate change is a shift in temperature, precipitation, wind and other long-term weather patterns. According to the Massachusetts Department of Environmental Protection, there is broad scientific consensus that our climate is changing - both regionally and globally - largely due to the combustion of fossil fuels and other human activities that increase atmospheric concentrations of greenhouse gases, namely carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).

Almost all (97%) greenhouse gas emissions in Massachusetts consist of carbon dioxide released in fossil fuel combustion. According to data from the US Energy Information
Administration compiled by Environment Massachusetts, 30% of these energy-related CO2 emissions were generated by the transportation sector. Between 1990 and 2004, estimated CO2 emissions from the transportation sector in Massachusetts increased 16%, while those due to gasoline consumption increased even faster, rising 19% from 1990 to 2004 (according to the Boston Indicators Project). Rising greenhouse gas emissions from motor vehicles pose a major challenge to the state’s ability to meet its goal of reducing greenhouse gas emissions below 1990 levels, as required by the Global Warming Solutions Act (2008). Strategies focused on VMT reduction, fuel-efficient fleets, and implementing Transit Oriented Development and are critical in meeting these goals.

The Commission is currently participating in a federal Interagency Climate Change Scenario Planning Pilot Project. Commission staff assist in bringing together multiple federal agencies and local stakeholders to work toward a shared and practical future development strategy. The strategy will plan for climate change impacts in transportation and land use decision-making while at the same time reducing the region’s greenhouse gas (GHG) emissions. A scenario planning process will be used to develop the most desirable development strategy.

Another tool in mitigating potential impacts of Climate Change is the integration of land use planning with transportation planning via the Land Use Vision Mapping (LUVM) efforts. LUVM results are intended to reinforce Transit-Oriented Development and other forms of compact development patterns, thereby reducing VMT (and resulting climate-changing emissions). Conversely, my melding SLOSH/A&V zones in designating Resource Protection Areas, development is discouraged in locating in such areas.
The blue colored areas shown in the figure above are a graphic illustration of the potential effects of sea-level rise on the low-lying regions of Cape Cod. The longer-term effect of sea-level rise permanently disabling important portions of the transportation network is a major cause for concern. In the nearer future, increased weather-based threats from storm surge, flooding, and hurricane wind damage highlight the vulnerability of our transportation system.

The Cape Cod MPO is committed to implementing transportation strategies that will help reduce fossil fuel energy and GHG emissions. The Cape Cod MPO’s RTP update demonstrates a commitment to a transportation system that supports environmental quality and Smart Growth strategies.

To address climate change on Cape Cod, the following categories of recommendations are proposed to address causes, improve efficiencies, and strategically protect or
construct critical infrastructure to resist the effects of weather-based events and sea-level rise.

**Smarter Fleets & Fuels: Reduction of Greenhouse Gases**

Clean fuels and efficient vehicles can result in significant reductions in GHG production. The Cape Cod Commission continues to encourage the development of fueling infrastructure for bio-diesel. Biofuels are derived from plant matter that absorbs CO2 in their growth process. This CO2 is sequestered in the biofuel and released when it is burned returning the original CO2 (green house gas) from the plant matter to the atmosphere. Unfortunately, usually energy is expended in the harvesting and production processes that may have been from petroleum. One of the promising sources of feedstock is algae. Using wastewater as a feedstock and free sunlight for the production, algae may be the Cape’s closest thing to “free lunch fuel” that doesn’t compete against other food sources (e.g., corn-based ethanol). Currently, biodiesel is available to Cape Cod towns through Barnstable County’s procurement process.

Efficient vehicles means less emissions from whatever fuel is being used. Through a partnership with the Cape Cod Regional Transit Authority, the Cape Cod MPO has and will continue to support the purchase of fuel-efficient and alternative-fuel vehicles when procuring new or replacement buses.

**Smarter Management: Shortening Trips and Avoiding Congestion**

The Cape Cod Commission continues to encourage smarter land use patterns through the Cape Cod Regional Policy Plan. By encourage mixed-use and transit-oriented development, and discouraging sprawl, travelers are afforded shorter commute distances or convenient access to commercial areas and municipal services thus reducing vehicle travel distance. Even more beneficial are the trips that can be made by public transit, bicycling, or walking.

See:

www.capecodcommission.org/RPP

The continued deployment of intelligent transportation systems will provide travelers with the tools to avoid congestion. Tailpipe emissions of idling vehicles represent the worst case scenario of air pollution.

See:

www.gocapecod.org/congestion
Smarter Infrastructure: Location & Protection

Construction of new transportation infrastructure in an area threatened by sea-level rise is probably the least desirable strategy. Notwithstanding the expense of repairing storm-damaged roadways following an initial event, there is reason to believe that future events would occur with ever-increasing probability. In effect, we would be “shoveling against the tide.”

A recommended action is to perform an analysis of the transportation infrastructure located in threatened areas. This information will help identify needed upgrades (e.g., raising roadbeds, retaining walls, etc.) and guide new infrastructure away from threatened areas.

2.1.7 DOCUMENTING GREENHOUSE GAS EMISSIONS REDUCTION FOR GREENDOT IMPLEMENTATION

MassDOT, using its statewide travel demand model, has provided the Cape Cod MPO with statewide estimates of CO2 emissions resulting from the collective list of all recommended projects in all the Massachusetts RTPs combined. Emissions are estimated in the same way as the criteria pollutants (volatile organic compounds, nitrogen oxides, and carbon monoxide) whose emissions are required for the air quality conformity determination (for further description, see Appendix-Air Quality Conformity). However, the CO2 emissions shown here are part of an effort separate from the conformity analysis and are not part of those federal standards and reporting requirements.

The Global Warming Solutions Act (GWSA) legislation requires reductions by 2020 and further reductions by 2050, relative to the 1990 baseline. The project mix from this RTP (and all other RTPs) was modeled for both 2020 and 2035 using an Action (Build) vs. Baseline (No-Build) analysis to determine the CO2 emissions attributed to the all MPO’s mix of projects and smart-growth land use assumptions. The estimates of the modeled CO2 emissions are provided below:

<table>
<thead>
<tr>
<th>Year</th>
<th>CO2 Action Emissions</th>
<th>CO2 Base Emissions</th>
<th>Difference (Action – Base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>101,514.4</td>
<td>101,514.4</td>
<td>n/a</td>
</tr>
<tr>
<td>2020</td>
<td>105,747.5</td>
<td>105,856.4</td>
<td>-108.9</td>
</tr>
<tr>
<td>2035</td>
<td>115,034.1</td>
<td>115,028.0</td>
<td>6.1</td>
</tr>
</tbody>
</table>

(All emissions in tons per summer day)
As shown above, collectively, all the projects in the RTPs in the 2020 Action scenario provide a statewide reduction of nearly 109 tons of CO2 per day compared to the base case. However, the 2035 Action scenario estimates an increase of about 6 tons of CO2 emissions compared to the base case. It should be noted that this current analysis measures only projects that are included in the travel demand model. Many other types of projects that cannot be accounted for in the model (such as bicycle and pedestrian facilities, shuttle services, intersection improvements, etc.) will be further analyzed for CO2 reductions in the next Transportation Improvement Program development cycle. This information will be updated and reported at that time.

Working closely with MassDOT, the Cape Cod MPO will continue to report on its actions to comply with the GWSA and to help meet the GHG reductions targets. As part of this activity, the MPO will provide further public information on the topic and will advocate for steps needed to accomplish the MPO’s and state’s goals for greenhouse gas reductions.

2.1.8 CONCLUSION

When planning for the Cape’s future transportation system, we ignore the environment at our peril. By focusing on a combination of (1) a thorough understanding of the location and importance of the Cape’s environmental resources with, (2) a vision of land use that mitigates impacts to the environment with efficiencies in location such as transit-oriented-development, the RTP will be instrumental in developing a transportation system that maximizes efficiency while addressing the sensitivity of Cape Cod’s context.